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CORRECTION.

P. 22, 6 lines from bottom, *for* W. Ellis *read* E. H. Ellis.

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THE GENERA PHYLLODOCE AND CASSIOPE.

By R. D'O. Good, M.A., F.L.S.

The family *Ericaceæ*, as defined by Drude in the *Pflanzenfamilien*, is primarily divisible into four main groups or tribes, the *Rhododendroideæ*, the *Vaccinioideæ*, the *Arbutoideæ*, and the *Ericoideæ*. Among these the last is peculiar in two respects—namely, its distribution, which is almost entirely African and thus supplementary to that of the rest of the family, and in the very peculiar and specialized growth-form of the plants composing it. Characteristic of the one tribe as this "ericoid" habit is, it is also to be found very rarely and in somewhat different shape in the other tribes. In many of the larger genera, such as *Rhododendron*, *Kalmia*, and *Vaccinium*, there is a distinct tendency towards the habit, but in only two widespread genera is it exclusively found. These are the genera *Phyllodoce* and *Cassiope*, both widely ranging in the cooler northern hemisphere, where they are the ecological and geographical representatives of the true *Ericoideæ*.

Although so similar in appearance and habitat, the two genera are not very close relations according to the taxonomy of the family. *Phyllodoce* has a capsule which dehisces septicidally and anthers without appendages, and is therefore placed in the tribe *Rhododendroideæ*; *Cassiope* has a loculicidal capsule and anthers furnished with appendages and belongs to the *Arbutoideæ*. Unlike the true *Ericoideæ* the corolla in both is not persistent.

In the following pages a comparative account of these two genera is given, and attention drawn to some of the more interesting features of similarity and difference.

The Genus *Phyllodoce*.

The Phyllodoces are all rather small undershrubs, arctic-alpine in habitat, having small close-set linear coriaceous leaves with deflexed margins, and with flowers aggregated into umbel-like inflorescences towards the tips of the branches.

The total generic range is completely northern circumpolar with a somewhat variable southern limit. Its extension south is greatest in

the mountain-region of Western North America, where it reaches 33° N. lat., and is least in Central North America, where it is about 55° N. lat. In Japan it reaches 35° N. and in Europe 43° N. The limit in Continental Asia is imperfectly known, but is probably about the latitude 40° N. From these southern limits the genus is found northward almost wherever there are any flowering plants (see fig. 1).

Within the genus there are two well-marked types of floral structure which form the basis for a division into two subgenera. In the subgenus *Parabryanthus* A. Gr., the corolla is campanulate, with comparatively large lobes: in the subgenus *Eu-Phyllodoce* A. Gr., it is urceolate with very small lobes. The first type is found chiefly in the mountain system of Western North America from Sitka southward to California. Here there are two endemic species. *P. empetriformis* (Sm.) D. Don, with small flowers and included anthers, is found along the mountains from Sitka to Montana and Northern California. *P. Breweri* (A. Gr.) Heller, with larger flowers and exserted anthers, is a very local, more southerly form, confined to the high Sierras of California. Besides these, the subgenus is also found in the highlands of Japan, where it is represented by two species. *P. nipponica* Mak. is very closely allied to *P. empetriformis*, but has a larger habit and very much smaller anthers. *P. tsugæfolia* Nakai is a little-known plant also showing affinity with *P. empetriformis* and *P. nipponica*, from which it seems to differ mostly in the leaves. This subgenus thus has four species, and is found in two regions of similar latitude, but of very unequal size and separated by 70 degrees of longitude.

Eu-Phyllodoce has a much wider range, comprising that of the whole genus except the southern part of the range of *P. Breweri*, but over the very great majority of this area only one species is found. This is the well-known *Phyllodoce cærulea* (L.) Bab. It is completely circumpolar, and is the only representative of the genus found in America east of about 110° W., and in Europe and Asia west of about 130° E. It is also the only species in Greenland and the Arctic American Archipelago. It seems to extend north as far as any flowering-plant, but appears to be absent from one or two arctic localities. With a single locality in the Highlands of Scotland, it is the only representative of the genus in the British Isles. The flowers have a characteristic purple-blue colour and, taking its wide distribution into consideration, the species is remarkably constant. In Japan, however, there seem to be one or two well-marked local forms. One of these with glabrous calyces has been described as *P. alpina* Koidz., and is known only from one or two alpine localities in Nippon. A second less marked form has been described by the same author as *P. cærulea* var. *yesoensis*, and is known only from Yeso. Like *P. cærulea*, both these have purple-blue flowers.

The subgenus *Eu-Phyllodoce* also contains two other well-marked species, both with yellowish-green flowers. *P. glanduliflora* (Hook.) Howell is a small plant with glandular inflorescences and filaments, and has much the same range as *P. empetriformis* over the mountains of Western North America, but is slightly more northerly, extending

from Alaska to Montana and Oregon. It has the same habitat as *P. empetriformis*, and the two species are usually found side by side. The second species, *P. aleutica* (Spreng.) Heller (including *P. Pallasiana* D. Don) is a plant with a larger habit and glabrous filaments. Its distribution, unlike *P. glanduliflora* is predominently Asiatic, and it reaches from Japan through North-East Asia across the Behring Straits to Alaska.

Besides the forms already mentioned, several other Phyllodoces have been described. Among these, *P. amabilis* Stapf, based upon living material from an unknown source, is undoubtedly identical with *P. nipponica*. *P. Grahamii* (Hook.) is a form of *P. empetriformis*. Two others have been described more recently from the American mountain-region. Both of these, *P. intermedia* (Hook.) Rydb. and *P. hybrida* Rydb., are intermediate in character between the two American species *P. empetriformis* and *P. glanduliflora*, and occur only where the two species are found together, and there is little doubt that they are natural sporadic hybrids between the two.

It is possible that hybridization is also illustrated elsewhere in the genus. It is interesting and suggestive to note that *P. aleutica* is, in floral characters, if not in habit, almost completely intermediate between *P. cærulea* and *P. glanduliflora*, and is found not only within the range of the former, but over that part of the range which is also common to that of *P. glanduliflora*. It is an attractive suggestion that *P. aleutica*, whatever its present status, may have arisen as a hybrid between these two species.

The genus *Phyllodoce* is also concerned in another case of hybridization. This is the plant known as *Bryanthus erectus*, of Lindley and Paxton, found only in cultivation. It is generally considered to be a bi-generic cross between a Phyllodoce (most likely *P. empetriformis*) and *Rhodothamnus Chamæcistus* Reichb. The latter is a European plant, and so the hybrid is not known in a wild state.

To summarize the preceding paragraphs: *Phyllodoce* contains some eight species, equally divided between two subgenera. Geographically there is a single very wide circumpolar species occupying nearly the whole of the generic area. Within this are two aggregations of narrower species, one in Japan and North-East Asia and one in North-Western America. Japan, in particular, possesses one or two specially local forms. The geographical centre of the genus is about the Behring Straits. The generic area is single and continuous.

Most closely allied to *Phyllodoce* is the monotypic genus *Bryanthus*. This plant is a tiny creeping undershrub with very small leaves. It differs from *Phyllodoce* in the tetramerous almost polypetalous flowers borne in small very few-flowered racemes at the apices of the branches. Its geographic range is over North-Eastern Siberia, the peninsula of Kamchatka, the islands (Behring Is. and Coffee Is.) in the Behring Sea, extreme Western Alaska, the Kuriles, and the islands of Yezo and Hondo in Japan (see Kudo in Jap. Journ. Bot. vol. ii. no. 4).

The Genus *Cassiope*.

The Cassiopes are all small undershrubs with very small broadly triangular leaves, more or less closely and regularly imbricated, and arranged in vertical rows on the stem. In most cases the leaves have a very strongly-marked abaxial sulcus or furrow, but in some species this is absent or modified. The white or pink flowers are solitary and axillary among the upper leaves. The plants are all arctic-alpine in habitat and ecologically agree closely with the Phyllodoces.

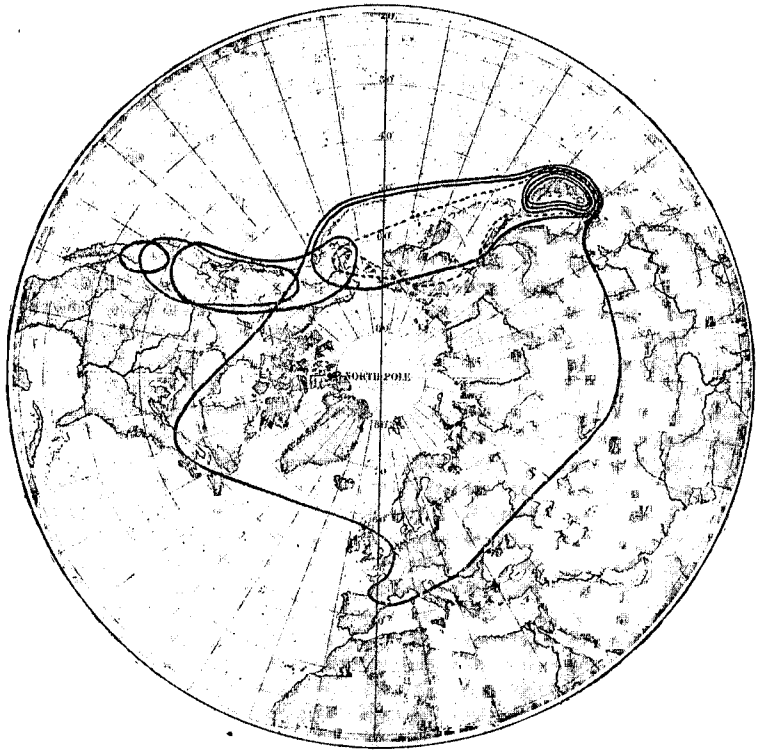

Fig. 1.—Map showing the distribution of the genera *Phyllodoce* and *Bryanthus* (dotted). The specific areas are described in the text.

The total generic range is made up of two distinct and isolated parts, the more important of which is the northern circumpolar portion. As in *Phyllodoce*, there are extensions down both Pacific coasts to California and Japan. There is also a slight extension in Eastern North America across the St. Lawrence River. In Europe the southern limit is comparatively far north, about 65° N. From this point eastward the southern limit becomes gradually further south, although its actual position in Continental Asia is doubtful.

The smaller portion of the generic area is that covering the Himalayas and the mountain-region of South-Western China, where there is a considerable group of endemic species (see fig. 2).

The specific differences in the genus are chiefly those of foliage, and particularly those of hair-covering and arrangement. The floral characters throughout the genus are remarkably constant and do not afford convenient systematic criteria. Despite the varying leaf-characters the general generic facies is well maintained, and there is no conspicuous segregation into subgenera.

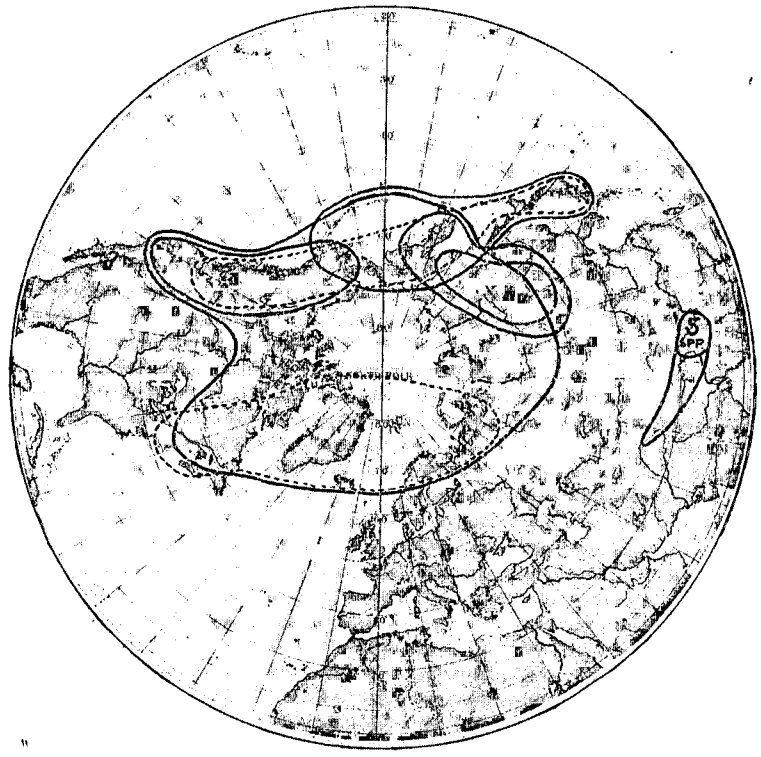

Fig. 2.—Map showing the distribution of the genera *Cassiope* and *Harrimanella* (dotted). The specific areas are described in the text.

Five species of *Cassiope* are easily recognisable by the absence of the furrow on the abaxial surface of the leaf. Three belong to the circumpolar part of the genus. In one of them, *C. Redowskii* G. Don, the leaves are actually hollow with a cylindrical or conical central cavity, but this is not indicated externally. It is a rare and little-known plant occurring only in North-East Continental Asia and part of Manchuria. The other two species, *C. Mertensiana* (Bong.) G. Don and *C. lycopodioides* (Pall.) D. Don, have solid and unfurrowed leaves.

The first is North-West American, and ranges over the mountains from Alaska to Northern California. The second is Asiatic, and has an opposite kind of distribution along the Asiatic Pacific Coast from Japan northward through Sagalien to Kamchatka and Western Alaska. A variety *laxa* Nakai of this species has been described from Japan, but this seems to be only a straggling growth-form and is probably not narrowly confined geographically. The two other species are local endemics in the mountains of South-Western China. In *C. myosuroides* W. W. Sm., the leaves are small, imbricated, swollen at the base, and with a very broad hyaline margin, so that in general vegetative appearance the plant closely resembles a *Lycopodium*. In *C. palpebrata* W. W. Sm. the leaves are small, elliptic, and flat. They are not imbricated, but lie at right angles to the stem, and their edges are conspicuously thickened and bear a few stout setæ. The general habit of the plant recalls the genus *Harrimanella* mentioned below.

The other five species of *Cassiope* have leaves with a conspicuous abaxial furrow, and specific differences are based chiefly upon the nature and distribution of the leaf-hairs. Two species are particularly distinct and both belong to the circumpolar group. *C. tetragona* (L.) D. Don has minutely pubescent leaves without any conspicuous hairs. This species is the most widely distributed of all and is completely circumpolar. It is particularly widespread in Eastern North America, where it follows the limit of the subarctic forest-zone and just reaches the North-Eastern United States. It is found in Europe only in the extreme north of Scandinavia, and does not occur on the Southern European Mountains. In Eastern Continental Asia it extends further south, almost to latitude 50° N. It is found in Kamchatka and Northern Sagalien, all down the Pacific coast to California, and is an extremely common plant in the Arctic regions. Another very closely allied form from the Rockies has been described as a species (*C. saximontana* Small), but seems doubtfully distinct from *tetragona*. The second well-marked species is *C. ericoides* (Pall.) D. Don. The branches are comparatively slender and the leaves, which are not very closely imbricated, are furnished with long reddish hairs on the margins and apices. This species is not very well known and has been found only in part of North-Eastern Asia, including Kamchatka and Manchuria.

The remaining species form a very marked group both structurally and geographically. They all have abaxially furrowed leaves with some sort of conspicuous white ciliation on the margins and tips, and they are to be found in the Himalayan–Western Chinese mountains only. Most important of them on account of its wide distribution is *C. fastigiata* (Wall.) D. Don, which ranges from the western Himalayas right through to China. It is variable in habit, and a particularly slender form has been described as *C. selaginoides* Hook. f. & Thoms. This plant usually has longer pedicels than those of true *fastigiata*, but the two form a continuous series, so that it is impossible to divide them by any definite

character and they are here considered as one wide species. They are found between 9,000 and 14,000 ft.

The other two species are endemics of the Western Chinese mountains. *C. pectinata* Stapf is of robust habit with large leaves fringed with stout cilia. In general habit it is very close to *fastigiata*. *C. Mairei* Lev. is a very little known plant, of which there is only a most inadequate description. It appears to show close affinity with *fastigiata* or the *selaginoides* form of that species.

The genus *Cassiope* is here considered as composed of 10 species. Five of these are very distinct and form a group with a high northern and completely circumpolar range. One species, *C. tetragona*, has a much wider range than any other and is the only one in Eastern North America, Europe, and North-Western Asia. Of the other four, one is confined to the mountains of Western North America, one is found in Japan and North-East Asia, and two are limited to North-East Continental Asia. There is also a group of five isolated and endemic species in the Himalayan–S.W. China region, one of which has a much wider range than any of the others. The geographical centre of the genus is in Continental Asia.

Cassiope has two very close allies in the species of the little genus *Harrimanella*. These differ in having ovoid instead of slender styles, corolla-lobes equalling the corolla-tube and solitary flowers at the apices of the branches. These plants are very small creeping undershrubs with minute foliage (in one case loosely imbricated) and in habit are extremely like the genus *Bryanthus*.

H. Stelleriana (Pall.) Colville has a remarkable distribution from Japan through North-Eastern Asia to Alaska and down the North American mountains to Washington. *H. hypnoides* (L.) Colville also has a striking area, occurring in Baffin Land and Greenland, reaching down to the North-Eastern States in America, and to Northern Europe and Asia. It is, however, absent from Eastern Asia and Western North America.

It will be apparent already that a comparison of the two genera *Phyllodoce* and *Cassiope* shows a number of striking similarities and some equally remarkable differences. In the following paragraphs the structural features are discussed first, and this is followed by a consideration of the geography of the two genera.

The fundamental differences of capsular dehiscence and anther-structure which cause the inclusion of the genera in two distinct tribes has been mentioned. Whatever the phylogenetic significance of these differences may be, the two genera certainly do not seem to be very closely related at the present time.

In point of size the genera are much alike, *Phyllodoce* having 8 species and *Cassiope* 10, but while those of the latter seem to be fairly equal in systematic value those of the former vary considerably. For example, *P. nipponica* and *P. alpina* are both very closely related to wider spread and commoner forms and should possibly be classed as local varieties only.

The nature of the specific differences in the genera is also very different. Of course, specific characters as such may be of no biological significance, but they are at all events based on the most marked and obvious characters in the genus. In the case of *Phyllodoce*, these characters are exclusively those of flower-structure, and differences of leaf- and stem-structure, while undoubtedly present, occupy a subordinate position. A comparison of floral structure actually allows the division of the species into two sub-genera. In *Cassiope* the reverse is the case. Here the flower-structure and organization are remarkably constant and the taxonomic diagnostic characters have to be sought in the leaf-form, and more particularly in the number and distribution of the hairs upon them. Flower-differences are, of course, present, but are relatively inconspicuous. The specific differences in *Cassiope* are much more similar in degree, and as a result the genus is not divisible into subgenera. These points have been emphasized in order to indicate the difference in actual constitutional make-up of two genera which in many other directions show considerable similarity. Another feature bearing upon the same point is the relative frequency of hybridization in *Phyllodoce* and its entire absence, as far as can be seen, in *Cassiope*.

Turning to smaller characters there are several interesting points. In both genera there is the same kind of character-variation present, such as length of pedicels, presence or absence of glandulation in the inflorescences, and of hairs upon the parts of the flowers. In flower-colour, on the other hand, *Phyllodoce* shows a much wider range than does *Cassiope*.

What is perhaps the most striking of all the structural relationships between the genera is in the nature of their closest generic relatives. In both cases the most nearly allied form is a monotypic or ditypic genus, and these genera are remarkably alike. Both *Bryanthus* and *Harrimanella* are tiny creeping undershrubs with very small narrow leaves not closely imbricated and with flowers at the apices of the branches. So close is the superficial likeness between the two that, if the purely tribal characters of capsular dehiscence and anther form are neglected, all three species would certainly be considered as closely related forms in one and the same genus. It is true that there is rather more difference between *Phyllodoce* and *Bryanthus* than there is between *Cassiope* and *Harrimanella*, and many systematists would not consider the last-named to be a good genus, but, by recognising all four, as is done here, the extraordinary relation between them is rightly stressed. As will be seen later, the similarity between the two very small genera does not extend to their geographical distribution.

Before leaving the structural aspect of the comparison emphasis must again be laid upon the ecological and biological equivalence of *Phyllodoce* and *Cassiope*. In this respect they are apparently completely interchangeable, and seem to afford one of the clearest and most authentic examples of biological similarity as a result of convergent development in two distinct phylogenetic lines.

When the genera are considered geographically a very marked difference is at once apparent. This is the presence of *Cassiope* and the absence of *Phyllodoce* in the great Himalayan–Chinese mountain-region. It is inconceivable that *Phyllodoce* is absent owing to the lack of suitable localities, because the two genera are known to grow together in many other parts of the Northern Hemisphere. Presumably, then, the explanation is that *Phyllodoce* has never reached these mountains. This particular difference in distribution is found in a great number of the genera which possess circumpolar arctic species. Some, as *Cassiope*, have their only extra-arctic range in the Himalayan–Chinese system, while others—as, for example, *Empetrum*—have extensions southwards in other parts of the Hemisphere, but are absent from the Himalayas. It is only rarely that the two types are combined in the same genus. This phenomenon seems clearly to indicate that the present arctic circumpolar flora has been derived from a number of geographic sources, the differences of which are suggested by the differences in the extra-arctic distributions of the genera concerned. In the case of *Cassiope* it may be suggested that the Himalayan group of species represents the more ancestral portion of the genus.

If these outlying species of *Cassiope* are for the time being neglected, the distribution of the two genera becomes directly comparable. In both cases there is a single very widespread completely circumpolar species, *P. cærulea* and *C. tetragona*, but the ranges of these two differ considerably in detail. The former has a very much greater southern extension in Eurasia, and includes the Central European mountains and Japan. On the other hand, it is not found on the western North American mountains, where the latter plant extends south as far as California. In the case of *Cassiope*, Japan forms the apex of a marked southern extension of the circumpolar range. Another marked distinction between the two genera is the occurrence of two species of *Cassiope* in North-East Siberia, where there are no endemic species of *Phyllodoce*.

Broadly speaking, the greatest similarity in the distributions lies in the grouping of species on either side of the Behring Straits and their distribution along both Pacific coasts. This is particularly marked in the case of *Phyllodoce*, of which seven out of eight species are confined to this region. The same thing is seen in *Cassiope*, but less marked, and the centre of the genus is shifted towards the centre of Asia. In *Phyllodoce*, again, it will be noticed that all the really well-marked species except *P. cærulea* are to be found on the American mountains. *Cassiope* has only one American endemic.

In Japan there are three endemic species of *Phyllodoce*, but all are very closely allied to wider-ranging species. This is a feature observable in many genera which reach Japan and is possibly an indication that the genera concerned have had a similar history. The Japanese endemic element in *Cassiope* consists only of a single very doubtful variety.

In conjunction with the foregoing account, the distribution of the

two related genera is of interest. *Bryanthus* is endemic to North-East Asia, and thus affords a parallel to two species of *Cassiope*. One of the species of *Harrimanella* has a range all the way from Northern California to Japan on both sides of the Pacific. This type of range is characteristic of *Phyllodoce*, but no single species is found on both American and Asiatic coasts. The second species, *H. hypnoides* (L.) Coville, which is rather more like the typical Cassiopes in facies, has quite a different range over eastern North America, Greenland, and northern and arctic Europe and Western Asia. In Hooker's *Flora Boreali-Americana* this plant is said to have been collected on the North-West Coast by Nelson. The specimen cited is in Herb. Mus. Brit. and turns out to be *Cassiope lycopodioides*.

The explanation of the distribution of *Phyllodoce* and *Cassiope*, with its strange similarities and differences is not at once clear. It does seem to indicate that the genera originated in quite distinct regions, *Phyllodoce* possibly in the mountains of America and *Cassiope* in Asia. It must also be remembered that these genera are among those most tolerant of arctic conditions, and would be among the forerunners in the colonization of land-areas uncovered by the retreating ice at the end of the Glacial ages. The resemblances in the present distribution may well be due to this similarity of habitat, and points to a similar later history. The differences in the distributions, on the other hand, may well be the relics of a dissimilar history in pre-Glacial times.

LINNÆUS'S SPECIES OF JUSSIEUA.

By William Fawcett, B.Sc., F.L.S.

Mr. H. N. Ridley, in Journ. Bot. lix. 257 (1921), has so seriously challenged the opinions of former botanists in the names to be assigned to species of *Jussieua* that, before venturing to name specimens for the *Flora of Jamaica*, it seemed advisable carefully to examine his statements.

There are certain considerations relating to Linnæus's methods of work which should be stated as a preliminary: The "trivial" name and the diagnosis given by Linnæus were the result sometimes of personal examination of specimens, and he added as synonyms the diagnoses or common names or figures given by other authors. If he had no specimen, he nevertheless classified other authors' contributions so far as he was able, adding again synonyms. It is frequently obvious that his definition must have been founded on a specimen, as it contains information not obtainable from the authors cited. As his knowledge became more exact, or on further consideration, he constantly corrected his synonymy, as may be seen on comparing the *Hortus Cliffortianus*, *Hortus Upsalensis*, first and second editions of the *Species Plantarum*, *Systema*, etc.

Many specimens examined by him and named were never contained in his Herbarium, and it is evident sometimes in later identifications that he had forgotten the appearance and character of the original

specimens. This has to be allowed for in consulting his Herbarium. If a specimen named by himself in his Herbarium is at variance with his original definition, we must accept the evidence afforded by the definition rather than that of the specimen named by himself or his amanuensis.

Besides considerations relating to Linnæus's work, we have to remember that species of *Jussieua* inhabit swampy places or ponds, which give rise to great variations in environment and corresponding varying forms in the characters of the several species. This may be well illustrated in the case of *J. repens* L., a species which varies in the size of the plant, its leaves, flowers, and indumentum. All the forms are connected by intermediates, but the character of the seed is the same throughout.

The great importance of the seed in determining species of *Jussieua* and their limits was pointed out by C. Wright (Journ. Linn. Soc. x. 476, 1869), confirmed by Micheli ("Note sur les Onagrariées, etc.," 9, 1874, from *Archives Sci. Biblioth. Universelle*), and demonstrated by him in his treatment of the genus in the *Flora Brasiliensis* (xiii. pt. 2, 147, 1875).

Jussieua erecta L. Sp. Pl. 388 (1753).

Linnæus, in Hort. Cliff. 491, 1737, describes a species of *Ludwigia*, and points out that there is a second species—namely, that figured in Rheede, Malab. ii. 97, t. 50, under the name of "Cattu-Carambu"; it was evidently not cultivated in Clifford's Garden, as it is not numbered, and the only information about it at the time was Rheede's description and figure.

In Fl. Zeyl. (1747) Linnæus defines a species (No. 170) of *Jussieua*, giving Cattu-Carambu as a synonym; there is no specimen in Herb. Hermann—only a drawing, t. 181, which bears a certain resemblance to Rheede's figure. Linnæus's diagnosis is "*J.* erecta, floribus tetrapetalis octandris sessilibus," and, as neither drawing gives any indication of stamens, he must have had some plant before him to enable him to state that it has eight stamens. The explanation is given in a note—"frequens hodie in hortis Academicis ex annuo semine." This implies that the diagnosis belongs to a cultivated plant in an Academic Garden, and that the figures of Rheede and Hermann are only synonyms like the other synonyms *Comm.* and *Raj.* This is made clear in *Hortus Upsalensis*, 103 (1748), where the same diagnosis is given accompanied by a description of a plant growing in the Garden, its habitat being America. But the synonyms *Rheed.*, *Comm.*, and *Raj.* are displaced by two others, *Pluk.* and *Seb.* In Sp. Plant. 388, the specific name *erecta* is given to the plant defined in Fl. Zeyl. and Hort. Upsal., with the same synonyms as in the latter. The doubtful inclusion of Plukenet's plant is indicated by the addition to the habitat "America" of the words "forte in Virginia." In Sp. Pl. ed. 2, 556 (1762), Linnæus omits Plukenet, and adds for the first time a synonym "Herba vitiliginum *Rumph. amb.* 6, p. 49, t. 21, f. 1." It is evident therefore that Ridley is not correct in assuming that

Linnæus founded his species on this drawing; and certainly Lamarck did not found his species *J. angustifolia* on it, as stated by Ridley, for Lamarck says that he has seen a specimen, and that he is doubtful whether the "Herba vitiliginum" is the same species.

A specimen exists in Herb. Linn. named by Linnæus, which may be taken as the type. A specimen in Herb. Miller (in Herb. Banks), *J. Onagra* Mill., is correctly named *J. erecta* L. by Banks's amanuensis. It was grown from seed sent to Miller by Houstoun from Carthagena, and it is possible this was the source of the plants growing "in hortis Academicis." Gaertner's drawing (Fruct. i. t. 31) is from a capsule "ex herbario Banksiano," and this capsule may very well have been one taken from the lowest axil of Miller's specimen. Micheli gives a good description of this species (Fl. Bras. xiii. pt. 2, 160); he states that it is a native of a great part of the earth.

J. erecta Ridl. (non L.) seems to be identical with *J. suffruticosa* L. as generally accepted.

Jussieua suffruticosa L. Sp. Pl. 388 (1753).

Ridley assumes that Linnæus founded his species, *J. suffruticosa*, on Rheede's "Carambu" (Hort. Malab. ii. 95, t. 49). The opinion of the older botanists is opposed to this. Lamarck, in describing his *J. villosa*, says it is probable that it is Linnæus's *J. suffruticosa*, but that the Linnean specific name is not a suitable one, and his synonymy is still more defective, for, he says, it is assuredly not the "Carambu" of Rheede. De Candolle (Prodr. iii. 58) agrees with Lamarck that the citation of Rheede as a synonym is incorrect. Grisebach (Fl. Br. W. Ind. 273) makes *J. villosa* Lam. a synonym of *J. suffruticosa* L., and places *J. angustifolia* Lam. in very close alliance with it. He adds numerous synonyms to each, but does not include Rheede. Bentham (Fl. Austral. iii. 307) combines these two species and accepts all Grisebach's synonyms. He says in confirmation that "the nearly glabrous forms distinguished sometimes as *J. angustifolia* seem frequently to pass into the villous ones in most localities." Micheli in *Flora Brasiliensis* is the latest exponent of species of *Jussieua*. He states his opinion that Rheede's figure cannot even be treated as a synonym—much less then can it be taken as the basis of Linnæus's definition. He divides what was considered by Bentham to be one world-wide species into two species—*J. suffruticosa* L. and *J. octonervia* Lam.

J. suffruticosa Ridl. (non L.) (see description and citations in Journ. Bot. *tom. cit.* 258), of which *J. fissendocarpa* Haines is a synonym, is *J. linifolia* Vahl.

Jussieua repens L. Sp. Pl. 388 (1753).

This species is the type of the genus (see Gen. Pl. 126, 1737), which was founded on Rheede's description and drawing of "Nir-Carambu" in Hort. Malabar. ii. 99, t. 51 (1679). The definition of the species occurs in Fl. Zeyl. no. 169, 75 (1748). There is a specimen in Herb. Hermann in Herb. Mus. Brit. (ii. f. 43) and two drawings (tt. 304, 374). In the Sp. Plant. Linnæus gives the same definition, but omits the first of three synonyms.

Jussieua peruviana L. Sp. Pl. 388 (1753).

Linnæus founded this species on the description and plate in Feuillée's *Journal des Observations, etc.* ii. 716, t. 9 (1714); his definition reads "*J.* erecta, floribus pentapetalis, pedunculis foliosis." The genus is originally described as pentamerous, and, although two out of four species of Sp. Plant. are tetramerous, this variation is considered exceptional and is so treated in Gen. Pl. ed. 5 (1754). Accordingly, Linnæus, in Syst. ed. 10, 998 (1759), classified Plumier's figure in Pl. Amer. (Burm.) t. 174. f. 2 with tetramerous flowers as a species of *Œnothera*—namely, *Œ. hirta*. Swartz (Obs. 142, 1791) corrected the name to *Jussieua hirta*, as Vahl did also a few years later. The drawings and descriptions of *J. peruviana* and *J. hirta* agree so well, except in the numbers of petals etc., that Grisebach (Fl. Br. W. Ind. 273) suggested in describing *J. hirta* that *J. peruviana* might be the same species with five petals. That this suggestion is correct is supported by the figure of *J. grandiflora* Ruiz & Pav. (Fl. Peru, iv. t. 382), which depicts a plant which is evidently the same as Feuillée's, with two flowers pentamerous and one tetramerous.

J. speciosa Ridl., *tom. cit.* 259, belongs to this species. An error has crept into the Latin description, which says "flores sessiles."

Jussieua pubescens L. Sp. Pl. ed. 2, 555 (1762).

This species has puzzled botanists. De Candolle puts it among "species non satis notæ." Micheli (Fl. Bras.) omits it altogether. Grisebach (*loc. cit.*) and Urban (Symb. Ant. iv. 467) offer the suggestion that it is the same as the species known under the various names—*J. leptocarpa* Nutt., *J. variabilis* Mey., *J. pilosa* H. B. & K. However, there is a specimen in Herb. Linn., named by Linnæus, with ripe capsules and seeds, which proves that it is *J. suffruticosa*.

Linnæus cites as synonyms Mill. Dict., Loefl. Iter 282, and Sloan. Jam. 85. Miller's specimen of *J. pubescens* in Herb. Mus. Brit. was grown from seeds sent by Houstoun from Jamaica, and is *J. suffruticosa*. We have no means of knowing what Loefling's plant was. Sloane's specimen, cited by Linnæus, is *J. peruviana* L.

It may perhaps be useful to state that *J. erecta* and *J. hirsuta* of Miller Dict. (1768), as shown by his specimens in Herb. Mus. Brit. are *J. suffruticosa* L.; his *J. Onagra* is *J. erecta* L.

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from Journ. Bot. 1925, p. 116.)

Rhizophoraceæ.

Cassipourea Brittoniana, sp. nov. *Arbor* usque ad 30 ped. alt. *Folia* 4–6 cm. l., elliptica, breviter acuminata, basi obtusa; petioli 3–4 mm. l.; stipulæ 4 mm. l., lanceolato-oblongæ, glabræ. *Flores* 1–3-ni, subvirides; pedicelli 3 mm. l. *Calyx*: tubus 2·5 mm. l., lobi 3·5 mm. l. *Petala* parte superiore fimbriato-lacera albo-villosa. *Stamina* calyce longiora.

Coco-plum of Troy.

Hab. Woods, Tyre, near Troy, 2000 ft., *Harris*, 10,670!

We have named this species after Dr. N. L. Britton, who indicated in the Jamaican Herbarium that it was a new species.

Nearly allied to *C. elliptica* Poir, but differs in the obtuse base of the leaves and shorter pedicels.

Myrtaceæ.

Calyptranthes Urbanii, sp. nov. *Arbor* 30 ped. alt.; ramuli annotini glabri, hornotini tomentosi, uterque teretes vel subcompressi. *Folia* 9–10 cm. l., ovali-elliptica, acuminata, basi obtuso, subtus basi atque nervo medio tomentosa, nervo medio supra impresso subtus prominente, nervis lateralibus venisque supra applanatis aut vix prominentibus, subtus prominulis, tenuissime et creberrime punctulata, punctis non pellucidis, subcoriacea, margine non recurva; petioli 6–7 mm. l., tomentosi. *Inflorescentiæ* rufo-tomentosæ, foliis brevi-ores, paucifloræ; pedunculi 3·5–5 cm. l., 3 ad nodum terminalem umbellati, ramulis vegetativis carentes, 1–3-trichotomi, ramulis ultimis cymulum 3-flore gerentibus; pedicelli 5–12 mm. l., tomentosi. *Baccæ* 8 mm. diam., atræ.

Hab. In fruit only, in September, on banks of Black river between Lacovia and Elam, *Harris*, 9846!

We have named this species after Prof. Dr. I. Urban, who has elaborated the Myrtaceæ of the West Indies.

Allied to *C. nodosa* Urban, but differs in the presence of tomentum on back of leaf and petiole, and the longer petiole.

Eugenia Nicholsii, sp. nov. *Ramuli* hornotini puberuli. *Folia* 5·5–3 cm. l., 1·5–2 cm. lat., lanceolata v. anguste elliptica, acuminata, acumine longo, obtuso, basi rotundata v. obtusa, nervo medio supra impresso, nervis lateralibus venisque supra vix conspicuis, subtus prominulis, punctis pellucidis supra impressis, subtus in juvenilibus conspicuis, glabra, coriacea; petiolis 5–6 mm. l. *Inflorescentiæ* terminales atque axillares, 3–10-floræ, racemulosæ, rhachi terminalis 1-3·5 cm. l., axillaris 4–10 mm. l., glabræ, glandulares; pedicellis 4–6 mm. l.; bracteolis 1·2 mm. l., ovatis, ciliatis. *Sepala* 2–1·5 mm. l., semicircularia v. rotundata, ciliata. *Petala* elliptica, 3·5–4 mm. l.

Ovula in quoque loculo circiter 12. *Bacca* ellipsoidalis, 6 mm. l., 1-sperma.

Hab. Morses Gap, 5000 ft., Blue Mts., *G. E. Nichols*, 23!

Allied to *E. crenata* Berg, which differs in having more abundant smaller flowers with longer pedicels. Type in Herb. Kew.

Eugenia Wilsonella, sp. nov. *Ramuli* hornotini glabrati. *Folia* 3·5 cm. l., 10–17 mm. lat., lanceolata vel elliptico-lanceolata, acuminata, acumine acuto, basi acuta v. obtusa, nervo medio supra impresso, nervis lateralibus venisque supra vix conspicuis, subtus prominulis, punctis pellucidis supra juvenilibus prominulis aut impressis aut obsoletis, subtus prominulis aut obsoletis, supra præsertim nervo medio puberula, tandem glabrata, chartacea; petiolis 3 mm. l. *Inflorescentiæ* axillares, 4–6-floræ, racemulosæ vel subglomeratæ, rhachi 2·0 mm. l., minute puberulæ vel glabratæ, pedicellis 4–8 mm. l., bracteolis 1·5 mm. l., triangularibus, acutis basi conjunctis. *Sepala* 1·5–1·1 mm. l., rotundata, ciliata, apice mucronato, calycis tubus verruculosus. *Petala* 3–3·5 mm. l. *Ovula* in quoque loculo 2–7.

Hab. Locality in Jamaica not stated, *Wilson*!

The inflorescence sometimes grows on into a leafy shoot.

Allied to *E. abbreviata* Urb. and *E. Schulziana* Urb., but differs in its leaves, the longer pedicels, and other characters. Type in Herb. Kew.

Chenopodiaceæ.

Atriplex cristata Humb. & Bonpl. ex Willd. Sp. Pl. iv. 959 (1805), see *Flora of Jamaica*, iii. 125 (1914). *Spinacia littoralis* Jacq. Enum. 33 (1760), the identity of which has hitherto been uncertain, is shown by a specimen received from Jacquin in Herb. Banks (in Herb. Mus. Brit.) to be synonymous with the above. A new combination is therefore necessary, namely, *Atriplex littoralis*.

A MYSTERIOUS PLANTAGO.

By C. E. Salmon and E. G. Baker.

In A. W. Bennett's herbarium (now in the possession of C. E. Salmon) an interesting *Plantago* exists, labelled "*P. argentea*. Great Arran Isle, West Coast of Ireland, 1849, Wm. Andrews." Its beautiful silky leaves, decumbent-ascending scapes, and rounded capitula showed us at once that we had here an unrecognized member of the Irish flora.

An examination of the material in the British Museum Herbarium soon led us to the conclusion that our plant was undoubtedly the Pyrenean *P. monosperma* Pourr. (*P. argentea* of some authors, but not of others). The following is Pourret's description of the plant (Mem. Acad. Toul. iii. 325, 1788):—foliis lineari-lanceolatis, sericeis, scapum æquantibus; spica ovata; capsulis monospermis. Dans les Pyrénées, à Nouris, Eynes, Anas, etc. A somewhat amplified description would run as follows:—A perennial of 3–10 cm., silky-hairy, with a thick obconical rootstock; scapes spreading, not striate, with adpressed hairs, exceeding the leaves; leaves in a dense rosette,

silvery-silky on both sides, lanceolate-linear, sessile, with 3–5 nerves; spikes somewhat hairy, subglobular, small (5–10 mm. long); bracts oboval-rounded, emarginate and apiculate, silky on the back; sepals rounded, the lateral ones carinate; corolla glabrous, with oval lobes; capsule oval, with 2 oblong seeds, canaliculate on the inner face, rugose.

At once our hopes ran high that we had unearthed another member of the Lusitanian element of Western Ireland, and it was only when we investigated the collector's past history that certain disquieting mists of doubt began to arise. William Andrews (1802–80) was for a time President of the Dublin Natural History Society. The Biographical Index (Britten and Boulger), p. 5 (1907), tells us, *inter alia*, that he discovered *Trichomanes radicans Andrewsii* and wrote upon Irish *Saxifrages*. In Journ. Bot. 1883, 152, A. W. Bennett reported the finding in his herbarium of several examples of *Saxifraga pedatifida*, labelled as having been gathered in Achill Island in 1853 by W. Andrews. This note drew a further one from Mr. T. H. Corry (p. 181), who wrote: "Irish botanists have of late years regarded the distributed plants of Andrews (especially *Saxifrages*) as open to very grave question with reference to the localities from which they were reputed to be derived; for it is no secret that many of these plants were taken from specimens cultivated in Mr. Andrews's garden, and that hence accidental mistakes in their issue not unfrequently arose." He considered that *S. pedatifida* belonged to this category.

There is no doubt that Andrews visited Great Arran Island (see Hooker, Lond. Journ. Bot. iv. 569, 1845), but no mention is made of any *Plantago* discovered. One cannot therefore say definitely that *P. monosperma* does not occur there. If grown in his garden, it was a very critical species to be in cultivation, and we cannot find that it was known in the Royal Botanic Garden, Glasnevin, or at Kew, in those days.

Altogether, the whole record is wrapped in mystery, and this note is written to ask adventurers to that Island on the west coast of Ireland to gather any suspicious silky-leaved *Plantago* and to send it to one or other of us for examination. Care should be taken to discriminate between this plant and forms of *P. lanceolata*, particularly those with hairy or silky leaves.

THE BRITISH OROBANCHE LIST.

By H. W. Pugsley, B.A., F.L.S.

While recently examining, with the aid of Dr. G. Beck's *Monograph*, a few species of *Orobanche* which I collected last June near the Pyrenees, the disparity between the nomenclature of the *Monograph* and the new edition of the *London Catalogue of British Plants* attracted my attention and suggested the following notes.

The new British list, which is the same as that in the previous edition except for the addition of *O. reticulata* b. *procera*, is represented in the *Monograph* as follows:—

Sect. Trionychon Wallr.
Sect. *O. purpurea* Jacq.; *O. arenaria* Borkh.
Sect. Osproleon Wallr.: subsect. Angustatæ.
Trib. Galeatæ. *O. caryophyllacea* Sm.
Trib. Curvatæ. *O. major* L. (*O. elatior* Sutton) with f. *Ritro* Beck (*O. Ritro* Gren. & Godr.).
Trib. Arcuatæ. *O. Rapum-Genistæ* Thuill. (*O. major* auct.).
Trib. Glandulosæ. *O. alba* Stephan f. *rubra* Beck (*O. rubra* Sm.); *O. reticulata* Wallr. f. *procera* Beck.
Trib. Minores. *O. amethystea* Thuill.; *O. Picridis* Schultz; *O. minor* Sutton with f. *Crithmi-maritimi* Beck (var. *flavescens* Reut.); *O. Hederæ* Duby.

Of these names, *O. arenaria*, which stands first in the Catalogue, should apparently have been deleted, as suggested by Mr. Lester-Garland in 1904 (Journ. Bot. xlii. 119) and by Messrs. Groves in the ninth edition of Babington's *Manual*. Syme's Alderney specimen in Herb. Mus. Brit. seems to be a scrappy example of *O. purpurea*. According to Beck, *O. arenaria*, which has distinctly larger flowers than *O. purpurea*, is parasitical not on *Achillea* but on *Artemisia*. I have collected it on *Artemisia campestris* at Stalden, in the Swiss Valais.

It will be seen that Beck applies the Linnean name *O. major* to *O. elatior* Sutton, rather than to *O. Rapum-Genistæ* Thuillier. The *O. major* of the *Species Plantarum*, as he points out (Mon. p. 4), represents not any single species, but in a general sense the whole section *Osproleon* of the genus. Of this, 53 species are described in the *Monograph*. In *Flora Suecica*, ed. ii. 219 (1755), however, a single plant is described as *O. major* by Linnæus, viz.: the one species native in Scandinavia, subsequently named *O. elatior* by Sutton. The limitation of *O. major* L. to this form, when other species of the section are admitted, seems to accord with Art. 47 of the Vienna Rules, and the case appears different from what it would have been had the original Linnean name included only *O. elatior* and *O. Rapum-Genistæ*. But the sheet of *O. major* in the Linnean Herbarium contains neither of these two plants. Its two specimens strongly resemble *O. Picridis*, and it is annotated in Smith's handwriting "*minor*, Mr. Sutton." This introduces a further complication, and it is debateable to what plant the name *O. major* L. should be applied.

Orobanche Ritro Gren. & Godr. f. *hypochæroides* Beck, which formerly followed *O. major* (*O. elatior* Sutton) in the Catalogue, but is now unfortunately separated by the interpolation of *O. reticulata*, is treated by Beck in his *Monograph* as a form only of *O. major*, distinguished by its dwarfer habit and different colour. The form-name *hypochæroides* of the Catalogue has not been published, I think, and was apparently intended simply to indicate that in Jersey the plant grew on *Hypochæris radicata* instead of on *Echinops*. *O. Ritro* is treated by Rouy (Fl. France, xi. 181) as a race of *O. major*, and seems to be permanently distinct.

It is noteworthy that Beck does not include *Ulex* among the hosts of *O. Rapum-Genistæ*, nor does Rouy in his *Flore de France*. I have seen this species only on Broom, but it is recorded as growing also on Furze by numerous British authorities.

Orobanche rubra Sm. is identified by Beck with *O. alba* Stephan in Willd. Spec. Plant. iii. 350 (1800), of which it is reduced to a colour-form. Mr. Arthur Bennett drew attention to this in 1903 (Journ. Bot. xli. 380). At the Lizard, and perhaps generally in Britain, the flowers of this species are of a deep purplish red, but in the Alps, where the plant is widely distributed, their colour varies from dark red to a light flesh tint, more or less suffused with red, as shown in Beck's figure of *O. alba*. This light-flowered form must presumably be regarded as the specific type.

The addition of *O. reticulata* Wallr. to the British list is of considerable interest. As a species absent from Northern France, and whose headquarters are the Alps, whence it extends to Eastern Europe, it would not be expected to occur in Britain. But the original record from near Leeds is doubtless correct, and the plant may be a true native there. It is to be regretted that the later records do not appear equally authentic, for the probability that the species is indigenous would be much strengthened if its occurrence in several neighbouring localities could be established.

The existence of *O. amethystea* Thuill. in Britain, though commonly taken for granted, is, I think, open to question. It has been regarded by British botanists as a maritime species, parasitic on *Eryngium maritimum* and *Daucus gummifer*, but Beck mentions *Eryngium campestre* as its only certain host, and cites *E. maritimum* and *Daucus* on the authority of Sowerby and Hooker. The stations that he gives are mostly inland ones. Babington, too, remarks in his *Manual* that the British *O. amethystea* may perhaps be a form of *O. minor*. The true *O. amethystea* Thuill., as described by Beck and confirmed by authentic Continental exsiccata, appears to differ from *O. minor* chiefly in the much larger flowers (15–23 mm. long, instead of 10–18 mm.), by its long subulate calyx-teeth, and by its less glandular corolla. This plant may occur in the Channel Islands, but the form recorded as *O. amethystea* (on *Eryngium maritimum*) from St. Helen's Spit, Isle of Wight, is clearly *O. minor* (*vide* Journ. Bot. li. 336), and that occurring on *Daucus* on the Kentish coast and elsewhere does not at all agree with Beck's account.

Orobanche Picridis Schultz seems very closely allied to *O. amethystea*, and has similar long calyx-teeth. But it is much paler in colour, with more glandular corollas, and its delicately-tinted spikes are quite beautiful in well-grown examples. The oldest British records for this species are indisputable, but more recent ones, especially for a form growing on *Crepis virens*, should probably be referred to *O. minor*.

The commonest species in Britain at the present day is certainly *O. minor* Sutton, which not only frequently infests clover-fields in the south, but grows in wild situations on a great variety of plants.

A large-flowered form, with corollas attaining 18 mm. in length, which is not rare, seems referable to Beck's form *procerior* (*O. minor* var. *procerior* Reichb. Iconogr. vii. fig. 880). According to Dr. Druce (Journ. Bot. xlix. 300) the variety *flavescens* Reut. from Jersey proved to be *O. major* f. *Ritro* Beck.

ABSTRACTS OF PAPERS OF INTEREST TO STUDENTS OF THE BRITISH FLORA.

THE FORTY-FIRST ANNUAL REPORT OF THE WATSON BOTANICAL EXCHANGE CLUB, 1924–25 (vol. iii. no. 8).

The following are among the more interesting notes :—

Sagina ciliata Fries. Chiefly the glandular form. Sand Point, N. Somerset, July 5, 1924.—H. S. THOMPSON. This is a small state, due, perhaps, to exposure, of *S. filicaulis* Jord. It holds a middle position between *apetala* and *ciliata*. The sepals are not invariably appressed to the ripe capsule, and it differs from both species by its more filiform peduncles, smaller flowers, etc. From *S. ciliata* it is distinguished by its sepals being less acute, shorter in proportion to the ripe capsule, etc. I am not surprised Mr. Thompson named it *ciliata*; Corbière considered it a variety of the species. C. E. S.

Saxifraga umbrosa L. var. *genuina* Syme. Cult. at Wimbledon, June 15, 1924. Origin, Heseldon Glen, Yorks, 1919.—H. W. P. This is the variety *genuina* Syme (E. B. ed. iii., iv. p. 70), collected in the glen where it was originally discovered in 1792. It is distinguished by Syme as having "leaves spreading, in compact rosettes; lamina oblong-obovate, crenate; petioles short," while the usual Irish form, var. *punctata* Haworth, is diagnosed "leaves ascending, in rather lax rosettes; lamina obovate-roundish, crenate-serrate; petioles longer than in *genuina*." The leaves of var. *genuina* are also notable for their very dark colour and marked cartilaginous margins, and for the remarkably broad, truncate, apical tooth. Both of these varieties differ from the "London Pride" of British gardens, which has leaves of somewhat intermediate form, long-petioled and ascending as in var. *punctata*, with crenate margins, but not apically truncate. Its flowers are larger than those of var. *genuina*, with broader, more finely-speckled petals. This form is represented in Herb. Mus. Brit. by specimens from the Chelsea Garden, and by material from Culborne, Somerset; Thorp Arch, Yorks; Ashwood Dale, Derby; and Dingle, Kerry. In these places it has been introduced, unless possibly wild at Dingle. I have seen no certainly wild examples that match this form, which Marshall and other authors do not seem to have distinguished from var. *genuina*. The variety *genuina* occurs in Britain only in a few Yorkshire glens, where it has been considered a native by Babington and other good botanists who have seen it *in situ*. It appears to be identical with the Pyrenean form of the species, while the Irish variety, *punctata*, coincides with the plant growing in the mountains of Asturias and

Portugal. This interesting fact is readily seen on going through the material in Herb. Mus. Brit., and the difference between the two forms in Spain is noted by Wilkomm and Lange (Fl. Hisp. iii. 125). The variety *genuina* seeds readily in my garden, but I have never found a seedling of "London Pride."—H. W. Pugsley.

Galium palustre var. *elongatum* Presl. Lane N. of Horsell Common, Woking, Surrey, Sept. 1924.—W. Biddiscombe. This plant, though robust, cannot, I think, be referred to var. *elongatum* (*G. elongatum* Presl), which, according to Rouy (Fl. France, viii. p. 43), has very smooth stems, much thickened at the nodes, and lanceolate leaves, not dilated towards the apex. It seems nearer to var. *umbrosum* Aschers. (Flor. Brandenb.), as described by Rouy (*l. c.*). I have collected in Surrey a robust form of *G. palustre* that differs from this plant and agrees with the description of var. *elongatum*.—H. W. P. This does not quite agree with the true *G. elongatum* Presl, but it is the var. *elongatum* of some British authors. The true *elongatum* has leaves attenuated at the summit and ample many-flowered panicles. This plant is a form of var. *umbrosum* Ascherson. Dr. Cesarini Chiti, in Nuov. Giorn. Bot. Ital. Nuov. ser. xvi., has a careful paper on these plants. Ascherson, in Flor. Brandenb., describes var. *umbrosum* as follows (trans.):—"Leaves large, thin, linear-obovate, in approximating whorls. Inflorescence few-flowered. Shady, marshy places." There seems to be a slight discrepancy between this and Rouy's description of the plant. The latter says that the panicles are "large, many-flowered."—E. G. Baker.

Centaurea aspera L. Le Quenvais, Jersey, May 31, 1896.—J. W. White. A few of the more vigorous specimens of this gathering, with the leaf-bases distinctly auriculate, may be safely placed to var. *auricularia* DC., in Prodr. vi. 600, described in the following terms:—"Foliis inciso-dentatis basi utrinque auriculatis amplexicaulibus." I have indicated the specimens that, in my opinion, may pass as the variety.—C. E. Britton.

Salix triandra L. var. *concolor* Koch, *S. amygdalina* auct. Walton withy-bed, near Clevedon, N. Somerset, May 24 and Sept. 2, 1924. Leaves bright green on both sides, and so should be the variety or form *concolor*. This Walton plant, however, has been accepted as *S. amygdalina*, which Andersson, according to Buchanan White, regarded as equivalent to *discolor* Koch—the glaucous-leaved form. These forms grow together at Walton, and, as it has been found that both glaucous leaves and green ones may be borne on the same plant, it cannot be worth while to trouble about such so-called varieties of *S. triandra*.—Jas. W. White. Correctly named. The narrowly-oblong leaves, nearly of equal width throughout the greater part of their length, and suddenly narrowed to both ends, are characteristic of the typical form of *S. triandra*, as distinguished from *S. triandra* L. var. *amygdalina* (Sm.). Both have forms with

the leaves green (*concolor*) on the under surface and glaucous there (*discolor*). The best form of the leaves is well shown upon the strong summer growths. All the shoots are full and well dried.—J. Fraser.

Carex contigua × *vulpina?* Ref. No. 4423. Lane-side, near Whitchurch, N. Somerset, June 11, 1922. Both parents and *C. divulsa* were near.—H. S. Thompson. This is a very interesting gathering, and I believe Mr. Thompson is right in labelling it *contigua* × *vulpina*. The more slender, less-winged culms are those of *contigua*, and the perigynia in many cases are strongly veined, as in *vulpina*. In several fruits examined the nuts seemed quite sterile.—C. E. Salmon. This seems likely to be correct, but seems to want the rampant growth of *vulpina*, but may be overpowered by the lesser growth of *contigua*. If so, I can find no record of such a hybrid.—A. Bennett.

E. G. B. & C. E. S.

H. von Oettingen, "Critical Observations on the Genus Poa L., especially on the Section Pachyneurae Aschers.," Fedde, *Repertorium*, xxi. 306 (July 1925).

Dr. von Oettingen carefully contrasts, in tabulated form, the following species of the genus *Poa*:—*P. pratensis* L., *P. Chaixii* Vill., *P. remota* Forselles, and *P. hybrida* Gaud. He has one novelty, *P. athroostachya*, occurring in the marshy meadows, scrub, and open woods of the north German fens. Of its position in the genus he says:—"*P. athroostachya* is most nearly allied morphologically to *P. Chaixii* Vill. and *P. pratensis* L., from which it may be distinguished as follows:—From *P. Chaixii* it differs in the shape of the spikes, the dislocation of the spikelets on the panicle, the hairiness of the flowering glume veins and of the base of the glume (*lana conjunctiva*), and in the less close toothing of the keel of the pale. From *P. pratensis* it differs in the breadth of the leaf-shoots, their striking flattened form, the shape of the spike, the dislocation of the spikelets, the rough intercostal space of the flowering glume, and the unusual toothing of the keel of the pale." (In *P. pratensis* the teeth are much more regular in size, and are wider apart.)—E. G. B.

"The Sixteenth Report on the Flora and Botany of Devon," by Miss C. E. Larter, Recorder (Trans. Devon. Assoc. Advan. Science, Lit. & Art, lvi. 111–121, 1924), contains the following interesting records:—*Draba muralis*, Bishop's Tawton. Miss V. Fogwell. New to Devon.—*Ophrys apifera* var. *Trollii*: Near Seaton. Mr. Barr.—*Lilium Martagon*. Near Luppitts. G. T. Harris. From the description of the locality this may prove to be native thereabouts. *Herniaria glabra*. Haccombe-cum-Combe.—Miss R. E. Carr Smith. Claimed as a new county record, but surely only as an alien? *H. glabra* is apparently only a true native of East Anglia.

There are many other plant-notes of value, but botanists have only themselves to blame when it becomes necessary to state that "*Bupleurum aristatum* . . . has suffered from depredation, and only four specimens . . . remained in the well-known station."

C. E. S. & E. G. B.

OBITUARIES.

William Norwood Cheesman
(1837–1925).

Mr. William N. Cheesman, who died at his residence in Selby, on Nov. 7th, aged 78, was a well-known Yorkshire naturalist and antiquarian. Although a business man, the head of an important undertaking, he found time, during his busy life, to devote to the study of natural history, and especially to botany, with many branches of which he was familiar. He was, however, during the later years of his life, mainly concerned with the study of Mycetozoa, and not only made himself acquainted with their microscopic structure and life-histories, but contributed much to our knowledge of their distribution, both in this country and in various other parts of the Empire, to which from time to time he journeyed as a member of the British Association, and from which he usually returned with collections and observations of great interest. He was a man who always inspired in his fellow-workers feelings of respect and affection, and many of his younger colleagues will carry with them pleasant memories of the old Mycologist and his kind and considerate treatment of them as beginners in the science he loved so well. He was an important figure in the town of Selby, and many years ago, in recognition of his sterling worth as a public-spirited man, he was made a Justice of the Peace for the West Riding of Yorkshire. His long and close association with Selby Abbey, in which he took the greatest interest, and about which he had a store of information, aroused in him an interest in antiquarian lore, and he became a well-known and influential member of the Yorkshire Archæological Society. As a prominent Freemason, he took a great interest in the history of Freemasonry, and wrote many interesting and valuable papers. For many years he had been a Fellow of the Linnean Society (elected 1903), a Member of the British Association, and a valued member of the Yorkshire Mycological Committee. He had been President of the Yorkshire Naturalists' Union, and at the time of his death he was President of the British Mycological Society, of which he was a foundation member. It is, perhaps, of some interest to remember that it was in the town of Selby that this Society was founded. He was a generous contributor to many worthy objects, and his last donation to scientific work was a gift of £100 to the British Mycological Society.

Those of us who knew him well feel that we have lost a sympathetic friend, a charming companion, and a wise, upright-living man.

H. Wager.

List of Mr. Cheesman's Botanical Papers, compiled by W. Ellis, of the Department of Botany, British Museum.

A Christmas Afternoon's Fungus Ramble near Selby, Yorkshire. *Naturalist*, 1903, 101–104.

Schizophyllum commune in East Yorkshire. Nat. 1904, 122.

Badhamia punicea. Nat. 1905, 189.

Contribution to the Mycologic Flora and the Mycetozoa of the Rocky Mountains. Trans. British Mycol. Soc. iii. 267–276 (1911).

Economic Mycology. Nat. 1917, 185–200.

Polyporus Rostkovii in S.E. Yorks. Nat. 1918, 270.

Fungi in Yorkshire. Nat. 1921, 176.

A Contribution to the Mycology of South Africa, with a Note on the Coprophilous Fungi by T. Gibbs. Journ. Linn. Soc. (Bot.) xxxviii. 408–417 (1909).

Mycetozoa of Australia and New Zealand (with G. Lister). Journ. Bot. liii. 203–212 (1915).

Notes on Mycology of Yorkshire Naturalists' Union Forays. Nat. 1912–18.

William Rickatson Dykes
(1877–1925).

The news of the tragic death of Mr. W. R. Dykes on December 1, as the result of an accident to his motor-car, was a great shock to his many friends in botanical and horticultural circles. Born on November 4, 1877, he was educated at the City of London School, whence he went to Wadham College, Oxford, where he is still remembered as a great football player. He gained honours in the classical schools and then studied in Paris where he took the L.-ès-L. in the University. For sixteen years he was a master in the Charterhouse School, where his leisure was devoted to the study and cultivation of Irises, in which he was a disciple of the late Sir Michael Foster. After Foster's death he was recognized as the authority on the genus, and in 1913 he published the important monograph "The Genus Iris," on which depends his reputation as a botanist. An exhaustive review of the book by the late James Britten will be found in the Journal, 1913, pp. 103–9. This monograph is one of those valuable contributions to botanical systematic literature, which, like Maw's monograph on the genus "Crocus," combines the first-hand knowledge of the collector and cultivator with study in the herbarium, and will long remain the standard work of reference on the subject. Mr. Dykes contemplated a similar work on Tulips, which he had studied in the field, garden, and herbarium for many years, but he admitted that so far he had been unable to find distinctive characters between many of the species. Dykes had also a good general knowledge of horticulture, and his appointment as Secretary to the Royal Horticultural Society in 1920, on the retirement of the late Rev. William Wilks, was undoubtedly a welcome change from schoolmastering. Mr. Wilks was a difficult man to succeed; he had nursed the Society from a condition of insolvency to one of almost surprising prosperity, and Dykes came in on the flowing tide. During his short period of office the general enthusiasm for gardening has shown no signs of decreasing, and the new secretary found his duties continually increasing. The strenuous work of the last few years has included arrangements for a new hall and offices necessitated by the rapid increase in membership of the Society. Sad, indeed, is it that he has been struck down in the prime of life with the promise of many years of useful work unfulfilled.

Mr. Dykes was elected F.L.S. in 1920, and had, we understand, been recently nominated to a vacancy on the list of Victoria Medallists of Honour of the Royal Horticultural Society.

Rev. Samuel James Whitmee, F.R.G.S.

(1838–1925).

To this veteran of the London Missionary Society, whose death on December 10 is announced, science owes pioneer work of exploration in the South Pacific. He left England for Samoa in 1863, and during 14 years worked in this and other islands of the South Pacific, including the Gilbert group and Loyalty Islands. His natural history collections, which included plants from the islands mentioned, were acquired by the British Museum. He returned to England in 1877, but from 1891–94 was again in Samoa, engaged in work for the London Missionary Society, and during this period became an intimate friend of Robert Louis Stevenson.

Dr. Rudolf Schlechter

(1872–1925).

In the summer of 1895 a very keen and energetic young German botanist worked for some weeks in the Department of Botany at the Museum. He had just returned from South Africa, where he had made extensive botanical collections, including many novelties and rare species. He was specially interested in Asclepiads and Orchids, and it was chiefly these that he studied during his stay in London. Young Schlechter had a great capacity for work, a remarkable memory, great ambition, and considerable self-confidence. I saw a good deal of him and he told me many things; *e. g.* that without a good memory it was of no use trying to be a botanist, one had better give it up and be a merchant; also, that he had set himself to describe at least one new species every day. He must have gone a long way towards achieving this ambition, for he was a most industrious collector and indefatigable worker. In addition to extensive trips in South and South Tropical Africa, he visited West Africa (including the Yoruba country, Cameroons, and Togo-land) (1895–1898) as leader of an expedition on behalf of the German Colonial Department for investigation of the caoutchouc industry; the botanical appendix to his *Westafrikanische Kautschuk-Expedition* (1899–1900) includes the names of many new species. In 1901–2 he was in German New Guinea, which he again visited in an official capacity from 1906–1909. Though his work was ostensibly economic he found time for the collection and study of the Orchids, with the result that whereas 90 species belonging to 32 genera were known from the area in 1901, his collections brought the total up to the surprising number of 1450 species (1102 of which were new), representing 116 genera. His systematic description *Die Orchidaceen von Deutsch-Neu-Guinea* (1911–14) forms a large octavo volume of over 1100 pages. Schlechter also visited New Caledonia (1902–3); the results of his collections were published in Engler's Bot. Jahrb. vols. 36 & 39; here again he specialized in the Orchids.

In the intervals of his various collecting trips he came to London, visiting the herbaria at Kew and the British Museum. He was always interesting, though he trod on one's toes and was no respecter of persons or things.

Before the war he had married and settled down in Berlin, where he had taken his Ph.D., and was appointed Custos in the Botanical Museum. He continued his taxonomic work, devoting himself mainly to the Orchids, both of Old and New Worlds, including enumerations of those of the Chinese-Japanese regions and various parts of tropical America, which were published as Beihefte of Fedde's *Repertorium*.

A. B. R.

SHORT NOTES.

Veronica agrestis var. micrantha var. nov.—A typo differt floribus minutis corollis fere 3 mm. latitudine petalis omnino albidis vel nervis pallide cœruleo-pictis.

In July 1912, in a garden on the Boulder-Clay at Finchley, Middlesex, v.c. 21, occurred on a large crop of *Veronica agrestis* L., which differed very markedly from the ordinary plant in the minute and very pale-coloured corolla. The habit was slender and straggling, and the general colour pale green. The plant was grown from seed for several successive years and retained its characteristics, and there seems to be no doubt that it is a good variety; I have been unable to find any reference to such a plant in the literature.—E. Drabble.

London Catalogue, Ed. xi.; Corrections.—In the *Rubus* catalogue, under 487 *incurvatus*, omit reference to var. *rotundifolius*, *subcarpinifolius* is thus b. not c. 518 *Colemanni*—for Bab. read Blox. Under 525 *leucostachys*, ×*pulcherrimus* should read ×*polyanthemus*; and the author of c. *leucanthemus* should appear in brackets (*P. J. Muell.*).

In the *Apium* list, "*Moorei*" should read "×*Moorei*."—H. J. Riddelsdell.

REVIEWS.

Monocotyledons: a Morphological Study. By Agnes Arber, M.A., D.Sc. Royal 8vo, pp. xvi & 258; with frontispiece and 160 figs. Cambridge University Press, 1925. Price 21*s*.

An association more or less intimate, of many years' duration, with the Monocotyledons, has led me to the conclusion that they represent in our present state of knowledge a watertight compartment. For the most part an extraordinarily well-defined group, they show, within the limits of the definition, a remarkable variety of form and arrangement of parts, which, considering the moderate size of the group, exceeds that presented by the other far larger group of Angiosperms—the Dicotyledons. Outside the well-defined enclosure are small orders marked, as in the Helobieæ, by one or more distinct characters, or, as in Pandanales, by striking lack of definition. My friend Mr. H. N. Ridley, from whom I took over the charge of the Monocotyledons at the British Museum on his departure for Singapore in

1888, and who has a pre-eminent knowledge of this group in the field, will forgive me for quoting an incident. We were looking together at the microscopical preparation of Mr. Hamshaw Thomas's male flower of the Caytoniales at the Royal Society's conversazione last summer. "What does it remind you of?" I asked; and simultaneously we said "*Pandanus*!" But we will not pursue the subject.

I have read Dr. Arber's book with great interest. Though her expressed aim is to describe "pure" as contrasted with "applied" morphology, she has, I think, successfully laid the ghost of the derivation of Monocotyledons from Dicotyledons, which had been constructed on the basis of the supposed relationship between the seed-leaves of the two groups, and has discredited the assumption that the smaller has arisen from the larger group as the result of adaptation to a special mode of life.

This volume is one of the excellent Cambridge Botanical Handbooks, several of which, including volumes on Lichens, Fungi, and Ferns, have already appeared. The late Ethel Sargant was prevented by failing health from writing a book on Monocotyledons, but Dr. Arber acknowledges a debt of gratitude for training received from Miss Sargant, first as assistant and later as colleague in her investigation. She has also had the use of Miss Sargant's library and collection of slides. Appropriately she has dedicated the volume to her former teacher and fellow-worker. At the first glance, the most striking feature of the book is the wealth of illustration. The author is artist as well as investigator, and a large proportion of the figures are by her own hand. The majority of the 160 figures contain a number, often a large number, of drawings, so that the individual figures must run into many hundreds.

In an introductory chapter on the principles of morphology the author explains her standpoint, which is that of pure morphology—the comparative examination of form studied in itself and for its own sake, and directed to the discovery of what A. P. de Candolle called "les lois générales de la symétrie organique"—as contrasted with applied morphology, which seeks to use the evidence of form to elucidate evolutionary history, and which, in the author's opinion, has proved bankrupt. The author also emphasizes the importance of anatomy in deducing the homologies of an organ, and regrets the neglect of vegetative characters generally, as contrasted with reproductive, as indicators of affinity.

In successive chapters the vegetative organs are described at length—the root, the axis, the foliage-leaf, and the prophyll. The root of the Monocotyledon is characteristic. The ephemeral radicle is early replaced by adventitious roots, and most of the peculiarities of the root can be correlated with lack of normal secondary thickening and absence of a deep-seated periderm, features which are probably themselves connected; the frequent tuber-formation is in part an expression of the importance of the cortex owing to absence of secondary thickening. The mechanism of the contractile cortex is still an unsolved puzzle. The chapter-heading "axis" is used

"in deference to the accepted units of morphology," but in view of the leaf-skin theory recently elaborated by Miss E. R. Saunders, it is preferable to treat leaf and axis together as an entity, the shoot. The poor branch-development of Monocotyledons, as compared with Dicotyledons, is regarded as the result, not of an inherent incapacity for branching, but as merely a mechanical effect of the characteristic abbreviation of the axis and its enclosure within a succession of leaf-sheaths, which cause lack of space for bud-development. In the consideration of the leaf, the author develops her phyllode theory, which regards the lamina as non-existent in the Monocotyledon, and all foliar structures, whether narrow or broad, as merely petiolar developments. If the Law of Irreversibility be accepted and it be granted that the original Monocotyledonous stock had leaves which were petiolar phyllodes, this assumption is necessary, though its extension to the palm-leaf requires some explanation. For the single two-keeled prophyll the author adopts the theory that it is equivalent to a single leaf, which is supported by the presence of only one axillary bud. The phylloclades of *Myrsiphyllum* and the *Ruscea* are interpreted as prophylls borne on short shoots, and the assimilating organs of the Duckweeds are similarly explained.

In a chapter on the seedling and its significance the "value" of the single cotyledon is discussed at some length. Conclusive evidence, based on anatomical as well as characters of external form, is adduced for regarding it as a single foliar member, and the author takes up the very natural position that one section of the flowering plants is monocotylar; not because there has been fusion of two seed-leaves nor suppression or displacement of the second, but because the growth-rhythm happens to be of the type which produces a single leaf at the first node.

The author does not attempt to consider in detail the flower and fruit of Monocotyledons, but a comparatively short chapter is devoted to the reproductive phase and a consideration of some floral types; incidentally the view of "open" and solid carpels, recently developed by Miss Saunders, is accepted.

In a chapter entitled "Taxonomy and its Interpretation," the author maintains the impossibility of explaining existing generic and specific differences as adaptive, and stresses the remarkably isolated character of the different groups of families and the absence of any evidence from palæobotany for the former existence of synthetic types. The present is an age of reduction: "the epoch in which the cohorts of Monocotyledons took their origin represents the active, constructive, juvenile period of Angiospermic evolution, and we are living to-day in the period of their late middle life, in which no energy is left for changes other than those which are essentially losses or limitations"; "we must, at least for the moment, give up the hope of bridging the gulfs which separate the great Angiospermic groups." In a brief final chapter, numerous cases of parallelism in evolution are cited from among Monocotyledons. The view that phyletic drift may be determined by external conditions is rejected, and it is suggested that "the tendency to progress in a

certain definite direction is as much an inherent character of a given race as are the features of its chemistry or morphology."

In conclusion, we have not only to thank Dr. Arber for an interesting and suggestive book, but also the Cambridge Press for the care which has evidently been taken with its production.

A. B. R.

The Marine Algæ of the Pacific Coast of North America. Part III. Melanophyceæ. By WILLIAM ALBERT SETCHELL and NATHANIEL LYON GARDNER. University of California Publications in Botany. Vol. viii. Part 3. Pp. 383–898, Plates 34–107. Berkeley, California, 1925.

THE two previous parts of this work gave an account of the Myxophyceæ and Chlorophyceæ of the Pacific Coast of North America; the present part is concerned with the Melanophyceæ or brown algæ. The scheme of classification adopted for this subclass is founded partly on the views of Kylin (1917), partly on those of Oltmanns (1922), embodying the additional ideas formed by the authors themselves during long years of study of the material. The Melanophyceæ are arranged in three series—Phæosporeæ, Aplanosporeæ, Cyclosporeæ. The Phæosporeæ comprise the following orders:—Sphacelariales, Ectocarpales, Dictyosiphonales, Desmarestiales, Chordariales, Laminariales—all of which possess both sexual and asexual reproduction, but are devoid of aplanospores. The Aplanosporeæ consist of two orders—Tilopteridales and Dictyotales—which have the same forms of reproduction as the preceding series, but are provided with aplanospores in addition. The third series, Cyclosporeæ, is limited to sexual reproduction only, and is represented by the *Sargassaceæ* and *Fucaceæ*. The various orders, families, genera, species, varieties, and forms are elaborated and fully described, and are rendered the more easily accessible to students by the introduction of keys and by plenty of illustrations. In all, seventy-three genera of brown seaweeds are represented in the work, the largest of these (*Ectocarpus*) containing as many as thirty-four species, while four other genera are credited with about a score each. Several new genera and species, preliminary diagnoses of which have already been published, are added to the flora of North America. It was not, of course, probable that many of our British seaweeds would be represented in a flora of the Pacific Coast. A search through the work shows that about thirty species are common to the two regions; but it is a parallelism rather than an actual identity of genera and species that will be observed. However, this is a subject that will doubtless receive attention in the final volume of the work. A notable feature of the flora is the development of the kelps, several of which are monotypic, and some of which attain large or gigantic dimensions, such as *Nereocystis*, an annual with an elongate slender stipes and a large buoy-like pneumatocyst; *Postelsia*, the "Sea-Palm"; *Macrocystis*, up to 60 yards long; *Alaria fistulosa*, with chambered midrib, and the lamina 30 yards long and 1 yard wide.

The authors are to be congratulated upon the thoroughness and masterly skill with which they are presenting the rich results of their prolonged and patient investigations of the Pacific Coast Algæ.—A. GEPP.

A Selection of Botanical and other Papers. By the late JORGE V. PEREZ. 8vo, pp. 53. London. Printed by Taylor and Francis, Red Lion Court, Fleet Street, for private circulation. 1925.

THE late Dr. Perez was much interested in the flora of the Canary Islands, its forestry and crops, and contributed numerous articles to journals on various subjects. Madame Perez has collected in book form a few of these articles for private circulation, translating into English those which were originally published in Spanish and French. The subjects of the twenty articles include three very characteristic native trees, *Phœnix canariensis*, *Juniperus Cedrus*, and *Pinus canariensis*, the influence of forests on water-supply, and horticultural and agricultural notes on some native plants and others.

Madame Perez states in her preface that she will be pleased to send a copy to those interested in the matter it contains.

Vegetationstudien im Limmattal. By Dr. MAX SCHERRER. 8vo, pp. 115. Publications of the Geobotanical Institute Rübel of Zurich, pt. 2. Rascher, Zurich, 1925. 4 francs.

THIS is an ecological study of the vegetation of the area stretching from Zurich to Killwangen, with a length of 18 km. and a breadth of 5–7 km. It is a fertile cultivated area, comprising a broad inhabited plain, cut by the winding course of a river, and on either side are wooded ridges, attaining 600 to 700 m. in altitude. The whole district has been profoundly influenced by man; his cornfields, crops, and orchards extend through the plain, and the river-terraces with a southerly aspect form a natural situation for the vine. The exceptionally mild climate is indicated by the large number of warmth-loving species which flourish in the valley.

The author describes in detail three plant associations, the *Molinietum*, the *Brometum*, and the *Arrhenatheretum*. The first includes four subassociations, characterized respectively by the dominance of *Molinea cærulea*, *Calamogrostis epigeios*, *Equisetum maximum*, and *Juncus subnodulosus*. The second includes two subassociations, *Brometum bromosum* (with *Bromus erectus* dominant) and the *Molinia cærula* var. *litoralis* subassociation. The *Arrhenatheretum* of the Limma valley, to which large areas owe their bright fresh aspect, is an artificial product due to the centuries-old influence of man in changing the natural vegetation.

The author gives a detailed analysis of the various subassociations, and discusses their origin and the effect which has been produced upon them by the operations of man.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on November 19 Dr. H. S. Holden and Mr. S. H. Clarke communicated a paper "On the Seedling Structure of *Tilia europæa*." Although the Lime flowers freely in England, it rarely perfects seed, but 1923 seems to have been specially favourable, as in the spring of 1924 more than 70 seedlings were noted at Nottingham, upon which the present observations are based. The seedling of *Tilia europæa* possesses two typically five-lobed epigeal cotyledons. These lobes vary in size, and may also develop accessory lobes. The aerial parts are thinly pubescent, the hairs being of two types: (*a*) unicellular hairs, confined to the epidermal ridges above and below the veins of the cotyledon laminæ, but generally distributed over the hypocotyl; (*b*) club-shaped multicellular hairs, confined to the upper surfaces of the cotyledons between the veins. The vascular system is tetrarch in plan, and typical root-structure is only attained some distance below the collet; seedlings showing triarchy or pentarchy also occur. Syncotylous seedlings, where the syncotyly is unilateral and pronounced, show triarch symmetry. The polycotylous seedlings examined were pentarch, though the pentarchy was not homologous with that found in dicotyls.

In the discussion following, Dr. Miles Thomas indicated the general and constant features of the anatomy of seedlings which she had summarized in the British Association Report of 1924. The most important were the primary alternating arrangement of xylem and phloem in hypocotyl and cotyledons as well as root, and the production of root-poles in the cotyledonary plane. She drew attention to the desirability of visualising the vascular system of seedlings as a whole, and suggested that the structure of the hypocotyl might prove to be the best point of departure for consideration and of the greatest phylogenetic importance.

Dr. E. J. Salisbury, referring to the frequency of Lime seedlings, mentioned their occurrence in large numbers in certain years as suggesting an intermittence in abundant seed-production comparable to that exhibited by the Beech.

Dr. G. Claridge Druce exhibited specimens of :—(1) Two varieties of *Anthriscus sylvestris*—var. *angustisecta* Druce, the prevailing form in Scotland, and var. *latisecta* Druce, the common plant of southern and central England. Each of these has minor variations which have been described by Petersen of Copenhagen, but in Britain *sylvestris* falls easily into the two divisions mentioned above.

(2) *Taraxacum nævosum* Dahlst. (§ *Spectabilia*), a well-characterized species, shown from Marcham, Berks, gathered in 1920, but since found in localities from Kent northwards to Shetland. *T. balticum* Dahlst., gathered in Oxfordshire in 1912, which belongs to the § *Palustria*, as does *T. anglicum* Dahlst., found by the exhibitor in Oxfordshire, Berks, etc. *T. oxoniense* Dahlst., a pretty plant of the § *Erythrosperma*, from Oxford and Carnarvon.

(3) *Gentiana septentrionalis* Druce, which is the prevailing form

of the *axillaris* section on the sandy coast of W. Sutherland, Caithness, and Shetland, which has uniform corollas, pinkish or reddish-tinted outside, and nearly pure white on the under surface; the plants may be simple or branched. In sunny weather the star-like white flowers add a great beauty to the dunes of Spiggie and Dunnet.

(4) Twelve sheets of British Thymes illustrating the plants described by Ronniger (Rep. B. E. C. 1923, 226–240), namely, *T. pulegioides* L., *T. glaber* Mill., *T. neglectus* Ronn., *T. Drucei* Ronn., *T. britannicus* Ronn., *T. pycnotrichus* Ronn., *T. lanuginosus* Mill., etc., as well as the more recently described *T. zetlandicus* Druce & Ronn., from Ronas Hill, Zetland.

(5) *Rumex arifolius* All., identified by Prof. Danser, discovered by the exhibitor on Loch-na-Gar in 1910 at 2900 feet, and again in 1924 and this year on mountain cliffs in the counties of Ross and Sutherland.

(6) *Potamogeton Seemenii* A. & G., a hybrid of *P. gramineus* and *polygonifolius*, from the River Laune, in Co. Kerry (not in the Channel Islands, as erroneously given in Lond. Cat.), and *Ajuga pyramidalis* × *reptans*, a hybrid of these species discovered in Sutherlandshire, and also found in Co. Clare.

At the meeting of December 3, the President (Dr. A. B. Rendle, F.R.S.) referred to the recent death of our Honorary Member, H.M. Queen Alexandra. The Fellows rising in their places, an address of sympathy to H.M. The King was read from the Chair.

Prof. F. J. Lewis, D.Sc., of Edmonton, Alberta, communicated "A Preliminary Account of a Fungus in the Tissues of Coniferæ." The results recorded refer particularly to *Picea canadensis*, which has been collected from many habitats and varying in age from small seedlings to trees over two hundred years old. The cortex of the youngest rootlets is penetrated in every direction by fine hyphæ, which not only enter the living cells, but grow through the middle lamellæ of the walls: the contents of the cortical cells disappear. Hyphæ also penetrate the endodermal cells, and in some cases almost fill the lumen. Older rootlets from which the primary cortex has been cast off show the cells of the broad pericycle filled with masses of very fine branched hyphæ; where periderm is fully developed, the phellome is frequently penetrated in every direction with hyphæ, which also extend into the phelloderm. It is not possible to say yet whether this is the same fungus, as its hyphæ are much larger, clearly septate, not profusely branched, and exhibit different staining reactions.

Not only the periderm of the root, but also the periderm of the stem and the outer bud-scales, are profusely penetrated by hyphæ—in fact, a mycelial mantle extends through the periderm from the root to the second-year shoots. Observations suggest that this fungal mantle is not connected with the true endophytic fungus in the deeper tissues.

The distribution of the fungus in the unopened bud is particularly interesting because of its localization in certain enlarged cells irregularly distributed above the crown near the base of the embryonic leaves. The cells appear to be the earlier stages of the cortical cells.

As the meristematic cone bearing the embryonic leaves elongates, the fungus spreads upwards from the region of the crown, forming a network of infested cells, and the same features occur in the young cortical cells outside the procambial strands.

In the discussion that followed, the President referred to the difficulties under which isolated investigators, such as Prof. Lewis, had to conduct researches, and to the desirability of helpful criticism.

Mr. Ramsbottom pointed out that there were several matters which were not settled in this preliminary communication. The behaviour of the fungus in relation to the root suggested that it was an ordinary ectotrophic mycorrhizal one. Concerning the fungus in the stem, it would be interesting to know whether it is constantly present or only occasionally; also whether it is connected with the mycorrhizal fungus. Accumulated evidence leads to the supposition that many Basidiomycetes may be concerned in forming mycorrhiza within the roots of the same species of Conifer, and field-observation showed that two or three different types of mycorrhiza may occur on the same tree. If the stem-fungus was joined with the root-fungus, were all Basidiomycetes able to spread from the roots, either singly or in company? If an unattached fungal mycelium existed in the stem, there was a possibility of a state of affairs such as we have in *Lolium*, where there is an internal mycelium near the stem-apex; but it was more likely that we have a parasitic fungus, definite in its attack. A species of *Picea* may have a hundred parasitic fungi.

Dr. M. C. Rayner (visitor) pointed out that Melin's work on Conifers—*Picea*, *Pinus*, *Larix*—left no doubt as to the identity of the fungus, the structure of the mycorrhiza, or the cytology of the infected cells. Professor Lewis's description of root-infection in respect to the intercellular "net" agreed with the structure of the mycorrhiza long known to exist in Conifers. Melin had recently reported profuse intracellular infection with subsequent digestion of the mycelium in the cortical cells. Infection of the dead tissues of the periderm was invariable, but no evidence had been produced that the mycelium present was related to that forming mycorrhiza. With regard to stem-infection, if it were the rule, it would be necessary to establish identity of the mycelium before assuming relationship with the mycorrhizal fungi. In view of the close relationship known to exist in the root, it would not be altogether surprising to find an extension of infection to the shoot, as in *Ericaceæ*, but Professor Lewis's slides suggested infection.

THE older generation of Fellows of the Linnean Society will hear with regret of the death of Dr. James Murie, on December 21, at the age of 95. Dr. Murie was elected F.L.S. in 1868, and served the Society as Assistant-Secretary, 1876–80, and Librarian, 1880–88. For the last thirty years he had been living in retirement at Leigh-on-Sea, Essex.

WE note with regret the announcement of the death of Mr. W. P. Hiern, F.R.S., at Barnstaple, on November 29. An appreciation of his work will appear in the next number of this Journal.

REPRODUCTIVE MECHANISM IN LAND FLORA.

III. SPORES.

BY A. H. CHURCH, M.A., F.R.S.

AS it becomes increasingly evident that the Life Cycle of the highest land-plant stands in no direct causal relation to the present conditions of land-environment, but is to be regarded as the inherited equipment of the sea—persisting in its ancient form since long stereotyped by response to the more inferior and changing conditions of the tide-range in seasonal latitudes,—it also appears that the entire mechanism of so-called 'sexual' and 'asexual' reproduction of the haploid and diploid phases respectively is equally the expression of the deeply-impressed inheritance of an older benthic phase of existence, to be adapted secondarily, but effectively, to the exigencies of subaerial life [1].

That this conception holds for the history of the 'sexual' mechanism of *fertilization*, in which a flagellated antherozoid still fuses with an immobilized oosphere or ovum, may be said to be freely accepted, so far as aqueous conditions for aquatic fertilization are obtainable. Such zoïdogamic mechanism prevails up to the horizon of early Gymnosperms (*Cycas*, *Ginkgo*) in a manner which so directly parallels the animal side of the story that the 'sexual' nature of the latter mechanism was never in doubt—any more than the zoologist would now doubt the advancing progression of all phyla of land-animals also from the sea.

But it is in the diploid or so-called asexual phase of the cytologically dicœcious pair that interest primarily centres; since it is this phase which has secured the full dominion of the land-surface; and it is in its reproductive mechanism, involving the elaboration of *meiotic tetrads*, that new advances are to be traced, as such *spores* [2] change their methods of dispersal by moving water for flotation in air and movement by air-currents—this being the outstanding effect of transmigration on the reproductive mechanism, and now a *sine qua non* of subaerial existence.

[1] *Journal of Botany*, July 1925, p. 193.

[2] The word spore (σπορά), as the Greek equivalent for seed, has long come to be associated with the reproduction of Cryptogams, as the Linnæan use of seed (*semen*) was kept for Phanerogams. Linnæus did not use the word spore at all. The oldest definition appears to rest with Schleiden (*Grundzüge*, 1842, Engl. Trans., Lankester, 1849, p. 144), and his connotation presents remarkable interest: *e.g.*, 'The single or complex cell out of which the new individual is developed, I name *spore* (spora); the parent-cell forming and enclosing the former, the spore-case (*sporangium*); a number of these combined together in a definite form with the special parts of the plant which encloses them, a *sporocarp*." That is to say, the term *sporangium* was first applied to algal organs, and what are now called the sporangia of Pteridophyta were included by Schleiden as sporocarps of sporangia, as also were moss-capsules and the anther of the stamen. His conclusions were clearly and logically drawn, beginning with algal forms.

All autotrophic vegetation of the land, from the lowliest Bryophyta to the largest trees, maintains absolute constancy to a special type of asexual spore-production, as a tetrad-group of 4 units following meiosis, of closely comparable volume and details of organization, of which the individual protoplasts attain a special 'wall'-investment of their own, as a 2-layered *exospore* and *endospore* (exine and intine), formed of resistant polysaccharide; the inner of cellulose nature, the outer 'cutinized' as a more gas-proof and water-proof coating.

One has not far to look for the precursors of this special type of spore-formation. Spore-tetrads of identical nuclear and plasmic organization, produced as *tetraspores* in so-called tetrasporangia, occupying the same position in the life-cycle as the reproductive unit of an asexual phase, and germinating in turn to produce a sexual individual, are found in marine algæ[1], as Dictyotaceæ (Phæosporeæ), and even more conspicuously in the great group of Florideæ of the sea[2].

In these last groups, again, the relation of such tetraspores to the antecedent condition of flagellated zoïd is the accepted story of algology. The phases of progression from a motile flagellate 5 μ zoïd, itself undoubtedly initiated in the life-cycle as an apogamous flagellate zoogamete, is the obvious record of Phæophycean reproduction; while the later stages of tetrad-organization are exemplified by the generality of the Florideæ—leading to the inevitable conclusion that the *Spore* is but the end-term evolved in the sea as the output of a unilocular sporangium (meiotangium) in which meiosis has been located, and increase in the mass of the zoïd is correlated with loss of flagellar motor-mechanism, or may bear some relation to the increasing volume of the oosphere in heterogamic series.

With so much of past benthic history fully accounted for in the reproductive organization of Phæophyceæ and Florideæ, there is little need to review the older stages of the progression. It remains to consider the further relations of spore-tetrads to the plant producing them, from the standpoint of (1) their location, (2) nutrition on or in the vegetative soma, (3) special methods of emission or

[1] Nägeli (1836) appears to have been the first to note that Floridean tetrads (the familiar Vierlingsfrüchte of Kützing) were formed exactly like the pollen-grains of higher plants, within a parent-cell or sporangium. Thus Schleiden describes the archesporial layer of the moss-capsule as a tract of sporangia which speedily disappear; *loc. cit.* p. 201,—'Sexual plants (*i. e.*, Phanerogams) develop cells clothed by a peculiar membrane within a mother-cell (the *sporangium* of the Agamæ) which becomes absorbed subsequently'; in other words, the type sporangium was a tetrad, and when Schleiden says the pollen-grain is identified with a spore, he means the tetraspore of an alga.

Although sea-weeds were familiar to Nägeli, Schleiden, and Kuetzing, later botanists of the land ignored these conceptions, and the modern use of the term *sporangium* dates from Von Mohl and Hofmeister, the latter being also responsible for the term 'mother-cell' (cf. *Vergleichende Untersuchungen*, 1851; Eng. trans., Currey (1862).

[2] Out of 300 genera and some 3000 scheduled species, only some 20 genera and 60 species do not produce tetraspores.

dispersal in the circumambient medium, as also (4) the relation of their wastage-coefficient to the continuance of the race.

While still in the sea, extensive specialization of these products of the meiotangium may be noted—commonly following increased volume in the spores themselves,—and though the latter may appear intelligible in the case of the great heterogamic oospheres from the meiotangium of the Fucoid (*Fucus*, ♀, 80 μ diam., *Himanthalia* and *Sargassum* over 300 μ), the reason why asexual spores should also enlarge is less obvious. Suggestions, however, are not wanting. So long as the two cytological generations live side by side, exposed to the same environmental influences, and so far homothallic, both phases require to start on equal terms. Thus in the case of types presenting both homothally and heterogamy, the asexual spore increases *pari passu* with the corresponding oospore-zygote of the complementary phase, though apparently presenting a slight lag; *e. g.*, in *Dictyota* the oospheres are immobile and spherical at 80 μ diam., the spermatozoid flagellated and 5 μ, the tetraspores also immobile and spherical at 70 μ. The special case of the Florideæ, producing tetraspores which give rise to homothallic sexual plants, again compares with the case of *Dictyota*, with the further suggestion that the present volume of the tetraspores may be taken as a guide to the original volume of the heterogamous oospheres, *before* they assumed their present method of post-sexual nutrition of the zygote, and so diminished secondarily to the volume of merest somatic units. But it is the carpospore of the parasitic diploid stage which now appears as the apparent output of the homothallic sexual plant, and in turn balances the tetraspore in volume[1]. All three examples (*Fucus*, *Dictyota*, and the Florideæ) are the more remarkable, in that for all of them this increasing volume of the products of the meiotangium bears no direct relation to the size of the somatic cells of the thallus produced from it. The latter are always of the 10–15 μ level, and the large spores require to be 'broken down' in germination to such smaller units[2].

In the case of heterothallic types the range is more irregular, as each phase of the cytological pair takes on different biological growth-relations. Thus in *Laminaria* the asexual zoïd remains 10–12 μ long, though the oosphere is now immobile and spherical at 25 μ diam.[3]. The oosphere of *Cutleria* is 26 μ long, with some 30 chloroplasts, and flagella in the body-length ratio of 1·5 : 1. This contrasts with the small male gamete, 5 μ long, with 2 chloroplasts and b. l. ratio 4·5 : 2. But the *Aglaozonia* zoïd at full development is 22·5 μ long, with 20 chloroplasts, and b. l. ratio 3 : 1·3[4]. On the other hand, the *Zanardinia* homothallic type gives a closer approximation—oosphere 19–23 μ, 30 chloroplasts, and b. l. ratio 2·25 : 1·3,

[1] Cf. *Graciliaria confervoides*, both carpospores and tetraspores closely alike at 25 μ diam.; *Polyides rotundus* both closely 50 μ; *Chondria tenuissima*, both closely 75 μ.

[2] The same applies to the spores of *Pellia epiphylla* germinating before emission.

[3] Kuckuck (1917), *Berichte*, p. 573.

[4] Yamanouchi (1912), Bot. Gaz. liv. p. 454.

as compared with the asexual zoïd at 22·5 μ, also about 30 chloroplasts, and b. l. ratio 2 : 1[1].

In all cases, increasing volume of the spore-stage is associated with diminishing output in the number of free units from the meiotangium[2], and with this increase in volume is sooner or later associated the loss of the older tractor-mechanism of the flagellate stage. Thus, in the limit, the contents reduce normally to the product of one meiotic tetrad of immobile spores, as seen in at least three distinct series of living marine algæ (Dictyotaceæ, *Zanardinia*, Florideæ); as it also holds in all probability for the asexual zoïds of *Œdogonium* and *Hydrodictyon* in fresh water, and is thus to be accepted as a general feature of plant evolution. Such algal types, though in no sense in the line of direct succession, still serve to illumine the path of progression, and exemplify the nature and possibilities of antecedent marine equipment.

Hence the flora of the land, in taking off from algæ with the highest combined attainments of the sea, is based on an output of tetraspores from the diploid phase, as relatively large units (averaging 30 μ–50 μ diam.), passive, spherical;—the output restricted to one tetrad per meiotangium, and the units discharged as naked masses of plasma by the dissolution of the sporangial membranes, or 'slipped in endochiton'[3], to round off by surface-tension in the external medium. Such tetraspores closely parallel the tetrad-units of Land Flora, which have been approached from the land side as the normal product of an *archesporium*. It begins to be clear that these two things are really the same, as foreseen by Schleiden. One archesporial mother-cell giving rise to a tetrad is the direct homologue of an older tetrasporangium setting free four free spore-units in the sea. There is no need to postulate an entirely new evolution of all these meiotangial mechanisms of spore-production, for a purely hypothetical 'antithetic phase intercalated in an older algal life-cycle.' The things required are already in existence; it is more difficult to imagine new methods of making identically the same thing than to take the data provided; but it remains to see to what extent the new spores differ from those of older category, and to what causes such new departures, if they are really new, may be attributed. So far as general volume is concerned, the coincidence in the relations of the spores of autotrophic land-flora is remarkable. An average of

[1] Yamanouchi (1913), Bot. Gaz. lvi. p. 8.

[2] *Fucus* (♂) 64, (♀) 8: Laminariaceæ 64–32: *Chorda*, 16.

[3] The limiting wall of algal cells as a tract of excreted celluloses and hemicelluloses acquires a firmer limiting membrane externally where in contact with the external medium, as also an inner firmer layer in contact with the cell plasma. The central portion is a softer and more gelatinous colloid. To these three regions Farmer and Williams (1898, Phil. Trans. p. 628) gave the names *ectochite*, *mesochite*, and *endochite* respectively, in the case of the meiotangium of *Fucus*; both antherozoids and oospheres being discharged actively by the swelling of the mesochiton, rupture of the outer ectochiton, and hence emitted enclosed in the thin endochiton, to be finally set free by the solution of the latter. This normal method of sporangial dehiscence is also presented in the tetrasporangia of the Florideæ.

100 50 μ diam. is still maintained, even in pollen-grains, though the volume again bears no definite relation to the growth of vegetative units on germination. The full range is, however, considerable—from half the first number to twice the last; *e.g.*, from some 10 μ to over 100 μ. Yet these numbers may be closely paralleled in widely different groups:—*Polyides rotundus*, 50 μ; *Anthoceroslævis*, 50; *Lepidium Filix Mas*, 50; *Equisetum Telmateia*, 45; *Lycopodium clavatum*, 35; *Hornea*, 50; *Rhynia*, 40–65; *Dictyota dichotoma*, 60 70; *Pellia epiphylla*, 60–80; also—*Graciliaria confervoides*, 90; *Polytrichum formosum*, 15; *Funaria hygrometrica*, 15; *Lophocolea bidentata*, 12; *Ficus carica*, 13; *Riccia glauca*, 90; and *Malva sylvestris*, 100.

But the spores of Land Flora, however closely alike in mode of production, at first sight differ widely in other respects,—

(1) as being of definite shape, since confined within the rigid mechanism of enclosing spore-coats;
(2) as produced in archesporial tracts, imbedded in somatic tissues;
(3) and hence requiring a new method of emission and discharge; the older aquatic method of slipping in endochiton being naturally wholly lost.

It is interesting, therefore, to see to what extent these departures may be initiated or foreshadowed in the antecedent algal stage; since new departures can only follow along pre-existing lines.

(1) The definite shape of subaerial spores clearly follows the inclusion of the plasmic masses within definite limiting membranes, so that they are no longer free as naked plasma to assume spherical form in the water. The form so commonly follows the tetrad-division of the mother-cells that 'tetrads' are commonly recognized by the 'tetrahedral' form[1] of the units, as a sphere is cut into four segments to give the most perfect attainment of four equal and approximately isodiametric units. But 'zonate' and 'cruciate' arrangements are general among higher plants, as among Florideæ (*cf.* the zonate pollen-tetrads of *Asclepias*, and cruciate tetrads conspicuously among the normal tetrahedral forms in *Lycopodium*). That such definite form-factors follow the rigidity of the membrane may be assumed; the membranes are the difficulty. These are characteristically two—the endospore of 'cellulose' and the exospore of more 'cutinized' material. Chemical analysis of such cutinized substance is still in a rudimentary condition; but it is evident that the endospore represents the functional wall of the somatic unit formerly produced on attachment to a substratum in the open aqueous medium, and its occurrence within the sporangium is so far only a precocious production of what took place normally when a spore germinated in the sea.

[1] The tetrahedral plan of septation affords the optimum attempt at dividing a sphere in four isodiametric sections; and the extent to which the latter are free to round off, before fixed in shape by a wall-deposit, depends on the duration and texture of the investing mother-cell wall. Hence tetrad-spores may be taken as the primary case.

The exospore affords a further difficulty; but similar cutinized and resistant membranes are the common equipment of all spores of the land, whatever their algal ancestry (Fungi, Lichens, Bacteria), and they occur in the spores of fresh-water algæ which may have to perennate over periods of desiccation (*Spirogyra*, *Œdogonium*, *Vaucheria*, *Volvox*) in many diverse lines of descent, and run parallel with the cyst-stages of many animal flagellates. Again, the presence of a cutinized outer layer to the cell-soma is the *sine qua non* of all successful land-vegetation existing in sub-saturated air, and the production of such a layer within the sporangium is equally an indication of precocity as is that of the endospore[1]. It is this precocity which saves the situation. Such formation of 'cuticle' is again the commonplace of many marine algæ, more particularly of parenchymatous organization (*Laminaria*, *Dictyota*); and though the chemical constitution may be wanting, the so-called cuticle of many parenchymatous Phæophyceæ has a close resemblance to that of a land-plant, of which it is clearly the morphological precursor[2]. It is formed as a definite secretion, beyond the normal wall, as is shown most strikingly in the case of Laminarias—*e.g.*, in *L. saccharina* it is formed over the ends of the free paraphyses, and as the sporangia mature it may be stripped off in sheets which still carry the impress of the polygonal meshwork of the individual cells. Similar sheets of 'cuticle' require to be stripped from the antheridial sori of *Dictyota*, and even from the plurilocular gametangia of *Scytosiphon*. The cuticle of *Saccorhiza* is particularly well-defined and stripped from the ends of the paraphyses it gives a faint cellulose-reaction with 66 per cent. H_2SO_4. Iodine, but is destroyed by the concentrated acid. Apparently it only differs from the cuticle of land-plants by lack of hydrocarbon fats impregnating it—a detail of chemical metabolism comparable with the lack of 'lignification' in the spirally-thickened elater-'tracheides' of Hepaticæ[3].

(2) In the elaboration of all large spores and gametes, even in the sea, some methods of protection against intrusive organism or the chances of the medium are necessitated during growth and maturation—the more as the time required may be the longer. Although originally meiotangia are produced as the end-ramuli of a system of free filamentous ramalia, these are soon reduced and specialized in more elaborated and parenchymatous somata, becoming stalked or sessile organs of the peripheral ramalia, and soon restricted to surface-cells of the thallus, which may extend beyond the periphery (*Dictyota*), or remain flush with the surface. In extreme cases they may be still further sunk, as in conceptacles (cf. *Fucus*, in which

[1] For comparable utilization of phenomena of precocity in spore-production, *cf.* the segmentation of the spores of *Pellia* and the 'germination' of the pollen of *Pinus*, as also early nuclear division in the pollen of many Angiosperms.

[2] As pointed out long ago by Schleiden.

[3] A minor point of interest is that such potentialities of 'cuticle' are present in the sexual plant of *Dictyota*, as well as in the asexual. Hence any distinction between the formation of cuticle on the sporophyte of Land Flora or its absence in the gametophyte is probably only a question of degree.

older filamentous ramalia are so maintained); but more particularly among more massive Florideæ all stages of higher specialization may be noted, as the tetrasporangia are buried in the filamentous exocortex, sunk in the endocortex, commonly enclosed by a single surface-layer at the periphery (much in the manner of a hypodermal archesporium), or even deeper in the cortex of a centric axis (*Furcellaria*) or of laminate expansions (*Rhodymenia palmata*); furnished with special 'cover-cells' (*Polysiphonia*) and even aggregated in nemathecial pustules; or, again, borne imbedded in special filamentous branches (stichidia of *Dasya ocellata*), more massive ramuli (*Dasya coccinea*, *Plocamium*), on special 'leaflets,' homologous again with purely vegetative ramuli of similar organization (*Ptilota*), or of markedly distinct form (*Delesseria sanguinea*). In fact, among the more massive subparenchymatous Florideæ, every suggestion of immersed archesporial tracts, subspherical sporangia, or sporophyll and sporogonium, may find its analogue, as every possible method is tried out in the infinite possibilities of ringing the changes on a few morphological and structural factors in this great series of reef-pool algæ.

Such immersion just below the external layer entails full protection for the maturing spores from the effects of water-currents and mechanical attrition of surfaces, as well as retaining for them a position still within the range of light-penetration. Hence a hypodermal tract may be regarded as giving the optimum effect, and omission between the adjacent cells takes place with little difficulty. That is to say, the tendency of archesporial tissue is to become more deeply immersed, if anything, rather than increasingly superficial.

(3) Admitting the general advantage of such immersion of the tetrasporangia within the soma, these phenomena imply a further necessity for a mechanism of discharge at the surface. Among forms with soft gelatinous membranes this is readily effected, and even in *Laminaria* the sporangia elongate and push up between the mucilaginous paraphyses by turgor-pressure, in order to discharge free zoïds at the surface. Among the Florideæ the older method of discharge 'in endochiton,' as seen in *Fucus*, is still well-marked, though the membranes are so increasingly tenuous and transparent that they are observed with difficulty,—as is shown by the general tendency in the past to speak of tetraspores instead of tetrasporangia including spores. But the point of interest is that the tetrasporangium-wall becomes increasingly inconspicuous, and with complete immersion tends to vanish in gelatinous hemicelluloses. Protective adaptations may be required in the peripheral units of the plant-soma, as also in the spores when set free, but they are not added to the tetrasporangium-wall.

Hence what is termed a *sporangium* in land-flora is quite different from the older meiotangium which is now reduced to a mere mother-cell of the archesporium. Further, the deterioration of the meiotangial membranes may be taken to imply that complete immersion of the tetrasporangia had been attained in the sea before land-flora was initiated—as, indeed, follows from the fact that the immersed

archesporium is so universal in Bryophyta and Pteridophyta that it passes as an essential feature of their organization.

Relics of these older tetrad-units are now utilized to build up what hence appears as a new organ, peculiar to land-flora, and concerned with the protection, nutrition, and emission of the subaerial spores. What is henceforward to be regarded as the *sporangium* is by no means a new structure in the academic sense of an organ *sui generis*; it has a long and distinct algal history behind it, however much botanists of the land, working backwards from flowering-plants to the first transmigrants, may have failed to understand it. Such newly constituted and improved organs, devoted to spore-production, are now effective products of the diploid phase on the land, and include both the sporogonium (axial) of the Bryophyte and the sporangium (foliar) of the Pteridophyta—the new departures concerned in the progressive improvement and adaptation of these structures to subaerial life marking them off from the merely vegetative tissues as the special reproductive organ of their phase.

ALABASTRA DIVERSA.—Part XXXV.

By Spencer Le M. Moore, B.Sc., F.L.S.

(Continued from Journ. Bot. 1925, p. 172.)

3. New Asclepiadaceæ from the Cameroons.

Marsdenia Batesii, sp. nov. Herbacea, *caule* volubili sat robusto fistuloso distanter folioso glabro; *foliis* amplis petiolatis cordatis acuminatis apice obtusis basi 5-nervibus firme membranaceis costis minute puberulis exemptis glabris; *umbellis* per paria axillaribus pedunculatis et paris ejusdem sessilibus plurifloris; *floribus* pedicellatis quam pedicelli multo brevioribus; *calycis* segmentis ovatis obtusis margine ciliolatis; *corollæ* rotatæ extus glabræ lobis anguste ovatis obtusis intus præsertim basi velutinis; *coronæ* phyllis gynostegio æquilongis ovatis breviter cuspidulatis dorso compressis sursum liberis crassiusculis; *polliniis* oblongo-pyriformibus caudicula brevi glandulæ sibi ipsis æquilongæ conjunctis; *stigmate* in rostrum gynostegium superans exeunte.

Cameroons, Yaunde, Bitye; *Bates*, 1427.

Folia 9–12 × 7–9 cm., in sicco læte viridia; petioli 2·5–5 cm. long. Pedunculi dum adsint 4–7 mm. long., basi bracteis exiguis onusti. Pedicelli teneri, 1–1·5 cm. long. Flores pansi circa 1 cm. diam., saturate purpureo-brunnei. Calycis segmenta 4 mm. long. Corollæ tubus 2·25 mm. long., intus glaber; lobi 5 mm. long. Coronæ phylla 2 mm. long. Stigmatis rostrum 2 mm. ex gynostegio eminens, apice bifidum.

A very distinct species, in appearance much like *Anisopus*, with which it shares the peculiarity of a sessile and a peduncled umbel in opposite axils.

Ceropegia Batesii, sp. nov. Herbacea; *caule* volubili aliquanto compresso sparsim folioso glabro; *foliis* petiolatis ovato- vel obovato-oblongis breviter acuminatis mucronulatis basi obtusis vel rotundatis membranaceis glabris; *cymis* sessilibus subumbellatis usque circa 10-floris bracteis parvulis præditis; *floribus* pedicellatis pedicello crassiusculo glabro; *calycis* segmentis lanceolatis acuminatis glabris; *corollæ* tubo extus glabro basi dilatato inde infundibulari lobis tubo brevioribus oblongis apice cohærentibus intus sursum pilosis.

Cameroons, Bitye, River Ja; *Bates*, 1435.

Folia 4–7 × 1·5–2·5 cm., basi obscure 3-nervia; costæ lat. paucæ, teneræ; reticulum arctum; petioli plerique 1–2 cm. long. Pedicelli (sub alabastro) 3 mm. long. Calyx 2·5 mm. long. Corolla in toto 4 cm. long.; basis inflata 7 × 8 mm.; tubi pars superior 15 mm. long., inferne 2 mm. sub limbo 7 mm. lat.; lobi 8 mm. long.

The inflated base of the corolla is cream-colour with dark purple markings, the rest of the flower dark purple with cream spots on the lobes. Affinity with *C. anceps* S. Moore. There being only one expanded flower, the structure of the corona must remain doubtful.

4. The African and Mascarene Species of Gelonium.

Exclusive of ten Indian and Malayan species, Pax and K. Hoffmann (Pflanzenr. Euphorb.-Gel. 14 *sqq.*) enumerate eight species of *Gelonium*, of which two each are from Tropical and South Africa and the remaining four natives of Madagascar. So far as is known, the tropical species are restricted, one (*G. zanzibariense* Müll. Arg.) to the Kenia Colony and the Tanganyika Territory, while *G. procerum* Prain extends from Kenia to Rhodesia, and no species has been reported hitherto from the Western side of the Continent. This hiatus Mr. Gossweiler's labours now enable us to fill up, two species from the Portuguese Congo having been included in his most recently received collection. Besides these, descriptions are appended of two others, one from Madagascar, the other from the Comoro Islands, making six insular species in all and so raising the number of African species to twelve.

The species may be arranged as follows:—

Stamina 20 vel plura.
- Folia basi acuta.
  - Flores sessiles ..... 1. *borbonicum* Pax & [K. Hoffm.
  - Flores pedicellati ..... 2. *procerum* Prain (*lithoxylon* Pax & K. Hoffm.).
- Folia basi rotundata vel obtusa ..... 3. *comorense*, sp. n.

Stamina 8–20.
- Sepala eglandulosa.
  - Folia integra.
    - Folia obtusa, perspicue reticulata.
      - Pedicelli ♂ 2 mm. long ..... 4. *pycnanthum* Pax & [K. Hoffm.
      - Pedicelli ♂ subsessiles..... 5. *Baronii*, sp. n.
    - Folia acuminata, obscure reticulata. Pedicelli ♂ subsessiles..... 6. *congoense*, sp. n.
    - Folia sursum crenata. Pedicelli ♂ 3 mm. long. 7. *africanum* Müll. Arg.

Sepala glandulosa. [Arg.
Folia integra. Pedicelli ♂ vix ulli..... 8. *zanzibariense* Müll.
Folia haud integra.
Folia utrinque acuminata crenulata. Pedicelli ♂ 3–5 mm. long. ..... 9. *laurinum* Müll. Arg.
Folia obtusa basi acuta, crenato-dentata. [Arg.
Pedicelli ♂ 4–9 mm. long. ..... 10. *adenophorum* Müll.
Folia acute serrulata. Pedicelli ♂ vix ulli. 11. *serratum* Pax & [K. Hoffm.
Stamina —. Folia dentata. Sepala glandulosa ... 12. *Gossweileri*, sp. n.

G. Boivinianum Müll. Arg. is a Madagascar plant, of which the flowers are said to be unknown.

Gelonium comorense, sp. nov. *Frutex* ? ; *ramulis* angulatis crebro foliosis cortice pallido obductis ; *foliis* amplis brevipetiolatis oblongo-ovatis apice attenuatis ipso obtusis basi obtusis nisi rotundatis integris subtus pustulato-glandulosis tenuiter coriaceis glabris costis lat. utrinque 6–7 pag. inf. (uti reticulum sat laxum) tenuibus mediocriter visibilibus ; *cymulis* sessilibus plurifloris ; *floribus* ♂ pro genere longi-pedicellatis pedicellis tenuibus glabris ; *sepalis* 5 orbicularibus glandula destitutis ; *staminibus* 20 ; *floribus* ♀ —.

Comoro Islands ; *Humblot*, 251.

Folia summum 14 × fere 7 cm., sed plerumque ± 9 × 4·5 cm., nitidula, pag. inf. pallidiora ; petioli circa 5 mm. long. Pedicelli usque 6·5 mm. long. Sepala 2 mm. diam. Filamenta 2 mm., antheræ 1 mm. long.

Gelonium Baronii, sp. nov. *Frutex* ? monoicus ; *ramulis* subteretibus bene foliosis cortice dilute albo-viridi circumdatis ; *foliis* brevipetiolatis ovatis obtusis vel rotundatis basi cuneatis integris coriaceis glabris nitidis pag. utraque prominenter reticulato-nervosis costis lat. utrinque 4–6 summis cito dichotomis ; *stipulis* subulatis rigidis ; *cymulis* masculis vel bisexualibus pauci- vel pluri-floris pedunculatis pedunculis petiolos æquantibus vel excedentibus ; *pedicellis* brevibus crassiusculis uti sepala minute puberulis ; *sepalis* 5 orbicularibus eglandulosis ; *staminibus* 11–14 ; *florum* ♀ *sepalis* ♂ similibus ; *disco* crenulato staminodiis exiguis perpaucis induto ; *ovario* globoso 3-loculari glabro ; *stylis* 3 patentibus complanatis bipartitis ; *capsula* 3-cocca coccis pallidis reticulatis loculicide dehiscentibus ; *seminibus* albo-brunneis subnitidis.

Central Madagascar ; *Baron*, 3045 (also at Kew ; *Baron*, 2445, 2522, and 4982).

Folia pleraque 4·6 × 2–3 cm. ; petioli circa 5 mm. long. Stipulæ 1–2 mm. long. Pedunculi usque 1 cm. long., plerumque vero breviores sc. ±5 mm. long. Pedicelli circa 2 mm. long. Flos ♂ pansus 4 mm. lat. ; sepala summum 2·5 mm. diam. Filamenta basi dilatata, 1·25 mm., antheræ fere 1 mm. long. Flores ♀ 4 mm. lat. ; ovarium 1·75 mm. diam. Capsula vix 1 cm. diam. Semina 4·4 × 4 mm.

Gelonium congoense, sp. nov. *Fruticosa* ? ; *ramulis* subteretibus deinde angulatis corticeque sordido circumdatis ; *foliis* brevipetiolatis

ovatis vel ovato-oblongis acuminatis apice obtusis basi cuneatim angustatis integris tenuiter coriaceis nitidis glabris præsertim pag. inf. pustulis parvis obsitis ; *cymulis* subsessilibus paucifloris floribus bracteis parvulis stipatis ; *pedicellis* abbreviatis crassiusculis ; *sepalis* 5 orbicularibus eglandulosis ; *staminibus* 13.

Portuguese Congo, Luvuluge River ; *Gossweiler*, 8802.

Folia 6–9 × 3–4 cm., in sicco læte flavo-viridia ; costæ lat. teneræ, utrinque 5–7, sat procul a margine dichotomæ uti reticulum pag. utraque eminentes. Inflorescentiæ axis 1·5 mm. long. ; hujus bracteæ triangulares, ciliolatæ, vix 1 mm. long. Pedicelli 1–1·5 mm. long. Sepala (in alabastro) 1·5 mm. diam. Antheræ 5 mm. long.

Gelonium Gossweileri, sp. nov. Verisimiliter *frutex*, glaber ; *ramulis* patentibus teretibus crebro foliosis ; *foliis* lanceolatis ellipticis breviter acuminatis obtusis basi in petiolum brevem angustatis marginis dimidio distali dentatis chartaceis pag. utraque sed præsertim sup. pustulatis pellucideque punctatis nitidis in sicco læte viridibus ; *stipulis* parvulis triangularibus acutis decoloribus ; *cymulis* sessilibus vel subsessilibus paucifloris ; *floribus* ♂ —; *florum* ♀ breviter pedicellatorum sepalis 5 subrotundatis microscopice ciliolatis dorso glandulis 0–2 onustis ; *disco* denticulato ; *ovario* subgloboso 3 loculari ; *stylis* abbreviatis breviter bifidis ; *capsula* —.

Portuguese Congo, Sumba, Peco ; *Gossweiler*, 8694.

Folia plerumque 8–10 × 2·5–3·5 cm. ; costa media subtus eminens ; costæ lat. utrinque circa 10 ; reticulum sat laxum, pag. inf. obscurum, pag. sup. prominens. Cymulæ sæpissime 2–3-floræ. Sepala 2 mm. long. Ovarium 3 mm. diam.

The toothed leaves coupled with the glandular sepals are the chief marks of the species.

RICHARD DYER

(1651–1730).

By R. T. Gunther, M.A., F.L.S.

The late editor of the *Journal of Botany*, Mr. James Britten, was always so ready to welcome new recruits to his roll of British botanists of the seventeenth century that it is difficult not to think of him when suggesting yet another name for inclusion in his lists.

Richard Dyer came to my notice as one of the contributors to a collection of natural history specimens, which was formed by John Pointer, of Merton College, at the end of the seventeenth, or at the beginning of the eighteenth, century, and which was bequeathed to St. John's College about 1740. For many years the collection, to which the botanists Samuel Dale and Jacob Bobart also contributed, was kept in the College Library ; but, at no very distant time, it was cast out into a cellar, where it not only suffered greatly from the attacks of insects and moulds, but also was partly destroyed by

the fall of plaster from the ceiling, and everything got into a dreadful state of dirt and confusion. Fortunately, the librarian-custodians had taken better care of the manuscript catalogue, and with its aid, and that of a few of the surviving labels, it was possible to make out that Dyer had presented a series of ores from various mines in Devon and Cornwall, and a small collection of seeds and fruits from Barbadoes. So, with a strong prepossession in his favour, I turned to my friend Mr. Todd, Dyer's successor as a Fellow of Oriel College, to enquire what more was ascertainable. Our collector was the son of Richard Dyer de Malborough, co. Devon, and at the age of 18 years matriculated at Oriel on 16 Nov., 1669. On 21 Oct., 1673, as a Bachelor of Arts of only four months' standing, he was elected to a fellowship, being then described as of Yard, Devon. He was a great friend of Hearne's, who describes him as "an excellent scholar and admirably well-skilled in Botany," but so modest that he published nothing under his own name. He did, however, contribute anonymously a Preface to the third volume of the Oxford *Historia Plantarum*, and has been accredited with the Life of Morison that precedes it. It is also said that Bishop Fell gave him the refusal of the chair of Botany, but he declined it. In 1685 he gave eight Virginian Cedars to Oriel, which were planted "in the Grove" on March 5. The College historian, Mr. Rannie, notes that his benefaction did not stop here, for in 1720 he contributed £300 towards the purchase of the advowson of Ufton Nervet in Berkshire; he also gave £65 17*s.* 6*d.* for laying out the gardens of the college, and £100 13*s.* 6*d.* towards the improvement of the college fabric. He withdrew from Oxford to Devonshire in 1724 to the great regret of Hearne, but retained his Fellowship until 1729, the year before his death.

"A very healthful man, a great walker, and had not he married in his old age, but lived in Oxford after his old way, he might have lived much longer, and been a very great benefactor to his college; but the broils in the college forced him to retire."

His Barbadian plants are numbered and are named with English names, which are, on the whole, similar to those of specimens in the Sloane collection, which, thanks to the courtesy of Dr. Rendle, I have had the privilege of consulting. The collection included seeds of the 'Cedar tree,' Horse Nickar, Indian-wood or Ink-berry, Prickly Yellow-wood, Jack-in-a-box, Indian River-wood, Sweet Mastic, Sweet Timber-wood, Poison Olive, Tamarinds, Black Nickar, Lignum Vitæ, Indian Wood, Pea-tree, Sour Cherry, Clammy Cherry, Seaside Grape, Maccaw tree, Fat Pork, White Wood, Canna Indica, Everlasting Pea and Bean, a Barbadoes Senna, Palmetto, and Thorn-Apple. And by the kindness of St. John's College the collection is at present on view with other early scientific collections in the Old Ashmolean Museum.

A NEW BRITISH EROPHILA.

By E. Drabble, D.Sc., F.L.S.

In May 1907 and 1908 an *Erophila* was found on the more turfy banks of the sand-hills at Wallasey, Cheshire (v.c. 58), and again in April 1910 at Ashover, Derbyshire (v.c. 57), growing amongst moss on damp Carboniferous Limestone rocks. In both places it grew plentifully and without admixture of other Erophilas. It is clearly different from any *Erophila* that has hitherto been recorded for this country. The fruits are terete—that is, so greatly inflated as to be circular in transverse section,—but it is certainly not *E. inflata* Wats. The Wallasey and Ashover plants are alike in all respects except that those from Wallasey are rather more hairy and have a greater proportion of 4–6-pronged hairs. The description of the plant is as follows:—

Flowering stems very slender, 2–5 cm. in height, generally single, occasionally 2 or 3, upright or slightly decumbent at the bases; stem and leaf and calyx with 2–6 (chiefly 3 or 4)-pronged hairs. Leaves spreading in a rosette, very small, 2–6 mm. long, oblanceolate, broadest above the middle and gradually tapering to the base, entire or more or less dentate distally. Petal about 2·5 mm. long, bifid to about one-third of its length, lobes slightly divergent. Fruit narrowly oblong, obtuse, somewhat narrowed below, 3–4 mm. long by 2·25–2·5 mm. broad, terete (round in cross-section); seeds 14–16 in loculus. Lower pedicel about once and a half as long as the fruit.

Compared with the Erophilas admitted to the London Catalogue, ed. xi. (1925), the plant somewhat resembles in habit certain specimens which have been called *E. virescens*, but the nature of the hairy coating at once distinguishes it from *E. virescens* Jord., as also from *hirtella* Jord. and *glabrescens* Jord., while the outline of the fruit marks it off from *verna* E. Mey., *stenocarpa* Jord., and *brachycarpa* Jord., and the whole habit is quite different from that of *majuscula* Jord. *E. inflata* Wats. from Ben Lawers is an altogether larger plant, with usually several or many flowering stems which are strongly decumbent at the base, linear-lanceolate leaves and larger broadly oval or elliptical fruit (I cannot describe them as ovoid-oblong, as is done in *Hooker's Student's Flora*, ed. 3 (1884) 35), many more seeds and long fruiting pedicels, the lowest being 3–4 times as long as the fruits. This Ben Lawers plant keeps its characters in cultivation, as is shown by a specimen grown by H. M. Drummond Hay and kindly lent to me by Mr. Groves.

A careful examination of the works of Jordan (*Pugillus* and *Diagnoses*), Clavaud (Fl. Gironde, 1882), Rouy and Foucaud (Fl. France, ii. 1895), Moranne (Bull. Soc. Bot. France, xiii. 1913), and others, has failed to find any description that fits the plant now under consideration. Perhaps the nearest resemblances are to *E. decipiens* Jord., which, however, differs in its larger fruit and more decumbent stems, and to *E. spathulifolia* Jord., which is altogether larger in leaf-stem and fruit, while neither of these has a terete siliqua.

E. subrotunda Jord., which has a tinged fruit, differs entirely in the shape of the fruit and in other characters.

A plant from Duston, Northamptonshire (May 1909), sent by Mr. F. G. Wilcox to the Watson Exchange Club as *E. inflata* Hook. f. by Mr. W. Bell, presumably had turgid capsules, although this feature is not mentioned in the note in the Watson Ex. Club Report for 1909–10, p. 220. Neither Mr. Arthur Bennett nor the Rev. E. S. Marshall would accept Mr. Bell's plant as *E. inflata*, but to me it appears to be strikingly like it, though the fruits are larger than those of the Ben Lawers *inflata* as I know it. However this may be, it is quite different from my Ashover and Wallasey plants.

Erophila œdocarpa, sp. nov. *Herba* pilis 2–6 (plerumque 3–4)-furcatis obsita; *scapo* sæpius unico (vel interdum scapis paucibus), erecto vel basi leviter decumbente; *foliis* oblanceolatis 2–6 mm. long.; *petalis* 2·5 mm. l.; *siliculis* anguste obovato-lanceolatis, a tertia parte inferiore ad basin angustatis, 3–4 mm. long., 2·25–2·5 mm. lat. teretibus; *seminibus* in quoque loculo 14–16; *pedicello* infimo fructibus dimidio longiore.

Whether this plant should be called a species or a variety depends largely upon one's point of view. I am inclined to regard it as a species. If *inflata* be given this rank, it cannot be denied to *œdocarpa*.

"NATIVE" BRITISH PLANTS.

By G. Claridge Druce, LL.D., F.R.S.

The producers of the new edition of the *London Catalogue* are to be congratulated upon their completion of an arduous task. Necessarily it invites criticism, and on many points there is not only diversity of opinion, but there is much to be said for and against when the grades of plant-species, varieties, subspecies, and forms are involved. Then there will be differences of opinion as to the rejection or inclusion of certain plants, and various views are held as to the British status of many species. In this work three methods are used: native species are in roman letters, well-established but not native plants have an asterisk, while alien species more or less settled are in italics. A glance through the Catalogue reveals that there is much to object to, especially in the first two categories. It appears astounding that full rank, as native species, is given to *Silene conoidea* L., *Chenopodium Berlandieri* Moq., *C. hircinum* Schrad., *Rumex obovatus* Danser, *Urtica Dodartii* L., *Sisyrinchium californicum* Ait., and *Festuca glauca* Lam.

My own opinion, and that of all the botanists I have met with, is that not one of the foregoing have the slightest claims to be put into our indigenous flora. Indeed, with the exception of the *Sisyrinchium*, not one is even naturalized, although the Chenopods and Dock occur from year to year in one place or another on rubbish-tilts. I do not suppose there is a living botanist who has seen *Urtica Dodartii* in

Britain. *U. pilulifera*, under which it is put as a variety, is in Italies, and now is one of our rarest aliens.

Silene conoidea L. only appeared as a rare alien in Jersey, where Mr. Piquet and myself gathered it on a rubbish-heap at St. Ouens with other aliens, and as such it has appeared now and then in Britain. Brébisson rejects it as a plant of Normandy in the *Flore de France*; the authors say, "très rare dans les moissons," and Nyman only gives it for the South of France, Spain, and Liguria—it is a native of the East. In Normandy, as Brébisson says, "a form of *conica* has been mistaken for the true *conoidea*"—I suspect that is the case in Jersey, since Lester-Garland omits it from his Flora, and neither of the many botanists who have visited the island have recorded it. Moreover, the plant figured for it in the *Cambridge British Flora* is almost certainly *conica*.

Chenopodium Berlandieri Moq. is not even European—it is a native of dry places (see Adv. Fl. Tweedside, 1919, 197) of N. America—Missouri to Texas and Florida and Mexico.

C. hircinum Schrad. is also extra-European, being a native of S. America—Brazil, Paraguay, Uruguay, Argentina, and is adventive only in South Africa, Europe, Central and S., and Britain; but it is of comparatively recent occurrence here.

Rumex obovatus Danser is also not European, but of S. American origin. It was first (B. E. C. 1920, 258) named *R. paraguayensis* (the earliest-known specimen is one gathered by me at Ware, Herts, in 1914). Subsequently Professor Danser has described it as a distinct species. It appeared in Germany, Prov. Rhenana, in 1911. It does not become established at present, and has no claim to be considered indigenous.

Curiously, *Rumex Brownii*, an Australian species which has established itself on Tweedside, is omitted, with *Acæna* and many others, from the Catalogue.

Sisyrinchium californicum Ait. This plant is completely naturalized in a large field near Wexford Harbour, in Ireland, but we may be quite confident that it is not a native Hibernian species. The Canadian *Polygonum sagittatum* has a similar habitat on the shores of Kenmare Bay. There it is abundantly and widely naturalized as is the Sisyrinchium, yet by a lucky accident on my visit to that habitat in 1906 I met the one peasant who could give me the history of its introduction (see B. E. C. 1906, 241). Had careful enquiry been made at the time at Rosslare, it is quite probable that the history of the introduction of the Sisyrinchium might have been elicited. One must bear in mind that it has been a garden-plant in Britain since 1796, so that to hortal or agrestal means the introduction of this Western American species (limited as it is to a strip of the Pacific coast) must probably be due. Even the Blue Sisyrinchium itself may be an introduced species. The yellow-flowered plant has been found adventive in Northern England this year.

Festuca glauca L. Professor Hackel is quite certain that this garden-species with us is not a native of Britain; that, too, was the opinion expressed by Mr. Howarth in his paper recently read before

the Linnean Society. The species has been much confused with glaucous members of the *ovina* or *rubra* groups.

It would be well to make it quite clear to phyto-geographers that neither of the foregoing plants are indigenous to Britain or Ireland.

It is curious to see *Calla palustris* put in the second grade when the date of its introduction to Surrey is known and the name of its planter. Why should it have this grade (with *Quercus Cerris* and *Q. Ilex*) when *Populus serotina*, the *Fuchsia*, *Rhododendron*, *Symphoricarpus*, and *Larix*, among others, are absent from the Catalogue, and although the extinct alien *Kentranthus Calcitrapa* (never more than a garden-escape) and *Pyrus domestica* (Sorbus), of which the solitary tree in Wyre Forest was burned down half a century ago, still survive in the pages, which are too crowded to admit the segregates of *Bursa*, *Thymus*, or *Taraxacum*?

The foregoing instances relate to geographical distribution, the more debatable examples of nomenclature, doubtful identifications, and omissions remain undiscussed, but one might ask if any of your readers can supply British examples of *Ranunculus Aleæ*, *Orobanche arenaria*, *Thymus Trachselianus*, or *Rumex maximus*, as they would be much valued.

OBSERVATIONS ON BRITISH LEMNACEÆ.

By J. Gordon Dalgliesh.

On August 2, 1925, Bramber, Sussex, a ditch was found covered entirely with *Lemna gibba*. Free flowering must have taken place during the unusually hot months of June and July, as nearly all individual plants examined were in fruit. Amongst these were a few flat fronds. The water they were in had no flow at all, neither was it connected with the main stream that wound its way through the rest of the meadows. This is contrary to the statement of Dr. Agnes Arber, in her work *Water Plants*, that "The fronds are most conspicuously gibbous in *running* water" (the italics are the writer's). One easily learns to distinguish *L. gibba* from *L. minor* at a glance, even when the plant only produces flat fronds, by its larger size. Moreover, viewed *en masse*, the former is a brighter green, and presents a more polished surface than the latter, and the growth is more luxuriant. No doubt the flat fronds are frequently confused with *L. minor*, and *L. gibba* may therefore be more common than is generally supposed. It would appear from observations that *L. gibba* might only be expected to flower in exceptionally hot summers. It was found that during August the gibbous fronds gave rise to flat fronds, the appearance of these always resulting in the death of the parent fronds. This was after flowering, and agrees with the observations of Dr. Guppy (Journ. Linn. Soc., Bot. vol. xxx. 1895). It would be quite reasonable to assume that the rarity of *L. gibba*, as compared with *L. minor*, is because the former requires a higher temperature than is needed for the latter. It was, however, found that when both species were confined in a room under a bell-jar, the excessive temperature resulted in the death of *L. gibba*, whereas *L. minor* was not affected at all. A writer over the initials "W. G. S." in *Science Gossip*, January 1865, states that "*L. gibba* only affects those localities where one might expect to find typhus fever and cholera morbus rampant. The amateur in search of the latter species (*L. gibba*) must look out for a pestilent and loathsome ditch, rich with the putrid remains of dead dogs and defunct cats. In such places the Gibbous Duckweed grows and fattens, for, be it noted, this is probably the sole cause of its gibbosity." This has certainly not been the writer's experience. On the contrary, *L. gibba* was found in, though perhaps not exactly pure water in the strict sense of the word, yet nevertheless far from living in such a situation as that described by "W. G. S." The same writer goes on to affirm that "If the same ditch is followed towards one of its extremities, where the water may be purer, it will certainly be found that the Gibbous soon becomes mixed with the Lesser, and at last, in the pure element the Lesser Duckweed reigns supreme." Again, "Three or four hundred fronds were collected and placed in an aquarium, covered with a flat glass to induce flowering to take place, without the least effect. In the course of three or four days, a botanical friend was shown the plants of the Gibbous Duckweed, and, lo! they were no longer *gibba* but *minor*! The experiment was repeated time after time, and invariably with the same result, for, whenever the Gibbous Duckweed was taken from its unclean element and placed in purer water, it immediately put the Banting process into operation, and got rid of its superfluous fat, ultimately becoming a Lesser Duckweed." The author of the above remarks jumped to the conclusion, because of this, that "these two species are one and the same."

On August 2, 1925, plants of *L. gibba* were procured with some of the water in which they were growing and placed in a glass bowl. On August 27 most of the plants had lost their gibbosity, and had put out flat fronds. The habitat was visited about a week previous to the above-mentioned date, and a very large proportion of the plants here had lost their gibbosity. There can be little doubt that the writer in *Science Gossip* mentioned above was mistaken in supposing the flat fronds of *L. gibba* were those of *L. minor*. A possible solution is this. *L. gibba* does not depend on either foul or stagnant water to enable it to produce gibbosity, but only in exceptionally hot summers is the spongy parenchyma strongly developed, and this gibbosity precedes flowering. But more observations are needed to verify this. Dr. Agnes Arber confirms this, for she says (*Water Plants*): "The degree of development of the air-tissues varies with external conditions." It would be therefore reasonable to assume that to ensure gibbosity and flowering in *L. gibba*, the plant requires a surface temperature of 70° Fahr. (21° C.), and probably a depth temperature of 90°, or possibly more, foul water having nothing to do with the matter. The decay of the gibbous fronds is fairly rapid, all green matter disappearing, leaving a spongy skeletonized frond, from which the young flat frond may often be found arising.

On August 3, 1925, at Henfield, Sussex, two ponds contained

Spirodela polyrrhiza as well as *L. minor*, *gibba*, and *trisulca*. *Spirodela*, so far as Sussex is concerned, would appear to be local and sporadic. Not one was found at Bramber, only a few miles distant. In the above-mentioned pond it could not be counted rare, yet on the other hand it was not abundant, as was the case with *L. minor* and *trisulca*. Hitherto, according to observations, it had been found scattered about in a few localities sparingly. On August 6 a ditch was found in Lewes Levels about a couple of yards wide completely covered with *Spirodela*, to the exclusion of all else. There must have been thousands of plants growing in thick masses. It is quite a common occurrence to find *L. minor* covering a pond or ditch, but coming upon what had always been regarded as a comparatively rare species growing in such profusion gave rise to much speculation as to the cause. This abundant growth had not spread to further ditches, being confined to the one small spot only. *Spirodela polyrrhiza* might, under such favourable weather conditions prevailing during 1925, continue to produce abundantly. The ponds where it was found at Henfield were of some size as compared with the Lewes ditch, and amongst other aquatic vegetation here, having a much wider area to cover, the growth would be scarcely noticeable as anything out of the common. The surface-temperature in the ditch at Lewes registered about 80° Fahr. All the *Lemnaceæ* had during the summer of 1925 an exceptional season of sunshine inducing vigorous growth, enabling sexual or vegetative reproduction. It is stated that the flowers of *Spirodela polyrrhiza* are unknown in Great Britain.

Observations show that vegetative reproduction would seem to promote more vigorous growth than sexual. *Hydrocharis Morsus-ranæ* is an example of this. In Great Britain seeds are seldom set, and the plants reproduce so rapidly by vegetative process as to choke ditches with its tangled growth. In *Hydrocharis*, the *Nymphæaceæ*, and other aquatic plants, anthocyanin is present, but as to whether it possesses the property of converting light rays into others which have a high heating-power there seems to be a diversity of opinion. For the sake of hypothesis, let it be assumed such is the case.

L. gibba, *minor*, and *trisulca* probably flower oftener than is generally supposed. These, then, would not only have to depend on vegetative production to increase, as is the case with *Spirodela polyrrhiza*, whose flowers and fruit in other countries are rarely found. In consequence, perhaps, *Spirodela* has a greater need of protection than other Duckweeds. It is much more leaf-like in form than the other *Lemnaceæ*. Its close resemblance to a liliputian *Nymphæa* leaf must be apparent to all who have paid any attention to the Duckweeds. Its larger size, heavier bulk, and leaf-like form may render it more liable to damage by wind and heavy rain. Its many roots help to stabilize its equilibrium, for it is less convex than either *L. gibba* and *minor*. *L. trisulca* being submerged is in the safest position of all from weather conditions.

Spirodela polyrrhiza has sometimes as many as twenty-two fronds connected, eight or nine have been found on *L. minor*, while a group of eighteen fronds has been noticed on *L. gibba*.

OBITUARIES.

William Philip Hiern
(1839–1925).

Like the late C. B. Clarke, who was five years his senior at Cambridge, Hiern approached Botany by way of the Mathematical Tripos. Born on Jan. 19, 1839, at Stafford, he was sent in 1848 to a boarding-school at Worcester, and in 1857 entered St. John's College, Cambridge. He was ninth wrangler in 1861, and a Fellow of his College from 1865–8. He also graduated (M.A.) at Oxford. We have his own word for it that as a boy and in his early University days he was not interested in Botany, and between 1861 and 1863 he contributed three papers to Journals devoted to Mathematics. In the British Association Report for 1865 there is a note by him on *Ranunculus radians* as a British plant, and notes on other British plants appeared in the reports for 1867 and 1869 and in the *Journal of Botany* for 1867 and 1870. In 1868 he married a Yorkshire lady and settled at Richmond, in Surrey. Then followed some years of active botanical work in the Kew Herbarium under the direction of Sir Joseph Hooker and Prof. Daniel Oliver. Hiern contributed accounts of the *Lythraceæ*, *Umbelliferæ*, *Araliaceæ*, *Rubiaceæ*, *Valerianeæ*, *Dipsaceæ*, *Goodenovieæ*, *Ebenaceæ*, and *Compositæ*, the last with Prof. Oliver, to vols. ii. (1871) and iii. (1877) of Oliver's *Flora of Tropical Africa*, and of *Meliaceæ* and *Sapindaceæ* to Hooker's *Flora of British India*, vol. i. (1875), and of *Solanaceæ*, *Acanthaceæ*, *Gesneraceæ*, and *Verbenaceæ* to Warming's *Symbolæ ad floram Brasiliæ centralis cognoscendam* (Part xxiii., 1876). But the most important piece of work of this period was his *Monograph of the Ebenaceæ*, published by the Cambridge Philosophical Society (1873). His selection of this family was characteristic; he said that he had consulted Dr. Hooker as to what families most required elucidation; Hooker suggested *Ebenaceæ* and *Sapotaceæ*, and "as he put *Ebenaceæ* first I selected that." He published notes on the same family at intervals in the *Journal of Botany*, and his last botanical contribution, an account of Dr. H. O. Forbes's Malayan *Ebenaceæ* appeared in the Supplement of the *Journal* in 1925. He was interested in the *Rubiaceæ* of Tropical Africa; his paper "On the Peculiarities and Distribution of *Rubiaceæ*" appeared in the *Journal of the Linnean Society*, *Bot.* xvi. (1878), and "On the African Species of the Genus *Coffea*" in the *Transactions*, ser. 2, i. (1880). In 1871 he wrote in the *Journal of Botany* "On the Forms and Distribution over the World of the *Batrachium* section of *Ranunculus*"; and about the same period brought his knowledge of the mathematics to bear "On a Theory of the Forms of Floating Leaves in certain Plants" (Proc. Camb. Phil. Soc.).

In 1881 he published, with Count de Ficalho (Trans. Linn. Soc., Bot. ser. 2, ii. 1881), an account of a collection of Central African Plants by Major Serpa Pinto, which was later issued in Portuguese.

Hiern had been intimate with Dr. Friedrich Welwitsch, whose magnificent collections of Angolan plants were the subject of a

lawsuit after the collector's death in 1873. The compromise which was effected gave to the British Museum as complete a set as possible after the study set, which was returned to Lisbon, and the work of separation was entrusted to Hiern and carried out at the Museum. Hiern also undertook the preparation of a Catalogue, and had made some progress when his botanical work was interrupted by a call to the family estate in North Devon. He took up his residence at "The Castle," Barnstaple, where, except for the break to be referred to immediately, he spent the rest of his life. After the lapse of about fifteen years he found himself able to resume his work upon the Catalogue. He took a house at Kensington and worked steadily at the Museum, producing his elaborate account of the Dicotyledons, which was published by the Trustees of the British Museum in four parts, totalling 1035 pages, between 1896 and 1900. The F.R.S., to which Hiern was elected in 1903, was a fitting recognition of his contribution to taxonomic botany.

It was at this period that I made his acquaintance. I was instructed to work out the Welwitsch Monocotyledons, and this entailed constant reference to certain notes, of which Hiern had charge. I was much impressed with his great precision and also his tremendous respect for Welwitsch. Part of his work as distributor of the collections had been the supervision of the accurate transcription of all Welwitsch's very copious notes on the plants, and woe betide me if I dared to suggest any omission or condensation.

During the time of Hiern's sojourn at the Museum, botanists were stirred by Otto Kuntze's rigid application of the law of priority to botanical nomenclature. Hiern became an ardent disciple, and was never happier than when he could adopt some old genus name which displaced the current one; many such occur in the Catalogue, and he resented the compromise of the list of "Nomina Conservanda" adopted at Vienna in 1905.

After completing the Welwitsch Catalogue, Hiern worked for a time at Kew, elaborating the *Scrophulariaceæ* for the *Flora Capensis* (iv. 1904), an important piece of work.

After his return to Barnstaple we saw him only occasionally, though he contributed notes to the *Journal* at intervals, on points of nomenclature, on the *Ebenaceæ* in which he still retained his interest, or on the Devon flora. It was always understood that he would publish a Flora of his county, for which he had accumulated a large amount of material, and had compiled an elaborate "Census-List." Miss C. E. Larter, who had been botanical recorder for Devon and to whom I am indebted for information on Mr. Hiern's life and work in his county, refers feelingly to his passion for complete accuracy which militated against accomplishment in this particular direction. It is to be hoped that it will be possible to make use of the material.

I last saw Hiern in 1914, when, though 75 years of age, he went with the British Association to Australia, and read a paper on Australian *Ebenaceæ* at the Melbourne session. I recall an incident which illustrates a quaintly humorous side of his character. When travelling together from Adelaide to Melbourne, I asked him the time. "Yes," said he, "I will tell you the correct time"; noticing that it required some calculation, I found that he had not altered his watch since leaving England, and when I expressed surprise he merely remarked "I refuse to tamper with Greenwich time."

Though as botanists we may regret the interruption of Hiern's botanical work, we must admire his untiring devotion to his town and county. His public service was maintained with the same steady, precise, and methodical effort which had characterised his scientific work. As Lord of the Manor of Stoke Rivers he had important local responsibilities; and the affection and respect which his public services inspired are reflected in the appreciations which appeared at his death in the county newspapers *, where he is described as "A Great Devonian." He was deeply interested in the work of the Devon Education Committee, of which he had been Chairman, and was also a Governor of the Barnstaple Grammar School. He served on numerous Committees of the County Council, and was one of the original Aldermen of the County. In 1919 he was President of the Devonshire Association, and of the Union of Educational Institutions, 1922–3. He was a staunch Liberal and one of the leaders of the party in the North-West Devon Division. A paralytic stroke in 1923, from which he partially recovered, disabled him, but he still fulfilled some of his public engagements. He died at his home at Barnstaple on November 29; his wife and only son predeceased him by many years.

Hiern's botanical interests were purely taxonomic; I think he was a little suspicious of the modern school of botany, but he was too cautious to express an opinion. As regards his own affairs he was very reserved, but he gave the impression of a man who had set for himself a high ideal of conduct, and pursued steadily and persistently what he thought to be the right course.

He was elected F.L.S. in 1873 and served on the Council of the Society, 1874–76. He was also a corresponding member of the Royal Academy, Lisbon. A. B. R.

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The Rev. George Henslow
(1835–1925).

George Henslow, who was born on March 23, 1835, was the son of the Rev. John Stevens Henslow, rector of Hitcham, Suffolk, and Professor of Botany in the University of Cambridge, who has been described as the pioneer of practical elementary teaching in botany. George was educated privately at Sawston Parsonage, Cambs, and afterwards at the Grammar School of Bury St. Edmunds. In 1854 he became a scholar of Christ's College, Cambridge. He must have worked hard at the university as he not only gained a first-class in the Natural Sciences Tripos, but also a second-class in both Mathematics and Divinity. A reference in Mr. Leonard Huxley's 'Life and Letters of Sir Joseph Hooker' indicates that in his student days young Henslow was considering a career as a botanist. Hooker, who in 1851 had married George's sister Frances, writing to Professor Henslow in 1856 on the subject of his son's career, says, "keep him to botany if you can, but not to the exclusion of other scientific pursuits, drawing, &c. I am well sure that there will be openings, and good ones, for accomplished botanists ere long."

However, after taking his B.A. in 1858, Henslow was ordained and became curate of Steyning, Sussex, where he remained till 1861, when he was appointed headmaster of Hampton Lucy Grammar School, Warwick; four years later he became headmaster of a grammar school in Store Street, London, remaining there till 1872. He was curate at St. John's Wood Chapel from 1868 to 1870, and from 1870 to 1887 assistant minister at St. James's, Marylebone. In 1886 he was appointed Lecturer on Botany at St. Bartholomew's Medical School, where he served until 1890; he also held botanical lectureships at the Birkbeck Institute and Queen's College, London. For many years he was Honorary Professor of Botany to the Royal Horticultural Society, and examiner in botany to the College of Preceptors. He did useful work in helping to popularize science, and was frequently at the service of local natural history societies; from 1882 to 1904 he was president of the Ealing Natural History Society.

Henslow was a good lecturer. He had a clear and fluent delivery, and took great pains to present his subject in an attractive manner with the help of illustrative specimens and drawings. His afternoon lectures at the meetings of the Royal Horticultural Society were much appreciated by amateurs who were glad to learn something more about their plants than names and methods of cultivation. His scientific communications to the Linnean Society, though often adversely criticized, were models of clear exposition. He was, indeed, an exponent rather than an investigator. While accepting the general idea of evolution, he was unable to follow Darwin's explanation of the origin of species by the natural selection of chance variations. He maintained that the environment had played a very active part in the origin and development of existing plant-structures. In his two volumes, published in the International Science Series, 'The Origin

of Floral Structures' (1888) and 'The Origin of Plant Structures' (1895), this view was developed. He considered, for instance, that the form and arrangement of the parts of a flower which is visited by bees were the direct result of the visits of the insect, operating over a long period. Few botanists were able to accept this theory; it was too mechanical; and Henslow suffered the mortification of finding his work ignored, though he himself remained firmly convinced of the soundness of his views. He also published several useful books for elementary students, 'Botany for Children,' 'How to Study Wild Flowers,' and 'South African Flowering Plants,' and also wrote on 'The Uses of British Plants,' 'Poisonous Plants,' and 'The Plants of the Bible.' On a different plane were some works on the bearing of science on theology, such as 'Evolution and Religion,' 'Christian Beliefs reconsidered in the Light of Modern Thought,' and 'Present-day Rationalism critically examined.'

In physique Henslow was broad and well-set with an impressive bearing; to the passer-by he looked the prosperous Churchman of assured position. As a chairman, or in any position requiring dignity of bearing or a little of the grand manner, he was excellent. But his somewhat didactic manner and a tendency to dogmatize were sometimes resented by his fellow-scientists, though they could not but admire his enthusiasm. His kindly disposition and readiness to help on any movement for the spread of knowledge brought him many friends during the course of an unusually long and varied life. In his later years, which were spent in retirement at Bournemouth, he became interested in Spiritualism. He was twice married; his first wife died in 1875; the second, whom he married in 1882, also died before him. He was a Fellow of the Linnean and Geological Societies; and the Royal Horticultural Society signified appreciation of his services by appointing him one of the 60 original Victoria Medallists of Honour in 1897. He died at his home in Bournemouth, on December 30, in his 91st year. A. B. R.

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Miss Winifred Smith
(1858–1925).

Miss Winifred Smith, who died on December 24, entered University College, London, in 1899, after some years devoted to teaching, and graduated B.Sc. with honours in Botany in 1904. In 1905 she obtained an 1851 Exhibition Scholarship, and working at the Royal College of Science investigated the seedling phases of certain rubber-producing *Sapotaceæ* ("The Anatomy of some Sapotaceous Seedlings," Trans. Linn. Soc. ser. 2, vii. 189–200 (1909)). From 1912 until her death she was Tutor to women students at University College.

NATURE RESERVE ON KANGAROO ISLAND, SOUTH AUSTRALIA.

At the meeting of the Linnean Society on January 7, Prof. F. Wood-Jones, D.Sc., F.R.S., gave a brief account of the Fauna and Flora reserve on Kangaroo Island, South Australia. This Reserve—known as Flinders Chase—comprises some 500 square miles at the western end of the island. It was set aside as a sanctuary by the Government of South Australia by Act of Parliament in 1919. The administration of the Reserve is carried out by a small Board, of which Prof. Wood-Jones is the honorary secretary. The work carried on by the Board was outlined and some account of the Fauna and Flora was given. Funds for the Chase have to be raised by the Board, and on all moneys collected the Government grants a pound for pound subsidy. It is intended that the Reserve shall function, not only as a sanctuary, but as a depot for the legitimate supply of scientific material to workers in Australia and other lands, and for the furnishing of living animals to zoological gardens, specimens to museums, and pelts to the fur market. In this way the Board is confident that ample revenue can be raised for much needed work upon the Chase, and granted a continuance of public goodwill and proper political support, it may be safely predicted that Flinders Chase will rank among the important sanctuaries of the world, and be a cherished possession of South Australia when the terrible depletion of the indigenous Fauna and Flora, which is proceeding on the mainland, has robbed Australia of its unique zoological and botanical interest. Considerable progress has already been made in the direction of introducing on the Chase those species which are in most immediate danger of extermination on Continental Australia, and this policy will be steadily continued so far as opportunity and funds permit. A series of lantern-slides illustrating the topography and some of the animals and plants of the Chase was shown, and the following Resolution was unanimously adopted:—

> "That the Linnean Society in General Meeting assembled having heard with great interest and pleasure the account by Prof. Wood-Jones of the Flinders Chase Reserve in Kangaroo Island, desire to express their appreciation of the work which is being done for the preservation of this portion of the South Australian Fauna and Flora."

INTERNATIONAL CONGRESS OF PLANT SCIENCES.
(Fourth International Botanical Congress.)

British botanists have been awaiting further information as to the programme for the proposed International Congress at Ithaca, to which it will be remembered an informal invitation was issued at the final meeting of the Imperial Botanical Conference in July 1924.

A notice communicated by the organising committee, consisting

of Dr. B. M. Duggar (Missouri Botanical Garden), Chairman, Dr H. C. Cowles (University of Chicago), Secretary, and Dr. H. H Whetzel (College of Agriculture, Ithaca) to *Science* (Jan. 16, 1925) formulated the following general regulations .—

1. An International Congress of Plant Sciences (Fourth International Botanical Congress) shall be held in Ithaca, New York, August 16–23, 1926.
2. Membership in the Congress shall be unrestricted and conditional only upon subscribing to any regulations announced and upon the payment of such nominal fee as may be necessary for legitimate expenses in organising and conducting the Congress.
3. In the scope of the Congress shall be included the different branches of botanical science together with what are known as its broader applications in the fields of bacteriology, agriculture, and forestry—these various aspects to be suitably grouped in sections.
4. The work of the Congress shall be primarily with problems of fundamental research and teaching, but adequate opportunity shall be accorded all sections for the discussion of regulatory recommendations of international significance.
5. Ample time shall be reserved in the preparation of the programme for excursions of interest to the various sections.
6. Particulars of the meetings, discussions, and excursions shall be published as early as practicable.

Within the last few days letters of invitation to participate in the work of the Congress by communicating papers have been received by a number of botanists in this country, and the following letter has also been issued :—

DEAR COLLEAGUE,—

Permit me to draw to your attention the arrangements that are now definitely going forward for an International Congress of Plant Sciences to be held at Ithaca, New York, August 16–23, 1926. The inclosed Preliminary Announcement will give you some idea of the proceedings leading to the determination to hold this Congress in the United States at the time stated. As you will note, the scope of the Congress has been so broadened as to include all of the fundamental and the applied plant sciences ; accordingly, a considerable phase of what is commonly regarded as agriculture and horticulture is included. Permit me also to emphasize the fact that the present Congress will deal primarily with the research and educational aspects of this group of sciences. The program will be arranged primarily with a view to the presentation and discussion of fundamental research. Nevertheless, abundant opportunity will be afforded for the discussion of matters pertaining to nomenclature or other regulatory aspects of the sciences included. This will offer opportunity for arriving at a closer international understanding on such questions. It is not anticipated that at the present time a Congress of this nature could be truly representative of all countries and educational institutions; accordingly, it has been ruled by the Organizing Committee that the final adoption of rules of procedure purporting to be international in character will not be permissible.

In view of the enthusiastic support thus far received, it is believed that the Congress will be well attended and of far-reaching importance. No restriction whatsoever will be placed upon attendance, and in the arrangement of the invitation programs for the various sections or subdivisions, an endeavour will be made to secure participation of all nationalities in so far as they may be able to offer important contributions.

The Organizing Committee is sincerely desirous that notice of this Congress may reach all botanists and students of plant material. The Committee would, therefore, greatly appreciate your co-operation in transmitting to the botanists in your institution and to those in your vicinity the information the present letter endeavours to convey. Further printed announcements will follow in due time.

Hoping that you may arrange to be in Ithaca in 1926, I am

Very truly yours,

B. M. DUGGAR,

Chairman, Organizing Committee.

SHORT NOTES.

ACOSTA SPICATA Lour. (see Journ. Bot. 1925, p. 282). Another synonym for this is *Vaccinium orientale* Sw. in Weber u. Mohr, Beitr. zur Naturk. Bd. i. p. 4, tab. ii. (1805). As Swartz mentions having before him other Loureiro specimens than that under notice, search in the Stockholm herbarium should bring to light more Loureiro material, and possibly lead to the elucidation of names still upon the unknown list. The plate (from Swartz's own drawing) accompanying the description vies with it in excellence.—S. MOORE.

CHROMOSOMES AND CHARACTERS IN ROSA AND THEIR SIGNIFICANCE IN THE ORIGIN OF SPECIES: C. C. HURST 1925, in *Experiments in Genetics*, xxxviii, 534–550, figs. 169–175.

The genus *Rosa* is well known as one of the most critical in Western Europe, and Mr. Hurst's work throws such new light on the way to a possible solution of the classification of this, and perhaps of other equally difficult genera, that it needs to be made as generally known as possible. Briefly stated, the facts are as follows:—All Roses have the chromosomes in multiples of seven, but study of the morphological characters shows that where several series of seven occur these septets are not necessarily merely duplications of an original septet, but that there are five different septets which may be called A, B, C, D, and E. Thus diploid species with 14 somatic chromosomes are of five different kinds, AA, BB, CC, DD, and EE. Fifty different taxonomic characters have so far been correlated with definite septets as occurring in the five simple diploid species. Species with more chromosomes may be of the kind AAAA or of compound nature such as AABDE, AABBEE, BBCCDDEE, and so on. It was Mr. Hurst's observation of an octuploid species such as the last that brought about the discovery, since Mr. Hurst noticed that it possessed characteristics of four distinct diploid species. Further study of the plants indicates that these septets work independently, and that in complex species they may show themselves in the morphological characters in different parts of the plant or even at different stages of the plant's growth. Sometimes one septet may be dominant part of the time, while another predominates at another season or even only temporarily under unusual conditions.

The ability to discover a definite chromosome formula correlated with taxonomic characters may make it possible to begin a classification based on the real differences between the forms. Mr. Hurst would put all forms with the same chromosome formula into the same "species." To do this adds one more to the already too numerous connotations of the term species, and seems unnecessary. There are, of course, many different Roses with the same chromosome formula, just as in other genera there are many distinct species with the same chromosome number. There are evidently variations within the chromosomes themselves responsible for the further differentiation.

It seems clear that at the present stage we shall not be able to name and classify Roses definitely without knowing their chromosome formula. But the ordinary morphological taxonomist need not despair, as this is clearly but a stage in our knowledge of the group. It may be necessary at this stage to discover to which septet each morphological character belongs, so that one may know its real significance for classification. But when this is done it should be possible to know what must be the chromosome formula from the morphological characters of the plant, and so to identify the forms in the usual way, with the difference that the classification will be fixed, resting on a more definite basis. We get a step behind the external morphological characters. It seems possible that similar study of *Hieracium* and *Rubus* may also provide one with a similar bed-rock on which to build a definite classification.

Mr. Hurst's remarks concerning the phylogeny and origin of species seem open to criticism. He rejects the view that the complex "species" arose by crossing of the simple "species," as it "would seem to involve a complete reversal of the generally accepted views of the Arctic origin of the flora of the Northern hemisphere." As I have long considered that this theory is against all general principles, and that there is considerable evidence in distribution pointing to the origin in the more tropical regions, it seems a pity that Mr. Hurst's conclusions should be strained to fit in with a theory which is in urgent need of revision. The theory appears to be largely based on misidentification of fossils. Anyone who has ever studied an Arctic vegetation will realise its extreme poverty. The Arctic is a kind of plant hovel, in which it is impossible to imagine the production of such wealth as is found in the tropics to-day. Everything not absolutely valuable for life is eliminated under such conditions, while many variations of little or no biotic value persists in wealthy surroundings. Wealth is not produced in hovels.

Mr. Hurst finds that the simpler diploid species have a distribution nearer the tropics, while the more complex ones are nearer the poles. To square with the Arctic origin theory he therefore postulates the origin of existing Roses from an original primitive (more Arctic) type of the formula AABBCCDDEE. The origin of simpler species by gradual loss of chromosomes is said to be the "more simple proposition." But, is it? One may ask where the complex species came from. Somehow it seems against all general principles to regard a complex type as primitive. That one may sometimes

get reductions to simplicity is possible, but scarcely throughout a whole genus.

His other arguments against the simple species being primitive are not very strong. The fact that the different simple species now usually occupy different habitats and usually flower at different times is not really a great objection. The distribution may well have been different in the past, and occasional crosses occur in other genera where the normal flowering times are different. And the occasional crosses are all that are needed. We also know that in a hybrid of the type AB there may rarely occur (and once is enough!) a duplication to the type AABB which will enable the hybrid to breed true. Mr. Hurst points out that the possession by a plant of several different septets should enable it to survive difficult conditions, as the necessary adaptations may be provided by the operation of a different septet. This may account for their more northerly distribution.

But whatever the correct phylogenetic interpretation may be, the discovery that there are two kinds of polyploidy, *i. e.*, mere duplication and differential polyploidy, is a new idea which may prove of great value. So much so, that it seems unfortunate that the more natural conclusions are rejected in order to avoid conflict with the probably erroneous theory of the Arctic origin of Angiosperms.

A. J. WILMOTT.

LEDUM PALUSTRE.—The Report of this plant growing in a moor on the edge of Lancashire and Yorkshire is of interest to Scotch botanists. Dr. Druce's *Hayward* in later editions gave it as naturalized in Perthshire, and flowering in June–July. It has been reported from the moss near Dunblane, but on what authority we cannot say; a Glasgow botanist who searched the moss could not find it. We remember the late Mr. Shearer, some thirty years ago or so, exhibiting a piece to the Glasgow Natural History Society in flower from the Flander's Moss, near Buchlyvie, but its precise locality was a secret. About two years ago in a paper to the same society on alpine plants, it was mentioned that *Ledum palustre* was not a British plant. This statement was challenged on the facts given above, and it was then mentioned that one of our well-known botanists of a generation or more back had said that the plant was not uncommon on the Flanders Moss between Buchlyvie and Cartmore. We accordingly made an expedition there, and subsequently two other excursions to different parts of the moss, but failed to locate the plant. We went about May and July, and the season was a late one. Admittedly we looked for the white flowers of the shrub. From the observations in the *Journal* the plant evidently seldom flowers, and is difficult to locate. We hope to renew the search next season with better information and let us hope with success; but Flanders Moss, which is lowlying, and resembles an Irish bog rather than a Scotch moor, is wide, and it is easy to overlook a small shrub among the mass of vegetation all about the same height.—R. GRIERSON.

REVIEW.

Manual of the New Zealand Flora. By T. F. CHEESEMAN, F.L.S., F.Z.S., Curator of the Auckland Museum. Second edition, revised and enlarged by the Author. Edited by W. R. B. OLIVER, F.L.S., F.Z.S. 8vo, pp. xliv, 1162. Wellington, N.Z.: New Zealand Board of Science and Art, 1925.

THE original edition of the late Mr. Cheeseman's *Flora* appeared in 1906 and was very favourably reviewed by the late editor in the *Journal* (1907, 74). At his death, in October 1923, Mr. Cheeseman had completed the manuscript of the main portion of the new edition, the synoptical key to the families, the list of Maori names, and the glossary; the list of introduced plants was about half finished; this has been completed by the editor from Mr. Cheeseman's notes and published papers. Mr. Oliver has also added a review of botanical work in New Zealand from 1905 to 1924 and a list of the published works of Mr. Cheeseman.

The new edition is of a larger octavo than the original, and though with about the same number of pages is a much bulkier work to use. The number of species described is 1763, or 192 more than in the first edition; their distribution among the great groups is as follows: 159 Pteridophytes, 20 Gymnosperms, and 1584 Angiosperms, of which 400 are Monocotyledons and 1184 Dicotyledons. A striking change from the original edition is in the systematic arrangement of the families, which now follows Engler's *Syllabus*, instead of the arrangement adopted by Bentham and Hooker in their *Genera Plantarum*. This alteration, which must have involved considerable labour, does not facilitate a comparison of the two editions, but in the second Mr. Cheeseman has included references under each species to the original edition and also to his *Illustrations of the New Zealand Flora* (1914). Comparison of the two editions indicates that the author had carefully revised the text, bringing notes on distribution up to date, and adding the results of his own study and those of other workers on the New Zealand Flora.

BOOK-NOTES, NEWS, ETC.

AT the meeting of the Linnean Society on December 17, 1925, Prof. R. R. Gates gave an account of his recent visit to the Amazon Basin, illustrated by a series of lantern-slides of the vegetation. The whole of the Lower and Middle Amazon basin, from the Atlantic to the Andes, lies within a few degrees of the equator and represents the greatest area of forest in the world. Practically the whole region is clothed with luxuriant tropical rain-forest, but little altered by the hand of man. The largest unexplored areas in the world are to be found there. At high river, in June, the water-level is in many places

over 50 feet above its level at the end of the "dry" season. As the river rises, thousands of square miles of forest-country are inundated, often many feet deep. This is known as *igapo*, and the annual flooding has striking effects on the vegetation. Large areas of coarse grasses, called *canarana* (chiefly species of *Panicum* and *Paspalum*), often occur along the river-margin. These have rhizomes half an inch in diameter, which root in the mud and grow out into the river. As it rises they float on the surface, while masses are torn loose from their moorings by the floods and float down the river as green carpets of vegetation.

Another interesting plant on the river's edge is *Montrichardia linifera*, an Aroid whose stems form a striking palisade, rooting in the mud. Of ecological interest is a formation of *Salix Martiana* and *Alchornea castaneifolia*, often intermingled. They are small trees usually forming a river-fringe, often with areas of *canarana* behind them. Among floating plants, several species of *Eichhornia* are common, sometimes flowering in masses in sheltered lagoons. Utricularias are found in similar situations, as well as *Salvinia*, *Azolla*, and *Lemna* spp. *Victoria regia* also spreads its leaves in sheltered lagoons, and late in the season is apt to be overgrown by *canarana*.

Another characteristic plant along the river is a gigantic "pampas" grass (*Gynerium sagittatum*); the upper part of the stalk is used to make arrows for shooting the turtles which abound everywhere. Small fine-leaved bamboos of many species occur in some places. Another characteristic tree of the river's brink, which evidently likes to have its trunk submerged, is *Bombax Munguba*. It drops its leaves while maturing its fruits. The bare whitish branches hung over with large brick-red fruits make a striking sight. The silk-cotton tree, *Ceiba pentandra*, another member of the *Bombacaceæ* the giant of the Amazon jungles—has the same habit. It would be very interesting to make a study of annual growth-rings under these conditions.

Interesting in another way is *Triplaris surinamensis* (*Polygonaceæ*), a tall myrmecophilous tree. Its abundant flowers made a great show on the river in July and August. A blow on the trunk brings down a shower of ants. Innumerable other trees are of commercial and botanical importance, and woods which might be used commercially are too numerous to consider.

The two most numerous families in the forest are the *Leguminosæ* (Cæsalpinioideæ) and the Palms.

AT the meeting on January 7, 1926, Mr. Eric Marsden Jones described his further observations on the pollination of the Primrose. Observations were made by day and night in a wood at Potterne in Wiltshire in order to ascertain with the greatest degree of accuracy the part that day- and night-flying insects might play in the pollination of this plant. A series of systematic observations were made by day, between April 8 and May 15, 1925. The length of time in observing was in all 12½ hours, and the number of important species

of insects seen pollinating frequently was five. They comprise *Bombus hortorum*; *Anthophora pilipes*, ♂ and ♀; *Bombylius major*, ♂ and ♀; *B. discolor*, ♂ and ♀; *Rhingia campestris*, ♂ and ♀. All these have a proboscis long enough to pollinate.

The night observations extended from April 9 to May 15, 1925. Fifteen visits were paid to the wood at various hours, covering the entire night from 8.15 P.M. to 4.40 A.M. The time spent was 16 hours 20 minutes, and the only visitors seen were *Meligethes erythropus*, *Tachyporus salutus*, and *Forficula auricularia*, which are of no value from a pollinating point of view.

Besides these direct observations a control experiment was also carried out. Two blocks of 50 plants each were covered alternately day and night. The patch from which insects were excluded at night produced 343 capsules, while the one exposed by night, and from which day-flying insects were excluded, produced only 5, for which there is an explanation. This experiment lasted from April 19 to May 23. A further control experiment was carried out, six plants being covered entirely day and night; these proved to be absolutely sterile.

The conclusions drawn from the direct and experimental evidence prove that diurnal insects do pollinate efficiently, and that nocturnal Lepidoptera play no part whatever in the pollination of *Primula vulgaris*.

Prof. F. Wood-Jones, F.R.S., gave an account of the Fauna and Flora Reserve on Kangaroo Island, South Australia (see p. 57).

HEARTIEST congratulations are extended to Professor John Bretland Farmer, whose name appears among the Knights in the New Year's Honours. Reference is made to Professor Farmer's services as a member of the Advisory Council to the Department of Scientific and Industrial Research, and a Governor of the recently-organised Imperial College of Tropical Agriculture, Trinidad. In these and other ways Prof. Farmer has rendered yeoman service to the State and to Science; he is also remembered among many generations of students for his work, extending over more than thirty years, at the Royal College of Science (now part of the Imperial College of Science and Technology), where he succeeded Dr. D. H. Scott in 1892 as Head of the School of Botany. Sir John is also known among botanists as an eminent scientific investigator.

WE hear with regret the report of the death of Mr. J. H. Maiden, the eminent Australian botanist, who had recently retired from the Directorship of the Botanic Gardens, Sydney. We hope later to publish some account of his work.

APPOINTMENT.—Mr. Geoffrey Tandy, B.A. (Oxon.), has been appointed an Assistant in the Department of Botany, British Museum. For the past three years Mr. Tandy has been successively Research Student and Demonstrator in Botany at the Birkbeck College under Professor Dame Helen Gwynne-Vaughan.

EPIPACTIS DUNENSIS Godf.

EPIPACTIS LEPTOCHILA Godf.

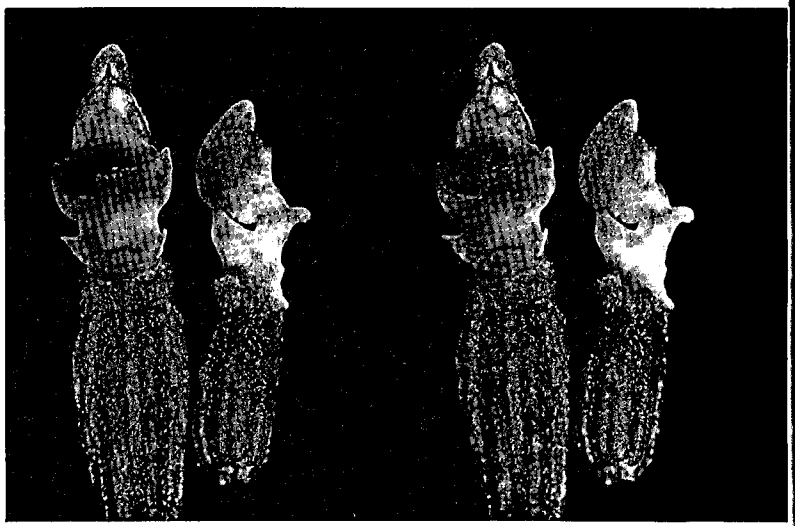


Fig. 1.—Ovary and column of EPIPACTIS LEPTOCHILA Godfery, ×4.

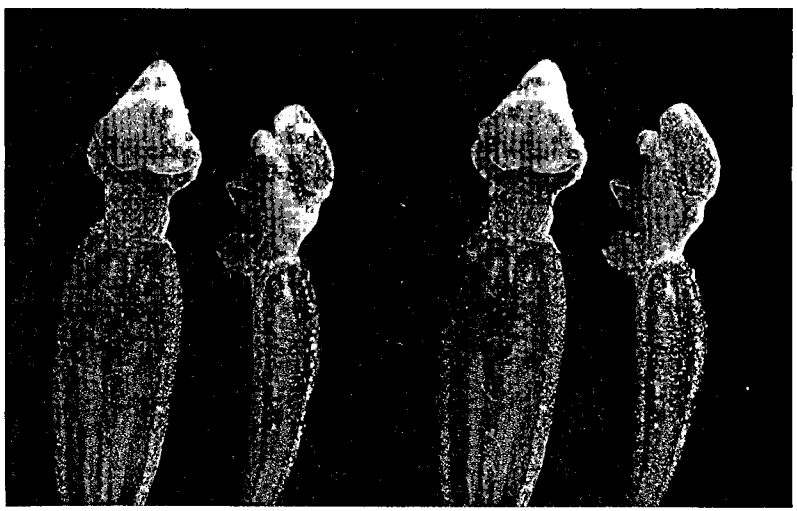


Fig. 2.—Ovary and column of EPIPACTIS DUNENSIS Godfery, ×4.

EPIPACTIS DUNENSIS GODF.

BY COLONEL M. J. GODFERY, F.L.S.

(PLATES 574–576.)

MESSRS. WHELDON and TRAVIS published an excellent description of this plant under the name *Helleborine viridiflora* (Journ. Bot. 1913, 343), stating that the late Mr. Rolfe thought that it completely agreed with "authentic" specimens of *Epipactis viridiflora* Reichb. at Kew. A water-colour drawing (*vide* Pl. 574) was sent by me to Dr. Keller, of Aarau, Switzerland, who named it *E. latifolia* var. *viridiflora*. There was thus a strong *prima facie* case for its identity with the latter. Later, however, it was stated at Kew that there is no evidence that Reichenbach passed or saw any of the specimens there, which cannot therefore be strictly called authentic. In 1924 Dr. Keller asked to see the drawing again, and returned it marked *Epipactis dunensis*.

Epipactis viridiflora was first described by Hoffmann (Deutschl. Flora, 182; 1804), as follows:—"*S(erapias) viridiflora*, foliis elliptico-lanceolatis sessilibus inferne vaginantibus, floribus pendulis externe cum germine purpurascentibus, interne viridantibus, nectarii labio obcordato, pallide roseo, bracteis flore longioribus. Fl. dan. t. 811? Ad margines sylvarum; fl. Aug." [Leaves elliptic-lanceolate sessile, sheathing below, flowers drooping, like the ovary purplish outside, greenish inside, lip of nectary obcordate, pale rose, bracts longer than the flower. Fl. dan. t. 811? Flowers August.]

In *dunensis* neither flowers nor ovary are purplish outside, its habitat is not the margins of woods, and it flowers June, July.

Reichenbach described it as follows (Fl. germ. Excurs. 134; 1830):—"*E. viridiflora* (*Serap.*) Hoffm. Foliis elliptico-acuminatis amplexicaulibus, labio cordato-ovato acuto plano, petala sepalaque lanceolata ovario oblongo longiora æquante. *Serapias latifolia* b. *sylvestris* Pers., *Serap. latifolia* Fl. dan. 811. Pedales, vaginæ arctæ præcedentis, folia omnesque reliquæ partes magis elongatæ tenuioresque ut ortum e locis umbrosis indicent; flores virides plus vel minus rubicundi. In schattigen Laubwäldern in der Ebene! Jul., Aug." [Leaves elliptic-acuminate amplexicaul, lip cordate-ovate acute flat, equalling the lanceolate petals and sepals (which are) longer than the oblong ovary . . . . One foot high, with the close-fitting sheaths of the preceding (*E. latifolia*), leaves and all other parts more elongated and slender, as if sprung up in shady places; flowers green, more or less reddish. In shady woods in the plains. July, August.]

Although this somewhat vague description gives no tangible character by which *E. viridiflora* can be distinguished with certainty from *E. latifolia*, it does furnish points of discrepancy between the former and *E. dunensis*—the sepals and petals of the latter are not longer than the ovary, the lip is neither flat nor equal to the sepals, and the basal sheaths are loose or even funnel-shaped, not close-

fitting. Neither the leaves, bracts, sepals, or petals of *E. dunensis* can possibly be called slenderer or more elongated than those of *E. latifolia*; the habitat is totally different, and the time of flowering does not agree. In the face of these numerous discrepancies it is impossible to maintain the identity of *E. dunensis* with *E. viridiflora* Reichb.

Ascherson and Graebner (Syn. Mitt. Eur. Fl. iii. 802) state that *viridiflora* has no rostellum and is self-fertilised. Dr. Schlechter kindly ascertained for me from Dr. Graebner that this statement was based solely on literature, not observation, *i. e.*, on H. Müller's paper on *E. viridiflora*. It has been shown (Journ. Bot. 1921, 101) that Müller was dealing, not with *E. viridiflora* Rchb., but with *E. Muelleri* Godf., recently renamed *Parapactis epipactoides* by W. Zimmermann, who took it as the type of a new genus (Orch. Rev. 1923, 259). The younger Reichenbach puts *E. viridiflora* Hoffm. under his *Epipactis Helleborine* var. *varians* Crantz, which appears to have been *E. violacea* (Oest. Bot. Zeit. 1905, 267). He cites *E. purpurata* Sm. as a synonym, giving Surrey and Boxhill as localities (*Icones*, xiii. 143, 1851), and, as habitat, woods, almost always in the most shady places, often with *Equisetum sylvaticum*. The strongest argument for the identity of *dunensis* with *viridiflora* was the absence of a rostellum and the fact of self-fertilisation. Since these two characters were attributed to *E. viridiflora* (which we shall presently see has a very efficient rostellum and is extremely well visited by insects) in error, this argument falls to the ground.

At Thorenc, Alpes Maritimes, France, in 1920, I watched *E. latifolia* sous-espèce *viridiflora* (E. G. Camus, Bergon, A. Camus) throughout its flowering-season, which began June 27th. Specimens sent to Mdlle A. Camus were confirmed as belonging to the above. It has a very efficient rostellum, the flowers are promptly visited, and the pollinia removed by insects (wasps). The same year Dr. Keller sent me two batches of Swiss *viridiflora*, not in good condition, but yet exhibiting the same characteristics. On Aug. 11th, 1924, he sent me further specimens in quite fresh condition. In all these the floral mechanism was exactly that of *E. latifolia*, the method of pollination by insects the same, and there was no self-fertilisation. Careful study of French and Swiss specimens compelled me to admit, contrary to my previous opinion, that Continental *viridiflora* is a mere variety of *E. latifolia* (Journ. Bot. 1921, 101). It does not resemble either *dunensis* or *leptochila*. In *E. dunensis*, as in *E. leptochila* (Journ. Bot. 1920, 36), the main method of pollination is by the protrusion of pollen over the sloping upper edges of the stigma on to its viscous frontal surface. In this respect they both resemble the Continental *E. microphylla*, but the latter has a large rostellum, and self-fertilisation only occurs if the flowers are not pollinated by insects. In *E. dunensis* tiny globules of pollen may often be seen adhering to various parts of the flower, the young pollinia being friable, though later becoming much less so. I

have never seen this in *E. leptochila*. Both species occasionally develop a rostellum in the newly-opened flower, and a flower may be found here and there from which the pollinia have disappeared, leaving only a little fringe of pollen on the upper edge of the stigma. It seems probable, therefore, that cross-pollination through insects may sometimes occur in both.

Dr. Stephenson (Journ. Bot. 1921, 205) places *dunensis* as a variety of *E. leptochila* Godf., and in respect of its method of pollination it is identical. The following considerations, however, seem to justify the separation of (D) *dunensis* from (L) *leptochila*:—

(1) In general appearance D shows substantial differences from L (*vide* Pls. 574 and 575). They could hardly be mistaken for each other.

(2) The root-system in L is strongly developed. There is a thick knotted rhizome with numerous stout fleshy roots springing from the nodes—*i. e.*, at different levels. In D the root-system is extremely poor. There is no knotted rhizome. The stem descends deep into the sand, and a few (usually only 2 or 3, rarely as many as 10) short slender wiry roots spring from its extremity, a small hard mass which appears to be the remains of previous plants.

(3) In L the nodes are shorter, though the stem itself is taller.

(4) The spike in L is longer and more graceful, and the bracts usually longer and more acuminate.

(5) In D the flowers are considerably smaller, and do not open so wide as in L.

(6) In D the sepals and petals are short, broad, and slightly hooded, while those of L are long and more or less acuminate.

(7) In D the epichile is cordate-triangular, as broad as long, the tip usually recurved; in L it is long, narrow, cordate-acuminate, projecting straight forward.

Some specimens of *leptochila* from Maidenhead and Gloucester had sepals, petals, and epichile short, as in *E. latifolia*. These were, I believe, hybrids between *E. latifolia* and *E. leptochila*. A similar plant was sent me by Mr. Tahourdin from Godstone, and raised doubts in my mind as to whether in some localities *leptochila* might not vary in the direction of *latifolia*, but on visiting the place with Mr. Tahourdin last year, I found only typical *leptochila* and typical *latifolia*. I later received typical *leptochila* from the Gloucester localities also.

Doubtless, there may be systematic botanists who will prefer to consider both *E. dunensis* and *E. leptochila* as varieties of *E. latifolia*. This is merely transposition into another key. The differences between the plants and their relation to each other remain exactly the same, whether personal predilection regards them as species, races, or varieties. There is this much to be said in favour of their specific rank, that while no one seriously questions that they have been

derived from a common ancestor, no proof has yet been adduced that this ancestral form still persists unchanged as a present-day species.

The following is a description :—

Epipactis dunensis, sp. nov. *Caulis* 20–40 cm. long. profunde descendens, vaginis basalibus laxis, radicibus paucis brevibus tenuibus rigidisque. *Folia* disticha oblongo-lanceolata rigida sæpe plicata. *Racemum* laxum floribus paucis, parvis, flavido-viridibus; bracteis lineari-lanceolatis, inferioribus flores superantibus. *Ovarium* breviter pedicellatum glabrum vel pilis brevibus parcissime indutum. *Sepala* ovario breviora ovata obtusa carinata cucullata. *Petala* sepalis similia sed magis acuta translucentia. *Labellum* sepalis breviore, hypochilo dilute viride intus roseo-maculato, epichilo deltoideo acuto albido vel roseo-tincto apice recurvato, callis binis humilibus levibus interdum deficientibus. *Stigma* oblongum marginibus superioribus pronis. *Rostellum* deficiens vel mox evanidum. *Pollinia* primum fragilia, clinandrio tumescentia et super marginem stigmatis effusa.

Hab. Sand-dunes amongst *Salix repens*, on the coast of Lancashire and Anglesey. In flower June–July.

Synonyms. *Helleborine viridiflora* Wheldon & Travis; *Epipactis leptochila* Godf. var. *dunensis* T. & T. A. Stephenson.

Explanation of the Plates.

Plates 574 and 575 are from photographs (reduced by one third) of water-colour drawings (natural size) by Mrs. H. M. Godfery.

Plate 574.

Epipactis dunensis Godf. Hall Road, S. Lancs, 21 July, 1917. (1, 2) Flowering plant; (3) Single flower, ×2.

Plate 575.

E. leptochila Godf. Horsley, 29 July, 1918. (1) Plant with four flowering-stems; (2) One of the four flowering-stems; (3) Single flower, ×2; (4) Part of fruiting-stem.

Plate 576.

1. Stereoscopic front and side views of ovary and column of *E. leptochila* Godf. (×4); 2. Similar views of *E. dunensis* Godf. (×4).

In (1) *E. leptochila* the anther protrudes much further over the edge of the stigma, and is perched on a nib-shaped pedicel, the space between the back wall of the column and the back of the stigma is greater, and there is a deep incision on each side of the column.

In (2) *E. dunensis* the anther is almost sessile on the flat wall of the column.

These stereoscopic photographs are by Herr Pfeiffer-Wellheim, 21 Mommseng, Vienna, N., from whom excellent stereoscopic photographs of nearly all European orchids can be obtained.

ABSTRACTS OF PAPERS OF INTEREST TO STUDENTS OF THE BRITISH FLORA.

Notes on British Carices (Trans. & Proc. Bot. Soc. Edinburgh, xxix, pt. 2 (1925) 126–9).—Mr. Arthur Bennett gives some interesting notes on some of our rarer Carices, and among these we notice the following :—*Carex Davalliana* Sm.; doubts have been expressed for many years whether this has really occurred in Britain. The only true specimens were gathered by Mr. Groult and Mr. Ward at Lansdown, Bath. There are specimens in the British Museum, in the herbarium of York Phil. Society, and in Mr. Spencer Bickham's herbarium. *Carex aquatilis* Wahl.; the latest addition to the area of this species is Cumberland (C. E. Salmon, 1919). *C. spiculosa* Fr. var. *hebridensis* Ar. Benn.; Dr. Almquist agreed that Fries's plant was the only one to which it could be referred, differing only in the want of scabridity on the glumes, although these are equally as long. Fries's species is one of the rarest of Carices, known only on the shores of the White Sea in Russian Lapland. *C. flava* × *saxatilis* L. (× *C. Marshalli* Ar. Benn.); this *Carex* is known from Argyll (*Druce*), Perth (*Marshall*), Forfar, Aberdeen, and W. Ross. *C. inflata* var. *borealis* Laest.; easily known when barren by its long involute leaves. *C. inflata* var. *utriculata* Kük.; Bailey considered it a distinct species, but Kükenthal makes it a variety. *C. saxatilis* L. var. *glomerata* Ewing; this is very like small plants of *C. atrata* L., and grows on Ben Lawers, Creag Mhor, Glen Lochay, and Beinn Heasgarnich.—E. G. B. & C. E. S.

Additions to the Flora of Orkney (*tom. cit.* 151–170).—This is a careful review, by Colonel H. H. Johnston, of recent additions to the flora of Orkney. Amongst these we notice :—*Viola tricolor* L., subsp. *genuina* Wittrock, var. *færöensis* (Becker) Ostenfeld; common—a weed of cultivation. This is a new record for this variety. *Cerastium tetrandrum* Curtis var. *eglandulosum* Salmon; widely spread. *Rosa omissa* Déséglise var. e. *suberecta* Wolley-Dod, form *b. glabrata* Wolley-Dod; rare. *Solidago Virga-aurea* L. var. *Plukenetiana* Druce sub-var. *acutifolia* Druce; 380 ft. above sea-level, Burandie, Hoy. *Jasione montana* L. var. *latifolia* Pugsley; grassy banks at seashore, Carrick, Eday. *Euphrasia*; certain corrections are made in the previous records. *Plantago Edmondstonii* Druce; formerly recorded as *Plantago maritima* var. *hirsuta* Syme, edge of cliff, Hoy. *Chenopodium album* L. var. b. *virescens* Wahlenberg; Masons Arms Hotel, Stromness Town. *Polygonum æquale* Lindman; 10 ft. above sea-level, Clett, between the Nevi and Fishy Ness, Graemsay. *Orchis incarnata* L. var. *pulchella* Druce; marsh, 60 ft. above sea-level, Kirbister. *O. incarnata* L. var. *dunensis* Druce; marshy loch-side, Loch of Skaill. *O. prætermissa* Druce; marsh near the Burn of Selta, Stromness: and *O. prætermissa* Druce *O. purpurella* T. & T. A. Stephenson; from the same locality. *O. prætermissa* Druce var. *pulchella* Druce; widely spread. *O. purpurella* T. & T. A. Stephenson; widely spread. *O. maculata* L.

subsp. *ericetorum* Linton × *O. prætermissa* Druce var. *pulchella* Druce; widely spread. *Potamogeton pectinatus* L. var. *diffusus* Hagström forma *longipedunculatus* Tiselius; determined by Arthur Bennett; N.W. end of Loch of Stenness, Stromness: also forma *pratensis* of the same species; Bay of Voy, N.W. end of Loch of Stenness. *Equisetum umbrosum* Meyer (*Equisetum pratense* Ehrh.); native, rare. *E. sylvaticum* L. var. *serotinum* Milde; banks of Naversdale Burn, Orphir. *Chara delicatula* Agardh var. c. *annulata* Groves & Bullock-Webster; near Holmes of Washbister, Loch of Harray.—E. G. B. & C. E. S.

The Genus Festuca (Nederl. Kruid. Archief, 1924, 203-212).—P. Jansen and W. H. Wachter continue their critical remarks on the genus *Festuca*. In their previous paper (Nederl. Kruid. Archief, 1922, 167) they dealt with the numerous forms and varieties of *F. ovina* L. and *F. rubra* L. In the present paper they deal with the forms and varieties of *F. pratensis* Huds., *F. arundinacea* Schreb., and *F. gigantea* Vill.

Under *F. pratensis* Huds. they have var. *eu-pratensis* St. Yves, with the following five subvarieties:—subvar. *typica* Hack., subvar. *fasciculata* Sonder, subvar. *subspicata* A. & G., subvar. *Hocquettei* R. Lit., and subvar. *intermedia* Hack. Of the first subvariety, *typica*, they have the following forms:—f. *mucronulata* Belli, f. *aristata* J. & W. (an aristate form), f. *angustifolia* J. & W. (leaves narrow, 2–5 mm. broad, involute), and f. *distantiflora*, J. & W. (lax-flowered form).

Of *F. arundinacea* Schreb. they have three varieties: var. *genuina* Hack., var. *glaucescens* Boiss., and var. *Uechtritziana* Hack. They have two subvarieties of the first of these: subvar. *vulgaris* Hack. and subvar. *mediterranea* Hack.

The following hybrids are also given:—*F. pratensis* × *Lolium perenne*; *F. pratensis* × *gigantea*—this was mentioned in the Floristische Aanteekeningen xviii. of the same publication; and *F. arundinacea* × *gigantea*—found near Amsterdam in 1922.—E. G. B. & C. E. S.

Aconitum anglicum Stapf (*Botanical Magazine*, pl. 9088, 1926).—Dr. Stapf describes as a new species *Aconitum anglicum* from S.W. and W. of England and E. Wales. There is a careful figure and a good description. It is, of course, a close ally of *A. Napellus*, but flowers earlier—in the latter half of May well on into June,—and has racemes of mauvish-blue flowers and light green foliage of soft, if not limp, leaves, deeply dissected into long pointed lobes with the margins slightly rolled backwards. The author has failed to locate this Aconite outside England, so concludes that it is a native of this country, which does not imply that every one of its stations is natural. It is the *A. Napellus* of English authors, and was figured by Syme in *English Botany*, and by Moss in the *Cambridge British Flora*.—E. G. B. & C. E. S.

Lactuca alpina (*The Naturalist*, Oct. 1925, 315).—Mr. R. J. Pilsbury reports that a friend has sent him *Lactuca alpina* from N.E. Yorkshire (v.c. 62), where it occurred as a patch two yards long by a hedge dividing fields, and had been known there for fifteen years. This is presumably either a garden escape or has been purposely planted, but it is not often seen in cultivation, the usual species listed by nurserymen being *L. Bourgæi* and *L. Plumieri*.—C. E. S. & E. G. B.

In *The Vasculum* (xi. No. 4, July 1925, 121) Dr. J. W. Heslop Harrison discusses the Marsh Orchids which occur in Durham. Some very interesting field-notes are given, which all who study this group of plants should consult.

The following are reported from the county:—*O. incarnata* L., *O. prætermissa* Druce, and its var. *pulchella* Druce, *O. Fuchsii* Druce, *O. ericetorum* Linton, *O. O'Kellyi* Druce. Also the following hybrids:—*O. incarnata* × *prætermissa*, *O. ericetorum* × *incarnata*, *O. prætermissa* × *Fuchsii*, *O. Fuchsii* × *ericetorum*, *O. Fuchsii* × *Gymnadenia conopsea*, *O. ericetorum* × *G. conopsea*, *O. purpurella* Stephenson. The last Dr. Harrison regards "as the outcome of a cross between *O. Fuchsii* and *O. prætermissa* of a later generation than the F_1 lot, which is the hybrid above-mentioned and probably also the *O. latifolia* of various authors."—C. E. S. & E. G. B.

ON THE IMMIGRATION OF SOME BRITISH TREES*.

By O. G. E. Erdtman, D.Sc.

This note is based chiefly on a statistical investigation of pollen from two series of peat samples collected in July 1925, from Chat Moss, west of Manchester, and from West House Peat Moss, Kildale, N. Yorkshire.

Chat Moss. At the bottom is sand or clay, usually covered with dark forest-peat, thickness 0·5–1 m. This layer was not developed at the place where the samples were collected. Above the forest-peat follows *Eriophorum vaginatum*-peat (2·5–7 m.), often with lenticles of slightly-decayed *Sphagnum* peat.

West House Peat Moss. At the bottom clay, then 45 cm. Detritus-Gyttja (*cf.* Journ. Linn. Soc. (Bot.) xlvi. 455, 1924), 85 cm. forest-peat (birch), and 425 cm. cotton-grass peat. The Detritus-Gyttja must be older than the oldest layers of Chat Moss. It contains, but rather sparingly, pollen-grains of birch (dominating) and pine.

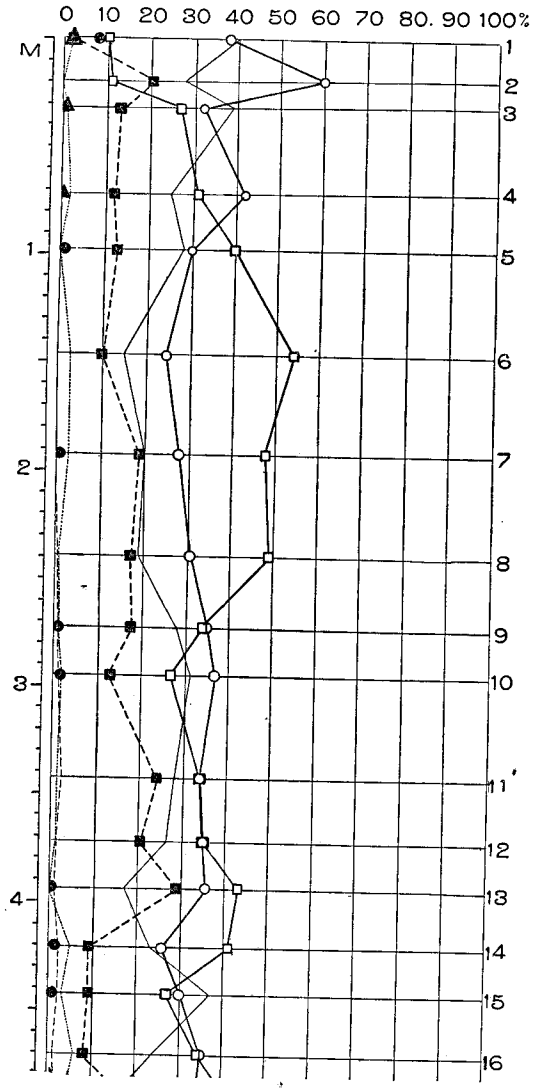
The relative frequency for the forest-trees expresses the percentage of pollen-grains for each tree in relation to the whole number of pollen-grains, exclusive of *Corylus* and *Salix*, which are not

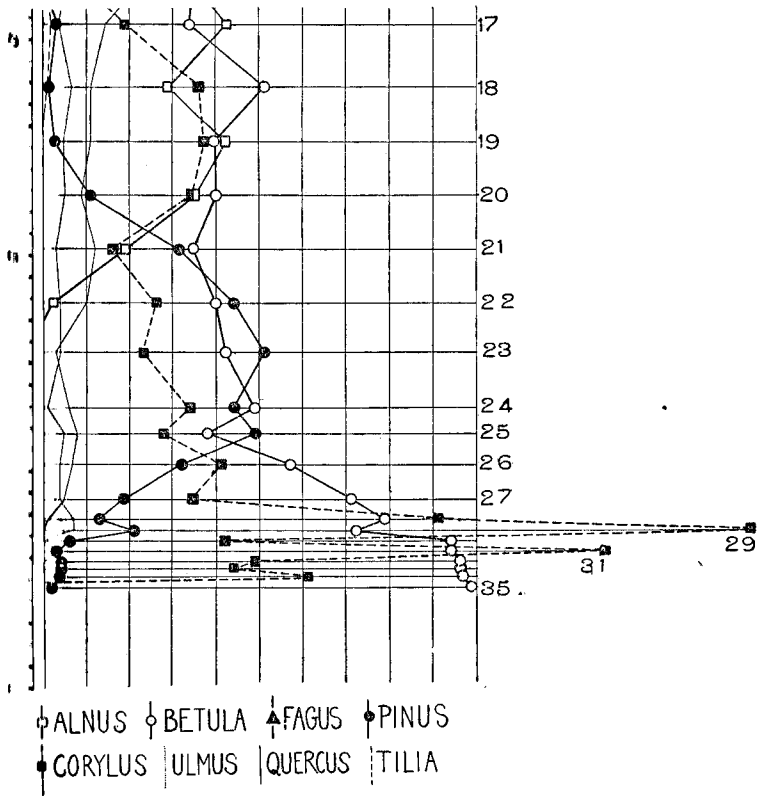
* From the Botanical Laboratory, The University of Stockholm.

included among the forest-trees. For these the percentage is calculated separately, as a percentage of the above-mentioned total.

The relative frequency-number of *Salix* pollen reaches 50 per cent. or even more.

A pollen-diagram from Chat Moss is shown. The very rapid increase of hazel pollen is noteworthy. A similar early post-glacial





Pollen-diagram from the Chat Moss.

In this pollen-diagram the horizontal scale gives the percentages of pollen-grains for the various forest-trees (indicated by signs as shown). The vertical scale shows, on the left, the depth in metres from which the samples were taken; on the right, the numbers under which the successive samples are recorded.

Corylus-pollen maximum has already been described from S.W. Sweden (L. von Post in Geolog. Fören. Förhandl. xlii., Stockholm, 1920); South Germany (K. Bertsch in Jahreshefte Ver. vaterl. Naturkunde Württemberg, lxxx. 1924); P. Stark in Ber. Naturf. Ges. Freiburg i. Br. xxiv. 1925); Czechoslovakia (Rudolph & Firbas in Beih. Bot. Centralbl. xli. 1924); and from certain places in North Scotland, although not so typically (Journ. Linn. Soc. (Bot.) xlvi. (1924)). After the maximum period of pine pollen (samples 20–29) this pollen appears more or less sporadically. *Tilia* pollen (maximum frequency 2·5 per cent.) was only found in samples 8–18.

Judging by the evidence derived from the statistical investigation of pollen from Chat Moss and West House Peat Moss, it appears that the forest-trees must have reached the middle of England in the following order:—

1. Birch and, probably a little later, pine (less frequent). Willows. 2. Hazel. 3, 4. Elm, oak. 5. Alder. 6. Lime. 7. Beech.

With regard to ash, holly, and maple, nothing can be said with certainty from the investigation of the above peat-deposits only. Pollen of holly (*Ilex Aquifolium*) is rather frequent in some Irish bogs (Svensk Botan. Tidskr. xviii. 1924). A single pollen-grain belonging to this species was found in sample 5, Chat Moss.

The relation between the history of the forests and the post-glacial changes of land-level will be dealt with later in another note on Lancashire and Yorkshire peats.

THE FIRST "ANGIOSPERM."

At a recent meeting of the Linnean Society Dr. H. H. Thomas gave an account of the three Middle Jurassic fossils, *Gristhorpia*, *Caytonia*, and *Antholitus*, from Yorkshire, on the study of which he has founded a new group of plants, the Caytoniales. The first two fossils are presumed to represent leaf-pinnules, at the end of which a closed fleshy carpel-like structure is borne, having a basal stigma and containing a double row of "seeds" on what corresponds to a dorsal suture. The third, *Antholitus*, bore groups of "anthers" similarly placed on the ultimate branches of a leaf; the anther consisted of four equal pollen-sacs arranged longitudinally at the end of a filament, dehiscing longitudinally, and containing pollen-grains each provided with a pair of wings; similar pollen-grains were found on the stigmas of the "carpels." The close association with the reproductive bodies of leaves known as *Sagenopteris* suggests that this fossil genus may represent the leaves of Caytoniales. The question at issue was the relation of these fossil forms to modern Angiosperms. They were certainly Angiosperms in that they had seed-like structures developed in a closed "ovary," but what, if any, was their relation to the present-day Angiosperm, and what light did they throw on the origin of this group? Dr. Thomas suggested that a flower might be produced by the crowding of the sporophylls and the suppression of all but a terminal one or a pair of carpels and the fusion of the latter into a single structure. The resulting structure would in the latter case have two vascular strands, two double rows of ovules, and an apical stigma, perhaps with lobes—a condition analogous with the view of a consolidated carpel with ovules in two rows close to and on either side of the midrib, recently put forward by Miss E. R. Saunders.

The Caytoniales do not lend support to the suggestions that primitive Angiosperms were insect-pollinated, that the occurrence of many ovules in the carpel of a modern wind-pollinated flower is an indication of its recent derivation from an entomophilous form, and

that the primitive Angiosperm seeds were large like those of *Cycas*. Nor do the microsporophylls support the view that the primitive stamen was a leaf-like organ bearing sporangia on its surface or edge. Is it reasonable to suppose that the modern stamen represents such a sporophyll with its anthers reduced until only one is present? The arrangement of the anthers in groups suggested a comparision with the branched stamens of *Ricinus*, some of the Malvaceæ, and others, and with such forms as the male flowers of *Pandanus* where stamens are produced in an indefinite bunch.

The Caytoniales supply no definite evidence as to the characters of the primitive flowers or inflorescences; their sporophylls were probably borne at considerable intervals on slender stems, and no trace of bracts or perianth-leaves are found with them. However, it requires no great morphological assumption to imagine that in some allied form they were more closely aggregated. At first sight a sporophyll suggests a comparison with an amentum, but the stalk of the mega- and micro-sporophylls is probably a foliar and not a cauline structure. Even though they became crowded together on a branch with a reduction of the numbers of carpels and stamens, we should not get a catkin like that of *Salix* and *Populus*, because there would be no bracts. Nevertheless, some of the modern groups with simple unisexual flowers may have arisen independently from the stock which also gave rise to the Caytoniales.

A second and more plausible view brings the Bennettitales once more into the argument. The seed-structure of *Caytonia* suggests a somewhat distant relationship with the Bennettitales, probably through a common group of Pteridosperm ancestors. The sporophylls of the Bennettitales are very unlike the stamens and carpels of the modern flower, but their arrangement in a bisexual strobilus is comparable with that seen in the Polycarpicæ. The reproductive structures of the Caytoniales are like those of the modern flowers, but they do not show a strobilar arrangement. May we consider that some other group of plants, also derived from the Pteridosperms, existed in Mesozoic times, which resembled the Caytoniales in the structure of their sporophylls and the Bennettitales in the mode of production of their sporophylls? From such a group many of the modern flowering plants may have been derived. But if we may consider that the Caytoniales and the Flowering Plants sprang from a common ancestor which had already evolved the carpel and the anther, there is no reason why some of the Amentifloræ and Polycarpicæ should not have evolved along distinct lines from such an ancestor.

We know nothing of the habit of the fossil plants which bore the reproductive structures which have been described, but it is probable that their leaves have been identified. The somewhat variable leaf-forms long known as *Sagenopteris Phillipsi* are referred to Caytoniales on the evidence of association and of similarities in the character of the epidermal cells in the petioles and sporophylls. The characters of the *Sagenopteris* leaf are such as we might expect to find in an early Angiosperm. It generally has a petiole bearing four

leaflets in a palmate manner, but sometimes trifoliate or simple forms are found, while the normal arrangement may be derived from a type which was pinnate like the sporophylls. The leaflets are sometimes reduced, and the petiole has winged expansions of assimilating tissue, so approaching a phyllode. The nervation of the leaflets shows a series of closed meshes formed by the anastomosis of veins which spring from an inconstant midrib. There are, however, no fine veins ending blindly within the meshes. Now, leaves with a venation of this character, the normal type of dicotyledonous venation, may have evolved in a way similar to that seen in the Ferns. Many other leaves have been found in the Lower Cretaceous rocks of America which are much more modern in their general appearance, but which have a venation with small closed meshes that can be compared with *Sagenopteris*.

The Caytoniales were probably widely distributed throughout the world in Mesozoic times. Species of *Sagenopteris* occur in both hemispheres, and range from Greenland to Grahamsland. The reproductive structures originally found in Yorkshire have now been detected in Greenland, and will probably turn up wherever the *Sagenopteris* leaves are abundant. These discoveries tend to show that the Angiosperms originated at a much earlier period than was formerly supposed, and that at least one group of early Angiosperms achieved a very wide distribution in early Mesozoic times.

In the discussion which followed, the use of the term carpel to describe the numerous seed-containing structures borne on a single leaf was criticized, in view of the original and general use of the term to connote a modified leaf.

Dr. Scott observed that the Caytonial female fructification, if a megasporophyll, was totally unlike that of any known Angiosperm, and rather suggested some peculiar form of Cycad. The late Dr. Krasser had described some remarkable fossil fructifications, referred to Cycads, from the Trias of Lunz. Dr. Thomas knew them well. Among them was *Haitingeria*, described as a deeply pinnatifid sporophyll, bearing numerous seeds on the edges of the segments. Was it possible that some such form, with the edges of the segments rolled in to enclose the seeds (as the sporangia are enclosed in the Ostrich Fern), might have given rise to the Caytonial type of megasporophyll?

Prof. F. W. Oliver, referring to the *Sagenopteris* type of leaf, thought there was no inherent objection to accepting as an archaic Angiosperm a plant with a type of foliage more appropriate to a lower status—provided always that the evidence for allocation were good. As Arber and others have pointed out, reproductive and vegetative evolutionary advance did not necessarily go hand in hand, and a plant might rise in the reproductive scale whilst still retaining its ancestral foliage. He agreed that in cases like the present it was good tactics to scrutinize closely the relations to the Pteridosperms, in view of their great richness in the pre-Mesozoic flora, their diversity of form, and wide geographical range. If the result was not very useful in the present instance, it was probably due to the refractory nature of the preservation in *Caytonia* and *Gristhorpia*. He had not been impressed with the case for associating at all closely these new seeds with types like *Gnetopsis* and *Conostoma*.

Mr. John Parkin did not consider that the Caytoniales were connected with the modern seed-plants, which he preferred to derive directly from the Bennettitean stock. He also deprecated the comparison of the "anther" of *Gristhorpia* with the modern anther, which he preferred to derive from an organ bearing pollen-sacs laterally on a connective, as in Magnoliaceæ, e. g. *Liriodendron*.

Mr. H. N. Ridley commented on the resemblance of *Antholitus* to the male inflorescence of *Pandanus*, and remarked that the pollen of an allied genus, *Sararanga* Hemsl., was winged. Dr. E. J. Salisbury expressed the view that, even if the Caytoniales were really related to the Angiosperms, a suggestion which was based on slender support, there seemed no justification for the assumption that the features of the Caytoniales were unspecialized, and therefore represented the condition in the primitive Angiosperm. To mention but one feature, the basal stigma, this had been compared with that of *Tetracentron*, but the ontogeny in the latter showed the basal stigma to be a specialization, and the same may well have been the case in *Caytonia* and *Gristhorpia*.

The general trend of the discussion indicated that while botanists were unanimous in admitting the great interest of Dr. Thomas's discovery, they were at present unable to recognize any relation between the Caytoniales and the modern Angiosperms, though biologically the ancient group were undoubtedly angiospermous. Some of those present were a little surprised at Prof. Oliver's refusal to admit of any close association between Caytoniales and Pteridosperms. To the writer of this note the absence of any trace of an embryo alike in the "seeds" of the Caytoniales and the Pteridosperms indicates a difference of the first importance from modern seed-plants. The function of the modern seed is to protect the embryo during the periods of dispersal and rest. These early seed-like structures are found in considerable quantities, and to say that an embryo is a soft structure and has therefore disappeared does not seem an adequate explanation, as more delicate structures are sometimes preserved. A late development of the embryo is only a partial explanation, for even if late in developing it should have left some trace. Can we regard these ancient "seeds" as anything more than somewhat superficially comparable with those of the modern seed-plant? The origin of the Angiosperms seems as great a mystery now as it was to Charles Darwin half-a-century ago.—A. B. R.

OBITUARY.

William Bateson

(1861–1926).

By the death of William Bateson after a few days' illness, biological science has lost one of its most eminent exponents and investigators. The son of the Rev. Dr. W. H. Bateson, Master of St. John's College, Cambridge, he became, on leaving Rugby School, a scholar of the same College, and took the Natural Sciences Tripos in 1882 and 1883, his principal subject being Comparative Anatomy. He was elected a Fellow of his College in 1885. His first important work was the investigation of the anatomy and development of *Balanoglossus*. But pure morphology did not satisfy him; his great interest was the problem of species, and the study of variation was the path along which the solution of the problem was to be sought. He worked hard to collect facts, and in pursuit of variations he travelled through Europe and Eastern and Central Asia; the results of his work were published in 1894 in his *Materials for the Study of Variation*. His adoption of the idea of discontinuity in variation brought him into conflict with the then orthodox school of evolutionists, and there were battles in which Bateson defended his position ably and forcefully. His great opportunity came with the rediscovery, in 1900, of the Abbé Mendel's work on heredity, of which he at once saw the great significance, for he had already begun his experimental study of the same subject. He became the apostle of Mendelism, and his powerful resources of energy and intellect were henceforth devoted to the vindication and extension of the work started by Mendel.

In 1902 he published *A Defence of Mendel's Principles*, with a translation of Mendel's original papers on hybridisation. His enthusiasm attracted other workers, and his experimental garden at Cambridge became a centre of the study of "genetics," as the new phase of biological investigation was termed. In 1906 Bateson was President of the International Conference of Genetics, held in London under the auspices of the Royal Horticultural Society. His great work on *Mendel's Principles of Heredity* appeared in 1909. In the previous year he had been appointed to the newly-established professorship of Biology at Cambridge. Shortly afterwards the John Innes Horticultural Institution was founded at Merton, Bateson became Director, and from then until his death worked steadily in developing a school for the experimental study of genetics, which has been described as the finest institution of its kind in the world.

The high merit of Bateson's work was recognized by scientific societies at home and abroad. He was elected F.R.S. in 1894, and was awarded the Society's Royal (1920) and Darwin (1904) medals. In 1904 he was President of the Zoological Section of the British Association, and in 1914 presided over the Meeting in Australia. He

was President Elect of the Botanical Section for the Oxford Meeting in the present year. In 1922 he was elected a Trustee of the British Museum. His services were sought by our scientific societies and freely given. Botanists will remember his demonstrations of the work at Merton at meetings of the Linnean Society, which he joined in 1909, and of which he was a member of Council at the time of his death, and had twice served as Vice-President. He was at the Society's Library on the Tuesday before his death; later in the same day he was smitten by the illness (angina), which ended fatally.

We mourn the loss of a great man, a vigorous personality, a keen, almost ruthless searcher after truth, and a good friend.—A. B. R.

Mr. A. J. Wilmott, a former pupil of Dr. Bateson's has kindly contributed the following appreciation of his work as a teacher:—

It was my good fortune to have attended Mr. Bateson's classes at Cambridge before he left for Merton. How far it was the subject which interested me and how far it was his presentation of it, I cannot say. The obvious fact that someone is talking about things from personal experience and understanding tends to create interest. I do not think that as a lecturer he was lucid. His tables on the blackboard frequently were rubbed out and started with fresh gusto a second, even a third, time—but we always arrived. When, however, his address was written, everything was lucid to a degree.

His main strength lay in his capacity to stimulate. He held 5 o'clock classes, during which we read, one year the *Origin of Species*, and another, *Animals and Plants under Domestication*. We read one or two chapters during the week, and met for discussion of points of interest. Specimens from the museum were brought out and demonstrated, and demonstration brought out his powers and wide range of experience.

I find it difficult to say where his power of stimulus came from. I think it must have been in his intense enthusiasm.

My own appreciation of him came more from my contact with him while I was living with one of his assistants at Merton. His wide range of interest and of reading, and the corresponding freshness, even astonishingness, of his comments on people and things, prevented any tendency to fall into a rut.

I remember an excursion to Oxshott with his sons, who wanted some of the beetle larvæ kept as cows by the wood-ants. We started prodding the ant-hill with sticks. But Bateson went down on his knees, swept the top off with one wave of his arm, dug a pit into the centre and shovelled out heaps from its base with his hands, which at the end he casually rubbed together. We looked on aghast: I remember we could not see the bottom of the pit for the mist of formic acid. I felt that a man who could get his information in this way would get at whatever fact he intended, if anyone could. There can be no doubt that this ruthlessness, while it might make some enemies, made him the great man he was, and was the source of his power.

Of the work at Merton one might mention the generous way in which he offered facilities to anyone who wished for opportunities of research. It is a pity that more of the results have not been written up. Possibly the interest of the path that lay ahead continually tempted him from the more tedious work of putting the results on paper. For it is rarely possible to make a piece of work artistically complete, and he had somewhat of the artistic temperament. Be that as it may, the results of his work expressed themselves in the other activities of his life, and were the foundation of his value as a critic and councillor, and, as one of my colleagues remarked to me, "I fear we shall not look upon his like again."—A. J. WILMOTT.

SHORT NOTES.

REGENERATION.—A French translation, by M. H. Mouton, has been issued * of the late Dr. Jacques Loeb's book *Regeneration from the Physico-chemical View-point.* The object of the work described in this book is to show that all the phenomena of regeneration can be explained in a purely mechanistic way as a result of the laws of physics and chemistry. The subject chosen for experiment was *Bryophyllum calycinum*, and the results of a large number of experiments on this plant are described and tabulated. The author enunciates the principle of the "relation of mass," which states that the absolute mass of regenerated tissue is directly proportionate to the absolute mass of the regenerating organ or organs. The effects of mutilation he explains as due to the accumulation of sap in parts of the plant where it would not normally accumulate. The latter part of the book deals with polarity. This also is explained in terms of physics and chemistry as resulting chiefly from the difference in constitution between the ascending and descending saps. There are nineteen chapters, and the text is illustrated by 115 figures, showing the results of many of the experiments performed.—R. D. GOOD.

NEW RECORD FOR BRITAIN.—CHARA MUSCOSA *Groves & Bullock-Webster* (in Journ. Bot. lxii. 33, tab. 570, 1924) (*fide* James Groves, 1st November, 1925).—Reference No. 3176, mud at bottom of clear water, 1½ foot deep, in a loch, 30 feet above sea-level; Loch of Rango, Sandwick, Mainland, Orkney, Scotland, 28th August, 1925, Henry Halcro Johnston. Native.—A new record for this species for Britain, discovered by me on 28th August, 1925. This species was first discovered in Loch Mullaghderg, West Donegal, Ireland, by Canon G. R. Bullock-Webster, in July 1917.—HENRY HALCRO JOHNSTON.

THE J. A. WHELDON HERBARIUM.—The botanical collections formed by the late J. A. Wheldon, A.L.S., of Liverpool, have recently

* Gauthier-Villars, Paris, 1926. Fr. 30.

been purchased by the Department of Botany, National Museum of Wales, Cardiff. The collections comprise the following:—

Flowering plants and ferns	11,200
Liverworts	2,000
Sphagna	2,700
Harpidia	1,600
Other mosses	7,900
Lichens	3,000

Making a total of 29,400 specimens. Wheldon was a recognised authority on the genus *Sphagnum* and on the harpidioid *Hypna*, and it is hoped that students of these and other groups will continue to make the utmost use of the collections. Workers desirous of consulting the Wheldon or other collections in the Welsh National Herbarium, and unable to visit Cardiff, are invited to communicate with the Keeper of the Department of Botany, National Museum of Wales, Cardiff.—H. AUGUSTUS HYDE.

REVIEWS.

The Families of Flowering Plants.—I. Dicotyledons. Arranged according to a new system based on their probable phylogeny. By J. HUTCHINSON, F.L.S., Assistant in the Herbarium, Royal Botanic Gardens, Kew. 8vo, pp. xiv, 328, frontispiece and 264 text-figs. by W. E. Trevithick and the Author. Macmillans, London, 1926. Price 20*s.* net.

MR. HUTCHINSON has done good service in compiling in the English language a handbook to the families of the flowering plants, and elaborating a key, based on macroscopic and easily observed characters, by means of which the family to which any given plant belongs may be determined. A description in technical language is given of each family, an indication of its geographical distribution, and references to Bentham & Hooker's *Genera Plantarum* and the *Pflanzenfamilien* of Engler & Prantl. The more important genera and useful products are enumerated. A striking feature of the book is the wealth of illustration. Each family is accompanied by an illustration, by the author or by Mr. W. E. Trevithick. As the figures include analyses of the flower, fruit, and seed they will be helpful in elucidating the necessarily bare details of the descriptive text. Some figures are original, others have been adopted from the *Botanical Magazine* or other well-known works on descriptive Botany. One figure having to suffice for each family, it is impossible to illustrate adequately the larger families, but, as the author takes a somewhat limited view of the family, this disadvantage is not so marked as it might be otherwise. Mr. Hutchinson is to be congratulated on his ability to illustrate his own book, he generally succeeds in bringing out the salient points in floral structure. Many of Mr. Trevithick's figures are good, but he sometimes gets out-of-hand

and hurls his figures at the reader in a frenzy of black and white—see, for instance, *Casuarina*, p. 225, or *Allamanda*, the latter a striking but not very helpful figure. Occasionally outline maps are introduced, a useful means of showing the distribution of the family in space; sometimes the distribution of one genus only is illustrated—for instance, *Pernettya* in Ericaceæ and *Wormia* in Dilleniaceæ,—the reason for this is not stated. . . .

The author recognises 264 families of Dicotyledons; a very much larger number than that of the *Genera Plantarum*. The modern tendency is to segregate, and, as Mr. Hutchinson remarks, the delimitation of families is very much a personal matter, but it is an open question whether the grouping together of different closely-related types may not be more scientific than their separation as distinct families. It is a little strange that while commending Bentham's and Hooker's judgment in this connection, as compared with that of the authors of the *Pflanzenfamilien*, Mr. Hutchinson is more inclined to follow or even outrun the latter in the matter of segregation. A few new families are proposed. One, Scyphostegiaceæ, is founded on a plant of which only the female flowers and young fruit have been seen. "When male flowers are known this genus may be found to belong to Moraceæ." The establishment of a doubtful family on inadequate material is to be deprecated.

Mr. Hutchinson has not only supplied a useful précis of the families and an elaborate key to their determination, but has also developed a new arrangement of the families. In this he has followed the lead of Hallier and other botanists, who assume, first, that the Ranalian type of flower approaches most nearly to the presumed primitive type of flowering plant, and, secondly, that it therefore follows that all present-day families have been derived from this type. An interesting feature of Mr. Hutchinson's arrangement is that there are two trees, one springing from Magnoliales, in which the arborescent habit predominates, the other, with a predominant herbaceous habit, springing from Ranales. Some of the orders and families—*e.g.*, Umbellifloræ, Rosaceæ, Asterales (Compositæ etc.)—are assumed to be polyphyletic, having been recruited from branches of both trees. Mr. Hutchinson's arrangement contains much that is suggestive, but the discussion is often very meagre. For instance, Polygonales (Polygonaceæ, Illecebraceæ) are described as reduced degraded types of Caryophyllales; they may be, but the evidence is not very patent. Among the general principles adopted (pp. 6–7) is one that the spiral arrangement of leaves precedes that of the opposite whorled type, and this principle is transgressed in this and other instances, as in the derivation of Chenopodiales from Caryophyllales. A relation between these two orders is generally recognized, but we should prefer to regard them as representing different grades of development from a common ancestor, rather than one as a degraded form of the other.

Again, as always, the "Amentiferæ" are a crux. Mr. Hutchinson follows the view which derives them *en bloc* from Hamamelidales. They are, in truth, a very heterogeneous crowd to have so simple an origin—compare (if you can) *Casuarina*, Salicaceæ, and Fagales!

Mr. Hutchinson also endeavours to work out in detail the now widely accepted view that the origin of the Sympetalous orders must be sought among several groups of the Archichlamydeæ, and agrees with Hallier in regarding the Tubifloræ as representing the highest development among Dicotyledons.

The great difficulty in constructing a phylogenetic tree lies in the fact, often insufficiently realized, that the material available is not comparable to the parts of a puzzle which time, skill, and patience will enable us to reconstruct, but that, so many of the component parts having been lost, the arrangement of what remains must be to some extent a matter of individual opinion.

In following the lead of those who assume a common Ranalian origin for Angiosperms, Mr. Hutchinson has burnt his boats. It is a tenable view that some of the apetalous orders may be survivals of far earlier types than the Ranalian; and it is not a necessary corollary that the Ranalian type has been derived from these Apetalæ. We shall look forward to the volume on Monocotyledons which Mr. Hutchinson has wisely resolved to study before committing himself to a new arrangement. As in the case of another worker at the group, he may find that his prejudged opinion of their origin in a Ranalian stock may have to be revised.

Dr. Hill, in a sympathetic Foreword, refers to Mr. Hutchinson's study of the evidence afforded by fossil plants as giving additional interest and value to the scheme proposed, and the author himself refers to recent work on fossil records as largely supporting his position. But we find no discussion in the text of fossil records. Do those statements imply more than Mr. Hutchinson's acceptance of the Bennettitalean ancestry of the Angiosperms? A. B. R.

Photosynthesis—the Assimilation of Carbon by Green Plants. By WALTER STILES, Sc.D. Pp. vi and 268. Longmans, Green, & Co., 1925. Price 16s. net.

THE confines of Plant Physiology have been extending of recent years so rapidly that the difficulty of keeping abreast of the advancing tide of research is a very serious one. Reviews which will provide an adequate account of our present knowledge of various branches of botany are thus of the greatest value. Prof. Stiles has already shown his quality in his book entitled *Permeability*, in which he reviewed the question of the entry of substances into the plant-cell. He has again laid plant-physiologists under a heavy debt of gratitude by the publication of this book, in which he surveys our present knowledge of photosynthesis. It is a most comprehensive piece of work, filling over 260 pages and including a bibliography of over 870 references.

The subject is widely interpreted, for not only are the physico-chemical relations of the process reviewed, but chapters are devoted to "the system involved," to the assimilating pigments, to the demon-

stration and measurement of photosynthesis, and also to the relation of photosynthesis to other plant-activities. Though we are still far from possessing a clear picture of the process of carbon-assimilation, and the picture is likely to remain obscure until we can devise such conditions as will enable the chlorophyll pigments to produce carbohydrate *in vitro*, yet marked advances have been made of recent years, which are fully described in the present work.

The question of the efficiency of the photosynthetic system—on which, of course, man is dependent for his food—is one of great interest. The system of the green leaf is notoriously an inefficient one, but the recent work of Warburg and Negelein shows that in *Chlorella* the photosynthetic process may reach the surprising high level of 60 per cent., though this is only true for light of very low intensity.

In discussing such questions as that of efficiency just mentioned, or of the modifications that may be necessary in the theory of limiting factors, or in dealing with the value of the formaldehyde hypothesis of carbon-assimilation, and indeed throughout the book, Prof. Stiles exhibits to a high degree that critical acumen and cautious scientific judgment which we have been led to expect from his earlier work. The book is not only of value to students, but is indispensable to all plant-physiologists. Focussing as it does the present state of our knowledge, it will certainly stimulate investigators to attempt to illuminate the many dark places in this field of work. V. H. B.

An Introduction to Plant Anatomy. By A. J. Eames and L. H. MacDaniels. 8vo, pp. xiv, 364, tt. 146. London, McGraw-Hill Publishing Co., 1925. Price 17*s.* 6*d.* net.

Among the recent text-books of botany emanating from American Universities, this work is notable for fulfilling in a very efficient manner the need for an up-to-date class reference-book of plant anatomy. A preliminary chapter provides an account of the general forms and functions of the plant-cell, and in particular illustrates in commendable detail the varied forms of specialized cell-types. An excellent series is given showing the wide range of wall-sculpture produced by pitting in vessels and tracheids. A commonly occurring feature, the microscopic "checking" or splitting of the secondary wall in tracheids, which often simulates the elongate bordered pit, is included as a warning to the unwary. There is also a three-dimensional diagram of a funnel-shaped bordered pit, a structure often difficult for the student to visualize clearly from the examination of sections. The subsequent chapters, which treat successively with the tissues, primary and secondary, and the main organs, are well illustrated with drawings of cell-types such as can be studied in macerated material. These are often far more effective than sections in elucidating the ultimate structure of tissues. The maceration method might well be employed to a much greater extent in practical classes, in conjunction with the more general practice of section-cutting, as sections alone frequently fail to reveal the forms and relationships of the component parts of tissues.

There are, in addition, reproductions of sections, including a number of photo-micrographs of secondary wood and bast. The text bristles with the terminology, much of which, in scientific literature, defeats its own ends when the same word is used by different authors in different connections. In the case of some such words which have suffered confusion, their present-day meaning and use and misuse are discussed, so that in this way a useful glossary is provided. There is a chapter on Ecological Anatomy and, finally, a Sketch of the History of Plant Anatomy.

The book is written on the basis of descriptive morphology, which the authors believe to be the most generally useful. The evolutionary aspect of the subject is scarcely touched upon. Physiological anatomy and the practical bearing of the subject-matter are discussed briefly and incidentally to the general treatment. Within its limits, however, which are wide, the treatment is essentially thorough. The bibliography is excellent. B. J. Rendle.

Flora of the Presidency of Madras. By J. S. Gamble, C.I.E., F.R.S., etc. Part VII. Nyctaginaceæ to Euphorbiaceæ. Small 8vo, pp. 1161–1346. Published under the Authority of the Secretary of State for India in Council. London, Adlard & West Newman, 1925. Price 10*s.*

A melancholy interest attaches to this part of the Madras Flora, as it was the work on which the author was engaged almost to the day of his death. Dr. Hill informs us in an introductory note that Mr. Gamble had revised for the press all but the last two sheets before his death on October 16. Part VII. contains the first part of the section of the Monochlamydeous Dicotyledons, the most important families of which, in the area considered, are Lauraceæ, Loranthaceæ, and Euphorbiaceæ, the last-named, with 57 genera represented, occupying nearly one-half of the part. We hope that arrangements will be made for the issue of the remaining parts dealing with the concluding families of Dicotyledons and the Monocotyledons.

Practical Pharmacognosy. By T. E. Wallis, B.Sc., Lecturer in Botany to the Pharmaceutical Society of Great Britain. 8vo, pp. x, 111, with 81 illustrations. Churchills, London, 1925. Price 7*s.* 6*d.*

In a Foreword to the text Dr. Greenish, Professor of Pharmaceutics in the University of London, deprecates the neglect of laboratory practical work in the study of pharmacognosy, resulting in a mere superficial knowledge of drugs on the part of the student. In the School of Pharmacy of the Pharmaceutical Society lectures are followed by practical instruction, and the present volume is a concise account with illustrations and detailed directions for carrying out the

work. Mr. Wallis has also made a careful re-examination of the drugs which are the subject of the work.

The book contains two Parts. Part I. is a series of eighteen schedules of instruction for the examination of drugs, classified as leaves, flowers, fruits, seeds, herbs, barks, rhizomes and roots, &c. Detailed directions for practical work are given, and the figures indicate what the student may expect to see in his preparations. Part II.—medicinal plants and plant description—contains brief botanical descriptions of the plants in question arranged systematically in their families; many are accompanied by figures of the plant, with dissections of flowers, fruit, &c.

The text is well arranged and clearly printed, and the figures, in the preparation of which Mr. Wallis has had the assistance of his wife, are clear and helpful. The pharmacist will find the book a useful introduction to a knowledge of his drugs.

BOOK-NOTES, NEWS, ETC.

At the Royal Society on Thursday, January 28, Prof. A. C. Seward, F.R.S., described the Cretaceous Plant-Bearing Rocks of Western Greenland, as illustrated by the plants collected by himself in 1921 on the coasts of the Nûgssuak Peninsula and on the south-east coast of Disko Island. The fossils obtained include many species previously described by Heer, and the following new species were described:—

Filicales, twenty species; *Incertæ sedis*, two species; *Cycadophyta*, eight species; *Ginkgoales*, six species; *Coniferales*, twenty species; *Monocotyledoneæ*, four species; *Dicotyledoneæ*, seventeen species; *Incertæ sedis*, eight species. *Fossilis incertæ sedis—Fasciculites grœnlandicus* Heer.

The question of Geological Age was discussed and reasons were given for regarding, for the present, the Cretaceous plants from Greenland as a single flora; it was pointed out that Heer's threefold division (Kome, Atane, and Patoot series) cannot be accepted as an entirely satisfactory classification of the Greenland beds. Attention was called to the association in Greenland of several species of Ferns and Gymnosperms, which in other parts of the world are characteristic of the oldest Cretaceous floras and closely allied to Jurassic types, with representatives of Angiosperms that are strikingly modern in the form and venation of the leaves.

Comparison of the Greenland flora with floras of Lower and Upper Cretaceous age in different parts of the Northern Hemisphere led to the conclusion that the Greenland Cretaceous flora is Wealden-Cenomanian in age. Reasons were submitted in support of the view that several deciduous Dicotyledons were evolved in Arctic regions, where, in Cretaceous days, as now, a short summer with continuous sunshine alternated with a long period of semi-darkness; from their Arctic home the flowering plants spread to the South. The Wealden-Jurassic species in the Greenland flora were regarded as elements from older and more southern floras which had wandered into the far North.

The paper concluded with a brief discussion of the Cretaceous climate, and the present geographical distribution of certain families of plants was contrasted with their range in the Cretaceous period.

At the meeting of the Linnean Society on February 4, Mr. A. B. Jackson showed a hybrid between two species of Cypress, *Cupressus macrocarpa* and *C. nootkatensis*, raised by Capt. Naylor, Leighton Hall, Welshpool, in 1911, from seeds of a cone of a tree of *C. macrocarpa* growing about 50 yards from a tree of *C. nootkatensis*. A reciprocal cross had been raised, with the same tree as the male parent, twenty-three years earlier. This appears to be the first record of a hybrid in this genus. No opportunity of hybridising occurs in Nature, as the two species grow in widely separated areas in Western America.

Mr. B. O. Coventry exhibited a beautiful series of Lumière coloured lantern-slides of Cashmir scenery and plants. Mr. Coventry referred to the change of colour in the corolla of certain species, and Mr. S. K. Mukerji mentioned that the same phenomenon was a characteristic of other species in Cashmir. Dr. O. Stapf laid stress upon the great importance of the exploration of the Cashmir Flora and of its plant-associations from a phytogeographical point of view.

Dr. C. C. Hurst gave an exposition, admirably illustrated by a large series of drawings, specimens, and lantern-slides, of his work on the nature and origin of species in *Rosa*. A review of Dr. Hurst's work was given by Mr. A. J. Wilmott in the February number of the *Journal*. In reply to various criticisms Dr. Hurst deprecated the view that an Arctic origin of the flora of the Northern Hemisphere implied its development under present-day Arctic conditions.

Jubilee of the Botanical Society of Geneva.—The *Journal de Genève*, 19th Dec., 1925, gave an account of the fiftieth anniversary of the Société botanique de Genève. The meeting was held at the University, Dec. 16th, 1925, under the Presidency of M. Henri Romieux, who was the first and the fiftieth president—a very rare occurrence.

The President traced the history of the Society since 1875, and mentioned that the first local Botanical Society was founded at Geneva in 1852, but ceased to exist in 1856. The first bulletin appeared in April 1879; the third contained an account, by Reuter, of the Geneva flora, and a catalogue of *Rubi* by Schmiedli. The fiftieth comprised works by Prof. Chodat and Dr. John Briquet. At the foundation of the Soc. suisse de botanique, the Geneva Society asked to be affiliated as the Geneva section. From 1901 to 1908, M. G. Beauverd compiled the *Catalogue*. In January 1909 an annual bulletin was decided on. Thanks were expressed to Prof. Chodat and M. Beauverd, who for many years assiduously helped the meetings and excursions.

Addresses were presented to the President and to Dr. Penard, a foundation and honorary member. M. Oltramare, conseiller d'Etat, pointed out that botany is the most Genevese of the sciences, and referred to the de Candolles, Charles Bonnet, Vaucher, and others. The University diploma of docteur *honoris causa* in botany was

conferred upon M. Gustav Beauverd, "a savant whose scientific worth equalled his modesty." Prof. E. Wilczek, President of the Soc. suisse de botanique and delegate from the Soc. Botanica Italica, recalled that the Soc. des sciences naturelles was founded at Geneva in 1815.

Congratulations were received from delegates from Swiss botanical and natural history societies, and from numerous scientific societies in various parts of Europe; and Prof. Chodat gave an interesting account of the activities of the Society.—H. S. THOMPSON.

IN the *Journal of the Royal Horticultural Society* (li. 68–70, 1926), Mr. Buxton describes some experiments in screening primroses, the results of which coincide with those of Mr. Marsden Jones, recently communicated to the Linnean Society (see this *Journal*, 1925, 124), and confirm his view that pollination takes place only by day. A lecture before the Society, entitled "The Botanical Magazine: its History and Mission," by Dr. O. Stapf, F.R.S., the present editor, is also reported. Dr. Stapf tells the remarkably interesting story of this unique publication from its initiation by William Curtis, of Lambeth, in 1787, to its assumption by the Royal Horticultural Society a few years ago. Mr. E. A. Bunyard appeals for Nurserymen's Catalogues for preservation in the Lindley Library, where they will be available for consultation. Mr. Bunyard points out that a large amount of information on the date of introduction of plants, on new "varieties," hybrids, &c., is contained in these ephemeral publications.

DR. RUDOLPH MARLOTH.—On the occasion of his 70th birthday, 28th December, 1925, Dr. Marloth, of Cape Town, was the recipient of a congratulatory address from the Deutsche Botanische Gesellschaft. Dr. Marloth is well-known as an authority on the plants of South Africa, and an account of his early collections was published in Engler's *Botanisches Jahrbuch* as long ago as 1888. He is the author of the magnificently illustrated *Flora of South Africa*, two parts of which were published in 1913 and 1915 respectively; a third part is expected to appear shortly.

ROYAL SOCIETY FELLOWSHIP.—Dr. Edwin John Butler, C.I.E., Director of the Imperial Bureau of Mycology and formerly Imperial Mycologist, Agricultural Research Institute, Pusa, India; and Professor Robert Scott Troup, C.I.E., Professor of Forestry, Oxford University, and formerly of the Indian Forest Service, have been nominated by the Council for election to the Fellowship of the Royal Society.

HOOKER LECTURE.—Prof. Carl Schroeter, of Zurich, Foreign Member of the Linnean Society, has accepted an invitation to deliver the Hooker lecture at the General Meeting of the Society on Thursday, April 15. The subject of the lecture will be "The Swiss National Park, and Scientific Researches into its Nature."

BRITISH botanists are invited to meet in the rooms of the Linnean Society, at 3.30 P.M., on Wednesday, March 10, to consider a suggestion that the Fifth International Botanical Congress shall be held in London in 1930.

CAPT. G. H. WILKINS'S GROOTE EYLANDT PLANTS.

DURING the recent British Museum expedition to the North Australian Islands conducted by Captain G. H. Wilkins, a short time (February and March 1925) was spent on Groote Eylandt and about 200 plants were collected. In December 1924 a small collection, mainly fruiting specimens, was made on the Crocodile Islands, close to 135° E. longitude; these are indicated in the following enumeration by the letter C.

The flowering plants, with the exception of the Leguminosæ, for the determination of which Mr. E. G. Baker is responsible, have been determined by Mr. S. Moore. Mr. Gepp has determined the Ferns. A remarkable diatomaceous mass found in August 1923 at Cape York Peninsula has been examined by Mr. F. W. Payne.

Groote Eylandt, near the western end of the Gulf of Carpentaria, except Tasmania, Melville Island, and possibly Kangaroo Island, the largest insular mass of the many lying off the Australian mainland, was originally discovered by the Dutch. During the early days of 1803, Flinders, in the 'Investigator' carefully charted the coast, and has left in his *Voyage to Terra Australis* a few notes about the island. He writes (vol. ii. p. 190):—"A close-grained sand-stone, nearly resembling that of Pellew's group, seems to form the basis of Groote and the neighbouring islands; we found also coral, iron-stone, and quartz. In many places, quartz in almost a crystallised state was sprinkled in grains through the sand-stone, and in others the sand-stone itself was partly vitrified. Wherever we landed, the surface was so entirely composed of stone and sand, that the idea of any kind of cultivation could in no wise be assimilated with it; the hills at a little distance from the water side were, however, well covered with wood, and it is not improbable that there may be vallies in the central parts of Groote Eylandt possessing some degree of fertility. The central hill, which is six or eight hundred feet in elevation, appeared to be not so much as three leagues from the head of North-west Bay, and I was desirous to have made an excursion to the top to see the interior of the island; but the state of the ship being such as to press us forward with all practicable haste, it was not attempted."

The only landing on the island itself took place on Jan. 15th on a bluff of the bay just mentioned. In his MS. notes Brown states under this date:—"In the morning after breakfast went on shore on Groote Eylandt, and remained till 4 o'clock P.M. Walked over but little ground, but found several new plants and others seen before in a better state. This part of the Island seen to be composed of sandstone of various degrees of hardness and some difference of grain, some blocks containing pretty large generally angular fragments of quartz. On a plane S.W. of the buffhead near which we landed saw white ants' nests of an uncommon size, one of them being at least 11 feet in height and of a proportionable thickness. On the shore near the mangroves ironstone as usual and very ponderous."

Many of the plants collected are conspecific with Brown's, and

of special value and interest when, as occasionally happens, they supplement these.

About the flora, as presented in the following pages, there is little to be said. In general facies it is largely Indo-Malayan, showing but little affinity to that of cooler parts of Australia. In this connection one may mention the rarity of *Leguminosæ* including *Acacia*, of *Sterculiaceæ* tribe *Lasiopetaleæ*, *Rutaceæ* tribe *Boronieæ*, *Myrtaceæ* tribes *Chamælaucieæ* and *Leptospermeæ*, *Compositæ* (*Helichrysum* &c.), *Proteaceæ*, and others. Most of the specimens have been named without much difficulty; but in a few cases it has been found necessary to give a new specific or varietal name.—A. B. Rendle.

PHANEROGAMIA.

(By S. Moore.)

Dilleniaceæ.

Hibbertia dealbata Benth. 147.

H. oblongata R. Br. 157, 190.

H. lepidota R. Br. (*Rossittia scabra* Ewart & Davies). 69, 135.

Pachynema complanatum Benth. 119.

Menispermaceæ.

Tinospora smilacina Benth. 179.

Capparidaceæ.

Polanisia viscosa L. 86.

Capparis quiniflora DC. (C) 201.

C. umbonata Lindl. (C) 207. Var. latifolia S. Moore, var. nov. Folia brevia quam in typo latiora et nervis magis conspicuis, sæpissime 10–12 × 3·2–3·5 cm. (C) 215.

Violaceæ.

Ionidium suffruticosum Ging. 137, 161, 169.

Polygalaceæ.

Polygala orbicularis Benth. 186.

Caryophyllaceæ.

Polycarpæa corymbosa Lam. 182.

Portulaceæ.

Portulaca bicolor F. Muell. 92.

Malvaceæ.

Hibiscus rhodopetalus F. Muell. Yellow-flowered form. 163.

H. geranioides A. Cunn. 132.

H. zonatus F. Muell. 70, 129.

Sterculiaceæ.

Sterculia ramiflora Benth. 136.

Helicteres cana Benth. 61, 166, 174.

Keraudrenia Hookeriana Walp. 62.

Tiliaceæ.

Grewia polygama Roxb. 121, (C) 223.

Triumfetta appendiculata F. Muell. 194.

Corchorus sidoides F. Muell. 65, 100.

Zygophyllaceæ.

Tribulus terrestris L. 168.

Rutaceæ.

Boronia artemisiæfolia F. Muell. 103.

Olacaceæ.

Opilia amentacea Roxb. 226, (C) 218.

Celastraceæ.

Denhamia obscura Meisn. (C) 214.

Stackhousiaceæ.

Stackhousia viminea Sm. var. micrantha Benth.

Vitaceæ.

Ampelocissus acetosa Planch. (*Vitis acetosa* F. Muell.). 229.

Cissus repens Lam. (*Vitis cordata* Thunb.). 228.

Leguminosæ.

(By E. G. Baker.)

Burtonia subulata Benth. 130.

Jacksonia dilatata Benth. 162.

Bossiæa phylloclada F. Muell. 104.

Crotalaria calycina Schrank. 183.

Tephrosia porrecta R. Br. 57, 87.

T. oblongata R. Br. 133.

T. purpurea Pers. 78, 94, 102. A form with the inflorescence more white-silky than in the type.

T. purpurea Pers. var. axillaris Bak. fil., var. nov.

Suffruticosa, erecta, ramis virgatis; *foliis* 3–5-jugis, foliolis cuneato-oblongis subretusis basi acutis supra glabris subtus glabriusculis 10–15 mm. long. 3–5 mm. lat.; *pedunculis* 2–3 axillaribus multiflori vel flores in racemos dispositi; *alabastris* sericeis; *floribus* parviusculis; *legumine* lineare ±4 cm. long. 3–4 mm. lat. 5–7-spermo adpresse pubescente.

Hab. Carpentaria Is., Groote Eylandt, *R. Brown* (Dist. No. 4115), Jan. 1803; *Wilkins*, 99.

There is a long and careful description of this plant as a new species in the Brown MSS., but we think it should be considered only as a variety of the widely-spread *T. purpurea* Pers. It differs from type in its sometimes axillary flowers and silky buds.

DESMODIUM POLYCARPUM DC. 84.

URARIA LAGOPOIDES DC. 154.

ATYLOSIA RETICULATA Benth. 195.

CASSIA CONCINNA Benth. 146.

C. MIMOSOIDES L. 150.

ACACIA ALLENIANA Maiden. 114, 115.

R. Brown collected this plant on Groote Eylandt in January 1803. In the Brown MSS. there is a description of it under a name different from that given (also a *nomen ined.*) to the closely-related Queensland plant subsequently described by Bentham, together with the North Australian, as *A. juncifolia*. Brown's Groote Eylandt specimen (Dist. No. 4303 in part.) is in fruit as well as in flower. The rest of No. 4303 from the East Coast is a mixture of true *A. juncifolia* and its near ally *A. pugioniformis* Wendl. Maiden (Ewart & Davies, Fl. North. Terr. 320) has identified as conspecific with his *A. Alleniana* (*l. c.* 330) a fruiting Carpentaria specimen from the Queensland Herbarium, surmised to be of Brown's collecting and to come from Groote Eylandt. There is no reason to doubt this as being part of Dist. No. 4303.

Capt. Wilkins's specimens, which are in flower only, agree well with the description and figure (*l. c.* pl. xxvi.) of *A. Alleniana*, the chief differences from *A. juncifolia* being in the longer-peduncled flower-heads up to 5 in each axil of the former, and its floral bracts exceeding the young buds so as to give a spiny appearance to the very young heads.

Acacia nuperrima Bak. fil., sp. nov. Species ad *A. translucentem* Cunn. valde affinis, primo intuitu phyllodiis multo angustioribus et longioribus, et pedunculis quam phyllodia brevioribus, differt.

Frutex erectus; *ramis* conspicue angulatis; *phyllodiis* subsessilibus falcatis lineari-lanceolatis parallele multinervosis junioribus apice glandulosis; *pedunculis* solitariis vel geminatis phyllodiis brevioribus; *capitulis* globosis; *calyce* dentibus brevissimis; *petalis* lanceolatis basi connatis apice acutis.

Hab. Groote Eylandt. 101.

Phyllodia 20–30 mm. long, 3–4 mm. broad; peduncles 10–14 mm. long; capitula ±5 mm. diam.; calyx not 1 mm. long; petals 2 mm. long.

This belongs to the section *Plurinerves*. The plant collected by R. Brown on Groote Eylandt, Dist. No. 4285, is conspecific. The pods on Brown's specimen are oblanceolate-falcate, 3–3·5 cm. long, 7–8 mm. broad, 8–10-seeded.

In spite of the small flowering heads and narrow phyllodia, Bentham (Fl. Austral. ii. 379) considered this conspecific with *A. translucens*, a N.W. Australian plant.

A. SIMSII A. Cunn. var. MULTISILIQUA Benth. 189.

A. AURICULIFORMIS A. Cunn. 188.

DROSERACEÆ.

DROSERA PETIOLARIS R. Br. 72.

COMBRETACEÆ.

TERMINALIA BURSARINA F. Muell. 60, 85, 105.

T. GRANDIFLORA Benth. (C) 211.

MYRTACEÆ.

CALYTHRIX MICROPHYLLA A. Cunn. 170.

MELALEUCA SYMPHYOCARPA F. Muell. 113.

M. LEUCADENDRON L. var. CUNNINGHAMII Cheel.

A very fine form with leaves, somewhat thinner than those of the type, reaching 17 × 6 cm., and 8-nerved at base. The same form was collected by Allan Cunningham on S. Goulburn Island (No. 199 of 1818 coll.).

As Mr. Cheel, who has studied this extremely polymorphic plant (Fl. North. Terr. 295), would appear not to have seen types of two of Schauer's species (Walp. Rep. ii. 927), and, as both are in the British Museum, a short description of each should be useful.

M. mimosoides A. Cunn. ex Schauer, *l. c.* Branches slender, glaucous. Leaves up to about 12 × 1·5 cm., 3-nerved at base. Rhachis of inflorescence becoming leafy in its upper part, quite glabrous. Fruit generally in pairs or threes separated by 5–10 mm. No flowers on specimen. Rockingham Bay; *A. Cunningham*, 253 of 1819 coll.

M. saligna Schauer, *l. c.* In his key (*op. cit.* 295) Mr. Cheel says this has leaves 6 in. or more long, acuminate, about ½ in. broad, 3–5-nerved. But none of the leaves of the type are as much as 4 in. long, the length usually varying between 6 and 9 cm. (2½ and 3½ in.), and the breadth between 7 and 10 mm. Some of the leaves are very plainly 5-nerved at base, others only 3-nerved. The specimen has only a small portion of one inflorescence; this shows, however, a hairy rhachis. Endeavour River; *A. Cunningham*, 256 of 1819 coll.

EUGENIA SUBORBICULARIS Benth. (C) 217. Fruiting specimen: fruit globose 4·5 × 4·5 cm., with a few longitudinal raised lines, and crowned by the 4 persistent segments of the calyx.

CAREYA ARBOREA Roxb. (C) 212.

MELASTOMACEÆ.

OSBECKIA CHINENSIS L. 68, 93, 108, 193.

MELASTOMA MALABATHRICUM L. 76, 144.

CUCURBITACEÆ.

MUKIA SCABRELLA Arn. 220.

UMBELLIFERÆ.

DIDISCUS MICROCEPHALUS Domin. 106, 152. The specimens are without the remarkable lower leaves; hence the determination must be regarded as somewhat doubtful. The type (Brown Dist. 4524), it may be added, is from Arnhem Bay.

RUBIACEÆ.

Tarenna foliosa S. Moore, sp. nov. Verisimiliter *frutex* elatus; *ramis* quadrangularibus lateribus compressis sursum foliosis glabris; *foliis* petiolatis oblongo-ovatis basi cuneatim angustatis integris in sicco fuscis chartaceis supra pallide nitidis glabris subtus in costis pubescentibus; *stipulis* rigidis ovatis breviter acuminatis; *floribus* in corymbum terminalem trichotomum microscopice puberulum foliis breviorem digestis; *bracteolis* anguste linearibus quam pedicelli brevioribus; *ovario* turbinato quam calyx paullo longiore; *calyce* medium usque 5-lobo lobis rotundatis breviter ciliatis; *corollæ* tubo elongato tenui extus pubescente lobis obovato-oblongis obtusis vel retusis tubo multo brevioribus; *staminibus* corollæ ori insertis antheris breviter exsertis oblongis apiculatis basi sagittulatis; *stylo* exserto infra medium pubescente apice clavellato; *ovulis* quove in ovarii loculo paucis (2–3).

Hab. Groote Eylandt, Feb. 1925. 116.

Branches stoutish, where bare marked with scars of fallen leaves, drying cinereous, 4–5 mm. across. Leaves apparently up to about 17 cm. long (upper part absent) and 7 cm. broad; side nerves probably about 12 pairs, well seen on both faces, reticulum obscure; petioles 18–20 mm. long. Inflorescence about 8 × 10 cm., its three primary branches about 2 cm. long. Bracteoles mostly 2–3 mm. long, and pedicels ±6 mm. Ovary 1·5 mm., calyx 1 mm. long. Corolla-tube 17 mm. long, slightly expanded above, at base about ·6 mm. wide, at the throat 1·5 mm.; lobes 6 mm. long. Anthers 6 mm., style 23 mm. long. Fruit not seen.

T. expandens, comb. nov. (*Webera* F. Muell.), a N. Australian plant, according to the description has somewhat different leaves not drying dark, corollas with a longer tube, and anthers not half the size. The corollas of the Queensland *T. Dallachiana*, comb. nov. (*Webera* Benth.) are little more than half as long.

GARDENIA SUFFRUTICOSA R. Br. 66, 177.

G. FUCATA R. Br. 63, (C) 107. This has globose fruits 2 × 2 cm., crowned by the 13 mm. long calyx-lobes.

SPERMACOCE MULTICAULIS Benth. 91.

S. LÆVIGATA F. Muell. var. HISPIDA Benth. 79.

COMPOSITÆ.

VERNONIA CINEREA L. 80.

HELICHRYSUM BRACTEATUM Willd. 83.

WEDELIA URTICÆFOLIA DC. 192.

GOODENIACEÆ.

GOODENIA HISPIDA R. Br. 187.

CALOGYNE PILOSA R. Br. 73, 89, 126, 173.

PLUMBAGINACEÆ.

PLUMBAGO ZEYLANICA L. 140.

OLEACEÆ.

JASMINUM SIMPLICIFOLIUM Forst. var. MOLLE Benth. (C) 198.

APOCYNACEÆ.

TABERNÆMONTANA PUBESCENS R. Br. (*Ervatamia*). 111.

ALYXIA SPICATA R. Br. 176.

ASCLEPIADACEÆ.

GYMNEMA TRINERVE R. Br. 64, 75. The type from Groote Eylandt (Brown, Dist. 2888) is without fruit. The glabrous, somewhat fleshy follicle is 7·5 cm. long, and barely 5 mm. wide at the base, gradually enlarging to 8 mm. about half-way up, thence tapering off to 2 mm. at the top. It would appear to be pale green.

BORRAGINACEÆ.

HELIOTROPIUM OVALIFOLIUM Forsk. 123.

H. VENTRICOSUM R. Br. 127.

CONVOLVULACEÆ.

IPOMÆA GRACILIS R. Br. 125.

CONVOLVULUS PARVIFLORUS Vahl. 143.

BONAMIA PANNOSA R. Br. 98.

SOLANACEÆ.

Solanum Wilkinsii S. Moore, sp. nov. *Frutex* (vel *fruticulus*?) ramosus; *ramis* subsparsim foliosis teretibus spinulis debilibus rectis subnudis onustis uti inflorescentiæ breviter fulvo-tomentosis; *foliis* thinnibus petiolatis ovato-oblongis obtusis basi obtusis subrotundatis leve integris (rarissime obscure repandis) supra in sicco fuscis tomentellisque subtus griseo- vel fulvo-tomentosis; *cymis* plerumque 4-floris; *pedunculis* oppositifoliis foliis brevioribus fulvo-tomentosis cum pedicelli sparsim spinulosis; *pedicellis* calycem cito excedentibus sub fructu elongatis; *calycis* tubo subgloboso vivide fulvo-tomentoso margine spinuloso lobis tubo æquilongis triangularibus acutis extus

tomentosis; *corollæ* calycem plane excedentis lobis brevibus rotundatis dorso magna pro parte fulvo-tomentosis; *antheris* oblongis sursum haud attenuatis; *ovario* subgloboso apice ipso sparsim breviterque pilifero ceterum glabro; *stylo* glabro apice incurvo; *bacca* calyce aliquanto accrescente inclusa matura haud visa.

Hab. Groote Eylandt, March 1925. 131.

Habit rather slender, the sparingly spinulose branches only some 2 mm. thick, the pale brown spinules about 2 mm. long. Leaves at most 6×2 cm., usually 3–4×1·5 cm., the younger ones still smaller; petioles up to 1 cm. long, but usually shorter, tomentose. Cymes up to 5 cm. in length, though often shorter; peduncles mostly 1·5–3 cm. long. Pedicels at time of flowering 5–15 mm. long. Calyx-tube very spiny, some of the spinules reaching nearly 5 mm. in length, in flower 3·5×4·5 mm.; lobes 3·5 mm. long. Corolla 13 mm. long and about 2 cm. across; its lobes 5 mm. long. Filaments inserted in the corolla-tube 2 mm. above its base; anthers 5·5×1·5 mm. Ovary 2×1·75 mm. Style 11 mm. long.

Near *S. Cunninghamii* Benth., a plant of coarser habit with much larger leaves, longer and differently-shaped calyx-lobes and much larger corolla.

SCROPHULARIACEÆ.

LINDERNIA SUBULATA R. Br. 81.

STRIGA CURVIFLORA R. Br. 67, 149.

ACANTHACEÆ.

PSEUDERANTHEMUM VARIABILE, comb. nov. (*Eranthemum variabile* R. Br.). 155.

HYPOËSTES FLORIBUNDA R. Br. 164.

VERBENACEÆ.

VITEX TRIFOLIA L. var. OBOVATA Benth. 112.

V. GLABRATA R. Br. (C) 210.

LABIATÆ.

COLEUS SCUTELLARIOIDES Benth. 191.

ANISOMELES SALVIFOLIA R. Br. 172.

NYCTAGINACEÆ.

BOERHAAVIA DIFFUSA L. 128.

AMARANTACEÆ.

GOMPHRENA CANESCENS R. Br. 138, 156.

PROTEACEÆ.

PERSOONIA FALCATA R. Br. (C) 206. Fruit 9×13 mm. when quite ripe.

GREVILLEA PUNGENS R. Br. 95.

THYMELÆACEÆ.

PIMELEA PUNICEA R. Br. 71

EUPHORBIACEÆ.

EUPHORBIA MITCHELLIANA Boiss. 159.

Euphorbia (§ *Anisophyllum*) **pubicaulis** S. Moore, sp. nov. *Herba* ramosa, verisimiliter perennis; *ramis* bene foliosis subteretibus striatulis subtiliter pubescentibus; *foliis* omnibus oppositis subsessilibus anguste lineari-lanceolatis acutis basi rotundatis pag. utraque pubescentibus costa media pag. sup. impressa pag. inf. valde prominente; *stipulis* minutis vel obsoletis; *involucris* pedunculatis campanulatis pubescentibus in cymam terminalem laxam pubescentem folia floralia attenuata foventem digestis; *glandulis* peltatis appendice petaloidea suborbiculari alba onustis; *capsula* puberula rugulosa.

Hab. Groote Eylandt, March 1925. 175.

Branches erect, brown when dry, the internodes mostly 2–4 cm. long. Leaves firm, 2·5–3 cm. long, 3–4 mm. wide, the youngest much narrower, drying grey-brown, paler on the underside. Stipules at most 1 mm. long, but usually invisible. Cymes 2–3 cm. long, the floral leaves ±6 mm. Involucre about 1 mm. long; glands 1·8 mm., their appendage 1 mm. in diameter. Capsule small, trigonous, barely 2 mm. across. Seeds not seen.

A very distinct species, differing from *E. Mitchelliana* chiefly in the pubescence, the longer differently-shaped acute leaves, relatively broader appendages to the glands, and rugulose capsule.

E. PILULIFERA L. 171.

Phyllanthus (§ *Eu-Phyllanthus*) **exilis** S. Moore, sp. nov. *Herba* annua, monoica, glabra, sesquispithamea, habitu tenui, fere a basi ramulosa; *ramulis* gracillimis teretibus distanter foliosis; *foliis* parvis subsessilibus anguste linearibus nisi filiformibus; *stipulis* minutissimis; *floribus* ♂ minutis breviter pedunculatis; *sepalis* 6 inter se liberis ovato-oblongis obtusis; *staminibus* 3 ima basi solum connatis; glandulis valde deminutis; *floribus* ♀ quam ♂ majoribus longiusque pedunculatis; *sepalis* ovato-oblongis obtusis; *disco* breviter cupulari crenellato; *ovario* globoso glabro; *stylis* liberis bifidis patentibus; *capsula* parvula trigona glabra.

Hab. Groote Eylandt, Feb. 1925. 109.

Lower leaves 5–10 (rarely up to 15) mm. long, 1 mm. wide, the rest very narrow, and at most 5 mm. long. Male flowers barely 1 mm. in diameter on stalks ·75 mm. long, the sepals when expanded 1 mm. in length. Female flowers about 1 mm. in diameter, the stalks 2–4 mm. long and sepals expanded barely 1 mm. Ovary 1 mm. across. Capsule dark brown, scarcely 2 mm. across.

In appearance this is very like *P. arnhemicus* S. Moore, which, besides belonging to another section, has shorter-stalked flowers different in several respects. The nearest affinity is with *P. minutiflorus* F. Muell. var. *gracillimus*, which has different foliage.

FLUGGEA MICROCARPA Bl. 158.
PETALOSTIGMA QUADRILOCULARE F. Muell. 160.
ANTIDESMA GHÆSEMBILLA Gaertn. (C) 213.
MALLOTUS NESOPHILA Müll. Arg. 153.

ORCHIDACEÆ.

GEODORUM PICTUM Lindl. 225.
HABENARIA ELONGATA R. Br. 203, 231.

DIOSCOREACEÆ.

DIOSCOREA SATIVA L. 122.

LILIACEÆ.

SMILAX AUSTRALIS R. Br. 167.
FLAGELLARIA INDICA L. 120.
DIANELLA CŒRULEA Sims. 180.
THYSANOTUS TUBEROSUS R. Br. var. PARVIFLORA Benth. 107.
T. CHRYSANTHERUS F. Muell. 151.

COMMELYNACEÆ.

COMMELYNA ENSIFOLIA R. Br. 141.

CYCADACEÆ.

CYCAS MEDIA R. Br. (C) 208.

CRYPTOGAMIA.

(BY A. GEPP.)

FILICES.

SCHIZOLOMA LANCEOLATUM R. Br. var. 58.
CHEILANTHES TENUIFOLIA Sw. 139.
LYGODIUM SCANDENS Sw. 59, 142, 145.

LYCOPODIACEÆ.

LYCOPODIUM CERNUUM L. 96.

DIATOMACEÆ.

Wilkins Australian Islands Expedition, No. 7. Olive River, York Peninsula, North Queensland: found on beach.—G. H. Wilkins, Aug. 12, 1923.

This specimen, a chalk-like mass about the size of a human foot, has a low specific gravity. It was submitted to Mr. F. W. Payne for microscopical examination. He reports that it is a mass of marine diatoms almost all broken and crushed, cemented together by diatom débris and sponge-spicules with infiltration of some mineral matrix, which is very difficult to separate from the diatoms. The diatoms observed are ordinary marine forms, and comprise 6–8 species

of *Coscinodiscus*, numerous small forms of *Actinoptychus undulatus* and minute species of *Cocconeis*, a small *Actinocyclus*, an *Ichnanthus*, a broken *Navicula*, several frustules of a *Melosira*, and a *Pseudo-eunotia*. The lack of *Naviculæ* and the abundance of *Coscinodiscus* suggest that the nodule formed part of a deposit laid down far from land.

Mr. Payne has kindly prepared two excellent slides from the material, for inclusion in the collection of Diatom slides in the British Museum.

REPRODUCTIVE MECHANISM IN LAND FLORA.

IV. SPOROGONIA.

BY A. H. CHURCH, M.A., F.R.S.

LARGELY owing to their small size and characteristic occupation of admittedly inferior stations, Bryophyta (Mosses and Hepaticæ) have always stood somewhat apart from the rest of autotrophic Land Flora. To the first collectors of the Linnean epoch they appealed wholly as miniature forms with reproductive organs and fruits somewhat after the model of the Flowering Plant[1].

Unger (1837)[2] correctly interpreted the antherozoids of *Sphagnum* as male cells, and when Hofmeister (1849) distinguished the sexual plant from the asexual capsule-stage, pointing out that the sexual stage was homologous with the prothallus of the Fern, and that there was in both cases a definite *alternation of generations*—though in the Moss the asexual stage might be feeble and short-lived,—the Mosses became a central and extremely important group among simpler Cryptogamic Land Flora, constituting a link in the hypothetical chain connecting flowering plants with aquatic forms as *Chara*[3], before the days of modern evolutionary theory.

Older views as interpreting the systematy of the eighteenth century had already included an enormous amount of details of external morphology, more especially of the independent sexual stage; and following the bias of botanists of the day for discussing morphology in terms of stem, leaf, and root, the five tribes of Hepaticæ were arranged in series, beginning with the Foliose Jungermannieæ as the most highly differentiated in these respects. Thus the *Synopsis*

[1] Dillenius (Oxford, 1741), *Historia Muscorum*. Linnæus called the capsule of the Jungermanniæ a 4-valved anther. Hooker (*British Jungermanniæ*, 1816) describes roots, stems, leaves, stipules, also pistilla and seeds, giving a useful summary of the eighteenth century outlook. Schleiden (1849) "merely objects of petty species making."

[2] Sachs, *History of Botany*. Eng. Trans., 1890, 438.

[3] Hofmeister (1851), *Vergleichende Untersuchungen*, Eng. trans., Currey, 1862, 439. "The phænogams therefore form the upper terminal link of a series, the members of which are the Coniferæ and Cycadeæ, the vascular cryptogams, the Muscineæ and the Characeæ."

Hepaticarum (1844) schedules[1]:—(1) Foliose Jungermannieæ, (2) Frondose Jungermannieæ, (3) Marchantieæ, (4) Anthoceroteæ, and (5) Ricciеæ; the last as the lowest types, and the whole presenting an academic downgrade scheme to which no evolutionary significance need be attached.

The standpoint of the middle nineteenth century is given by Sachs in his text-book[2]. The Hepaticæ are described as usually divided into five families, which are now arranged as an upgrade series—Anthoceroteæ, Ricciеæ, Monocleæ, Marchantieæ, Jungermannieæ,—on the understanding that the higher members possess stems and leaves, and the leafy Mosses have to follow on. The lower groups are defined as presenting the sexual generation as a mere leafless thallus, though any definite reason for such distinction of stem and leaf, beyond mere popular experience of higher land-vegetation, was still wholly wanting[3].

New departures followed the classical and detailed researches of Leitgeb[4] and suggestive papers by Kienitz-Gerloff[5], the latter emphasizing more particularly the segmentation history of the young sporophyte, as illustrated by a series of types (*Riccia, Marchantia, Pellia, Frullania, Radula*, etc., thus arranged in a sequence of progressive stages of complexity)—*e. g.*, as epibasal and hypobasal products of segmentation, with an added suggestion that embryos of Vascular Cryptogams, and even higher plants, followed a similar plan, *Riccia* being henceforward definitely visualized as the first and lowest member of the series (that is to say, with the simplest sporophyte as well as a simple gametophyte). A fuller series of forms based on the work of these investigators was given by Goebel (1882)[6], and appears in his text-book[7]. In the latter[8], the meaning of the series is elaborated in terms of initiation of the foot, stalk, and columella-regions, and this interpretation has been so freely accepted as to pass for the general modern presentation of the subject, hence found in all treatises dealing with Bryophyta[9].

It may be noted, however, that such a series was put forward as a mere abstraction of academic morphology. No reasons were adduced, or asked for, as to why such things should happen; and as an

[1] Hooker (1816), *British Jungermannieæ*. Lindenberg (1829), *Synopsis Hepaticarum*. Gottsche, Lindenberg, and Nees (1844), *Synopsis Hepaticarum*.

[2] Sachs, *Text-book*, Eng. trans. (1875), 302. Edition ii. Eng. trans., Vines (1882), 352, repeats the same series.

[3] *Cf.* Schleiden, *Grundzüge*, Eng. trans. (1849), 214. Sachs regarded stems and leaves as correlative terms with no further definition.

[4] Leitgeb (1874–1881), *Untersuchungen über die Lebermoose*.

[5] Kienitz-Gerloff, Bot. Zeit. (1874), 165. Inaugural Dissertation, "Vergleichende Untersuchungen über die Entwickelungsgeschichte der Lebermoos-Sporogoniums," *op. cit.* 1875, 777, 1876, 705. The word *Sporogonium* is due to Sachs; it eliminates the idea of a fruit (sporocarp), and includes the entire spore-output of the sporophyte-stage, separating the Moss-capsule from his Carposporeæ.

[6] Goebel (1882) in Schenk's *Handbuch*, ii. 321.

[7] Goebel (1882), *Outlines of Classification*, Eng. trans. (1887), 152.

[8] *Loc. cit.*, 153, footnote.

[9] Vines (1895), *Students' Text-book*, 335.

academic series it is clearly open to be read in either direction. It may, for example, just as well illustrate the decadence and progressive loss of these regions as their initiation. So far, the series merely follows and elaborates the bias of older systematists for putting 'simple,' and hence presumably 'lower,' types at the beginning of a scheme[1].

More striking was the next step in the theory of the origin of alternation propounded by Pringsheim (1878)[2], who drew attention to the obvious fact that a large number of Algæ of fresh water and the sea, as also many Fungi, presented very similar alternating sequences of sexual and asexual stages as a normal part of their life-cycle; though the reason for this might not be clear. One came to distinguish, in the terminology of Celakowski, *homologous* alternation from *antithetic*—the latter expressing a wholly new departure, the former connoting a repetition of what had been the rule in possibly older phylogenetic stages. Hence a full algal series, including such very minor forms of freshwater Algæ (*Vaucheria, Œdogonium, Coleochæte*) might be adduced as suggestively leading on to the beginning of the *Riccia*-story[3]. This plausible series attained a certain value as covering a wide range of facts, and was long fashionable. Hence, with the enthusiastic admiration of the German school of Botany, so characteristic of this country in the latter part of the nineteenth century, it is interesting to find British botanists still further elaborating the idea. Thus Vaizey (1887)[4] draws attention to the presumed 'sterilization of sporogenous tissue,' tracing the *Riccia*-stage from freshwater Algæ; and Bower (1890)[5] carefully explains the origin of the sporophyte by interpolation, with 'small beginnings' in the Bryophyta. But the conclusions of the latter are noteworthy for the introduction of a causal factor, as visualized in the significance of desiccation in the spore-stages, which somehow supplement the assumed failure of the sexual process in migration to the land. This statement of theory was long accepted with little question, since the difficulty was to get a complete proof. It served to bring all the plant-story into one connected scheme, which might be criticized as being too good to be true (Sachs); but which serves to illustrate the manner in which would-be evolutionists of the late nineteenth century attempted without restraint to pour new wine into old bottles of systematy without waiting for them to burst. Much depended obviously on the linkage of the chain at the horizon of *Coleochæte* and *Riccia*, as the chain is no stronger than its weakest link: the gap between a Moss-capsule and a Fern-plant was also too great to be lightly glossed over—though this may be left for further consideration[6].

[1] Much the same lines of thought would put *Lemna* in thallus and floral organization as a very primitive member of the Angiosperms.

[2] Pringsheim (1878), Prings. Jahrb. xi. 6.

[3] Vines (1886), *Physiology*, 628.

[4] Vaizey (1887), *Annals of Botany*, iv. 1890, 374.

[5] Bower (1890), *Annals of Botany*, iv. 347.

[6] Bower (1894), Phil. Trans. 493, proposed to solve the gap between the Moss and Fern by an even more fantastic 'Theory of the Strobilus.'

The connection with *Coleochæte* was regarded as broken when Allen (1905)[1] showed that the post-sexual phase in this plant was haploid, and hence not a diploid 'sporophyte' at all: since at this time, following Strasburger's remarkable dictum (1894), a sporophyte must be diploid, and conversely anything diploid was a sporophyte[2]. But the position of the *Riccia*-capsule and its associates still remained unassailable as the hypothetical starting-point for the flora of the land[3]. This has been adopted to build up a plausible if fantastic tale, which, expressed in elegant phrases, has constituted the sort of morphological pabulum served out to students who were taught for examination purposes to murmur such shibboleths as—(1) The intercalation of a post-sexual phase; (2) Amplification of the products of sexuality; (3) Progressive sterilization of archesporial tissue; while any alleged causal factors for such changes, or any indications of the actual mechanism employed, were of the slenderest speculative order. The standpoint is very fully examined by Bower (1894)[4], though reducing in bare terms to little more than an expansion of the idea foreshadowed by Hofmeister (1851), that the object of the new sporophyte in the life-cycle was to form numerous free reproductive cells or spores[5].

These views have been persistently maintained with an enthusiasm more usually associated with the home of lost causes, than with the teaching of any ultra-modern university. So that one may be excused for turning the subject wholly the other way round, and giving the alternative proposition a chance. The really astonishing thing, perhaps, is the way in which the infinitely varied algal life of the sea is almost entirely ignored from the time of Hofmeister on. Land-botanists dealt entirely with land-plants; students of liverworts were limited to their special horizon; freshwater algologists were dominated by the depauperated types of fresh water. To seek for the *origin* of a sporophyte among a series of land-plants, all of which had one, seems about as satisfactory a proceeding as it would be for zoologists to analyse the factors underlying the origin of a backbone solely from consideration of land-vertebrates. Even Goebel (1882) pointed out that the higher algæ of the sea could scarcely be included under the academic expression 'thallophytes.' Hence the antithetic theory struck on the rock of marine algæ, as soon as meiosis was explained and two cytological generations were established for *Dictyota*

[1] Allen (1905), *Berichte*, 290.

[2] Strasburger (1894), *Annals of Botany*, 281. Bower (1908), *Land Flora*, 73. It may be noted in passing that the introduction of meiosis in the first division of the zygote is probably as secondary in the case of *Coleochæte* as it is in other freshwater Algæ as *Spirogyra* and *Chara*, or even in *Nemalion* of the sea, and may be merely the expression of a decadent life-cycle under conditions of somatic impoverishment.

[3] Bower (1908), *Land Flora*, 260: *cf.* Campbell (1918), *Mosses and Ferns*, 13, 'It seems probable that all higher plants are derived from Liverwort-like forms'; p. 14, 'The sporophyte of *Riccia* is very much like the spore-fruit of *Coleochæte*.' (Only in an excessively bad drawing, it might be added.)

[4] Bower (1894), Phil. Trans. 491.

[5] Hofmeister, Eng. trans. 435.

(1900), when it was seen that the same must hold for a multitude of algæ with similar asexual tetrads.

But, as already indicated, it is not to the homothallic *Dictyota* that one must look for comparable phenomena as to the *heterothallic* algæ of the sea. The initiation of cytological diœcism, as in the parallel examples of so-called sexual diœcism (♂ and ♀) or in the latter diœcism of floral stages, implies that sooner or later divergence of the two types of soma will occur, as such dimorphic phases present in some degree a complementary division of the type or come to occupy complementary stations. What does emerge in the case of the hypothetical ancestors of autotrophic land-flora is that such divergence and somatic dimorphism must have been already attained, and even very highly specialized, in the sea, long before there was any suggestion of the transmigration which has been successfully negotiated in virtue of such attainment.

(To be continued.)

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from p. 15.)

Melastomaceæ.

Through the courtesy of the Director of the Naturhistoriska Riks-Museum at Stockholm we have been able to examine the specimens of this family in Swartz's Herbarium.

Swartz, in the Preface to his *Prodromus Descript. Veg.*, mentions his indebtedness to Sir Joseph Banks in allowing him to study his herbarium containing collections made by Dr. Wm. Wright, Roger Shakespear, F. Masson, and others in Jamaica. This must have been during parts of the years 1786, 1787, for, after travelling in the West Indies, Swartz returned to Jamaica in 1786, whence he sailed for London during the same year. He probably wrote the *Prodromus* actually in Banks's Herbarium, and also many of the descriptions in *Fl. Ind. Occ.* (for instance, *Melastoma umbrosa*), as he had no specimens of his own or his specimens were inadequate. Swartz presented Banks with very many duplicates from his own collection. These are in many instances written up by himself, but in other cases by Dryander, presumably at the instance of Swartz, who was then working in the herbarium. It is interesting to find also that Swartz wrote at that time some of the binominals in Banks's copy of Sloane's *Natural History of Jamaica* in the margin opposite the descriptions.

A comparison of the Swartzian types in herb. Banks. (at the British Museum) and in Swartz's own herbarium at Stockholm has brought to light certain discrepancies in the naming, and also indicated the intimate relationship between the *Prodromus* and the Banksian Herbarium.

Thus the description of *Melastoma strigillosa* Swartz (Prodr. 71; Flor. Ind. Occ. 793) agrees with specimens from Wright and Masson in Herb. Banks. written up by Swartz as *Melastoma strigillosa*. This species is represented in Swartz's Herbarium by a single leaf and a portion of the inflorescence, apparently taken from one of Dr. Wright's specimens in herb. Banks., but has been named by Swartz *Melastoma hispida*. But Swartz's description of *M. hispida* (Prodr. 72; Flor. Ind. Occ. 821) agrees, not with this specimen, but with a specimen from Masson in herb. Banks. named by Swartz, first *M. glandulosa* and later *M. hispida*, and with a similar specimen in herb. Swartz. named by him *M. glandulosa*. *M. glandulosa* Swartz (Flor. Ind. Occ. 799) is a synonym of *M. hispida*, and the species is now known as *Tetrazygia hispida* Macfadyen (Flor. Jam. ii. 58 ined.) ex Triana in Trans. Linn. Soc. xxviii. 100 (1871).

The specimen in herb. Swartz., named by him *M. strigillosa*, represents the species now known as *Heterotrichum octonum* Naud.; a specimen of this species from Swartz in herb. Banks. was not written up by him. *Melastoma strigillosa* Swartz is now known as *Clidemia strigillosa* DC.

Melastoma trinervia Sw.

This species is described in *Prodr.* 69 (1788) and *Fl. Ind. Occ.* 774. The only authentic specimen is in herb. Swartz. at Stockholm. It proves to be the same species as Schlechtendal subsequently described under the name *Melastoma? scorpioides* in *Linnæa*, v. 464 (1830). Naudin also overlooked Swartz's description, and cited Schlechtendal's *scorpioides* (under *Miconia*) in a list of uncertain species (Ann. Sc. Nat. sér. 3, xvi. 243). On an earlier page (*l. c.* 150) he described the same species as *Miconia anceps*. Cogniaux (in DC. Monogr. vii. 782) included the species under the name *Miconia scorpioides* Naud.; but, without having seen Swartz's specimen, uses his name for plants of a second species (*tom. cit.* 810) collected by Anderson (Jamaica) and Eggers (St. Vincent and Grenada). So far as we know, Anderson was never in Jamaica, but as he was Curator of the St. Vincent Botanic Garden, there is not much doubt that his specimen was collected in St. Vincent. This species therefore requires a name, and we propose *Miconia Andersonii* as a fitting one, for Anderson appears to have been the first collector. The synonymy of the two species is as follows:—

(1) *Miconia trinerva* D. Don ex Loud. Hort. Brit. 174 (1830).
Melastoma trinervia Swartz, Prodr. 69 (1788).
M. (?) scorpioides Schlechtend. in Linnæa, v. 564 (1830).
Miconia scorpioides Naud. in Ann. Sc. Nat. sér. 3, xvi. 243 (1857); Cogn. in DC. Monogr. vii. 782.
Miconia anceps Naud. *tom. cit.* 150.

(2) *Miconia Andersonii* Fawc. & Rendle, comb. nov.
M. trinervia Cogn. in DC. Monogr. vii. 810 (1891), non D. Don.

Blakea trinervia L. var. **Normanii**, var. nov. *Folia* elliptica vel rotundo-elliptica, 10–14 cm. l., 5·5–8·5 cm. lat. *Petala* quam in specie minora, circa 2 cm. l., purpurea.

Hab. Mandeville, *Norman* 77! Also collected by *Rev. J. Waters*!

Onagraceæ.

Fuchsia cuspidata, sp. nov. *Frutex* 6 m. altus; caule, ramis, petiolis, foliis subtus, pedunculis atque ovariis dense puberulis. *Folia* 7–18 cm. l., opposita vel terna, elliptica v. oblongo-elliptica, in apicem angustata, basi subacuta sæpe obliqua, margine integra v. obtuse denticulata, supra sparse puberula, nervis lateralibus utrinque 11–24; petioli 1–6 cm. l. *Racemi* terminales speciosi. *Flores* penduli; pedunculi 1–1·5 cm. l.; alabastra cuspidata. *Calyx* extus sparse puberulus; lobi 1·7–2·1 cm. l., basi 4 mm. lat., lanceolati, apice acuminati, cuspidati; tubus 4·5–6·5 cm. l., apice 7 mm. lat. ad basin sensim angustatus, intus dense puberulus. *Petala* 1·5 cm. l. *Stamina* longiora 1·4 cm. l. *Stylus* apicem calycis loborum demum attingens. *Ovarium* lineare, 8–13 mm. l. *Bacca* lineari-oblonga, 1·5 cm. l.

Flowers solitary in axils of much reduced leaves simulating a terminal raceme or panicle. Buds mucronate at apex with united cusps of calyx-lobes. Calyx dark red. Petals oblong, acute, light red. Filaments light red; anthers creamy white.

Hab. Near Woodcutters Gap, Blue Mts., *Harris* 5825!, also cultivated in Hill Gardens, Cinchona. The following are conspecific: Bolivia: *Mandon*, 622! *Bang*, 327! 1806!; Guatemala: *J. Donnell Smith*, 2176!.

Near *F. dependens* Hook., but distinguished by the long narrow ovary and fruit and generally larger leaves.

THREE FUNGI IMPERFECTI.

By Jessie S. Bayliss Elliott, D.Sc. (Birm.), B.Sc. (Lond.).

Each of these species has a very striking and characteristic form. The first, *Dispira circinata*, sp. nov., appeared on a sheep-dung culture in the zoological laboratory at Birmingham (June 1922), while *Scopularia venusta* Preuss, and *Tolypomyria microsperma* (Corda) Sacc., representing two new records for the British Isles, were found in my garden at Tamworth-in-Arden (February 1925), growing close together on a cone of *Pinus sylvestris*.

***Dispira circinata**, sp. nov. *Conidiophoræ* erectæ, septatæ, hyalinæ, apice in ramos 3–6 evadunt. *Rami* iterato inæqualiter dichotomi, ramulo altero semper in duo brachia diviso, quorum brevius capitulo aspergilloideo conidiorum coronatur, longius sterile curvatum attenuatum ipsi capitulo quasi circinatim circumducitur, ramulo altero producto mox autem pariter dichotomo. *Ramulus fertilis* in vesiculam sphæricam aspergilloideam, 12–16 μ diametro, sufflatur, quæ in pedicellis exiguis utriculos globosos præ se fert; hi vero sterigmatibus brevibus

* My thanks are due to Mr. W. B. Grove for this Latin diagnosis.

in catenas conidiorum desinentibus obruuntur, *conidiis* ovalibus hyalinis $4 \times 2\ \mu$, sterigmatibus $4–12 \times 2\ \mu$ (fig. 1).

Habitat. On sheep-dung culture. Zoological laboratory, Birmingham University. June 1922.

The conidiophore about ·5 mm. in height, gives off three to six branches ·5 to 1·5 mm. in length, each of which may dichotomise. On these branches, by a peculiar sympodial method of growth, Aspergillus-like heads of conidia are produced in the following way:—the base of the branch dichotomises, and one arm immediately dichotomises again producing a shorter branch, at the end of which appears an Aspergillus-like head of conidia, and a somewhat longer branch which encircles the head of conidia while gradually tapering to a point. Meanwhile the second arm of the main branch continues its growth for a few millimetres and then dichotomises, and another head of conidia, as

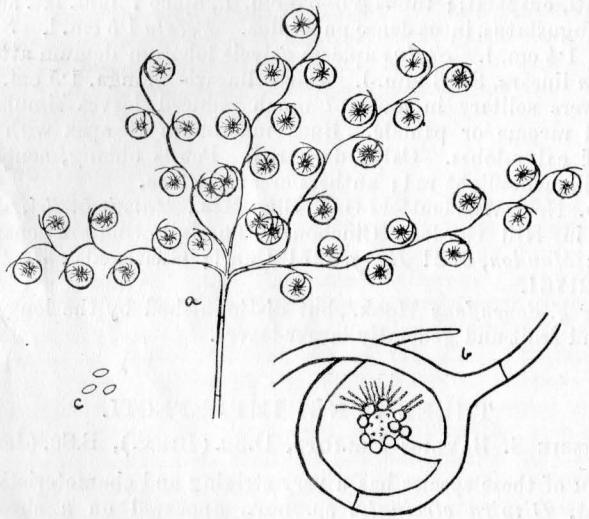


Fig. 1.—*Dispira circinata*, sp. nov. *a*. Branched conidiophore, ×55; *b*. Head of conidia with encircling branch, ×125; *c*. Conidia, ×425.

just described, surrounded by an encircling sterile branch, is produced by the one arm, while the other continues the growth of the main branch in the same way; so ultimately each of the five or six main branches radiating from the main conidiophore seems to consist of an axis bearing on each side a row of Aspergillus-like heads of conidia, each head surrounded by an encircling sterile branch.

This fungus is closely allied to *D. cornuta* Van Tiegh., and was found growing in a somewhat similar habitat. It differs in having five or six instead of two branches radiating out from the erect conidiophore. The branches bearing the Aspergillus-like heads of conidia have the same peculiar method of growth, but in *D. cornuta* the branch which is equivalent in origin to the encircling branch of *D. circinata* is shorter and projects outwards in a horn-like fashion.

Further, in *D. cornuta* each of the globular branches bears only one chain of spores.

SCOPULARIA VENUSTA Preuss, in Linnæa, xxiv. 133 (1851).

The fungus forms broadly-extended patches on cones of *Pinus sylvestris*, almost invisible except that the heads of hyaline conidia held together by mucus stand out as very minute white spots.

The conidiophores are erect, septate, fuscous-brown, 250–300 μ long, giving off at the apex a few short aseptate branches about 10 μ long, also fuscous-brown. Each of these short branches again

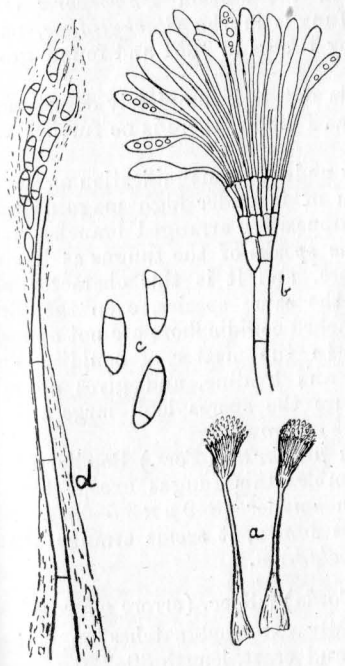


Fig. 2.—*Scopularia venusta* Preuss. *a*. Conidiophores, ×100; *b*. Head of conidiophore and conidia, ×450; *c*. Conidia, ×450; *d*. Old conidiophore with mucilage massing about it, ×225.

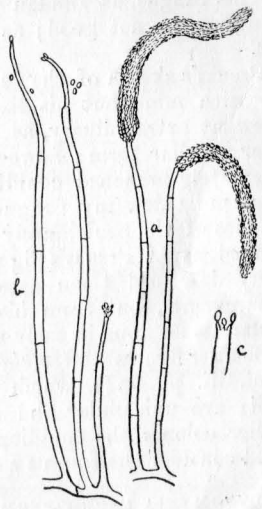


Fig. 3.—*Tolypomyria microspe*rma Sacc. *a*. Conidiophores with details of conidia attached, ×250; *b*. Conidiophores from which conidial tails have fallen; *c*. Apex of a young conidiophore, ×500.

produces two or three short branches, but of a paler brown colour, from each of which arise several long hyaline aseptate branches 30–35 μ, each terminating in a conidium. The lower series of short brown branches arise basipetally, the youngest branches being on the outside of the penicillate head so formed; they curve round, and adhere so closely to the main stem or other short branches that it is impossible to separate them; they grow to the same height as the other short branches, and then produce long hyaline branches of very nearly the same length.

The conidia are somewhat fusiform or clavate, 21–23 $\mu \times 5$–6 μ, hyaline, 2-septate, producing a large middle cell and two short terminal cells; they are very numerous, and are held together by copious mucus, which may stream down the conidiophore and mass round its base, carrying with it conidia (fig. 2).

Habitat. Garden, Tamworth-in-Arden, Warwicks. Feb. 1925.

This fungus is a Hyphomycete belonging to the section *Dematiaceæ*. Since the conidia are 2-septate, it should come in the *Phæophragmiæ* division of this section. However, of the six families grouped here, there is not one which possesses the characteristic conidiophore of this fungus; but in the section *Phæosporæ* (spores unicellular) there is a similar fungus in the *Stachylidieæ*, namely *Scopularia venusta* *, recorded by Preuss in 1851 and found growing on Pine wood.

This fungus, as Lindau points out, is incompletely described, and the figures are not good; as far as I know, there is no further record of it.

Preuss's sketch of the fungus under low magnification agrees very well with mine, but his diagram of it under high magnification is somewhat extraordinary, as the oppositely arranged branches take a rather peculiar form; however, he speaks of the fungus as having a penicillately branched conidiophore, and it is this character which makes me think my fungus is the same species, even though the branches of the penicillately branched conidiophore are not oppositely arranged as in Preuss's figure. In the matter of conidia, Preuss merely described them as oval and hyaline, and gives no spore-measurements, but from his figure the spores look large and unicellular, as do mine in early stages of growth.

Boudier figures a *Gliocladium piliforme* (Pers.) Boudier (Icones Mycol. iii. pl. 587), which resembles this fungus except that the conidia are unicellular and much smaller (8–9 $\mu \times 3{\cdot}5$–5 μ). Since Boudier colours the conidiophores brown, it seems strange that he should consider the fungus a *Gliocladium*.

Tolypomyria microsperma (Corda) † Sacc. (errore *microspora*).

The conidiophores form broadly extended patches on cones of *Pinus sylvestris*; each is simple and erect, length 80–220 μ, septate, brown, but hyaline for a short distance towards the apex, where it is more delicate and beset with minute sterigmata, from which are abstricted oval hyaline conidia, 1·5–2·5 $\times$ 2–2·5 μ; the conidia are so abundant that many must be abstricted in succession from each sterigma, although they do not occur in chains; they are held together by mucus, and form tail-like masses pendant or erect, 70–90 μ long, attached to the end of the conidiophore (fig. 3).

Corda describes the tail-like masses of conidia as of a green colour; in my specimen they looked quite colourless.

Habitat. Garden, Tamworth-in-Arden, Warwicks. Feb. 1925.

As far as I know, the only other record of this fungus is the original one of Corda for Bohemia.

* See Rabenh. Krypt., Fl. viii. 744.

† See Rabenh., Krypt. Fl. viii. 307.

THE INTERNATIONAL NAMES OF THREE ORCHID GENERA.

By T. A. Sprague, B.Sc., F.L.S.

The three genera, represented respectively by (I.) *Epipactis Helleborine* (*E. latifolia*), (II.) *Serapias lingua*, and (III.) *Goodyera repens*, have been known severally for over a century under the names (I.) *Epipactis*, (II.) *Serapias*, and (III.) *Goodyera*. Within the last twenty years, however, the generic names have been changed and partially transposed, as illustrated in the following table:—

Authority.	I.	II.	III.
Benth. & Hook. f. Gen. Pl. (1883).	*Epipactis* Adans.	*Serapias* L.	*Goodyera* R. Br.
Rendle & Britten, List Brit. Seed-Pl. (1907).	*Epipactis* Adans.	[*Serapias* L.]	*Goodyera* R. Br.
Druce, List Brit. Pl. (1908).	*Helleborine* Hill.	[*Serapias* L.]	*Goodyera* R. Br.
Schinz & Keller, Fl. Schweiz, ed. 4 (1923).	*Helleborine* Mill.	*Serapiastrum* Kuntze.	*Goodyera* R. Br.
Ames in Gray's New Man. Bot. (1908).	*Serapias* L.	[*Serapiastrum* Kuntze.]	*Epipactis* Boehm.

The generic names enclosed in square brackets were not actually used in the works cited, but would have been adopted if the authors of these works had had occasion to refer to the genera concerned.

At the present time genus I. is variously known as *Epipactis* Adans., *Helleborine* Hill, *Helleborine* Mill., and *Serapias* L., by authors who severally endeavour to follow the International Rules, and genera II. and III. are each known under two names. It seems desirable, therefore, to ascertain what names the three genera should bear under the Rules.

I. Serapias and II. Serapiastrum.

The first use of the name *Serapias* by Linné was in Syst. Nat. ed. 1 (1735), where he cited *Helleborine* Tourn. as a synonym. In Gen. Pl. ed. 1, 271 (1737), he described the perianth-segments of *Serapias* as ovate, and the labellum as being almost as long as them; and in Hort. Cliff. 429 (1738) he recognized only a single species, *Serapias caule multifolio multifloro*, which is *S. Helleborine* of Sp. Pl. ed. 1. In 1740 he described a second species, *Serapias bulbis subrotundis, nectarii labio trifido acuminato petalis longiore* (Act.

Soc. Sc. Upsal. 1740, 23 : 1744), which is *S. lingua* L., and modified his generic description in Gen. Pl. ed. 2, 433 (1742), so as to include it, describing the perianth-segments as ovate-oblong, and the labellum as equalling them in length. This description he reproduced in Gen. Pl. ed. 5 (1754). In Sp. Pl. ed. 1, 949, he recognized two species of *Serapias*—*S. Helleborine* and *S. lingua*. If the type-method as generally employed is applied strictly, the name *Serapias* must be retained for *S. Helleborine* and its congeners. Under Art. 45, "if a genus contains a section or some other division, which, judging by its name or its species, is the type or the origin of the group, the name is reserved for that part of it," the genus *Æsculus* being cited as an example. "The name *Æsculus* must be kept for the species *Æsculus Hippocastanum* L., as this is undoubtedly the type of the genus founded by Linnæus (Sp. Pl. ed. 1, 344), as is seen by a comparison with Linnæus, Hort. Cliff. 142 and early editions of the Gen. Pl. (ed. 1, 310; ed. 2, 367)." The case of *Serapias* is parallel: the only species in Hort. Cliff. and Gen. Pl. ed. 1 is the one which he afterwards named *S. Helleborine*. Hence, under International Rules, the genus commonly known as *Epipactis* or *Helleborine* becomes *Serapias* L., and the genus typified by *S. lingua* should be known as *Serapiastrum* Kuntze (Rev. Gen. iii. pars 1, 141 : 1893).

Briquet (Prodr. Fl. Corse, i. 375 : 1910), who employed the names *Helleborine* and *Serapias* for the genera typified by *Serapias Helleborine* and *S. lingua* respectively, apparently did not realize that *Serapias* L. (1735–38) was based on the species subsequently named *S. Helleborine*.

Schinz and Thellung (Vierteljahrsschr. Nat. Ges. Zürich, liii. 588 : 1909) declared that *Serapias* L. was a "nomen confusum," and rejected it on that account. But there is nothing in the International Rules which warrants the rejection of a name merely because it has been *misapplied by subsequent authors*. The "nomina confusa," which may be rejected under Art. 51, 4°, are names which were confused *ab initio*—e. g., *Rosa villosa* L., "a plant which has been referred to several different species, and of which certain identification seems impossible (International Rules, ed. 2, 48). Genus I. under International Rules bears the name *Serapias* L., unless some other name—e. g., *Epipactis* or *Helleborine*—is conserved for it.

Those who use the name *Helleborine* Hill (Brit. Herb. 477 : 1756) for *Serapias Helleborine* and its congeners have overlooked two decisive facts: not only is *Serapias* L. the correct name for the genus in question, but *Helleborine* Hill is intrinsically invalid, being a "nomen abortivum." Hill merely replaced *Serapias* L. by *Helleborine* Tourn., as was pointed out by Britten (Journ. Bot. 1908, 10 ; 1917, 177). It is true, as pointed out by Druce (Journ. Bot. 1908, 9) that Hill in 1756 included only species of *Helleborine* and *Cephalanthera*, and that his generic description excludes *S. lingua*. But Hill was dealing only with British plants, and there is no conclusive evidence that he excluded *S. lingua* from *Helleborine*. Authors of local floras not uncommonly introduce into their generic descriptions characters which do not apply to all the exotic species of the genus.

Four years later Hill gave up the generic name *Helleborine* in favour of *Serapias* (Fl. Brit. 460 : 1760), and fourteen years afterwards he still retained the latter name (Veg. Syst. xxiv. 36, 37, tt. 36, 37). He at that date (1774) included *S. lingua* in the genus, and there is no evidence that he had ever excluded it, although his restriction in 1756 of the generic characters to those observable in the British species might lend colour to that supposition.

The name *Helleborine* Mill. (Gard. Dict. Abridg. 1754), recently adopted by Schinz and Thellung (Fl. Schweiz, ed. 4, i. 166 : 1923), is a "nomen abortivum," because it was a new name for a genus embracing three Linnean genera (*Serapias*, *Limodorum*, and *Cypripedium*), all dating from 1753.

III. Epipactis Boehm.

Excluding references prior to 1753, the first use of *Epipactis* was by Zinn, Cat. Pl. Gott. 85 (1757), but this was a "nomen abortivum," being a new name for the combined genera *Serapias* L. (1753) and *Ophrys* L. (1753), and hence contravening Art. 44 and 46. The next (and first effective) publication of *Epipactis* was by Boehmer in Ludw. Def. Gen. Pl. ed. 3, 357 (1760). *Epipactis* Boehm. was based on *Epipactis foliis ovatis radicalibus* Gmel. Fl. Sibir. i. 13 (1747), a synonym of *Satyrium repens* L. Sp. Pl. ed. 1, 945 (1753), which is *Goodyera repens* R. Br. Hence *Goodyera* R. Br. (1813) must be replaced by *Epipactis* Boehm. (1760), on the grounds of priority. This was discovered by A. A. Eaton (Proc. Biol. Soc. Wash. 1908, xxi. 63), and was accepted by Ames (Gray's New Man. Bot. ed. 7, 315 : 1908) and Britten (Journ. Bot. 1909, 31). Schinz and Thellung (Vierteljahrsschr. Nat. Ges. Zürich, liii. 587 : 1909) rejected *Epipactis* Boehm. on the ground that *Epipactis* was a "nomen confusum." But there is not the slightest confusion about *Epipactis* Boehm., and this name cannot be rejected under International Rules except by conserving some other name for the genus. Schinz and Thellung's action in retaining *Helleborine* (see above) and *Goodyera* amounts to conserving these names without the authorization of an International Congress.

The correct names under International Rules and the synonymy of the three genera under consideration (*Epipactis*, *Serapias*, and *Goodyera* sensu Benth. & Hook. f.) are the following :—

I. Serapias L. [Syst. ed. 1 (1735) ; Gen. Pl. ed. 1, 271 (1737) ; Hort. Cliff. 429 (1738)] ; Sp. Pl. ed. 1, 949 (1753), partim ; Gen. Pl. ed. 5, 406 (1754), partim ; Kuntze, Rev. Gen. iii. sect. ii. pars 1, 141 (1898) ; A. A. Eaton in Proc. Biol. Soc. Wash. 1908, xxi. 66 ; Ames in Gray's New Man. Bot. ed. 7, 313 (1908) ; Britt. & Brown, Ill. Fl. ed. 2, 563 (1913) ; Abrams, Ill. Fl. i. 478 (1923).

Helleborine Mill. Gard. Dict. Abridg. (1754), partim ; Schinz & Thell. in Schinz & Keller, Fl. Schweiz, ed. 4, i. 166 (1923).

Helleborine Hill, Brit. Herb. 477 (1756) ; Druce, List Brit. Pl. 67 (1908) ; Lond. Cat. Brit. Pl. ed. 10, 37 (1908).

Epipactis Zinn, Cat. Pl. Gott. 85 (1757), partim ; Adans. Fam. 70, 554 (1763), partim ; Swartz in Vet.-Akad. Handl. Stockholm,

1800, xxi. 232, partim; R. Br. in Ait. Hort. Kew. ed. 2, v. 201 (1813), partim; L. C. Rich. in Mém. Mus. Par. iv. 51, 60 (1818); Endl. Gen. 213 (1837); Benth. & Hook. f. Gen. Pl. iii. 619 (1883); Pfitzer in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 6, 111 (1889); Dalla Torre & Harms, Gen. Siphonog. 94 (1900); Aschers. & Graebn. Syn. Mitteleur. Fl. iii. 857 (1907); Rendle & Britten List. Brit. Seed-Pl. 29 (1907); Wilmott in Bab. Man. ed. 10, 405 (1922); Lond. Cat. ed. 11, 42 (1925); Camus, Monogr. Orch. 407 (1908), et Iconogr. Orch. tt. 101–103 (1921); non Boehm. (1760).

Type-species: *Serapias Helleborine* L.

II. Serapiastrum Kuntze, Rev. Gen. iii. sect. ii. pars 1, 141 (1898); A. A. Eaton in Proc. Biol. Soc. Wash. 1908, xxi. 67; Schinz & Thell. in Vierteljahrsschr. Nat. Ges. Zürich, liii. 588 (1909), et in Schinz & Keller, Fl. Schweiz, ed. 4, i. 163 (1923).

Serapias L. Sp. Pl. ed. 1, 949 (1753), partim; Gen. Pl. ed. 5, 406 (1754), partim; Swartz in Vet.-Akad. Handl. Stockholm, 1800, xxi. 225; R. Br. in Ait. Hort. Kew. ed. 2, v. 194 (1813); L. C. Rich. in Mém. Mus. Par. iv. 41, 54 (1818); Endl. Gen. 211 (1837); Benth. & Hook. f. Gen. Pl. iii. 620 (1883); Pfitzer in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 6, 89 (1889); Dalla Torre & Harms, Gen. Siphonog. 90 (1900); Aschers. & Graebn. Syn. Mitteleur. Fl. iii. 773 (1907); Camus, Monogr. Orch. 43 (1908), et Iconogr. Orch. tt. 1–10 (1921); Briq. Prodr. Fl. Corse, i. 373 (1910).

Lonchitis Bub. Fl. Pyren. iv. 50 (1901).

Type-species: *Serapias lingua* L.

III. Epipactis Boehm. in Ludw. Def. Gen. Pl. ed. 3, 357 (1760); A. A. Eaton in Proc. Biol. Soc. Wash. 1908, xxi. 63; Ames, Orchid. ii. 261 (1908), et in Gray's New Man. Bot. ed. 7, 315 (1908); Britten in Journ. Bot. 1909, 31, in obs.

Peramium Salisb. in Trans. Hort. Soc. i. 301 (1812), sine descr.; Schinz & Thell. in Vierteljahrsschr. Nat. Ges. Zürich, liii. 587 (1909); Britt. & Brown, Ill. Fl. ed. 2, i. 569 (1913); Abrams, Ill. Fl. i. 481 (1923).

Goodyera R. Br. in Ait. Hort. Kew. ed. 2, v. 197 (1813); L. C. Rich. in Mém. Mus. Par. iv. 49, 58 (1818); Endl. Gen. 214 (1837); Benth. & Hook. f. Gen. Pl. iii. 602 (1883); Nyman, Consp. Fl. Eur. 689 (1882); Boiss. Fl. Or. v. 89 (1884); Pfitzer in Engl. & Prantl, Nat. Pflanzenf. ii. Abt. 6, 117 (1889); Dalla Torre & Harms, Gen. Siphonog. 96 (1900); Aschers. & Graebn. Syn. Mitteleur. Fl. iii. 894 (1907); Rendle & Britten, List Brit. Seed-Pl. 29 (1907); Druce, List Brit. Pl. 67 (1908); Lond. Cat. ed. 10, 37 (1908); ed. 11, 42 (1925); Wilmott in Bab. Man. ed. 10, 403 (1922); Camus, Monogr. Orch. 392 (1908), et Iconogr. Orch. t. 84, ff. 14–21 (1921); Schinz & Thell. in Vierteljahrsschr. Nat. Ges. Zürich, lx. 348 (1915), et in Schinz & Keller, Fl. Schweiz, ed. 4, i. 170 (1923).

Type-species: *Satyrium repens* L.

To sum up: under the International Rules the genus *Goodyera* R. Br. becomes *Epipactis* Boehm.; *Epipactis* Adans. emend. L. C. Rich. becomes *Serapias* L.; and *Serapias* L. emend. Swartz becomes *Serapiastrum*.

It was in order to avoid such disadvantageous changes in the nomenclature of genera by the strict application of the Rules that a list of conserved names was authorized under Art. 20. "These names are by preference those which have come into use in the fifty years following their publication, or which have been used in monographs and important floristic works up to the year 1890." The date 1890 was apparently introduced so as to exclude names revived by Otto Kuntze or under the various American Codes.

These requirements are fulfilled in the cases of the three generic names, *Goodyera* R. Br., *Epipactis* Adans. emend. L. C. Rich., and *Serapias* L. emend. Swartz, and I therefore propose that they should be placed on the list of "nomina conservanda." The cases for conservation of the three names may be summarized as follows:—

I. Epipactis Zinn, Cat. Pl. Gott. 85 (1757), partim; Swartz in Vet.-Akad. Handl. Stockholm, 1800, xxi. 232, partim; emend. L. C. Rich. in Mém. Mus. Par. iv. 51, 60 (1818).

The name has been continuously in use in this acceptation for over a hundred years. It was adopted by L. C. Richard, Endlicher, Bentham & Hooker, and Pfitzer in Engler & Prantl, and in Camus's *Monographie* and *Iconographie* as well as in a great majority of floras.

The conservation of *Epipactis* (sensu L. C. Rich.) would avert the necessity of using the name *Serapias* for the genus, which would be bound to cause confusion, since *Serapias* has been generally applied to *S. lingua* L. and its congeners.

Standard-species: *Epipactis Helleborine* (L.) Crantz.

II. Serapias L. Sp. Pl. ed. 1, 949 (1753), partim; emend. Swartz in Vet.-Akad. Handl. Stockholm, 1800, xxi. 225.

The name has been continuously in use since 1753 for the genus typified by *S. lingua* L. It was employed in this sense by Swartz, L. C. Richard, Endlicher, Bentham & Hooker, and Pfitzer in Engler & Prantl, and in Camus's *Monographie* and *Iconographie*, as well as in most floras.

The name *Serapiastrum*, proposed by Otto Kuntze in 1898, appears to have been adopted only in North America and Switzerland.

Standard-species: *S. lingua* L.

III. Goodyera R. Br. in Ait. Hort. Kew. ed. 2, v. 197 (1813).

The name has been continuously in use since the date of its publication. It was accepted by L. C. Richard, Endlicher, Bentham & Hooker, and Pfitzer in Engler & Prantl, and in Camus's *Monographie* and *Iconographie*, as well as in an overwhelming majority of floras.

In default of the conservation of *Goodyera*, the genus will have to be called *Epipactis*. As the latter name is generally associated with a different genus, confusion would certainly be caused.

Standard-species: *G. repens* (L.) R. Br.

CONSERVATION OF NATURE.

Selsdon Wood, Surrey.

An effort is being made to secure as a Nature Reserve and Bird Sanctuary a tract of Surrey woodland on the borders of Sanderstead and Addington, known as Selsdon Wood. The site is 107 acres in extent, and the purchase price £3,210. It consists of groves of oak, pine, beech, chestnut, and yew, rising above tangled coppices where the nightingale abounds. It is the home of many species of wild birds, and the various seasons are marked by flowers characteristic of the chalk country. It is twelve miles from the centre of London, on a hillside, 500 feet above sea-level, overlooking a hitherto secluded valley, and is within easy walking distance of Croydon. Thirteen acres adjoining, known as Court Wood, have been recently secured as a Sanctuary, and it is proposed that the two areas should become one under the guardianship of the National Trust.

We quote the above from a tastefully illustrated appeal received from Miss A. M. Bonus, one of the Hon. Treasurers of the Committee which is endeavouring to secure the area. Miss Bonus ("Sarum," Radcliffe Road, Croydon) or her colleague Mr. L. W. Chubb, of the Commons and Footpaths Preservation Society, will be glad to receive contributions towards the purchase fund, a large proportion of which is still required.

Sheen Common.

Residents of Sheen and Richmond are vigorously protesting against the action of the Barnes Local Council in destroying the rural character of Sheen Common. A correspondent describes this as, in 1920, a real little piece of Surrey heathland, aglow with golden gorse, May trees a mass of bloom, great patches of white bedstraw, with bracken and grasses, and later a carpet of purple heather. Bird-life was abundant, many varieties finding a natural sanctuary in the masses of gorse and bramble. Recently, however, an alteration in the site of a football pitch has caused the destruction of a large area, and a gravel road has been replaced by a modern drive planted with chestnut trees. Further "improvement" is threatened in the way of removal of a rural foot-path between hawthorn hedges.

A similar note is struck by the following charming little paragraph from the Personal column of *The Times*" of Friday, March 12, 1926:—

> TO THOSE RESPONSIBLE.—Please do not take any "slices off" our Public Parks and Gardens.—Peter Pan, on behalf of his friends the children, old people, tired workers, and dogs, especially those who can afford neither gardens of their own nor motor cars to take them to the country.

REVIEWS.

A Monograph of the British Lichens. A Descriptive Catalogue of the Species in the Department of Botany, British Museum. Part II. 2nd Edition, revised, by Annie Lorrain Smith, F.L.S. 8vo. Pp. viii, 447, with 63 Plates and one text-figure. Trustees of the British Museum, 1926. Price 20*s*.

It is fifteen years since the publication of the first edition of Part II. of this Monograph, and one might expect that after so long a period important alterations would appear in a revised second edition. Such is the case, but the author, in a prefatory note, states that there have been no fundamental changes. The chief alterations are:—(1) the inclusion of four genera (*Dirina*, *Roccella*, *Pyrenidium*, and *Sarcopyrenia*); (2) a new full-paged plate of the genus *Sarcopyrenia*; (3) a figure in the text, page 373, representing the genus *Clathroporina* Muell. Arg., new to the British flora; and (4) the indexing of forms and varieties.

These changes, with the exception of the last, were clearly foreshadowed in the appendix to Pt. I., pages 387–486. They were due in order that the classification should coincide with modern views of affinity.

At first the book strikes one as being smaller than the previous edition; this is due to use of thinner paper; there are in reality 447 pages of printed matter in place of 409 and 4 extra plates, three of which have been transferred from the appendix to Pt. I. (1911), the fourth being the new plate already mentioned.

Several new species have been recorded for the British Isles since the publication of the first edition. Descriptions of the original species appear in the new volume, and in most cases a specimen has been placed in the British Museum Herbarium.

Five genera of the Lecideaceæ exhibit an increase in number of species when compared with those previously included in the Monograph. The extra number in each genus is: *Lecidea* 3, *Biatorella* 2, *Bilimbia* 2, *Bacidia* 2, *Rhizocarpon* 1. The figures given are also representative of the larger genera of Graphidiaceæ and Verrucariaceæ—that is, an average increase of approximately 2.

By the acquisition of specimens, knowledge of the areas of distribution becomes more and more exact. As examples, taken at random, of what has taken place since 1911, the new edition shows that the number of extra localities of distribution are: *Racodium rupestre* 8, *Lecidia panæola* 6, and *Verrucaria hydrella* 10. Many more similar examples could be given.

An alteration in the grouping of species in the genus *Lecidea* is evident on putting the new edition to practical use—*Lecidea panæola* changes its sequence from 110 to 138, *L. atrofuscescens* (=*L. athroparpa* of second edition) 162 to 128. This regrouping is a welcome aid to identification, as the order of the species now corresponds to that adopted in the author's *Handbook of British Lichens* *.

We notice a slip under *Lecidea Bauschiana* (p. 47), where

* *Handbook of British Lichens*, by Annie Lorrain Smith, F.L.S. Published by the Trustees of the British Museum. 1921. Price 6*s*. 6*d*.

var. *indigula* should be var. *infidula*. This variety has always appeared to be of higher rank, if colour of the hypothecium is to be regarded as an important feature in the identification of species. *L. sylvicola*, page 107, has hypothecium *thick, blackish-brown or violet-black*, while that of the variety *infidula* is described in the previous edition as having hypothecium *pallid or almost colourless*. This makes it possible that in the present edition it was intended to raise var. *infidula* to specific rank, as it is not associated there with *L. sylvicola*.

Miss Lorrain Smith omits any reference to certain genera that are still retained by Continental writers. The reason for doing so is evidently for the purpose of following an arrangement similar to that where *Psora* and *Biatora* in the genus *Lecidea* are regarded as sections of the larger genus.

Towards the end of the volume (pp. 364–90) there is a list under the title "Species of Microfungi recorded by British Authors as Lichens." The citations from literature accompanying this list are practically exhaustive. It should prove most useful as a valuable aid for saving time.

The Appendix (pp. 394–404) contains a revision of the genus *Acarospora*, as represented in the British Flora. The Museum species are now arranged in agreement with *A Monograph of the Genus* Acarospora, by A. H. Magnusson, Göteberg, 1924. Miss Smith remarks in respect to the results of the examination of these by Magnusson, 1925, that "He has found changes in nomenclature—and in some instances in determination—to be necessary, and has delimited a number of species not hitherto recognised by British Lichenologists."

Attention is drawn to a statement that must have been puzzling to students using Magnusson's Monograph. In it he describes the thalline reaction of *A. Lesdainii* as K— or yellowish, while Harmand based the original species on the reaction, K+ yellow, then red. The latter is that retained in the British Monograph, p. 334, for an obvious reason. Seven species based on Magnusson's diagnoses, new to Great Britain, are described.

There is also a note on *Crocynia*, an obscure genus of the Family Chrysothricaceæ. Until the publication of a *Monographia Crocyniarum*, commenced by the Abbé Hue, and completed by Dr. Boulay de Lesdain, one species only, and that always sterile, was known in the British Isles. It is fairly common, and is represented in the British Museum Herbarium from thirty-three localities widely scattered through Great Britain. In the monograph of the genus 11 species and many varieties and forms are diagnosed, and of these eight species are described from Great Britain, five from different localities in Scotland, and four from England (Yorkshire). A preliminary key is appended.

Although no fundamental changes have been made in this edition, it contains a great deal that is new. The work involved in the revision must, necessarily, have been long and arduous, but in the result the new edition fully maintains the high standard always associated with the *Monograph of British Lichens*.

ROBERT PAULSON.

Soil Characteristics, a Field and Laboratory Guide. By PAUL EMERSON, Ph.D. 8vo, pp. x, 222. McGraw Hill Publishing Co., Ltd. London, 1925.

THE author of this book, who is Associate Professor of Soils at the Iowa State College, has produced a readable and instructive manual, which is intended to serve as a guide "to the student, the instructor, and the investigator." It may, however, be stated at the outset that it is more likely to be of value to those in the first two categories than to the latter. The subject covered by the title is a wide one, and far more than the 222 pages of this book would be needed to make it of any real value to the soil-investigator. Moreover, as frankly admitted by the author, "practically all references are given to American publications." This does not necessarily detract seriously from the value of the book for instructional purposes; the principles of the subject and the methods of routine examination are the same or similar the world over, and they can be taught well enough by wholly American examples. The soil-investigator, however, must have an international outlook and knowledge. It is precisely the differences between the views, methods, and results of workers in different countries, and the variations in soil-types and conditions, with which he must concern himself.

On the whole, the many and varied aspects of the study of soils are well and adequately dealt with; but, by confining his attention almost solely to American methods the author has made a number of important omissions, and a certain inequality of treatment is noticeable. Thus, in dealing with the physical and mechanical properties of the soil, no mention is made of the more modern methods of mechanical analysis, such as those of Robinson, Odén, and Wiegner, although three pages are devoted to Allison's method of determining the modulus of rupture of the soil. Further, modern work on exchangeable bases and their relation to the absorptive power of the soil and to soil reaction is entirely disregarded. Other instances of this type could be cited, but these suffice to show that the book is not sufficiently comprehensive for the advanced soil-investigator.

The student and teacher, however, will find a useful account of the subject in the book. The subject-matter is divided into four sections, treating respectively of a general study of soils (2 pp.), soil physics (25 pp.), soil fertility (125 pp.), and soil microbiology (44 pp.). The first section contains a description of methods of soil classification, soil-survey methods, mechanical analysis, and the microscopic measurement of soil particles. In the section on soil physics are included instruction for the determination of the usual physical constants of the soil, its water relationships, and its absorptive properties. The third and longest section, on "soil fertility," is devoted wholly to the chemical examination and analysis of the soil and of fertilisers. The title of this section is rather unfortunate, since soil fertility is such a complex in which physical and biological factors play parts at least as important as chemical factors. The fourth section describes the estimation of the numbers of the various types of soil micro-organisms and the study of the chemical changes that they effect.

It may be questioned whether there is any real need to include a description of elementary volumetric analysis, to which ten pages are devoted. The student who is taking up the study of soils must be expected already to have received an adequate grounding in elementary chemistry, which should include the simple theory and practice of volumetric analysis. If he is not acquainted with this, he is still less likely to be familiar with the details of elementary microbiological technique, a knowledge of which is taken for granted in the chapter on soil microbiology.

It is almost inevitable that faults of this type should occur in a handy-sized book on a subject with such a wide scope, and the reviewer is perhaps liable to give more attention to its defects than to its many excellent qualities. The student using such a book will usually be under the personal supervision of a teacher, who will be able to fill in the gaps, and the book under review is well adapted for use under such conditions. For instructional purposes it possesses one specially valuable feature: the provision of a copious number of practical exercises, which are usually well chosen, and in the carrying out of which the student will gain invaluable practical experience of soil characteristics.

The book is well printed, and very few misprints have been noticed, although some of the chemical equations (*e.g.*, p. 148) are not quite all they should be.

H. J. Page.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on February 18th, the President, Dr. A. B. Rendle, F.R.S., referred to the recent death of Dr. William Bateson, F.R.S., and moved the following Resolution, adopted in silence unanimously, those present standing in their places:—

> That the Fellows of the Linnean Society in General Meeting assembled desire to express their deep sense of the grievous loss which Science has sustained by the death of Dr. William Bateson.
>
> And the Fellows would also record their high appreciation of Dr. Bateson's services to the Society as a Vice-President, a Member of Council, and an eminent and helpful Fellow.

Mr. J. Ramsbottom exhibited a series of aerial photographs and lantern-slides lent by Mr. O. G. S. Crawford, of the Ordnance Survey. These, taken for archæological purposes, illustrated the prevalence of "Fairy Rings" on downs; the appearance and manner of growth of the rings were described. In response to the President, Mr. Crawford expressed the opinion that the determination of the age of "Fairy Rings" might well prove of value in archæological work. He agreed that interesting points in succession might be made out, and stated that the appearance of the vegetation, as viewed or photographed from an aeroplane, differed according to the time during which the areas under inspection had been under or free from cultivation.

Dr. Hamshaw Thomas stated that with suitable photographic plates and filters, and under favourable illumination, differences in the character of the vegetation, imperceptible to ordinary naked-eye examination, appeared with remarkable clearness in the photographs.

Professor F. O. Bower, F.R.S., expounded and illustrated with a series of lantern-slides a scheme of phyletic grouping of Ferns.

No attempt had been made to construct an evolutionary tree with connected limbs, but only to indicate such general relations as follow from wide comparison. The arrangement is based upon certain conventions. Those Ferns that are held as the most primitive are placed lowest, and it will be found that they include the earliest fossil types. To the left are those in which the sori are distal or marginal in position, a feature which they share with the Botryopterids. To the right are those in which the sori are superficial, a state that is regarded as a secondary result of a widened leaf-area. The reason for attaching weight to this distinction is that, once attained, the superficial position of the sorus—with its obvious biological advantage—is generally permanent. The marginal is probably the primitive position; some families departed from it early (Marattiaceæ, Gleicheniaceæ); others tenaciously retained the marginal position (Ophioglossaceæ, Hymenophyllaceæ, Loxsomaceæ); others again show various degrees of adoption of the superficial position (Schizæaceæ, Dennstædtiinæ). The Osmundaceæ are particularly interesting in this feature: for in *Osmunda* the sporangial tassels are marginal, in *Todea* superficial; but abnormal *Osmunda* sporophylls with broadened surface bear their sporangia superficially, as in *Todea*.

The application of this distinction separates the Dicksoniaceæ from the Cyatheaceæ, though most systematists place them together. But their separation is supported by the intermediate links that exist between these gradate Ferns and the Simplices. There are also anatomical distinctions; moreover, while the Dicksoniaceæ have only hairs the Cyatheaceæ have broad scales as their dermal appendages. Thus the separation of the Dicksoniaceæ and Cyatheaceæ, originally associated chiefly on the ground of their dendroid habit, has other justification than the mere soral position, which in itself might well suffice.

The scheme accords with the distinction of the primitively simple sorus from the gradate and the mixed. All the lowest groups in the scheme (excepting Hymenophyllaceæ and Loxsomaceæ) are Simplices. The gradate state was adopted in some lines but not in all, and it was not an obligatory step. For instance, in *Plagiogyra* and *Dipteris* there is evidence of a direct step from the simple to the mixed sorus. But as a rule the mixed condition was not attained till we arrived at the six large groups at the top of the scheme named after certain leading genera, into which fall the mass of modern Leptosporangiate Ferns. It remains to trace out, as far as possible, the phyletic relations within those groups. But here the difficulties which arise from widespread polyphylesis complicate the problem. In particular, the Acrostichoid state has probably arisen along fully six distinct phyletic lines, while the Polypodioid state has probably originated, on the one hand, from primitively naked superficial sori,

such as those of *Gleichenia* or *Dipteris*, on the other, by the abortion of the indusium either of a Pterid (*Hypolepis*) or of a Dryopterid (*Dryopteris Phegopteris*). The logical result of such views will then be that the old generic names of *Polypodium* and *Acrostichum* do not connote genera of blood-relationship at all. Their soral condition represents not real affinity, but a biological state that may be arrived at polyphyletically. They are mentioned here to show examples of the subversive effect of phyletic study upon the older systematic groupings.

At the meeting on March 4th, Miss Mary Florence Rich, M.A.(Dubl.); Dr. Nellie Carter, D.Sc.(Birm.); Miss Eva Jennie Fry, M.Sc.(Wales); and James Bryde, B.Sc.(Edin.), were among those elected Fellows.

The President referred to a specimen of *Typha latifolia* received from Mr. J. H. Owen, of Felsted, which was shown at the Meeting held on 17th December, 1925, and reported that the culm appears to have been split below during the development of the inflorescence. The exposed edges of the split, including part of the inflorescence, have healed, but are not re-united, so that the condition has the appearance of two fused inflorescences.

Mr. E. Heron-Allen, F.R.S., gave an account of the history of the myth of the Barnacle-Goose. The legend that the stalked Barnacle, *Lepas anatifera*, upon trees overhanging the water, or upon rotten timber, at maturity produces a goose or duck, permeates scientific literature from the XIth to the XVIIth centuries, and since the invention of printing has been fancifully illustrated. The myth appears to have passed current in the Near East in 1000 B.C., and is illustrated upon Mykenæan pots; a series of lantern-slides showing these representations was exhibited.

Mr. H. W. Pugsley, B.A., communicated further notes on *Fumaria* and *Rupicapnos*. Since the publication of the revision of these genera in the Society's Journal in 1919, a number of specimens have been received for examinatian from Algerian botanists, especially from Dr. R. Maire, of the University of Algiers. This material is largely the fruit of recent French botanical expeditions into parts of Morocco hitherto unexplored, and has yielded some new species both of *Fumaria* and *Rupicapnos*. New forms were also discovered in Algeria during a visit to that country in 1922.

Hooker Lecture.—At the General Meeting of the Linnean Society on Thursday, 15th April, 1926, at 5.0 P.M., Prof. Carl Schroeter, Foreign Member of the Society, will deliver the Hooker Lecture on "The Swiss National Park, and Scientific Researches into its Nature."

Fifth International Botanical Congress.—At a fully representative meeting of British botanists held at the Linnean Society on Wednesday, March 10, the suggestion was considered that the Fifth International Botanical Congress should take place in London in 1930. It was unanimously decided to send an invitation to the botanists assembled at Ithaca, New York, for the Fourth International Congress, in August next, to meet in London in 1930 for the Fifth Congress.

A CONTRIBUTION TO THE DESMIDS OF NORTH MANCHURIA.

By B. W. Skvortzow.
(Harbin, Manchuria, China.)

Very little attention has been bestowed upon the Freshwater Algæ of Manchuria. In O. Borge, "Ueber tropische und subtropische Süsswasser-Chlorophyceen" (Bih. K. Svenska Vet.-Akad. Handl. xxiv. 3, No. 22 (1899)), there are descriptions of the following species:—*Closterium acerosum* (Schr.) Ehrenb., *Sphærozosma granulata* Roy & Biss., *Gymnozyga moniliformis* Ehrenb., *Cosmarium tesselatum* (Delp.) Nordst., *C. subcrenatum* Hantzsch, *C. subspeciosum* var. *validum* Nordst.

These Algæ were found by O. Borge on *Utricularia intermedia* Hayne, collected by Maximovicz about fifty years ago in South Manchuria in the valley of the Ta-situhe River.

The Desmids now described were studied from numerous collections gathered near the Chinese Eastern Railway line in North and Middle Manchuria, mostly in the environs of Harbin and from the following localities:—1. Near Harbin in the Sungari River and in the Sungari River valley in lakes, pools, and marshes, 1915–1917; 2. Near Cheng Station in lakes and in marshes, 1915–1916; 3. Near Ertzendsiantze Station in marshes, 1916; 4. Round Tzaidiagou Station in lakes and marshes, 1916; 5. Near Hingan Station in marshes and rivulets, 1916. The list includes 152 species and varieties, 6 of which are new to science. The number indicates the locality as given above. The geographical distribution of the species or variety is also indicated.

Gonatozygon De Bary.

G. Brebissonii De Bary. Length 199–201 μ; breadth 5–5·3 μ. In lakes amongst other algæ. 1, 4.—South Manchuria (*Borge*), Turkestan, Siberia and in tropics.

G. Kinahani (Arch.) Rabenh. Length 200–255 μ; breadth 10–11 μ. On submerged plants in lakes near Harbin. 1.—Siam, Siberia (Tomsk).

Cylindrocystis Menegh.

C. Brebissonii Menegh. var. *minor* W. & G. West. Length 30–38 μ; breadth 13–14 μ. In bogs in the Sungari River valley. 1.—The typical form known from Siam, Java, India, &c.

Penium Bréb.

P. Navicula Bréb. Length 40–47·6 μ; breadth 9–11 μ. Sufficiently rare in marshes. 1.—Siberia (Tomsk), Kamtschatka.

P. Jenneri Ralfs. Length 65–68 μ; breadth 16–17 μ. Sufficiently rare in swamps. 1.—Europe.

P. Clevei Lund., forma. The Manchurian specimens are somewhat narrower and longer than the typical form. Length 119–120 μ;

breadth 34 μ. The typical *P. Clevei* has the cells 96–108 μ in length and 36–42 μ in breadth. In marshes. 1.—Europe, America.

P. margaritaceum (Ehrenb.) Bréb. Length 136–145 μ; breadth 20–23 μ. In swamps in May and June.—Baikal lake, Kamtschatka (forma) and tropics.

Closterium Nitzsch.

C. Archerianum Cleve. Length 187–213 μ; breadth 19 μ. Frequent in swamps. 1.—Europe and tropics.

C. striolatum Ehrenb. Length 243–246 μ; breadth 27–30 μ. Near Harbin in marshes. 1.—Siberia (Tomsk, Irkutsk), Japan and China.

C. regulare Bréb. Length 270–285 μ; breadth 27–30 μ. In a pool. 1.—Europe, India.

C. intermedium Ralfs. Length 242–273 μ; breadth 16·5–18 μ. Pretty often in lakes in the Sungari River valley. 1.—North Siberia.

C. juncidum Ralfs. Length 273–283 μ; breadth 7·5 μ. In marshes. 1.—South Asia, Java.

C. parvulum Näg. Length 85–93 μ; breadth 12–13 μ. In the plankton of lakes. 1.—North Siberia, Japan.

C. Venus Kütz. Length 45–57 μ; breadth 8·5–10 μ. Pretty often in marshes. 1, 2, 3, 4, 5.—Siberia (Tomsk, Irkutsk), Kamtschatka, North Siberia, Japan, China.

C. moniliferum (Bory) Ehrenb. Length 297–320 μ; breadth 37–50 μ. A common form in marshes. 1, 2, 3, 4, 5.—Siberia (Tomsk, Irkutsk, Baical), Kamtschatka, Tibet, Central China, Japan.

C. Malinvernianum De Not. Length 320–430 μ; breadth 51–64 μ. Found in a pool. 1.—India, Europe.

C. Ehrenbergii Menegh. Length 390–395 μ; breadth 79 μ. On stones in a mountain stream. 5.—Siberia, Central China, Japan, India, Siam.

C. acerosum (Schrank) Ehrenb. Length 300–320 μ; breadth 30–34 μ. In marshes. 1.—South Manchuria (*Borge*), Siberia, Mongolia, Central China.

C. lanceolatum Kütz. Length 272–310 μ; breadth 42–47 μ. Near Harbin in swamps. 1.—Siberia (Tomsk), Tibet.

C. Lunula (Müll.) Nitzsch var. *intermedium* Gutw. Length 360–380 μ; breadth 74–76 μ. In a mountain stream. 5.—Siberia (Tomsk).

C. peracerosum Gay var. *elegans* G. West. Length 240–255 μ; breadth 17 μ; breadth near apices 3·4–4 μ. In a pool. 1.—Europe.

C. tumidum Johnson. Length 60–67 μ; breadth 9–10 μ. In marshes. 1, 5.—South Asia.

C. prælongum Bréb. Length 610–655 μ; breadth 17–19 μ. In swamps. 3, 4.—South Asia.

C. gracile Bréb. Length 180 μ; breadth 4 μ. Pretty often in the plankton of lakes. 1.—Asia Minor, South Asia, Central China.

C. attenuatum Ehrenb. Length 473–497 μ; breadth 38–42 μ. In marshes and pools. 1.—South Asia.

C. Pritchardianum Arch. Length 340–540 μ; breadth 34–40 μ. Very frequent in marshes. 1, 4.—Siberia (Tomsk), Tibet, Central Asia.

C. pronum Bréb. Length 360–383 μ; breadth 6·2 μ. In the plankton of lakes. 1.—Japan, South China.

C. acutum (Lyngb.) Bréb. Length 150–166 μ; breadth 4 μ. Found once in great number in a pool. 2.—Baical, Central China, South Asia.

C. subulatum (Kütz.) Bréb. Length 112–119 μ; breadth 5–6 μ. In bogs. 2.—Europe, America.

C. Ralfsii Bréb. var. *hybridum* Rabenh. Length 300–321 μ; breadth 30–33 μ; breadth near apices 10 μ. In lakes. 1.—Siberia, Kamtschatka, South Asia.

C. lineatum Ehrenb. Length 445–748 μ; breadth 16–27·2 μ; breadth near apices 6·8–7 μ. In marshes. 1.—Kamtschatka, Japan.

C. setaceum Ehrenb. Length 270–289 μ; breadth 14 μ; breadth near apices 3 μ. In bogs. 1, 3, 4.—Siberia (Tomsk).

C. Leibleinii Kütz. Length 120–145 μ; breadth 27–31 μ. In swamps. 1.—Irkutsk, Mongolia, Japan.

Closterium Leibleinii Kütz. var. **manschuricum,** var. nov. (Figs. 1, 2.)

Cellulæ mediocres, diametro 6-plo longiores, multo curvatæ, margine interiore valde concavæ, medio parum tumidæ, apices versus gradatim attenuatæ apice ipso rotundatæ; membrana cellularum levis hyalina verrucis parvulis instructa; chromoplastida pyrenoidibus 8 induta; vacuolæ terminales conspicuæ, granulis 3–4 oscillantibus instructæ; longæ 94–96 μ, latæ 14–15 μ.

Hab. In a swamp. 1.

Closterium manschuricum, sp. nov. (Figs. 3, 4.)

Cellulæ mediocres, diametro 7-plo longiores, multo curvatæ, margine interiore vix tumidæ, apices versus optime curvatos acutosque sensim attenuatæ; membrana cellularum levis et hyalina chromoplastida pyrenoidibus 8 instructa; vacuolæ terminales conspicuæ, granulis 4 oscillantibus donatæ, longæ 61–85 μ, latæ 12–13·5 μ.

Hab. In a swamp. 4.

C. rostratum Ehrenb. Length 306–322 μ; breadth 19 μ. On stones in a mountain stream. 5.—Europe, America.

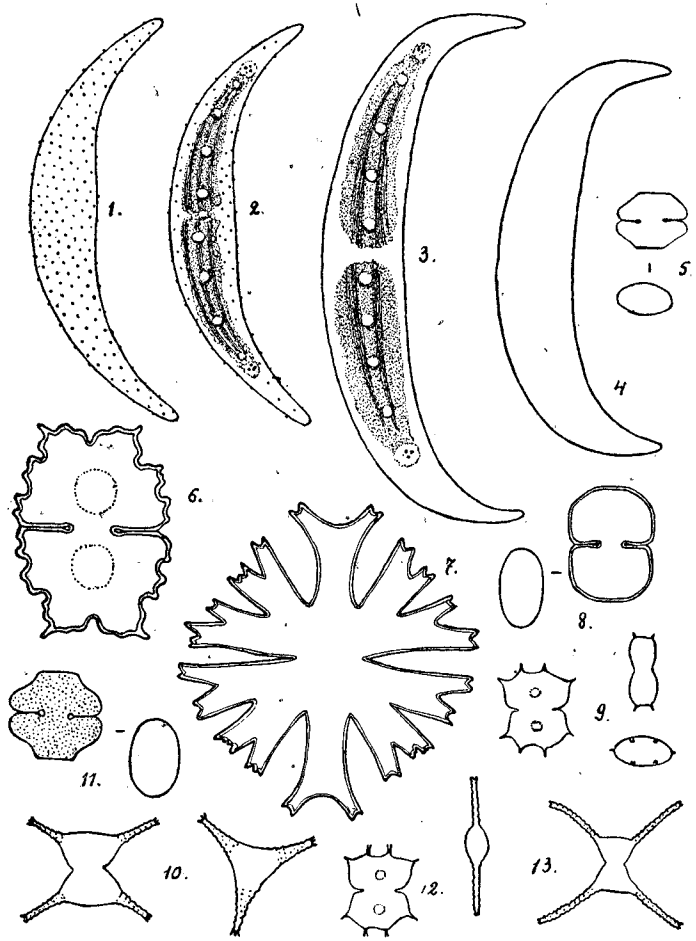
C. rostratum var. *brevirostratum* West. Length 272 μ; breadth 20 μ. On stones in a mountain stream. 5.—Europe, America.

Docidium Bréb.

D. baculum Bréb. Length 314–350 μ; breadth 12 μ. In marshes. 1.—Siberia (Tomsk), Baical, South Asia.

Pleurotænium Näg.

P. truncatum (Bréb.) Näg. Length 440–450 μ; breadth 60–68 μ. In swamps, rare. 1.—South Asia.



B. W. Skvortzow del.

Figs. 1, 2. *Closterium Leibleinii* Kütz. var. *manschuricum*, var. nov.
Figs. 3, 4. *Closterium manschuricum*, sp. nov.
Fig. 5. *Cosmarium succisum* West var. *hyalinum*, var. nov.
Fig. 6. *Euastrum Turneri* West.
Fig. 7. *Micrasterias crux-melitensis* (Ehrenb.) Hass.
Fig. 8. *Cosmarium subrectangulare* Gutw., forma.
Figs. 9, 12. *Xanthidium manschuricum*, sp. nov.
Fig. 10. *Staurastrum paradoxum* Meyen.
Fig. 11. *Cosmarium retusum* (Perty) Rabenh. var. *manschuricum*, var. nov.
Fig. 13. *Staurastrum tetracerum* Ralfs var. *manschuricum*, var. nov.

P. Ehrenbergii (Ralfs) Delp. var. *undulatum* Schaarschm. Length 670–690 μ; breadth 30 μ. In marshes. 1, 3.—Siberia, Tibet, China.

P. Trabecula (Ehrenb.) Näg. Length 390–554 μ; breadth 30–40 μ. Somewhat rare. 1.

Var. *clavata* (Kütz.) W. & G. West. Length 320 μ; breadth 27–30 μ. In marshes with the previous form. 1, 2, 3.

Var. *rectum* (Delp.) W. & G. West. Length 250–278 μ; breadth 23 μ. In marshes. 1, 4.

P. Trabecula occurs in Europe, South Asia, Siberia, Japan, Central Asia.

Euastrum Ehrenb.

E. sibiricum Boldt. Length 17–18 μ; breadth 13–14 μ. In pools. 1.—North Siberia, Kamtschatka, Japan.

E. Turneri West (fig. 6). Length 34 μ; breadth 26–27 μ. In swamps. 1.—Europe.

E. bidentatum Näg. Length 51 μ; breadth 30·6 μ. Found only at Hingan Mountains. 5.—Kamtschatka (var.).

E. dubium Näg. Length 30 μ; breadth 21 μ. Found with the previous form. 5.—Asia.

E. elegans (Bréb.) Kütz. Length 38 μ; breadth 24 μ. Fairly often in marshes. 1.—Siberia, Asia Minor, Japan.

E. binale (Turp.) Ehrenb. Length 20·4–21·5 μ; breadth 17 μ. In marshes. 1, 3.—Siberia, South Asia.

Var. *hians* West. Length 16 μ; breadth 13 μ. Rare, in marshes. 1.—South Asia.

Var. *secta* Turn. Length 23–24 μ; breadth 17–18 μ. In pools. 1.—Asia.

E. gemmatum Bréb. Length 54 μ; breadth 47 μ. Somewhat rare. 1.—Kamtschatka.

E. verrucosum Ehrenb. var. *coarctatum* Delp. forma *minor* Lobik. Length 77–79 μ; breadth 63–64 μ. Somewhat rare in marshes. 1.—Russia.

Var. *alatum* Wolle. Length 81 μ; breadth 68 μ. Very rare in marshes. 1.

E. verrucosum occurs in Siberia, Japan, South Asia.

Micrasterias Ag.

M. pinnatifida (Kütz.) Ralfs. Length 56 μ; breadth 58 μ. Found in marshes only once. 3.—Asia Minor, Japan.

M. crux-melitensis (Ehrenb.) Hass. (fig. 7). Length 98–112 μ; breadth 92–112 μ. On submerged plants in lakes. 1, 3, 4.—Siberia (Tomsk), Asia Minor, Japan, tropics.

Cosmarium Corda.

C. obsoletum (Hantzsch) Reinsch. Length 44–48 μ; breadth 40–45 μ; breadth of isthmus 15–17 μ. In pools. 1, 3.—Japan, South Asia.

C. circulare Reinsch. Length 54–55 μ; breadth 55 μ; breadth of isthmus 20–21 μ. In lakes. 1.—Europe, South Asia.

C. pachydermum Lund. Length 95·2–101 μ; breadth 72·4–77 μ; breadth of isthmus 30·6–33 μ. Sufficiently often in marshes. 1, 2.—Japan.

Var. *æthiopicum* West. Length 68–70 μ; breadth 57·3–60 μ; breadth of isthmus 27·8 μ. In lakes. 1.—Scotland, W. Africa.

C. undulatum Corda var. *minutum* Wittr. Length 22–23·8 μ; breadth 20·4–21 μ; breadth of isthmus 10 μ. In marshes. 1.—Siberia (Irkutsk), Mongolia, South Asia.

C. Lundelli Delp. var. *ellipticum* West. Length 61·2 μ; breadth 47 μ; breadth of isthmus 27 μ. In a mountain stream. 5.—South Asia.

C. Phaseolus Bréb. Length 29–32 μ; breadth 26–27 μ; breadth of isthmus 7 μ. In the plankton of lakes. 1, 4.—Siberia, Mongolia, Asia Minor, Japan.

Var. *elevatum* Nordst. Length 25 μ; breadth 24 μ. In the plankton of pools. 1.—Known from Asia.

C. asphærosporum Nordst. Length and breadth 10 μ; breadth of isthmus 6·8 μ. Plankton of pools. 1.—South Asia.

Var. *strigosum* Nordst. Length 8–9 μ; breadth 8·5 μ. The typical form has the cells 10–11 μ in length and 8–10 μ in breadth. In a stream. 5.—Europe.

C. subrectangulare Gutw., forma (fig. 8). Length 40–44 μ; breadth 31–34 μ; breadth of isthmus 7–8 μ. The typical form has the cells of 28–40 μ in length, 34·5–37 μ in breadth, breadth of isthmus 9 μ; semicells subhexagonal-reniform (*Flora glonow okolic Tarnopola*, 1894, 92, tab. 3. fig. 23). In lakes. 1.—Europe.

C. tenue Arch., forma. Length 12 μ; breadth 11·5 μ; breadth of isthmus 3·4 μ. The typical form has the cells 14–16 μ in length, 13·5–15·5 μ in breadth; isthmus 3·5–4·5 μ. In the plankton of lakes and pools. 1.—North Siberia.

C. succisum West var. **hyalinum**, var. nov. (Fig. 5.)

Cellulæ minutæ, diametro circa æquilonga, mediocriter constricta, sinu aperto fundo brevi angustoque; semicellulæ a latere visæ circulares; membrana pellucida; chloroplastida axilia, pyrenoidi unico gaudentia; longæ 10 μ, latæ 8 μ, isthm. lat. 3 μ.

Hab. Found in plankton of lakes. 1.—The typical *C. succisum* occurs in Europe.

C. retusiforme (Wille) Gutw. Length 22–23 μ; breadth 19–20 μ; breadth of isthmus 7 μ. In pools. 1.—Europe, America, Africa.

C. trilobulatum Reinsch. Length 21–23·8 μ; breadth 17–18 μ; breadth of isthmus 4·5–5 μ. In marshes. 1, 3.—Europe, America, Africa.

C. pygmæum Arch. Length 10–12 μ; breadth 11 μ; breadth of isthmus 5 μ. In plankton of lakes. 1.—Siberia, Asia Minor, Japan, tropics.

C. granatum Bréb. Length 27–42·8 μ; breadth 13–30 μ; breadth of isthmus 6·8 μ.—A common form in marshes and pools. 1, 2, 3, 4.

Var. *subgranatum* Nordst. Length 27–30 μ; breadth 20–21 μ; breadth of isthmus 6–6·5 μ. With the previous form. 1, 2, 3, 4.

C. granatum occurs in Siberia, Asia Minor, Central China.

C. pseudonitidulum Nordst. Length 42 μ; breadth 34–35 μ; breadth of isthmus 10–11 μ. In pools. 1.—Siberia, Central China.

C. obtusatum Schmidle. Length 49–65 μ; breadth 44–50 μ; breadth of isthmus 15–16·5 μ. In pools, rare. 1, 4.—Europe, Africa.

C. moniliforme (Turp.) Ralfs. Length 25 μ; breadth 14 μ. In marshes and pools, very frequent. 1, 2, 3, 4.

Var. *panduriformis* Heim. Length 17–19 μ; breadth 13–14 μ; breadth of isthmus 6–6·5 μ. In plankton of small lakes. 1.

C. moniliforme occurs in Siberia, Central China, Japan.

C. pseudoconnatum Nordst. Length 57 μ; breadth 44·2 μ. In marshes. 1.—Europe.

C. globosum Bulnh. Length 34 μ; breadth 23·8 μ. In a marsh. 4.—Central China, Europe, America.

Var. *minus* Hansg. Length 20·4 μ; breadth 13·6–14 μ. Found with the previous form. 4.—Europe.

C. novæ-semliæ Wille. Length 14·2–15 μ; breadth 12 μ; breadth of isthmus 6·8 μ. In the plankton of lakes. 1.—Europe, Africa, Siberia, Nova Semlia.

C. Regnesii Reinsch var. *montanum* Schmidle. Length 11 μ; breadth 10·5 μ; breadth of isthmus 6 μ. In plankton of lakes and pools. 1, 3, 4.—Europe, Japan, America.

C. angulosum Bréb. var. *concinnum* (Rabenh.) W. & G. West. Length 11–12 μ; breadth 10–11 μ. In plankton of lakes. 1.—Europe, tropics.

C. lævo Rabenh. Length 22–25 μ; breadth 15–17 μ. In marshes, frequent. 1.—Siberia, tropics.

C. Cucurbita Bréb. var. *attenuatum* G. West. Length 27·2 μ; breadth 8 μ. In pools. 1, 3.—Europe, tropics.

C. reniforme (Ralfs) Arch. Length 54–58 μ; breadth 51–52 μ. On submerged plants in lakes. 1, 3.—Europe, America, Siberia (Irkutsk, Enisei River), Kamtschatka.

C. binoculatum Bréb. Length and breadth 17 μ; breadth of isthmus 4–4·7 μ. In the plankton of lakes. 1.—Siberia, Mongolia, Central China.

C. subochthodes Schmidle. Length 42·8–44 μ; breadth 35–37 μ. Zygospore 37–40 μ in breadth. Found in marshes.—Europe.

C. punctulatum Bréb. Length 35 μ; breadth 33 μ; breadth of isthmus 10·5 μ. In marshes. 1, 5.—Siberia, Mongolia, Japan, tropics.

C. humile Nordst. Length 16–16·5 μ; breadth 15 μ; breadth of isthmus 5 μ. In the plankton of lakes. 1.—Europe, Asia Minor, Japan.

C. arctoum Nordst. Length 17 μ; breadth 13·4 μ. In marshes. 5.—Europe, tropics.

C. rectangulare Grun. var. *hexagonum* (Elfv.) W. & G. West. Length 30–31 μ; breadth 8–8·5 μ. In pools. 1.—Siberia, Europe,

C. norimbergense Reinsch. Length and breadth 11 μ. In a swamp. 4.—Europe, South Asia.

C. helcangulare Nordst. Length 13 μ; breadth 12 μ. In the plankton of lakes. 4.—Europe.

C. impressulum Elfv. Length 27–30 μ; breadth 18–21 μ; breadth of isthmus 7 μ. In marshes. 1, 3.—Siberia, Japan, tropics.

C. Regnellii Wille. Length 18–20 μ; breadth 17–19 μ; breadth 4·5–5 μ. Sufficiently rare in marshes. 1.—Siberia, tropics, Europe, America.

C. Meneghinii Bréb. Length 18–20·8 μ; breadth 15–16 μ; breadth of isthmus 4·7–5 μ. Very frequent in swamps. 1.—Siberia, Central Asia, Japan, China.

C. clepsydra Nordst. Length 20 μ; breadth 21 μ. In marshes. 4.—Asia, Japan.

C. Blyttii Wille. Length 24–26 μ; breadth 21–23 μ; breadth of isthmus 6–6·5 μ. In marshes. 1.—Siberia, Central China, tropics.

C. formosulum Hoff. Length 44·2 μ; breadth 40 μ; breadth of isthmus 13–14 μ. In pools. 1, 5.—Europe, tropics.

C. Botrytis Menegh. Length 78–92 μ; breadth 68 μ. Fairly frequent in marshes. 1, 5.—Siberia, Asia Minor, Mongolia, Japan, tropics.

Var. *subtumidum* Wittr. Length 57·8 μ; breadth 51 μ; breadth of isthmus 16 μ. Sufficiently often in marshes. 1, 3.—Siberia, tropics.

C. biretum Bréb. Length 60–64·6 μ; breadth 58–63 μ; breadth of isthmus 23–23·5 μ. Rare in marshes. 1.—Kamtschatka, tropics.

C. Pseudobroomei Wolle var. *convexum* W. & G. West. Length 47 μ; breadth 44 μ; breadth of isthmus 15–18 μ. The typical form has the cells 46 μ in length, 37·5 μ in breadth, and the isthmus has 12·5 μ. Found once in a pool. 1.—Europe, America, India, China.

C. quadrum Lund. Length 75–81 μ; breadth 70–74 μ. In marshes, rare. 1, 3.

Var. *minor* Nordst. Length 44 μ; breadth 42–44 μ. Fairly often in marshes. 1.

C. quadrum occurs in Europe, tropics.

C. retusum (Perty) Rabenh. var. **manschuricum**, var. nov. (Fig. 11.)

Cellulæ parvæ, diametro paullulum longiores, alte constrictæ; sinu anguste lineari, ad imum leviter dilatato; semicellulæ a basi subreniformi subtriangulares, angulis basalibus late rotundatæ; membrana cellularum minute punctulata; pyrenoidi unico centrali; longæ 30·8 μ, latæ 27·2 μ, isthm. lat. 6·8 μ.

Hab. Rare, in marshes. 1.

C. retusum is found in Europe, Japan, tropics.

C. undulatum Corda var. *minutum* Wittr., forma. Length 33–34 μ; breadth 22–23·8 μ; breadth of isthmus 8·5 μ; thickness 12 μ. In marshes. 4.—Europe.

XANTHIDIUM Ehrenb.

X. antilopæum (Bréb.) Kütz. Length with spines 61 μ, without spines 44 μ; breadth with spines 51 μ, without spines 42 μ. In the plankton of lakes. 1.—Siberia, Japan, Kamtschatka.

X. cristatum Bréb. Length without spines 44–55 μ; breadth 42–51 μ. In plankton.—Kamtschatka.

Var. *uncinatum* Bréb. Length and breadth 74·8 μ. 5.

X. fasciculatum Ehrenb. Length without spines 45–53 μ; breadth 43–51 μ. In swamps. 1.—Siberia, Japan.

Xanthidium manschuricum, sp. nov. (Figs. 9, 12.)

Cellulæ minutæ diametro circiter æquilongæ; semicellulæ transversim subhexagonales, apice late truncatæ, angulis lateralibus spina simplici apicalibus spinis binis breviter furcatis terminantibus; semicellula a latere visa subcircularis, a vertice elliptica; chloroplastida quaque in semicellula pyrenoidi centrali singula induta; zygospora incognita; longæ (spinis inclusis) 21 μ; latæ (spinis inclusis) 17 μ; isthm. lat. 5 μ; crass. 2 μ.

Hab. In plankton. 1.

ARTHRODESMUS Ehrenb.

A. convergens Ehrenb. Length 36 μ; breadth 55 μ. In pools. 1.—Siberia.

A. Bulnheimii Racib. var. *subincus* W. & G. West. Length 52 μ; breadth 28 μ. In the plankton of lakes. 1.—Europe.

A. bifidus Bréb. Length 10 μ; breadth 11 μ. Very rare. 1.—Asia, Japan.

STAURASTRUM Meyen.

S. muticum Bréb. Length 20·4–27 μ; breadth 20–23 μ. Fairly frequent in marshes. 1.—Siberia, Mongolia, tropics.

S. orbiculare Ralfs var. *depressum* Roy & Biss. Length 23–24 μ; breadth 27–30 μ. Near Harbin in swamps. 1.—Siberia, Japan, Central China.

S. aversum Lund. Length 33 μ; breadth 30 μ. In marshes. 4.—Europe, America.

S. dilatatum Ehrenb. var. *hibernicum* West. Length 26–27 μ; breadth 24–25 μ. Only in the plankton of the Sungari River.—Japan, tropics.

S. punctulatum Bréb. Length 34–35 μ; breadth 28 μ. Frequent in marshes.—Siberia, Japan, tropics.

Var. *Kjellmani* Wille. Length 32–35 μ; breadth 28–29 μ. Frequent in marshes. 1, 5.—Central Asia.

S. dejectum Bréb. Length with spines 20·4–22 μ; breadth without spines 17·2–18 μ; length of spines 3 μ. In marshes. 1.—Siberia, Asia Minor, Mongolia, Japan, tropics.

S. Dickiei Ralfs var. *parallelum* Nordst. Length 27 μ; breadth 22–23 μ (without spines). In the plankton of lakes. 1.—Japan.

S. polymorphum Bréb. Length 34 μ; breadth 27·2 μ. In the plankton of lakes. 1.—Turkestan, Enisei River (Siberia), Asia Minor (var. *chætoceras*).

S. cuspidatum Bréb. Length 23–24 μ; breadth 23 μ. In the plankton of lakes. 1, 3.—Siberia, Japan.

S. lunatum Ralfs. Length 23 μ; breadth 20·4 μ. In marshes. 1.—Siberia, tropics.

S. furcatum (Ehrenb.) Bréb. Length 27 μ; breadth 23 μ. In the plankton of the Sungari River and in marshes. 1, 3.—Siberia.

S. subcruciatum Cooke & Wille forma *nana* Lütkem. Length and breadth 20 μ. In the plankton of lakes. 1.—Europe.

S. hirsutum Bréb. Length 34–42 μ; breadth 30·6–37 μ (without spines). Rare in marshes. 1, 3.—Kamtschatka.

S. candianum Delp. Length and breadth 25 μ. In lakes. 1.—Central Asia.

S. teliferum Ralfs. Length 36–37 μ; breadth 30–35 μ. Frequent in marshes. 1.—Japan.

S. spongiosum Bréb. Length 34–35 μ; breadth 30 μ. In the plankton of lakes. 1.—Kamschatka.

S. papillosum Kirch. Length 27 μ; breadth 30 μ. In plankton and in marshes.—Europe.

S. quadrangulare Bréb. Length 27·2 μ; breadth 17 μ. In the plankton of lakes. 1, 3.—Japan.

S. inflexum (Bréb.) Fritsch. Length 34–37 μ; breadth 40 μ. In marshes. 1.—Japan.

S. excavatum West. Length and breadth 34 μ. In the plankton of lakes. 1.—Central Asia,

S. gracile Ralfs var. *nanum* Wille. Length 23 μ; breadth 30 μ. In the plankton of lakes. 1.—Siberia, Asia Central, Asia Minor, Mongolia, Japan.

S. tetracerum Ralfs var. **manschuricum**, var. nov. (Fig. 13.)

Forma quam in typo paullo major corpore centrali comparate longiore, processubus aliquantulum curvatis; longum processubus exclusis 20 μ; processubus inclusis 45 μ; latum processubus inclusis 39 μ; isthm. lat. 5 μ.

Hab. In the plankton of lake. 1.

S. paradoxum Meyen (fig. 10). Length 23–25 μ; breadth 30–35 μ. In the plankton of lakes. 1.—Siberia, Japan, tropics.

S. proboscideum (Bréb.) Arch. var. *furcatum* Istav. Length 23·4–28 μ; breadth 23·6–30 μ. In the plankton of lakes. 1.—Europe.

S. Sebaldi Reinsch. Length 74–78 μ; breadth 44–48 μ. In the plankton of lakes. 1.—Europe.

S. margaritaceum Menegh. Length 24–27 μ; breadth 24 μ. In lakes and marshes. 1, 3, 5.—Siberia, Japan.

SPHÆROZOSMA (Corda) Arch.

S. granulata Roy & Biss. Found by O. Borge in South Manchuria.—Siberia, Japan, tropics.

S. excavatum Ralfs. Length 11 μ; breadth 11·5 μ. In marshes. 1, 4.—Siberia, Kamtschatka, Japan.

S. vertebratum Bréb. Length 22·5 μ; breadth 14 μ. In the plankton of lakes. 1.—Central Asia, tropics.

SPONDYLOSIUM Bréb.

S. papillatum W. & G. West. Length 10–10·5 μ; breadth 7–8 μ. In the plankton of lakes. 1.—Siberia (Altai Mountains).

COSMOCLADIUM Bréb.

C. subramosum Schmidle. In marshes and pools. 4.—South Asia.

DESMIDIUM (Ag.) Ralfs.

D. Swartzii Ag. var. *silesiacum* Lemm. Length 37–37·5 μ; breadth 16–17 μ. In marshes. 1, 3.—Siberia, Central Asia, Kamtschatka, Japan.

D. quadrangulare Ralfs, forma. Length 42–43 μ; breadth 21–22 μ. In marshes. 3, 4.—Europe.

D. Aptogonum Bréb. Length 24–29 μ; breadth 13·6–24 μ. In the plankton of lakes. 1, 4. Central Asia, Japan.

HYALOTHECA Kütz.

H. dissiliens (Sm.) Bréb. var. *tridentula* Nordst. Length 21–24 μ; breadth 11–13·6 μ. In marshes. 1, 2, 3, 4.—Siberia, Central Asia, China, tropics.

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REPRODUCTIVE MECHANISM IN LAND FLORA.

IV. SPOROGONIA (*continued*).

BY A. H. CHURCH, M.A., F.R.S.

THE story as outlined in the past for the progression of the sporophyte generation in Bryophyta is based on one feature there is no gainsaying. In no diploid Bryophyte phase is there any indication of the production of leaves, as lateral appendages of photosynthetic order; though in larger mosses such lateral laminæ following acropetal sequence in development, as a normal phyllotaxis system (which may be of Fibonacci order [1]), as morphologically defined leaf-members, do

[1] Church (1920), *Botanical Memoirs*, vi. 40.

occur in the gametophyte or haploid sexual phase. It is true that many of the lower Hepaticæ have no leaves at all, but present a mere residual dichotomous dorsiventral thallus-system; but this difficulty has been persistently shelved by assuming that Bryophyte gametophytes present stages in the evolution of leaf-members, and even in several different ways [1]—again completely ignoring Bower's useful dictum that all dorsiventrality is secondary. Even among Algæ primitive shoots are always radial and centric; while all Hepatic 'series' illustrating 'leaf-development' are equally well read the other way, as presenting phenomena of leaf-deterioration (cf. *Blasia*, *Fossombronia*, *Jungermannia*) [2]. Prostrate shoots with secondary dorsiventral orientation tend to reduce and even lose the lower rank of photosynthetic members; though these may be long residual as scales and amphigastria. Lateral ranks reduce to mere teeth as the axis itself broadens to a bilateral lamina, in which the margins utilize all the light falling on them without the necessity of arranging a vestigial leaf-mosaic.

Omitting the case of the leaves as foliage-members, the presence of a three-sided apical cell in the gametophyte of Mosses and Jungermanniæ Acrogynæ, involved in the phyllotaxis-system, is the feature which most vividly recalls an older algal soma, to which dorsiventrality owing in a change to a two- or four-sided apical is again always secondary (cf. *Fucus*) [3]. But no sporophyte among the Bryophyta has such an apical cell, though again a two-sided apical cell is general among the radial sporophytes of the Eubryineæ, and hence apparently a secondary feature.

The outstanding fact remains that the leafless sporophyte, as compared with the gametophyte, belongs to a distinctly older order of Algal soma; in that while the radial or centric habit is uniformly maintained [4], and apical growth may be present, there is no indication

[1] Goebel, *Organography*, Eng. trans. (1905), 35.

[2] Cavers (1910), *New Phytologist*, 229; *cf.* hypothetical phylogenetic tree showing leafy forms of Jungermanniæ spaced along divergent lines (*Blasia*, *Haplomitrium*, *Fossombronia*, Acrogynæ, *Umbraculum*).

Campbell (1918), *Mosses and Ferns*, Edit. iii. 14, suggests the independent origin among dorsiventral Hepaticæ for the scales of Marchantiaceæ, the case of *Blasia*, and the cases of *Symphogyna* and *Hymenophytum*: the conspicuously radial leafy Moss is saved by interpreting it as a 'gametophore' from a *Pellia*-like protonema, 226.

Cf. Bot. Mem. vi. (1920), 42, for similar phyllotaxis-relations of *Polytrichum* and *Cystoseira ericoides*.

[3] The three-sided apical cell is a product of the higher Algæ of the sea (Fucaceæ): it is also found residual in Leptosporangiate Filicineæ, Equisetineæ, Mosses, *Haplomitrium*, and dorsiventral leafy Jungermanniæ; but is lost, or had never been attained, in other phyla: at any rate, it is not further developed, as it might have been if a new departure evolved in land-flora. A three-sided apical cell is the neatest solution of the problem of building tissue in a massive centric apex, the orientation of successive segments being apparently controlled by the changing orientation of the mitotic spindles at successive divisions. Bot. Mem. i. 44.

[4] Variations towards eccentric or dorsiventral growth are very slight (*Funaria*, *Buxbaumia* (*cf.* Bower, Land Flora, 280)).

of any lateral leafy appendages (even as ramuli of older order), though branching by dichotomy of the apex is perhaps not wholly inconceivable[1].

Such distinction of leafy and leafless algal forms (foliose and frondose) is general among seaweeds. Well-defined leafy forms, with three-sided apical cell in the main axis and definite acropetal production of lateral members of leaf-category, occur in higher Fucoids (*Cystoseira*, *Sargassum*); though *Pycnophycus* is leafless, with smooth centric forked stems of older order, just as the radially centric and unbranched *Chorda* is morphologically older than the laminate and dichotomizing Laminarias: similarly among the Florideæ, laminate forms as distinct from true leafy types abound (*Delesseria*), as also purely centric and dichotomizing cladode-forms as *Polyides* and *Furcellaria*, now even growing side by side. The factors dealing with the specialization of the algal thallus in the sea have been outlined elsewhere, and the initial stages in leaf-development summarized[2]. Hence it would appear that the Bryophyta present a case in which, for some reason dating to unknown benthic time, the diploid phase lags behind the haploid in its morphological differentiation of heterothally, and the sporophyte is to be interpreted as the continuation of an older type of algal soma (of which parallel examples still occur in many living seaweeds). That is to say, however much the sporophyte of Bryophyta may adapt itself *anatomically* to sub-aerial conditions, it remains permanently handicapped by an inferior *morphological* attainment in the past. As it had no leaves to begin with, so it could never attain any on land; the initial stages of leaf-production being solely a phenomenon of the sea. However much the parenchymatous cell-tissues may pass on to higher anatomical differentiation (as in equally parenchymatous Pteridophyta)—involved in the formation of intercellular spaces, stomata, cuticularized epidermis, palisade mesophyll[3], or tracheide-like elaters—the sporophyte generation remains at best only a *cladode* type of soma, at a morphological horizon indicated by many modern Algæ; though the gametophyte of the Moss had contemporaneously attained a full leafy and monopodially branched shoot-system (as exemplified in the subaquatic *Sphagnum* and *Fontinalis*).

It thus begins to appear that many morphological and anatomical features, initiated in the sea in response to its special environment (and hence not to be similarly evolved *de novo* elsewhere), tend to be divided between the two members of the cytologically diœcious pair of land somata, as these heterothallic types tend in some degree to become complementary. The causal factor in the selection of such

[1] Bower (1894), Phil. Trans. 484.

[2] Bot. Mem. x. 56.

[3] Good palisade tissue occurs in *Himanthalia*; the cuticle of *Laminaria* is morphologically present, if not chemically perfected; intercellular spaces are general in pneumatocyst production (cf. *Halidrys*), and stomata are but initiated as intercellular spaces in the peripheral layer. The beginnings of all these things may be traced in the sea: the point is, which generation carries them on, and makes further use of them on the land.

heterothallic types in the sea has been traced to climatic changes in the past, at an epoch so remote that even living seaweeds, growing side by side in the same pools or on the same rocky foreshore, are but residual and vestigial strays.

Similarly, existing types of Bryophyta, curiously and often widely differing in both gametophyte and sporophyte stages (*Sphagnum* and *Anthoceros*, *Marchantia* and *Haplomitrium*, *Riccia* and *Polytrichum*), gain enormously in interest, once it is realized that their sporogonia do not represent a wholly hypothetical intercalated generation—inventing *de novo*, and out of only a mere mass of spore mother-cells, as the response to conditions of subaerial life, all sorts of curious departures (which may occur equally well among Pteridophyta), as cuticle, apical cells, archesporial layers, tracheide-like elaters; but they are the few successful and widely divergent adapted forms of an older phase of submarine existence, in which it now becomes a pleasure to trace the vestigia of older habits and mechanism under and among the new departures of the land—just as the zoologist traces the vestigial characters of fish-morphology in the human hand or head. Take away the land-features common to Pteridophyta and higher plants, and much that remains is a relic of the common equipment of older parenchymatous Algæ of the sea. Many of the special factors involved are traced to-day in the Dictyotaceæ and Florideæ as characteristic reef-pool algæ of the warmer seas.

Beyond any stages of high anatomical differentiation, closely paralleled in the leafy sporophytes of Pteridophyta, but never fully vascular, the essentially new and characteristic Bryophyte departure follows the defects of archegonial mechanism. Like other products of evolution the archegonium has its good points, but also limitations which may become defects. Fertilization *in situ*, however specialized and economical of oospheres and sperms, implies, at any rate in the sea where there is no resting-spore, germination of the zygote also *in situ*, and ultimately, since the present plant lives on, some degree of post-sexual nutrition[1]. A very comparable chain of consequences is admirably presented in marine Florideæ, as reef-pool algæ of very similar size and general development; and these may be taken again as illuminating the path of biological progression, though obviously with no structural relationship, since the Florideæ are never even fully parenchymatous in cell-anatomy. Post-sexual nutrition implies the protection of the developing diploid phase, as by sinking it among the cortical ramalia (*Nemalion*), or in the endocortex (*Schizymenia*, *Dilsea*), or by surrounding it with a cystocarpic wall from adjacent tissue (*Gracilaria*, *Polysiphonia*). In the Bryophyta the method adopted is that of a secondary growth in the venter of the archegonium, giving a calyptra-formation, within which, as in the case of the Florideæ, the developing zygote is, it is true, sheltered and nourished, but also shielded from the light, with consequent enfeebling of its

[1] The fact that there is no resting-spore at the zygote stage in land flora affords satisfactory evidence that fertilization *in situ*, followed by germination *in situ*, had been attained in the sea before transmigration.

autotrophic habit. As in the Florideæ, a vicious circle is thus established—the more protection the embryo gets the more it becomes dependent on the parent for food-supply. Breaking out of the archegonial growth at an early stage (Muscineæ), it may be photosynthetic to a considerable extent, though capped by the persistent calyptra which still protects it in some degree from desiccation. But in Jungermanniæ and Marchantiæ the consequences of longer enclosure work out, until in the limiting case (*Riccia*) the sporophyte never ruptures the archegonial investment, but sheds its spores on decaying *in situ*. However elegant further specializations to protect the young sporophyte, thus reduced to a mere spore-capsule from desiccation, by perigonial leaves, perichætial folds, or even by sinking it in the ground, all have the same effect of still further diminishing any effective light-supply, and so rendering it the more dependent and parasitic. At the same time, the longer the sporogenous tract remains enclosed in parental tissues of an enfeebled thallus, and hence the more subject to inferior vicarious water-supply during maturation of the spores, the more it condenses to the limiting form of a sphere with minimum surface-exposure. The end-term is thus a spherical sporogonium and little else, which is far more like the cystocarp of many Florideæ—in form, volume, and contents—than the alleged 'sporophyte' of *Coleochæte*.

From such a standpoint it would appear that while the original diploid phase of the Bryophyta must have been free and autotrophic, the oldest and 'most primitive' members of the series are to be sought in those which (1) soonest escape from the bondage of the archegonium, (2) have the most developed photosynthetic tissues (including stomatal mechanism), (3) are furthest removed from the sub-spherical capsular form.

Hence it is to the prototype of the Eu-Bryineæ, to *Sphagnum*, and to *Anthoceros* that one looks for stages to illustrate the primitive Bryophyte. Jungermanniæ and Marchantiæ are as down-grade in their capsules as in the highly specialized but secondarily dorsiventral thalloid gametophytes. The *Riccia*-story is thus completely turned round, and one begins to appreciate the remarkable type of *Anthoceros*. It is not disputed that the Eu-Bryineæ are by far the most highly organized and successful forms of modern Bryophyta; but the point is that they have built this new specialization on a more primitive type of sporophyte-soma: the seta is largely new, it is the elongated capsule formed from a centric axis with a two-sided apical cell which affords the features of primary interest.

(To be continued.)

THE SWISS NATIONAL PARK.

The subject of the Hooker Lecture delivered by Prof. Carl Schroeter at the Linnean Society on April 15 was "The Swiss National Park and Scientific Researches into its Nature." Prof. Schroeter received a cordial welcome from the Fellows of the Society, some of whom had been privileged to visit the National Park under his guidance and to take part with him in various phytogeographical excursions, while his work on the plant-life of Switzerland has made his name familiar to all students of alpine floras. Prof. Schroeter, with Dr. Paul Sarrasin and Dr. Brunies, has taken a leading part in securing the area in the Lower Engadin and in the arrangements for its organization as a natural reserve for the flora and fauna of the Alps. The Swiss League for the protection of nature, which shares with the Government responsibility for the National Park, has nearly 30,000 members; the annual subscription is two francs, and fifty francs will purchase a life-membership. The results achieved by the League up to the present include the preservation of 400 erratic blocks, the protection of mountains (for instance, the Matterhorn) from invasion by railways, the protection of individual trees of special size or beauty, and the preservation of fifteen fens and twenty bird-sanctuaries and several "free" mountain-districts where shooting is prohibited. In the National Park no interference with plant or animal life is allowed. Huts are provided, but there are no hotels, and camping and fires are prohibited. There are four resident keepers who are responsible to a commission of five members appointed by the Government, which pays the rent, while the League maintains the paths and huts and defrays the cost of the scientific investigations.

The area of the Park in the Lower Engadin comprises about 54 square miles, and extends from Zernez to Val Scarl, including numerous valleys and mountains. During the ten years of reservation wild-animal life has greatly increased—for instance, the number of golden eagles observed has increased from fifteen to forty. Plant-life has developed luxuriantly, especially on the abandoned pastures; edelweiss gardens have appeared in several places.

The lecturer enumerated various scientific researches, which have been carried out under natural conditions; reports by forty investigators have already been published.

The scenery, flora, and fauna of the district were described in an imaginary tour illustrated by nearly eighty beautifully coloured lantern-slides. The snow-line is at 3000 metres, the tree-limit at 2300 metres; there are extensive forests of *Pinus montana* var. *arborea* and *P. Cembra*, and an abundant herbaceous flora varying with the great variety of geologic strata. The abundant animal-life includes deer, ibex, chamois, marmot, foxes, hares, ptarmigan, and golden eagles.

OBITUARY.

Joseph Henry Maiden

(1859–1925).

By the death of Joseph Henry Maiden, on the 16th November, 1925, at Turramurra, Sydney, Australian science lost one of its leading votaries and the botanical world one of its most distinguished colleagues.

Born at St. John's Wood, London, in April 1859, he received his early education at the City of London Middle Class School. He became assistant to the late Professor F. Barff, from whom, on coming to Australia for health reasons in 1880, he brought a letter to Professor A. Liversidge of the University of Sydney. It was not long before he became associated with the formation of the Technological Museum, Sydney, of which he was Curator from 1881 to 1896, when he became Director of the Botanic Gardens, Sydney, Government Botanist, and Officer in Charge of the Centennial Park, which positions he held until his retirement in 1924. Other positions which he filled were: Consulting Botanist to the Departments of Agriculture and Forests from 1890, Lecturer in Forestry in the Sydney University from 1913, and Lecturer in Agricultural Botany from 1914 to 1921.

Soon after his arrival in Australia Maiden became interested in the flora, and many were the Saturday excursions he made around Sydney accompanied by a party of nature-lovers. He learnt much concerning native plants from the late Rev. Dr. William Woolls, and also the late Baron von Mueller until his death in 1896. In these early days much collecting was done in localities now covered by the city extension, and Maiden used his opportunities to form the nucleus of the herbarium at the Technological Museum. Later, he formed the National Herbarium at the Botanic Gardens, which ranks as one of the finest herbaria in the southern hemisphere. He did much by his own personal exertions to enrich these collections.

None but those who were closely associated with this great botanist and worthy citizen can form any conception of the amount of energy he displayed, or of the methodical persistence with which he constantly carried on his labours. He had the brain to devise and the hand to execute, and these were ever working in unison. No sooner was some important scheme decided upon than he put in motion the machinery—usually human machinery, of which he himself formed a conspicuous part—to bring the matter to fruition.

To the Linnean Society of New South Wales he contributed no fewer than 95 papers, either singly or under joint authorship. His first contribution to that Society was in 1887, a paper entitled "Notes on some Indigenous Sago and Tobacco from New Guinea"; this was followed by another entitled "Some reputed Medicinal Plants of New South Wales," these being followed by a series of papers on the gum and other exudations yielded by various plants. Later, in conjunction with Mr. R. T. Baker, he began a series of papers entitled "Botanical Notes from the Technological Museum, Sydney," and in 1897 he started another series, "Notes from the Botanic Gardens, Sydney," in conjunction with the late Mr. E. Betche. With both these authors new species of plants were described. Subsequently, in collaboration with the late Mr. Henry Deane, Maiden wrote much concerning the genus *Eucalyptus*, describing many new species, though very many more were subsequently described by Maiden alone.

His contribution to the Royal Society of New South Wales consists of 45 papers on various subjects, but much is included concerning the genera *Acacia* and *Eucalyptus*, the largest two in Australia, and many new species are described. He made numerous valuable contributions on various subjects, including Weeds, to the 'Agricultural Gazette of New South Wales,' and the service he has rendered during his long career in the interest of forestry in the State and even in the whole Commonwealth has been very great and of the highest importance.

His zenith in the field of botanical research is reached in his great monograph 'A Critical Revision of the Genus *Eucalyptus*,' of which sixty-four Parts had appeared at the date of his death; the remaining Parts, about half-a-dozen, are going through the press, the material having been prepared by Mr. Maiden.

Another valuable publication is the 'Forest Flora of New South Wales,' which has been completed with seventy-seven Parts. Other publications are 'Useful Native Plants of Australia' and 'Illustrations of New South Wales Plants.'

Maiden was a member of the Royal Society of New South Wales for forty-two years, Honorary Secretary for twenty-two years, and President in 1896 and 1911; a member of the Linnean Society of New South Wales for forty-two years, a member of the Council for thirty-five years, and President in 1901 and 1902; President of the New South Wales Horticultural Society for twenty years and of the Royal Australian Historical Society for two years. He was a foundation member of the Australian National Research Council in 1919 and a Vice-President at the time of his death.

His regard for the memory of Sir Joseph Banks, whom he styled "The Father of Australia," was so great that he had an excellent biography of Sir Joseph published, chiefly for the purpose of raising funds for a memorial to that great botanist and patron of science.

Maiden was elected a Fellow of the Linnean Society of London in 1888, and in 1915 was awarded the Linnean Medal—this being the first occasion upon which the medal had been given to an Australian. In 1916 he was honoured by having the Imperial Service Order conferred upon him, and also by being elected a Fellow of the Royal Society of London. In 1921 he was nominated for the Presidency of the Australasian Association for the Advancement of Science, but declined it for health reasons, and in 1922 was awarded the Mueller Medal by that body, of which he was permanent Honorary Secretary for fourteen years. In 1924 he was awarded the Clarke Memorial Medal by the Royal Society of New South Wales; and as some evidence of the affection and esteem in which he was held by his colleagues in science he was presented in 1916 with his portrait in oils. He was honoured in his own country and abroad, for, in addition

to having been made Honorary Member of many Australian scientific societies, his work had been recognized in a somewhat similar manner by at least fifteen institutions in various parts of the world, outside the Commonwealth, including Europe and America. For years he was regarded as the doyen of Australian botanists, and he takes a worthy place beside those illustrious pioneer workers in Australian botany—Robert Brown, J. D. Hooker, Allan Cunningham, George Bentham, and F. von Mueller. Some time after the death of Mueller, who for very many years had been stationed at Melbourne, an eminent English botanist who was in close touch with Australian botanical affairs wrote that "Maiden, since the death of Baron von Mueller, has removed the centre of botanical gravity in Australia from Melbourne to Sydney."

He is commemorated in a new genus, *Maidenia* Rendle (Hydrocharidaceæ), and the following species: *Acacia Maideni* Mueller; *Arctotus Maidenii* Beauverd; *Baeckea Maidenii* Ewart and White; *Croton Maideni* R. T. Baker; *Dampiera Maideniana* Krause; *Eriochloa Maidenii* A. A. Hamilton; *Eucalyptus Maideni* Mueller; *Goodenia Maideniana* W. V. Fitzgerald; *Heleocharis Maidenii* Kükenthal; *Loranthus Maideni* W. F. Blakely; *Melaleuca Maideni* R. T. Baker; *Pritchardia Maideniana* Becc.; *Pultenæa Maidenii* Reader; *Stackhousia Maideni* Pampamini.

He was ever ready to point out the virtues or defects of trees or shrubs which might be introduced into public places, and his long experience in such matters gave him a knowledge which was constantly sought. In one instance he was asked to inspect a country park and offer advice. The Town Clerk informed me that those who accompanied Mr. Maiden were appalled at the number of trees he suggested should be removed, but his advice was followed in every detail, with the result that in a few years the better growth of the trees which were left and the vistas introduced commanded the admiration of all concerned.

Maiden was a worthy citizen, a zealous officer, and an outstanding supporter of Australian science in its broadest aspects. Lovers of botany and allied sciences who came from abroad soon found their way to his home, where they were sure of a welcome and an intellectual entertainment. After upwards of forty years' faithful, efficient, and highly successful service, he left us commanding our affection, our admiration, and our unbounded esteem. R. H. Cambage.

Mr. Cambage has very kindly, and promptly, responded to my request for an appreciation of the work of his friend and colleague in the study of the Australian Flora. The botanists who took the excursion from Sydney to Mt. Victoria and the Jenolan Caves in the Blue Mountains in August 1914 will remember Mr. Cambage as guide and botanical friend on the trip. And all who attended the British Association meetings in Australia will recall Mr. Maiden's busy devotion to their interests during their stay in Sydney. I recall a telegram of welcome received from him when we touched at Freemantle; and when, after meetings at Adelaide and Melbourne, we reached Sydney Mr. Maiden was very much in evidence. His

remarkable knowledge of the flora was at our service during a long day excursion by motor through the National Reserve to the Bulli Pass and the Cataract Dam, returning inland through some of the old settlements which had lapsed into grazing country after the discovery of the fertile lands beyond the Blue Mts. Visits to the Botanic Garden, flanked by the park-like Domain and finely situated on the slopes of one of the many bays of Sydney Harbour, and to the Museum, are also remembered. But above all stands out a day "on our own" after the close of the meeting, when he took me to Botany Bay and we landed on the little beach where Banks and Solander first came ashore from the 'Endeavour'—and to other places rich in memories of the pioneers in the study of Australian botany. A. B. R.

REVIEW.

The Earliest British Herbal.

The Herbal of Apuleius Barbarus. From the early Twelfth-century Manuscript formerly in the Abbey of Bury St. Edmunds (MS. Bodley 130). Described by Robert T. Gunther, M.A., LL.D. 4to, pp. xxxvi, 148 including 95 folios (a few gaps) of facsimile reproductions in photograph, 7 plates (5 coloured), and text-figs. Printed for presentation to the members of The Roxburghe Club, Oxford, 1925.

This beautiful volume is owed to Captain Edward George Spencer-Churchill, who dedicates and presents it to the President and Members of The Roxburghe Club. In his preface Captain Spencer-Churchill records his special thanks to Dr. R. T. Gunther, "who gave so much time and erudition to compiling the introduction and appendices." The manuscript codex, the photographic reproduction of which is the subject of the volume, contains vii+101 parchment leaves $10\frac{1}{8}$ by $7\frac{1}{8}$ inches, mostly with coloured illustrations. It comprises several distinct treatises, two botanical, one medical, and one zoological, in Latin, written in England about A.D. 1100. It therefore includes the earliest Herbal believed to have been written and illustrated in this country.

Dr. Gunther has been at some pains to work out the history of the volume. A faded superscription on the first leaf indicates that about 1300 it was in the library of the Abbey of Bury St. Edmunds, and it may well be that it was copied within the Abbey walls. The monks of Bury evidently made use of the book, for most of the plants therein described have had English plant-names added in handwritings of the thirteenth or fourteenth centuries. At the dissolution in 1536 the library would have been dispersed, and an inscription on the first page suggests that the volume passed, with an estate, to Sir Thomas Knyvett. Later it belonged to Dr. Edward Tyson (1651–1708), the eminent zoologist and anatomist of Magdalen Hall, Oxford, who gave it to the Bodleian library, where it has reposed for the last 220 years. In the codex the Apuleian Herbarium, which occupies the first 56 folios, is followed by a portion of a supplementary Herbarium extracted from Dioscorides, and trans-

lated into Latin (folios 57 to 67). Folios 68–75 contain some general medical recipes and a partial index to the Herbarium; these have not been reproduced in the present volume. The last thirteen folios contain an illustrated account of Animal Medicine that has been taken from a book ascribed to Sextus Placitus (fourth century).

The original Herbarium of L. Apuleius Madaurensis, the Platonic philosopher of the time of the Antonines, is probably a Latin compilation of the fifth century. One hundred and thirty plants are described in as many chapters. The Greek name of each herb is followed by a list of synonyms, a note on its habitat and character, and an enumeration of its virtues. This Herbarium was based on Dioscorides *Materia Medica* and on the *Medicina Plinii*. The earliest manuscript, sixth century, is at Leyden, and the first printed edition dates from Rome, before 1484. The various manuscripts and printed editions vary greatly as to their contents. Dr. Gunther remarks that the interest of the illustrations is the chief justification for the reproduction of the manuscript in facsimile. They are for the most part based upon the traditional drawings, commonly known as Dioscoridean, which have come down to the herbals of the Middle Ages from a remote antiquity. The most complete series of such early plant-drawings is contained in the manuscript illustrated about A.D. 512 by Greek artists as a wedding gift for Julia Anicia, daughter of Flavius Anicius Olybrius, Emperor of the West, in which is incorporated the text of the *Materia Medica* of Dioscorides. This manuscript, which is now in the Imperial Library at Vienna, has recently been beautifully reproduced in a photographic facsimile *.

The value of the present facsimile reproduction of the Bodleian manuscript is much enhanced by Dr. Gunther's first Appendix, "The Herbs described in MS. Bodley 130, with Notes." The Herbs are indicated in the order of the MS. under the titles taken from printed and other versions of the MS. Modern botanical names are added, mostly reprinted from Cockayne's edition of an Anglo-Saxon version of the Herbal. For many of these names and titles there is very little support, as will be seen from the notes on the plants, for assistance in the identification of which Dr. Gunther acknowledges the help of the Botanical Department of the British Museum. Thus No. I. Herba Centauria major or Curmel, *Blackstonia perfoliata* Huds., is a very fair representation of *Chrysanthemum Parthenium*; No. II. Herba Centauria minor, Lesser Curmel, *Erythræa Centaurium* Pers., is perhaps a Crucifer. Dioscoridean and Theophrastan synonyms are added, as given by Dr. Daubeny and Hort and Dyer respectively, also the various glosses on the MS. The colours of the parts of the plant in the original are indicated and other notes are added. A second Appendix contains a table showing the variations in the numerical order of the plants described in three manuscripts and one printed version. There is also a note on the printed editions. Appendixes III. and IV. deal with the "Book of Extracts from Dioscorides" and the "Medicina Animalium" respectively. A subject-index completes the volume. In addition to the facsimile reproduction of the manuscript there are also seven plates, mainly in colour, in which illustrations from various manuscripts bearing on the same subject are beautifully reproduced.

* Dioscurides. Codex Aniciae Julianae picturis illustratus, nunc Vindobonensis Med. Gr. I., phototypice editus. 2 Vols. folio, Lugd. Batavorum, 1906. A copy is in the Department of Botany, British Museum; where also is a copy of the Apuleian Herbal presented by Capt. Spencer-Churchill.

It is a pleasure and a privilege to have the opportunity of noticing a work of such extraordinary interest, and the thanks of all botanists who value the literature of their subject are due to Captain Spencer-Churchill and his able co-adjutor Dr. R. T. Gunther. Incidentally we may refer to the association of alumni of Magdalen College in connection with the MS. and its production or more generally with the historical side of botany—in addition to the two names just mentioned, we note Simon Forman (1603), Dr. Charles Daubeny, and more recently Dr. Charles Singer, while Edward Tyson, a former owner of the MS., was near by at Magdalen Hall.

A. B. R.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on March 18th, Mr. J. L. Sager exhibited fresh specimens of Primrose flowers from a plant originally found in a disused burial-ground at Lympstone in South Devon. The flowers showed the petals like foliage leaves in all respect except size, and were extreme examples of phyllody of the corolla.

The President remarked on the unusually fine development of the condition in Mr. Sager's specimens, and stated that Mr. F. J. Chittenden had also sent up a specimen of a virescent Primrose from Maidstone, in which, however, the petals were not nearly so distinctly foliaceous as in Mr. Sager's plant; the Maidstone specimen represented the well-known green Primrose, figured by Parkinson and Gerard. In reply to a question by Sir Sidney Harmer, Mr. Sager stated that he would endeavour to regulate pollination by protecting the plant.

The President showed a dried specimen (from Brockenhurst) illustrating phyllody of the calyx, the sepals were much enlarged and broad and leaf-like in appearance. He also showed a fine specimen of a caulescent Primrose sent by Mr. Walter Barratt, F.L.S., from Mullion, Cornwall. The very short stem on which the flowers are borne in a normal Primrose had become much elongated, and bore a truss of true Primrose flowers. The inflorescence suggested a huge Oxlip.

Dr. R. T. Gunther gave an account—illustrated with lantern-slides and a facsimile reproduction by Captain E. G. Spencer-Churchill of the early manuscript herbal of Apuleius Barbarus.

Dr. Helena Bandulska read her paper "On the Cuticles of some Fossil and Recent Lauraceæ," illustrated with lantern-slides.

The paper demonstrates the possibility of interpreting certain elements of the floras of the past by a comparative study of their cuticles with those of recent forms. By this means the Lauraceæ have been found to be the most abundant fossils with cuticle preserved in the Bournemouth Eocene; many have lanceolate leaves with pinnate venation and strong midrib. Three species of *Aniba* and various species of *Neolitsea*, *Litsea*, and *Lindera* have been discovered.

The leaf previously described as *Dictylophyllum spiculatum* is now referred to the genus *Aniba*. *Aniba* has a tough resistant epidermis; the lower surface possesses depressed scale-bearing guard-cells, surrounded by two or four accessory cells which in some species are markedly lobed and have a cruciform outline and strongly thickened free border. Spicular ridges may be present.

Neolitsea and *Litsea* are closely-related genera with far less resistant cuticle than *Aniba*. They, too, have complex stomata—scale-bearing guard-cells bordered by unequal accessory cells, one of which may be more or less triangular, while the wall common to accessory cell and guard-cell tends to break down, giving an appearance of extreme breadth to the stoma.

A fossil *Neolitsea*, *N. Gardneri*, has been identified *in situ* in the Bournemouth cliffs, and two magnificent specimens of the same species were found in the collection of Mr. Starkie Gardner.

Three different species of *Litsea* have been distinguished, which, while quite evidently belonging to the genus, cannot be referred to living species.

Three species of *Lindera* have been collected *in situ*. This genus has thin-walled transparent stomata with guard-cells of variable size, often depressed and overlapped or bordered by a varying number of accessory cells. The poles of the long axes of the guard-cells and scales are prolonged and nodulose. The poral outline is much like that of *Pseudonavicella*. The leaves show paired secondary veins springing from the base of the midrib, so that the lower part of the leaf appears trinerved. This is typical of many recent Linderas.

It is evident that the physiological characters of the fossil Lauraceous cuticles here described are such as at the present time are associated with the need for controlling transpiration, and may be of assistance in the interpretation of the nature of the flora and the climate of Middle Eocene time.

Mr. W. N. Edwards remarked that the genera found fossil by Dr. Bandulska were now East Asiatic in distribution, which supported the view, put forward by Mr. and Mrs. Reid, that the Tertiary flora of Europe resembled that of certain East Asiatic regions of the present day.

Mr. H. N. Ridley referred to the difficulty in separating *Litsea* and *Neolitsea*. Species of *Litsea* with broad leaves were mainly confined to the wet forests, while species with narrow leaves occurred usually on dry hills at considerable elevations. Most of the species of *Lindera* and *Neolitsea* were more or less xerophytic and hill-dwellers.

Mr. A. J. Wilmott expressed the view that the apparent stability of foliage characters over long periods of time was in opposition to the usual idea of their rapid change by adaptation, and gave some ground for doubting whether ideas of convergence were always valid.

We note with regret the announcement of the death of Dr. Narcisse Patouillard, the French mycologist, in Paris, at the age of 71. Dr. Patouillard was Assistant at the Paris Muséum d'Histoire Naturelle, and a foundation member and Président Honoraire of the Mycological Society of France.

LEGUMINOSÆ–DESMODIINÆ QUOTED IN RAY'S 'HISTORIA PLANTARUM,' Vol. III.

By A. K. Schindler.

In his *Historia Plantarum* (vol. iii.), Ray describes twenty-one papilionaceous plants belonging to the tribe Desmodiinæ, of which seventeen had previously been described or cited, namely: two by Sloane in *Catal. Plant. Jamaic.*, three by Plukenet in the *Phytographia*, and ten in the *Mantissa*, one by Rheede in *Hort. Malab.*, and one by Petiver in the *Museum*. To these Ray adds eight new ones, accompanied by detailed descriptions. Of these eight, only one has later been taken up properly, namely, by Poiret; another was erroneously identified by Linnæus, the other six have never been mentioned again. Also of the ten species which Ray took up from Plukenet's *Mantissa*, six have sunk into oblivion, one has been taken up by Dillenius and Linnæus, two by Gronovius and Linnæus, and one by Poiret.

It is surprising that no one has since concerned himself about these species, especially as of a good number of them the type-specimens were easily to be found by clear indications in literature and in easily accessible collections, and for the rest the descriptions are so complete and detailed as to make the task of elucidation comparatively easy.

In the preface to the third volume of his *Historia Plantarum*, Ray states (pp. ii, iii) that the specimens described by him are to be found in the collections of Sloane, Petiver, and Sherard; a search in these herbaria, which I was able to make in September 1925 by kind permission of Dr. Rendle and Dr. Druce, and with the valuable assistance of the staff of the British Museum, revealed such an astonishing abundance of information that I am able to elucidate all of Ray's quotations of Leguminosæ–Desmodiinæ.

Ray, Hist. Pl. iii. (1704), p. 483: "38 Phaseolus parvus spicatus *Maderaspatensis*, cordatis et incanis foliis, siliqua articulata nigra Ejusd. t. 52, f. 2." According to Herb. Sloane, vol. xc. fol. 82, it is *Pycnospora lutescens* (Poir.) Schindl. The name has never been cited. The plant was collected again about 1740 by Poivre, near Canton; his specimen, which is in Herb. Jussieu, has been described by Poiret (1804) under the name of *Hedysarum lutescens*, and referred by Desvaux (1825) as a synonym to *Phyllodium elegans*. De Candolle (Prodr. ii. (1825) 326) made it a species of *Desmodium*. Wight and Arnott, in 1834, described the species as *Pycnospora nervosa* after *Crotalaria*? *nervosa* R. Grah. in Cat. Wall. n. 5428. The synonymy is as follows:—"Pycnospora lutescens (Poir.!) Schindl. comb. nov.—*Hedysarum lutescens* Poir.! in Lam. Enc. Bot. vi. (1804) 417.—*Zornia lutescens* Steud. Nom. ed. 1 (1821) 900.—*Desmodium lutescens* DC. Prodr. ii. (1825) 326.—*Phyllodium lutescens* Desv.! in Mém. Soc. Linn. Paris, iv. (1825) 324 p. p. (quoad syn. cit. Poir.; cet. excl.).—*Meibomia*

lutescens O. Ktze. Rev. gen. i. (1891) 198.—? *Flemingia monosperma* Moon, Cat. Ceyl. (1824) 54 [sec. Wight & Arn.].—*Crotalaria* ? *nervosa* Grah.! in Wall. Cat. (1831-32) n. 5428.—*P. nervosa* Wight & Arn. ! Prodr. i. (1834) 197.—*P. hedysaroides* R. Br.! MSS. ap. Wight & Arn. *l. c.* in adn.—*Desmodium viride* Vog. ! in Nova Acta Acad. Nat. Cur. xix. Suppl. i. (1843) 29.—*Meibomia viridis* O. Ktze. *l. c.* 198.—*Indigofera desmodioides* Benth. ! ex Bak. in Hook. f. Fl. Brit. India, ii. (1876) 153 sub syn.—*Crotalaria Tappenbeckiana* K. Schum. ! u. Lauterb. Fl. Deutsch. Schutzgeb. Suedsee (1901) 351.

P. 440: "61. Phaseolus unifolius *Orientalis*, summo folio sinuato, monospermos Pluk. Phyt. t. 105, f. 1": "An. Phas. minimus perennis *Americanus* flo. luteo Melioti, fol. Asari lanuginosis, solitariis Br. Prodr. 2." The plant cited from Plukenet's *Phytographia* is *Eleiotis monophylla* (Burm. f.) DC., according to Plukenet's specimen in Herb. Sloane, vol. xciv. fol. 45 (top right), but the synonym cited refers to Breyne's plant, which does not belong to the Desmodiinæ, and which has been described by Ray in the paragraph under no. 61.

P. 450: "3. Onobrychis *Zeylanica* trifolia minor perennis. D. *Herman.* Inter plantas à D. *Sherardo* communicatas occurrit. Flores in summis ramulis profert in spicas excurrentes, estque Hedysari trifolii species. Vide infra." *Cf.* page 457, no. 30.

P. 453: "1. Scorpioides *Bisnagarica*, folio singulari rigido, siliquis articulatis erectis Pluk. Phytogr. Onobr. *Zeylanica* folio singulari oblongo rotundo. D. *Hermanni.*"

A MS. note in Sloane's copy of Ray's book, now in the Department of Botany, British Museum, refers to Herb. Sloane, vol. xciii. fol. 19, bottom left. The specimen, collected by Dr. Plukenet, corresponds well with the figure in Phytogr. tab. 59. fig. 3, and is *Alysicarpus vaginalis* (L.) DC.

The second line, giving the synonym of Hermann, is also taken from Plukenet, where the author's citation reads—"D. *Hermanno.* D. *Sherard.*" The specimen preserved in Herb. Sherard at Oxford is, according to Mr. Gamble and Dr. Druce, also *Alysicarpa vaginalis* (L.) DC., but has been cited by J. Burmann in *Thesaurus zeylanicus* under tab. 49, fig. 2, i. e. *Desmodium gangeticum* (L.) DC., certainly without any authority whatever, and following Burmann, Linnæus cites it as a synonym of *Hedysarum gangeticum* L.

P. 455: "1. Hedysarum triphyllum fruticosum, siliquâ variè distortâ Slon. [*sic*!] Cat. Jamaic. D. *Sloane.*" Here follows a description, prior to Sloane's in Jam. Nat. Hist. i. (1707) 184, tab. 116. fig. 2, of the plant collected by Sloane in Jamaica and preserved in Herb. Sloane, vol. iii. fol. 86, which is *Meibomia purpurea* (Mill.) Vail. The plant is not mentioned by Linnæus. P. Browne cites it, properly, as a synonym to his *Hedysarum* 8, in 1756; Miller founds on it the binominal *Hedysarum purpureum* in 1768; Swartz, *Hedysarum tortuosum*, in 1788; and since 1825 it has been known as *Desmodium tortuosum* (Sw.) DC., until A. M. Vail restored in 1903 the original epithet.

P. 455: "2. Hedysarum triphyllum *Marilandicum*, siliquis compressis asperis, ad unum latus dentatis, longioribus.

"In ramulo quem ex *Marilandia* allatum D° *Sloane* communicavit D. *Vernon*, eidem pediculo oblongo communi terna insidebant *folia* simpla, subrotunda, lævia, venosa, extremo lateralibus duplo majore. Supra folia *caulis* in longum excurrit, ad longa intervalla ramulos emittens, in quibus ut & medio caule *flores* rarius dispositi, in uncialibus aut semiuncialibus tenuibus pediculis post se relinquunt *siliquas* compressas asperas, 4 aut 5 torulis ex inferiore parte velut dentatis, isthmo interceptis compositas. *Semina* in singulis torulis seu loculis singula nondum matura erant. Flores autem præterierant."

The collections made in Maryland by Vernon and Dr. Krieg and sent to Sloane are preserved in Herb. Sloane, vol. xxxvii., where Desmodiinæ are found on pages 20–22, 98, 102–106*. These were examined and compared with Ray's descriptions. There can be no doubt that the present description is meant to illustrate the plant in Herb. Sloane, vol. xxxvii. fol. 104, pl. 4, and that it would not agree with any of the other plants there preserved. The species is *Meibomia rotundifolia* (Michx.) O. Ktze.; it has never been cited.

P. 455: "3. Hedysarum triphyllum *Marilandicum* minus, siliquis compressis articulatis asperis, brevioribus. Onobrychis phaseolodes, flor. purpureis siliqua aspera bidentata et tridenta majore Pluk. Mantiss.

"*Cauliculi* huic tenues, teretes, satis tamen rigidi, supina parte rubentes. *Folia* parva, glabra, oblonga, obtusa, obscurius viridia, tenuibus & brevibus pediculis nixa, extremo lateralibus multo majore. *Caulis* ut in præcedente ultra folia in longum excurrit, ramos hinc inde emittens plures quam in præcedente, qui summa parte, (ut & medius caulis) in pediculis tenuibus oblongis *flosculos* singulares proferunt, siliquas post se relinquentes compressas, asperas, deorsum nutantes, 3-bus loculis subrotundis velut isthmo interceptis compositas, singulis singula *semina* continentibus, quae nondum maturuerant."

Ray gives no locality except in the word "*Marilandicum*," nor collector, but, as Plukenet (*Mantissa*, 140) states: "ex Provincia Mariana," it is evident that the plant has been collected by Vernon, while the same locality in Dr. Krieg's collection is nearly always styled by Plunkenet: "Terra Mariana." Sloane's MSS. note refers to Herb. Sloane, vol xxxvii. fol. 104, where plant 2 answers extremely well to the description, the stem is reddish and the leaves are very dark. The species is *Meibomia marilandica* (L.) O. Ktze. Ray's description has been cited by Dillenius in *Hortus eltthamensis*, 174, tab. 144, fig. 171, under *Hedysarum trifoliatum, siliqua breviore*, which is an aggregate composed of four species of *Meibomia* and one of *Desmodium*, but evidently meant to illustrate *Meibomia Boottii* (Torr.) Schindl. Besides this Dillenius gives as a synonym Pet. Mus. n. 419, which is a *Psoralea*, and adds: "Ceterum Rajus hujus synonymam facit, Onobrychem phaseolodem, floribus purpureis, siliqua

* There is another set of Maryland plants collected by Vernon and Dr. Krieg in Herb. Sloane, vol. lxxiv., which, however, has apparently not been seen by Ray.

aspera, bidentata et tridentata, majore Pluk. Mant. 140, cui pag. 456 num. 11 eandem suspicatur, Onobrychem Marianam parvo subrotundo folio [etc.] Pluk. Mant. 140, in quo ab ejus sententia recedo [etc.]." In Herb. Sherard, n. 1521, Ray's description is written down in Sherard's hand together with Plukenet's first synonym, given by Ray, and Dillenius has added: "dubito de synonymo." As to the second synonym of Plukenet's, Dillenius is wrong in saying that Ray makes his n. 11 synonymous with the present species, as Ray says there (see below): "Forte Hedysarum nostrum Marilandicum tertium," which is evidently Ray's number 5, as numbers 1 and 4 are not from Maryland. Only by Dillenius' erroneous citation Ray's species found its way into Linnæus' Spec. Plant., where it stands accidentally in its proper place.

P. 455: "4. Hedysarium trifolium *Maderaspatanum*, siliquis membranaceis asperis Mus. Pet. 649.

"Folium extremum multo majus est & acutius quam lateralia. Siliquæ breves, rectæ obtusæ." Petiver's plant is *Pseudarthria viscida* Wight & Arn. according to the specimen in Herb. Sloane, vol. xciv. fol. 115.

P. 456: "5. Hedysarum trifolium *Marilandicum* foliis latis subrotundis, floribus in pediculis longis ex eorundem alis egressis.

"*Folia* pediculis satis longis hirsutis insident, terna simul, quorum medium seu supremum, quod pediculum terminat, lateralibus majus est & latius, circa margines hirsuta, non crenata. Pediculi floriferi valde hirsuti sunt seu pilosi, palmares aut etiam longiores, tenues, foliolis parvis acuminatis per intervalla vestiti, in fastigio *flosculos* gestantes paucos, in pedicellis tenuissimis, parvos, binos simul, & (quantum in sicca discernere licuit) purpurascentes. Fructum nondum protulerat, ideoque quod Hedysari species sit certo affirmare non audemus."

The plant in Herb. Sloane, vol. xxxvii. fol. 105, pl. 3, answers very well to the description, it is again *Meibomia rotundifolia* (Michx.) O. Ktze., which he did not recognize as being conspecific with his *Hedysarum* n. 2, because it has only flowers, while n. 2 is in fruit. What Ray calls "foliola parva acuminata" are the bracts of the inflorescence. It is this plant, to which he alludes in the note to n. 11 (*cf.* remarks to n. 3). This description has never been cited.

P. 456. "6. Hedysarum trifolium *Marilandicum* foliis modice latis, acuminatis, saturatius, plurimas e superiorum foliorum alis & ipso caule supra folia florum spicas emittens.

"*Caules* quamvis tenues sint, satis rigidi esse videntur; brevi & vix conspicua lanugine superiore versus hirsuti, uti sunt & flosculorum calyces & pediculi, ita ut vestibus, adhærescant, Aparines in modum. *Folia* circa costam mediam albicare videntur in sicca. E foliorum superiorum alis, & supra folia e caulis lateribus hinc inde exeunt pediculi communes, prælongi, tenues, in summo florum purpurascentium spicas sustinentes. Pedicelli quibus flores insident tenuissimi. Qualem fructum proferat nescimus.

"In *Marilandia Americæ* provincia collegit D. *Vernon*. Ex habitu plantæ et conformitate cum præcedentibus Hedysari speciem esse conjicimus."

There is only one specimen with leaves marked whitish along the midrib, viz. Herb. Sloane, vol. xxxvii. fol. 105, pl. 2, but this specimen is so incomplete that Ray's recognizing its alliance to the preceding species is highly admirable. As the flowers are well preserved and show a distinctly hirsute calyx, there can be no doubt that it is *Meibomia Boottii* (Torr.) Schindl., notwithstanding its leaflets being rather sharply pointed, a fact not very common in this species. Never cited.

P. 456: "7. Hedysarum trifolium *Marilandicum* foliis parvis angustissimis, summa parte in multos divisum furculos, flores sustinentes.

"*Caules* tenues sunt, longi, *foliis* ad intervalla ternis, angustis acuminatis vestiti. E foliorum alis, & supra folia ex ipso caule, in longum procurrente, ad intervalla non longa, exeunt ramuli seu pediculi communes, tenues, prælongi, fere recta extantes, *flosculos* sustinentes in petiolis prætenuibus parvos, rarius sitos, purpureos quantum in sicca discernere licuit. Fructum nondum perfecerat, videbatur tamen siliqua esse parva, brevis, articulata. Summitates ramulorum hirsutæ erant, & vestibus adhærescebant, quamvis folia inferius prorsus glabra essent."

A MSS. note of Sloane refers to the plant in Herb. Sloane, vol. xxxvii. fol. 105, where pl. 1 answers extremely well to the above description. It is *Meibomia paniculata* (L.) O. Ktze., and has never been cited.

P. 456: "8. Hedysarum trifolium majus, totum hirsutum, foliis acuminatis, floribus in summo caule, inque pediculis e foliorum alis egressis, in spicas tenues excurrentibus.

"Tota Planta, [folia, caulis, spicæ] lanuginosa est & vestibus adhærescit. Folium in unoquoque pediculo extremum lateralibus multo majus est, e lata basi in acutum cuspidem sensim desinens; omnia autem pallidius virent. Spicæ e foliorum alis exeuntes, nulla habent in communi pediculo folia. Pauciores e caule supra folia emittit pediculos floriferos quam præcedentes, eosque breviores. *Flores* autem rarius siti sunt, papilionacei. Verum figuram eorum & colores in sicca clare discernere non potui. Caulis firmior est & robustior quam præcedentium."

All items given above coincide with the specimen in Herb. Sloane, xxxvii. fol. 105, pl. 4, which is *Meibomia canescens* (L.) O. Ktze., and has never been cited. The "acuta cuspis" of the leaflets is what we now call "mucro."

P. 456: "9. Hedysarum trifolium *Marilandicum* simplici in summo caule spica florum purpurascentium.

"*Folia* præcedentis foliis similia sunt, e lata basi in acutum mucronem sensim desinentia pallide viridia, extremum quod pediculo summo insidet lateralibus duplo majus est. Summos caules seu spicarum pediculos obsident foliola præparva, simplicia, acuminata, lata basi cauli adnata."

There is some difficulty with this species, as no specimen with "pale green" leaves, otherwise answering the description, is in the collection, but "the very small, simple leaflets" give a clue, as they apparently

apply to floral bracts, and the only specimen showing long dense bracts is the one in Herb. Sloane, vol. xxxvii. fol. 22, left bottom. But the leaves are almost black, and they do not seem to have been paler when less dry and old. Yet one of the leaflets is turned over showing the under surface, which indeed is pale. As all other facts agree with the description and no other specimen of the collection is found to match the diagnosis, I am satisfied that the present specimen is the type, which is *Meibomia grandiflora* (Walt.) O. Ktze. [in part, excluding the synonyms *Hedys.* and *Desmod. acuminatum*]. As S. F. Blake has lately shown (in Bot. Gaz. lxxviii. [1924] 277) that *Hedysarum grandiflorum* Walt. (Fl. carolin.) is the same as *Meibomia bracteosa* (Michx.) O. Ktze. and *M. cuspidata* (Muehlb.) Schindl., and as Walter's name has precedence, the combination *M. grandiflora* O. Ktze. has to be adopted, because it is founded in the first place on Walter's epithet. Ray's species has never been cited.

P. 456: "10. Hedysarum . . . . . " is a *Psoralea*.

P. 456: "11. Onobrychis *Mariana* parvo subrotundo folio trifoliata, procumbens, summo caule & ramulis floribunda Pluk. Mantiss. Forte Hedysarum nostrum *Marilandicum* tertium."

Plukenet (*Mantissa*, 140) does not say more about it than cited by Ray, but a MS. note of Sloane refers to Herb. Sloane, vol. xxxvii. fol. 20, where (left bottom) a plant is preserved, collected by Dr. Krieg (or Vernon ?), agreeing with the short diagnosis and which somewhat resembles the "Hedysarum *Marilandicum* tertium," viz. *Meibomia rotundifolia* (Michx.) O. Ktze., at least in the shape, if not in the size, of the leaflets and in the prostrate habit. It is *Lespedeza repens* (L.) Bart. This species has been mentioned by Dillenius (see above, remarks to n. 3), but never cited again.

P. 456: "12. Onobrychis Phaseolodes ramosior, floribus sulphureis parvis, falcatis & dentatis siliquis. Ex provincia *Mariana Ejusd. ibid.* An Hedysarum nostrum Marilandicum primum."

Plukenet (*Mantissa*, 140) gives no further information, we only see from the locality given that it was collected by Vernon; but the flowers said to be yellow at once indicate what we might expect, as there is only one species in the whole group of Desmodiinæ with yellow flowers and a prostrate habit. It ought to be prostrate, for Ray suspects it to be perhaps the same as his first Maryland *Hedysarum*, which, I have shown, is *Meibomia rotundifolia* (Michx.) O. Ktze., and which, indeed, is very like (as far as the Rayan specimens are concerned). There is in Vernon's collection a yellow-flowered, branched, creeping specimen, with falcate and dentate rough lomenta *Meibomia ochroleuca* (Curtis) O. Ktze. in Herb. Sloane, vol. xxxvii. fol. 20. This species was collected at about the same time by Marshall in Virginia, and has been distributed by Petiver under the name of *Hedysarum triphyllum scandens. Marianum rotundifolium auriculatum*, published in Mus. Pet. Cent. v. (1699) 39, n. 420, of which a specimen is preserved in Herb. Sloane, vol. clix. fol. 263, with Petiver's printed slip. More than a century elapsed before it was collected again by Elliott in South Carolina, and sent to

Muehlenberg in 1812, and another half-century before it was described by M. A. Curtis and published by Canby in 1864. Neither Plukenet's nor Ray's name has ever been cited.

P. 457: "13. Onobrychis, forte Asphallites, angustiori folio triphylla, floribus purpureis spicatis Terra *Mariana Ejusd. ibid.* An Hedysarum nostrum *Marilandicum* quintum ?"

See remarks to n. 14.

P. 457: "14. Onobrychis *Mariana* triphylla, Passifloræ pentaphyllæ angustiori folio & facie, siliqulis dentatis asperis, a præcedenti plurimum diversa. *Ejusd. ibid.* Hæ omnes plantæ a D. *David Krieg* in Marilandia collectæ, & nobis communicatæ sunt, inquit D. *Plukenet.*"

Notwithstanding Plukenet's statement, "a præcedente plurimum diversa," I should think both are *Meibomia paniculata* (L.) O. Ktze. N. 14 is in Herb. Sloane, vol. xxxvii. fol. 20, right bottom, and there can be no doubt either as to the identity of the specimen or its matching the description. Besides, it agrees well with the figure in Pluk. Amalth. tab. 432. fig. 6. But n. 13 is not represented in the Maryland collection of vol. xxxvii. Probably Ray has only copied it from Plukenet. Vernon's and Krieg's collections came apparently at the same time to Sloane and Plukenet, who were not on good terms. We might therefore presume that Ray only saw the first, at least there is no evidence that he had seen Plukenet's set. After his death, his herbarium was bought by Sloane, and his set of Maryland plants, or part of it, is in Herb. Sloane, vol. lxxiv., and a poor specimen of *Meibomia paniculata* on fol. 34 might be the type of n. 13. I was led to this opinion by Ray's remark "an Hedysarum nostrum *Marilandicum* quintum," which is the same species (n. 7), and by the fact that no other specimen resembling n. 7 is to be found. The statement "a præcedente plurimum diversa" might be understood in the sense that Plukenet himself thought the differences between the two plants, though not great, sufficient for specific separation. Ray is probably wrong in saying that all these plants were collected by Dr. Krieg; certainly Plukenet does not state it in the *Mantissa*. The Maryland species in Pluk. Mant. are on fol. 140, pls. 4–9; no collector is given with pl. 4; the indications with the other plants are as follows:—

Pl. 5: "in *Terra Mariana* collegit D. *Krieg*, & nobis communicavit."

Pls. 6 and 7: "Utræque ex Provincia *Mariana*."

Pl. 8: "ex *Terra Mariana*."

Pl. 9: "Ab *eodem* ornatissimo Viro D. *David Krieg* collecta est; & nobis communicata."

Possibly Plukenet did not know that part of the collection was made by Vernon. I have not seen his name cited in the *Mantissa*, and on one occasion I find Krieg's name connected with the locality "*Provincia Mariana*," viz. on p. 89 (*Gentianella minor*).

Plukenet's description and figure have been cited by Gronovius and Linnæus.

P. 457 : "17. Onobrychis *Indiæ Orientalis* monophyllos, siliculis numerosis asperis *Ejusd. ibid.*"

Plukenet adds in *Mantissa*, 140 : "a D. *Adaire* accepimus," and gives a figure in Amalth. tab. 432. fig. 3. When in London I could not find the plant in Sloane's Herbarium, and Mr. Exell, who on my request kindly undertook to trace it, was also unsuccessful. I saw, however, a specimen in Herb. Sherard with the Plunkenetian name in Sherard's writing. This may be the type. Plukenet's drawing seems to represent *Desmodium velutinum* (Willd.) DC. var. *Plukenetii* (Wight & Arn.) Schindl. Plukenet's figure has been cited with a query by Poiret in 1817 under *Hedysarum lasiocarpum* (= *Desm. velutinum*).

P. 457 : "18. Onobrychis *Gangetica* monophyllos, siliculis singularibus, lævibus, falcatim per internodia discriminatis Pluk. Phyt. t. 50, f. 3." The figure shows *Desmodium gangeticum* (L.) DC., and has been cited by Dillenius, Burmann, and Linnæus in its proper place. Type-specimen in Herb. Sloane, vol. xc. fol. 51.

P. 457 : "30. Onobrychis *Zeylanica* trifolia minor perennis D. *Herman.* Folia in pediculis longiusculis ovata fere, parva. *Flores* in summis caulibus & ramulis in spicas excurrunt, parvi, & (ut in sicca videbatur) purpurascentes, quibus succedunt *siliquæ* parvæ, breves, articulatæ, velut isthmis semina intercedentibus."

A plant bearing in Hermann's handwriting the name cited by Ray is in Herb. Sherard, fol. 1022, 4, and is *Desmodium heterocarpum* (L.) DC. J. Burmann cites it under *Hedysarum trifoliatum, siliculis glabris, peltatis, geminis, inarticulatis*, t. 50. fig. 2, which is *Dicerma biarticulatum* (L.) DC., and is followed in this by Linnæus (in Fl. Zeyl. and Spec. Pl.), who did not see Hermann's plant, which is not represented under the name cited in Hermann's Herbarium.

P. 457 : "31. Onobrychidis trifoliæ ramulum habemus inter siccas *Sherardinas*, flore & fructu viduum, cui D. *Hermanni* manu inscribitur, *Onobrychis spicata Zeylanica trifolia frutescens.* Folia inferiora in ramulis obtusa sunt & subrotunda."

This plant, with a label bearing the above name in Hermann's hand, is also in Herb. Sherard, fol. 1022, and is again *Desmodium heterocarpum* (L.) DC. It has only been cited by J. Burmann under *Hedysarum trifoliatum arborescens, floribus spicatis, foliis subrotundis, subtus lanuginosis*, which, according to another citation of Mus. Zeyl. 22, is the same. Linnæus does not mention it. Poiret, in 1804, quotes it again, together with Mus. Zeyl. 22, erroneously under *Hedysarum conicum*, which is *Desmodium retroflexum* (L.) DC. (usually known under the name of *D. capitatum* (Burm. f.) DC. It has not been cited later.

P. 458 : "32. Hedysarum triphyllum fruticosum, supinum, flore purpureo Slon. Cat. Jamaic. Onobrychis *Americana*, floribus spicatis, foliis canescentibus, siliculis asperis Pluk. Almag. Bot. t. 308. f. 1. An Trifol. *Americanum* spicatum Marcgr.? D. *Sloane.*"

Here follows a detailed description, prior to Sloane's in Jam. Nat. Hist. i. (1707) 185, t. 118 [sphalm. 119], fig. 2, of Sloane's plant from Jamaica (Herb. Sloane, vol. iii. fol. 88), which is *Desmodium frutescens* (Jacq.) Schindl. Plukenet's plant, which is described in Almag. 270, and figured in Phytogr. t. 308. f. 5 (not 1, as stated by Ray), is in Herb. Sloane, vol. ci. fol. 67, bottom. Marcgraf's plant I could not find. Plukenet quotes also "Caapamonga 3ª *Pison*, lib. 4, cap. 40, fol. 201," where a rather good drawing is given, certainly representing the same species.

Sloane's plant and figure have been cited by Gronovius (1739) under *Hedysarum caule infirmo*, etc. (Clayton, n. 180), which is *Meibomia grandiflora* (Walt.) O. Ktze. (in part), and by Linnæus, together with Ray's description and Plukenet's, in Hort. Ups. (1748) under *Hedysarum foliis ternatis subtus scabris*, etc., which is *Meibomia canescens* (L.) O. Ktze. Eleven years before, in Hort. Cliff. (1737), Linnæus had given Plukenet's name and figure as a synonym to *Hedysarum foliis ternatis et solitariis*, etc., which is also *Meibomia canescens* (L.) O. Ktze., and all these names he cited in Spec. Pl. ed. 1 (1753) under *Hedysarum canescens*, which therefore contains *Meib. canescens* and *Desmodium frutescens*, and which he enlarged in the second edition (1763) by adding the synonym *Hedysarum* 7, P. Browne, which is *Meibomia intorta* (Mill.) Blake (in part).

P. 462 : "1. Trifolium siliquosum rotundifolium glabrum, floribus luteis *e Maderaspatan* Pluk. Phyt. t. 231. f. 4."

Plukenet's specimen, described in Almag. 374, is now in Herb. Sloane, vol. xcviii. fol. 123, top left, and is *Desmodium triflorum* (L.) DC. It has never been cited.

P. 463 : "14. Trifolium spicatum luteum, venosis subrotundis foliis, averso parte canescentibus *Ejusd. ibid.* ubi Synonyma vide."

The synonyms added in Plukenet's *Mantissa*, 184, I could not trace, but I do not believe in their being conspecific. The drawing in Amalth. t. 447. f. 1 agrees well with Plukenet's specimen in Herb. Sloane, vol. lxxiv. fol. 39, pl. 3, which is *Lespedeza hirta* (L.) Hornem. It has never been cited.

P. 463 : "15. Trifolium spicatum luteum, venosis subrotundis foliis, apicibus sinuatis, sericea lanugine subtus argenteis *Ejusd. ibid.*"

To this Plukenet, in *Mantissa*, 184, adds : "An Loto affinis Lagopoides." The plant could not be found, but, as the diagnosis differs from n. 14 in saying that the leaflets are sinuate at the apex, it might be suggested that the same species, *Lespedeza hirta* (L.) Hornem., is meant, in which the older leaflets sometimes are emarginate. That Plukenet compares his species with "Loto affinis Lagopoides," which is the very similar *Lespedeza capitata* Michx., strengthens my suggestion. Such specimens with emarginate terminal leaflets are those in Herb. Sloane, vol. xxxvii. fol. 21 and 103. They have never been cited.

P. 469 [sphalm. 472] : "24. Loto affinis Lagopoides *Nov. Anglicana*, frutescens, foliis ternis, subtus sericea lanugine argentatis, Monospermos *Ejusd. ibid.*"

Plukenet's specimen, described in *Mantissa*, 120, now in Herb. Sloane, vol. c. fol. 189, top left is *Lespedeza capitata* Michx. It has never been cited.

P. 469 [sphalm. 472]: "25. Loto affinis trifoliata frutescens glabra, ex *Marilandia*, *Ejusd. ibid.*"

There is no hint in Sloane's copy of Ray's Hist. Pl. as to the specimen, but in Plukenet's collection in Herb. Sloane, vol. lxxiv. fol. 39, pl. 2, as well as in the Maryland set sent to Sloane, in Herb. Sloane, vol. xxxvii. fol. 21, *Lespedeza virginica* (L.) Britton, var. *typica* Schindl., very well matched the short diagnosis. Gronovius (1739) has made it a synonym of his *Medicago caule erecto ramosissimo*, etc., and Linnæus (1753) of his *Medicago virginica*, which are both *Lespedeza virginica*. Unfortunately, when revising the genus *Lespedeza* in 1912 for my paper in Engler's Bot. Jahrb. xlix. (1913) 570–658, I took erroneously the two species in Plukenet's *Mantissa*, 120 (*i. e.*, Ray, n. 24 and 25) for one and identified n. 25 with *Lespedeza capitata*, which, of course, is wrong, and my statements on pages 594, 628, 629, and 630 should be corrected.

P. 474: "1. Nir-Murri *H. M.* p. 9, t. 32. Legumen erectum foliis simplicibus, floribus in summis caulibus & ramulis, velut in spica; seminibus quadratis.

"Tetricis & aquosis gaudet, altitudine duum pedum & amplius. *Rami* parum lignosi, virides. *Folia*, quæ pedunculis brevibus proveniunt, oblonga, tenuia, viridi-clara. *Flores* papilionacei, rubescentes, in medio ex rubro ad cœruleum vergentes, inodori. *Siliquæ* parvæ, longæ, rectæ, angustæ, compressæ, per siccitatem rubescentes. *Semina* longa quadrata, albicantia."

The drawing in Rheede's *Hortus malabaricus*, as well as Ray's good description, point to *Alysicarpus bupleurifolius* (L.) DC. The last paragraph in Ray's description: "Hanc speciem, vel ei valde similem . . . . " does not belong here. The name has never been cited again.

I have to thank Dr. A. B. Rendle for kindly allowing me to study the various herbaria of the British Museum, and Mr. A. W. Exell for helping me in the search for authentic specimens and for finding, comparing, and determining specimens, which I had no time to look up, after my departure.

A REPORT ON THE LONGEVITY OF THE FRUIT OF NELUMBIUM.

By Ichiro Ohga.

While studying the germination of *Nelumbium* fruits found in the peat of the Plantein basin, South Manchuria, I found the following quotation by C. De Candolle:—"In 1850 Robert Brown, out of curiosity, sowed some seeds from the collection of Sir Hans Sloane (in the British Museum), of which they had formed a part for more than a hundred and fifty years. He succeeded in making several of them germinate, particularly a seed of *Nelumbium speciosum*. The plant has been preserved in the galleries of the British Museum, where I saw it a few years ago."

During my journey, I have had the opportunity to visit the British Museum, and there, through the kindness of Dr. A. B. Rendle, in charge of the Botanical Department, I saw the collection of Sir Hans Sloane, the results of Robert Brown's experiments preserved in acetic acid, a note by Mr. Carruthers describing Robert Brown's experiments and some correspondence about them. My request to carry out some germination experiments with the *Nelumbium* fruits in Sloane's collection was willingly granted. The result of these experiments carried out at the Museum is given below.

In 1885, writing on the popular belief in the capacity of germination of wheat taken from mummy cases, Mr. Carruthers, Keeper of the Botanical Department of the British Museum, stated that the story was entirely untrue, and added, "The longest lived seeds are those which are naturally sown in water, from the destroying operation of which they are protected by a specially hard protective covering. Perhaps the most authentic case of an old seed germinating is that of a *Nelumbium* water-lily. Forty years ago Robert Brown experimented with seeds which had come from Sir Hans Sloane to the British Museum, and had certainly been in the box in which he found them for a hundred and fifty years."

Sloane's specimens included both *Nelumbium luteum* (no. 8110 & no. 8517, named in the Sloane Catalogue "*Lotus ægyptiaca*, from Carolina") and *N. speciosum* (no. 506, without locality). No. 8110 is a receptacle still containing fruits; and there is also a somewhat smaller receptacle, without a number, also containing fruits. No specimen of no. 8517 now remains except the material used by Brown, which is preserved in acetic acid. No. 506 consists of fruits preserved in a small two-sided glass box—the usual method employed by Sloane for preserving his fruits and seeds. The boxes are completely closed by stoutish paper stuck round all the edges. The box containing no. 506 was presumably opened by Brown, who did not reseal it.

The seedlings, obtained by Robert Brown, are preserved in acetic acid in stoppered bottles, which bear in Brown's handwriting the notes of his experiments.

These specimens show that Brown carried out four separate experiments.

Date.	Number of the fruit used.	Result. Germinated.	Failed.
I..... 1843	3	2	1
II. 1843	4	3	1
III. 1850	2	2 (well developed)	0
IV. 1855	5	5	0
	14	12	2

These experiments show that 85 per cent. of the *Nelumbium* fruits had retained the power of germination for about 150 years.

In my own experiments four kinds of the fruit material were used as follows:—

1. 11 of the fruits from Sir Hans Sloane's collection.
2. 4 fruits in the British Museum Herbarium from Reeves's collection in China (1838).
3. A number of fruits collected at Tokyo, Japan (1923).
4. A number of fruits collected from the peat in Manchuria (1923).

The following methods were adopted:—

1. The fruit was soaked in concentrated sulphuric acid for either 5 or 17 hours and then washed with tap-water. After it had been left in water for a short time, the coat was taken off; then it was kept in the oven at 30° C.
2. After filing one end of the fruit, the outer coat was taken off with a pen-knife and the seed was kept in the oven at 30° C. as above.

According to my two years' experience, in an ordinary case, when thus treated, the sprout comes out after two days.

Five experiments were carried out, using other specimens of *Nelumbium* fruits as controls. The results were as follows:—

	Sloane.	Result.	Reeves, 1838.	Result.	Tokyo, 1923.	Result.	Manchurian peat.	Result.
I.	2	non-germinated	...	...	2	germinated	2	germinated
II. ...	3	non-germinated	...	...	2	germinated	2	germinated
III. ...	2	non-germinated	2	non-germinated	2	germinated	2	germinated
IV. ...	4	non-germinated	2	non-germinated	2	germinated	2	germinated
V. ...	1	non-germinated	...	...	2	germinated	2	germinated
	12		4		10		10	

A single specimen from Castleton Garden, Jamaica (1887), also germinated. In experiments II., III., IV., and V. traces of Mould were found in all the fruits except in one specimen in the fourth experiment.

According to my previous experience, when the colour of the naked seed is reddish-brown, or when the water in which the seed is kept becomes tinted reddish-brown and remains transparent, it shows that germination will occur. When, however, the colour of the naked seed is greyish brown, or when water in which the seed is kept becomes turbid, no germination results. In the present experiments the specimens from Tokyo and Manchuria belonged to the former category, and the Sloane and Reeves specimens to the latter.

In the fourth experiment when one of the four Sloane fruits was cut open a green plumule was observed, though it had not elongated. In such a case I have usually assumed that there is no germination power or true vitality of the seed, for no indication of the stretching of the plumule can be observed. A thin section of the cotyledon was made, and when hydrogen peroxide was poured on to it some bubbles of gas were liberated. This indicates catalase activity.

The germination of the seeds of *Nelumbium* by Robert Brown has hitherto constituted the record period of the viability not only for *Nelumbium*, but for any fruit or seed.

My fruits dug out of the peat are probably some centuries old, but the exact age cannot be determined until the age of the peat has been settled. It may be stated, however, that the normal germination rate of *Nelumbium* fruits from the peat is approximately 100 per cent.

In the experiments of Robert Brown in 1855, the longevity of the Nelumbo fruit was proved to be about 150 years, but since then no germination experiments have been carried out until my present experiments. These indicate that during the last 70 years the fruits have lost their vitality through an attack of mould. Whether the mould-spores came from the air, or whether the spores had been in the fruit from the first, cannot be easily decided. I have found, however, a few fruits, both from Tokyo and Manchuria attacked by fungi, *Penicillium* sp., according to Dr. Kunkel, of Boyce Thompson Institute, Yonkers, N.Y., U.S.A. In my cases it may be considered that the fungus got in at an early stage.

At any rate, it may be stated that *Nelumbium* fruits can live 150 years in the air and in the soil, at a more constant temperature possibly for indefinitely longer. I cannot give any reason for the differences in the colouring of the seed-coat and of the water in which the seeds had been soaked, mentioned above.

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My grateful acknowledgments are due to the Keeper and members of the Staff of the Department of Botany, especially Mr. A. W. Exell, for the facilities granted and assistance given in carrying out my experiments.

British Museum (Natural History),
December 1925.

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from p. 105.)

Araliaceæ.

Gilibertia Swartzii, sp. nov. *Folia* 7–14 cm. l., lanceolata, ovato-lanceolata, vel anguste elliptica, apice acuta nonnunquam obtusa, basi acuta, decurrentia, nervis cum venis reticulatis supra applanatis aut vix prominulis subtus tenuiter prominentibus, chartacea ; petioli ad 4 cm. l. *Pedunculi* 23–10 cm. l., articulati. *Receptaculum* supra convexum subtus concavum, 5–7 mm. lat. *Umbella* simplex, 50–70-flora ; pedicelli 15–18 mm. l. *Petala* 5 mm. l., ovato-elliptica. *Filamenta* 7 mm. l. *Ovarium* turbinatum, circa 3 mm. l. *Stylum* simplex, conicum, 2·5 mm. l. *Fructus* circa 6 mm. l., ellipsoideus, 5-angulatus.

Hedera pendula Griseb. Fl. Br. W. Ind. 306 (1860) (in part.).

Hab. In fl. Feb. ; Jamaica, *Swartz* (with label attached inscribed *Hedera nutans*)!, *Wilson* (specimen in Herb. Kew., locality in Jamaica not mentioned, named by Grisebach *Hedera pendula*)! Newhaven Gap, Blue Mts., J. P. 983, *Hart*!, also *Harris*! ; Claverty Cottage, Blue Mts., J. P. 983, *Hart*!.

This species is near *G. pendula* March., which differs in *leaves* ovate-oblong or narrowly elliptical, obtuse at both ends ; nerves and veins indistinct, leathery ; and in *peduncle* to 3 dm. l. and more. *G. nutans* March. differs in *leaves* broadly elliptical, shortly subacuminate at both ends, veins evident beneath, papery-leathery ; and in peduncle 5–7 cm. l.

Gilibertia ovalifolia, sp. nov. *Frutex* aut *arbor*, 12–25 ped. alt. *Folia* ad 13 cm. l., 5–7 cm. lat., ovali-elliptica, brevissime acuminata, acuta vel rarius obtusa, basi rotundata, emarginata, vel subcordata, nervis venisque supra applanatis aut prominulis, subtus prominentibus, chartacea ; petioli ad 8 cm. l. *Pedunculus* 26–20 cm. l., articulatus ; receptaculum subcapitatum, minus quam 1 cm. lat. *Umbella* 55–90-flora ; pedicelli 15–18 mm. l. *Calyx* subinteger. *Petala* subviridia, triangularia, acuta, 4 mm. l. *Filamenta* 6 mm. l. *Stylus* simplex, 2 mm. l.

Dendropanax pendulum Britt. in Bull. Torr. Bot. Cl. xxxix. 2 (1912).

Hab. Lapland, near Catadupa, 2000 ft. ; Mulgrave, St. Elizabeth, 1300 ft. ; *Harris*, 9188 !, 12,378 !.

We do not understand Dr. Britton's statement (*l. c.*) that "this specimen [Harris, 9188] agrees with the type-specimen of *Hedera nutans* Sw. in the herbarium of the British Museum, Natural History." The specimen of *H. nutans* from Swartz does not agree with the species described above.

Sciadophyllum prætermissum Norman, sp. nov. *Arbor* 20 ped. alt. *Folia* digitata utrinque glabra, foliolis 12–22 cm. l. et usque 10 cm. lat., ovato-oblongis, acuminatis, basi rotundatis, petiolulis inæqualibus, usque 8 cm. l. *Inflorescentia* longe racemosa, albo-tomentosa vel pulverulenta, rachide ad 40 cm. l. demum glabrescente. *Umbellulæ* numerosæ, ad apicem rachidis congestæ, ad basim interruptæ. *Pedunculi* crassi 2–3 mm. l. *Flores* 9–12 sessiles, post anthesin subsessiles. *Calyx* glabrata vel sparsim tomentosa ; dentibus minutis circa ·4 mm. l. *Corolla* 1 mm. l., campanulata glabra. *Styli* 5, ·4 mm. l.

Hab. In young flower and fruit, December, Morses Gap, 4900 ft., *Harris*, 6997 !.

Nearly allied to *S. Brownei*, but differing in its more densely tomentose inflorescence, and especially in the sessile flowers and minutely toothed calyx [*C. Norman*].

Correction.

Fuchsia cuspidata sp. nov. Supra p. 105.

Dr. N. L. Britton has called our attention to the description of *F. boliviana* Carr. Rev. Hort. xlviii. 150, with plate (1876), which we regret to have overlooked. Our *F. cuspidata* is undoubtedly conspecific.

ABSTRACTS OF PAPERS OF INTEREST TO STUDENTS OF THE BRITISH FLORA.

Spartina in France (*Gardeners' Chronicle*, March 20, 1926, 212).—In this paper Prof. F. W. Oliver deals with the more than usually rapid spread of *Spartina Townsendii* in the mouth of the Seine and with the overwhelming of *Spartina* by *Glyceria maritima* in one isolated locality. A chart and photograph illustrate clearly the present conditions and direction of spread of *Spartina*. The method of extension here differs from that at Poole, in that numerous streamers of *Spartina*-tussocks stretch out into the estuary almost at right angles to the main belt. Here they attract silt, and so the level of the ground around the tussocks becomes raised at once, and indirectly the slopes become affected and raised to a level at which *Spartina* can operate. This phase is at present in full development and will probably continue until a point is reached at which the scour of the waters of the estuary renders the ground too mobile for further advance.

In one isolated locality, on the landward side of a shingle-pit, is a stretch of saltmarsh occupied by a dense sward of *Glyceria maritima*. The locality was formerly covered mainly by *Spartina*, but now only a few isolated haulms remain. This is of special significance, as elsewhere *Spartina* holds the ground which it has won and the next stage in succession has never been recorded.

Prof. Oliver concludes by suggesting that *Glyceria* may be able to suppress *Spartina* by its unaided merits as a fighter, and that this is only a foretaste of what is going to happen in many localities. On the other hand, he points out that the conditions here are rather peculiar and that it is evident that there is something in this locality which is especially favourable to the growth of *Glyceria*, and he suggests that this something may be the abundance of decaying rubbish which drifts to this spot.—D. Powell.

On the Anatomy of Orobanche Hederæ Duby, and its Attachment to the Host (*New Phytologist*, xxiv. No. 5, Dec. 1925).—Mr. P. Tate gives a detailed account of the anatomy of the region of union between the host and parasite at various stages of growth. He finds that the seeds of *Orobanche* germinate only in the presence of the roots of the host-plant. In the first stages of germination observed by him, the parasite appeared as a small nodule already attached to small ivy roots. He finds that no definite haustoria are formed where the parasite enters the host, but that the union extends in an irregular manner over a considerable area. The ivy root becomes much swollen at the point of attachment and, normally, dies off beyond it. The tissues of the root at this point curve towards the parasite, spread out and extend into its tissues, thus taking a considerable part in the development of the connexion. He finds, further, that the tissues of host and parasite are not nearly so closely merged together as has been indicated by other writers. The cortical cells of host and parasite come into close contact, the sieve-tubes meet end to end, and the xylem of the host connects with that of the parasite by files of short reticulated tracheids. The boundary-line between host and parasite often pursues an extremely irregular course, yet the point of meeting of their tissues can always be recognized.

D. Powell.

Anacamptis pyramidalis (*Orchid Review*, xxxiv. 51, Feb. 1926).—Messrs. T. & T. A. Stephenson give an account (with figure) of a remarkable form of this orchid found on the chalk downs near Winchester in 1925. It was ten inches high, with short, narrow, yellowish leaves and bore a pyramidal head of pale pink (not red) flowers; these had no spurs, and their lips were scarcely trilobed.

The writers considered that their plant was not of hybrid origin but an abnormal form of *A. pyramidalis*.—C. E. S. & E. G. B.

In *The Naturalist* for Nov. 1925 (p. 346) Mr. F. Snowdon reports *Centaurium capitatum* Willd. from the Whitby district, N.E. Yorkshire. This is apparently a new record for the whole county.—C. E. S. & E. G. B.

The two Reports of the Botanical Society and Exchange Club of the British Isles for 1924 (published Sep. 1925), being vol. vii. pts. iii. & iv., contain, as usual, much that is of interest.

We note, on p. 434, a new variety of *Arenaria trinervia* which bears the name of var. *hyemalis* D'Urban; and *Galium debile* Desv.—a close ally of *palustre*—is reported from the Channel Islands, etc.

Taraxacum (p. 440) is well represented by *T. glaucinum* Dahlst., *T. aloniense* Dahlst., *T. ancistrolobum* Dahlst., *T. cyanolepis* Dahlst., *T. lætifrons* Dahlst., *T. mucronatum* Lindb. f., and *T. triangulare* Lindb. f.

Thymus Serpyllum L. subsp. *zetlandicus* Ronniger & Druce is described on p. 450 from specimens gathered in Shetland by Dr. Druce.

Amongst the obituaries are long accounts of the late Charles Bailey and J. A. Wheldon, with good portraits of both botanists.

Pages 613–628 are occupied with Mr. J. Fraser's account of *Mentha* determinations by J. Briquet upon a set of these plants sent him by Dr. Druce in 1894. Many new varieties, etc., are noted and described in this interesting article.

Additions to the Flora Zetlandica by Dr. Druce (who explored these islands in 1924 with Prebendary Burdon and Mr. T. Churchill) are mentioned on pp. 628–657, and there is a lengthy list (pp. 667–684) of Corrected Names of Roses distributed in the past through the B. E. C. by Col. Wolley-Dod. Part iii. (to which the above notes refer) is by the Secretary, Dr. G. C. Druce; part iv. by the Editor and Distributor, Mr. W. O. Howarth, contains experts' opinions upon the plants contributed.—C. E. S. & E. G. B.

OBITUARIES.

Henry Brougham Guppy.

We have heard with much regret of the death at Martinique on April 23, on his way home from Tahiti, of Henry Brougham Guppy, at the age of 71. A singularly modest and retiring man, Mr. Guppy was probably known, except perhaps by correspondence, to very few of his fellow-scientists. Many years of his life were spent on the shores of the great Oceans in the study of problems of geology and plant-dispersal, and when at home he was rarely to be met in London. As a surgeon in Her Majesty's Navy, he visited the Corean Archipelago in 1878, and later on H.M.S. 'Lark,' commissioned for survey work in the Western Pacific, he studied the ethnology, geology, and natural history of the Solomon Islands. A visit to the Cocos-Keeling Islands, in 1888, elicited an important contribution on the much-debated question of coral-formation; and also afforded opportunity for an essay on plant-dispersal as illustrated by the Flora of the Islands (Journ. Victoria Institute, 1890).

Guppy became deeply interested in the problem of plant-dispersal by means of water. In 1892 he contributed a paper on "The River Thames as an Agent in Plant Dispersal," and in 1894 one on "The Habits of *Lemna major*, *gibba*, and *polyrhiza*" to the Linnean Society. He brought together a vast number of facts and the results of many years' personal observation and experiment in three books. In *Observations of a Naturalist in the Pacific between 1896 and 1899*, vol. ii., *Plant Dispersal* (1906), he discussed dispersal in

relation to the littoral floras of the Pacific Islands, and the part played by ocean currents in carrying fruits and seeds; and *Plants, Seeds, and Currents in the West Indies and the Azores* (1917), a similar investigation of the littoral flora of these islands of the Atlantic Ocean, embodying the results of investigations carried out in those regions between 1906 and 1914. *Studies in Seeds and Fruits, an Investigation with the Balance* (1912), describes the results of a detailed investigation on permeability, hygroscopicity, and other characters of fruits and seeds which bear on their chances of of dispersal by water.

In a paper read before the Linnean Society in 1918, "Plant Distribution from the Standpoint of an Idealist," Guppy dealt with problems of general distribution and the origin of the families of flowering plants. He maintained that the great families had arisen in an early period of comparatively uniform conditions, and their differentiation with present-day tribes, genera, and species was a response to the differentiation of climatic and other conditions. To some degree he found himself in sympathy with the "Age and Area" theory of Dr. Willis.

A recognition of the importance of his work was the award of the Linnean Medal in 1917, and his election to the Fellowship of the Royal Society in 1918; in the same year he was also elected F.L.S.

In the preface to his *Studies in Seeds and Fruits*, Mr. Guppy allows an insight into his methods of work: "The circumstances of my life enabled me to devote all my time to it, a very important condition for extensive original investigation"; and the single-minded devotion of the unembarrassed searcher after truth is indicated when he writes: "As I scrambled about on the coasts and in the inland woods of the West Indian Islands, or sat quietly working in my study at home, or lay in my cabin during the voyages to and fro across the Atlantic, ideas came floating through my mind which often took solid form and developed into lines of investigation before unsuspected."

Workers on British Botany will regret to hear of the death on May 7, after a short illness, of Mr. John Cryer. We hope to give some account of his work in the next number of this *Journal*.

REVIEWS.

The Leguminosæ of Tropical Africa. By Edmund G. Baker, F.L.S. Part 1. Suborder Papilionaceæ. *Pleiospora* to *Tephrosia*. 8vo, pp. 215. Erasmus Press, Ghent. January, 1926. Price 15*s*.

Mr. Baker is to be congratulated on the appearance of the first part of the work to which he has devoted himself since his retirement from official responsibilities at the British Museum. Since the date of the elaboration of the Leguminosæ by the late Mr. J. G. Baker in the *Flora of Tropical Africa* in 1871 our knowledge of

the representatives of the family in the area in question has very much increased, as may be seen from the list of the more important works published since 1871 included in the present publication. We understand that Part 1 will be followed by two other parts, and the whole volume will include a treatment of the three subfamilies. Mr. Baker is himself responsible for a number of the contributions included in his bibliography and his great knowledge of the family, which formed an important item of his charge during his long term of service at the Museum, renders him eminently fitted for his self-imposed task. Students of the Leguminosæ and of the flora of Tropical Africa will welcome a clear and straightforward *precis* such as Mr. Baker is providing. A key to the included species follows the description (in English) of each genus. Under individual species, a reference is given to the original description or some well-known work; then comes the distribution followed by a line or two of description indicating obvious characters useful for recognition. Latin diagnoses are given in the case of new species and of the one new genus—*Caulocarpus*, allied to *Tephrosia* and founded on one of Gossweiler's Angolan plants.

The work is very clearly printed, but consultation would have been greatly facilitated if some use had been made of the page-headings; the name of the genus as a right-hand heading would have been helpful, as in the citation of species the genus is indicated only by an initial.

Vascular Plants from Novaya Zemlya—B. Lynge, 1923. Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya, 1921. No. 13. Pp. 151; pl. xlvii. (i.–xx. contain 120 distribution-maps). Kristiania: A. W. Brøggers.

This valuable addition to the literature of the Novaya Zemlya flora is in English. There is a short historical introduction containing a summary of botanical exploration in Novaya Zemlya and a brief account of this expedition: the full account has already appeared as No. 1 of the series (1922). The main body of the work is a list of the plants collected—including Ferns and Horsetails. The families are in order according to modern classification, but with the Dicotyledons first, while the genera and species are arranged alphabetically.

This list contains 155 species, which shows that the Flora is slightly richer than that of Spitsbergen, but not much so*. This list is possibly not really complete; *Empetrum* has been collected recently. The distributions of the species are indicated on maps, of which there are six to each of the first twenty plates. The shape of Novaya Zemlya lends itself admirably to this method of representation, which would be impossible with a larger flora or any other outline.

* One interesting fact is that there are four species of Leguminosæ in Novaya Zemlya, but not a single one in Spitsbergen, which is considerably further north.

Throughout the list there are numerous biological notes on the species, which indicate considerable field-work. These include notes on the habitats, on pollination, on the frequency of fruiting, on fertility, &c., which are of special interest at such high latitudes.

The Salices are named by J. Lid, and include several species not in Spitsbergen—e.g., *S. arctica*, *S. lanata*, *S. reptans*, *S. taimyrensis*, and *S. rotundifolia*,—while many hybrids are described.

There is a long critical note on *Cerastium Regelii*, as on many other species—*e.g.*, the Potentillas. These notes are very valuable, since many of these Arctic species are not well described in any Flora. The *Flora Arctica* started by Ostenfeld has not been completed, and such a work is much wanted. There are no notes on the two species of *Melandryum*, which is to be regretted, since I found it very difficult to name dried material of these from Spitsbergen. Nor in this case are there any references to earlier work which would serve instead of such notes. The original descriptions are rarely sufficiently good to be of much use for modern identifications, and such citations as "*Draba Wahlenbergii* Hn. p.p." are to be deprecated, since there can be no precision unless the part intended is indicated. In this case there is a good synonymy, but the emending author should be cited after the name. It is a pity that references were not given in all cases. I do not know what the author intends by *Draba alpina* var. *glacialis* (Adams) Kjellm. There has been considerable diversity of opinion as to what Adams's plant was, and I do not know where Kjellman's account is: for this reason I consider this plant has not been identified sufficiently for a publication so good as this is. No doubt this merely indicates my own ignorance, but with so many existing species and such a vast modern literature, such ignorance must belong to all systematists, whether they recognise it or not, and identifications should be fuller: the mere citation of an author's name cannot precise the use of a name. However, the work is so full of useful notes that one must not cavil too much at what is a customary weakness.

A few comments based on my own work on the Spitsbergen flora may be useful. I certainly do not consider *Cochlearia arctica* and *C. grœnlandica* to be varieties of *C. officinalis*. I have *C. grœnlandica* in cultivation, and it retains its minute size and slow growth, and also has fewer chromosomes than any other *Cochlearia*. This genus requires cultivation. One may add that there is no *C. grœnlandica* in Britain, although it has been recorded several times. It is quite unlike any British plant.

The *Cardamine pratensis* of high latitudes is not likely to be the var. *dentata*; cf. Kerner in Fl. Exsicc. Austro-Hung. 886, where only *C. pratensis* is given as occurring in the North, while *C. dentata* is restricted to Central Europe. But, again, there is no reference given to indicate why this name was given.

The Drabas are those which I had identified among large numbers collected in Spitsbergen, with the exception of *D. alpina* var. *glacialis* commented on above, and *D. rupestris*, which I have not so far seen except from Ben Lawers. But this last determination may be correct, as I have not seen many foreign specimens so named.

There is no mention of *Hesperis pygmæa* Hook. (*Sisymbrium pygmæum* of Fielden exsicc. from Belusha Bay, Lukke Land). This list may only contain such species as were collected on this expedition and not be a complete list of the flora.

There is no note on the number of stamens found in *Chrysosplenium alternifolium* var. *tetrandrum* (Lund), which is the only *Chrysosplenium* recorded. Dried material seems to indicate that the number is not so constant as the name indicates.

A long note on *Catabrosa* (*Phippsia*) *algida* does not seem conclusive as to its distinctness from *C. concinna*. The extremes are very distinct, but in Spitsbergen there seem no characters by which one can separate them. The characters given in the various works on the Spitsbergen flora all break down, and certainly the description of *C. algida* is wrong, as Lynge states.

The genus *Poa* was determined by Prof. C. Lindman. He makes four species:—*P. abbreviata*, *P. alpigena*, *P. alpina*, and *P. arctica*, and considers all the viviparous forms as the result of hybridisation. *P. abbreviata* and *P. arctica* are plentiful in Spitsbergen, and are certainly well-marked species. But the evidence that the viviparous forms are due to crossing seems very slender. It is far more likely to be correlated with the humidity of the atmosphere. In the very wet summer of a few years ago I received numerous grasses in a viviparous condition, which were certainly not the result of crossing. I also received *Scirpus cæspitosus* in a similar condition from the West Coast of Scotland. The arctic Poas are a very difficult group, but I think this solution is too easy a way out of the difficulty.

Besides the new *Salix* hybrids, a new form (*glabrata*) of *Ranunculus auricomus* is described and a new species of *Taraxacum* (one of five listed). The additions to the flora include *Ranunculus reptans*. A list of stations additional to those mapped, a tabulated distribution list, and a good bibliography complete the text. The plates include some good representations of plants and numerous photographs of habitats and plants.

In conclusion, it may be said that the work is clearly printed on good paper, while the English is also very good and misprints are scarce. Spitzbergen is a mis-spelling throughout. It is a Dutch name, and there is no justification for the Germanised form.

A. J. Wilmott.

The History of Protozoology. By F. J. Cole, D.Sc. Oxon, Professor of Zoology, University College, Reading. 8vo, pp. 64, 2 pls. University of London Press, 1926. Price 3*s.* net.

This little volume is the substance of two lectures delivered before the University of London, at King's College, in May 1925. The history of protozoology encroaches on the botanical side of biology, and botanists will find much of interest in Dr. Cole's account of the growth and development of our knowledge of the Protozoa. The early investigators did not distinguish precisely between plants and

animals; O. F. Müller, who discovered the Dinoflagellata in 1773, included in his important monograph on the Infusoria (published in 1786), besides Protozoa and other small animals, Bacteria and Diatoms. Dr. Cole has something to say about the distinction between animals and plants. Though it has been demonstrated that the chlorophyll and its derivatives which may occur in Protozoa and other animals is in nearly all cases due to intrusive Algal cells, or in the form of diffuse pigment derived from vegetable food, it is still possible that the chlorophyll of certain Protozoa may represent a true animal product. The close relation between chlorophyll and hæmoglobin remove any *à priori* difficulty in admitting this difficulty.

The story of Haeckel's famous Gastræa theory provides a warning against the excessive use of the imagination in perverting facts to make them fit in with a preconceived theory. The doctrine of spontaneous generation is traced through its various chapters—"a controversy which has existed in some form since the time of Aristotle, and cannot even now be regarded as extinct." The work of Bütschli and Maupas on conjugation and rejuvenescence is touched upon, and the potential immortality of the Protozoa, which seems established by Woodruff's culture of *Paramœcium* which, begun in 1907, is still proceeding, and up to the summer of 1924 had produced some 11,000 generations, without the intervention of a process of conjugation. Finally, the study of blood-parasites and the work of Ross, Bruce, and others on the life-history cycles have given a tremendous impulse to this special branch of protozoology. Incidentally, the author emphasises the great importance of the study of the systematic side, a lack of a proper knowledge of which has repeatedly proved a serious handicap in the study of these problems.

The two plates represent respectively the Dutch microscopist, Antoni van Leeuwenhoek (1632–1723), "the father of Protozoology," most of whose results were communicated to our own Royal Society in the form of letters, and Émile Maupas (1842–1916).

Practical Microscopy. An Introduction to Microscopical Methods. By F. Shillington Scales, M.A., M.D., B.Ch. Third Edition. Crown 8vo, pp. x, 332, pls. 119. London: Baillière, Tindall & Co., 1926. Price 8*s.* 6*d.* net.

In the present edition this excellent little manual has been brought up to date, especially in the matter of the chapters dealing with the choice of a microscope and the description of the objectives, eye-pieces, and various accessories. These occupy the earlier chapters. The practical optics of the microscope are explained at some length (Chap. VI.), a chapter (VII.) is devoted to manipulation, and another (VIII.) to photo-micrography. The last chapter (IX.) on microscopical technique, explains the general principles of preparation and mounting, section-cutting, and staining. An appendix gives a classified list of the most useful books dealing with the microscope, and also an aperture table and some useful memoranda.

The text is well arranged and clearly printed, and the illustrations are helpful.

BOOK-NOTES, NEWS, ETC.

At the Meeting of the Linnean Society on May 6 two new foreign members were elected—Dr. René Mairé, the eminent French mycologist, now Professor of the Faculty of Sciences, Algiers, and Dr. Wilhelm Ludwig Johannsen, Director of the Plant-physiological Institute in Copenhagen, whose great work on the laws of inheritance, including his demonstrations of "pure lines" in flowering plants, is well known to all students of heredity.

The President announced that at the close of the present session Dr. Jackson would retire from his post of General Secretary, which he had held for the past twenty-two years. The Council had appointed Dr. Jackson "Curator of the Linnean Collections" from the beginning of the new session. Dr. Jackson completed his eightieth year on April 3 last.

Dr. A. W. Hill read a paper on the genus *Lilæopsis* (Umbelliferæ), formerly known as *Crantzia*, a genus of small herbs containing about 14 species, the distribution of which extends from Alaska through the American Continents to the Falkland Is., South Georgia, and Australasia. The earliest specimen was described by Linnæus as *Hydrocotyle chinensis*, a remarkable geographical error.

Mr. R. D'O. Good read a paper on the genus *Empetrum*. The genus has a wide but discontinuous geographic range. In the Northern Hemisphere it occurs almost everywhere above the latitude 40° N.; in the Southern it is found in Western South America below the latitude 35° S., throughout Fuegia and the Falklands, and in the Tristan d'Acunha island group.

Examination of a large number of specimens shows that the individual plants differ considerably among themselves. This variation is due chiefly to the differential development of seven important morphological characters—namely, general habit, degree of hairiness, shape, size, and arrangement of leaves, angle of leaf-insertion, sex of flower, and colour of the berry. There are certain other variable minor characters, but it is to these seven that the noticeable differences between individuals are due. Among these characters there are three distinct types of variation, which may be distinguished as "continuous," "compound continuous," and "discontinuous."

It might be supposed that such variation would result in an enormous number of slightly and equally different forms within the genus. Actually, however, only a very few of the theoretically possible character-combinations occur, and any individual plant can be placed without hesitation into one, and only one, of ten perfectly distinct units. This feature is due mainly to correlated variation (the association of a particular condition in one variable character with a definite condition in some other character), but also to marked geographical segregation, especially in the more isolated parts of the generic range. These phenomena are best expressed taxonomically by recognizing two distinct species, one with a subspecies, a variety, and three forms, and the other with three forms.

The British Empire Vegetation Committee, appointed by the Imperial Botanical Conference, London, 1924, has prepared a

book entitled *Aims and Methods in the Study of Vegetation*, edited by A. G. Tansley and T. F. Chipp, which should be useful to workers on vegetation in all parts of the Empire, and give some idea of the opportunities and methods of work required for a survey and study of the natural vegetation. In order to sell the book as nearly as possible at a price corresponding with the cost of production, the Committee is relying on voluntary methods of distribution. Local distributors have been appointed in overseas portions of the Empire. Copies may also be obtained post free (price 12*s.* 6*d.*) from the Crown Agents for the Colonies, 4 Millbank, Westminster, or from Dr. T. F. Chipp, Secretary to the Committee, 199 Kew Road, Kew, Surrey.

Collection of the Chief Wheats of the World.—The Botanical Department of the British Museum has acquired a set of the specimens of the species, races, and varieties of Wheat, prepared by Prof. John Percival, from the collections grown at the University Farm, Reading, which have been collected from all parts of the world during the last twenty-five years. The collection includes more than 1300 forms, and represents the chief wheats of the world, which have been recently grown or are at present in cultivation.

To celebrate the completion of his eightieth year (on Feb. 14, 1927) by the Abbé Giacomo Bresadola, the distinguished mycologist of Trent, the *Societa Botanica Italiana* and the *Museo Civico di Storia Naturale di Trento* propose to publish a complete set of his mycological plates. The Abbé has sketched from nature new and rare species during the fifty years that he has devoted to the study of Fungi, forming a collection of over one thousand plates, the greater part of which are still unpublished. The publication, the *Iconographia Mycologica*, will be issued under the direction of Prof. G. B. Traverso, Director of the *Flora Italica Cryptogama*; and the first number will be sent to subscribers this summer.

We are informed that the late Mr. W. P. Hiern's collection of foreign plants has been sent to Cambridge, together with all papers relating thereto. His herbarium of British plants, including a large number of Devon specimens, has been given to the Exeter Museum. The papers referring to that have been deposited, together with others of Mr. Hiern's papers, in the Library of the North Devon Athenæum, at Barnstaple. It is to be regretted that Mr. Hiern left no directions as to the disposal of his herbarium and the large series of notes that he had accumulated with a view to the preparation of a County Flora. The separation of notes and specimens indicated by the above arrangement will not facilitate the production of the Flora should this be possible at some future time; but we understand that the Directors of the Athenæum are prepared to lend papers, &c., if they are required at any time for serious study.

[Owing to the delay and inconvenience caused by the General Strike, it has not been practicable to supply a full number of the *Journal* this month. The Supplement on Gossweiler's African plants will be continued in the July number.]

THE GENERA CHALAZOCARPUS AND SCHUMANNIOPHYTON.

By R. D'O. Good, M.A., F.L.S.

Among the plants collected by Welwitsch in the Cazengo district of Angola in 1855 were three specimens, consisting of leaves and fruits, of a Rubiaceous plant. From this scanty material Hiern, in 1898, described the genus *Chalazocarpus* (Welw. Afr. Pl. i. 464). The original description was not accompanied by any plate or any indication of the plant's affinities, except that it was inserted between the genera *Macrosphyra* and *Oxyanthus*. The reason for this is not quite clear, since the plant, so far as it was known, differed from *Randia* or *Gardenia* only in the 4-celled ovary.

Just previously to this, in 1896, K. Schumann had published the genus *Tetrastigma* (Engl. Bot. Jahrb. xxiii. 444), based upon a flowering specimen collected by Zenker in the Cameroons. The author placed the new genus between the two genera *Randia* and *Oxyanthus*, the difference from the former being the 4-celled ovary and from the latter the club-shaped corolla-tube and the number of corolla-lobes. The generic name *Tetrastigma* was, however, preoccupied by a Chinese genus of Ampelideæ by Planchon. Harms, therefore, in the 1897 *Nachtrage* of the *Pflanzenfamilien*, p. 313, replaced it by the generic name *Schumanniophyton* and the plant from the Cameroons became *S. magnificum* (K. Sch.) Harms. The plant was next collected by the Talbots in Southern Nigeria, and this specimen was described by Wernham in 1913 (Cat. Talbot Niger. Pl. 45) as a new species of *Randia*, *R. immanifolia*. The Talbots again collected the plant a little later.

In the collections made in Angola and Portuguese Congo by John Gossweiler now being worked out at the British Museum (Natural History) is a specimen of *Schumanniophyton magnificum* and also a flowering specimen of *Chalazocarpus hirsutus* Hiern. It has thus been possible to complete the description of this genus, and it is at once apparent that the two species are congeneric and that the name *Schumanniophyton* (1896), having priority, must replace the name *Chalazocarpus* (1898).

A third species of Rubiaceæ collected by Bates in the Cameroons differs from the above only in the trimerous flowers. Such a difference, when associated with very marked resemblances in other points, can scarcely be considered of generic value, and the plant therefore represents a third species of the genus.

The most striking feature common to all three species is the arrangement of the leaves and the flowers. The leaves are large and few in number, in one species appearing only after flowering. They are borne in what may be termed pseudo-whorls of three at the apices of the branches. Each pseudo-whorl consists of a lower pair of leaves, and just above them one individual of a second and opposite pair. The second leaf of this pair is absent, and in its place are two woody persistent stipules, between which the flowers are produced, in apical clusters and more commonly sessile.

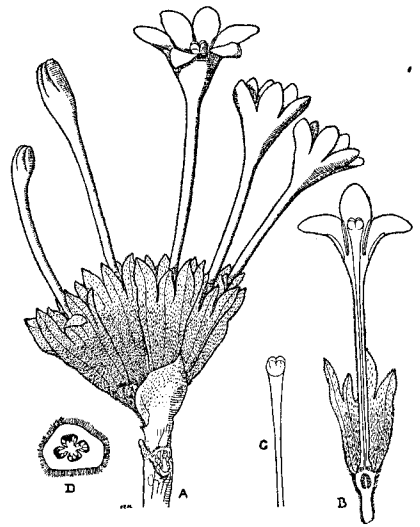
The following is a revision of the taxonomy of the genus in th light of our present knowledge:—

Key to the Species.

Leaves hairy, rounded at the base, appearing after the flowers	*S. hirsutum* (Hiern) R. Good.
Leaves glabrous, cuneate and auricled at the base, appearing with the flowers.	
Parts of the flower in fours	*S. magnificum* (K. Sch.) Harm
Parts of the flower in threes	*S. trimerum* R. Good.

SCHUMANNIOPHYTON Harms emend. R. Good (*Tetrastigma* K.Sch *Chalazocarpus* Hiern).

Folia magna apice ramorum pseudo-ternata. Stipulæ lignos persistentes inflorescentiam terminalem cingentes. Ovarium 3- v



Schumanniophyton hirsutum (Hiern) R. Good.

A. Inflorescence, ⅓ nat. size.
B. Flower in section, ⅓ nat. size.
C. Style and stigma, ⅓ nat. size.
D. Transverse section of ovary ×2.

4-loculare, ovulis numerosis angulo interno affixis. Calyx irre lariter 6–8-lobatus vel denticulatus. Corolla infundibulariform hypocrateriformis superne ampliata 6–8-lobata, æstivatione conto Stamina infra sinus loborum corollæ in dilatatione affixa; anth lineares rima longitudinali dehiscentes. Stilus tubo corollæ æqu apice in stigmata 3 vel 4 divisus, disco plano vel subconico.

S. MAGNIFICUM (K. Sch.) Harms (*Randia immanifolia* Wernha A shrub or small tree of 3 to 4 metres height, with enorm leaves up to 1 metre long and whitish or lemon-yellow coroll

CAMEROONS: among the undergrowth of the primæval forest, near Yaunde Station, in fl. December, *Zenker*, 441! SOUTHERN NIGERIA: Oban, *Talbot*, 189! Degema District, *Talbot*, 3681! PORTUGUESE CONGO: a rare shrub growing in the shade of the forest-trees near Malize, Mayumbe, in fl. March, *Gossweiler*, 7023!

S. trimerum R. Good, sp. nov. *Frutex* glaber; *stipulis* ovatis acutis intus hirsutis; *foliis* utrinque glabris lanceolatis acutis basi longe cuneatis auriculatis, venis secondariis utrinque 25–30 arcuatis; *floribus* sessilibus; *calyce* hirsuto tubo cylindrico 6-denticulato; *corolla* subglabra tubo longo angustissimo supra expanso et incrassato, lobis 6 lineari-lanceolatis marginibus ciliatis; *staminibus* inclusis, antheris subsessilibus lineari-acutis; *stylo* supra expanso, stigmate 3-diviso; *ovario* hirsuto angulato 3-loculare.

Hab. CAMEROONS: "shrub less than a man's height; in forest," *fide* Erigolo, who says, "the branches fall off, leaving a single stem." Mulu name "tite-moto." Corolla greenish white. 3 Feb., 1920. Bitye, River Ja, *Bates*, 1551! Collected again by the same collector in the same region in 1925.

Leaves 40 × 14 cm., paler below. Stipules 1–1·5 by 1 cm. Corolla-tube 5–6 cm. l. by 3 mm. in diameter for most of the length. Lobes about 1 cm. l. Calyx about 5 mm. l., teeth minute.

S. HIRSUTUM (Hiern) R. Good, comb. nov. et emend. (see figure). ... inflorescentia fasciculata ante folia; *floribus* pedicellatis fasciculatis ad apicem ramorum; *stipulis* lignosis intus rubro-hirsutis ovatis acutis; *pedicellis* dense hirsutis; *calyce* hirsuto late campanulato, limbo irregulariter 8-lobo, lobis lanceolatis acutis tubo æquantibus; *corolla* extus pubescente, tubo albido angusto apice infundibuliformi, limbo brunneo 6-lobo, lobis ovatis; *antheris* linearibus obtusis; *stylo* gracile tubo corollæ æquante supra leviter gradatim crasso, apice 4-diviso; *ovario* conico extus dense hirsuto 4-loculare.

Hab. ANGOLA: sporadic and rare in the very dense forests among the higher mountains of Serra de Muxaula, Cazengo, *Welwitsch*, 4744! PORTUGUESE CONGO: here and there in forests in mountainous situations at Buco Zau, Mayumbe, fl. Sept., *Gossweiler*, 1730!

Flowers with a whitish-green tube and a brown limb. Pedicels 1–1·5 cm. l. Calyx-tube 3 cm. l., lobes up to 2·5 cm. l. by 8 mm.; corolla-tube 10 cm. l. by 2 cm. in diameter at the throat, lobes 1·5 l. by 1 cm.; anthers 1·2 cm. l.

The specimens consisting of leaves only, *Welwitsch*, 4746, from Golungo Alto, and *Welwitsch*, 4747, from Pungo Andongo, possibly represent a fourth species of the genus.

All the specimens cited are in the British Museum Herbarium.

REPRODUCTIVE MECHANISM IN LAND-FLORA.

IV. Sporogonia (*concluded from* p. 136).

By A. H. Church, M.A., F.R.S.

Two special features are left to consider as confirmatory of the preceding deductions—(1) any evidence bearing on the originally free condition of the sporophyte, as being attached to the soil by rhizoids, (2) evidence as to the possible dichotomy of the shoot-apex. Curiously enough, *Anthoceros* was the starting-point of Hofmeister (1851)[1], and it is to the Anthocerotæ that one looks more particularly for the first of these possibilities. The idea that *Anthoceros* had rhizoids at the base of its sporophyte-axis has been familiar since the researches of Leitgeb (1879)[2], similar elongated units as haustorial cells being figured for the three genera, *Anthoceros*, *Dendroceros*, and *Notothylas*; and, though these are probably only a consequence of the very intimate haustorial connection, the suggestion that if the gametophyte were short-lived these might take water directly from the substratum, or even penetrate the thin parental thallus, appears unavoidable. Campbell[3] rather vaguely alludes to these cells as 'root-like processes,' and records experimental cultures of *Anthoceros* sporogonia in damp soil for over three months, though they made little growth. More recently he has described a plant of *A. fusiformis*[4] as attaining a length of 6 inches, in which the foot-region was partly denuded from the drying gametophyte, and was produced into a swollen and lobed foot-base resembling a 'protocorm'; thus distinctly suggesting that the sporogonium had become 'practically independent.' Where this species grows abundantly, with sporogonia 2–3 inches high, presenting the appearance of a tuft of fine grass, it it is difficult to avoid the impression that these structures were once free and independently attached to the soil.

For evidence of possible dichotomy of the sporogonium-apex reference may be made to cases of twin moss-capsules which have been described as teratological phenomena since 1814[5]. Such twin capsules, borne on the same gametophyte axis, often very loosely described, may be due to many causes; but where these are enclosed in the same calyptra and vaginula the choice lies between two interpretations. Either one has to deal with a case of the fertilization of two collateral oospheres in the same archegonium[6], or the single

[1] Hofmeister (1851), *Vergleichende Untersuchungen*.

[2] Leitgeb (1879), *Untersuchungen über die Lebermoose*, Heft 5, Die Anthoceroteen.

[3] Campbell (1918), *Mosses and Ferns*, Edit. iii. 136.

[4] Campbell (1924), *Annals of Botany*, 480. It may be noted that Campbell even imagined he saw in *Anthoceros* a stage leading to Eusporangiate Filicineæ as a "Pro-Ophioglossum": *The Eusporangiatæ* (1911), 210.

[5] Penzig (1922), *Teratology*, iii. 570.

[6] Lyon (1905), *Bot. Gazette*, xxxix. 365; collateral oospheres in *Sphagnum*.

embryo has bifurcated at some time, as a true dichotomy of the apical cell. Twin capsules of this type have been recorded for many genera (*Bryum*, *Dicranum*, *Polytrichum*, *Sphagnum*, etc.)[1]. Even the fusion of two collateral oospheres or embryos more or less completely in the stalk-region (seta) is not inconceivable, though it would evidently give rise to a form of Moss-chimæra; but where the forking takes place in the spore-region it is difficult to avoid the conclusion that true dichotomy has occurred. As a matter of fact, very similar dichotomy occurs as an atavistic freak in floral axes and even capitula of higher Angiosperms, though often perversely recorded by teratologists as 'synanthy.' It is important to note that such dichotomy, as expressing the equal division of a growth-centre (binary fission), can never appear as a wholly new morphological departure, but must be regarded as an atavistic appearance of an archaic growth-factor. Though of less satisfactory value, it is interesting to note that, while the sporogonium of *Anthoceros* dehisces by two valves, Jungermanniæ and *Tetraphis* by four, and *Andræa* also by four clefts; these numbers may indicate the retention of older principles of free binary ramification, or they may be merely dependent on primary lines of binary cell-segmentation; but it is significant that capsules do not split along three lines or five. The apical cell in Mosses is two-sided, and not three-sided as in the gametophyte axis, the latter scheme rendering pure dichotomy difficult; while the scheme of cell-segmentation itself may be correlated with an older plan of binary division, as in the case of the Laminariaceæ, where cleavage of the lamina at the intercalary growing region into strips begins by following lines of previous dichotomy into two and then four (*L. flexicaulis*), as the expression of somewhat comparable principles[2].

It remains to consider the mechanism of tetrad-formation in such sporogonia, and the arrangement of the spore-mother cells, which in all cases arise from a *non-segmented* archesporial tract in a radially constructed shoot, and hence associate the capsule with the term *sporogonium*. Schleiden long ago pointed out the strict homology of this tract as a layer of immersed spore-tetrads ('sporangia,' as he conceived them), and there is every reason to believe that he was

[1] Penzig (1922), *Teratology*, iii. 572. Brizi (1893) for *Tortula subulata*.

[2] It is difficult to see how such a phenomenon as dichotomy can ever arise *de novo*, though as the retention of an archaic method of stem-division it is readily interpreted. All older types of ramification date to the benthic period of the sea, the oldest method apparently being the wholly irregular production of outgrowths without implying any mechanism of apical control. Traces of this method survive in Land Flora as the casual 'adventitious' branch. With the evolution of a dominant growing apex, dichotomy appears as the simple adaptation of binary fission to such a centre of more massive cell-organization. Hence dichotomy may occur as an atavistic mutation at any horizon or in any member or axis. It is retained as the still dominant method of stem and root ramification in Lycopodineæ, in leaf-venation as far as *Ginkgo*. Even among Angiosperms it may occur sporadically in stems, inflorescence-axes, and floral receptacles, as also even casually in foliage-leaves with forked midrib of tree-types: *Bot. Mem.* x. (1920) 44.

right. The tetrad mother-cells (tetrasporangia) are well immersed beneath wall-tissues; and they are now combined to constitute a new and secondary structure in which the entire spore-aggregate is protected, nursed, and finally discharged from a communal organ which thus attains definite mechanism for these purposes. Once the essential significance of meiosis in the life-cycle is appreciated, it is obvious that the most thorough methods for securing uniformity of developmental conditions, food-supply, as also protection from desiccation and the chances of the external medium, become the more insistent as the shoot-systems are removed from water and exposed to the open environment of subaerial conditions. Hence the definite sinking of the archesporium below a more specialized and resistant epidermis or wall-layer is correlated with increased precision in its delimitation, the provision of feeding-layers (in this case 'elaters' and 'spore-sacs'), and the subsequent evolution of a new subaerial mechanism of emission and dispersal for cutinized spores in more or less dry air, by phenomena of tensions of tissues, whether the latter be dead or living.

It is this elaboration of a new communal mechanism which gives the archesporium its 'morphological dignity.' At the same time it serves to mark the connection of the land-form with the older story of the sea, as it also renders comparison of effective spore-output difficult. In the sea the tetraspore output of the diploid stage (*Dictyota*, Florideæ) is for the most part continuous, and the entire photosynthetic work of the diploid organism (beyond mere growth to an adult condition) is put into spore-production. The total output may well be astonishing. Reduced to the sporogonial type[1], in which growth to maturity and discharge of spores is now associated with climatic factors, and may take place within a restricted time period, it is evident that, though simpler forms may give one such discharge, the aim of increasing specialization will be to promote a graded distribution. It is interesting to note that among the three leading types of Bryophyte growth-forms, *Sphagnum* has no special grading mechanism, *Anthoceros* gains it by the secondary intercalary growth of the base of the sporogonium; while more dominant Eu-Bryineæ elaborate many beautiful and effective types of peristome-mechanism to the same end (*Buxbaumia*, *Funaria*, *Dawsonia*, *Polytrichum*).

The method of continuing the mental processes of older systematists, and thus building up a story from the presumed simplest forms (as in the *Riccia*-story of antitheticists), has still much to answer for; and nowhere, perhaps, more than in the attention paid to the segmentation of the diploid embryo into *amphithecium* and *endothecium*—the latter being regarded for some obscure reason as

[1] The spore-output of the capsule of *Polytrichum formosum*, with 2-layered archesporium, may be estimated at 430,000 spores; that of the *Funaria* capsule as 320,000. The sporogonium of *Pellia epiphylla* (1·5 mm. long) gives some 10,000; that of *Lophocolea bidentata* (less than 1 mm. long) 2,500; and *Anthoceros lævis*, attaining a length of 20 mm., may be estimated at an output of 10,000.

peculiarly sacred to spore-production. That this is the case in a multitude of minor forms (Jungermanniæ, Marchantiæ) is well-known; but its interpretation only suggests that in these reduced types extreme precocity of spore-formation obtains, the more as the photosynthetic tissues of the parent are restricted, and the archesporium is hence marked off at an early date by the first periclinal wall. Types in which it is not so precociously delimited, and which retain a fuller degree of photosynthetic activity, are more likely to be the main line of progression. While among the Eu-Bryineæ the rule is that the archesporium is derived from the outer layer of the endothecium, *Sphagnum* and *Anthoceros* are curiously alike in that it comes equally constantly from the inner layer of the amphithecium. In both cases this presupposes that these tracts have been previously defined in segmentation, as also that there is a central region (later designated as a *columella*) which is not spore-producing at all. The archesporium is initiated as a uniform immersed layer, which, if anything, in modern Mosses is becoming more deeply sunk, *i. e.* protected by a more efficient wall-region[1]; while the central cells as in an algal soma are relegated to a storage function, as they divide little, but may increase in volume, since but little photosynthetic.

Though initiated as a single layer, and retained as such to give a single layer of tetrads (*Anthoceros lævis*), further division is the rule in Bryales—*e. g.*, to two layers (*Funaria*, *Polytrichum*, as also *Anthoceros fusiformis*) or four (*Sphagnum*), thus increasing the single sporogenous layer to a more definite archesporial *tissue*. This is the feature which at first sight seems far removed from the original idea of immersed tetrasporangia, though perhaps paralleled in Floridean types with nemathecia; and such a local multiplication of meiotic tetrads in a three-dimensional sorus becomes the general attribute of sporangial formation in other land-flora. It is at this stage that increased output of spore-tetrads, if any, as hypothetically demanded by the stress of transmigration, is arranged for. The tetrasporangia themselves have been evidently too long restricted to their limiting output of a single tetrad to go back on their history and produce more spores[2]. Similarly, compensation for wastage would be preferably made by adding more tetrad mother-cells, in the event of restricting one such sporogonial organ to the shoot-apex.

Granted such secondary necessities, and an older algal specialization of the diploid shoot-system, it is interesting to note the production in both *Sphagnum* and *Anthoceros* of a dome-shaped archesporial layer, which, again, runs parallel with the case of the Eu-Bryineæ. In the latter a cylindrical archesporium is capped by a peristome region which occupies the top of the dome-layer; while a remarkably good example of a dome-shaped archesporium of an

[1] *Cf.* Bower (1908), *Land Flora*, 271. The archesporium is conceived in *Sphagum* and *Anthoceros* as becoming more *superficial*, though the benefit of such a proceeding is not stated—an academic view following Leitgeb and Goebel.

[2] Even among the Florideæ the case of *Pleonosporium* remains doubtful until its cytology is known.

undoubtedly early moss-type with no subsequent peristomial complications is seen in *Andreæa*. Hence for primitive Bryophyta, with a massive and fully photosynthetic diploid phase, the archesporium, differentiated as an immersed layer in the endo-cortical region, leaving a sterile central tract of storage-tissue (*columella*), as a dome-shaped tract or single layer of meiotangia, may be taken as normal. The implication of such a tract is significant, since the continuation of such a layer over the apex of the shoot means that the latter has ceased growth. Its short life-period closes abruptly in spore-production. That this, again, is to be associated with the same climatic stress which has produced the communal mechanism of the sporogonium, with its time-relations of spore initiation, development, maturation, and discharge, appears clearly unavoidable.

Hence, from several different standpoints, one reaches the conclusion that the nearest approach to the more primitive Bryophyte sporogonium at present growing on the world's surface is to be found in the Anthocerotales. The gametophytes of these forms are admittedly reduced to almost the last phase of dorsiventral leafless thalloid growth and dichotomous ramification, and the sexual organs are of admittedly inferior grade; but *Anthoceros* presents the only embryo which is not enclosed in the bondage of a calyptra—secondary growth in the archegonial region merely builds a sheath which serves to guide the basal merismatic region of the capsule. In *Anthoceros* alone the sporogonium grows to a green shoot, 2–3 (6) inches high in *A. fusiformis*, with potential photosynthetic equipment and stomata, in the manner of a cladode construction; though it presents no apical cell or any indication of apical ramification. The columella is a mere strand of 'central cells,' and there is no elaborated dehiscence mechanism or peristome, though spore-discharge may be graded by the introduction of continued basal growth.

In this manner the scheme of Bryophyte progression may be conceivably readjusted; the curious ancestral bias in favour of the *Riccia*-myth may be wholly discarded in place of something more strictly evolutionary. Many features in the specialization of the Moss-capsule are placed in clearer perspective, and the minor capsules of Jungermanniæ and Marchantiæ, their elater-mechanism and massive subspherical aggregates of sporogenous tissue, are seen to be on the whole distinctly downgrade. Their special features of spore-nutrition and water-supply of a subspherical spore-mass fall into line with those of the sporocarps of Mycetozoa (*Trichia*) and similar condensed fructifications, though on a larger scale, in Gastromycetes with capillitium.

The subject is not entirely closed by the interpretation of such obviously restricted living types of Bryophyta. In recent years considerable light has been thrown on the matter by the discovery of fossil forms, which seem to amplify the record and probably really afford a view of an older race in which algal somatic characters were more clearly represented in the sporophyte and the diploid phase was freely photosynthetic and independently attached to the soil.

Such plants as *Rhynia* and *Hornea* from the Devonian of Scotland[1] thus fill in the distant perspective of this curious group of Land-flora, as exemplifying older types which persisted well into the Palæozoic.

Rhynia and *Hornea* between them present all the characters deduced as significant for early Bryophyta, so far as the sporophyte-stage is concerned. The plants were free-growing, 6–8 inches high, the stems of *Rhynia* being 1–6 mm. in diameter. They were attached to the soil by rhizoids, and the reproductive axes erected from the creeping base as radially organized shoots, branching dichotomously once or twice, as a distinctly alga-like cladode organization (*Furcellaria*), with photosynthetic tissue, stomata, and intercellular spaces. These shoots presented limited growth, their tips were closed, and each terminated in a *sporogonium*. The archesporium ran dome-shaped over the ends (*Hornea*), and the spore-tetrads were normal; the ripe spores were of average size (*Hornea* 50 μ, *Rhynia* sp. 45 or 60 μ). Nothing could be seen of any special method of dehiscence; hence it was probably as simple as in the case of *Anthoceros*. The dimensions of the sporogonium, 12–15 mm. long, are again intelligibly of the order of a fine Moss-capsule, but are quite out of perspective as indicating an elementary Pteridophyte sporangium.

Hornea is, in fact, little more than a slightly ramified and free-growing *Anthoceros*, with a bulbous 'foot' and a considerable extension in the erect shaft for elevating the ripe sporogonia, which is clearly of intercalary order.

The only objection to such an interpretation is the presence in the main axis of tracheidal cells with ring-thickenings, which appealed to Kidston and Lang as exemplifying a suggestive stelar tract. But, in absence of any evidence of lignification, it is interesting to point out that such ringed cells are the commonplace of modern Bryophyta, if not actually in the same position. As identical cells are found in the sporogonial wall and at the base of the elaterophore of *Pellia*, it would not be so very surprising to find them also in the stalk of the capsule. The same class of water-storing and water-conducting banded cells, or their spirally thickened homologues, are the familiar equipment of the gametophyte of *Sphagnum* and the rhizoids of *Marchantia*; while in Jungermanniæ and Marchantiæ they play the same part as 'elaters' among the sporogenous tissue of the capsule. That such tracheidal cells may be freely lost in the more decadent

[1] Kidston and Lang (1917), Proc. Roy. Soc. Edin. 761, (1920) 603. Curiously enough, these authors, responsible for the original description of these fossils, were so deeply impressed by suggestions of tracheidal cells in the stems that they rushed to the conclusion that the plants must be vascular, and therefore to be placed elsewhere among the Pteridophyta; while the mechanism of the spore-regions, which presented an undoubted dome-shaped archesporium (*Hornea*) was considered as of less phyletic significance than ringed 'tracheides,' which could not even be proved to be lignified. No one disputes that these plants were wholly axial in nature, and the sporogonia terminated the shoots, closely resembling in size and organization a generalized Bryophyte sporogonium which is like nothing else on earth. The obvious relation to such a form as *Anthoceros* has been pointed out by Campbell (1924), with the curious dictum that *Rhynia* is 'derived' from *Anthoceros* and is a link with the Pteridophyta.

and dependent forms of sporogonia may be freely granted (as, in fact they are in *Riccia*).

Reproductive mechanism is, again, normally the more conservative and, in choosing between the phyletic merits of hypothetically lignified tracheides and a true axial sporogonium with a dome-shaped archesporial tract of tetrads, the verdict must infallibly lie with the latter.

Hence while *Rhynia* and *Hornea* have been recovered to point the way the Bryophyta have come, the form which to-day retains a majority of primitive characters (since no really primitive form can now exist) is found among the curious Anthocerotales. The further evolutionary specialization of the *capsule*, which gives the modern Moss its familiar aspect, is largely secondary. To its high degree of specialization for spore-nutrition and graded emission modern Mosses owe their dominance under special conditions of environment. The deteriorated subspherical capsules of dorsiventral Jungermanniales, *Marchantia* and *Riccia*, are in no sense 'primitive'; their apparently 'simple' features merely exemplify the continued deterioration of an autotrophic organism when enclosed within the calyptra, thus rapidly reducing to the category of a subspherical capsule as a mere spore-producing organ, to be left finally as but a vestige of the original algal transmigrants, in which it is difficult even to homologize what is left (*Riccia*). Some simple factors of organization may be retained when all else is lost, but it does not follow that a decadent type reverses the story of its original progression in the same sequence as that in which it was evolved.

CORNISH MOSSES AND HEPATICS.

By Francis Rilstone.

The following notes and records are supplementary to those published in this Journal in January 1919. For reference to plants in the Penzance area I am indebted chiefly to Dr. W. Watson, who stayed at Penzance during 1921 and kindly furnished me with a list of the bryophytes he found, and to Mr. J. B. Duncan, who collected in the same district in 1922. Some reference will also be found to the collection of West Cornwall mosses made by W. Curnow and presented to the Penzance Natural History Society, in whose Museum the collection is preserved, and to Cornish gatherings of the late Llewellyn J. Cocks, whose collection of bryophytes has been given me by his daughter, Miss C. M. J. Cocks. The numbers in brackets refer to the vice-counties—West Cornwall being v.c. 1 and East Cornwall v.c. 2.

Mosses.

Oligotrichum hercynicum Lam. Earthy banks by ponds near the Cheesewring (2). This locality is about three miles from St. Cleer, where Mr. R. W. Smitham first found the plant in 1918.

Polytrichum nanum Neck. Silverwell (1), Trelawne, near West Looe River (2).

P. formosum Hedw. Dr. Watson collected this plant in West Cornwall in 1921 from Castle-an-Dinas, Trevaylor, and Lamorna (1), and it has since been found by Mr. J. B. Duncan.

Diphyscium foliosum Mohr. Earthy banks by West Looe River (2). — Var. *acutifolium* Lindb. Castle-an-Dinas, between Penzance and the Land's End (1), W. Watson.

Ditrichum homomallum Hampe. Earthy banks near Polperro (2).

D. subulatum Bruch. Messrs. H. H. Knight and W. E. Nicholson collected this plant in 1923 from a new station at Porthkea near Truro (1). In a note-book compiled by Mr. H. Angwin of Newlyn, I find the record "Sunny Corner, Truro, R. V. Tellam." Sunny Corner is on the eastern side of Truro River (just opposite Trethowell, the station mentioned in Braithwaite's *British Moss Flora*) and is thus in v.c. 2. The plant also occurs between Pont and Bodinnick on the eastern side of the Fowey River (2).

Rhabdoweisia fugax B. & S. In R. V. Tellam's list of East Cornwall Mosses, published in the *Transactions of the Penzance Natural History Society*, this plant is recorded from St. Breock (2).

Dicranella cerviculata Schp. var. *pusilla* Schp. Goonhavern Moor (1).

D. varia Schp. Not infrequent in the neighbourhood of Polperro (2).

D. Schreberi Schp. Penzance (1), J. B. Duncan; Fowey (2).

Dicranoweisia cirrata Lindb. Various localities near Penzance (1), H. Angwin and W. Watson; Kilmar Tor (2).

Blindia acuta B. & S. Wet rocks on the cliffs, Zennor (1), Aug. 1896, Ll. J. Cocks.

Campylopus flexuosus Brid. var. *uliginosus* Ren. c.fr. in a moor near Calamasag (2); common, but barren in damp ground between Kilmar Tor and Bearah Tor (2).—Var. *zonatus* Limpr. Kilmar Tor (2).

C. introflexus Brid. A specimen of this from Kymyal Cliff (1) labelled *C. polytrichoides* is in the Curnow Collection in the Penzance Museum.

Fissidens incurvus Starke. Newlyn (1), W. Watson.

F. Curnowii Mitt. Mousehole (2), W. Watson. A gathering from this station is in the Penzance Museum.

F. serrulatus Brid. Mr. Duncan was unable to find this in Mousehole Cave in 1922, so it may have disappeared from that station since Curnow's time. I have in my possession a specimen gathered at Castle Horneck (not Hornoch, as in Braithwaite's *British Moss Flora*) in 1896.

F. adiantoides Hedw. Tremithick Moor; bog near Mousehole Cave; Chy-an-hal; between Lelant and St. Ives; near Connor Downs (1), H. A. Angwin.

Some fine stems gathered as *F. serrulatus* from Mousehole Cave have proved to be this plant.

F. decipiens De Not. Several places near Polperro (2) in ban and hill-sides.

Grimmia apocarpa Hedw. Noted by Angwin as scarce in We Penwith; Penzance (1), Watson.

G. pulvinata Smith. Not common in West Penwith, and whe occurring only found in small quantities, H. Angwin; The Liza (1), Watson.

G. Mühlenbeckii Schp. Kynance Cove (1), Ll. J. Cocks.

G. subsquarrosa Wils. Land's End (1), Watson; Tintagel (2).

Rhacomitrium aciculare Brid. This plant occurred on a tr branch overhanging the stream in Trevaylor Bottom (1), Watson.

R. canescens Brid. var. *ericoides* B. & S. Madron (1), Watson Tresawzen, Perranzabuloe (1).

Acaulon muticum C. M. Roadside bank, Callestick (1).

Phascum cuspidatum Schreb. Garden near Perranzabulo Church (1).

Pottia Heimii Fürnr. Chapel Rock, Marazion and near Mara zion Bridge (1), H. Angwin; by West Looe River (2).

P. viridifolia Mitt. Penzance (1), L. H. Pegler.

P. Wilsoni B. & S. Marazion (1), by the road to Helston (1) 1897, Ll. J. Cocks.

P. commutata Limpr. Marazion (1), 1897, Ll. J. Cocks.

Tortula ambigua Angstr. Very common on tops of walls abou Penzance (1), H. Angwin; Sheffield, near Penzance (1), or thatch W. Watson; Nanpean (2).

T. atrovirens Lindb. Newlyn (1), W. Watson; Kynance (1) Ll. J. Cocks; Kellow Hill, Polperro (2).

T. subulata Hedw. Madron (1), W. Watson.

T. lævipila Schw. var. *lævipilæformis* Limpr. Lansallos; Pol perro; Talland (2).

T. intermedia Berk. Paul, Penzance (1), W. Watson.

T. ruraliformis Dixon. Lelant Towans (1), W. Watson. Cur now's gathering of this plant in Penzance Museum is labelled *T. ruralis* (*v.* Dixon's *Handbook British Mosses*, 204).

Barbula tophacea Mitt. Lelant; Hayle; St. Erth; (1), W. Watson

B. recurvifolia Schp. Mousehole (1), W. Watson; Gear Sands Perranporth (1).

B. rigidula Mitt. Wall tops at Perranporth (1) and Looe (2).

B. revoluta Brid. Budock (1), L. H. Pegler; Polperro (2) sparingly. I have also seen a gathering of this from the Davidstow district (2).

B. convoluta Hedw. Penzance (1), W. Watson.—Var. *Sardou* Sandy cliff, Lelant (1), W. Watson; Polperro (2).

Weisia microstoma C. M. var. *elata* B. & S. Perranporth (1) Rev. H. H. Harvey.

W. crispata C. M. Kynance Cove (1), W. Watson.

W. viridula Hedw. Sheffield, near Penzance (1), W. Watson This is a common plant in most parts of the country.

W. mucronata B. & S. Lizard Downs (1), H. H. Knight and W. E. Nicholson.

W. calcarea C. M. var. *mutica* Boul. Mr. H. H. Knight detected this plant in some tufts I sent him from Perranporth Sandhills (1), on which grew the lichen *Placodium fulgens*.

W. verticillata Brid. Penzance (1), W. Watson.

Trichostomum crispulum Bruch. Perranporth Sandhills (1).

T. mutabile Bruch. In many parts of Cornwall, especially within a mile or two of the coast, this moss is abundant and well grown, as at Penzance (W. Watson), and near Perranporth (1) and Polperro (2); sparingly in fruit at Looe (2).—Var. *littorale* Dixon. Common about Penzance, Angwin and Watson; c.fr. at Lamorna (1), Angwin; by West Looe River and elsewhere near Looe and Polperro (2).—Var. *cophocarpum* Schp. Kellow Hill, Polperro (2).

T. tenuirostre Lindb. Carbis Bay (1), W. Watson.

T. flavovirens Bruch. Carbis Bay (1), W. Watson; of frequent occurrence in sandhills at Perranporth (1).

T. tortuosum Dixon. Summit of Rough Tor (2),

Pleurochæte squarrosa Lindb. Recorded by Mr. C. P. Hurst from a spot on the cliff-path between Polperro and Talland (2); the plant is, I find, not infrequent on cliff-slopes between the two places.

Encalypta streptocarpa Hedw. Rose near Perranporth (1).

Zygodon Stirtoni Schp. Kynance Cove (1), W. Watson.

Schistostega osmundacea Mohr. Near Ding Dong (1), W. Watson; Zennor (1), Ll. J. Cocks; in mouths of rabbit-holes and elsewhere on north-facing banks and hedges, Polperro (2).

Ephemerum sessile (B. & S.) Rabenh. Lizard Downs (1), H. H. Knight and W. E. Nicholson.

Funaria fascicularis Schp. St. Michael's Mount (1), W. Watson; Polperro neighbourhood (2), frequent.

Aulacomnium androgynum Schwaeg. Rocks by Liskeard Railway Station (2).

Webera proligera Bryhn. Marazion Marshes (1), W. Watson; Polperro (2).

W. carnea Schp. Lamorna (1), W. Watson.

W. Tozeri Schp. In several places near Perranzabuloe Church (1); c.fr. in two localities near Polperro (2). This is a frequent plant in South-east Cornwall.

Bryum pendulum Schp. Lelant Towans (1), W. Watson.

B. calophyllum R. Br. Marazion Marsh (1), W. Watson.

B. cæspiticium L. Penzance (1), W. Watson; Polperro (2).

B. Donianum Grev. Penzance (1), W. Watson.

B. atropurpureum W. & M. Paul, near Penzance (1), W. Watson.—Var. *gracilentum* Tayl. Polperro (2).

B. murale Wils. Polperro and Talland (2).

B. alpinum Huds. Lamorna (1), below 100 ft., W. Watson.

Mnium affine Bland. var. *elatum* B. & S. Near Sowden's Bridge at head of West Looe River (2).

Heterocladium heteropterum B. & S. A very slender form of this grows in a shaded bank at Trelawne (2); the cell-structure does not agree with that of var. *fallax*.

Thuidium abietinum B. & S. Hayle Sands (1), 1921, W. Wa
son. A gathering from Hayle is included in the Curnow collecti
in the Penzance Museum.

Brachythecium velutinum B. & S. Trevaylor near Penzance (1
W. Watson; near Polperro (2).

Eurhynchium crassinervium B. & S. Penzance (1), W. Watso

E. speciosum B. & S. Newlyn Cliff (1), W. Watson.

E. pumilum Schp. Penzance, W. Watson.

E. circinatum B. & S. Wall-top near Marazion Marsh (1), W
Watson.

E. murale Milde. Penzance (1), W. Watson.

E. megapolitanum Milde. A specimen from Hayle in the Pen
zance Museum; Perranporth Sandhills (1).

Plagiothecium silvaticum B. & S. Trevaylor and Mousehol
near Penzance (1), W. Watson.

Amblystegium Juratzkanum Schp. Lelant (1), W. Watson.

A. varium Lindb. Budock (1), L. H. Pegler.

Hypnum riparium L. Mousehole (1), W. Watson.

H. stellatum Schreb. var. *protensum* Röhl. Polperro and Bodmi
Road (2).

H. aduncum Hedw. var. *polycarpon* Bland. Near Perran
porth (1).

H. fluitans L. var. *falcatum* Schp. Goonhavern Moor (1).

H. uncinatum Hedw. Banks by railway, Liskeard (2).

H. commutatum Hedw. Lelant Cliff, L. H. Pegler; found b
Mr. A. Sutton at Bosinney Cove near Tintagel (2) in 1922.

H. cupressiforme L. var. *resupinatum* Schp. Common and oft
fruiting freely.—Var. *filiforme* Brid. Trevaylor, near Penzance (1
W. Watson; Callestick (1) and Polperro (2).—Var. *ericetorum*
B. & S. Castle-an-Dinas and Lamorna (1), W. Watson; nea
Mousehole (1), J. B. Duncan; near Polperro (2).—Var. *elatum*
B. & S. Gulval Down (1), W. Watson; Gear Sands near Perran
porth (1).

H. cordifolium Hedw. c.fr. at Chy-an-hal near Penzance (1)
1921, W. Watson; marsh at Par (2).

H. sarmentosum Wahl. Specimens of this collected by Curnow
from Trungle Moor (1) are in Penzance Museum; Goonhavern an
Ventongimps Moors (1).

Hylocomium brevirostre B. & S. Trelawne Woods by West Loo
River (2).

Hepatics.

Riccia Crozalsii Levier. Cliff-slopes, Polperro (2).

R. sorocarpa Bisch. Madron (1), W. Watson.

Reboulia hemisphærica (L.) Raddi. Near Lanteglos High
way (2).

Metzgeria furcata (L.) Dum. var. *fruticulosa* (Dicks.) Lindb
Madron, Chysauster, and Trevaylor near Penzance (1), W. Watson
wood at Trelawne near Looe (2).

Pallia Neesiana (Gottsche) Limpr. Chy-an-hal near Penzance
(1), W. Watson.

P. Fabbroniana Raddi. Lizard Downs (1), W. Watson.

Alicularia scalaris (Schrad.) Corda var. *procerior* Schiffn.
Gulval Down (1), W. Watson.

Aplozia crenulata (Sm.) Dum. var. *gracillima* (Sm.) Heeg.
Carbis Bay and Chy-an-hal (1), W. Watson.

A. riparia (Tayl.) Dum. Penzance (1), W. Watson.

Lophozia excisa (Dicks.) Dum. Cliff-slopes, Polperro (2).

Sphenolobus ovatus (Dicks.) Schiffn. Bearah Tor and Sharp
Tor (2).

S. exsectiformis (Breidl.) Steph. Near St. Ives (1), H. H. Knight.

Plagiochila asplenioides (L.) Dum. var. *minor* Lindeb. Pen-
zance (1), W. Watson.

Lophocolea heterophylla (Schrad.) Dum. Trevaylor (1), W.
Watson; tree-trunks near Polperro and at Trelawne (2).

Cephalozia Francisci (Hook.) Dum. Tremithick Moor (1),
May 1914, Ll. J. Cocks.

Cephaloziella byssacea (Roth.) Warnst. and var. *asperifolia*
(Duns.) Macv. Carbis Bay (1), W. Watson.

Prionolobus Turneri (Hook.) Schiffn. Hedgebank at Porthkea
near Truro (1), W. E. Nicholson and H. H. Knight.

Calypogeia trichomanis (L.) Corda. Gulval, W. Watson.

C. arguta Nees & Mont. Trevaylor near Penzance, W. Watson;
sparingly in fruit in a wood at Lambourne (1).

Scapania curta (Mart.) Dum. Paul, near Penzance, W. Watson.

Madotheca lævigata (Schrad.) Dum. and var. *Thuja* Nees.
Kynance Cove (1), Ll. J. Cocks.

Cololejeunea minutissima (Sm.) Schiffn. Trees, Trevellow near
Penzance (1), J. B. Duncan; Kynance Cove and Ruan Valley, both
near the Lizard (1), Ll. J. Cocks.

Microlejeunea ulicina (Tayl.) Evans. On *Ulex*, Chysauster (1),
W. Watson; Pont near Fowey, Polperro, Trelawne, and by the Lynher
River below Newbridge (2).

Harpalejeunea ovata (Hook.) Schiffn. Kynance Cove (1), Ll. J.
Cocks.

Marchesinia Mackaii (Hook.) Gray. On dry rocks, Kynance
Cove (1), Ll. J. Cocks.

Frullania germana Tayl. Zennor (1), Ll. J. Cocks.

F. Tamarisci (L.) Dum. var. *robusta* Lindb. Lamorna and
Chysauster (1), W. Watson.

F. microphylla (Gottsche) Pears. On rocks, Kynance Cove (1),
Ll. J. Cocks.

F. fragilifolia Tayl. Kynance Cove, W. Watson.

Anthoceros lævis L. Newlyn Cliff (1), W. Watson.

MARINE ALGÆ FOUND ON A SALVAGED SHIP.

By Lilian Lyle.

It has been considered that an examination of algal growths on the hulls of ships that had been submerged and subsequently salvaged would prove of interest and throw some light on the Age and Distribution of Marine Algæ.

Having heard that the Monitor 'Glatton,' sunk eight years ago in Dover Harbour, was available for this purpose, I went in April to investigate.

After several attempts, entailing the use of lifting-lighters, barges and 9-inch steel hawsers, the vessel had been raised towards the end of last February from a bed of mud and silt in which it was lying at a depth of 32 feet, with a tidal rise and fall of 19 feet. Some of the growth was scraped off during the salvage operations, and about two months of exposure to atmospheric conditions had evidently killed off much that remained, so that on approaching the 'Glatton,' which was bottom upwards, it seemed almost clean of seaweed. Behind the vessel, however, where there was some shelter from a jetty, a certain amount of vegetation was seen partially clothing the surface, and all the specimens found were collected there. Enteromorphas, Porphyras, and a few seedlings of *Rhodymenia palmata*, etc., represented this spring's growth. Laminarias were about 18 months old, their stalks covered with *Sertularia operculata*. *Delesseria alata*, *Ptilota sericea*, and other plants were thickly overgrown with the Polyzoon, *Membranipora pilosa*. Other creatures belonging to the animal kingdom were also present, such as *Crisia* sp., ascidians, sponges, mussels, crayfish, etc.

In all there were listed about 26 species, belonging mostly to the spring and summer flora already recorded from that coast, with about six additions new to the locality. The following three specimens were of special interest:—

Derbesia tenuissima Crn.—A delicate and rare species found in Devon, Dorset, and Scotland in the British Isles, and at Longlet and Querqueville in the north of France. A luxurious growth covered a portion of a sponge taken from the 'Glatton.'

Antithamnionella sarniensis Lyle was described and figured in the *Journal of Botany*, lx. 347 (1922), as a new genus and species, and a recent arrival on the shores of Guernsey and St. Malo. The distribution of this alga is still unknown. As allied species belong to S. Africa and S. America, *A. sarniensis* has probably come from remote regions. One tuft only was found on this occasion on a pod of *Halidrys siliquosa*. The plant produces abundant spores, and, attaching itself to any alga, grows profusely.

Bryopsis muscosa Lamour., another alga gathered from the wreck, is an inhabitant of the Mediterranean and Adriatic seas. It differs from the British *B. plumosa* in the mode of branching. In the latter, the main stem rising from a few interwoven rhizoidal filaments is undivided, and beset with an indefinite number of branches pinnated in a distichous manner. *B. muscosa* arises from a discoidal felt prolonged upwards into filaments clothed towards the ends with single branches, each being somewhat spathulate in outline.

As the 'Glatton' was lying within the Harbour, and not out in the tide-way or exposed to the influence of currents, it is unlikely that spores or fragment of this plant should have found their way into such an enclosed area and have settled on the wreck at Dover. Moreover, as no other specimens have been found in the neighbouring districts, *B. muscosa* is evidently not settling on our shores, as might have happened had currents been responsible for carrying spores or portions of plants.

To account for the presence of this alien, the following suggestion is offered:—The 'Glatton,' while visiting the native waters of the alga, may have carried off fragments adhering to its sides and continuing to grow. Travelling hither and thither, the ship with its "attaché" arrived at Dover. During the years of submergence, the rhizoidal stocks of *B. muscosa* persisted, sending up periodically a succession of shoots. New runners were observed extending in various directions, strong evidence of the perennial nature of this plant. H. Jonsson has referred in his *Botany of Iceland*, 168, to an abundant vegetative method of propagation among certain green algæ by means of offshoots, which can live all the year round in the sub-littoral zone.

As regards the age of these plants, it is difficult to make any definite statement. Where, however, plants and animals are associated epiphytically, it is possible in some cases to get a relative idea. For instance, the Sertularias, Crisia, and other Polyzoa found on the specimens collected were of too recent and rapid a growth to indicate the ages of the algæ they infested, yet, by ascertaining the ages of certain sponges and barnacles, a clue to those of the algæ overgrowing them was obtained. Thus, on a sponge of two months' growth there was a thick covering of *Derbesia tenuissima*, so that two or three weeks must have been its approximate age. The basal attachment of a *Laminaria digitata* showed some interesting points. The cramp-pons were in two series. The central, short and compact, represented a previous year's growth; the outer consisted of a whorl of widely-spreading branches, one of which grew over a barnacle of six months. Thus the age of this plant was evidently about eighteen months. A tuft of *Bryopsis muscosa* found covering a barnacle of three to six months would probably be about two months old.

It would be necessary when botanizing on salvaged vessels to be at hand as they come to the surface, so as to observe the vegetation before it disappears. A ship that is well out in the tide-way should be chosen, and not one in a harbour where the water is shallow and muddy, with a possible intermingling of varying quantities of fresh water.

My best thanks are due to Dr. Orton, of the Plymouth Marine Laboratory, who very kindly examined the animal growths associated with the specimens and reported on their approximate ages; to Dr. Rendle, for obtaining permission to visit the 'Glatton'; to the

Dover Harbour Board, for their kindness in facilitating the work [illegible] placing a motor-boat at my disposal; and to Mr. A. Gepp, for valuable advice.

The following is a list of Algæ gathered from the 'Glatton' April 30, 1926:—

A=Annual. P=Perennial. B=Biennial.

A *Enteromorpha compressa* Grev.
Ulva lactuca var. *latissima* DC.
A *Cladophora rupestris* Kütz.
P **Bryopsis muscosa* Lamour.
**Derbesia tenuissima* Crn.
P *Sphacelaria cirrhosa* v. *pennata* Hauck.
B *Laminaria digitata* Lamour.
P *Halidrys siliquosa* Lyngb.
A *Chantransia virgatula* J. Ag.
A? *Porphyra linearis* Grev.
Gracilaria confervoides Grev.
P *Rhodymenia palmata* f. *typica* Grev.
A *Lomentaria articulata* Lyngb.
P *Delesseria alata* Lamour.
P *Laurencia* sp.
**Polysiphonia nigra* Batt. (*P. atra rubescens* Grev.).
P *Polysiphonia nigrescens* Grev.
P * ,, *elongata* Grev.
P *Griffithsia flosculosa* Batt. (*G. tacea* Ag.).
A *Callithamnion Hookeri* Ag.
A * ,, *tetragonum* var. *brachiatum* J. Ag.
P *Plumaria elegans* Schm.
P? **Antithamnionella sarniensis* Lyl
A *Ceramium Deslongchampsii* Chau
A ,, *rubrum* Ag.
A ,, *flabelligerum* J. Ag.

The asterisks indicate those algæ hitherto unrecorded for [illegible] district. As, however, they were taken from a salvaged vessel, and [illegible] gathered in the district, they cannot yet be regarded as forming [illegible] of its Marine Flora.

LINNEAN SOCIETY ANNIVERSARY.

An interesting feature at the Anniversary Meeting of the Linnean Society on May 27 was the presentation of a portrait of the General Secretary, Dr. Benjamin Daydon Jackson, in commemoration of [illegible] forty-six years of service—twenty-two as Botanical Secretary, followed by twenty-four as General Secretary. The portrait, an excellent one painted by Mr. Ernest Moore, was presented to the Society by [illegible] David Prain on behalf of the subscribers, and, after some sympathetic remarks on Dr. Jackson's devoted service by Dr. D. H. Scott, was accepted by Dr. A. B. Rendle, the President, on behalf of the Society. Dr. Jackson, in responding, pointed out that the Society was celebrating its 138th anniversary, and that the length of his Secretaryship was one-third of the life of the Society. He expressed his grateful sense of the kindness he had experienced during his long term of office, and hoped that in his new appointment he might still be useful to the Society.

In reporting on the work of the Society during the past year, the General Secretary stated that since the last Anniversary 21 Fellows had died, 13 had withdrawn, and four had been removed from the list; during the same period 50 Fellows had been elected. Two Foreign Members, Dr. Jean Massart and Prof. Georg Schweinfurth, had died and their places had been filled by the election of Willis, Johannsen and Dr. René Maire. Six Associates had also been elected.

The Librarian reported that the total number of periodical publications received is now 634, 386 of which are by exchange and 165 by gift. A large collection of books and pamphlets had been presented by Mr. A. D. Michael. The new Authors' Catalogue of the Library had been published, and the distribution of free copies to scientific societies and institutions throughout the world had led to the filling up of some gaps in the Library.

Mr. Reginald Cory and Dr. E. J. Salisbury were elected on the Council in place of two botanists who had retired—namely, Prof. F. E. Fritsch and Mr. L. V. Lester-Garland. Dr. A. B. Rendle was re-elected President and Mr. J. Ramsbottom Botanical Secretary.

In his Presidential Address Dr. Rendle referred to the retirement of Dr. Jackson from the post of General Secretary, which he had held since 1902, having previously served as Botanical Secretary since 1880. The Council had appointed Dr. Jackson "Curator of the Linnean Collections"; he would therefore continue to be at the service of the Fellows and would, at the same time, have leisure for putting on record some of his accumulated stores of knowledge of Linnean matters. Lt.-Col. A. T. Gage, the Assistant Secretary, would take Dr. Jackson's place as the senior member of the executive staff.

The President referred to the work of several Fellows who had died during the past year. These included a former Assistant Secretary and Librarian, Dr. James Murie, and among botanists the Rev. George Henslow, Mr. W. P. Hiern, Sir Francis Darwin, Mr. J. H. Maiden (Linnean Medallist, 1915), Mr. James Gamble, and, quite recently, Dr. H. B. Guppy (Linnean Medallist, 1917).

After a review of the programme of the past session, the President remarked on a tendency in some of the discussions to get back to first principles or definitions and then to discover that what we had regarded as definite is after all vague. On one occasion the meaning of the term "carpel" was in question, and various authorities were quoted in support of differing definitions. The difficulty lies in the fact that our terms were created to express certain limited conceptions, and morphologists are apt to find themselves in the position of the present-day taxonomist who is endeavouring to typify species described by earlier workers. There is danger that we may assign to the definitions of these earlier workers a meaning which they never intended to convey.

Similarly, there is an important difference between the structure to which, by sanction of general use, we apply the term "seed"—namely, the seed of the Angiosperm—and the remarkably interesting structure for which the same term has been used in the Pteridosperms. So far as is known, the latter protects the gametophyte generation, and the fact that instances occur of postponement of embryo-formation after separation of the seed, as in Cycads, hardly removes the difficulty of comparison. Absence of an embryo has been described as negative evidence; is it not rather absence of the real criterion of the normal seed, a structure for the protection of the new sporophyte during a period of rest and transport? The conditions governing the phase in the life-history preceding and accompanying germination must have been widely different in the two groups.

Dr. Hamshaw Thomas's discovery of the Caytoniales had provok reconsideration of the meaning of the term "Angiosperm." We w ignorant as to the contents of the protected seed-like bodies, b whatever might be their structure and further development, t certainly embodied the Angiosperm-idea, and it was of special inte to note that, associated with this early presentation of the Angiosper idea, there was indubitable wind-pollination. Whatever their orig the present-day Angiosperms are a well-defined group. Can the sa be said of the Gymnosperms? In bringing together the very vari groups from Pteridosperms to Conifers, as Gymnosperms, are we in danger of subordinating taxonomy to a physiological consideratio

In conclusion, reference was made to the relationship between two great divisions of the Angiosperms and the various attempts derive one from the other. These were all open to serious criticis and it would seem more in accordance with present knowledge admit that we know nothing as to their individual origin. For solution of these various problems in phylogeny we require a kno ledge of many more facts than are at present available.

After his address the President, on behalf of the Council, hand the Linnean Gold Medal to Dr. Edgar Johnson Allen, F.R. Director of the Marine Biological Laboratory of Plymouth, a referred in eulogistic terms to his great services to science in t department of marine biology.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES: ANNUAL CONGRESS.

THE Thirty-first Annual Congress of the South-Eastern Union Scientific Societies was held at Colchester from the 9th–12th Ju under the Presidency of Reginald Smith, Esq., B.A., F.S.A., of t Department of British and Mediæval Antiquities, British Museum.

The 12th Annual Report was presented to the business meeting the Botanical Section, which showed a satisfactory increase in membe

Mr. Paulson delivered his Presidential Address on "The Bee Wood—its Canopy and Carpet"; this was illustrated by so excellent lantern-slides showing the beeches at Epping and Burnha and was listened to by a large and appreciative audience.

In his address the President spoke of beech woods on silicious (gravel and sand) covering the ridges and hills that are over 300 f O.D. in North-East Essex and in parts of the adjoining county Middlesex. The beech woods of Epping Forest, Essex, and Wood, Middlesex, are in part climax woods consisting of beech on They have, especially when showing the effect of lopping, a ol canopy and little or no undergrowth, with the exception of a f mosses, as the characteristic *Leucobryum glaucum, Campylo pyriformis, Dicranum scoparium, Mnium hornum*, and the gr *Holcus mollis*. The light intensity is low, ranging from a thirt to a fiftieth of the light in the open. The effect of a rent in t canopy, as when two or three mature trees, in close proximity, destroyed by the wound parasite *Fomes applanatus*, is soon appar

the inroad of *Pteris Aquilina* from the outskirts and by the appearance of *Calluna vulgaris, Epilobium angustifolium*, several grasses, and countless numbers of seedlings of the birch.

The carpet of these woods consists of three very well-defined layers, namely, (1) the light-coloured crisp layer of the leaves of the late autumn fall; (2) a system of slender, horizontal, interlacing root-branches in two to three planes mixed with semi-decayed leaves, to which the rootlets, that have been transformed to mycorrhiza, adhere firmly. These roots do not enter the ground, but often spread over the whole area of a wood at a depth of 1 to 4 inches—they are peculiarly sensitive to drought; (3) a peat-like layer of decayed leaves that has a PH value 3·6–3·7. Seedling beeches that develop in the second layer of the carpet have a root-system that is almost entirely mycorrhiza. During the autumn the uppermost layer of the carpet is freely covered with the sporophores of Agarics. With care the connection of a sporophore, by means of hyphal threads, with the mycorrhiza of a beech tree can be demonstrated.

The President's address was followed by a lecture by Dr. E. J. Salisbury, F.L.S., on "Plant Communities of the Seashore," illustrated by lantern-slides showing various types of foreshore from salt to sand dune. After lunch the party proceeded to Mersey Island by char-a-banc and was able under the guidance of Dr. Salisbury to trace the plant-communities from the appearance of the pioneer of the mud-flats, *Salicornia herbacea*, through the salt-marsh communities of *Aster Tripolium, Plantago maritima, Triglochin maritimum, Statice Limonium, Spergularia marginata*, and *Suaeda maritima*, to the salt-flats, and so to the higher ground salt-marsh with *Juncus maritimus, Glaux maritima*, and *Agropyrum pungens*. Among the many plants noted during the afternoon the Thrift was especially conspicuous and beautiful on the salt-marshes.

On Friday afternoon a ramble was arranged to Tiptree Common for the study of primitive heathland and sphagnum bog under the guidance of Mr. G. C. Brown, a local botanist, who pointed out the chief characteristics of the strikingly different parts of the heath. A delightful afternoon was spent among a profusion of wild flowers, in which the grasses and sedges were very prominent.

Dr. E. J. Salisbury was elected President of the Botanical Section for the 1927 meeting.—W. R. SHERRIN.

INTERNATIONAL CONGRESS OF PLANT SCIENCES, ITHACA, NEW YORK, AUG. 16–23, 1926.

WE have received the preliminary programme of this, the Fourth International Botanical Congress. It contains a list of the general officers of the Congress. The President and Presiding Chairman will be Prof. Liberty Hyde Bailey of Ithaca. Fifteen Honorary Chairmen have also been appointed representing various nationalities, and including two British Botanists, namely, Sir David Prain and Daniel McAlpine, formerly plant-pathologist, Victoria, Australia. The Vice-Chairman will be John Merle Coulter of New York, the General

Secretary Benjamin M. Duggar, Washington, and the Treasur George T. Moore, Missouri Botanical Garden.

The Congress will be divided into thirteen sections, the Chairm of which have been chosen mainly from among those attending fro overseas, while the Secretaries are mainly residential in Ithaca; th list of Chairmen is not yet complete. The following are th sections:—

A. Agronomy. Chairman: Charles Ambrose Zavitz, Ontar Agricultural College, Guelph, Canada.
B. Bacteriology. Secretary: J. M. Sherman, Cornell Universit Ithaca.
C. Cytology. Chairman: Georg Tischler, Kiel Universit Germany.
D. Morphology, History, and Palæobotany. Chairman: Robe Chodat, University of Geneva, Switzerland.
E. Ecology. Chairman: Edward Rübel, Technical High Schoo Zurich, Switzerland.
F. Forestry. Secretary: R. S. Hosmer, Cornell Universit Ithaca.
G. Genetics. Secretary: C. E. Allen, University of Wisconsin
H. Horticulture. Secretary: A. J. Heinicke, Cornell Universit
I. Physiology. Chairman: Wladimir Wasilievich Lepeschki Charles University, Prague, Czechoslovakia.
J. Pathology. Secretary: D. Reddick, Cornell University.
K. Pharmacognosy and Pharmaceutical Botany. Secretary: E W. Youngken, Massachusetts College of Pharmacy.
L. Taxonomy. Chairman: Carl Hansen Ostenfeld, Universit of Copenhagen.
M. Mycology. Chairman: E. J. Butler, Imperial Bureau Mycology, Kew.

The meetings will be held on the Cornell University campus, a it is expected that all persons attending the Congress will provided for in University Residence Halls on the campus.

On the evening of the opening day (Monday) Addresses Welcome will be delivered by the President of Cornell Universi and the Secretary of Agriculture; this will be followed by a receptio The forenoon of Tuesday, Wednesday, Thursday, and Friday will allotted to sectional programmes. Round-table and other discussio will be arranged, and addresses of general interest and other activit will occupy the evenings. Saturday and Sunday will be given field-trips, excursions, and other informal activities. A Gene Session of the Congress will take place on the last day (Monday).

Some general discussions have been already planned, name "The Significance of Taxonomic Units and their Natural Basi (Taxonomy, Genetics, and Cytology); "An Evaluation of t Structural Evidences for Genetic Relationships in Plants" (Morph logy); "The Phylogenetic Classification of the Angiosperm (Morphology and Taxonomy). Mycology and Forestry, respectivel are arranging excursions for collecting and inspection.

Various excursions have been arranged to take place after the close of the Congress.

Two meetings on cognate subjects will be held about the same time as the Congress.

An International Conference on Flower and Fruit Sterility will be held in New York City, Aug. 12–14, under the auspices of the Horticultural Society of New York. The programme includes over fifty papers with special reference to difficulties in the breeding of plants, problems of fruit and seed production in a wide range of horticultural and agricultural crops, and the botanical and genetical aspects of sterility and fertility.

The Association of Official Seed Analysts of North America will hold its nineteenth annual meeting at the same time and in affiliation with the meeting of the Congress. The following topics will be represented: The Botany of Seed-testing; Research-work in Seed Analysis; Germination Testing, including Physiological Problems; Legislation and Seed-control.

NOTES FROM THE BRITISH MUSEUM HERBARIUM.

A new Species of *Flourensia* from Argentina.

By S. Moore.

The genus *Flourensia* founded in 1836 by A. P. de Candolle (Prod. v. 592) was by Bentham (Gen. Pl. ii. 376) merged in *Helianthus*, to which it is closely allied, and this lead Baillon followed in his *Histoire des Plantes*. O. Hoffmann in Engler and Prantl's *Pflanzenfamilien* proposed its re-establishment, and this view is supported by Dr. Sidney F. Blake, a botanist well known for his valuable work on the *Helianthoideæ*. In a recent revision of *Flourensia* in Contrib. U.S. Nat. Herb. xx. 393 *sqq.*, Dr. Blake finds this originally almost monotypic genus to comprise no less than 33 species, of which 9 are Mexican (1 of these reaching Texas, New Mexico, and Arizona), while the rest range from Central Peru to Chili and the Argentine Province of Cordova. Though so close to *Helianthus* the species of *Flourensia*, apart from their characteristic achenes and pappus, can usually be distinguished on sight by their general facies, and especially by their resinous organs.

The Museum is indebted to Miss Wright of Alticry, Wigtownshire, for a small specimen of this genus recently gathered by a friend in the province of San Luiz, Argentina. On a cursory view this was thought to belong to the Asteroideous *Grindelia*, until dissection showed its true affinity. Comparison with the *Flourensia* material at the Museum and at Kew, followed by study of Dr. Blake's monograph, left little doubt that we have to do here with a species hitherto undescribed, and whatever doubt remained has been dispelled by Dr. Blake himself, who was good enough to examine a few fragments sent to him and report upon them.

Flourensia grindelioides, sp. nov. *Frutex*? (vel herba perennis?) glutinosus ⅔-metralis; *ramulis* ultimis solum visis tenuibus foliosis *foliis* oblongo-oblanceolatis acutis basi in petiolum brevem latum attenuatis integris (rarissime perpaucidenticulatis) chartaceis utrinque punctis lucentibus exemptis glabris costa media pag. utravis perspicu costis lat. pluribus reticulo arctissimo utrinque valde prominento *capitulis* pedunculatis majusculis ∞-flosculosis solitariis terminalibu *involucri* phyllis 2–3-serialibus oblongo-lanceolatis acutis dor striatis ciliolatis glutinosis; *receptaculo* convexo foveolato palea cymbiformibus munito; *ligulis* paucis longe exsertis; *disci corolla* basi levissime angustatis; *achæniis* disci nondum maturis compressi culis ambitu anguste obovatis obscure tetragonis villosis; *pappi* biaristato aristis simplicibus vel subsimplicibus barbellatis achæn longioribus additis squamellis paucis erosis apicibus acutis arist circa semiæquantibus.

Hab. Argentina, San Luiz ex spec. a dom. Wright communicatu

Folia 5–6 × 1·7–2·2 cm., pauca ultima circa 2·5 × 1·5 cm., in sic flavo-viridia; petioli circa 5 mm. long. Pedunculi 4·5–7 cm. lon bracteis perpaucis parvulis foliaceis onusti, glutinosi, puberu Capitula pansa (ligulis exclusis) 2·2 cm. diam. Involucra 7 mm. lon Receptaculi paleæ obtusæ, teneræ, striolatæ, glutinosæ, 7 mm. lon Ligulæ oblongo-ovatæ, 3-denticulatæ, 10 × 6 mm. Disci corol 5 mm. long. Achænia 3·5 mm. pappi aristæ 4·5 mm. et squamell circa 2 mm, long.

Dr. Blake writes—"The fragments of *Flourensia* from Argenti clearly represent a new species of the genus, evidently related t *F. oolepis*, but distinguished by its conspicuous squamellæ [of th pappus], and, no doubt, by other differences not readily observable i the fragments sent." But for the absence of teeth from the leave on a cursory view the plant might easily be sorted to *Grindel glutinosa* Dun.

CISSAMPELOS ROBERTSONII Exell, sp. nov. (Togoland).

Planta scandens novellis brunneo-pilosis, ramis pilosis; *foli* longe petiolatis, petiolo puberulo laminæ æquilongæ peltatim inserto suborbicularibus apice rotundatissimis longe apiculatis basi paull cordatis, supra sparse minute puberulis subtus velutinis, costis sup inconspicuis infra leviter prominentibus; *inflorescentiis* ♂ in cym paniculatas pilosas multifloras foliis subæquilongas dispositis; *bracteo* parvis filiformibus pilosis; *sepalis* 4 oblongis, apice obtusis, ext pilosis quam corolla duplo longioribus; *petalis* in corollam campan latam connatis; *synandrio* 4-loculare. (Flores ♀ et drupæ no suppetunt.)

Hab. Kpandu, Togoland, 1924; *J. M. Robertson*, 81!

Leaves 7·5–9 × 8·5–11 cm.; *petioles* up to 10 cm. long; *mucro* at the apices of the leaves up to 7 mm. long; *inflorescences* up t 14 cm.; *pedicels* 1–1·5 mm. long; *sepals* 2 × ·8 mm.; *corolla* formin a bell 1 mm. long and 1·2 mm. across; *synandrium* 1·2 mm. long.

The species is very near to *C. macrosepala* Diels, of which I ha only female plants. It differs in having a rather broadly campanulate corolla; while the pedicels are at least 1 mm. long, as compared with scarcely 1 mm. in *C. macrosepala*. The inflorescences are, moreover, very like those of *C. owariensis* P. Beauv., while those of *C. macrosepala* are more crowded with almost sessile flowers.

A. W. EXELL.

SHORT NOTE.

OLEARIA *versus* SHAWIA. According to the *Journal of Botany*, lxiii. 213, July 1925, the Committee on Australian Botanical Nomenclature proposes that the genus name *Shawia*, 1776, be rejected, and that the later name *Olearia*, 1802, be taken as the accepted name of the genus. In support of this proposal, it is claimed that the name *Shawia* has been practically unused for this genus since 1776.

The authors of the proposal admit that the name *Shawia* was used by Schultz in 1861 and by James Britten in 1901. They do not mention, however, its use by Baillon in 1882 (*Histoire des Plantes*, viii. 139). Nor do they mention, its use in the revision of the *Century Dictionary*, 1909 to 1911. To the adoption of *Shawia* in this, comparatively recent, work I wish especially to call attention. The revised definition of *Olearia* in the *Century Dictionary* (vi. 4101) is as follows:—

"A name given by Moench in 1802 to *Shawia*, a genus of plants of the family Asteraceæ. It is characterized by shrubby stems, capillary pappus, naked receptacle, achenes not compressed, and involucral bracts many-rowed, dry, and without herbaceous tips. There are about 90 species, natives of Australia, representing there the northern genus *Aster*. They have usually alternate leaves, and rather large heads with white or blue ray-flowers and yellow or purplish disks. The common name *daisy-bush* belongs to various New Zealand species, and is sometimes adopted for all plants of the genus. *Shawia stellulata* (*Olearia stellulata* of de Candolle) is the snow-bush of Victoria."

Under *Shawia* in the supplement of volume viii. is the following definition, including the derivation of the name:—

"N. L. [that is, new Latin] (Forster, 1776), named in honour of Thomas *Shaw* (1694–1751), an English clergyman, traveler, and botanist. A genus of plants belonging to the family *Asteraceæ*. See *Olearia*."

Under daisy-bush, iii. 1444, is the definition:—

"A New Zealand name for several species of the genus *Shawia*, shrubby composites nearly allied to the aster, but with terete achenes and the anther-cells more shortly caudate."

Under musk-tree, vi. 3910, is the definition:—

"A composite tree, *Shawia argophylla*, of Australia and Tasmania, with musk-scented leaves. It grows 25 or 30 feet high, and affords a white, close-grained wood, used for cabinet-work, implements, etc."

In the supplement of volume iv., under holly, is a definition of New Zealand holly:—

"A spiny-leaved shrub or small tree of the aster family, *Shaw ilicifolia* (*Olearia ilicifolia* of Hooker), valued by the Maoris on account of its musky odor."

Under snowbush, ix. 5735, is the following definition:—

"One of several shrubs bearing profuse white flowers. Such as *Ceanothus cordulatus* of California mountains, *Shawia stellulata* of Australia and Tasmania, and *Phyllanthus nivosus* of the New Hebrides."

In the supplement of volume i., under the entry ake, one of the definitions is:—

"In the Chatham Islands, a small tree, *Shawia Traver* (*Olearia Traversii* of Hooker), of the aster family."

The full descriptive title of the work from which these quotations are made is *Century Dictionary, an Encyclopedic Lexicon of the English Language*. The original edition came out from 1889 to 1891, the present revised and enlarged edition from 1909 to 191 The botanical definitions of both editions were prepared by botanists of technical training, under the supervision of the late Professor Lester F. Ward, the well-known palæobotanist. The *Century Dictionary* has the same title to consideration as a botanical work as *Lamarck's Encyclopedia*. It was published in very large editions, and probably is more widely used in the United States for botanical reference-purposes than any other botanical work.

The original edition of the *Century Dictionary* contained many new Latin names of plants. In the revised edition many new Latin binomials were published, such as those cited here under *Shawia*.

In the preceding paragraphs attention is called first to the revised edition of the *Century Dictionary* as a work that should be considered in establishing present usage, and second to what appears to be an insufficient reason for conserving *Olearia* in place of the earlier *Shawia*.—FREDERICK V. COVILLE, United States National Herbarium, Washington.

REVIEWS.

A Manual of the Flowering Plants and Ferns of the Transvaal with Swaziland, South Africa. By JOSEPH BURTT DAVY, M.A., Ph.D., F.L.S., Lecturer in Tropical Forest Botany, Imperial Forestry Institute, University of Oxford; formerly Government Agrostologist and Botanist, and Chief of the Division of Botany, Department of Agriculture, Union of South Africa. Part I. Pteridophyta to Bombacaceæ. 8vo. pp. 27 40 text-figs. Longmans, Green and Co. Ltd., London. Pr 15*s.* net.

THE need for handy floras of our numerous overseas dominions has been repeatedly emphasised. The ideal arrangement for the

production of the flora of a comparatively limited area is the association of the worker in the field with the systematist in the herbarium at home. Dr. Burtt Davy has been in the way of realising this ideal. After some years devoted to the critical study of the Transvaal flora in the field he has spent five years in England, and has worked in the great herbaria and benefitted by the help and advice of their staffs. He has therefore made a favourable start, and his manual should be of great value to students of the flora of the area with which he has dealt. The book, when completed, will comprise four parts; Part II. will deal with the remaining Archichlamydeous families of Dicotyledons, Part III. with the sympetalous families, and Part IV. with the Monocotyledons; the last part will also contain a complete index to the whole book. The four parts will ultimately be issued in one volume. Rapidity of publication greatly enhances the value of a manual, and we therefore wish the author a speedy issue in his undertaking.

The method of treatment, as explained by the author in his introductory chapter, is a compromise between a fully descriptive Flora of the 4500 species concerned and a bare annotated catalogue. A diagnosis of each family is followed by a descriptive key of the contained genera; under each genus is a fairly elaborate key to the various species. The habitat and geographical range of each species are recorded, specimens which have been critically examined are cited, and notes are included on the economic value of the species. The omission of generic descriptions is explained on the ground of economy of type, time and space, and also because of the imminent publication of a new edition of Harvey's *Genera of South African Plants* which will supply this information. Only so much synonymy has been included as seemed requisite to correlate the species with standard Floras and recent Monographs. The author has brought together a great deal of information in a very condensed form; the book, indeed, suffers somewhat from condensation. While it is important that a manual should be as light and handy as possible, there is a danger of sacrificing too much to exigencies of space and weight, and we do not envy those who have to find their way through these closely printed transparent pages. Some space might have been saved by the omission of the Latin diagnoses of the new species and varieties, which seem out of place and for which the author might surely have found some other medium of publication.

The introductory chapter contains a brief description of the area covered by the Manual, which is rather less than that of Great Britain and Ireland combined. There are also some useful hints on plant-collecting and a glossary of terms and their abbreviations as employed in the text. The descriptive matter is preceded by an analytical key to the groups and families. The text-figures, which are from drawings by Mr. W. E. Trevithick and Mrs. Davy, are mainly of plants of economic value. The account of the family Ficoidaceæ has been supplied by Mr. N. E. Brown.

Myths and Legends of Flowers, Trees, Fruits, and Plants in all Ages and in all Climes. By CHARLES M. SKINNER. 8v pp. 302, pls. 16. Lippincott: London, 1925. Fifth impressio Price 12*s.* 6*d.* net.

THIS somewhat remarkable book has no preface, but a note o the back of the title-page informs us that it is a new impression o book which was copyrighted in 1911. The author has brough together a surprising amount of information, the nature of which well expressed by the title of the book. A few short general chapter deal with plant-lore, early Christian legends, fairy flowers, narcoti and stimulants, and plants of ill-renown, but the greater part of th volume (page 34 to the end) is given to a chatty account of myth and legends, and popular uses of "flowers, trees, fruits, and plants which are arranged alphabetically under the names by which they ar generally known. The writer is American, and occasionally a nam will be unfamiliar to the English reader—as, for instance, Indi Plume; but the myths and legends are very largely of classical o mediæval origin. Internal evidence suggests that the legendar rather than the botanical side excites the author's interest—botanica names are rarely given, and then in an unfamiliar form, the gen being spelt without a capital initial, and the trivial often misspel the American *Arisæma triphyllum*, Indian Turnip, is confused wit our Lords-and-ladies (p. 22); "the Rose of Saron is also held t be a symbol of the resurrection, for when its blossoms fall they a borne by the wind to a distant place, there to root and bloom anew (p. 19); is there not here a confusion with the Rose of Jeric (*Anastatica*), which is transported bodily by the wind? The book light, handy to hold, readable, and often amusing. The plates ar good photographic reproductions, and include some well-know pictures, such as Sargent's Carnation, Lily, Rose, and Murillo' Grape-eaters.

Quarterly Review of Biology. Vol. I., pt. 1. Size 7×10¼ in pp. 137, 14 pls., numerous text-figs. Williams & Wilkins Co Baltimore, U.S.A. London Agents: Ballière, Tindall, & Cox January 1926. Annual Subscription, 21*s.*

RAYMOND PEARL and R. W. HEGNER, of the Johns Hopkin University, are respectively Editor and Associate-Editor, and a Advisory Board comprises representatives of the various branches o biological science from the larger American Universities.

The aim of the review is to supply authoritative and compr hensive reviews of the present state of knowledge in the differen fields of general biology, which may be of service not only to the ma of science, but may also help in the diffusion of a sound knowled about biological matters among intelligent men and women who ar not professional scientific workers. The present part contains articl

on "The Biology of the Mammalian Testis and Scrotum," by C. R. Moore; "Symbiosis among Animals, with Special Reference to Termites and their Intestinal Flagellates," by L. R. Cleveland; "Experimental Studies on Morphogenesis in the Nervous System," by S. R. Detwiler; "A Review of the Discovery of Photoperiodism, the Influence of the Length of Daily Light Periods upon the Growth of Plants," by K. F. Kellerman; and "Recent Discoveries in the Biology of *Amœba*," by A. A. Schaeffer. A useful list of literature follows each article. There are also a critical review of Prof. L. Cuénot's recent book *L'Adaptation*, and brief notices of a number of other new books in the various fields of biology. The botanical article, which is a comparatively short one, describes some results of the work of Dr. W. W. Garner and his associates on "The Remarkable Significance of Changes in the Duration of the Daily Periods of Light and Darkness," and is illustrated by eight excellent plates.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY.—At the General Meeting held on June 10, Mr. I. H. Burkill gave an exhibition of Hawaiian Volcano Plants, illustrated with lantern-slides.

Eight mature vascular plants from the surface of one-year-old lava in the crater of Kilauea, Hawaii, three being sedges and five grasses, were shown. These were found in cracks of the lava-flow of 1924 at places where steam issued. Within the steam-cracks was a mass of the moss-genus *Trematodon*, its capsules weighted down with condensed water; algæ were observed, as well as a number of spore-ling ferns and three small Dicotyledons, but none of them were mature enough for identification. It was very evident that the life of all these plants depended upon the moisture which the steam supplied.

On lava three years older isolated plants of *Vaccinium penduliflorum* Gaudich. and *Cyathodes tameiameiæ* Cham. existed where, steam-cracks being absent, the surface was sheltered by boulders from the perennial north-east trade-wind. But neither of these two species, which seem to be the most xerophytic of the local plants, nor any other broad-leaved plants were observed upon the 1924 lava, which lava alone was hot enough to return rain as steam. It is the rarity of broad-leaved plants where the sedges and grasses were present which is of chief interest.

The crater is a side vent of the volcano of Mauna Rea, and has no sheltering walls upon the down-hill side. The wind has easy access to it; and between rainy periods it dries the surface. The drying is obviously a greater hindrance to encroaching vegetation than the sterility of the lava; and very numerous seeds must arrive upon the surface which fail to establish plants.

It is worth recalling in connection with the presence of grasses upon new lava in Kilauea that grasses have played a very great part in reclothing Krakatoa—not in the number of species, but in the way in which the few that got there were relatively quick in taking

possession of the whole mountain side, from which at the pres
time they are being ousted by the broad-leaved plants which ha
grown up through them.

Mr. H. N. Ridley stated that in Java and Sumatra he had see
no grasses on the volcanoes visited by him. The species he had se
farthest up any crater were xerophytic ferns of the genera *Polypodiu*
and *Litobrochia*, the plants forming a short turf. Probably the
was not enough moisture in these Javan and Sumatran volcanoes t
support a flora similar to that on Kilauea. He had seen *Imperat*
cylindrica growing in sulphur smoke in a small crater. The grass
and sedges brought to Kilauea were wind-dispersed, widely distri
buted, and could grow almost anywhere. Mr. H. N. Dixo
mentioned, with reference to the occurrence of the moss *Trematod*
in steam crevices, that a species of that genus, *T. longicollis* Mich
which has a distribution in North America and Europe, occurs in th
latter continent only under very similar conditions, being found in
crater walls on the Island of Ischia and in the hot sulphur crevic
of the semi-active Solfatara at Pozzuoli, near Naples. It was als
interesting problem whether the peculiarity of *Trematodon* tha
enabled it to subsist in such conditions rested in the power of th
spore to germinate or in the power of the gametophyte to develo
It was curious that the cosmopolitan *Funaria hygometrica* had no
appeared.

Captain J. G. Dollman exhibited the skin of a rabbit sent fro
Australia as an example of a supposed new "mutation." The spec
men showed the fur thickly interspersed with what appeared at firs
glance to be "bristles" an inch or more in length. The "bristles
were, in fact, the awns of an Australian grass of the genus *Stipa*
the fruits of which had implanted themselves in the fur of the rabbi

Mr. T. A. Sprague discussed the taxonomic position of *Adoxa*
which depends primarily on the interpretation placed on the tw
perianth-whorls, those who regard these as "calyx and corolla" o
"involucre and corolla" placing the genus near the Caprifoliaceæ
whereas those who regard them as "involucre and calyx" place i
next the Saxifragaceæ or Araliaceæ. The interpretation of th
normal or usual type of inflorescence and flower according to th
"involucre and calyx" hypothesis involves fewer assumptions tha
are required by the other hypothesis, and the evidence derived fro
abnormal or rarer types is greatly in its favour. A study of th
external morphology of *Adoxa* seems to indicate that it has most i
common with Saxifragaceæ, less with Caprifoliaceæ, and least wit
Araliaceæ. It is suggested that the Adoxaceæ should be placed i
Rosales—Saxifragineæ besides Saxifragaceæ.

Lieut. S. K. Mukerji gave an account of the Vegetation o
Kashmir (illustrated with lantern-slides).

The paper, which is the outcome of an ecological investigatio
(from 1918–24) of the plant-communities of the Kashmir Himalaya
is divided into three parts:—(1) The Aquatic and Marsh Vegetatio
of the Dal Lake of Kashmir. (2) The Plant Communities of th
Temperate Region of the Kashmir Himalayas (from 5000–9000 ft.)

(3) The Sub-Alpine and Alpine Vegetation of the Kashmir Hima-
layas (from 9000–18,000 ft.). It deals primarily with the course of
development of the Dal Lake region of Kashmir and the various lines
of succession in the Temperate Zone which culminate in the meso-
phytic climatic climax—The Deodar Forest.

The next General Meeting will be held on November 4.

PROTECTION OF OUR NATIVE PLANTS.—It is interesting to record
another move towards the preservation of our wild plants—a subject
to which reference has repeatedly been made in the *Journal* (*cf.* 1925,
pp. 150, 273, 277; 1926, p. 114). The London *Times* of June 8
devotes a leader to the subject *à propos* of an appeal by Lt.-Col.
Cuthbert James, M.P., to the Royal Horticultural Society "as the
body with the best knowledge of the facts and of the proper measures
to be taken"; the leader-writer adds, "Parliament, we trust, would
not be slow to give effect to any recommendations which the Society
might suggest in so urgent a matter of the public good." We do
not know whether the Council of the Royal Horticultural Society will
welcome the appeal, but if it were able to interest its twenty-thousand
or so members in the protection of our native plants it would be
all to the good. The project of plant-protection in this country seems
to suffer from disjointed action. Before the war the plant-protection
section of the Selborne Society was making some progress in the
education of the people generally, and the County Councils in par-
ticular—several of the latter had adopted bye-laws for ensuring
protection to wayside plants. Unfortunately, the work was not
resumed after the war, and recently the Society for Promotion of
Nature Reserves has taken up the matter, and has prepared and
distributed a poster appealing to the public to be sparing in picking
flowers and to refrain from uprooting plants. And now comes
an apparently independent appeal to a third Society, which is already
well occupied on somewhat different lines. An *ad hoc* body on the
lines of the American "Wild Flower Preservation Society" would seem
to promise the best solution of the problem, given a few zealous indi-
viduals with adequate leisure, energy, and, above all, knowledge, to
start and develop it. True lovers of our British flora will not support
the suggestion called forth by the *Times* leader that boy scouts and
girl guides should be instructed to broadcast indiscriminately seeds of
violets, lily-of-the-valley, and other plants which may be in danger
of extinction.

IN the *Proceedings of the Royal Irish Academy* (xxxvii. B, no. 13,
pp. 91–116, 1926, Prof. Augustine Henry and Mrs. M. McIntyre
have given an account of the Swamp Cypresses of China and America.
The Chinese genus *Glyptostrobus* is an ancient genus of conifers
which is now on the verge of extinction; one species only survives in
two small areas in China where it seems to have been preserved in
cultivation by popular superstition. Fossils from tertiary strata
indicate that the genus was then widely distributed over North
America, Europe, and Asia, extending north to Greenland and the

Arctic Sea. The living tree was introduced to scientific knowled by Sir George Staunton, who accompanied Lord Macartney's missi to China in 1793; the specimens collected by him are in the Brit Museum Herbarium. It is able to live in wet swampy soil, wh the roots give off "knees" projecting above the ground, recalling t knees (or pneumatophores) of *Taxodium*, the well-known Americ swamp-cypress, represented by two species in the South-Easte United States and a third in Mexico.

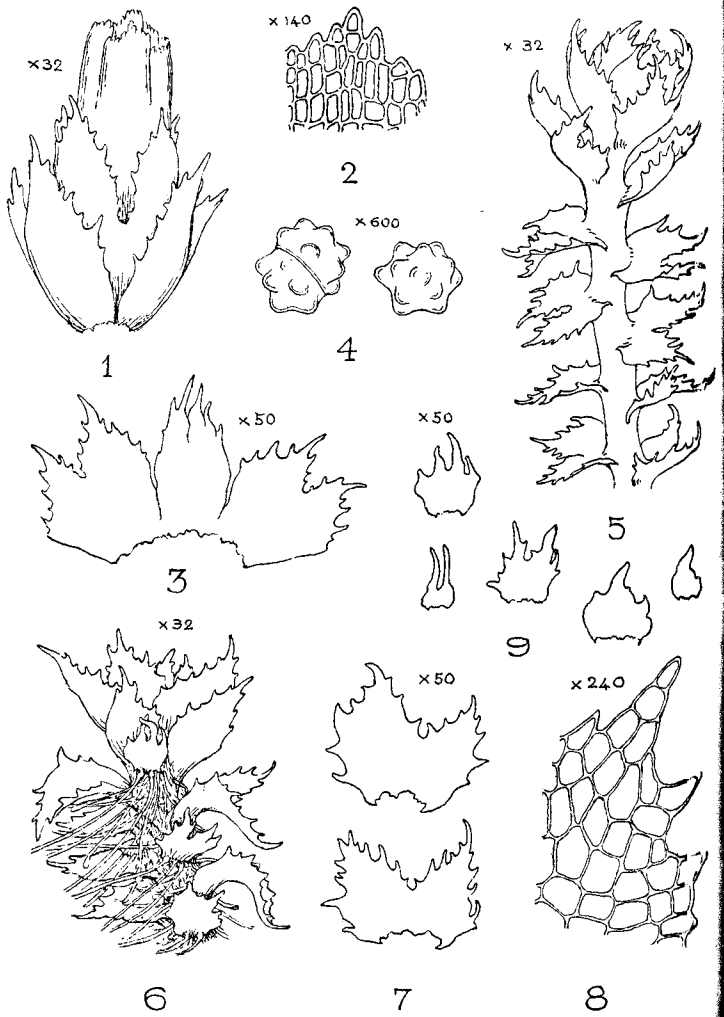
The two genera are closely related, but differ in characters the twigs, leaves, flowers, cones and seeds, and in the structu of the wood.

ADDITIONS TO THE QUEENSLAND FLORA.—The Queensla Botanists, C. T. White and W. Francis, publish descriptions a figures of a number of new species of flowering plants, mostly fro recent collections, with notes on species previously described ("Co tributions to Queensland Flora," no. 3, in Proc. Roy. Soc. of Queen land, xxxvii. no. 9, 1926).

WE hear with very great regret that the stock of the volum entitled *Aims and Methods in the Study of Vegetation*, edited b A. G. Tansley and T. F. Chipp, which was on the eve of publication b the British Empire Vegetation Committee, has been destroyed in th recent disastrous fire at the Whitefriars Press. The Committee, will be remembered, was appointed by the Imperial Botanic Conference in London last July for the purpose of encouraging an promoting the survey and study of the natural vegetation of th Empire. The Committee at once set to work to produce a handbo which would give some idea of the aims and methods of the wor A number of eminent workers at home and overseas had cooperate and the volume was on the eve of publication. Some delay in i appearance must be inevitable, but we trust that there will be n insurmountable difficulties.

ROYAL HORTICULTURAL SOCIETY.—The Council of the Roy Horticultural Society has appointed Lt.-Col. F. R. Durham, C.B.E. M.C., to be Secretary of the Society in place of the late Mr. W. Dykes. Lt.-Col. Durham served from 1919 to 1925 as Director o Works of the Imperial Graves Commission, and is well known in th horticultural world.

THE Department of Botany, British Museum, has acquired th remainder of the late Dr. Braithwaite's Herbarium of Mosses. I 1913 the Trustees of the British Museum purchased Dr. Braithwaite' study set of British Mosses typifying his classical work—the *British Moss Flora*. The collection now acquired (through Messrs. Bernard Quaritch) contains much useful supplementary material and als various exotic collections from the Herbarium of Dr. N. B. Ward, the main portion of which was purchased by the Museum fro Ward's executors in 1869.



CEPHALOZIELLA DENTATA (Raddi) K. Muell.

CEPHALOZIELLA DENTATA (RADDI) K. MUELL. IN BRITAIN.

BY W. E. NICHOLSON, F.L.S.

(PLATE 577.)

THIS species has been recorded from Britain before, but, so far as I have been able to investigate the material upon which such records were founded, it has proved to belong to *C. Turneri* (Hook.) K. Muell. or *C. Massalongi* (Spruce) K. Muell. It was therefore a source of some satisfaction when, on botanizing on the Lizard Down in April 1925 with Mr. H. H. Knight, we came upon a small quantity of this interesting little plant on practically the same ground as that from which I have already recorded *Fossombronia Loitlesbergeri* Schiffn. and *Gongylanthus ericetorum* (Raddi) Nees in this Journal (1925, 127–129). It was growing in small depressed tufts on moist soil, or soil which had been moist, among heather in company with *Dunaria ericetorum*, *Cephaloziella byssacea*, occasional stems of *Gongylanthus ericetorum*, and in one case a small tuft of *Cephaloziella calyculata*. At all times a very inconspicuous species, it was exceptionally so at the time of our visit, owing to the spell of dry weather which had preceded it, and it was also often very much overgrown by a species of alga which almost smothered it.

The following diagnosis may assist in the identification of the plant, which may possibly be found in other parts of the South-west of England or in South-west Ireland.

Dioicous. In small, thin, depressed tufts or scattered stems of a yellowish-brown or greenish colour on moist soil. Stem prostrate, to 5 mm. long, thickly covered with long hyaline rhizoids on the ventral side, simple or very sparingly branched. Leaves distant on the sterile stems, approximate and accrescent on the female stems, spreading, occasionally slightly reflexed, half-bilobed, lobes of variable width, acute, often divergent, irregularly dentate with large acute teeth, lobes 7 to 12 cells broad at the base, cuticle smooth. Underleaves always present, small, erecto-patent, very variable, oblong or triangular, 2–3-lobed at the apex, irregularly spinous-dentate. Cells with moderately and regularly thickened walls without trigones, 11–21 μ in diameter. Female inflorescence terminal. Involucral leaves slightly connate at the base with each other and the bracteole, larger than the leaves, divided to below the middle into 2, occasionally 3 lobes, coarsely spinous-dentate. Bracteole ovate, sharply toothed on the margins and occasionally bilobed or more or less laciniate. Perianth oblong, rather faintly plicate, truncate at the mouth, and divided into several short denticulate-crenulate lobes. Capsule and male plant unknown. Gemmæ frequent, in clusters at the apex of stems, which are generally slender and suberect, one- and occasionally two-celled, spherical and coarsely tuberculate, green to reddish brown.

Cephaloziella dentata has been the subject of much confusion both here and on the Continent. Thus Raddi, who described the

plant in 1820, did not always distinguish it from *C. Turneri*, which had been described by Hooker in 1812; and the plate and description in the late Mr. Pearson's *Hepaticæ of the British Isles* refer partly to *C. Massalongi* and partly to *C. Turneri* with some features derived from *C. erosa*. Limpricht (Krypt. Fl. von Schlesien, I. 201) refers it to a plant, described later as *C. erosa*, Limpr., which has no close relationship to *C. dentata*, and has been referred by Mueller to a form of *C. Hampeana*. The confusion was partly due to the comparative rarity of the plant and the difficulty of obtaining authentic material, but, if sufficient attention be paid to its essential characters there should be no difficulty in distinguishing it from allied species. The only British species with which it could well be confused are *C. Massalongi* and *C. Turneri*. The former appears to be confined to copper-bearing rocks, at least in this country, and is of a very different habit and colour. It grows in large dense tufts of a dark green colour inclining to black, the leaves have much smaller cells and a verrucose cuticle, and the plant has smooth elliptical gemmæ which are generally 2-celled. *C. Turneri* is distinguished by its much more regularly-placed pectinate-distichous leaves, the absence of under-leaves, the long-exserted, linear-pentagonal perianth, the angular, non-verrucose gemmæ, and the smaller leaf-cells with much thicker cell-walls. The gemmæ alone, which are almost invariably present, are sufficient to distinguish *C. dentata* from any other species of *Cephaloziella*. As Mr. Jameson has pointed out to me, they recall the spores of *Pottia Starkeana* (Hedw.) C. M., and M. Douin, who has made a very close study of the plant, makes them the crucial character of his new genus *Evansia*, of which *E. dentata* is the only European representative.

Growing with the type on the Lizard Down was a more slender form with smaller, subentire, more imbricate leaves and relatively larger under-leaves. It was almost invariably gemmiferous, and in some ways recalls M. Douin's var. *rubra*, but it is of a pale yellowish-green colour and entirely lacks the beautiful violet-red colour of that plant.

Perianths were rare on the Cornish material, but on one small tuft they are not infrequent in a more or less immature condition.

C. dentata is mainly of Mediterranean distribution, being found on the Dalmatian coast (Island of Arbe), the French Riviera, Corsica and the neighbourhood of Florence. It is also found on the Atlantic side of France, where it has been gathered abundantly by M. Douin in the Department of Eure-et-Loir, and by M. Corbière as far north as Cherbourg, almost in the same latitude as the Lizard promontory.

I am much indebted to the Rev. H. G. Jameson for the excellent Plate which he has drawn of *C. dentata*.

Explanation of Plate 577.

1. Perianth and bracts. 2. Portion of mouth of perianth. 3. Bracts and bracteole. 4. Gemmæ. 5. Portion of stem, antical view. 6. Do., postical view. 7. Leaves. 8. Apex of leaf. 9. Under-leaves. All from Cornish material.

SOME NEW VARIETIES OF WHEAT.

By Prof. John Percival, M.A., Sc.D., F.L.S.
(University of Reading).

I. Wheats from Abyssinia, Somaliland, Morocco, and Transcaucasia.

In 1922 I received a number of wheats from Dr. J. P. Mitchell, collected near Lake Tsana in Abyssinia. These wheats, whose native generic name is Sindie, are grown in the highlands of the country at an elevation of about 10,000 feet. Two years later a similar series was forwarded to me by Mr. C. H. Brown, of the Egyptian Ministry of Agriculture; these were pedigree lines raised from samples collected by Mr. G. W. Grabham, of the Soudan Geological Survey, in the same region as that from which Dr. Mitchell's wheats were obtained. A few forms were also received from Monsieur E. Miège from Morocco. These wheats I have grown and studied at the University Farm, along with a sample sent to me by Sir Rowland Hilton, derived from Somaliland, and three varieties which I received from Professor Zhukovsky, of the Tiflis Polytechnic Institute, collected in Transcaucasia.

a. Emmer (*Triticum dicoccum* Schüb.).

Key to the Varieties.

Section A. *Speltæ.*

Glume white, glabrous; awn white; grain red.	Var. 1. *Ajar* mihi.
Glume white, glabrous, with black margins, or with black or dark brown spots and stripes; awn black; grain red	Var. 2. *nigro-Ajar* mihi.

Section B. *Tenaces.*

Glume white, glabrous; awn white.	
a. Grain white	Var. 3. *Brownii* mihi.
b. Grain red	Var. 4. *uncinatum* mihi.
c. Grain purple	Var. 5. *Arraseita* mihi.
Glume white, with black stripes or spots, glabrous; awn black.	
a. Grain white	Var. 6. *pseudo-Brownii* mihi.
b. Grain red	Var. 7. *pseudo-uncinatum* mihi.
c. Grain purple	Var. 8. *pseudo-Arraseita* mihi.
Glume white, pubescent; awn white.	
a. Grain white	Var. 9. *tomentosum* mihi.
b. Grain red	Var. 10. *amharicum* mihi.
Glume white, pubescent; awn black.	
a. Grain white	Var. 11. *pseudo-tomentosum* mihi.
b. Grain purple	Var. 12. *Grabhami* mihi.
Glume red, glabrous; awn red.	
a. Grain white	Var. 13. *rubescens* mihi.
b. Grain red	Var. 14. *rufescens* mihi.
c. Grain purple	Var. 15. *Schimperi* Körn.
Glume red, with black margins, glabrous; awn black.	
a. Grain white	Var. 16. *pseudo-rubescens* mihi.
b. Grain red	Var. 17. *pseudo-rufescens* mihi.
c. Grain purple	Var. 18. *pseudo-Schimperi* mihi.

Glume red, pubescent; awn red.
a. Grain white ..... Var. 19. *vulpinum* mihi.
b. Grain red ..... Var. 20. *rubrivillosum* mihi.
c. Grain purple ..... Var. 21. *ethiopicum* mihi.
Glume black or dark brown, pubescent.
a. Grain red ..... Var. 22. *persicum* mihi.

All these wheats belong to the Indo-Abyssinian group of Emm (*T. dicoccum* Schüb.), first described in my monograph, "The Wh Plant"; some (indicated below as var. nov.) are hitherto undescrib They are of erect habit, the first few leaves narrow (4–6 mm. acro and pubescent, very different from those of *T. vulgare* or the glabro leaved *T. durum*, with which some of them have been erroneou classified. The culms are slender and comparatively short, the up internodes 1·7–2 mm. in diameter, with thick walls, or solid completely filled with pith.

The ears of the typical *Speltæ* Section are short, 6–7 cm. lo narrow across the face of the spikelets, but broad across the t ranked side, dense (density=30), with a fragile rhachis whose in nodes are very narrow (1 mm. across) and fringed with hairs, frontal tuft at the base of each spikelet up to 2 mm. long.

The ears of the *Tenaces* Section are of varied form and den the commonest being long and lax, 10–15 cm. long, quadr 7–10 mm. across the sides, density=15–20; other forms have 6–8 cm. long, occasionally clubbed, of various grades of density f 22–40, the densest being broader across the two-ranked side t the face.

The empty glumes are keeled throughout their length, and ha prominent lateral nerve; in some forms the keel ends in a short bl tooth, in others the tooth is acute and longer, sometimes stron curved, while in a few forms the empty glume terminates in a l awn, 1·5–6 cm. long.

The flowering glumes are awned, the awns slender, and in varieties 8–11 cm. long; a few have awns only 3–4 cm. long.

The grains are white, red, or purple, the latter tint being found in wheats belonging to varieties of the *Tenaces* Section *T. dicoccum*. In all the Indo-Abyssinian Emmers the coleoptil the embryo is remarkable in possessing from 2–6 nerves or vaso bundles. A few pedigree lines appear to have only two; the majo however, of all forms of the many varieties yield plants with 3, or 6 coleoptile bundles.

Except where otherwise indicated, all the varieties descri are from Abyssinia.

Var. 1. *Ajar* mihi. (Perciv. Exsicc., Chief Wheats, shee *Gluma* sterilis, alba, glabra; *arista* alba; *granum* rubrum.

Among the Moroccan Emmers sent by Monsieur Miège, collected in the region of Ouergha to the north of the French was a form exactly similar to the typical Abyssinian Ajar, with coleoptile bundles; others resembling the latter in habit and gen morphological characters had only two coleoptile bundles, while exhibited the characters of the European Emmers.

Var. 2. *nigro-Ajar*, var. nov. (Perciv. Exsicc., Chief Wheats, sheet 5.) *Gluma* sterilis, alba, nigro-maculata, ±nigro-marginata; *arista* nigra; *granum* rubrum.

The empty glume of this variety has a black stripe along the margin, and is more or less spotted with black, which colour in some specimens almost covers the outer face of the glume; in other respects the variety resembles var. *Ajar*.

Var. 3. *Brownii*, var. nov. (Perciv. Exsicc., Chief Wheats, sheet 7.) *Gluma* sterilis, alba, glabra; *arista* alba; *granum* album.

In the only form received of this variety, the ear is 7·5–10 cm. long, quadrate, 8–10 mm. across the sides, density=21–27.

Var. 4. *uncinatum* mihi. (Perciv. Exsicc., Chief Wheats, sheet 7.) *Gluma* sterilis, alba, glabra; *arista* alba; *granum* rubrum.

One of the commonest varieties of the *Tenaces* Section. Several forms occur, of which the following are the most prevalent:—

Form I. Ear long and lax, 10–15 cm. long, density 15–17. In the Abyssinian examples the rachis is more or less hairy, and the empty glume terminates in a slender apical tooth or awn 2–5 mm. long; in the Transcaucasian form *T. persicum* var. *stramineum* Klukovsky, the rachis is almost glabrous, and the awn of the empty glume is 1·5–6 cm. long.

Form II. Ear about 7 cm. long, of medium density (density =27–30); empty glume with a short blunt tooth.

Form III. Ear 5–9 cm. long, medium density (density =25); empty glume ending in a strong curved tooth; awn of the flowering-glume only 3–5 cm. long.

Var. 5. *Arraseita* mihi. (Perciv. Exsicc., Chief Wheats, sheet 12.) *Gluma* sterilis, alba, glabra; *arista* alba; *granum* purpureum.

The common purple-grained Abyssinian Emmer with long, narrow, lax ears, generally 9–10 cm. long, quadrate, 8 mm. across the sides, density=22.

Var. 6. *pseudo-Brownii*, var. nov. *Gluma* sterilis, alba, glabra, nigro-maculata vel nigro-marginata; *arista* nigra; *granum* album.

Ear long, narrow and lax, 8–11 cm. long, density=18; with black awn and keel, and a dark stripe along the margin of the empty glume; the spikelets sometimes grow out into short rudimentary ears.

Var. 7. *pseudo-uncinatum*, var. nov. (Perciv. Exsicc., Chief Wheats, sheet 8.) *Gluma* sterilis, alba, nigro-maculata vel nigro-marginata, glabra; *arista* nigra; *granum* rubrum.

Form I. Ear 9–10 cm. long, density=22, quadrate, 8–9 mm. across the sides.

Form II. Ear shorter and denser, about 6 cm. long, density =30–32, 8–9 mm. across the face and 12 mm. across the two-ranked side.

Var. 8. *pseudo-Arraseita*, var. nov. *Gluma* sterilis, alba, nigro-maculata vel nigro-marginata, glabra; *arista* nigra; *granum* purpureum.

Resembles var. *Arraseita*, but with black awns and keels and brownish spots on the glumes.

Var. 9. *tomentosum* mihi. (Perciv. Exsicc., Chief Wheats, sheet
Gluma sterilis, alba, pubescens; *arista* alba; *granum* album.

Form I. Ear 8–9 cm. long, of medium density, density =
quadrate, 10 mm. across the sides.

Form II. Ear short, dense, 5–6 cm. long, density = 35–36, broad
across the two-ranked side than the face.

Var. 10. *amharicum*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 8.) *Gluma* sterilis, alba, pubescens; *arista* alba; *granum*
rubrum.

Form I. Ear 8–10 cm. long, density = 20–21, quadrate, 7–9 mm.
across the sides, awns 10–12 cm. long; the empty glumes end in a
short acute tooth.

Form II. Ear resembling that of Form III. of var. *uncinatum*,
7–9 cm. long, quadrate, 10–11 mm. across the sides, density = 28,
spikelets often crowded at the apex of the ear; empty glume 6–8 mm.
long, with a short claw-like tooth, awn of the flowering-glume only
3–4 cm. long.

Var. 11. *pseudo-tomentosum*, var. nov. *Gluma* sterilis, alba pubes-
cens; *arista* nigra; *granum* album.

Resembles Form II. of var. *tomentosum*, but with black awns.

Var. 12. *Grabhami*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 12.) *Gluma* sterilis, alba, pubescens; *arista* nigra; *granum*
purpureum.

Ear 8–10 cm. long, moderately lax, quadrate, 8 mm. across the
sides, density = 22; awn black, grain purple, and the upper internode
of the straw usually purple.

Var. 13. *rubescens*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 9.) *Gluma* sterilis, rubra, glabra; *arista* rubra; *granum*
album.

Form I. Ear 9–10 cm. long, lax, density = 18, quadrate, 8–10 mm.
across the sides. Somaliland.

Form II. Ear short, 6–8 cm. long, very dense, density =
8 mm. across the face, 13–15 mm. across the two-ranked side. Abys-
sinia.

Var. 14. *rufescens* mihi. (Perciv. Exsicc., Chief Wheats, sheet
10.) *Gluma* sterilis, rubra, glabra; *arista* rubra; *granum* rubrum.

One of the commonest varieties of the *Tenaces* section.

Form I. Ear 9–12 cm. long, lax, with long awns; density = 18–
awns 10–11 cm. long In this variety I include the form *T. persi-
sicum* var. *rubiginosum* Zhukovsky, with long awns on the empty
glumes.

Form II. Ear of similar form and density to Form I., but with
strong incurved tooth to the empty glume, and short awn (5–6 cm.
long) on the flowering glume.

Var. 15. *Schimperi* mihi. (Perciv. Exsicc., Chief Wheats,
sheet 12.) *Gluma* sterilis, rubra, glabra; *arista* rubra; *granum*
rubrum.

Ear similar to that of var. *Arraseita*.

Var. 16. *pseudo-rubescens*, var. nov. (Perciv. Exsicc., Chief
Wheats, sheet 10.) *Gluma* sterilis, rubra, sæpe nigro-marginata;
arista nigra; *granum* album.

Form I. Ear as in Form I. of var. *rufescens*, but with brown or
black margin to the empty glume. Somaliland.

Form II. Ear 7–8 cm. long, of medium density, density = 25,
with black awns and black stripe along the margin of the empty
glume. Abyssinia.

Var. 17. *pseudo-rufescens*, var. nov. (Perciv. Exsicc., Chief
Wheats, sheet 10.) *Gluma* sterilis, rubra, sæpe nigro-marginata;
arista nigra; *granum* rubrum.

The common form of this variety resembles Form II. of var.
rufescens, but has black awns and black stripes on the margin of
the empty glume.

Var. 18. *pseudo-Schimperi*, var. nov. *Gluma* sterilis, rubra,
glabra, sæpe nigro-maculata vel nigro-marginata; *arista* nigra; *granum*
purpureum.

Similar to var. *Schimperi*, but black-awned and with black spots
on the empty glumes.

Var. 19. *vulpinum*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 11.) *Gluma* sterilis, pubescens, rubra; *arista* rubra; *granum*
album.

Ear 5–6 cm. long, flat and dense, density = 38–40, 10 mm. across
the face, and 15 mm. across the two-ranked side.

Var. 20. *rubrivillosum*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 11.) *Gluma* sterilis, pubescens, rubra; *arista* rubra; *granum*
rubrum.

Ear 7 cm. long, lax at the base, and densely crowded at the apex.

Var. 21. *ethiopicum*, var. nov. (Perciv. Exsicc., Chief Wheats,
sheet 12.) *Gluma* sterilis, pubescens, rubra; *arista* rubra; *granum*
purpureum.

Ear. 10 cm. long, lax, quadrate, 8 mm. across the sides, density
18–20.

Var. 22. *persicum* mihi. (Perciv. Exsicc., Chief Wheats, sheet 12.)
Gluma sterilis, pubescens, fuliginosa vel nigra; *arista* nigra; *granum*
rubrum.

Ear of the long, lax, quadrate type, 8–10 cm. long, 10 mm. across
the sides, density = about 20.

The typical form of this variety first distributed by Messrs. Haage
and Schmidt, Erfurt, under the name of Black Persian Wheat, is
reported by Vavilov to have been supplied originally to this firm by
Messrs. Immer, of Moscow, but from what country the latter obtained
it is unknown.

It has been recently discovered (1922) by Professor Zhukovsky in
cultivation in the mountainous districts of Georgia, and in 1925
in Armenia, by Mr. L. L. Dekaprelevich, along with white-eared
and red-eared varieties which with var. *persicum* have been constituted
a new species or race of wheat under the name *T. persicum* Vavilov.
In my monograph I included Black Persian Wheat in the *Tenaces*
section of the Indo-Abyssinian Emmers, and at present so retain it
along with the other varieties of Zhukovsky. In habit, morphology,
disease-resistance, chromosome-number, and other characters, these
Transcaucasian and Abyssinian wheats agree, and I have no doubt
have had the same origin. Both are cultivated in high mountainous

regions, and are remarkable in possessing 2–6 nerves or vascul bundles in the coleoptile, as in the typical Indian and Abyssinl *Speltæ* forms of Emmer (*T. dicoccum*), var. *persicum* and th vars. *stramineum* and *rubiginosum* of Zhukovsky, having 2, 3, 4 bundles, and not two only, as stated by Zhukovsky.

b. T. polonicum L. var. *villosum* Körn.
(Perciv. Exsicc., Chief Wheats, sheet 47.)

Among the Abyssinian wheats was found a form of Polish Wh belonging to var. *villosum*, with an ear typical of the race, 10–12 cm long, and the characteristic empty glumes 25 mm. long. The grain however, are only 7·6 mm. long, instead of 10–11 mm., as in th common forms of this race, and resemble those of the *Tenaces* sect of *T. dicoccum* in possessing 2–5 coleoptile bundles. Possibly th peculiar grain-characters are the result of hybridisation with th Abyssinian Emmers, but this can only be determined by experimen

II. Egyptian Wheats.

a. Egyptian Cone Wheat (*T. pyramidale* Perciv.).

Under the name of "Beladi" wheats (Beladi=native), I receiv from Mr. C. H. Brown a series of Egyptian endemic forms belongin to the race of Egyptian Cone Wheat. Among them were represent tives of the vars. *recognitum*, *compressum*, *pseudo-compressum*, *co ticum*, *pseudo-copticum*, and the two following new varieties:—

1. Glume white, glabrous; awn white; grain red ..... Var. *ptolomæum* mih
2. Glume red, glabrous; awn red; grain red..... Var. *thebaicum* mih

Var. *ptolomæum*, var. nov. (Perciv. Exsicc., Chief Whea sheet 60.) *Gluma* sterilis, alba, glabra; *arista* alba; *granu* rubrum.

A common form sometimes received under the name "Seifi."

Ear 5–9 cm. long, quadrate, 10 cm. across the sides, density = 2 28; spikelets 2–3-grained. Empty glume keeled, apex broad wi short blunt tooth, lateral nerves conspicuous. Flowering-glu keeled, with awns 15 cm. long. Grain red, flinty, about 7 mm. lon narrowed at the apex, laterally compressed, with prominent dor ridge.

Var. *thebaicum*, var. nov. (Perciv. Exsicc., Chief Wheats, sh 61.) *Gluma* sterilis, rubra, glabra; *arista* rubra; *granum* rubrum

Ear more or less tapered from the base to the apex, 6–7 cm. lon flattened, 8–10 mm. across the face, 15–17 mm. across the side, ve dense (density=35–40). Empty glume strongly keeled, with bro apical tooth, lateral nerves conspicuous. Flowering-glume with a 15 cm. long. Grain red, flinty, 7–8 mm. long, laterally compress dorsal ridge prominent, apex blunt.

b. Rivet Wheat (*T. turgidum* L.).

With the varieties of *T. pyramidale* came a new variety of *T. tu gidum* from Lower Egypt. It is doubtless an introduced form, *T. turgidum*, is not endemic in Egypt.

Var. *ramoso-megalopolitanum*, var. nov. (Perciv. Exsicc., Chief Wheats, sheet 51.) *Spica* ramosa; *gluma* sterilis, alba, pubescens; *arista* alba; *granum* album.

A form with white pubescent glumes, white awns, and white grain, as in the Greek var. *megalopolitanum*, but with copiously branched ears.

III. Wheats from Sinai.

Among a small collection of wheats from Sinai also sent by Mr. Brown were: *T. durum* vars. *leucomelan* and *africanum*, *T. vulgare* vars. *erythrospermum* and *Delfii*, *T. compactum* vars. *erinaceum* and *albiceps*, *T. pyramidale* var. *pseudo-compressum*, and two new varieties of *T. pyramidale*, namely:—

1. Glume white, pubescent; awn white; grain red. Var. *arabicum* mihi.
2. Glume white, pubescent; awn black; grain red. Var. *pseudo-arabicum* mihi.

In both these varieties the ear is about 6 cm. long, 10 mm. across the face, 12–14 mm. across the side, very dense (density=40). Empty glume keeled, with a curved blunt tooth, awn of the flowering-glume about 9 cm. long; grain short, about 7 mm. long, dorsal ridge prominent, apex blunt, flinty, often with mealy opaque patches.

IV. Iraq Wheats.

A collection of wheats from Iraq was received from Mr. J. F. Webster, Inspector-General of Agriculture, with notes by Mr. F. K. Jackson, the Agricultural Botanist. The wheats included *T. orientale* vars. *notabile* and *insigne*, from Khaniqin; *T. durum* vars. *apulicum*, *erythromelan*, and *cærulescens*, from Khaniqin; var. *provinciale* from Upper Euphrates, and a number of varieties of *T. vulgare* with black awns and empty glumes, more or less spotted with black or dark brown patches, which in some seasons completely cover the glumes. Under certain climatic conditions the black pigment is inhibited, and the awns and chaff then only show the merest traces of the brown tint, making classification difficult or uncertain.

Asia Minor, Iraq, and Western Persia is the home of these varieties of *T. vulgare*; in countries outside this area such wheats are of great rarity, and then probably not truly endemic.

The following varieties, obtained from Iraq, have been grown at Reading:—

Ears bearded.

1. Glume white, spotted with black, glabrous; awn black.
   - *a.* Grain white ..... Var. *nigro-græcum* mihi.
   - *b.* Grain red ..... Var. *nigro-erythrospermum* Jakush.
2. Glume white, spotted with black, pubescent; awn black; grain white ..... Var. *nigro-meridionale* mihi.
3. Glume white, pubescent; awn black; grain white ..... Var. *pseudo-meridionale* Flaksb.
4. Glume red, glabrous; awn black; grain white ..... Var. *pseudo-erythroleucon* mihi.
5. Glume red, pubescent; awn black; grain red ..... Var. *pseudo-barbarossa* Vav.

Var. *nigro-græcum*, var. nov. (Perciv. Exsicc., Chief Wheat sheet 67.) *Gluma* sterilis, alba, nigro-maculata, glabra; *arista* nigra; *granum* album.

Two forms of this variety were obtained from Northern Iraq.

Form I. Ear 9–11 cm. long, somewhat narrow, quadrate, 8–9 mm. across the face and side, lax, density=20. Empty glume keeled, narrowed at the apex, and ending in a black awn 5–10 mm. long, considerably streaked with black. Flowering-glume with black awn 6–8 cm. long, stout at the base. Grain flinty, small, 5–6 mm. long, prominent dorsal ridge, and laterally compressed.

Form II. has shorter ears, shorter awns, and less black colour on the glumes.

Ear 7–8·5 cm. long, narrow, quadrate, 8–9 mm. across the face and side. Empty glume with narrow apex, and short awn 2–5 mm. long. Flowering-glume with black awn 2–4 cm. long.

Var. *nigro-erythrospermum* Jakush. (Perciv. Exsicc., Chief Wheats, sheet 91.)

Ears short and similar to those of Form II. of var. *nigro-græcum*, but with longer awns, 6–7·5 cm. long, and dark red flinty grain.

Var. *nigro-meridionale*, var. nov. (Perciv. Exsicc., Chief Wheat sheet 93.) *Gluma* sterilis, alba, nigro-maculata, pubescens; *arista* nigra; *granum* album.

Ear 7–8 cm. long, quadrate, about 10 mm. across the face and side, moderately dense, density=23–25. Empty glume, keeled, narrow at the apex, and ending in an awn 5–12 mm. long; the black streaks with the white hair covering the surface of the glume give the latter a grey appearance. Flowering-glume with black awn 2·5–5 cm. long. Grain short and stout, 6 mm. long, dorsal side prominent, apex blunt.

Var. *pseudo-meridionale* Flaksb. (Perciv. Exsicc., Chief Wheat sheet 94.) Ear about 9 cm. long, 10–12 mm. across the face and side, density=20. Empty glume narrow at the apex, ending in a tooth 3–5 mm. long. Flowering-glume with stout black awn, 4–5 cm. long. Grain flinty, short, stout, 5–6 mm. long, dorsal side rounded, apex blunt.

Var. *pseudo-erythroleucon* var. nov. (Perciv. Exsicc., Chief Wheats, sheet 99.) *Gluma* sterilis, rubra, glabra; *arista* nigra; *granum* album.

Ear 8 cm. long, narrow, quadrate, about 8 mm. across the face and side, density=23–24.

Empty glume, pale red, keeled, narrow apex ending in an awn 10–20 mm. long. Flowering-glume with a stout black awn 3·5–5 cm. long. Grain flinty, short, about 6 mm. long, dorsal side prominent.

Var. *pseudo-barbarossa* Vav. (Perciv. Exsicc., Chief Wheat sheet 128.) Ear lax, 9 cm. long, quadrate, 10 mm. across the face and side, density=20.

The type-specimens of these new varieties may be seen in the Botanical Department of the British Museum (Natural History) London (Percival: Collection of the Chief Wheats of the World Set no. 1).

REPRODUCTIVE MECHANISM IN LAND FLORA.

V. Sporangia.

By A. H. Church, M.A., F.R.S.

As previously indicated, even the still existing forms of Bryophyta serve admirably to illustrate the manner in which algal meiotangia with limiting tetrad of asexual spores have been aggregated to constitute the archesporium of Land-flora, in which spore-tetrads are now wholly immersed beneath the epidermis of the land-soma, nourished by feeding layers (*tapetum*), and ultimately discharged by special mechanism of dehiscence, to be wind-distributed as more or less dry cutinized spores still retaining chloroplasts. It is equally evident that the Bryophyte diploid soma, once free and autotrophic, radial in organization, and dichotomously branched, is now increasingly vestigial and depauperated from its original habit, reducing in stages of increasing hemiparasitism to a mere spore-producing capsule the more it is buried in the parental tissues of the calyptra. On the other hand, it is undeniable that the full dominion of the land-surface has been attained by the descendants of some wholly distinct series of algal forms. In these, marked specialization of the photosynthetic soma had already taken place—as presented in the differentiation of main stem and special leaf-ramuli; the former branching by original dichotomy or by monopodial mechanism involving apical cells. The now specialized leaf-ramuli, increasingly dorsiventral, are produced in a definite and acropetal rhythmic sequence (*Fibonacci phyllotaxis*); while, as in algal forms, the production of meiotangia and included tetrads is now relegated to these photosynthetic laminæ, as the spores are matured at the source where the food is elaborated. The stem subserves the function of attachment, mechanical stability, and distribution of the working members in optimum light-intensity; but this implies its own diminished value as a photosynthetic tract. Hence while the Bryophyta may illustrate some features in the biological progression of early Land-flora, they have no direct bearing on the main story, but are increasingly regarded as representing a side-track of less successful autotrophic vegetation and of so far very inferior morphological grade.

Members of the great class of Pteridophyta persist in specialized, isolated, often greatly reduced vestigial forms, to carry on the tale of the beginnings of more dominant land-vegetation, which may now be followed through the stages of sporangial evolution to phases of advanced *heterospory*, though always falling short of the attainment of the seed-habit. Yet all higher phyla of seed-plants (Phanerogams) must have undoubtedly come much the same way from very similar transmigrant forms. These present very much the same anatomical differentiation of vascular tissues, and their reproductive organs are still essentially *sporangia*, as the same new problems of subaerial life

were solved in closely parallel fashion by plants of similar parenchymatous organization [1].

The story of the origin and significance of sporangial structures has been naturally biassed in the past by the study of common and familiar Pteridophyte types of the North Temperate zone, unfortunately regardless of the fact that the most common modern type is to be regarded as more probably the end-term of more recent evolutionary specialization — the dominance and vast numerical majority of Leptosporangiate Ferns, for example, being in this respect as confusing as the vast variety of modern Mosses (Eu-Bryineæ). But the range of terrestrial Pteridophyta has been by this time sufficiently surveyed to admit of a broader view in dealing with the series as a whole.

It is generally accepted that the first distinctive feature of the diploid phase in Pteridophyta is perhaps not so much their advanced vascular and anatomical organization, as the fact that they produce definite *leaves* as lateral appendages, and the leaves in turn bear special structures (sporangia) [2] in which the spore-tetrads are elaborated. Though such sporangial structures may have the same general reproductive function and also value in the life-cycle as the sporogonia of the Bryophyta, they disclose a fundamentally distinct morphology [3]. So much so that the problem of the origin of these spores, their nutrition and subsequent dispersal, requires to be approached wholly anew; though again the essential subaerial features of (1) relative volume, (2) tetrad-development, (3) provision of spore-coat, (4) cutinization, as also (5) necessity for dispersal by air-currents of the characteristic spores of Land-flora, remain unaffected, as presenting

[1] Since all seed-plants must have passed through a condition of free growth for the sexual stages, and all heterosporous Pteridophyta must have been once homosporous, while still spore-producing land-vegetation, it follows that all higher plants must have been at some distant time of the Pteridophyte horizon as far as their reproductive mechanism is concerned. Behind this they may show indications of algal ancestry, and the story of the Moss is relegated to a side track of evolution in another series.

[2] The expression *sporangium* dates to Schleiden (Grundzüge, Eng. Trans. 1849, 145), and as already indicated was intended to cover the tetrad mother-cell or unilocular sporangium of an alga, and hence corresponded with the term *meiotangium* as now used. While Schleiden and Nägeli grasped this connection with seaweeds, land-botanists as Von Mohl (1837) and Hofmeister (1851) used the term as convenient for the spore-capsules of Pteridophyta (called by Schleiden 'sporocarps'), and their usage was followed by Sachs, and hence appears customary. The 'Anglicised' form *sporange* is difficult either to swallow or defend. Bennett and Murray (1889), *Handbook of Cryptogamic Botany*, 6; *Journal of Botany* (1889), 280.

[3] The distinction by older morphologists of the plant-somata of the land into popular categories of stem, leaf, and root merely follows 'common knowledge' and has no scientific value or definition (Schleiden, 1849, 214). The wonderful confusion of ideas involved in 'Stem and Leaf,' 'Root and Shoot,' Botany to the time of Sachs merely illustrates the fact that these distinctions, common to the higher Land-flora, are older than Land-flora itself—*i.e.*, they do not represent the response of plant-life to subaerial conditions, but to some antecedent environment of the sea. For the origin of stem, leaf, and root in Seaweeds, *cf.* Bot. Mem. 56, 61.

parallel developments from some very comparable older organization in response to similar subaerial conditions.

The general botanical features are beyond dispute. While the cytologically dicœcious Bryophyta present two generations—one the sporophyte, hemiparasitic and wholly destitute of leaves, roots, or branches,—the Pteridophyta present a well-developed free-living sporophyte of most advanced structure with all these parts well-marked; but it is the gametophyte which lacks them, and is at the best but a thalloid shoot of the horizon of a dorsiventral and decadent *Pellia* or *Anthoceros*. The more these groups are examined the clearer it becomes that it has always been so, and that even on transmigration this probably represents the older equipment of the race—at any rate, there is no evidence to the contrary. Hence the relation of Pteridophyta to Bryophyta has always proved a puzzle; though at first, when the common features of the life-cycle were first made out by Hofmeister, the gap was less defined, as points of reproductive resemblance appeared to counterbalance features of somatic difference [1].

It is well to remember that Hofmeister's original presentation of the sequence of plant-life from Algæ to Flowering Plants was based solely on features of the reproductive mechanism. Following the general enthusiasm for details of sexual mechanism, as soon as sexual phenomena were demonstrated in plants, extreme importance was attributed to all details of reproductive processes; and, so far, quite correctly, since it is now accepted that this covers the entire mechanism of racial continuity and development. Biology deals with races rather than with individuals, and races which do not reproduce soon die out and are negligible. But it is a mistake to misunderstand plain language. Hofmeister's dictum that the "object of the sporophyte was to produce spores" is a metaphorical half-truth, about as satisfactory as saying that the object of the human race is to produce children. The first object of the plant, as of the animal, is undoubtedly to maintain its own somatic existence. It was admittedly difficult to realize that the plant life-cycle was only completed in two individuals, each wanting to live its own life; hence the confusion introduced by pseudo-evolutionists of a more modern school, who sought to apply ideas of an ascending series too strictly to the development of plant-somata as well. A sequence of reproductive horizons, quite correctly isolated by the genius and penetration of Hofmeister, was given the interpretation of a phylogenetic sequence of plants in following somatic and genetic succession. Much ingenuity of botanists of the late nineteenth century seems to have been wasted in trying thus to fit the Fern-plant on to a Moss-capsule, in order to save the series, and because it had become the custom in text-books to arrange the different forms in this manner. There was no doubt whatever that in Pteridophyta the diploid phase was dominant, even if asexual; and in comparison with the hemiparasitic and feeble Moss-sporophyte the wonder grew as to how the latter could

[1] The labelling of both Bryophyta and Pteridophyta as *Archegoniatæ*, from a mistaken sense of the significance of the organ devoted to fertilization *in situ*, led immediately to the conception of common origin or even of lineal succession.

ever turn into the former. Needless to say, it is ridiculous to suppo that it ever did so.

Although of even doubtful historical value, it may be interestin at this point to review the different suggestions in exhausting all th possibilities whereby such evolutionists approached the problem, i defiance of all laws and principles of biology and morphology, or ove of practicable evolution following natural selection. Even whe morphological principles were involved, these included an appeal t wholly academic authorities of the eighteenth century (Wolff, Goeth and of a pre-evolutionary epoch. An appearance of erudition wa thus often presented, which served to keep the laity and enquirin students, not too well versed in obscure German literature, at respectful distance. The dates of such suggestions serve to show ho long it took for ideas of working evolution to sink into gener Botany.

Thus Naegeli (1884) rather vaguely suggested that the Mo capsule might continue apical growth and branch, as in dichotomou twin capsules; or, again, it might grow out basally from th apophysis and afford a sympodial shoot-system![1]

Prantl (1875) compared the sorus-cup of the Hymenophyllace with the capsule of *Anthoceros*, in 'columella' and valva dehiscence![2]

Vaizey (1890) was impressed with the exaggerated apophysis o *Splachnum*, as suggesting a leaf-like growth which, if repeated an cut into leaf-members, might give rise to whorled phyllotaxis![3]

Campbell (1911) suggested that the lateral outgrowth of a sol rooting *Anthoceros* capsule might give rise to a Pro-*Ophioglossum*![4]

Bower's (1894) views have been most thoroughly advertised, an he has at great length repeated the conception that the apex of Moss-sporogonium becomes a strobilus on the lines of *Equisetum* first segmenting into sporangial *enations*, and then giving *leaves* sterilized sporophylls![6]

To the modern student such speculations appear crude and fanta tic, or merely humorous, the fault common to all being an endeavou to solve the problem of somatic life entirely from the standpoint o reproductive homologies. Equally vital questions as to—

(1) The origin of apical ramification of the shoot;
(2) The origin of leaf-members and their phyllotaxis relations;
(3) The origin of sporangia and conducting tissues;
(4) The origin of roots—

are regarded as wholly subsidiary, and even as trivial details in co

[1] Naegeli (1884), *Theorie der Abstammungslehre*, 476.
[2] Prantl (1875), *Untersuchungen zur Morphologie der Gefässkryptogame* 62.
[3] Vaizey (1890), *Annals of Botany*, v. 1.
[4] Campbell (1911), *The Eusporangiatæ*, 210.
[5] Bower (1894), Phil. Trans. 559.
[6] *Loc. cit.* 493, "The apex of the sporogonium is the correlative of the apex the strobilus: appendages are an eruption of outgrowths." Cf. *Origin of a La Flora* (1908), 132, 244.

parison with the production and sterilization of spore-tetrads; and hence as minor problems superimposed on the original one, and left still hopelessly unsolved[1].

But seeing that all these features, together with the satisfactory production of spore-tetrads on a large scale, are given in the morphology of highly differentiated existing seaweeds, and obviously do not require to be re-invented under the wholly new conditions of subaerial environment, it is safer to give the older vegetation of the sea-world a chance to say something for itself, and not to merely put it on one side[2] as something wholly derogatory to the morphological dignity of Land-flora.

(To be continued.)

NOTES FROM THE BRITISH MUSEUM HERBARIUM.

NOTE ON *IXORA TRIFLORA* R. BR.

BY S. MOORE.

THERE are two gatherings of this Queensland plant in the British Museum—one of Banks and Solander from the Bay of Inlets, the the other of Brown from Thirsty Sound. In the Brown MSS. will be found an elaborate description of the plant, including the corolla, by some mischance missing from the specimens, but which Brown is able to describe from a Solander MS., which a careful search has, unfortunately, not enabled me to find. Brown writes: "Flores non nobis visi sed cor. descr. in Mscr. Sol." The description runs: "Corolla hypocrateriformis tubus cylindraceus longus. Limbus quadripartitus laciniæ oblongæ acutæ patentissimæ"—obviously, so far as concerns the corolla, a typical *Ixora*. At the time (1866) vol. iii. of *Flora Australiensis* was published, Kew had no specimens of *I. triflora*, the Brown material now there having been acquired under the terms of the Bennett bequest in 1872; but Bentham evidently saw the Museum specimens, and had he read Brown's MSS. description, he would have avoided the mistake he made when treating of this plant in *Flora Australiensis*, iii. 416. His description under *I. triflora* is incorrect as regards the shape, size, and consistence of the leaves, the inflorescence, and especially the corolla, which, he writes, has a tube "not two lines long," a very unusual thing in *Ixora*, and

[1] Bower (1908), *loc. cit.*, 'Origin of the Root,' 221: 'Evolution of the Leaf,' 111, 251. The situation is closely paralleled in other fields, and a comparable confusion of the mechanism of evolution may be noted in the practice of painters and even modern sculptors who can 'derive' an angel from the human figure by adding wings, with no equipment of muscles and bones to render them a practicable proposition, though meticulous accuracy may be shown in the rest of the anatomy. Thus a winged Eros may appeal to popular admiration, while minor imperfections of a Rima only excite objurgation.
[2] Bower (1908), *loc. cit.* 256, "The Thallophyta may be left on one side"; (1923), *The Ferns*, 24, "The question must therefore be left over for the Algologists."

quite irreconcilable with Brown's—or, rather, Solander's—statemen cited above. In fact, he was dealing with quite a different plant, a pla not belonging to *Ixora* at all, but, as Mueller afterwards pointed out, *Diplospora*. Mueller called the plant *Diplospora ixoroides* (Frag. 182), and, following Bentham's lead, naturally gave "*Ixora triflor* R. Br." as a synonym. Finally, under the name "*Diplospor ixoroides*," *I. triflora* is well represented in James Miller's drawi on tab. 141 of *Illustrations of Australian Plants*, and this prov Solander's description of the corolla to be correct.

Thanks to Mr. C. T. White, Queensland Government Botani the Museum has now a flowering specimen of *I. triflora*, found b Mr. H. Tryon on Percy Islands off the Queensland Coast, and al one of *D. ixoroides*. It is the receipt of these and Mr. Whit letter accompanying them, in which he points out the differen between true *D. ixoroides* and the plant figured in the Miller drawi just mentioned, that has led to the writing of this note.

A few details relating to *I. triflora* may now be given. T obovate-oblong obtuse leaves vary in size from 7·5 × 3·5 cm. (Brow and Tryon's specimens) to 2·5–5 × 1–2 cm. (Bank's and Solander' except for the uppermost pair just beneath the inflorescence (occ sionally one or two preceding pairs) which, as sometimes happens the genus, are suborbicular, and measure in the first case 2·5–3 × 2· 2·5 cm., and in the other 1–1·5 × 1·5–2 cm. These broad leaves, prominent feature of the plant, would seem to function as protecto of the buds, possibly also of the expanded flowers. Corolla whit tube 10–12 × 1 mm.; lobes acute, half as long as the tube. Fru subglobular, 6 × 5 mm.; seeds 2, each with the concave inner face often met with in the genus. The specimens dry brown, a ligh shade on the underside; the corolla, judging from the Tryon o dries reddish.

SOLANUM HOPLOPETALUM Bitter & Summerhayes. This W Australian species is described in the *Kew Bulletin* for the curr year (No. 3, p. 116). The plant has been mistaken hitherto *S. hystrix* R. Br., a native of South Australia and New South Wal which it greatly resembles. The authors of the notice cite for it f localities from the Kew Herbarium and one from that of Berlin; these should be added the following from the British Museum, v Mount Marshall; *Steward*, 377: Cowcowing; *Id.* sine no.: Co gardie District; *Webster*. These further localities, however, do increase the range of the plant, which is from Ashburton to De G rivers in the north-west to Coolgardie on the south-east.—S. MOO

A NEW SPECIES OF *DIPLOSPORA* FROM SOUTHERN QUEENSLAND

BY C. T. WHITE, Government Botanist of Queensland.

Diplospora Cameroni, sp. nov. *Frutex* vel *arbor* parva glab partibus junioribus sæpe resinam flavo-viridem exsudantibus. *Fo* lanceolata vel oblanceolata, lamina plerumque 7 × 2 cm. ad basin

petiolo angustata, supra atroviridis et nitida, subtus pallida et opaca; nervis lateralibus utrinque 7–8, et nervis lateralibus et venulis haud albilibus; stipulis triangularibus obtusis, parte superiore mox decidua. *Cymæ* terminales foliis ca. 2-plo breviores (3–4 cm. longæ atque latæ); ramis præcipuis complanatis in sicco nigris 0·8–1·2 cm. longis, sessilibus vel in pedunculo brevi sitis. *Flores* omnes sessiles vel cymarum ultimarum flos centralis sessilis flores duo laterales breviter pedicellati. *Calyx* campanulatus 2 mm. longus, margine hyalino integro vel sinuato. *Corollæ* tubus 2 mm. longus; ore pubescenti; lobis 5 vel 4 imbricatis ovatis obtusis ca. 4 mm. longis intus in parte inferiore dense pubescentibus. *Stamina* tubi prope ostium applicata; antheris oblongis 2·5 mm. longis, filamentis brevissimis. *Fructus* ovoideus ca. 8 mm. longus, 2-locularis; seminibus plano-convexis irregulariter orbicularibus ca. 4 mm. latis.

Hab. Australia: Yarraman, South-east Queensland; *M. A. Cameron*. (Flowering specimens Oct. 1924, fruiting specimens Dec. 1924.)

Very closely allied to *D. ixoroides* F. Muell., which is distinguished by its much smaller, less branched inflorescence and round, not ovoid, fruits.

I have recently been in communication with the Botanical Department of the British Museum over the supposed identity of *Diplospora ixoroides* F. Muell. with *Ixora triflora* R. Br.

The enquiry arose out of the receipt of a specimen from Yarraman, South-eastern Queensland, that I at first considered new, but afterwards somewhat hesitatingly referred to *D. ixoroides* F. Muell. The examination of this plant necessitated the study of the whole of the *Diplospora* material in our herbarium. Specimens of typical *Ixora triflora* R. Br., *Diplospora ixoroides* F. Muell. and the Yarraman plant were sent to the British Museum, and were handed over to Mr. Spencer Moore for report. Regarding the last, Mr. Spencer Moore wrote: "Do you think this may prove different from *D. ixoroides*? The shape of the fruit does not tally in the two cases; this is often a reason for suspecting specific divergence in Rubiaceæ."

This opinion, coinciding with my original one on the plant, I have described it as above.

THE GENUS *SONNERATIA* IN QUEENSLAND.

In the *Flora Australiensis*, iii. 301, Bentham recorded *S. acida* Linn. f., from Northern Australia. In the *Queensland Flora*, ii. 679, Bailey recorded *S. alba* Sm. from the Johnstone River, Northern Queensland, and placed "*S. acida* Benth. *l. c.*, non Linn. f." under the list of synonyms, being no doubt influenced in this decision by Clarke's notes in Hook. Fl. Brit. Ind. ii. 580. The Johnstone River specimens are somewhat imperfect, but I have no hesitation in referring them to *S. acida* Linn. f. A flowering specimen from Olive River, Cape York Peninsula, collected by Mr. J. E. Young (Wilkins Expedition, July 1923), is unquestionably referable to this species.

S. alba Smith also occurs in Queensland, and is represented in the Queensland Herbarium by specimens collected at Cooktown by Dr. W.

E. Roth. This species is very common on the southern coast of Papua, and I have received specimens from various collectors.—C. T. WHITE, Government Botanist, Brisbane.

[The Australian specimens in the British Museum Herbarium (Banks & Solander, R. Brown) are *S. alba* Sm., and not, as Bentham and also Mueller thought, *S. acida* Linn. fil.—ED. JOURN. BOT.]

ACONITUM LUDLOWII Exell, sp. nov. (Tibet).

Herba perennis erecta; *tubere* oblongo-obconico extus grisco-brunneo intus eboris vultu; *caule* verisimiliter simplice primo albo-tomentello mox pubescente tandem glabro; *foliis* supra brevi- infra longipetiolatis, petiolo applanato sparsim puberulo, plerumque ad-natim sectis, segmentis ambitu obovatis alte bipinnatifidis lobis lineari-oblongis obtusiusculis margine retusis fere glabris supra sicco viridibus subtus glaucis; *floribus* in racemum spiciformem dense positis pedicellatis vel subsessilibus purpureo-viridibus puberulis pedicello tomentello sitis; *galea* semilunatim falciformi apice rostrata puberula; *nectariis* glabris, unguiculo recurvo, calcare longo recurvato; *staminibus* filamento superne sparse puberulo inferne glabro, antheris atro-viridibus; *carpellis* 5 glabris haud patentibus, stylis erectis; *folliculis* oblongis truncatis glabris.

Hab. Sowgon, near Gyantse, Tibet (*F. Ludlow*), fl. specimen July 1924, and fl. & fr. specimen 1925.

Tuber about 8 cm. long and 1·5 cm. in diam.; *leaves* up to 4·5 cm. long; *petioles* from 6 cm. in the lower leaves to 3 mm. in the upper leaves; *pedicels* up to 5 mm. in the lowest flowers of the raceme; *flowers* 2 cm. long and about 1 cm. across; *stamens* 6–8 mm. long; *carpels* 4 mm. long and 1 mm. in diam.; *follicles* 1–1·5 ·5–·8 cm.

A herb 1–1·5 m. in height, with purplish-green flowers growing in abundance by water-courses at 13,500 ft. altitude.

The species belongs to the Sect. *Napellus* DC., and resembles in appearance *A. brachypodum* Diels, of Yunnan, but is at once distinguishable by the glabrous carpels.—A. W. EXELL.

DEVONSHIRE ASSOCIATION. BOTANY REPORT.

THE Seventeenth Botany Report of the Devonshire Association (*Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art*, 1925, lvii. 75–89) shows that in the past year, as in former ones, good work has been done by the Members. Probably few counties have been more thoroughly explored by a band of zealous and competent workers, at the head of whom was the late Mr. W. P. Hiern, the first Editor of these annual botanical Reports, of which the present one is the last that will be written by his successor, Miss C. E. Larter, who, in turn, has now passed on her office to Mr. G. T. Harris, of Buckerell, Honiton, to whom all records relating to the county should henceforth be sent and by whom the Report for 1926 has already been prepared, although

that is not yet published. The Association year begins in July. This 1925 Report is rich in Mr. Harris's records of the Freshwater Algæ in three of the eight botanical districts, namely: I., V., and VI. Many of these are new not only to the parishes (the norm of distribution in these Bot. Reps.) for which they are recorded, but to the county. One, *Œdogonium suecicum* Wittr., from Grimspound, is an addition to the flora of the British Isles.

Mr. G. B. Savery gives a list of the roses collected by him within three miles of Silverton (VI., Exeter). In every instance these have been examined and named by Col. Wolley-Dod, who has given the name "*Saveryi*" to a new variety of *R. dumetorum*. Unfortunately, in 1924, the two slightly-differing specimens could not be re-found. The last enterprise on which Mr. Hiern was engaged was the working out of the distribution of the genus *Rosa* in Devon. He had already collected a large amount of material, to which the species recorded in Mr. Savery's list are a valuable addition. Dr. Watson's list of the plants found on Bewley Down (V.) contains all three species of the genus *Drosera*, together with the hybrid *D. anglica* × *rotundifolia* (*obovata* Mert. & Koch). Under VI. (Torquay) is to be noted the interesting confirmation by the Editor of many plants in the Teign Basin, recorded in the *Journal of Botany* in 1882 by the late Rev. W. Moyle Rogers.

After long search, confirmation has also been found of a 1902 record of *Pinguicula vulgaris* L. in the parish of Ilsington. The plant now collected by Mr. H. C. Robinson may be seen in the Herbarium of the Torquay Natural History Society.

Viola rupestris Sch. var. *glaberrima*, from Manaton, in 1921, determined by Mrs. E. S. Gregory, is the first record in the county of one of the varieties of that much-discussed violet. Since that year, another variety, *glabrescens* Neuman, has been frequently recorded there, as also an apparent hybrid, *R. Riviniana* × *rupestris*. Mrs. Gregory suggests that these "varieties" may be, in reality, the southern forms of the type. Evidently, much more work is required in regard to the presence of *V. rupestris* and its varieties in Devon. The mention of the gathering, in Ilsington (VI.) parish, of the fasciated form of *Cnicus palustris* Willd. recalls a description of that form as long ago as the 1801 edition of Withering's *A Systematic Arrangement &c.* iii. 681. Therein it is given as "Var. 2 *cristatus*" of the same plant, and is called "a monstrous variety." He adds: "It grew in the middle of a pasture. The root produced the same for two years together."

Notes of two Devon specimens of *Thymus* are, with due acknowledgment, taken from an article on the genus by K. Ronniger, Vienna, that appeared in the *Rep. Bot. Ex. Club*, for 1923. The finding, by Mr. R. M. Milne, near Dartmouth, of *Arum italicum* L., is a recent confirmation of that species as a South Devon plant. Good contributions to the Devon Fungi records are made by Rev. E. S. Elliott, Mr. H. G. Peacock, and Mr. A. Beaumont. Mostly around Newton Abbot the last-named has collected, and two of his plants are new county records, namely: *Armillaria denigrata* Fr., and *Hypholoma elæodes* Fr.—C. E. LARTER.

OBITUARY.

John Cryer.

The death of John Cryer, on May 7th last, makes another gap in the small band of botanists devoted to the study of British flowering plants. Cryer for many years utilised his leisure in working out the flora of his native county, Yorkshire, and came to general notice in 1903, through his discovery of *Polygala amarella* Crantz at Grassington, near Skipton. In collaboration with the late W. West, he contributed an account of this plant to this Journal (xli. 114 (1903)). For many years Cryer also investigated the hawkweeds of his native county, to which his attention was directed by the late Augustin Ley, and he regularly supplied notes on the material of this genus communicated to the Exchange Clubs, which will not be easily replaced. More recently the numerous adventive plants of the waste around Bradford attracted his notice, and on these he wrote a short paper for the *Report of the Botanical Exchange Club (British Isles)* in 1919.

Outside his botanical work, Cryer achieved honourable distinction by his fifty years of labour devoted to the cause of education in Bradford. From a teacher in an elementary school in that city, he became Inspector of Science and Superintendent of Gardening in elementary schools under the Education Authority, and a highly popular member of the town's School Board; and he will be gratefully remembered for his singularly successful efforts to extend the number of scholarships in the elementary schools.—H. W. Pugsley.

SHORT NOTES.

A Variety of *Ceriops tagal* C. B. Rob. (*C. Candolleana* W. & A.).

C. tagal C. B. Rob. (*Rhizophora tagal* Perr.) var. **australis** var. nov. Forma radicula tereti nec angulata nec costata.

Hab. Queensland: Moreton Bay, *C. T. White* (type); Fraser Island (Wide Bay), *F. C. Epps*; Bustard Bay and Bay of Inlet, *Banks & Solander*. Papua: Port Moresby, *C. T. White*; Kapa Kappa, *L. J. Brass*.

In the *Proceedings of the Royal Society of Queensland*, xxvii. 97 (1915), I recorded the presence in Moreton Bay, Southern Queensland, about four degrees south of the tropic of Capricorn, of *C. tagal* C. B. Rob. (*C. Candolleana* W. & A.). This species has a wide range over the tropics of Asia, Malaya, the Philippines, Papua, and Australia; but, so far as I know, had not previously been recorded any distance outside the tropics.

A characteristic feature of all the extratropical plants I have seen is that the protruding hypocotyl is terete and not angled or ribbed as in the typical form. The variety *australis* is also found in the tropics; it is quite common in North Queensland and Papua, in both of which places it occurs along with the normal form.

C. tagal is a common mangrove along the Queensland coast, and some time ago I had separated the two forms in the Queensland Herbarium collections, intending to name the variety *australis* as a distinct species, as it seemed to possess a general facies rather distinct from typical *C. tagal*, the leaves seemed to be less distinctly veined, and more inclined to be recurved, the inflorescence and the flowers showed no marked differences, and *C. tagal* is well known to be very variable in the inflorescence (length of peduncle, branching, etc.); but further specimens show distinctions other than the terete radicle not to be constant.

Banks's and Solander's description and figure in the *Illustrations of the Botany of Capt. Cook's Voyage*, pl. 97, refer to the variety. One of the localities quoted (Bustard Bay) is extratropical.

Work on this plant was much facilitated by the fine series of specimens from Papua, received from Mr. L. J. Brass, who is at present in the territory on a collecting tour on behalf of the Arnold Arboretum.—C. T. White, Government Botanist, Queensland.

Ranunculus ophioglossifolius Vill. in West Gloucestershire.—On June 26th, we came across this very rare British species in a new locality in West Gloucestershire, within the limits of Mr. J. W. White's Bristol area. Owing to the constant visits which are yearly paid by botanists to the plant in its East Gloucestershire station, this place may be adequately described as a typical piece of Gloucestershire common-land, situated between Yate and Wotton-under-Edge. It thus lies some ten to fifteen miles N.E. of Bristol, and about twenty-five miles S.W. of the East Gloucestershire locality. The plant is scattered in limited quantity round the margin of a fair-sized pond, and was also noticed very sparingly in a small drying-up depression not far distant. The largest patch is growing in several inches of water, quite out of the range of *R. flammula*, which is plentiful on the muddy edges of the pond, and under these conditions the plant is far more robust and bears larger flowers than of late years in East Gloucestershire, where we have seen it only on the comparatively dry margin of the pool. Similar variations can be noticed in large series of Continental specimens. It is always possible that *R. ophioglossifolius* may be passed over as *R. Flammula*, but besides the better-known scientific characters, the distinctly greenish (not golden) yellow colour of the smaller flowers, resembling more the colour of *R. scleratus*, should easily distinguish it. As it is said—perhaps quite incorrectly—to be an annual, collectors should treat it with the greatest consideration.—C. I. and N. Y. Sandwith.

[For previous records in Britain, see *Journ. Bot.* 1914, 277, where the discovery by Mr. R. Good near Dorchester is noted. Mr. Good informs me that it has not been seen in that locality for some years past.—Ed. Journ. Bot.]

EQUISETUM VARIEGATUM IN CARDIGAN.—On August 14th, 19[illegible] I found several specimens of the above near Borth. This local pl[illegible] does not seem to have been reported previously from Cardigan, and o[illegible] occurs in one of the six adjoining counties (Merioneth). The Cardi[illegible] plant comes under the var. *a. arenarium* Newm.—D. POWELL.

REVIEW.

The Flora of South Africa, with Synoptical Tables of the Genera the Higher Plants. By RUDOLPH MARLOTH. Vol. II. Se[illegible] tion I. Families Podostemonaceæ to Dichapetalaceæ. [illegible] pp. xii, 120, with 42 plates (26 coloured) and 75 text-[illegible] Wheldon & Wesley, London, 1925.

IT was a fortunate combination of circumstances that rendered possible the production of this spacious and beautifully-illustrated account of the families and genera of the South African Flora. The first volume, including the Cryptogams, Gymnosperms, and the section of the Dicotyledons, appeared in 1913, and was followed in 1915 by Volume IV., dealing with the Monocotyledons. As a consolation for the disappointment which the delay in the issue of another volume may have caused some subscribers, the present volume has been increased in size (it will contain 52 coloured and monochrome plates), and is being issued in two sections. The second section will describe the remaining families of polypetalous Dicotyledons; and Volume III. will contain the sympetalous families.

The present volume is uniform with the two previously issued and the author again acknowledges the help of Mrs. F. Bolus; and Dr. F. C. Kolbe has also contributed observations of biological interest. Mr. Spencer Moore, with help from Dr. Rendle, has again been responsible for seeing the book through the press. The coloured plates are striking representatives of characteristic portions of a large number of species, and many of the monochrome plates and text-figures are admirable reproductions of photographs depicting species in their natural habitats. The descriptions of the genera include references to some of the species, with notes of biological interest. Three of the more important South African families fall into the present section—Crassulaceæ, Leguminosæ, and Geraniaceæ; the last named including the almost endemic and highly polymorphic genus *Pelargonium*.

From a biological point of view, the volume supplies a number of striking instances of adaptation to xerophytic conditions, exemplified especially in the Crassulaceæ; while among numerous other examples may be mentioned the "resurrection" habit of *Myrothamnus*, recalling the rose of Jericho and species of *Selaginella*, and the water-storing root-stocks of certain Leguminosæ, such as *Erythrina acanthocarpa*, the remarkable cistern-rhizome of which is figured. The 40 species of *Acacia* include small shrubs a foot or two high, and large trees like the camel-thorn, *Acacia giraffæ*,

which Dr. Marloth remarks that in Burchell's time numerous large trees adorned the country beyond the Orange River, but since the opening of the diamond mines the engines at Kimberley have consumed nearly all such trees within hundreds of miles. The author has no doubt as to the protective character of the spines, which are produced in numbers and of full size only on the younger shrubs or on the lower branches of trees, which are within reach of roaming animals like springboks and other antelopes.

A point of bibliographical importance is the establishment of a new name, *Cotyledon humilis* (p. 17), in place of *C. nana* Marloth (not of N. E. Brown).

We trust that the opportunity will arise, at no long interval of time, of congratulating Dr. Marloth on the completion of the work.

BOOK-NOTES, NEWS, ETC.

EXTERMINATION OF THE PARSLEY FERN IN WALES.—Mr. H. Augustus Hyde, Keeper of the Department of Botany, Natural History Museum of Wales, Cardiff, in a letter to the *Gardeners' Chronicle* (July 3), draws attention to the threatened extermination of the Parsley Fern, one of the rarer Welsh plants, from one of its haunts in Montgomeryshire "by the efforts of money-grubbing collectors." It is stated that Orchid growers are willing to pay 15*s.* to £1 per bag for material of the Fern, the roots of which form a suitable nidus for the cultivation of Orchids. Mr. Hyde appeals to Orchid-growers to refuse to buy the Fern. Local action would seem likely to be the more effective.

BRITISH BRYOLOGICAL SOCIETY.—The Society held its Annual Meeting and Excursion at Ingleton, Yorkshire, at Whitsuntide. Mr. H. N. Dixon, M.A., F.L.S., was elected to the Chair, in the absence of the President. In spite of transport restrictions, about thirty members were present. Ingleborough, with the Limestone Pavements, and the two glens close by, were studied under the expert guidance of local bryologists, and many interesting mosses and hepatics were found. Farther afield, Crummack Dale, Moughton, and Malham were visited, with good results. Some of the more important plants met with were: Mosses—*Dicranodontium longirostre* var. *alpinum*, *Trichostomum crispulum* var. *nigroviride*, *T. mutabile* var. *cophocarpum*, *Zygodon gracilis*, *Splachnum sphæricum*, *Philonotis capillaris*, *Cinclidium stygium*, two or three species of *Thuidium*, *Cylindrothecium concinnum*, *Orthothecium intricatum* and *rufescens*, *Pylaisia polyantha*, *Hypnum falcatum* var. *virescens* and *H. incurvatum*. Hepatics—*Riccia Lescuriana*, *Metzgeria pubescens*, *Haplozia riparia* var. *rivularis* *, *Lophozia badensis* *, *L. hicrenata* *, *Anastrepta orcadensis*, *Leptoscyphus Taylori*, *Cephaloziella myriantha* *, *Bazzania trilobata*, *Lepidozia reptans* vars. *julacea* * and *tenera* *, *Blepharostoma trichophyllum*, *Scapania Hartlingii* *, *Lejeunea patens*, *Cololejeunea calcarea*, and *C. Rossettiana*. (Those new to v.c. 64 are starred.)

At the Annual Meeting it was reported that the new edition the *Moss Census Catalogue* would soon be ready, and that the edition of Macvicar's *Students' Handbook of Hepatics* should be before the end of the year. The next Meeting will be held Brecon, Aug. 12-19, 1927, under the Presidency of the Rev. C. Binstead, F.L.S.—E. ARMITAGE.

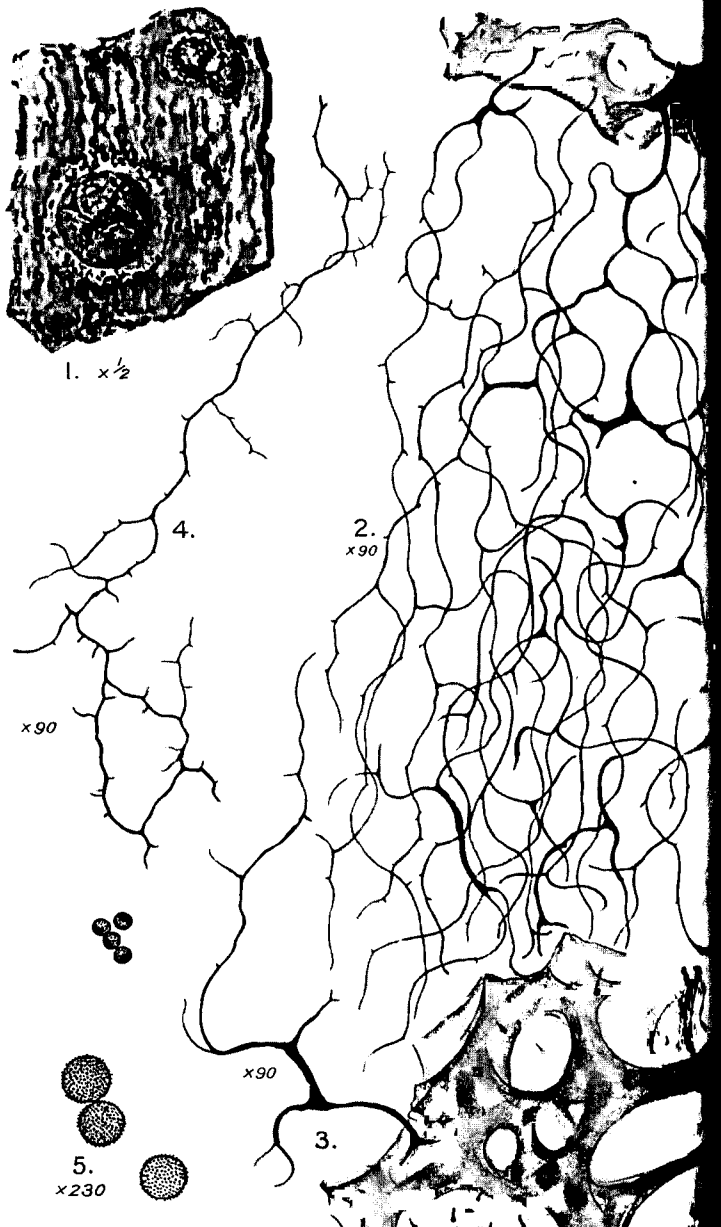
BIBLIOGRAPHY OF CANADIAN PLANT GEOGRAPHY TO THE OF THE YEAR 1920.—Mr. J. Adams, of the Division of Botany Ottawa, has sent for the Library of the Department of Botany British Museum, a typed copy of a list of literature dealing with distribution of plants in Canada, which he has prepared. The contains 2461 entries, classified under six sections, namely: I. Publications before the end of the year 1800; Section II. 1801–185 Section III. 1851–75; Section IV. 1876–1900; Section V. 190 1910; and Section VI. 1911–1920. The entries in each sect are in alphabetical order. Botanists may be glad to know of existence of this valuable list, which may be consulted in Department of Botany.

BRITISH MUSEUM (NATURAL HISTORY) POST-CARDS. Series 10, 11, and 12 of the set illustrating British Flowering Plants h been issued. As in preceding series, each contains five card colour and a descriptive leaflet. The subjects are as follow Series 9. *Cuscuta Epithymum, Orobanche minor, Statice maritim Sparganium neglectum*, and *Ruscus aculeatus*. Series 10. *Barba vulgaris, Drosera rotundifolia, Carlina vulgaris, Ballota nigra*, a *Verbena officinalis*. Series 11. *Cotyledon Umbilicus, Erynginm maritimum, Dipsacus sylvestris, Adoxa Moschatellina*, and *Verba cum Thapsus*. Series 12. *Ranunculus repens, Glaucium flavum, burnum Opulus, Vaccinium Myrtillus*, and *Aristolochia clemati* The drawings were by Miss B. O. Corfe. Two series of Brit Orchids have also been issued from drawings by Mr. E. J. B ford. The subjects are:—Series 1. *Orchis morio, O. mascula, Fuchsii, O. prætermissa*, and *O. incarnata*. Series 2. *O. pyram dalis, Ophrys apifera, O. sphegodes, O. muscifera*, and *Neot Nidus-avis*. Other series of the same set are in preparation.

ON the occasion of the Coming of Age Celebrations at Shef University, July 1 and 2, congratulatory addresses were presen from the Royal Society by Prof. F. O. Bower, and from the Linn Society by the President, Dr. A. B. Rendle.

MANY botanists will hear with regret of the death of the Rev. R. R. Stebbing, F.R.S., which occurred at his house in Tunbri Wells, on July 10, in his 91st year. Mr. Stebbing was an emin zoologist, his chief interest being the Crustacea; he was for m years a familiar figure at the meetings of the Linnean Soci and served as Zoological Secretary from 1903–1907.

WE tender congratulations to Dr. A. W. Hill, Director of Royal Botanic Gardens, Kew, on the honour (C.M.G.) which h been conferred upon him.



AMAUROCHÆTE COMATA G. Lister & Brandza.

NEW SPECIES OF *AMAUROCHÆTE*, AND SOME OTHER MYCETOZOA.

By G. Lister, F.L.S.

(Plate 578.)

Amaurochæte comata G. Lister & Brandza, sp. nov. In a letter received last autumn, Dr. Marcel Brandza describes the ravages of a storm which raged on August 31st, 1925, in the mountain-woods in the district of Neamt, Moldavia. He estimated that over half a million trees were blown down—chiefly old oaks, spruces, and silver-firs. On examining a number of them the following morning he noticed that the upper branches of many trees, besides being clothed with lichens, mosses, and liverworts, supported a rich growth of Mycetozoa. Among these arboreal forms, he found *Badhamia capsulifera* Berk., *B. utricularis* Berk., *B. decipiens* Berk., *Physarum conglomeratum* Rost., *P. crateriforme* Petch, *P. sessile* Brandza, small æthalia of *Fuligo septica* Gmel., and many other species. He also found on the branches small scattered æthalia of a species of *Amaurochæte*, which appears not to have been described hitherto; Dr. Brandza writes that it is not unfrequent on the trunks of *Abies pectinata* in the Moldavian woods, and that he has noticed it in previous years. Externally the glossy black æthalia resemble those of *A. cribrosa* Morgis, but the structure of the capillitium is entirely different. Where the fragile cortex has broken away and the spores are dispersed the mass of capillitium looks like a skein of the finest black hair or wool, when seen under a low magnification. It consists of flexuose slender black threads, 1 to 2 μ diam., repeatedly branching at a wide angle, and attached above to the membranous cortex and below to the smooth shining floor of the æthalium. Along the course of the threads, scattered branchlets are given off, which are usually spine-like and hyaline, but may be darker and repeatedly branched; coarser threads, 3 μ or more in diameter, may occur at irregular intervals. The capillitium breaks away easily from its attachment to the floor, leaving behind short spine-like bases. As in the more confluent forms of *Stemonitis*, no definite columellæ appear to be developed.

A description follows:—

Amaurochæte comata, sp. nov., *æthalio* hemispherico depresso, atro, 5–10 mm. diam., cortice fragili nitente; *capillitio* e floccis atris ramosis, ramis 1–2 μ diam., angulo obtuso divisis composito; *sporis* purpureo-fuscis, verruculosis, 12 μ diam.

Hab. Trunks of *Abies pectinata*. Moldavia, *M. Brandza*.

Plasmodium white; *æthalia* scattered, pulvinate, black and glossy, 5 to 10 mm. diam., seated on a shining membranous hypothallus; columellæ none; *capillitium* consisting of flexuose branching black threads, 1–2 μ diam., attached above and below to the membranous walls of the æthalium; *spores* 11–12 μ diam., dark purplish-grey, closely warted, rather paler and smoother on one side.

The specific name *comatum* refers to the hair-like character of the capillitium.

PHYSARUM NUCLEATUM var. ROBUSTUM G. Lister, var. nov. *Stipit* brevi, 0·2–0·4 mm. alto; *capillitio* e floccis hyalinis ad angulo expansis composito.

Hab. Lessness Wood Kent; *St. J. Marriott.*

An interesting form of this species was found this summer and last autumn by Mr. St. John Marriott on dead wood in Lessnes Wood, near Abbey Wood, Kent. The iridescent blue sporangia on short yellowish-red stalks and the wide expansions at the angles of the capillitium threads recall *P. psittacinum* Ditm.; the white plas modium and the numerous white lime-knots enclosing large granule are, however, entirely characteristic of *P. nucleatum*: a central ball of lime is sometimes present in the midst of the persistent capillitium. A similar form with pale yellow stalks has been obtained in Cornwall and Somerset, and also in Roumania, where Dr. Brandza has found the colour of the plasmodium to be sometimes orange. For con venience of reference, this short-stalked form with robust capillitium may receive the varietal name of *robustum*.

WILCZEKIA EVELINÆ Meylan (Bull. Soc. Vaud. Sc. Nat. lvi No. 216, 69, fig. 2, 1925). This representative of a new genus, the discovery and description of which we owe to M. Meylan, was found in some abundance on fir-needles under spruce-trees in July 1924, at an altitude of nearly 1100 m., near Ste Croix, in the Jura Mountains. The small grey sporangia are mostly ovoid and erect, and are clustered or scattered over the fir-needles; they are sessile on a narrow or broad base, and are often traversed by a white clavate or cylindrical columella which may reach the summit or may be absent; the capillitium consists of a close network of black threads with colourless extremities; the spores are purplish-grey, minutely and closely warted, 9–10 μ diam. Although resembling several species of *Diachea* in columella and capillitium, it differs both from that genus and from the allied *Leptoderma* in the sporangium-wall being opaque with deposits of lime-granules.

DIDYMIUM DUBIUM Rost. Dr. Jahn has courteously sent me a single sporangium of what he suggests is this species, and which was part of a gathering preserved in the Botanical Museum at Dahlem, Germany. The accompanying label states that it occurred on the upper branches and twigs of *Vaccinium Myrtillus*, and was collected June 5, 1812, in Oberwiesental, near the Bohemian frontier. The name of the collector is not known. On comparing this sporangium, which is greyish white, 8 mm. long and 2–3 mm. wide, with the fragment we possess of Rostafinski's type of *D. dubium* (collected by Opiz in 1834 in the Erzgebirge, also on the Bohemian frontier), I agree with Dr. Jahn that it is this species, although the sporangium walls are thicker in part and the capillitium-threads are stouter and longer. But there is no doubt either that it corresponds entirely with the variable Alpine form described by M. Ch. Meylan, in 1908, as *D. Wilczekii*, and which is abundant in the Jura Mountains and on the Swiss Alps. It is, moreover, not the same species as the lowland

snow-white form, not uncommon in the south of England, found also in Scotland, and in the Bermudas, which, unfortunately, we included under *D. dubium*, from its apparent resemblance to Rostafinski's description and type. This lowland form is distinguished by having smaller flatter sporangia, clothed with an eggshell-like calcareous crust, which often breaks away entire, leaving the mass of spores and capillitium exposed, and also by the shorter capillitium-threads, which in the deepest part of the sporangium are rarely over 200 μ in length, while in the true *D. dubium* they measure from 270–300 μ. Massee named the lowland form *D. Listeri* (*Monograph of Myxogastres*, 411, 1892), and this name must stand, while under *D. dubium* Rost. must be included all the Alpine forms we have known as *D. Wilczekii*.

EXPLANATION OF PLATE 578.

Amaurochæte comata.

1 Two æthalia; in the lower the cortex is cracked, in the upper the mass of capillitium and spores has almost broken free, exposing the shining floor.
2 Capillitium and fragment of cortex.
3 Fragment of floor of æthalium, showing attachment of capillitium and spine-like bases of threads that have broken away.
4 Capillitium with many branchlets.
5 Spores.

WAYFARING NOTES FROM SOUTHERN RHODESIA.

BY R. F. RAND, M.D.
(late Lieut.-Colonel, S.A.M.C.).

MIAMI—the Rhodesian, not the Floridan, one—is at about 4200 feet above sea-level and within one hundred miles of the Zambesi river. The country-rock is mica-schist, traversed in many places by veins of quartz and greisen. Mica is extensively mined in the district. The country is much cut into by rapidly-flowing streams with resultant ridge and valley. The open shallow valleys are densely overgrown with tall grasses and, at their lowest levels, the ground is apt to be boggy. The woodland occupies the upper slopes and summits of the higher ground. The trees are rarely of any great size; Machabel, Mahobohobo, the two species of Masasa, and the sugar-bush are principally seen. The last is the *Protea* which is so common in many parts of Southern Rhodesia. As I write, in early May, its large white flowers are in full blossom. The grass invades the woodland, sometimes in force, and it is miraculous how the trees contrive to escape destruction when the grass-fires rage. Large ant-hills (termites) are a frequent feature, and they are very fertile.

As collecting was only begun in April, the grand parade of summer, at this latitude, was past, and the plants sent can give poor idea of floral happenings during the summer months, now over. The grass, like an ocean, now swamps most herbaceous things. Where it has been cleared away by man's labour, many small things, not

seen elsewhere, begin to bloom, and such places may prove a product[ive] field for the collector. As elsewhere, the margins of the woodland a[re] fruitful. Few birds are to be seen, but, as snakes are plentiful, th[is] may afford an explanation. The fewness of the birds, in so wo[ll] wooded a district, is remarkable. *Clematis Thunbergii* Steud. [is] in full bloom during April, and is much later in flowering tha[n] *C. Stanleyi*. It is a scrambling climber, and abundant about Mian[i].

Biophytum abyssinicum Steud. (Oxalidaceæ), in the young st[ate] is highly sensitive. The leaves form a rosette upon the groun[d] surrounding the flower-buds grouped in their centre and almo[st] sessile. When the leaves are touched, they rise up and close in ov[er] the flower-buds in umbrella-fashion, their leaflets drooping at the sa[me] time. After the flower-stalks have lengthened, which they do to [the] extent of several inches, the leaves lose their sensitiveness, and [no] longer respond to the touch. Apart from touch, the leaves close [up] over the young flowers by night.

Kosteletzkya Büttneri Gürke (Malvaceæ) grows beside runn[ing] water, its roots well wetted. The flower is white, but it turns yell[ow] upon drying.

The Leguminosæ are specially well represented in this district.

Two Umbellifers, *Diplolophium zambesiacum* Hiern and *Lef[e]buria Stuhlmannii* Engler, late, as is their habit, in season of flow[er]ing, are thrown into competition with the tall grasses. The la[tter] is the taller, and may reach a height of 10 or 12 feet (see [al]p. 231).

Ottelia lancifolia Rich. (Hydrocharidaceæ).—This plant is [an] aquatic, growing in the pools of running streams. It is rooted in [the] mud, and its leaves are entirely submerged. The flowers are [of] bright golden yellow, and are about an inch in diameter. Sm[all] winged insects were seen visiting them. The perianth-tube is ab[out] 1½ inches in length; above, it expands into an infundibular [or] limbed portion, with three coloured segments, between which [the] outer green segments appear. They are narrow, upright, and tur[n] inwards at their tips. The spathe, of two segments, firmly uni[ted] springs from immediately below the base of the ovary, ending ab[ove] by firmly clasping the perianth-tube at its point of expansion. [It] is inflated, containing both water and air, and acts as a float, m[ain]taining the flower erect, and keeping the infundibular portion [of] the flower clear of the surface of the water. The upper six inc[hes] or so of the flower-stalk is four-sided, and gives a lozenge-sha[ped] section. The inflation of the spathe is maintained during [the] maturation of the fruit, and the green outer segments of the perian[th] survive the withering-up of the inner coloured ones. There are [six] stamens, upright and grouped in pairs. The pollen-grains are [fair]ly large. Six, almost sessile, pistillar members spring from the throa[t] the perianth-tube, each at once splitting into a pair of long ton[gue]-stigmas, whose stigmatic surfaces are beset with short tumid [hairs]. There is no style, as usually understood, the segments being me[rely] with the perianth-tube. The ovary stands free within the infl[ated] spathe. The walls of each of the six compartments just meet in [the]

axis of the flower, without forming a central column. The ovules are set upon the inner faces of the walls, and principally upon the lateral surfaces, but a few occur upon the external wall. The outer lateral surfaces of adjacent loculi are only slightly adherent. The parietal disposition of the ovules, taken in connection with the stylar path in the walls of the perianth-tube, is interesting (see p. 231).

Satyrium speciosum Rolfe.—An orchid of a striking pink colour. It favours moist situations, but is sometimes seen at the edge of woodland. Its height is usually from three to four feet.

Gnidia Buchananii Gilg. (Thymelæaceæ) came up, late in April, upon ground which had been cleared of tall grass. The Gnidias are usually the earliest of the spring flowers of the Rhodesian veld.

Alectra kilimandjarica Hemsl. (Scrophulariaceæ) may possibly be a root-parasite. It was found growing upon the southern aspect, the sheltered one, as regards the sun, of one of the great ant-hills.

Tinnea zambesiaca Baker (Labiatæ).—The anterior pair of stamens, longer than the posterior pair, come to stand posteriorly at the throat of the corolla. The filaments are yellow and flatly clubbed at their extremities, and overhang the anthers of the posterior pair like the davits of a ship's boats. The upper loculus of each anther, yellow and swollen, is sunk into a depression of the yellow clubbed extremity of the filament. The lower loculus is provided with a brush. These stamens are probably barren. The pointed stigma, bent sharply forwards near its extremity, occupies the interval between the brushes of the upper modified anthers and the fertile divergent loculi of the lower pair. In the gaping flower the yellow clubbed ends of the long stamens are conspicuous against the deep madder-brown background of the corolla. After fertilization, the two valves of the inflated calyx close in, frequently trapping the withered stamens and corolla in their duck-like beak, but this is only for a day or two. The four nutlets are interesting. They are set back to back like four handled hair-brushes, touching at their edges, but the free ends of the bristles are webbed together by an anastomosis of stellate hairs. The general surface of the web is depressed towards the body of the nutlet in a saucer-like fashion. As the nutlet ripens, the two valves of the inflated calyx dry up and fall, exposing the nutlets to the wind.

Leucas Randii S. Moore (Labiatæ).—This plant trails for many feet over the ground; its flowers are suggestive of those of *Lamium album*. The two anterior segments of the corolla and the lateral ones are united to form a flat horizontal alighting-platform, which is smooth and almost hairless upon its upper surface, whilst along the line of junction of the alæ with the anterior segments is a low rounded ridge bounding the path to the tube upon either side. There can be no mistaking the way. The hood is constituted by the posterior segment of the corolla. It is coated externally by white silky hairs. The margin of the hood is fringed by longer brush-like hairs, and these meet in the middle line, completely enclosing stamens, style, and stigma within the hood. The two anthers of the longer stamens are close to the peak of the hood, and when an appropriate insect enters

the tube of the newly-opened flower, the anthers emerge under th pressure, and the back of the insect is well dusted with the brigh orange-red pollen. In the older flower the platform begins to shriv up, and stamens, style, and stigma emerge from their seclusion.

Hypoestes Forskahlii R. Br. (Acanthaceæ).—The two stamen and the style are well exserted, projecting horizontally; they a bunched together. After dehiscence the filaments curl outward and bring the anthers beneath the lower corollal lip. Then it is th the tiny lips of the bilabiate stigma open out, the style continuing t occupation of the position formerly held by the three associates.

Spermacoce dibrachiata Oliver (Rubiaceæ).—The flowers a normally of a deep blue colour, but individuals with pink flowers, an others with white flowers, occur not infrequently.

Miami, Southern Rhodesia,
May 7, 1926.

It is only a month since the last communication was sent, but t the interval the country has taken on a parched and wintry aspe Most of the streams have been reduced to a trickle, their cour punctuated by large pools. Many of these are now beautiful wi the leaves and flowers of a water-lily, whose white blooms are ting with purple. In and by these tranquil pools, only too often, th crocodile lurks. Africa has been defined as "a cold country with hot sun," and that definition applies to Miami at the moment. F plants are coming up. In the immediate neighbourhood of th Station there are no Mopani, no Acacias, and none of the Combretace but, in a valley fifteen miles to the southward, some large arboresce Acacias were seen, as also two species of *Combretum* of similar hab Near by, upon a newly-made embankment by the road-side, *Clemat Stanleyi* Hook. was found in full flower, greatly out of its season.

Englerastrum djalonense A. Chev. (Labiatæ).—There is a re markable development in this plant. Late in the season, but befo all the flowers have fallen, a sticky exudate, which glistens in the su forms upon the stems of the racemes, which jut out horizontal from the main stem of the plant. The secondary offsets of th racemes, each of which carries a terminal flower, are also coat The main stem of the plant is free from this varnishing. This ma constitute a sure defence against the raiding of ants and other cree ing insects.

Loranthus erianthus Sprague.—The flowers lack the conspicuo ness of many species of this genus. The corolla is a deep red wi greenish colouring at the apex of the bud. Although opposite their origin, the flowers are mostly drawn to one side of the st The anthers clasp the style firmly, below the spherical stigmatic hea As result, there is a well-defined neck. Dehiscence occurs before th bud opens. In its upper part the bud is firm and under tension. it opens, the segments of the upper end of the corolla curl sudden backwards. Soon afterwards, the strap-like filaments curl inward rupturing the upper portion of the corolla-tube and into the rent th formed the style mostly falls, changing in decline from a green to dull red colour.

Adenostemma viscosum L. (Compositæ).—This plant grows in, and beside, the water of running streams. When first confronted with this flower, it is difficult to realise that the mob of large white clavate processes, which render the flower conspicuous, are the stigmatic arms widely outspread. The corolla of the floret is white and delicate, the dull red anthers showing through its wall. The outside of the bases of the five teeth fringed with short, woolly, glandular hairs form a ruff to the floret. The cypsela is crowned by a chaplet, with five upright processes, shaped much like the wooden pats used by the butterman, which clasp the base of the corolla. The cypsela is of a greenish-brown colour. As soon as the stigmatic arms have escaped from the corolla and the staminal cylinder, they grow rapidly, apparently from turgescence; indeed, one may watch the growth, in part—it is an affair of minutes. They are flattened upon their inner opposed surfaces. In the course of time and growth they slide apart. The pollen is "presented" upon their sides, not upon the glabrous heads. Later, they fade down to the floret and, finally, the dead florets, with their contents, fall off in a globose mass, exposing the cypselas mounted upon the receptacle. The effect is striking, for it is found that the five pappal processes have now taken up a horizontal position, and that their tips have become filled with a clear, highly-refracting oil. The surface of the body of the cypsela itself is seen to be freely studded with firm, short, glandular hairs.

Ottelia lancifolia Rich., further note (see p. 229).—As the flowers fade the petals become thin, whitish, and translucent, resembling tissue-paper. They droop down, outspread, upon the surface of the water, the three segments usually cohering and floating off in one piece. The effect is much like that of the toy flowers of the Japanese, which children float upon a basin of water. The first keeps its upright position and is ripened just beneath the surface of the water. It is detached, when ripe, by the maceration of the lower section of the stalk. Some fruits were seen floating upon the surface, which had become separated in this way. As the pools of the smaller streams appear to be the favourite habitat of this plant, and as these dry up in winter, failing animal agency, dispersion may not be very wide.

Diplolophium zambesiacum Hiern (see p. 228).—The inflorescence is visited by wasps of various species, bees, flies, and small beetles. Occasionally, large beetles take shelter in the depths of half-expanded umbels. Its height and colour make it conspicuous in the woods, and doubly so in the short twilight. The margins of the petals are walloped, slightly lipped at their tips, and broadly everted at the sides. Before the bud opens there is a slight retraction of the petals, sufficient to expose the two-limbed stigma, so that fertilization in the bud, given a receptive stigma, is not precluded, although, no doubt, fertilization usually takes place in the fully-opened flower. The opposed lateral bags of adjoining petals give ready passage to the filaments when they straighten themselves out and pass on to wide horizontal exsertion, by which time dehiscence is completed.

Lepidagathis Randii S. Moore MS. (Acanthaceæ).—This plant

grows plentifully at the edges of woodland. Normally, it is of erect habit, but individuals, with long weak stems, may be found prostrate. The flowers are of a light lilac colour, usually appearing singly, or in close pairs, from amidst the sharp points of the clustering bracts. When in pairs, adjoining flowers are usually found to be of different age. The mouth of the corolla gapes widely. The lower lip is three-tongued, the central tongue constituting the alighting-platform. The upper lip is bifurcated at its tip. Looking within the newly-opened flower, one sees the four filaments bowed strongly outwards, like ribs, against the corolla-wall, two upon either side. Their anthers meet in the middle line immediately beneath the roof of the corolla. They are dark in colour, and form a double row overhanging the fairway down to the bottom of the flower. The loculi are divergent and dehisce in a downward direction. Nothing is to be seen of style or of stigma at this stage. From the middle tongue, or lobe, of the lower lip of the corolla there is the fairway. Upon either side of it is a low fence of stiff, upright, white hairs. Outside of the fence upon each side, the corolla is worked into delicate horizontal and parallel corrugations. In so far as the central portion of the path is concerned, the arrangement suggests a ship's boarding gangway, the fence of hairs corresponding to the hand-rail. In the middle line of the upper lip there is a tube, recalling analogous devices elsewhere in the family, which is formed by an infolding of the lining-membrane of the corolla. The infolded edges touch, but do not cohere, so that the result is a split tube. This tube carries the style and stigma. At its summit there is a foramen, through which the stigma and a portion of the style are protruded in the later stages of the flower. As there is no indication of their presence upon the external face of the corolla, the infolded edges would appear to be epithelial in their nature. It may be noted that the style is easily dislodged from its confinement. After dehiscence, the anthers and filaments fall aside, and then it is that the stigma, leaning forward with the upper portion of the style, emerges, coming to occupy the position formerly held by the anthers.

Blepharis glumacea S. Moore (Acanthaceæ).—This plant is of procumbent habit. Only three individuals were seen, but it may be common. They were growing upon a dried-up floor formerly occupied by a shallow pool, out upon the open veld. The flowers are of a pale purple colour and inconspicuous. The lower lip of the corolla is obscurely three-lobed. It is made up, principally, of the central lobe which constitutes the alighting-platform, the lateral lobes being merely indicated. The upper limb of the corolla is aborted; it is a mere rim, its place, as protector at least, is taken by the sepals. There are four stamens springing low down from the sides of the corolla, the posterior pair, with strong, broad, flattened filaments are bowed with their convexity inwards. They stand upon either side of the style, their anthers, provided with brushes, meeting above. But it is the anterior pair of stamens which show the greater degree of adaptation. From the front of each filament there arises a stout process which projects forwards, forming a firm bulwark upon either

side of the corollal fairway. It functions as a hand-rail, exactly similar to the low palisade of hairs noted in the preceding species. The fairway is also indicated by low yellow eminences upon the inferior lip of the corolla, posted upon either side of the entry to the gangway, *i. e.*, the fairway. The posterior portion of the filament—upper, in the normal position of the flowers—carries the anthers, which are well provided with brushes, and meet in the middle line and overhang the fairway. They join up, posteriorly and above, with the anthers of the posterior pair of stamens, the four anthers forming a compact assemblage with the hairs of their brushes apposed and commingled. Near their bases, anteriorly, the filaments of the posterior pair of stamens have a process which fits into a bay upon the posterior margin of the lower part of the anterior filaments, there interlocking. The anterior pair of anthers have heavy brushes. Even upon the lines of dehiscence the slit is seen to carry a fine row of short lashes. The back of a visiting insect, of attuned size, is well dusted with pollen, and the brushes would tend to prevent waste. The pollen-grains, in bright sunlight, glisten with a metallic lustre, like grains of gold, a feature which may be observed in some Leguminosæ also.

The style is upright, standing in the middle of the flower, the stigma being behind the anthers. At its base it is embraced by a tent-like arrangement of hairs. It is stout, its stigma simple and terminal, lipped, and slightly indented at its tip. The white flat disc forms a pediment upon which the vase-like ovary is gracefully poised.

The ripe fruit is shed alongside of the plant. It is light in weight, many chaffy bracts forming an envelope. It is easily blown about by the wind. Within the bracts a tough rind encloses two seeds, divided by a septum. The seeds are plano-convex, the plane faces being apposed. The whole surface of the seed is covered with a veining or flat, white, arborescent lacing. When the seed is placed in water it sinks, and immediately these lines spring into activity and appear as a complete environment of beautiful, soft, pointed tentacles. In the unripe ovary the developing seed is seen to be surrounded by soft white processes, which give a clue to later developments.

NOTE.—The flowers are only seen at one stage.

Miami, Southern Rhodesia,
9th June, 1926.

[These notes accompany a continuation of Dr. Rand's Southern Rhodesian collections, which have been determined in the Department of Botany, British Museum, where the names of the species referred to in the notes have been added. Descriptions of new species and taxonomic notes will be published in our next number.—ED.]

REPRODUCTIVE MECHANISM IN LAND FLORA.

V. Sporangia (*concluded from* p. 215).

By A. H. Church, M.A., F.R.S.

For complete homology it is obviously necessary to take al forms of the sea, which are similarly laminate and present differ tiation into axes bearing photosynthetic leaf-appendages. A matter of fact, among recent forms the latter are found only amo highly organized Phæophyceæ (Cystoseireæ, Sargasseæ), in which asexual phase obtains, and the meiotangia follow the scheme the diploid *Fucus*, as also does their mode of production on ramu immersed in special conceptacles. Hence, in the case of for actually living, only analogies can be traced, as among Floridea which no true leaves are found, but as also in Dictyotaceæ the bilat laminate extension affects the entire shoot-system which, again, retain a dichotomous mode of ramification (Dictyotaceæ), or wholly irregular (*Rhodymenia*).

The evolutionary progression of the meiotangia, however, follo the same general rules as in radial axes; but since the broad surf of the laminæ is even more prone to damage by mechanical abra following movements of the water, advancing stages are more p nounced. Thus meiotangia are first borne on superficial filament ramalia, or as ramalia reduced to single cells (*Chorda*, *Laminar Dictyota*), or to superficial cells sunk in the peripheral tissues, become more and more thoroughly immersed, protected, and fin enclosed within the endocortex and beneath the surface-layer (*Dal seria sanguinea*, *Rhodymenia palmata*). But in dealing with broa expanses of photosynthetic tissue, a new feature is added in vary degrees of *sorus-aggregation*, as such production of primary sporan is increasingly localized over wide tracts or in smaller groups, o ill-defined (*Rhodymenia*), but ultimately strictly isolated (*Ni phyllum punctatum*) on either side of the lamina. Similar advan in sorus-localization are expressed equally clearly among Phæophyc which still discharge mobile zoïds (*Laminaria*, *Punctaria*, *Aspe coccus*), while the conceptacles of *Fucus* are but a special case of same restriction.

These superficial aggregates of immersed tetrad-meiotangia, wh may also imply special feeding-cells, conducting material for developing tetrads from adjacent tissues, as also special method liberation of the mature spores, constitute the starting-point for consideration of the familiar *sporangium* of Pteridophyta in simplest form. When so many features of parallel development given, any imaginary speculations as to the origin of such sporan from Bryophyte sporogonia are wholly uncalled for[1].

[1] *Chondrus crispus* produces circular pustules, 2–3 mm. diam., on its l laminate tips with enclosed aggregates of included tetrasporangia. These ar free by mechanical pressure and decomposition of the outer 'wall'-la Developmental stages show that the tetrasporangia are cells of branched ments ramifying in the intercellular mucilage of the sub-cortical tissue. W

Such a localized area, over which a tract of spore-tetrads may be nourished within a more or less massive wall-region, and be increased (as in many Mosses) by three-dimensional divisions of the mother-cells, much in the manner of a three-dimensional nemathecium—to the extent that the whole tract may ultimately present a swelling of the tissues, hence distinguishable externally as a pustule or emergence growth—is to be regarded as constituting the first beginning of the *eusporangiate sporangium*, characteristic of all advancing land-organism[1]. Only in comparatively recent times was it explained that the type of sporangium so familiar in that of the more dominant recent group of Leptosporangiate Ferns is really the specialized end-form of the series; the more generalized eusporangiate type of structure being equally characteristic of Eusporangiate Filicineæ, Equisetineæ, Lycopodineæ, and also all Phanerogams[2].

In other words, the eusporangiate sporangium of the Pteridophyta is the normal transmigrant homologue of an immersed sorus of algal tetrads; and knowing its origin and relation to an equally algal frond-lamina, it is interesting to note what exactly are the secondary departures associated in turn with a transition to subaerial conditions. These may be expressed in: (1) Form; (2) Volume and numerical output; (3) Mode of construction ontogenetically; (4) Mechanism of spore-initiation and nutrition; (5) Mechanism of spore-emission; (6) Xeromorphic adaptations or modifications.

(1) The general form is clearly that of a superficial sub-spherical enlargement of the bilateral leaf-member, occasioned by the growth of the included spores following 3-dimensional extension of the archesporial units, with subsequent increase in volume of the spores from the size of undifferentiated somatic cells to a general average of 30–50 μ diam. The whole spore-mass is enclosed by a few undifferentiated 'wall'-layers. As usual also among marine Algæ, sporangial tracts involved in the growth of the somatic tissues in any preferential direction may elongate in the same sense; but the subspherical construction is to be regarded as the general case.

(2) The volume attained in the adult stage depends on the number and size of the enclosed spores; continued segmentation of the isolated archesporial tissues being obviously the readiest method of increasing the spore-output in response to the necessities of increased wastage. In early Pteridophyta, as also in the little-changed micro-

each unit of these filaments becomes a tetrasporangium giving one tetrad, the intervening medullary cells act as a tapetal system of conducting tissue permeating the mass. Kylin (1922), Kongl. Svensk. Vet.-Akad. Handlingar, 63, 11, p. 21.

[1] The general conception of a simple sporangium in Land Flora requires to be abstracted from comparison of such structures as seen in *Ophioglossum* and the pollen-sacs of Gymnosperms. Further specialization is the rule—either fused into synangia on the photosynthetic leaves of Marattiaceæ, or borne on leaves which are no longer photosynthetic (Lycopodineæ), and even found residual in cases in which the leaf-laminæ are wholly wanting (Equisetineæ).

[2] The first recognition of this fact is due to Campbell (1890), Bot. Gazette, and the view has been greatly elaborated by Bower (1891), *Annals of Botany*, 147; *Land Flora* (1908), 496.

sporangia of many Gymnosperms, the spore output may be enormou extending to many thousands. Among living survivals of homo sporous types, *Lycopodium clavatum* gives an estimated output o 20,000 per sporangium, *Equisetum Telmateia* 5000. The sporan of the fossil form *Lepidostrobus Brownii* may have produced million. As in the case of the Bryophyte sporogonium, the outp is affected by biological factors of nutrition and discharge. In the original case, as among Algæ, the sporangia represent th working output of a local area of the photosynthetic leaf on whi they are borne; but where, as in more specialized types, food conducted from other parts of the soma, the sporangia may pres a greatly increased volume and output. It is interesting to note th the sporangia of Pteridophyta are of much the same volume an general form-relations as are the sporogonia of Bryophyta, being bas on somatic tissues of comparable dimensions, and giving rise meiotic tetrads also of fairly average volume. There is clearly a lim to the size of an individual sporangium and its output, possibly aga involving a time-factor dependent on the rate of growth and cel divisions, as well as on food-transport, in relation to seasonal con ditions.

(3) Ontogenetic origin has been exhaustively investigated in land plants whose tissues admit of ready sectioning, and has led to muc discussion. Thus Goebel (1880) formulated the rule that in higher land-plants the archesporium is *hypodermal*[1]. This may accepted for Phanerogams in which the conception of a Dermato layer may still hold; but, as shown by Bower[2], it is not a necessa condition for Pteridophyta, in which there is no such precision marking off the epidermis in young leaves and stems, and all cel divisions, if followed back far enough, include superficial units. It significant to note that in higher types specialization may invol definite anatomical rules; but the method of recognition of what to be regarded as archesporial tissue remains somewhat vague. Old observers went largely by comparison of changes in the plasm contents; but observation of the actual segmentation-scheme of cell-walls may take it a step further, though this does not affo any strict evidence of the first differentiation—just as in the lim all the cells of a leaf go back to the few units of the first primordiu as it is seen to arise at the apex of the stem. At any rate, th archesporial cells, as soon as they present any special differentiati are in all cases immersed below units which are concerned in con tuting a definite wall-layer, and other cells are delimited as nurs tissue—whether among the archesporial units themselves and pen trating the mass of tetrads, or from peripheral units,—thus constitutin a distinct tract as an ultimately well-defined *tapetum*. Water-supp appears to be more effective by the agency of the tracheides of th foliar vascular system; since in no case among Pteridophyta

[1] Goebel (1880), Bot. Zeit. 569.
[2] Bower (1894), Phil. Trans. 501; (1904), 204,

other-tracheids occur among the mass of spores[1]. But it is evident that, in any large three-dimensional mass of units, the problem of uniform food-conduction and distribution becomes insistent for those at the centre of the system. Hence in the larger sporangia trabecular strands of parenchymatous units may be left among the mother-cells for purposes of cross-conduction (*Isoëtes*, *Lepidostrobus Brownii*); but the idea for including such developments as indicative of the 'sterilization of potentially sporogeneous tissue' amounts to an obsession, without affording any necessary explanation of the facts; since there is no evidence that such tissue in large sporangia was ever fertile.'

(4) On the other hand, the mechanism of spore-development remains curiously constant to the type of the Moss, and incidentally to that of the Alga. New departures affect the accessory structures only. The membrane of the mother-cells is soon disorganized, and needs to be since all the food-supply for the spores has to be quickly passed through it. The common wall may hold the tetrad-groups together sufficiently long for the tetrahedral form to be deeply impressed on the four spores (*Lycopodium clavatum*), or the spores may be set free at an early date and so round off to uniform spheres (*Equisetum Telmateia*). More commonly (Ferns) something intermediate obtains, giving spores with rounded or slightly angular form, in which the tetrad origin may be traced. The spores possess the normal two coats, the outer being cutinized; they still contain chloroplasts, and in size are well within the 30–50 μ average, even more uniformly than among Bryophyta and Phanerogams[2].

(5) It is perhaps in the mechanism of spore-discharge that the Fern sporangium appears most widely different from the Moss-capsule; especially when the capsules of the highly-specialized Eu-Bryineæ are contrasted with the sporangia of the equally highly-specialized and modern lines of Leptosporangiate Ferns. In the former, hygroscopic tensions of portions of thickened cell-wall constitute an elaborate peristome-region (*Polytrichum*, *Funaria*); and in the latter the aqueous cohesion-tensions of a single line of living cells as an *annulus*[3] mark out two extremes of high elaboration. But the general case for eusporangiate sporangia follows more closely the dehiscence-mechanism of Hepaticæ, in which the wall-layers are thickened by annular or spiral bands in the manner of tracheidal cells. The same principle is effectively illustrated in *Equisetum Talmateia* (a single spiral band), as comparable banded cells are differentiated in the epidermis of the pollen-sacs of Conifers and in the hypodermal tract of Angiosperm anthers. In all such cases a cohesion-mechanism is more or less perfected, according to the life of the cells themselves, and the sporangium is opened by a split which ruptures the wall and sets the spores free simultaneously. The

[1] Treub (1891), Ann. Jard. Buit. 170, described tracheides among the sporogenous tissue of the ovule of *Casuarina*.
[2] *Cf.* Palæozoic Ferns, *Stauropteris*, 30–40 μ; ranging, *Ptychocarpus*, 20 μ, *Rhapteris*, 80 μ.
[3] Leclerc du Sablon (1885), Ann. Sci. Nat. 10.

advantage of a progressive discharge has been noted in the case of Bryophyte sporogonia, the growth of the capsule of *Anthoceros* and the peristome-mechanism of Eu-Bryineæ being interpreted from this standpoint. But, committed to a cohesion-mechanism, the sporangia of Pteridophyta obtain compensation for this arrangement by the greater number; while it is evident that such a factor has an important bearing on the individual spore-output in the sporangium with correlated increase in numbers both on the same sporophyll and on the same plant. It is interesting to note that Bower has arranged the modern Ferns in phyletic series on these lines, as Simplices, Gradatæ, Mixtæ[1]; the modern optimum being attained by having small sporangia with greatly reduced output (64–16 spores), produced more continuously, and so dehiscing at slightly different times, though presumably older types of eusporangiate Marattiaceæ may yield over 7000 (*Kaulfussia*) and *Ophioglossum pendulum*[2], 15,000.

(6) Further lines of sporangial differentiation follow exigencies of xerophytic protection, whether from simple desiccation or combined effects of intense insolation; these being most commonly seen in the secondary aggregation of sporangia to constitute *sorus*-clusters, as a repetition of the general mechanism of segregation which originally built up the sporangium itself as a sorus of meiotangia. Such protective arrangements are increasingly specialized in later stages as strobilus-organization, as the strobilus is itself a further response to similar demands; but, even on normally extended leaf-laminæ producing their own spores, it may be significant to note the elaboration of structures which have been included under the terms (1) Synangia, (2) Sporangiophores. The *synangium* is readily explained and accepted as the congenital union of the members of a sorus, as they are carried up and united by the intercalary extension of their basal regions; the general effect being to give increased protection represented by firmer wall-layers, more intimate aggregation, and communal dehiscence-mechanism[3]. At a higher horizon of sporophyll this idea repeats in the syncarpous ovary of Angiosperms. Very beautiful examples of synangia occur in modern Marattiaceæ, as also in fossil forms[4]. The stamens of Angiosperms express a similar organization in their twinned pollen-sacs opening by one line of dehiscence; the stamen being a micro-sporophyll now restricted to the limiting symmetrical expression of two synangial sori each of two sporangia. The *sporangiophore* has been more persistently misinterpreted as a special type of organ; but is nothing more than a 'stalked' sorus-aggregate, in which the intercalated growth-zone affects the region below the sporangial loculi, and this tract containing the vascular strand is exaggerated to constitute a stalk at the distal end of which the sporangia may be inverted and

[1] Bower (1899), Phil. Trans. 122, 128.

[2] Bower (1923), *The Ferns*, 262.

[3] Bower (1897), Phil. Trans. 77, alone has inclined to the converse view that sporangia are derived from synangia by septation.

[4] Cf. *Ptychocarpus, Scolecopteris.*

protected by the secondary growth of the peripheral portion[1]. The most illuminating modern example is that of *Equisetum*, which is clearly only the secondary development of such a simple type of sorus as seen in *Aspidium*, with the placental region exaggerated until it effectually protects the sporangia beneath a peltate head[2]. In such case secondary extension of the stalk-portion is ultimately correlated with increasing length of the sporangium, and new possibilities are opened up for such secondary utilization, many of which are characteristic of fossil plants; such sporangiophores being particularly well suited for close-packing and mutual protection hence indicate xerophytic types, more especially in the highly organised strobiloid forms (*Cheirostrobus*).

Beyond the scope of present considerations other lines of specialization, including the most significant departures in Pteridophyte sporangia, may be left to be dealt with from the standpoint of the later extension of Land Flora along lines of

(1) The Progression of Heterospory,
(2) Strobilus organization;

but for the general case the primary method of evolution is sufficiently clear. So far from being the new development of an intercalated antithetic phase, to be only remotely and fantastically 'derived' from a Bryophyte sporogonium, the fundamental features of these sporophytes trace back directly to marine algæ which may present a clear distinction of 'stem' and 'leaf,' while others afford all stages of sorus-elaboration of immersed tetrasporangia[3]. The extent to which developments in spore-stages run parallel among both Bryophyta and Pteridophyta, as again they are even more uniform in phyla of the latter (*e. g.*, in Ferns and Lycopods)—which, as indicated by their antherozoids, must have had a wholly distinct path of evolution back to remotest algal horizons, and yet have both come from algæ with morphological differentiation of leaf-appendages in the diploid phase, as the Bryophyta were leafy only in the haploid,—can only be interpreted as indicating the closely parallel response to new conditions of submerial existence in several distinct lines of marine algæ, which were nevertheless associated inheritors of a comparable metabolic and anatomical equipment.

[1] Bower (1903), Phil. Trans. 220. 'Theory of the Sporangiophore' 'as a fundamental growth,' but also organs '*sui generis*,' 222.

[2] A closely similar effect can be produced on a different line of descent in the condensate strobilus of *Taxus*.

[3] One of the most curious but misleading surviving expressions of a passing school of plant-morphology is that of the 'organ *sui generis*.' The expression serves to mask hopeless ignorance, and obviously implies the negation of all evolutionary theory, according to which every new organ is but the adaptation of something pre-existent. To talk of sporangia as organs *sui generis* is as futile as to say that leaves or roots, for the matter of that, are also organs *sui generis*. Some fallacies follow naturally from the initial error of supposing that the Pteridophyte sporophytes of Land Flora were of a new 'antithetic' order and that these new organs arose somehow spontaneously from a 'spindle-shaped ovo.'

For all higher types of Land Flora, the leaf, as a lateral mem produced in rhythmic phyllotaxis-sequence, is the important morp logical unit from the standpoint of both photosynthesis and re duction. The sporangium of the Pteridophyte appears as an a gated tract of older meiotangia. Except for the minor case of Bryophyte there is no indication of any other working method spore-production, and the relation of the leaf producing it (sporoph may be taken as established once for all in these early transmig forms.

In conclusion, it may be noted that:—

(1) Every modern example is a compromise between m factors, often in opposition, and due to recent condit of land environment, behind which there may rem a residuum of archaic features due to the older envi ment of the sea.

(2) The endeavour to abstract a generalized morphological t is only of use when the general causal factors are recognized. One has little sympathy with conception merely academic value.

(3) But having gained such an abstraction, one may pass to the deduction of the special factors underlying apparently aberrant or more anomalous forms.

THE BRITISH ASSOCIATION AT OXFORD.

THE British Association celebrated its ninety-sixth year at Ox from August 4–11. In his Presidential Address H.R.H. The P of Wales spoke of his general impressions, as an intelligent travelled observer, of the bearing of scientific research on the life of the community. The second meeting of the Associatio Oxford, in 1832, illustrated by contrast the modern realization o debt to Science. The proposal to confer honorary degrees Robert Brown and three of his scientific peers, on the occasion that meeting, called forth an angry protest from a distingu theologian. The second meeting at Oxford, in 1860, was marke the historic conflict between the Bishop on the one hand and Hu and Hooker on the other, which would seem, to those attending present and fourth meeting in the University city, almost eq remote.

His Royal Highness traced some of the various developmen which Science has been brought into touch with economic pro such as the establishment of the National Physical Laboratory, w now carries on, on an extended scale, the work initiated by the Br Association in 1841; and later, in 1908, the Development C mission, by means of which experimental work in agriculture, and

that maintained for many years as a private undertaking at Rothamsted, has been so greatly developed. The recent creation of the Government Department of Scientific and Industrial Research has realized an ideal of Brewster and his contemporaries, who founded the British Association in 1831. The movement of co-operation between science and the State has borne fruit in the overseas dominions; and His Royal Highness referred to the peculiar opportunities afforded for personal contact by the overseas meetings of the Association. In conclusion, the importance was emphasized of maintaining and widening the channels of communication between scientific research and the public mind, which fails to realise the necessity of periods, often long, of quiescence devoted to preparation by research before science can offer the world some striking benefit.

Prof. F. O. Bower, in his Presidential Address to the Botanical Section, made sympathetic reference to the death of Dr. William Bateson, the chosen President of the Section for the Oxford Meeting. Instead of attempting to fill the broad biological *rôle* that naturally fell to Bateson, Prof. Bower proposed to centre his remarks upon three dates when the Association has met in Oxford—namely, 1860, 1904, and 1926, which mark approximately periods of transition in the progress of biological science and particularly in Botany.

The 1860 Meeting witnessed the discussion on the "Origin of Species," which still holds its place as a great philosophical pronouncement. "The theory rested essentially on facts of heritable variation, without defining their magnitude, limitations, or origin." Discussing current opinion on the validity of Darwin's theory as a whole, Prof. Bower expressed the opinion "that heritable variations in plants have been promoted or actually determined in their direction, or their number, or their quality, in some way by external conditions. But these need not necessarily have worked within restricted time-limits of present experiment." A moral was drawn from the training of the four protagonists of 1860—Darwin, Wallace, Hooker, and Huxley, who were all equipped by personal experience in the great world. The theory of evolution was born and bred of foreign travel, and upon foreign travel, quite as much as upon work at home, its future still depends. But two attempts to establish a tropical working station have failed, namely, in Ceylon and Jamaica, indicating an "undervaluation of the importance of foreign, and particularly of tropical, study, and the lack of full perception that open Nature is the greatest laboratory of all."

Reference was made to the suggestion of the term "homoplasy" by Ray Lankester in 1870 to clarify the vague ideas surrounding the term "homology." Lankester defined homogeny as simply the inheritance of a common part, while homoplasy depends upon the common action of evoking causes or of a moulding environment upon homogeneous parts, *or* upon parts which for other reasons offer a likeness of material to begin with.

There is reason to believe that we are as yet only beginning to recognize in the evolution of the plastic plant-body how far-reaching has been the influence of homoplasy, not only upon external form,

but also in the internal evolution of tissues. As to external form, wide recognition of the results of homoplasy is now generally accepted for land-living plants, and in particular in respect of the origin of foliar appendages—for instance, the leaves in Bryophytes and Vascular Plants are held as homoplastic, not as homogenetic; similarly with the leaves of Bryophytes, and possibly also of Pteridophytes, *inter alia*. On the other hand, we may find among the larger Brown Algæ indications of the differentiation of a supporting organ and lateral appendages from a common branch-system, that can only have been homoplastic with an origin of like parts in certain Red Algæ. Such conclusions, drawn from the Algæ themselves as well as from the Archegoniatæ, have the natural effect of raising distrust of wide comparisons between any seaweed and any land-plant in respect of foliar differentiation. Comparisons of this nature cannot be held acceptable as mere guesses, by loose reference between one class and another. They would have to be based on the recognition of comparable sequences within reasonably close circles of affinity before they could carry conviction.

The outstanding feature of the Oxford Meeting of 1894 was Strasburger's generalization on the Periodic Reduction of Chromosomes, the effect of which was to establish the chromosome-cycle as general for plants that show sexuality. The cytological facts acquired since 1894 tend to confirm the normal constancy of a nuclear cycle. Their effect has been to accentuate the inconstancy of the somatic developments related to it.

"From the time that the periodic reduction of chromosomes was recognised as general in organisms showing sexuality, the nuclear cycle has formed a natural foundation for the comparison of the life-histories of plants. The normal cycle may be figured to the mind as a closed circular thread with two knots upon it, syngamy and reduction. Between those knots beads may be strung, one, or more than one, or none. These represent somatic developments, which are normally diploid between syngamy and reduction, haploid between reduction and a fresh act of syngamy. They follow in alternate succession in any normal cycle, but either may be repeated indefinitely by vegetative propagation. Certain questions arise with regard to the evolution of these somata as we see them. The first is, how far are the diploid and haploid somata of the same cycle comparable one with another? The reply will turn upon the constancy of the events of syngamy and reduction throughout descent. If they were constant, then it appears a necessary consequence that the alternating diploid and haploid somata must have been distinct throughout their history; and any similarity which they may show, as in *Dictyota* or *Polysiphonia*, would be homoplastic. It would indeed appear natural that they should be alike in Algæ since they are parts of the same organic life, and live under identical circumstances. It has, however, been suggested that reduction may not be a fixed, but a movable event in the individual life: liable to be deferred or carried over to a later phase, in which case a diploid generation might arise by transformation from an already existent haploid phase. The monosporic

of the Nemalionales have been cited as possibly convertible in other Red Seaweeds into tetraspores, by some sudden deferring of the act of reduction. I am not aware that this has been advanced by close comparison beyond the position of tentative suggestion, though the existence of a diploid gametophyte and of a haploid sporophyte in certain abnormal ferns would indicate the possibility of the suggestion being true. Pending the advance of a closely reasoned argument it is best to keep an open mind. Meanwhile, the weight of facts hitherto known from plants at large may be held to support the stability of the events of syngamy and reduction during normal descent. The two generations of the same life-cycle would, in the absence of a carry-over of reduction, be homoplastic, not homogenetic.

"It is, however, round a second question that divergent views as to alternation chiefly centre. How far are the diploid and haploid somata in the cycles of different types of organism comparable one with another? This is, in fact, the old problem of Pringsheim and Celakovsky. It applies to all plants where somata alternate, but a special interest attaches to the case of Land-living Plants; in particular, we shall trace the origin of the dominant sporophyte of a Land Flora, and inquire whether it originated by *transformation* of diploid developments such as are seen in certain Algæ or by formation *de novo* through *interpolation*? A clear statement of the former hypothetical alternative was made by Scott in 1911, viz. 'that the fern with its stem and leaves corresponds to the Seaweed in which stem and leaf are not differentiated, the whole plant being a thallus.' 'On this theory the sexual prothallus and the asexual plant are both alike derived from a thallus, and may once have been perfectly similar to each other.' In alluding to leafy Liverworts and some of the higher Seaweeds as illustrations, he then remarked that 'these are only analogies, it is true.' But after reference to the fossil evidence, as it then was, he concluded it is more probable that the higher Cryptogams came direct from plants of the nature of Algæ than from Bryophyta or any plants at all like them; he added, however, that 'this view is pure hypothesis.' It must, of course, be remembered that these quotations from Dr. Scott's 'Evolution of Plants' (p. 225) were of pre-Rhynie date. A luminous statement of his later views was contained in his address to Section K in Edinburgh in 1921, which will be in the memory of you all.

"Church, in his vivacious essay on 'Thalassiophyta' (1919), went much further than this guarded and scientific statement. By 'deduction from types still existent in the sea' he assumes 'Algæ of the transmigration' as a bridge between the vegetation of land and sea. His transmigrant Algæ 'appear, in fact, to have been more highly organised than any single algal type at present known to exist in the sea,' and 'to have combined the best features, as factors of the highest grade of progression, of the known great conventional series of marine phytobenthon, and yet to have belonged to none of them.' He boldly fills the gap that puzzles us all by hypothetical organisms that no one has seen, and which he expressly tells us we shall never see (*l. c.* p. 88).

"An alternative to such an effort of imagination may be found
the examination of organisms that really exist, or are known to h
existed, illuminated by the conception of homoplasy, or, as it is o
called, parallel-development. The comparisons should be placed u
the recurrent fact of the chromosome-cycle, since this underlies
ontogeny of all plants that show sexuality. Somatic development
sexually produced organisms is seen to be in some measure independ
of the successive events in the chromosome-cycle. The somata m
be unicellular, existing only as potential gamete or zygote resp
tively; they need not necessarily be alike in themselves, nor n
they appear at the same points in the cycle. For instance, it
found that the pennate Diatoms have diploid vegetative cells, wh
in the centric Diatoms they are haploid, this latter shape being sha
by the vegetative cells of the Desmideæ and Zygnemeæ. That a n
should appear at the same point in the cycle of two or more organi
does not necessarily prove that they have had the same phyl
history. The full proof that they did can only follow from
observation of sequences of close relationship, which should indic
the successive steps to have been the same if a true homogeny ex
We are, in fact, thrown back upon close comparative observation
tracing truly homogenetic sequences of somatic development, rat
than upon the mere position of a given soma in the cycle, or
recognition of its diploid or haploid state. Until such evidence
available it will be best to hold it as possible that the origin of
somata compared has been homoplastic.

"No one has yet made out a closely reasoned case for the der
of the Archegoniatæ from the Green, the Brown, or the Red Al
It is a perfectly tenable position to hold that the Archegoni
sprang directly from none of these groups, as we know them. In
absence of definite comparative evidence the field appears to be o
to an origin of alternation in the Archegoniatæ by interpolation
sporophyte *de novo*, developed not in water but in relation to a l
habit. Against such an origin of the sporophyte there is in
minds a strange, and to me an inexplicable, preconception. M
years ago Professor Von Goebel drew attention to a curious lea
among morphologists towards reduction-series. It appears
prevalent psychological phenomenon that men are more prone
admit down-grade sequences than those that are up-grade. But
clear that in evolution at large there must have been a credit-balan
upward development as a whole, otherwise no multicellular organ
could exist at all.

"Here it may be well to consider what rational explanati
now possible for the origin of a diploid generation. The old biolo
idea that the alternation arose in relation to amphibious life will
suffice, since alternation is seen to exist in fully aquatic A
Nevertheless, the amphibial life may have been one of the cir
stances that have modified the development, and guided it int
special channel seen in Archegoniate Plants. Svedelius, how
suggests a more general reason for the somatic development
diploid sporophyte which deserves the most careful attention ('

Bemerkungen ueber Generationswechsel und Reduktionstheilung,' 1921). Instead of laying weight upon meiosis as reconstituting the daughter-nuclei, he suggests that the greatest importance of the reduction-division lies rather in its making new combinations of chromosomes possible. He points to the difference between only one reduction in each cycle, as in the simplest organisms, and many as in those that have achieved a higher development; and he concludes that the origin of a large diploid sporophyte is thus an advantageous biological organisation, since it secures many reduction-divisions, and consequently numerous new combinations. This hypothesis has the advantage of giving a general explanation of the origin of a diploid sporophyte, independently of any special circumstances of life under which it came into being.

"The most impressive event of recent times in the sphere of morphology has been the recognition and constitution of a new class of vascular plants. The disclosure of the fossils of the Rhynie Chert, of early Devonian age, is notable as introducing in unusual detail a type of vegetation barely hinted at before, and also because those early land-plants present material of the highest importance for comparison. The new class of the Psilophytales was founded to receive them together with the old Devonian fossil *Psilophyton*, and some others; while their relation to the living Psilotaceæ is recognized. These rootless plants together present a new facet upon the problem as to the origin of members in vascular plants, though they do not wholly resolve it. We see a class of early rootless, land-living sporophytes sharing this feature with the Psilotales, and we may reasonably hold them to represent a primitive type. On the other hand, we see in all Pteridophyte embryos which have a suspensor that the root, often late in appearance, is a lateral appendage on the embryonic spindle. Moreover, the root arises as an exogenous growth in *Phyllotheca*, and in certain species of *Lycopodium*, as do also the endogmatical rhizophores of *Selaginella*. Provisionally, then, we may conclude that the root is a late addition to the plant-body in descent, and that it was in the first instance some form of exogenous branch at the base of the primitive sporophyte, such as is seen in the Psilotaceæ and in *Asteroxylon*.

"By inductive comparison based on an analysis of plants now living, we may arrive at a theoretical origin of leaves of the Fern-type from a dichotomously branching system; and already in 1884, long before the discovery of the Psilophytales, this conception had been tentatively extended to include the axis as well, though the material facts such as we now possess were not then in evidence. It was also concluded from comparison of living plants that the sporangia were originally distal on the branches. Thus the Psilophytales supplied in actual fact a sub-aerial type already contemplated as a result of inductive argument. If this origin of a Fern-shoot by sympodial development from the dichotomous branch system, such as that of the Rhynie fossils, be true, there would be no need to draw upon suppositious 'Algæ of the transmigration' to explain the origin of leaves of the Fern-type, for subaerial plants would be seen to have

originated such leaves for themselves. Any similarities between A
and Ferns in respect of foliar appendages would appear only as m
esting facts of homoplasy.

"As we pass from 1894 to the current period we perceive a ma
shifting of the interest of botanists from the study of form to
of the intimate constitution and functional activity of plants. W
fields of colloidal chemistry and physics, of quantitative physiol
of cytology and genetics, of ecology, of fungology and bacteriol
have been opened up. The present century has been specially ma
by the extension of opportunities for physiological research, by b
equipment of departments in the universities, and by the founda
of independent establishments carrying on experimental inquiry i
broadest application. This is rapidly bringing the science into cl
relation with Imperial and social aims. 'For better, for worse,'
pendulum has definitely swung over from the extreme systema
position of half a century ago, through a phase of prevalent morp
logy (or perhaps we should say of organography), to an extr
physiological position at the present time. Some of you may
have felt that this address is in itself an anachronism, in that it
not touched upon the moving physiological questions of the
While I may claim none the less to sympathise with physiolo
aspirations, I do not assent to any ultra-physiological aspect
botany that would degrade or minimise the comparative study
form. '*Medio tutissimus ibis*' is still a true maxim. The laborat
physiologist, dealing with the things of the moment, cannot
detach himself from the things of the past as recorded in herit
form. He should not allow himself to be immersed in statistics
neglect history. The pendulum has gone full swing, within a p
of about half a century; but we may confidently anticipate a re
towards some middle position."—A. B. R.

The meetings of Section K were very well attended, and a m
comprehensive programme of papers had been arranged.

A discussion on "The Conception of a Species" was held
conjunction with Sections C and D, and opened by Dr. F. A. Ba
Mr. Wilmott, Prof. Maclean Thompson, and Major Hurst spoke f
the botanical point of view, but, unfortunately, owing to lack
time, no definite conclusions were reached.

Two sectional discussions were held. Dame Helen Gwyn
Vaughan introduced the subject of "Sex Determination in Plan
and contributions were made by Dr. Heslop Harrison, Prof. K
and others. The second discussion was on "Vegetative Propagat
and was opened by Prof. Priestley: Dr. R. C. Knight, Prof. No
Jones, and others also spoke.

A joint meeting was held with the subsection of Forestry
which Prof. Bews read his paper, "The Ecological Evolution of
Angiospermous Tree Forms." He put forward the hypothesis
the present moist tropical flora was once much more widespread,
that it represents a very primitive type of Angiosperm flora.
varied floras of drier regions are each and all phylogenetically m
recent than the nearly allied moist tropical types. Prof. Bew

of opinion that the systematic work of the last 150 years was sound, but that further and less obvious taxonomic characters would have to be brought into use. The paper is to appear, *in extenso*, in the *New Phytologist*. Dr. Scott, in the subsequent discussion, referred to the enormous amount of work waiting to be done in the field of Angiosperm fossil botany, one of the least cultivated branches of the science in this country. Dr. Stopes inclined to the opinion that the higher plant types originated in high dry conditions.

Plant physiology was represented by several papers. Mr. Bennett Clark, in the absence of Prof. H. H. Dixon, described their work on "Electrical Stimulation and Response in Plant Tissues." Dr. Wager dealt with "Carbon Assimilation in the Blue-green Algæ," and described experimental results which go to support the view that glycogen is one of the products of the process in these organisms. Papers were also read by Dr. Macgregor Skene on the "Physiology of *Sphagnum*" and by Prof. Small on "The Reaction of Plant Tissues." A piece of work which promises to have important practical application is that described by Mr. Tincker in his paper "The Effect of Length of Day on the Growth and Internal Composition of some Economic Plants." He has shown that by reducing the length and amount of daylight the life-histories of certain plants can be considerably modified. The time of flowering can, to a large extent, be controlled, a fact which promises greatly to facilitate cross-pollination. Some plants, notably the Scarlet Runner, tend also to become biennial instead of annual, and produce tuberous starch-filled roots. In many cases the dry weight of plants subjected to diminished length of daylight is considerably greater than that of the controls.

Cytology and genetics were represented by a considerable group of papers. Prof. Weiss described unilateral heredity in *Ranunculus auricomus*.[1] Two forms of the plant are known, one with normal flowers and one apetalous. The occurrence of intermediate conditions appears to be due to the hybridizing of these forms. Further reciprocal crossing seems to result in what Blaringhem calls unilateral inheritance, in which all the offspring of one cross resemble one of the parents. Mr. Newton, in his paper on "*Primula kewensis* and its Derivatives," mentioned that aberrant plants occur in which a chromosome is lost, and that these plants are recognizable by their external appearance. Mr. C. C. Darlington, speaking on the cytology of the cherries, recognised three wild parent species, *P. Cerasus*, *P. avium*, and *P. fruticosa*, and expressed the opinion that all the cultivated varieties have arisen from these by crossing. Other papers of this group were by Dr. Collins on "Sex Distribution and Inheritance in *Silene nutans*," by Mr. R. J. Chittenden on "Chlorophyll Aberration in *Pelargonium*," by Mr. Huskins on "The Genetics of Fatuoid Oats," and by Miss Clint on "The Life-history and Cytology of *Sphacelaria*."

Mycology was the subject of three papers. Prof. Stevens described some of the fungi he had collected in the American tropics, and illustrated his talk with some very beautiful lantern-slides. The penetration of lichen gonidia by fungal constituents was discussed

with reference to *Lecania candicans*, by Miss Fry. Dr. W. Brow and Miss Harvey described the resistance of the cuticle to penetr tion by fungal hyphæ. The process of penetration appears to b purely mechanical and, by the use of membranes of graded resistanc the penetrating powers can be roughly compared. Communicatio of allied interests were those of Dr. Ellis on "The Reproducti Methods and Internal Structure of the Sulphur Bacteria," and Dr. Malcolm Wilson and Miss Cadman on "*Reticularia* and oth Mycetozoa."

The following were among the more morphological communica tions:—Prof. D. H. Campbell read a paper on "The Nature of th Sex-Organs in the Archegoniatæ," and this was followed by a sho discussion. The morphology of *Ankyropteris corrugata* was describe in some detail by Dr. Holden. Dr. D. H. Scott gave an abstract, i English, of Dr. Krausel's description of new Devonian fossil plant The paper is an extension and confirmation of Kidston and Lang work on *Asteroxylon* and allied forms, and emphasizes the fact th the Middle Devonian flora was very much more advanced than ha previously been thought. A second palæobotanical paper, by Prof. Johnson, on "A New Dipterid from Ireland," was read by Pro Bower in the absence of the author. Other papers of interest we those of Dr. Millard Griffiths on "The British Freshwater Phyto plankton"; by Prof. Harvey Gibson, who described his observatio on the transport of sperms by insects in *Polytrichum*; and by Dr. T. Gunther on "The Herbal of Apuleius Barbarus," believed to ha been executed about the year 1100 at Bury St. Edmunds, and th containing the earliest known English plant-drawings. At the co clusion of the President's address on the first day of the meetin Major T. F. Chipp appealed to the Section to use its influence preventing the destruction of hill-side forests in the tropics. At h suggestion a resolution deprecating such destruction was passed.

A number of very interesting excursions were arranged for Se tion K. One to Swinford Bridge and Godstow to examine the aqua vegetation was so popular that it was repeated on Sunday. O Saturday there was a whole-day excursion to the Berkshire Dow and on Sunday a visit was paid to Bagley Wood.

On Friday afternoon Sir Frederick and Lady Keeble invit Section K to a garden party at Boar's Hill. On Monday the Section Dinner was held at the Randolf Hotel, and was attended by a v large number. Dr. Wager, in a very amusing speech, proposed th health of the Section and of its President, Prof. Bower, and speech were also made by Prof. Bower, Prof. Weiss, Dr. Stevens, Prof. Kn and Prof. Priestley.—M. Rathbone and R. D'O. Good.

The sub-Section of Forestry also held a most successful meet and the following are the notes upon the more purely botanical side its deliberations:—

Lord Clinton, in his Presidential Address to the sub-Section Forestry, spoke on "The Relation of Small Holdings to a Nation Forest Policy." The meeting unanimously agreed to a proposal establish a permanent Section of Forestry in the Association in 19

Mr. L. Chalk's paper described the development of the secondary xylem of *Fraxinus excelsior*. Cambial activity in the stem begins two weeks before the bursting of the flower-buds and three weeks before the swelling of the leaf-buds. Activity begins earlier on the south side than on the north, but there is little difference observed at different heights on the same side. One-year old twigs begin to develop simultaneously with the bursting of the flower-buds and older twigs a week later. Vessels become differentiated about one week after growth starts. Individual vessels almost invariably swell tangentially much more rapidly than radially. The first summer-wood vessels were observed about the middle of June.

Prof. Augustine Henry contributed a paper on the Swamp Cypresses of China (*Glyptostrobus*) and North America (*Taxodium*). The object of the paper was to point out the desirability of making plantations of *Taxodium* and *Glyptostrobus* in this country on marshy land, which has hitherto been unproductive.

Mr. E. V. Laing gave an account of his experiments on the water content of coniferous seedlings, in connection with problems of transplanting. It was found that there is a period of low-water content and an extended period of higher water content. The periods of high and low water content both show fluctuations which, in roots, conform to changes in soil-moisture or rainfall, and, in shoots, to temperature. Root-content is high in the early part of the year in the spruces, and falls as the season advances. The reverse holds with the shoot. In larch the curves for root and shoot tend to follow each other. High temperature and low soil moisture content cause a decrease in all parts of the plant. The percentage water-content decreases with the age of the seedling.

Dr. A. S. Watt read a paper on "The Ecological Approach to Silviculture." Ecological studies in the South Downs and in Aberdeenshire indicate possible methods of assessing land available for planting. Much of this land bears grassland and heath, both of which plant communities comprise several types. While these areas produce markedly distinct types of tree forms, the original plant community (heath or grassland) may mask the variations and present a uniform aspect, which must be studied closely to distinguish the various types.

Mr. W. R. Day gave an account of his investigations on the Parasitism of *Armillaria mellea* in relation to Conifers. Trees are attacked at the root-collar a few inches below soil-level. Penetration of the cork layer by rhizomorphs is shown to be mechanical. The ability of *Armillaria mellea* to penetrate the tissues of apparently healthy and uninjured trees justifies its being classed as a virulent parasite. Genera differ in degree of susceptibility; of those examined hitherto, *Pinus* species appear to be among the most susceptible and Douglas Fir one of the most resistant. On the more resistent species cankers are formed at soil-level.—B. J. Rendle.

SHORT NOTES.

CAREX DISTICHA Huds.—In August, 1925, I found on the edge a shallow pond on the Hastings Sands of Southborough Common W. Kent, a *Carex* in ripe fruit, which I determined as *C. distich* I sent it to Mr. C. E. Salmon, who confirmed the name, and added "In Hanbury and Marshall's *Flora of Kent* (1899) it is noted very rare, except on the coast, and is not reported from District 8, which Southborough falls. Nor is it mentioned in Forster's *Flo Tonbrigensis* (1816), nor in Ed. 2 (1842); nor in Jenner's *Flora Tunbridge Wells* (1845)." It is not mentioned in Deakin's *Flowerin Plants of Tunbridge Wells* (1871). As a boy, I never observed it the marshes of the Medway Valley, where, if anywhere in the distric it might be expected to occur. Its existence in this isolated pond on Southborough Common, at an altitude of about 400 feet, is difficult explain, and one is tempted to surmise deliberate introduction; bu associated plants, as *Bidens cernua* and *Polygonum Hydropip* show that other marsh species have found their way thither. Can be an example of what Mr. W. H. Pearsall calls "Duck-carriage"? J. E. LITTLE.

MONŒCIOUS FORM OF *MERCURIALIS PERENNIS* L.—About a ye ago, I sent to the *Journal* a note on the monœcious form of *Me curialis perennis*. This I have again found this year—on April 10th near Chenies, Buckinghamshire. As was the case with the specimen found last year in Sussex, the plants might be described as femal bearing a few male flowers. I do not know if the converse form male plants with a few female flowers—has been recorded or not. J. A. WILLIAMS.

CORYDALIS CLAVICULATA DC.—According to the 10th edition Babington's *Manual*, the flowering season of this plant is in Ju and July. The 17th edition of Hayward's *Botanist's Pocke Book* gives the period as from June to September. This year, how ever, I found the plant in great quantity in an open wood, near Newa Priory, Surrey, on March 17th, when there were already very many well-advanced buds showing and a fair number of fully-open flowers. This early flowering is interesting as being even in advan of the season given in the *Flore de la France* by Coste, who s that *C. claviculata* flowers from April to September. Is this Ma flowering of common occurrence in England?—J. A. WILLIAMS.

RANUNCULUS HILTONI Groves.—On March 27th, 1926, I visit Copthorne Common, Sussex. It may be worth recording that that date the hybrid, *Ranunculus Hiltoni*, was blooming freely a even beginning to form a little fruit. Of its two parents, on *R. Lenormandi* F. Schultz, was thus also in full flower; but th other, *R. peltatus* Schrank, was not yet in bud, nor had it ev developed its floating leaves. The hybrid, therefore, occurs mu nearer to *Lenormandi* than to *peltatus* as regards time of flowering. J. A. WILLIAMS.

DEFECTIVE PAGINATION OF BOOKS.—I had occasion to make an extract from Prof. Bower's paper on "The Dermal Appendages of Ferns" in the April number of *Annals of Botany*, and naturally wished to add the page to my extract, but being at the commencement of the paper, no page-number was given. In a similar case Mr. Britten suggested that in making a citation the presumed number of the page should be put in square brackets, thus [479], but it seems unreasonable to have to resort to such a proceeding. That printers and publishers of ephemeral books should omit the page-number at the beginning of a chapter is not of consequence, but one is surprised to find such a defect in a publication of the Oxford University Press, to which august body we are accustomed to look for light and leading in such matters! Some publishers, at the beginning of a chapter, put the page-number at the foot, which enables one to make a complete citation, but I fail to see why, for the sake of a foolish old custom, the figures cannot appear in their proper place at the head of the page, so that one need not have to hunt for them. May I suggest that botanical writers should, when passing final proofs of their works, insist on the latter being properly paged throughout.—JAMES GROVES.

CORRECTION.—By an oversight, the name *Tarenna nigrescens* R. Good was published as that of a new species in the Gossweiler Supplement to the July number. The specific name *nigrescens* was used by Hiern for a plant described by him in Flor. Trop. Afr. iii. 92, and the name *Tarenna nigroviridis* R. Good is hereby substituted for *T. nigrescens* R. Good, in Journ. Bot. lxiv., Suppl. p. 10.—R. D'O. G.

REVIEWS.

The Nervous Mechanism of Plants. By Sir JAGADIS CHUNDER BOSE, M.A., D.Sc., LL.D., F.R.S., C.S.I., C.I.E., Director, Bose Research Institute, Calcutta. 8vo, pp. 224, 80 text-figs. Longmans: London, 1926. Price 16*s.* net.

UNDER this arresting title, Sir Jagadis Bose describes a large number of experiments, chiefly on the transmission by plants of various stimuli. *Mimosa pudica* is the plant most used for experiment, comparative experiments being occasionally made with *Biophytum*, *Mimosa Spegazzinii*, and other plants.

The author concludes that the vascular plants possess a well-defined nervous system, and that excitation is conducted by the phloem of the vascular bundle, in which tissue the conduction of stimuli can be modified experimentally by the same means as in animal nerves. In other words, the conducted excitation is a nervous impulse, and the conducting tissue is a nerve. The author also distinguishes sensory and motor impulses, and traces "the transformation of the one into the other in a reflex arc. The observations

involve the conception of some kind of nerve-centre. No structur corresponding to the nerve-ganglion of an animal has, indeed, bee discovered in the pulvinus of *Mimosa pudica*, but it is not impossibl that the physiological facts may one day receive histological verifi cation."

Sir Jagadis Bose is a physicist and a master in the invention o delicate instruments; he does not, however, appear always to appreci the biological point of view. For the biologist the term "nervou system" connotes a special tissue with certain distinct structural an histological features in addition to its function in the transmission o stimuli; the author lays the greatest stress on function, and is no sufficiently appreciative of structural detail. Thus he describes th vascular strands of *Mimosa* as being bicollateral, and considers tha the objection which has already been made to this statement i groundless. He says: "In order to prove that there is an interna conducting phloem, it is necessary to establish the following points:— (i.) That the internal phloem gives the same staining reactions a does the external; moreover, the reactions of the phloems, bot external and internal, should distinguish them from the interposed xylem, and also from other adjacent tissues such as parenchyma o cortex and pith. (ii.) That since the conductivity of the externa phloem is associated with the presence of tubular cells, if the interna phloem is conducting, it must be characterised by similar tubula cells. (iii.) That the internal phloem does conduct excitation."

By the use of hæmatoxylin and safranin and hæmatoxylin an Bismarck brown, the author finds that the normal phloem and th parenchymatous tissue situated immediately on the inner side of th protoxylem do stain similarly, and in a way different from that of th neighbouring tissues. It need hardly be pointed out that suc staining reactions are expressions of the physical and chemical pro perties of the cell-walls, and that the test for phloem is the presenc of sieve-tubes; the author, in effect, avoids this, the main point, i the criticism referred to, although in a later passage he apparentl admits their absence from the so-called internal phloem:—"Relativel few of the tubular cells of the outer phloem have perforated septa *i. e.*, are sieve-tubes, the other cells being imperforate, as are also th septa of the tubular cells of the inner phloem. But it must not b assumed that protoplasmic continuity is necessary for conduction o excitation, for I shall explain in the next chapter that excitatio is transmitted across synaptic membranes in the animal nerve, an that similar transmission of excitation takes place in the plant acros the septa of the conducting cells." But since continuity of proto plasm is not unknown in cells which are not sieve-tubes, it would have been well if the author had made a definite investigation on thi point.

Very few references to the relevant literature are given: the boo would have been more valuable to the student, had the author con sidered and compared his results with those arrived at by othe investigators using different methods of research. In some instanc the author's observations may be unique, but in others such referenc

are called for. Thus, in the consideration of the effect of light, no mention is made of the work of Blaauw, Sierp, Boysen-Jensen, and others.

In conclusion, may we suggest to the author the advantage of collaboration with a botanist?

T. G. H.

Botanical Exchange Club Report of the British Isles, 1925. Vol. VII. Pt. V. By G. C. Druce, M.A., D.Sc., etc. Pp. 751–1027. Price 10*s*. Part VI. By H. Downes, M.B., F.L.S., etc. Pp. 1029–1073. Price 4*s*. Bunde, Arbroath, 1926.

There is a great deal of interest to British botanists in these reports. The principal features are:—Plant Notes for 1925; New County and other Records; Notes on the British *Euphrasiæ*, by W. H. Pearsall; The Nomenclature and Orthography of the London Catalogue, by T. A. Sprague; Huntingdonshire Plants, by G. C. Druce; Clavis to Forms of *Centaurea nigra*, by C. E. Britton; Notes on *Sorbus Arsenii* Britton, by Louis Arsène; Notes on Travels in Egypt, Palestine, Norway, and Sweden, by G. C. Druce; Explanation of the *Salix* List in the London Catalogue, by J. Fraser; Adventive Flora of the Port of Cardiff, by A. E. Wade and R. L. Smith; Notes on Plants sent in during the Year.

The year 1925 was not, perhaps, marked with any remarkable discovery, but the glorious July enabled some of the Scottish alpines, like *Gnaphalium norvegicum* and the *Hieracia*, to flower freely.

Numerous publications and papers are mentioned, but we do not find any reference to a valuable paper on *Erythræa* by the late J. A. Wheldon and C. E. Salmon, which appeared in the *Journal of Botany*, 1925, p. 345 *et seq.*

Among the plant notes there is a translation of a key to the Norwegian *Euphrasias* by K. Jorgensen (Bergens Mus. Aarbok, 1916–17), which might be extremely useful. A little more care should have been used in the translation. The series having "stalked glands absent except sometimes on the corolla" are divided into (1) "Flowers 8 mm. long or longer," and (2) "Small flowered, corolla 7 mm. or *longer*." A reference to the original shows that "longer" in (2) should read "*shorter*."

Another key by Roland M'Kee and H. A. Schoth is on the described varieties and subspecies of *Vicia sativa*. Still another is given of the varieties of the very polymorphic *Eleocharis palustris* Br.—Beauverd in Bull. Soc. Bot. Genèv. 245 (1921).

The plant notes include various new varieties and forms. Among these we notice: *Papaver Rhœas* L. var. *Troweriæ* Druce, from Bury St. Edmunds, a plant having the aspect of *P. Lamottei*; *Crepis Druceana* Murr., which is *C. biennis* × *capillaris*, from Berkshire; *Senecio Jacobæa* L. var. *abrotanoides* Murr., from W. Ross; *Scrophularia aquatica* L. var. *angustifolia* Druce, from Yorkshire; *Plantago Coronopus* L. var. (or lusus) *ramosa* Druce, from Par, Cornwall; *Chenopodium glaucum* L. var. *microphyllum* Murr., from Oxford; *Eriophorum angustifolium* Roth var. *brevisetum* Druce,

from Jersey; *Alopecurus pratensis* L. var. *bulbosiforme* Druce, from Weymouth. There is a careful note on *Caucalis daucoides* L. var. *muricata* (Bisch.) G. & G., by N. Sandworth, and on *Quercus Ilex* by W. S. M. D'Urban.

The critical notes on the *Euphrasias*, by W. H. Pearsall, will be read with much interest.

There is a note on the true *Erodium Chærophyllum* Steud., a plant frequently mistaken. It is founded on *Geranium Chærophyllum* Cav. The type comes from the neighbourhood of Paris. The great majority of the material so named does not conform with the character of the petals as described and figured by Cavanilles. Some of it more nearly resembles *Boreanum* Jord.

Among the "New County and other Records" it is especially interesting to find *Callitriche polymorpha* Lönnr., coming from W. Ross, and *Rumex arifolius* All. from W. Ross and W. Sutherland.

Mr. Sprague divides his remarks between the nomenclature and the orthography of the *London Catalogue*. Among the former we regret to notice that Schinz and Thellung have shown that the earliest binary name for *Nasturtium palustre* DC. is *Sisymbrium islandicum* Oeder (1768). Among the orthography, Mr. Sprague insists on *Ranunculus acer*. "Any Latin Grammar will give nom. masc. of the adjective as 'acer.'" But we notice that Kew publications such as the *Index Kewensis* and Hooker's *Students' Flora* have "acris," and most Latin dictionaries give "acris" as an old alternative masculine form.

Lady Davy gives an interesting account of her year's collecting "From John o' Groats to Land's End." Dr. Druce also contributes a paper on his travels, and the numerous plants he collected testify to his inexhaustible energy.

In the List of Huntingdonshire Plants are numerous additions to the flora of that county which were not included in "Topographical Botany."

The clavis to the forms of *Centaurea nigra* and *C. Jacea*, by C. E. Britton, is well worthy of study; and salicologists will welcome Mr. Fraser's "Explanation of the Salix List in the *London Catalogue*." Where names given by F. B. White or Anderson are excluded, the alterations are due to the criticisms of S. J. Enandu and E. F. Linton.

Among the more interesting notes on plants sent in for 1925 we notice:—*Viola tricolor* L. subsp. *genuina* Wittrock var. *færoensis* (W. Becker) C. H. Ostenfeld, from the Orkneys—a flower with the two upper petals violet, the two lateral bluish-purple with 3–4 dark violet lines, and the lower petal bluish-purple with 7 dark violet lines and a yellowish base. This plant seems to have been variously named previously. Dr. Drabble states that "This adds a new name to our list, but I am by no means convinced that it adds a new plant." *Cerastium tetrandrum* Curtis, from the Orkneys—there seems to be some difficulty in distinguishing Murbeck's *subtetrandrum*. Murbeck, in his paper "De Nordeuropeiska Formerna af Slägtet *Cerastium*," gives under his diagnosis of *subtetrandrum*: "sepala in acumen

longum membranaceum producta; semina 0·45 mm. diam., dilute brunnea." In *tetrandrum* the sepals are "sat breviter acutata" and the seeds 0·6 mm. diam.

Numerous specimens of *Rubi* have been sent in, and the critical remarks on these, generally by Messrs. Barton and Riddelsdell, are most valuable.

The comments on the Mints, by Messrs. Fraser and Salmon, and also on the *Salices* (these more especially by Mr. Fraser) are of great interest.

E. G. B.

Key to the Families of the Dicotyledons taken from the Families of Flowering Plants. Vol. I. Dicotyledons. By J. Hutchinson, F.L.S. 8vo, pp. 54. Macmillans: London, 1926. Price 2*s*.

This is a reprint from Mr. Hutchinson's book, a review of which was recently published in the *Journal* (p. 81). The key here reprinted is not the least useful portion of the volume, and workers may be glad to possess it in a handier form. Opportunity has been taken to make a few corrections in the key, as well as in the general text, the more important of which have been embodied in an errata-slip for insertion in copies of the complete book.

BOOK-NOTES, NEWS, etc.

Protoplasma. Bd. I. Heft i., July 1926.—We have received the first number of this new Journal, described as the *International Journal of the Physical Chemistry of Protoplasm*, edited by Josef Spek (Heidelberg) and Friedl Weber (Graz), with the cooperation of Robert Chambers (New York) and Wm. Seifriz (Philadelphia). The Journal will appear irregularly in parts, four to five of which will form a volume of forty sheets. Communications will be accepted in English, German, French, or Italian. The present part contains 170 pages, comprising: (1) four Abhandlungen, namely, "Protoplasmic Papillæ of *Echinarachnius parma*, the Sand-Dollar," by W. Seifriz; "Cane-Sugar and Potassium Nitrate as Plasmolysing Agents," by W. A. Beck; "Beitrage zur Kenntniss der Plasmolyse," by Küster; and "Sur les Coefficients de Température des différentes Phases de la Mitose des Œufs d'Oursin," by B. Ephrussi. (2) Sammelreferat. "A Sketch of the Present Position of the Dielectricity Constant in Physiology," by J. Gicklhorn. (3) Sixteen pages of reviews. (4) "Literatur: Bibliographies," by E. Bersa, on "Action of Radiation in Protoplasm and Bicolloids"; and by F. Weber, on "Viscosity and Elasticity of Protoplasm." A long list of "Mitarbeiter" includes the names of several British biologists. The publishers are Gebr. Borntraeger, of Leipzig, and the price of Heft i. is 11 G. Mark.

Prickly Pears in Australia.—The Commonwealth Prickly Pear Board of Australia has issued a pamphlet ("The Prickly Pears and Cactus Problem in Australia," Sydney Govt. Printer, 1925) describing the various species of *Opuntia* and *Nopalea* that have been recorded

as growing in Australia. Nine species have become pests; clov
others and the Tree-Cactus (*Acanthocereus pentagonus*) occur, b
have not yet become pests. The pests are illustrated by life-s
coloured plates showing branches, flower, and fruit. The descriptio
have been prepared by Mr. C. T. White, F.L.S., Government Botan
of Queensland. The Prickly Pear has overrun an area of 58,000,0
acres in Queensland and New South Wales, and is increasing at
rate of about 1,000,000 acres annually. The Prickly Pear Boa
was constituted to carry out experiments on the introduction
certain insects by which the species are kept in check in Americ
The results of these observations are set out in the pamphlet, and
is believed that if certain of the introduced insects prove as effect
under field-conditions as they have been in cages, they will
merely check the spread of the pear, but will eventually bring ab
eradication of the mass of the pest.

The Gardeners' Chronicle, 14 August, 1926, publishes an arti
upon the appointment of Sir Daniel Hall, K.C.B., F.R.S., as Direct
of the John Innes Horticultural Institute at Merton, where
succeeds the late Dr. William Bateson, an account of whose work w
given last March in this Journal (p. 78).

WE receive with regret the announcement of the death of M
William Fawcett, at Blackheath, on August 14. He was working
the Herbarium of the British Museum until three days before
died. It is hoped to give some account of his work in a futu
number of the Journal.

APPOINTMENT.—Dr. W. Robinson has been appointed to succ
Prof. J. Lloyd Williams in the Chair of Botany at University Coll
Aberystwyth. Dr. Robinson, a graduate of London University,
senior lecturer in Botany at Manchester University, with which
has been associated since 1912; his scientific investigations have b
mainly on fungal and bacterial diseases of plants. Prof. Llo
Williams is retiring under the age limit.

WE have received the following plaint from a correspondent:-

ORCHIS PRÆTERMISSA.

(By an old-fashioned Flower-lover.)

Plain *Latifolia* once we knew,
With *Incarnata*, her pale cousin,
Ere learned men did murder do,
And split her into half-a-dozen.

Strange forms: distinguish them we can't.
There's one they've christened, deeming this a
Fit title for new-fangled plant,
The "Long-neglected" (*Prætermissa*).

And so for plain Marsh Orchis now
We single folk must mourn outwitted.
Ah, *Prætermissa*, would that thou
Hads't been for ever pretermitted!

REPRODUCTIVE MECHANISM IN LAND FLORA.

VI. SPOROPHYLLS.

BY A. H. CHURCH, M.A., F.R.S.

THE term *sporophyll*[1], sanctioned by modern usage for the obvious spore-producing and photosynthetic leaves of Cryptogams, as familiar in common Ferns of Western Europe, has passed as sufficiently useful to cover the case of such reproductive leaf-members, though the exact connotation of the term 'leaf' may have been still left wholly vague. From the special case of the fern-frond the expression was extended to that of Lycopods, *Selaginella*, etc.; and with broader phyletic views to that of the stamens (microsporophylls), and ultimately to the megasporophylls (carpels) of Gymnosperms and Angiosperms, there being no obvious objection to such usage of the term, which, it will be noted, henceforward expresses the conception of a *leaf-member*, so devoted to the production of spores that the presumed original photosynthetic significance of the former becomes wholly subsidiary and even negligible; as that of the spore-elaboration, maturation, and emission or further complications is considered the more important part in the life-cycle.

The nature of the *leaf* as a 'member' of the plant-soma was thus originally taken for granted, and the *correlative* nature of 'stem' and 'leaf' has been accepted from the general 'common knowledge' of higher plants (Schleiden to Sachs)[2]—just as in Zoology consideration of the general morphology of the animal body, following that of man, led to corresponding generalizations of 'axis' and 'appendages'; though the actual phyletic significance of this differentiation remained wholly obscure, and was originally not even dreamt of. In fact, it was only the further comprehension of the meaning of evolution—that everything must have had a beginning, some reason for its origin, and a life-and-death selection for its establishment in the general mechanism of heredity—that demanded further consideration of the facts; and such ideas were not incorporated into plant-biology until the latter part of the nineteenth century. Thus, so long as the idea of a *leaf* was accepted as part of the fundamental framework of plant-morphology, there was no gainsaying[3] it would be necessary to show that all structures to which the term *sporophyll* had been hitherto perhaps too loosely applied were essentially of leaf-nature. But the obvious difficulty remains that there is so far no precise and generally accepted criterion of the leaf

[1] The Spore Leaf (*Sporophyllum*) of Schleiden, *Grundzüge*, Eng. trans. (1849) p. 104. The word was not used by Sachs, but was revived in the present form by Goebel (1880) for 'a leaf bearing spores': cf. *Outlines of Classification*, Eng. trans. (1887) p. 488.

[2] *Cf.* Bower (1923), *Ferns*, p. 80.

[3] Following academic views of *Metamorphosis* of the eighteenth century, of which vestigia still exist in *Phytomer* theories.

itself as a distinct morphological entity; and until this deficiency has been made good there can be no real progress.

Thus Goebel[1] pointed out that all sporophylls arose *ontogenetically* in the manner of leaves—*i.e.*, as outgrowths of the axis (stem) as cellular protuberances involving epidermis and internal tissues from a definite growing-point, and in acropetal succession. On the assumption that such ontogeny more or less accurately recapitulates phylogeny, the case appeared sufficiently well made out in favour of all spore-producing members being regarded as of leaf-category. But all this still begs the question as to what is the essential nature of an ordinary leaf-member; and, to get a clear idea of the value of sporophyll as a spore-bearing leaf, it is necessary to probe still further back as to the origin and nature of what is to be regarded as a *leaf* in the first place. Thus it was left for Bower[2] to suggest the possibility of the converse view—that, after all, the familiar leaf of land-flora was but a 'sterilized' sporophyll, *i.e.*, now devoted secondarily to the function of photosynthesis; but that the reproductive function of spore-elaboration was the original meaning of its differentiation as an appendage of the shoot—a view which again begs the question as to what is an 'appendage' (enation). Bower's suggestions appear at first sight to be so opposed to all reasonable conceptions of plant-morphology and physiology, as applied to the working mechanism of the somata of higher plants, that they came as a shock to older morphologists. But it is always refreshing to have loose theories challenged, old view-points looked at from a new angle, even if the subject be turned completely upside down.

The first point brought out by such discussions is that one finds that one has no working definition of what a *leaf* really is, or why leaves were ever produced *phylogenetically*. One has to go back to fundamentals and trace the first origin of leaf-members, where they appear in the first evolution of plant-somata, to give reasons for their special attributes, and consider the factors to which they may be the response. Why, that is to say, are plant-somata developed in the form of *axes* and *appendages*; or what is the difference between a leaf (appendage) and a branch (axis)? The time for mere academic abstractions of *formal morphology* has gone; these belong to the eighteenth century and, having been initiated by speculative late philosophers, have had a curiously hypnotic effect on the interpretation of land-flora. If terrestrial vegetation came out of the water, as shown in the middle nineteenth century by the persistence of aquatic sexual mechanism, it is possible that the beginnings of all other problems are to be also traced back to an aquatic phase. Modern theories of evolution are expected to provide a key to all problems of plant-growth and form.

For the beginnings of the differentiation of the plant-soma one has to go back to the benthic phase of plant-life, as now illustrated by algal forms of the sea; and here the stages of progression

[1] Goebel (1880), Bot. Zeit. p. 753.

[2] Bower (1894), "The Morphology of Spore-producing Members," Phil. Trans. p. 493.

sufficiently clear[1]. With the elaboration of the first more massive benthic axes, whatever their type of structural organization, increase of a diffuse body-surface is given by *ramification*—in the simplest stages wholly irregular, and produced at any point, or at any time, in a soma which may present no special distinction of apex. Corresponding stages are traced in equally benthic lines of animal growth, as in the somata of Sponges, Hydroids, and Corals—all equally remote from the highly specialized cases of axis and appendages, as seen in Arthropods and Vertebrata. With increasing isolation of special growing-points there comes the general case of *dichotomy* of the apex, as a simple but quite secondary application of the method of binary fission, which leads to a new and better grade of soma-building, since affording greater possibilities of accuracy and design, with special biological applications, but also involving necessary limitations. In such somata any retention of the older irregular branch-production now comes to be indicated as that of *adventitious* order. Dichotomous ramification in turn persists throughout the plant-kingdom until replaced again by something better. Phases of this method are still available in stem, root, and leaf of vascular land-plants, and serve to illustrate both the use and defects of the method[2]. Granted that the essential significance of dichotomous ramification is the more regular distribution of the plant-soma to the influence of light and the external nutrient medium, and has so far no direct connection with methods of reproduction, the limitations of the process are shown in two directions:—

(1) Beyond a certain point successive dichotomy defeats its primary object, since it produces overcrowding and a distribution to the medium which is inferior to that given by the first ramifications. This tends to a bushy type of growth with increasing strain on the first axis; the mischief may, it is true, be counteracted by intercalary extension, or by the preferential development of one branch of the dichotomy giving a *sympodial* formation. Such variants are of general occurrence; but they are to be regarded as secondary corrections of a system which is initially imperfect, requiring the addition of new linked factors[3].

(2) Where associated with any degree of bilaterality, the mechanism of dichotomy leads normally to a type of ramification in a plane frond-system of two dimensions. Correction of such a construction, giving planes at different angles at successive points of ramification, again implies a secondary factor of control; since three-dimensional

[1] Church (1920), "Somatic Organization of the Phæophyceæ," Bot. Mem. p. 44.

[2] *Cf.* Stems of Lycopods, roots of *Selaginella*, fronds of Ferns, even persisting as a 'teratological phenomenon' in the case of 'twin-flowers' (synanthy) of Angiosperms, or in the case of abnormal foliage-leaves with a forked midrib (*Salix*).

[3] In *Fucus* such sympodial construction of essentially dichotomous order may be so advanced that it cannot be distinguished ontogenetically from monopodial ramification.

space-form is the optimum method of distribution to the medium, even if two-dimensional may be better for optimum light-effect [1].

But both these imperfections may be avoided by an alternative construction, so generally adopted in higher plants that it becomes the rule of plant-growth of the land; just again as that of a dorsi-ventral main axis and a system of dorsiventral appendages becomes the rule for all higher mobile animal organism, originally creeping and later free-swimming (nekton), which constitutes the basal type of construction of the land-animal. The morphological dominance of the main axis is assumed from the first, and lateral ramuli are produced at the growing-point, from the first, in a three-dimensional space-distribution. Dominance of the main axis implies a monopodial habit, which maintains, from the first, all the advantage of the secondary sympodial constructions of dichotomous order—just as the three-dimensional space-distribution of ramuli solves, from the first, all the difficulties of the second chance of failure [2]. This is affected by the introduction of what is later termed a phyllotaxis-construction of Fibonacci order, in which successive lateral ramuli are spaced at divergence angles of approximately 137½°, as the angle affording optimum distribution of ramuli produced one at a time and in close genetic succession at the three-dimensional shoot-apex. The causal factors of such an alternative mechanism are still vague, but evidence of the existence of the method is now seen among the higher Brown Algæ (*Cystoseira*, *Sargassum*); while the fact that the advantages of such a construction may be also followed with equal accuracy and comparable significance, as affording the optimum condensed system in admittedly animal and marine Protozoan series as Foraminifera, indicates its essential antiquity in biological mechanism [3].

With the addition of this factor, the essential feature that has been so persistently neglected, it is now possible to give a working definition of the leaf in its phylogenetic history. It remains fundamentally a lateral *ramulus*, produced acropetally at a growing-point but also borne in a rhythmically continued phyllotaxis-construction of Fibonacci order. Considered merely as a lateral ramulus, it may still retain features of older order, as such leaf-ramuli (1) present limited growth in relation to the main stem which takes the major strain and admits monopodial extension where necessary; (2) being primarily photosynthetic, the ramulus acquires and maintains a more bilateral frondose habit, to which dichotomous ramification in two-dimensional space may remain a distinct advantage.

The latter point is important, since it implies that such a lateral ramulus of limited growth need not necessarily present the same type of growth or ramification as that of the main axis which bears it. But it may retain characters of an older or different order; lagging

[1] The regularized adjustment of planes of successive dichotomies plays an important part in the ramification of the leaf-pinnules of Palæozoic Zygopteridæ and even lingers in the remarkable segmentation of the 'fertile' and 'sterile' halves of the spore-producing fronds of Ophioglossaceæ.

[2] Bot. Mem. x. 50. [3] *Op. cit.* vi. 44, *Quinqueloculina*.

behind morphologically, as it were, as it is increasingly relegated to special functions in the somatic organization—*i. e.*, it becomes the essentially photosynthetic organ, as the monopodial axis is more concerned with maintaining mechanical stability [1].

It is this which finally marks off the *leaf* as being of distinct morphological category, and necessitates a special term for it, rendering precise definition possible. That a leaf can only originate as a lateral ramulus of stem-nature has appealed to many land-morphologists; but this does not take one very far. Unless it were to be regarded as a special creation (*sui generis*) [2], it could not be anything else. The point is, where and how does the leaf cease to be a 'ramulus' and become an 'appendage'? What saves it is the special mechanism of continued production of similar members, which now gives it the added dignity of an appendage as a unit of a correlated system; hence implying definite properties of growth-construction as the initial departures for new possibilities of special organization. This is the missing factor so long neglected in plant-morphology, since it is not seen in individuals studied at any given moment—as, for example, when examined *dead*; but implies a factor of the continued growth of an apical mechanism which builds new members of similar order, continuously—a conception again wholly remote from the considerations of animal morphology on which primary views of *axis* and *appendages* were originally based.

In such a system, a leaf-primordium, appearing as a new growth-centre on an apex which is itself growing, becomes a subsidiary member, since still within the control of the main growth-centre of the shoot; and this dependent position involves definite mathematical and geometrical consequences. These, if they prove of special value in the working out of their inherent possibilities, may add to the special attributes of leaf-organization in higher land-flora. Such inherent properties have been examined from the standpoint of the vegetative system of land-plants, and may be summed up as involving the problem of a centric field of growth expanding within the field of a parent centre. These lateral centres now appear as primordia of appendages, which, though presenting a greater initial growth-rate, may be restricted in ultimate extension; but they are also necessarily *bilateral*, *dorsiventral*, and *isophyllous* in the

[1] It may be noted by the way that the *root*, as the survival of a ramulus (crampon) of even older (adventitious) order, may attain dichotomous ramification, a growing-point, apical cell, and even monopodial development of laterals, as also retaining archaic anatomical organization in its stele; but it is never produced acropetally in a phyllotaxis-system of Fibonacci order. The so-called 'roots' of the *Stigmaria* rhizome are a case in point, indicating their primary nature as being of the order of dichotomous leaf-ramuli, whatever their secondary function may be (Scott (1920), *Fossil Botany*, i. 238).

[2] As in the case of the sporangium, neither *leaf* nor *root* are organs *sui generis*, but have a long and varied phyletic history in older phases of marine organism. The enormous amount of ingenuity which has been wasted in looking for 'origins' of such structures in a land-flora, in which these organs are fully established as an integral part of highly-specialized, and even residual plant-forms, curiously emphasizes the initial fallacy of the 'antithetic' outlook and the *Riccia*-myth.

tangential plane of the shoot-axis, whatever may be the phyllotaxi construction (spiral or whorled) [1].

Leaves are thus to be regarded as ramuli of (1) special order, bu (2) also as often presenting older morphological growth-forms tha does the stem; though, again, in anatomy they may closely agre since the secondary land-specialization of parenchymatous and vascula tissue follows alike in both. That is to say, the leaf, like the roo may be more conservative of its ramulus organization; morphologica features may be older than anatomical, since the former go back t the sea, while the latter are traced more particularly in the vascula system, which is the outcome of subaerial conditions.

Essentially a leaf is most strictly defined by its production in three-dimensional phyllotaxis-system, either of original Fibonac order, or of some system intelligibly based on the latter [2]. To talk o the *origin* of leaves, without reference to the system in which the are produced, is nonsense—and this is the weakness of all 'enation hypotheses. A leaf-origin is something more than a mere lump o parenchyma (enation), which is all there is to be seen in sections o dead plant under the microscope. It has become an *appendag* with distinct morphological attributes based on its geometrical con struction, as a unit produced under special restrictions [3].

With this view of a leaf-appendage of higher plants as an adapt ramulus of older algal order, now increasingly specialized for phot synthetic function in a medium of open air, on transmigrant vege tion, it is possible to approach the subject of the natural production o reproductive units as spores in meiotangia—since the leaf-lamina the normal situation for these to be matured at the source of th food-supply.

[1] Church (1904), *Relation of Phyllotaxis to Mechanical Laws*, p. 331; Bo Mem. 6 (1920), 15.

Since the same theory of the appendage as a lateral growth-centre involved the continued growth of the parent axis also applies to animal morphology, th case of the dorsiventral animal with bilateral dorsiventral appendages, an phyllous in the longitudinal plane of the axis, similarly follows, affording th original geometrical bias for such construction as seen in Arthropod appendag the fins of fishes, and hence even the special case of asymmetry of the dor ventral human hand.

[2] *Cf.* "Whorled, Multijugate, and Anomalous Systems, R. P. M. L.," *loc. c* p. 218.

[3] *Loc. cit.*, "Theory of the Quasi-Circle," p. 336.

(To be continued.)

NOTES ON THE BRITISH PANSIES.

The *Arvensis*-Series.

By Eric Drabble, D.Sc., F.L.S.

The *arvensis*-series comprises all the British small-flowered annual pansies with the exception of *V. nana* DC. It includes *V. derelicta*, which M. Rouy (Fl. de France, iii. 48–49) places in the *Kitaibeliana* set, but excludes *V. Lloydii*, *V. Lejeunii*, and *V. variata*, which will be dealt with in the *tricolor*-series.

The petals in the *arvensis*-series are shorter than the sepals, or about equal to them in length, the corolla is white or pale-coloured, sometimes tinged with violet. Characters which seem to be of great importance are the direction of the branches, widely spreading horizontally or more or less upright, and the form of the stipules and their mid-lobes. On the contrary, the position of the bracteoles on the curvature of the peduncle or below it seems to be of no value. The relative position of the bracteoles changes as the flower becomes older. The peduncle continues to grow until the fruit is ripe, and thus the curved region may come to lie far above the bracteoles, which at an earlier stage were actually in the curvature itself. The striation of the lower petal is inconstant even in flowers on the same plant, and, while the upper petals are typically pale-coloured, they may occasionally be tinged with violet in any species.

It is extremely difficult adequately to characterize the pansies in written descriptions. The range of variation in any species may be considerable, and only long familiarity with the plants in the wild state and in cultivation renders it possible to determine them with confidence. That there are many distinct plants and not merely various states of one or few species becomes increasingly clear the more closely they are studied. Many of the plants described below have been cultivated and kept under observation for several years, and thus a knowledge of their behaviour under different conditions of growth has been obtained.

Only mature and well-grown plants show the characteristic vegetative features. It is very unwise to attempt to name fragments or immature specimens. Many, perhaps all, of them may begin to flower at a very early stage, and such specimens in most instances cannot be named with certainty, as the plants do not develop their distinguishing features until further growth has taken place.

It is an interesting fact that in general the different species do not grow intermixed. As a rule, only one species is to be found in any field, and quite often in any one district. The distribution of these plants is reserved for full treatment on another occasion.

Much confusion has been caused by inconsistent naming of plants in continental exsiccata. In citing these exsiccata it is necessary to state in what herbarium the particular sheet lies. In the following notes no specimens are cited that I have not personally examined.

The treatment of the pansies by Rouy (Fl. de France, iii. 1896),

Becker ("Violæ Europææ," Dresden 1910, reprinted from the *Bot. hefte zum Bot. Centralblatt*, xxvi. 1909), Wittrock ("Viol Studier I.," *Acta Horti Bergiani*, ii. No. 1, 1897), Clausen ("Studie in the Collective Species *Viola tricolor* L.," *Botanisk Tidsskrift* xxxvii. 1922), and others will be considered in a later communication

The characters on which Wittrock based his arrangement of th pansies are now receiving critical attention. So far, the evidenc seems to indicate that they are not the most suitable for delimiting species from species. In these notes the term "species" is used i in a non-committal sense. Which of these plants should be regarde as species, and which as varieties, is too large a question to be discussed within the limits of the present communication.

No attempt at a Key will be made until the *tricolor*, *saxatilis*, *lutea*, *Curtisii*, and *nana* sections have been considered.

Viola agrestis.

Jordan, Observations, ii. 15, 1846; Grenier et Godron, Fl. d France, i. 183, 1848; Boreau, Fl. du Centre, ed. 3, ii. 81, 1857 Drabble, British Pansies, Journ. Bot., Supplement, 2, 1909.

Plates:—*V. agrestis* Jord. Obs. ii. pl. 2 A; *V. arvensis* Murray subsp. *patens* Wittrock, Viola Studier I. pl. v. fig. 70.

(Smith's *English Botany*, 2712, apparently represents *V. agrestis* but the stems and leaves are not sufficiently hairy. The description (ed. 2, ii. 60) is not applicable. The figure in *British Pansies* pl. i. fig. 3, is not very characteristic; it shows too much resemblance to *V. segetalis*.)

Plant annual, *branched from the base. Stems flexuose, rather roughly hairy*; main stem upright with internodes shorter than the leaves; *lateral branches long, horizontal. Leaves* dark green, crenate-dentate, *with well-developed pubescence* giving a *cinereous* appearance to the plant; lowest cauline leaves oval obtuse, intermediate *lanceolate* or ovate-lanceolate *acute*, *uppermost narrowly lanceolate, acute or acuminate. Stipules with mid-lobe large, foliaceous, crenate* or nearly entire; *lateral lobes linear, palmately arranged or carried up in a pinnate manner on the lower part of the mid-lobe*. Sepals broad, oblong-lanceolate, shortly acuminate, with large appendages. Petals shorter than the sepals or equalling them in length, pale-coloured.

A very distinct plant of cultivated or broken waste land.

Exsiccata.

Herb. Imperial College of Science:—

V. agrestis Jordan, Lyon à Villieurbanne, Rhône. Ex herb. A. Jordan. (This locality is given in Jordan's Obs. ii. p. 17.)

The leaves on the plant are unusually broad.

Herb. Mus. Brit.:—

V. agrestis Jord. Lyon à Villieurbanne. Ex herb. Alexis Jordan 1864.

This is the long and narrow-leaved plant of Jordan's figure (Obs. ii. pl. 2 A). The sheet has also a little round-leaved plant, which occurs again on another sheet by Jordan from the same locality (1853). A third sheet (1864) shows the lower leaves in one specimen like those of this round-leaved plant. The round-leaved plants show some resemblance to *V. ruralis* and no doubt account for Boreau's remark under *ruralis* (Fl. du Centre, ed. 3, ii. 81)—"Confondue souvent avec l'*agrestis*." Formerly I was myself misled by these specimens (*British Pansies*, 5).

V. arvensis Murray var. *hirsuta* Wtg. Wirtgen's Herb. plant crit. hybr. select. Floræ Rhenanæ, Fasc. xii. no. 673.

This is certainly *agrestis*.

Viola segetalis.

Jordan, *Observations*, ii. 12, 1846; Grenier et Godron, Fl. de France, i. 183, 1848; Boreau, Fl. du Centre, ed. 3, ii. 83, 1857; Drabble, British Pansies, 2, 1909.

Plates:—Jordan, Obs. ii. pl. 1 B; Drabble, British Pansies, pl. i. fig. 5.

Plant annual. *Stem simple or branched from the base*; *branches long, straight, nearly erect*, glabrous or slightly pubescent; *internodes long*, generally as long as, or longer than, the leaves. *Leaves pale green, slightly pubescent* or glabrous, crenate or crenate-serrate; lower and intermediate leaves *lanceolate acute*, narrowed and lengthened at both ends, uppermost linear-lanceolate. Stipules with narrowly linear lateral lobes arising in a *palmate* manner near the base, *mid-lobe* lanceolate or linear-lanceolate, *acute*, *entire*, or slightly toothed. Peduncles long. Sepals lanceolate acuminate, with larger appendages. Petals shorter than the sepals or equalling them in length, white.

A plant of cultivated soil, especially corn-fields, readily distinguished from *agrestis* by its taller, *upright* habit, and the usually entire or sub-entire mid-lobe of the stipules.

Exsiccata.

Herb. Mus. Brit.:—

V. segetalis Jord. Schultz, Herb. norm. cent. 5, no. 433 (specimen received from Jordan).

V. segetalis Jord.! Alix (Rhône), 17 juin, 1848, E. Bourgeau, No. 10.

V. segetalis Jord.! Guincreux près Lyon, 1852. Alexis Jordan, 1853 (two sheets).

Herb. Imperial College of Science:—

V. segetalis Jord. Champs Calcaires de Berry, août 1874 (Herb. A. Déséglise).

This is *segetalis*, but the leaves are unusually broad and the mid-lobe of the stipule unusually crenate-dentate.

[From Nottinghamshire and from Lancashire I have plants with the general habit of *segetalis*, but with very deeply toothed, almost

incised, leaves. I have not been able to find a specimen of *V. ... incisa* Boreau (Fl. du Centre, ed. 3, ii. 83) in any herbarium, nor do I know where such plants are preserved. Any information would be very welcome.]

VIOLA OBTUSIFOLIA.

Jordan, *Pugillus*, 22, 1852; Drabble, British Pansies, 4, 1909.

Plate:—Drabble, British Pansies, pl. i. fig. 2.

Plant annual. *Main stem erect, simple, or with long lateral branches ascending from the base.* *Leaves* clear green, slightly pubescent or glabrous, crenate, *very obtuse*, the uppermost alone sometimes subacute, the *lower broadly elliptic-oblong*, the upper narrower. *Stipules* with linear lateral lobes arising in a *palmate* manner close to the base, *mid-lobe large, foliaceous, crenate.* Peduncles ascending. Sepals broadly oblong-lanceolate with large appendages. Petals shorter than the sepals or equal to them in length, white.

A plant of cultivated or waste land, readily recognized by its upright habit, obtuse leaves, and very foliaceous mid-lobe of the stipule.

EXSICCATA.

Herb. Mus. Brit.:—

V. obtusifolia Jord.! Lyon à Fontaine, mai 1852. Alexis Jordan, 1853.

V. obtusifolia Jord., de Fontaines près Lyon, Cult. 1853. Alexis Jordan, 1864.

V. banatica Kit., Schultz, Herb. norm. nov. ser, Cent. 27, 261!

Herb. Imperial College of Science:—

V. cognata Jord., Vienne. Ex herb. A. Jordan, 1864.

A stout-stemmed *obtusifolia* with rather large flowers in some plants and leaves a little less obtuse and more deeply crenate than usual. I cannot find that the name *cognata* was ever published.

Viola latifolia, sp. nov.

Plant annual. *Stem much branched near the base, some of the branches long and spreading horizontally, others short and bearing closely-set leaves with long slender petioles, round laminæ, and small stipules.* *Leaves with long slender petioles*, dark green, coarsely crenate, *obtuse* (except sometimes the uppermost), usually much longer than the internodes; *lower leaves round*, very obtuse, intermediate ovate obtuse, uppermost oval-oblong. *Stipules of lower leaves small with mid-lobe entire and not much larger than the small palmately-arranged lateral lobes; of the intermediate and upper leaves larger with long-stalked foliaceous mid-lobe* and linear lateral lobes borne in a palmate manner. Flowers small. Sepals narrowly lanceolate or triangular, acuminate. Petals pale-coloured, shorter than the sepals or equal to them in length.

Viola annua, caule basi ramosissimo, ramis aliis longis, procumbentibus, aliis brevibus; foliis in ramis brevibus longo-petiolatis

rotundo-laminatis parvo-stipulatis, contiguis; foliis subfuscis rotundo crenatis, plerumque multo longioribus quam internodis, obtusis nisi interdum summis; petiolis longis tenuibus; lamina foliorum inferiorum rotunda obtusissima, intermediorum ovata obtusa, superiorum ovato-oblonga; stipulis palmatifidis, foliorum inferiorum parvis, lacinia media integra non multo longiori quam laciniis parvis lateralibus, stipulis foliorum intermediorum superiorumque amplioribus, lacinia media foliacea longo-pedunculata; floribus parvis; sepalis anguste lanceolatis vel triangularibus acuminatis; petalis calycem subæquantibus.

The long slender petioles, the round laminæ, the horizontally spreading flowering branches, and the short leafy branches are very characteristic features of this plant.

EXSICCATA.

Herb. Mus. Brit.:—

V. arvensis Murr. *β. gotlandica* Wittr. (sed non *V. arvensis* Murr., *communis* Wittr. var. *gotlandica* Wittrock, Viola Studier I. 93, et tab. x. 135–139).

V. arvensis sublilacina Wittr. Hillstrom's Plantæ Scandinavicæ (sed non Wittrock, Viola Studier I., 84, et tab. xii. 182–195).

It is clear that neither *gotlandica* nor *sublilacina* can be used as the name of the plant now under consideration, since, although the specimens cited above appear to be this plant, the descriptions and figures in Wittrock's *Viola Studier I.* do not fit it or them.

VIOLA RURALIS.

Boreau, Fl. du Centre, ed. 3, ii. 81, 1857; Drabble, British Pansies, 4, 1909.

Plates:—Drabble, British Pansies, pl. i. fig. 4; Jordan, Obs. ii. pl. 2 B (as *V. gracilescens*).

Plant annual. *Stem with widely-spreading divaricate branches from the base.* *Leaves* crenate; lower leaves *ovate obtuse*, upper ovate or ovate-lanceolate. *Stipules with foliaceous crenate obtuse broadly-based mid-lobe, up which the oblong lateral segments arise for some distance in a pinnate manner.* Sepals lanceolate acute, with large appendages. Petals about as long as the sepals, pale-coloured.

A plant of cultivated fields, readily distinguished from *obtusifolia* and *agrestis* by the form of the stipules, and from *obtusifolia* by its spreading habit.

EXSICCATA.

Herb. Mus. Brit.:—

V. ruralis Jord., Billot, Fl. Gall. et Germ. no. 3526. This plant was supplied by Mr. J. G. Baker, from Thirsk.

Herb. Imperial College of Science:—

V. ruralis Jord. in Déséglise's herbarium.

[Under *ruralis* must be placed some of the small-flowered plants issued as *V. variata* Jordan in Billot, Fl. Gall. et Germ. no. 2625.]

The plant figured by Jordan as *V. gracilescens* (Obs. ii. pl. 2) *ruralis*, and if this figure stood alone I should have made these un synonymous. But Jordan writes (Obs. ii. 22): "D'après l'exam des échantillons de l'herbier de M. Seringe désignés sous le n *V. tricolor* var. *gracilescens* DC. et provenant de la Suisse j'ai lie croire que la plante que je viens de décrire est la même que celle est signalée, sous ce nom de variété, dans le *Prodromus* de De Candol v. i. p. 304, et dans la *Flore helvetica* de Gaudin, vol. 2, p. 2 C'est pourquoi je l'ai nommée *V. gracilescens*."

The description in De Candolle's *Prodromus* runs thus:—"*μ. gra lescens* (DC. MSS.) caulibus simpliciusculis elongatis erectis, sep angustis corolla bicolor sæpius longioribus." This is quite insuffici for purposes of identification. Moreover, I have examined the specim in Herb. Kew. from Seringe's herbarium, and am convinced that i not the same as Jordan's plant, and it is certainly not *V. ruralis*.

VIOLA DESEGLISEI.

Jordan, ap. Boreau, Fl. du Centre, ed. 3, ii. 82, 1857.

Plant annual. *Stem upright, usually with several ascending erect branches from the base. Leaves* crenate, the lower leaves v obtuse, intermediate *oval-oblong acute, upper lanceolate ac Mid-lobe* of lower stipules oblong-oval obtuse, somewhat crenato dentate, *of the upper stipules linear-lanceolate or linear, dent the lateral lobes arising in a pinnate manner* for as much as o third of the length of the stipule. Sepals narrowly elliptic lanc late, *appendages often violet*. Petals about equal to the sepals length, pale-coloured.

EXSICCATA.

Herb. Mus. Brit.:—

V. Deseglisei Jord. (*teste* Boreau!), Loir et Cher, juillet 187 A. Déséglise.

V. Deseglisei Jord. (*teste* Boreau), Cher près Allogny, 18 jul 1874, A. Déséglise.

The description given under *V. Deseglisei* in *British Pansi* 3, does not characterize the plant sufficiently, and, moreover, wou include *V. anglica*. This was due to certain specimens wron named *Deseglisei* by Boreau (see below).

[V. TIMBALI Jordan, Pugillus, 22–23, 1852.

EXSICCATA. Herb. Mus. Brit.:—*V. Timbali* Jord., Schul Herb. norm. nov. ser. cent. 24, 2313; *V. Timbali* Jord., Billot, Fl Gall. et Germ. no. 931 (these are small specimens). Herb. Kew. *V. Timbali* Jord. Toulouse, æstate, Th. Urgel.

Jordan's sheet in Herb. Mus. Brit., 1853 (Cult. 1852), carr what is probably the same plant, but it is very stout. There is a small specimen on this sheet which appears to be a young car flowering specimen of the same plant, but it is too young for accura determination, and the sheet is not altogether satisfactory.

The specimens labelled *Timbali*, cited above, do not appear to really distinct from *V. Deseglisei*. Although the name *Timbali* w

published in 1852, I cannot adopt it in place of *Deseglisei* (1857), as it seems to have been employed to designate a mere state of that species.]

VIOLA SUBTILIS.

Jordan, ap. Billot, Annot. Fl. Fr. et Allem. 101 (nomen), 1855; Drabble, British Pansies, 3, 1909.

Plate:—Drabble, British Pansies, pl. ii. fig. 2.

Plant annual. *Stem simple or with upright straight branches from the base.* Lower *leaves* ovate or lanceolate crenate, intermediate *linear-lanceolate* crenate-dentate, much narrowed into the petiole, *uppermost linear*. Stipules of the lower leaves with linear-lanceolate somewhat dentate mid-lobe and linear acute lateral lobes arising for some distance up the stipule; *stipules of the intermediate leaves with linear dentate or subentire mid-lobe*; *of the uppermost leaves with narrowly linear entire or slightly dentate mid-lobe* and subsetaceous lateral lobes. Peduncles upright in flower, slightly spreading in fruit. Sepals narrow, acuminate. Petals about equal in length to the sepals, pale-coloured.

EXSICCATA.

Herb. Kew.:—

V. subtilis Jord. 1 juillet, 1863, Cher. Legit Déséglise.

Herb. Mus. Brit.:—

V. subtilis Jord., Billot, Fl. Gall. et Germ. no. 2020.

Herb. Imperial College of Science:—

V. Deseglisei Jordan. Cultivated from seeds given by Jordan. Ex. herb. Déséglise. (This is *subtilis*.)

To treat *subtilis* as a narrow-leaved "variety" of *Deseglisei* seems to express its relationship most naturally. It is interesting in this connection to find that a plant in the herbarium of the Imperial College labelled *V. Deseglisei* Jord., grown from seeds given to Déséglise by Jordan himself, is really *subtilis*.

The plant is readily recognized by its upright habit, generally small size, very narrow leaves, and mid-lobes of the stipules.

Viola anglica, sp. nov.

Plant annual. *Stem branched from the base, the lateral branches spreading below, then ascending or erect*; *leaves* distinctly pubescent, dark green, *subcoriaceous, crumpled*, the lower oval obtuse, those of the middle of the stem lanceolate, obtuse, narrowed into the petiole, the uppermost lanceolate acute, *intermediate and upper leaves often deeply crenate-dentate with forwardly-directed somewhat irregular teeth*. Stipules with *linear lateral lobes arising successively for some distance up the stipule in a pinnate manner*; *mid-lobe narrowly lanceolate with a few crenulations or sub-entire*. *Calyx* dark green, *generally deeply tinged with violet*; sepals lanceolate, *appendages usually violet*. Corolla about equal in length to the calyx, petals yellowish white, the upper often tinged with violet, the lowest with or without violet striations, spur usually deep violet.

Viola annua, caule ramoso basi, ramis lateralibus patentibus; foliis pubescentibus fuscis subcoriaceis corrugentibus, inferioribus

ovatis obtusis, intermediis lanceolatis obtusis, coarctatis infra petiolum, superioribus lanceolatis acutis, intermediis et superioribus plerumque profunde et irregulariter crenato-dentatis, dentibus prorsum vergentibus; stipulis pinnatifidis, lacinia media anguste lanceolata subintegra vel leviter dentata, laciniis lateralibus linearibus sepalis et appendicibus sepalorum plerumque violascentibus; petalis albis vel subflavidis, calycem subæquantibus, calcare violascente.

This is a very well-marked plant, with leaves of a peculiar crumpled and almost coriaceous appearance, with deep crenations forming irregular forwardly-directed teeth. The usually purple tinge of the sepals and their appendages and of the petaline spur is very characteristic.

This plant was erroneously included in *V. Deseglisei* in *British Pansies*, 3–4, but it is really quite distinct. It seems to be rather widely distributed in this country, so far as my records indicate, but present, while the only Continental specimen that I have seen which might be identified with it is one collected by Boreau, Alloins, Ch. 5/54, and erroneously named by him *V. Deseglisei*. That Boreau was in error is shown by comparison with the plant in Herb. Mus. Brit., cited above under *Deseglisei*. Its absence otherwise from the Continental exsiccata that I have seen, and its abundance in this country, render the name *V. anglica* peculiarly suitable.

Viola arvatica.

Jordan, Pugillus, 24, 1852; Drabble, British Pansies, 5–6, 1909.

Plant annual. Generally a small plant about 5 in. in height or less, but when growing amongst corn sometimes reaching a foot or more. *Stem strongly flexuose, zigzag, usually simple. Leaves small*, slightly pubescent; lower leaves ovate, intermediate narrowly ovate acute or sub-acute, upper lanceolate acute. Stipules with linear lateral lobes arising successively in a pinnate manner; mid-lobe large, subfoliaceous, entire or slightly crenate. *Peduncles widely divaricate*. Sepals narrowly lanceolate acute, appendages short. Petals about equal in length to the sepals, pale-coloured.

This plant is readily recognized by its small size, zigzag stem, and very widely divaricate peduncles. When up-drawn amongst corn the flexuose nature of the stem may be less well marked, but the divaricate peduncles and the long internodes as compared with the leaves render the plant easily recognizable.

Exsiccata.

Herb. Mus. Brit.:—

V. arvatica Jord., de Pont à Mousson (Meurthe). Cult. 1852. A. Jordan. (The original locality, *Pugillus*, 24.)

Viola derelicta.

Jordan, ap. Billot, Annot. Fl. France et Allem. 101 (nomen) 1855; Drabble, British Pansies, 6, 1909.

Plate:—Drabble, British Pansies, pl. ii. fig. 1.

Plant annual, *usually very small. Stem simple*, 4–6 in. in height (rarely larger), glabrous or slightly pubescent, with long internodes. *Leaves small, pale green*, lower ovate-rotund, crenate, very obtuse with subcordate base, intermediate oval-elliptic-oblong, obtuse, crenate, uppermost ovate-lanceolate or lanceolate, subacute or acute. *Stipules of the lower leaves very small*, with few short linear lateral lobes and linear obtuse mid-lobe slightly broadened upwards; stipules of the upper leaves larger, with mid-lobe elliptical, sub-acute, slightly crenate. *Peduncles very long, slender, vertical* when in flower, slightly divaricate in fruit. Sepals narrowly linear-lanceolate, acute. Corolla usually much shorter than the calyx (occasionally rather longer). Upper petals white or with some suffusion of violet.

This is the smallest of the British Pansies of the *arvensis*-section. The simple, straight, upright stem and the pale green leaves are characteristic. In the Scottish plants the corolla may be larger than in the English plants.

The greatest care is necessary to ensure that small plants with the habit of *derelicta* are not merely young early flowering plants of *ruralis, obtusifolia, agrestis*, or other species. Such pædogenetic specimens are liable to be very misleading.

Exsiccata.

Herb. Mus. Brit.:—

V. derelicta Jord. ined., Billot, Fl. Gall. et Germ. 2022.

V. derelicta Jord. Haute Savoie, Août 1857. *Legit ipse.*

This is a very slender up-drawn *derelicta*.

Herb. Imperial College of Science:—

V. derelicta Jordan, Billot, Fl. Gall. et Germ. 2022.

The opinion was expressed in *British Pansies* (p. 6 and p. 28) that *V. pallescens* Jord. might prove to be synonymous with *V. derelicta*. At that time I had not seen plants named *pallescens* by Jordan himself, and had only the description and figures in Jordan's *Observations*, ii., on which to depend. Jordan's plate (Obs. ii. 1 A) shows a plant with tiny narrow-petalled flowers unlike anything that I have seen in this country. Recently I have found in the herbarium of the Imperial College a sheet labelled "*V. pallescens*, ex herb. Al. Jordan, 1864 (Cult.)." Here the flowers may be tiny like those in the figure, but a plant on the same sheet has much larger flowers. In this respect, as well as in its vegetative characters, the large cultivated plant is indistinguishable from *ruralis*. A sheet in Herb. Mus. Brit., labelled "*V. pallescens* Jord., de Bormes, ex herb. Al. Jordan, 1864," is clearly *obtusifolia*. It is therefore evident that Jordan's *pallescens* consisted of—or, at all events, included—young early-flowering plants of other species.

I acknowledge with gratitude the facilities given me for examining specimens in the Herbaria at the British Museum, Kew, and the Imperial College of Science, South Kensington. I also desire to thank Mr. A. D. Cotton for his help in looking up references and Professor Tabor for much kindness when I was consulting specimens at the Imperial College.

NOTES ON DUCKWEEDS.

By J. Gordon Dalgliesh.

It has been customary, as well as convenient, to class all the Duckweeds, with perhaps the exception of *Wolffia*, under the one genus *Lemna*. After a critical study of the whole group, this appears to be no longer tenable. It was whilst studying, in particular, the Ivy-leaved Duckweed that the necessity for placing this under the genus *Staurogeton* (Reich. Nomenclator, 33) was deemed essential. The Ivy-leaved Duckweed must perhaps be regarded as the most highly specialized of the *Lemnaceæ* in possessing a definite petiole, wanting in the other members of the group. In this family, where the vegetative body has been so modified that a distinction between petiole and lamina cannot be maintained, it has been usual to style these bodies as fronds. What their true morphological character is, is open to discussion. Hegelmaier (*Die Lemnaceen, Eine Monographische Untersuchungen*, 1868) recognised them as modified stem-organs performing the work of leaves. Goebel (*Pflanzenbiologische Schilderungen*, 1891–1893) affirmed them to be leaves inasmuch as the base of each frond (or leaf) has power to function as a growing point. Van Horen ("Observations sur la physiologie des *Lemnacées*," Bull. de la Roy. de Bot. de Belgique, 18[illegible] and Engler (*Vergleichende Untersuchungen über die morphologischen Verhältnisse des* Araceæ) both agreed that the distal end of the frond is foliar, while the proximal end is axial. The writer inclines towards Goebel's view, thereby placing *Lemna trisulca* in a higher and more specialized position than that of the other Duckweeds.

Superficially, the Ivy-leaved Duckweed appears to be a small monocotyledonous leaf with a definite petiole and lamina, in its long fronds and submerged habit differing very markedly from the other *Lemnaceæ*. The basal part of the fertile frond bears the inflorescence, raising it above the surface-level, as in other aquatic angiosperms, such as some of the Batrachian Ranunculi and *Limnanthemum nymphoides*, where the flower is raised clear of the water by the assistance of the floating leaf. The inflorescence of Duckweeds is probably always entomophilous, for small aquatic beetles and other insects have been observed to frequent the flowering fronds (Arber, *Water Plants*). The rapid power of vegetative reproduction shown by the *Lemnaceæ* is well exemplified by *Lemna trisulca* being in some ditches extraordinarily prolific, there even the ubiquitous *Lemna minor* being totally eclipsed. Yet it is local in its distribution even in districts where it is known to occur. It is rare in Scotland, being recorded from some five counties, widely distributed, but local in Ireland, and it is equally at home in the tropics (Nairns, *Flowering Plants of Western India*).

The distribution of water-plants is a big subject, and one beset with much speculation. The extreme localization in many cases is a puzzle that the writer has for long tried to solve, but without any success. There are three ponds in West Sussex within a radius of a few yards.

One contains only *Potamogeton crispus*, the second *Potamogeton natans* and *Potamogeton densus*, and the third *Potamogeton natans* only.

It is difficult to understand why in so many cases *Lemna trisulca* is almost isolated in a few ditches, and has not spread to neighbouring waters; for it is a most persistent clinger, and must, one would suppose, adhere to the plumage of water-fowl; *Hydrocharis Morsus-ranæ* and *Hottonia palustris* are other examples of extreme localization. From February to April the old fronds decay, and in the early spring the skeletonized fronds lie in masses on the surface of the water. *Lemna trisulca* can be found throughout the winter, its resting-stage not differing very much from the normal; some plants were observed in January, and were found to be totally, instead of partially, submerged. Microscopic examination revealed the presence of raphides in *Lemna trisulca*, though no traces of these could be found in the other Duckweeds. From this it is not meant to infer that these do not exist in the other species, but merely that the present writer failed to detect their presence. *Spirodela polyrrhiza* begins to develop turions or resting-buds very early. Some of these were found at the end of July in 1925. On April 17th, 1926, the ditch was visited where last year *Spirodela polyrrhiza* was found growing in such profusion (Journ. Bot., Feb. 1926, 50). Resting-buds were appearing in fair numbers, though a week previous to this date not one could be found. These resting-buds cannot better be described than as rootless kidney-shaped bodies of a bronze colour, measuring from 1 to 2 millimetres in length. Some were placed in an aquarium out of doors, and in less than a week had begun to put out roots. Young roots and fronds of *Spirodela* are hispid, the former being not unlike those of *Hydrocharis*, and, as in that plant, detritus is entangled amongst the hairs, possibly serving as nutriment for the growing plant. These hairs are extremely deciduous, immersion of the plant in alcohol causes them to drop off at once. The young shoots grow very rapidly from the resting-bud, and on May 2nd nearly all the buds had developed from two to three shoots. These young shoots are of a very pale translucent green, and interesting when viewed with a strong light under a one-inch objective, when numerous cells can be seen containing anthocyanin scattered about, sparkling like tiny rubies. The shoots grow in a very short space of time to twice the size of the resting-bud. The roots and fronds harbour numerous free-swimming Rotifers. The fronds attain their full size in four weeks' time. The largest fronds that have come under the notice of the writer were some taken in a pond at Henfield, Sussex, and measured about $5\frac{1}{2}$ millimetres.

Spirodela polyrrhiza, *Lemna gibba*, and *Lemna trisulca* require water with a much richer substratum than *Lemna minor*. The latter can exist in situations where the other three Duckweeds could not support life; it has been observed growing quite vigorously in a clear spring used for drinking purposes, with a sandy substratum, though the more stagnant the water the better it thrives. It was found growing on one of the dew-ponds near Chanctonbury Ring,

in Sussex, with *Spirodela polyrrhiza*. Here, however, the fron
were of extremely small size, measuring only about 1½ millimet
Lemna minor is, indeed, the most hardy of all the Duckwee
and it is not difficult to see how it has spread and covers such a wi
range.

Regarding the habitat of the *Lemnaceæ* in South Africa, M
Edith J. Stephens writes that: "Apparent specimens of *Lemna min*
are often found growing along with *L. gibba*, but it is possible th
these are only the young condition of the latter before elongation
the under cells. Specimens kept in culture have always develo
into *L. gibba*, and the only ones found in flower so far had its cha
teristic form" (*Notes on the Aquatic Flora of South Afri*
July 9th, 1924).

Lemna gibba would appear to be a delicate species. Attem
for two seasons to keep it under artificial conditions in an aquari
have resulted in failure, the plants all dying off after a few wee
though supplied with the same water and substratum in which th
were growing. On the other hand, *Spirodela polyrrhiza*, *Lem*
minor and *trisulca* have flourished.

Lemna gibba, on July 15th, 1926, had produced flat fronds on
though these were fully mature. Here and there amongst thousa
examined was an occasional example showing very slight gibbo
not to be compared with the swollen condition of last year, w
nearly every individual plant exhibited an almost pea-like form.
early summer of the present year (1926) was cold, days of hot sunsh
being the exception rather than the rule. It is quite reasonable
assume that this extensive gibbosity of *Lemna gibba* is only attain
during exceptionally hot summers, and this gibbosity is a prelude
profuse flowering. *Lemna gibba* was found in flower on a pond
Heyshott, West Sussex, on August 7th, 1926, this being a hith
unrecorded locality for it. Here the plant was growing in profu
with *Lemna minor*.

INDEX TO "BIBLIOGRAPHICAL NOTES" IN THE 'JOURNAL OF BOTANY,' 1893–1924 *.

By J. Ardagh.

* [The preparation of this Index was suggested by a less elaborate
pared at the Royal Botanic Gardens, Kew, for a copy of which we are
to the Director.—Ed.]

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Department of Botany,
British Museum.

A NEW *ALCHEMILLA* FROM CUMBERLAND.

By Dr. F. Jaquet.

Alchemilla Salmoniana, sp. nov. Planta altitudine mediocri, *primo nigro-cyanatro-viridis*, postea violacea vel straminea. Stipulæ basales leviter roseæ, glabrescentes. Petioli *primi pilis erectis diffusis modice præditi, posteriores pilis pluribus patentibus onusti.* Folia mediocria, 7–9-*lobata*, lobi quam pars indivisa ter vel quater breviores, dentibus *satis gracilibus ovali-acutis* inter se æqualibus manifeste ciliatis, *apice pag. sup. brunneo.* Folia *præsertim pag. sup. adpresse pilosa, in nervis sericea, æstivalia subtus glabra vel fere glabra*, tenua sed sat firma. Caules *basi arcuati erecti*, satis robusti, quam folia duplo longiores, *dimidio inferiore vel paullo altius leviter pilosi, superne glaberrimi*, hac atque illac sicut folia caulina dentibus satis acutis et conniventibus sæpe sordide violaceo-tincti. Folia superiora uti stipulæ satis profunde et inequaliter incisa. Rami *cum caule angulam acutissimam efficientes*, quam folia duplo longiores, 2–3 *corymbos parvos compactos e floribus majusculis* 4½–5 *mm. diam.* compositos sistentes. Pedicelli *erecti vel leviter recurvati*, quam corymbi urceoli *superiores breviores* sed quam *inferiores longiores*. Urceoli angusti obconici *glabri vel pilis sparsis appressis* inspersi. Calycis segmenta ovali-triangularia sparsim ciliata *fructu erecti*

Caliculi segmenta quam sepala dimidio angustiora et quarta parte breviora. Flores *fusco-virides* postea dilute luteo-virides.

Plante de taille petite ou moyenne teintée d'un vert bleuâtre particulier mais devenant plus tard violacée ou d'un jaune paille. Stipules basales légèrement rosées, glabrescentes. Pétioles, les premiers médiocrement garnis de poils dressés-étalés, les derniers plus fortement hérissés de poils étalés horizontalement. Feuilles plutôt petites, 7–9-lobées, lobes ⅓–¼ du rayon, à dents assez fines et régulières bien ciliées et colorées de brun en dessus à l'extrémité, ovales-aiguës. Feuilles poilues, plus fortement en dessus qu'en dessous, de poils apprimés, soyeux sur les nervures, les grandes estivales devenant presque ou tout à fait glabres en dessous, minces quoique assez fermes. Tiges assez fortes et droites courbées à la base, atteignant 2 fois la hauteur des feuilles, assez légèrement hérissées dans la ½ ou les ⅔ inférieurs, absolument glabres plus haut, souvent en partie teintées de violet sale comme les feuilles caulinaires dont les dents sont assez aiguës et conniventes. Les feuilles supérieures, de même que les stipuliums sont assez profondément et irrégulièrement incisées. Rameaux formant avec la tige des angles très aigus, 2 fois plus longs que les feuilles caulinaires se terminant par 2 ou 3 petits corymbes compacts de fleurs assez grandes, de 4½ à 5 mm. de diamètre. Pédicelles dressés ou légèrement recourbés, plus courts que les urcéoles dans les fleurs supérieures, plus longs dans les fleurs inférieures. Urcéoles étroits, obconiques, glabres ou l'un ou l'autre avec des poils épars et appliqués. Segments du calice ovales-triangulaires dressés après l'anthèse, ciliés de poils longs mais rares. Divisions du calicule ½ largeur des sépales et ¾ de leur longueur. Fleurs d'un vert sombre devenant légèrement vert-jaunâtre.

Bord de rochers calcaires à environ 600 m. d'altitude, dans le Cumberland, Nord de l'Angleterre.

Leg. C. E. Salmon.

Plante rappelant les *Splendentes* par le port, la forme, la teinte et la structure des feuilles et des tiges, mais se plaçant par tous ses autres caractères dans le groupe des *Heteropodæ* à côté du *tenuis* Bus.

SHORT NOTES.

A Remarkably Monstrous Brake Fern.—On August 7, during a trout-fishing expedition to the river Chew, I rapidly explored a narrow wooded and picturesque valley, through which a small stream had in places carved a deep narrow glen in its descent of about a mile and a half to the river Chew at Compton Dando, between Pensford and Keynsham, Somerset. In one of the deepest and most shady spots, I observed among the vegetation on the left bank, some four feet above a small pool, a curious pale green twisting or climbing plant which baffled me. Its upper part appeared less like a fern than some climbing exotic in a greenhouse, but closer inspec-

tion showed that it was an elongated and abnormal Brake (*Pteris aquilina*) extending its delicate and tortuous branches in search of light. Some of its branches were quite bleached, and others brown and shrivelled. Cutting it off two feet above ground, the whole measured ten and a half feet. I doubled it up and carried it in my fishing-bag, where it got bruised and broken, for there were other occupants. It is now in the press in four sections.

There are nine pairs of branches (pinnæ), the lowest of which were two feet from the ground. The largest pinnules, only $2\frac{3}{4}$ inches long, are on the lowest-but-one pinna, and most of the other pinnæ have pinnules of only 1–$1\frac{1}{2}$ inch in length. Though so narrow, the largest pinnæ are about two feet in length; and many of the internodes between the pinnules are three inches apart. Cut off, several of the branches with longest pinnules would resemble a limp and narrow frond of *Filix-mas*. The stem cut off at two feet is $\frac{3}{8}$ inch (8 mm.) in diameter, rather soft and very juicy throughout, and apparently it lacks silica. This was the only Brake fern noticed in the glen, but a few small *Lastrea Filix-mas* were there. The site is on the Coal Measures, with surrounding patches of red marl.

In two of the pastures near are numerous plants of *Œnanthe pimpinelloides*, which is rare in N. Somerset, though abundant on the liassic Polden Hills in the centre of the county and in pastures on New Red Sandstone about Bridgwater.—H. S. Thompson.

My attention has been called to the following passage in the issue for April 1926 of *School Nature Study* (the Official Organ of the "School Nature Study Union"), p. 28:—"Perhaps children might eventually repopulate our hedgerows with seedling ferns, or other flowering plants, raised in school cultural experiments—a development of 'Arbor Day,' in fact." I really do not know what "Arbor Day" may be, but if this is to be one of its developments, it does not commend itself to the botanist. To attempt to establish plants grown in school-cultures is to tamper with nature in a thoroughly reprehensible way, and such proceedings should be discouraged as vigorously as possible.—Eric Drabble.

Mentha Nouletiana Timb.-Lagr. (*M. nemorosa* × *viridis*).—I first became acquainted with this rare hybrid when on a visit to Belfast, where it had appeared within the last two years on the border of a neglected cultivation. The Irish plant is of particular interest since neither of the presumed parents is indigenous. Apparently, therefore, it must have been imported. On my return, I noticed in the herbarium a specimen gathered near Berrow, N. Somerset, in 1906, by the late Rev. E. S. Marshall, and labelled by him "*M. longifolia* var. *nemorosa*." This, however, has the slender interrupted spikes and deeply-incised toothing of *M. viridis*, together with the velvety pubescence of *M. nemorosa*, and I venture to think is really the hybrid. A little later, Mr. H. J. Gibbons brought me a corresponding plant from a cottage garden north of Clevedon. We

thus have it in the Bristol district from two localities—one horticultural and the other a wayside-green. Mr. Sandwith tells me that the specimen I sent matches well with examples of *M. Nouletiana* contained in the Kew Herbarium.

In France this hybrid appears to be even rarer than with us, being on record only from two Départements. But in this regard M. Ernest Malinvaud, writing in 1880 (Bull. Soc. Bot. Fr. xxvii.), says that, in accord with many other botanists, he was inclined to unite specifically *M. viridis* and *M. silvestris*, the first as a subspecies or glabrous variety of the second, and that intermediates derived from their crossing must of necessity be very difficult to recognize. Still, he believed that such crosses were far from being so rare as the silence of writers might lead one to suppose. In 1898 (*Comptes rendus*) he was of the same opinion, but owned that "practiquement l'élévation du *M. viridis* au rang d'espèce facilite beaucoup l'exposition des faits."—Jas. W. White.

REVIEWS.

Flora of Jamaica, containing Descriptions of the Flowering Plants known from the Island. By William Fawcett, B.Sc., F.L.S., and Alfred Barton Rendle, D.Sc., F.R.S. Vol. V. Buxaceæ to Umbelliferæ. 8vo, cloth, pp. xxviii, 453. With 156 text-illustrations. Trustees of the British Museum: Longmans, &c. 1926. Price £1 15*s*.

The issue of the present volume marks a very considerable step towards the completion of this important Flora. This volume brings to an end the systematic account of the Dicotyledons, apart from the sympetalous families which will appear in vol. vi., now in preparation. Vols. iii. and iv., which, along with vol. v., contain the free-petalled Dicotyledons, were noticed in this *Journal*, 1915, p. 116, and 1920, p. 275. Vol. i. deals with the Orchidaceæ (see this *Journal*, 1911, p. 172), while vol. ii., still to appear, will comprise the rest of the Monocotyledons. With the end now in sight, it is a matter of the greatest regret that the happy combination of authors is dissolved by the death of Mr. William Fawcett in the month following publication.

The volume under review follows in its character and arrangement the previous volumes, and is distinguished by the same accuracy, the same evidence of careful research, and the same high standard in the printing and illustrations. The families dealt with run from Buxaceæ to Umbelliferæ on the Englerian system. This section includes a considerable number of small families—small, at any rate, as represented in the Jamaican Flora,—and the major members in the book are Malvaceæ, Myrtaceæ, Melastomaceæ, Sapindaceæ, and Sterculiaceæ.

The number of new species which have come to light during th preparation of the volume is limited—perhaps a dozen in all,—and th Latin diagnoses of these have appeared from time to time in th *Journal of Botany* during the last five years. This may be taken a some measure of finality for the Jamaican flora, and evidence tha this standard colonial flora will have a long life of usefulness. Th Jamaican flora has attracted many botanists during the last 30 yea and it is due to this that the materials available are now so adequa for a satisfactory summation. Thus, during the period referred t *Comocladea* has increased from 1 to 9 recorded species; *Maytenu* from 0 to 6; *Calyptranthes* from 6 to 14; *Eugenia* from 14 to 3 whereas certain other genera, no doubt easier for discrimination in species, such as *Pavonia*, *Hibiscus*, and *Miconia*, remain witho additions to the number noted in the older records. It is noteworth that the two species of *Combretum* found in the island both appe among the new species described in 1925, having been previou confused with Tropical American members of the genus.

A conspectus of families with a useful Key is to be found at th beginning of the volume. Mention should be made of the excelle index, where the references to the specimens of Sloane and Brow are evidence of the care which has been given to this part o the work.

This further volume is sure to be appreciated—not least by th botanists who of late years both from Europe and from America ha chosen Jamaica and other West Indian islands as one of the readie means of securing an acquaintance with a tropical flora.

It is realised that the death of one of the authors is a serio check to the continuation of the Flora, but one may rely on h colleague pursuing with all expedition the issue of the two remainin volumes of so necessary a publication.—W. W. S.

The Forty-second Annual Report of the Watson Botanical Exchange Club, 1925–26. Edited by H. S. THOMPSON.

THIS Report contains evidence that its members continue t collect the more critical, rather than the rare, forms, which is all t the good. The referees and other helpers have contributed interes ing notes, and whilst these are, naturally, of chief value to th contributing members, we think the following may be of interest t botanists who do not receive the Report:—

"*Rosa canina* var. *Pouzini*, f. *anglica* Wolley-Dod. Fawke Co mon, W. Kent, v.c. 16, July 18, 1925. I send a few sheets of this for from its original station, but not from the original bush, which exists n longer. It is practically identical with my type specimens, thou in a more advanced stage, showing that the fruit is quite ovoid, n subglobose as described. The leaflets also are decidedly hairy on th

midribs beneath, not rarely so, as I wrote in my description. The type of *R. Pouzini* is glabrous, but there are Continental varieties with pubescent leaflets showing a connection with *R. dumetorum* through my Group Aciculatæ.—A. H. WOLLEY-DOD. This plant has been since seen by Dr. Keller, who agrees with the above determination."

"*Galium Mollugo* subsp. *erectum* (Huds.) Briq. I adopt the nomenclature of Dr. Briquet, the chief authority on *Galium*; but this series of mostly very small, delicate forms retained from a more normal gathering of June 19, 1922, is bewildering (see Report for 1922, 217, and Journ. Bot. 1919, 286). The whole came from a pasture at Sidcot, N. Somerset.—H. S. THOMPSON. In November 1922, I noted that the leaves of this gathering vary in number from 6–8, and in shape from linear to linear-oblong or linear-lanceolate. Some have a mucro, and the majority are turned in at the margin and have fine forward teeth. The young capsules are almost glabrous. Some specimens may come under *G. Mollugo* subsp. *tenuifolium* (All.) Schinz et Thellung. I also have a sheet of specimens gathered June 3, 1920 (when cows were grazing), which are only 4 to 8 inches high, leaves with a distinct mucro and a decided mid-rib, and flowers 4–5 mm. across. The aspect is that of *G. sylvestre*, but they may be crossed with *erectum*, or merely a depauperate form of the latter. In 1920 no larger specimens were seen in the field. *G. sylvestre* has never been recorded from within several miles of that field, and these further notes may be interesting to indicate the extreme variability of certain Galiums when growing under different conditions of cultivation in the same upland pasture, browsed by sheep for 'at least forty years,' mown for the first time in 1919, then grazed by a horse, and in 1920 by cows. If the various forms of *G. Mollugo*, *G. erectum*, and *G. sylvestre* could be cultivated and carefully watched, the results might be both useful and illuminating.—H. S. THOMPSON."

"*Hieracium decolor* Ley. Cult. Wimbledon garden, Sept. 16, 1925. Orig. Great Orme's Head, 1922.—H. W. PUGSLEY. (No. 414.) Styles yellow, leaves cæsious. This plant stands in W. R. Linton's *British Hieracia* as a variety of *H. cæsium* Fr., but was removed by Augustin Ley to the *Oreadea* as a distinct species in 1909 (Journ. Bot. xlvii. 10). The specimens now contributed, which may not be readily recognised as *H. decolor*, were brought from the Great Orme in 1922, and have materially changed under cultivation. They have grown into luxuriant tufts, and their foliage has become very long and narrow, with an increased development of the cauline leaves and of the long lower branches of the radical. Wild plants of this Hawkweed, both in Wales and Yorkshire, occasionally develop a similar habit, though in a less degree, and as this peculiarity is sometimes seen in other forms of *H. cæsium*, it may be regarded in *H. decolor* as evidence of affinity with that species. I do not find that cultivation produces a corresponding change in the Oreadean species, *H. Leyi*, *H. rubicundum*, *H. britannicum*, or *H. cambricum*, of which my garden examples differ little from the wild plants, except for

their smaller heads, as appears general in cultivation throughout th genus.—H. W. PUGSLEY."

"*Symphytum tuberosum* L. Copse near Liphook, Hampshir May 23, 1925.—I. A. WILLIAMS. I first found this growing in th copse, and the lane adjoining, in May 1924. In 1925 I could find it only in the copse. It was recorded in the last Report of B. E. C. a N. C. R., and I send the solitary specimen as a voucher. It i very doubtful whether this plant is native at Liphook; there a houses close by, and I am told that a previous owner of the propert was a lady 'of botanical tastes,' who may have introduced it into th copse.—I. A. WILLIAMS."

"*Mentha piperita* L. a. *officinalis* (Hull.). In water by th Upper Frome, Gurney Slade, N. Somerset, Sept. 11, 1925. Growin with *M. longifolia* and *M. aquatica*. A few examples from a ne locality. *M. piperita* is of exceptional interest on account of it obscure origin and remarkable stability. A hybrid with one paren alien to Britain, it must certainly have been introduced from abroad at some remote period. In no country has it been shown to b indigenous, but its cultivation as an officinal cordial and carminativ of high repute has long extended throughout Europe. An old writ (Woodville) says that only in Britain does it occur spontaneously remark that may still hold good. In the dozen or so localities (f *officinalis*) known to me, although often within sight of dwellings this Mint is never found in company with adventive species, but ha always the aspect of a true native, associated usually with *longifolia aquatica*, or *sativa*. Another noteworthy feature of British Peppe mint as a denizen is the absence of variation. We have merely th two distinct forms, *officinalis* and *vulgaris*. Very rarely has there been reported anything in the way of an intermediate between these I know of none existing, nor do any appear in our Catalogues. Th var. *Druceana* Briq., recently described, evidently leans toward *aquatica*, under which Dr. Druce placed it in his *Flora of Berkshire* In cultivation, however, those who are commercially interested in th production of essential oils for use in medicine or perfumery hav carefully selected the plants whose flowering tops and branches prove richest in their yield, and these of course are propagated and multi plied solely by their stolons. Such experimental selection is stated to be of far more importance in culture than soil or climate. Some of the results obtained are peculiar and surprising. In their elaborate *Etude Botanique des Menthes Cultivées* (Grasse, 1911), th brothers Camus state that selected strains of hybrid Mints will often show the habit of one parent with the inflorescence and floral organs of the other; and sometimes the inflorescence on the main stem does not match those on the secondary axes. In illustration they give a beautiful drawing of a choice form in cultivation at Grasse '*Mentha piperita* var. *sativa*, f. *rubescens*,' that has on the primary axis the indubitable spike of *M. viridis*, while the overtopping lateral branches bear the round heads of *M. aquatica*! Has such an occurrence ever been observed among wild plants?—JAS. W. WHITE."

"*Salix Andersoniana* × *phylicifolia*. Det. J. Fraser. Bank of na-ha, Kew, Surrey, v.c. 17, May 16 and July 11, 1925.—D. G. CATCHESIDE. The broadly oval leaves, with sub-cordate base, the blackening and the serrations running to the apex makes this close to *S. Andersoniana*; but the quick glabrescence and foliage of the twigs, as well as the pubescence of the ovaries, show the presence of *S. phylicifolia*. Not native in Surrey.—J. FRASER."

"*Populus* [*canadensis* Moench] ♀ (621) (det. C. E. Moss). Planted. The Avenue, Hitchin, Herts (see W. B. E. C. R. 1913, 459), May 3 and Oct. 6, 1925.—J. E. LITTLE. This is apparently the tree named *P. canadensis* by the German dendrologists, but doubtfully of Moench. It is best, I think, to call it *P. marilandica* Bosc., which, according to Henry, is its correct name, and under which it is known at Kew. It is always found as a female tree, and seems to be much less common in cultivation than *P. serotina* Hartig. The latter is invariably a male tree.—A. B. JACKSON. *P. marilandica* Bosc. This tree is identical with specimens of this name dating from 1833. It is usually called *P. canadensis* ♀ in Germany, and it is *P. canadensis* Hartig (1851), which is a hybrid. It is not *P. canadensis* Michaux (1813), a name given to the native American species (see *Trees of Great Britain*, vii. 1807). Rehder, in *Journ. Arnold Arboretum*, iv., iii., 161 (1923), argues that *P. canadensis* Moench (1785) is the oldest name for the hybrid between the American and European black poplars, and then uses this name as follows:—1. *P. canadensis* Moench var. *serotina* is the Black Italian Poplar (=*P. serotina* Hartig); 2. *P. canadensis* Moench var. *marilandica* is the hybrid, which I call *P. marilandica*. I consider this a needless complication and inaccurate, as no one knows what *P. canadensis* Moench really is; and it is more convenient to call a tree by two names (*P. marilandica*) than by three names—*P. canadensis* var. *marilandica*.—A. HENRY."

C. E. S. & E. G. B.

BOOK-NOTES, NEWS, ETC.

THE *Journal of the Linnean Society* for July 1926 contains a paper by Dr. H. S. Holden and Mr. S. H. Clarke, entitled "On the Seedling Structure of *Tilia vulgaris*." The material for this paper was obtained in 1924, when upward of 70 seedlings were found in the vicinity of University College, Nottingham—an unusual find, as *Tilia* apparently seldom sets good seed in England. The chief variations in the morphology of the cotyledons are shown in figs. 1–12. The usual type consists of two five-lobed epigeal cotyledons. The variations are chiefly in the comparative size of these lobes, although accessory lobes are sometimes developed. Two types of hairs are developed on the aerial parts, unicellular and club-shaped multicellular ones, the latter being confined to the upper surfaces of the

cotyledons between the veins. The vascular system is typically tetrach in plan, although seedlings showing triarchy or pentarchy also occur. Triarchy is shown in syncotylous seedlings where the syncotyly is unilateral and at all pronounced, while pentarchy is shown in polycotylous seedlings, although the pentarchy occurring in this case is not homologous with that occurring in dicotyls.—D. Powell.

Special Libraries Conference.—The Association of Special Libraries and Information Bureaux held its Third Conference during the week-end, September 24th–27th, at Balliol College, Oxford. The Rt. Hon. the Viscount Burnham spoke at the opening dinner. Papers were given on various problems affecting the collection and distribution of information by experts, including Dr. de Vos Van Steenwijk, of the League of Nations, and Mr. Kaiser, of the Engineering Societies' Library (New York), who spoke on "Systematic Indexing."

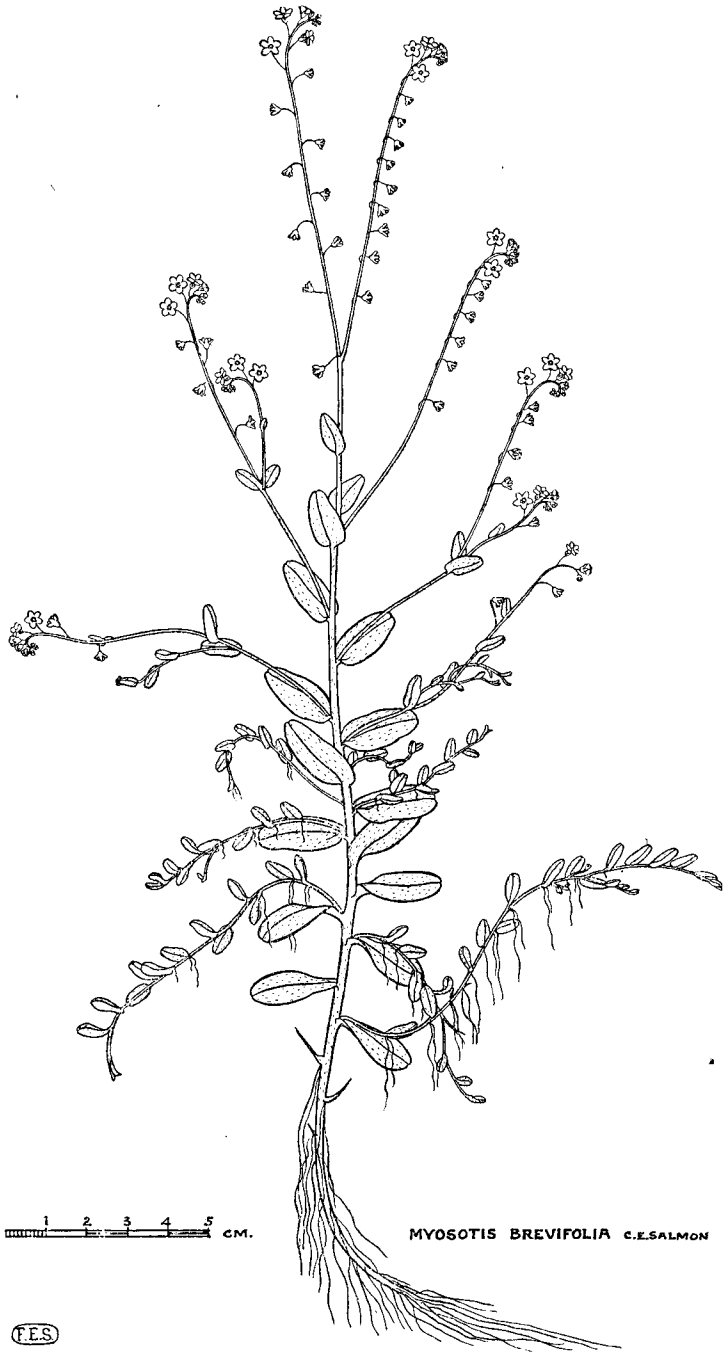
The address of the Association is 38 Bloomsbury Square, W.C. 1.

An interesting article on "Our Vanishing Wild Flowers" was contributed by Mr. Henry S. Salt to the August issue of the *Fortnightly Review*. He cites notorious instances of the destruction of our native plant-treasures, such as Lizard Orchis and Lady's Slipper, by rapacious collectors, and urges the adoption of legislative measures for protecting our rarer species, as in Switzerland, the United States, and South Africa, and the institution of a Wild Flowers Preservation Society for the education of public feeling in the matter.

Mr. Charles Turner, whose death occurred on 10 September, 1926, at Wilmslow, Cheshire, at the age of 62 years, was known as a pharmaceutical chemist and as a keen student of freshwater algæ, including Desmidieæ. He was Principal of the Manchester School of Pharmacy for over 20 years, and for many years lecturer in chemistry and botany. He was Vice-President of the Manchester Microscopical Society 1899–1914. The collection of microscopic slides of algæ which he prepared is stated to be very fine. We are indebted to the *Pharmaceutical Journal*, of 18 September for this information. He was elected F.L.S. in June 1922, and had communicated notes on freshwater algæ at the meetings of the Linnean Society. He was also F.C.S.

Correction.—We regret that the name of Mr. I. A. Williams was incorrectly printed J. A. Williams in the last issue of the *Journal*, p. 250.

The Editor gratefully acknowledges the help given by Mr. Antony Gepp in the preparation of the last and present issues of the *Journal* during his absence in his United States in connection with the International Botanical Congress, a report of which will appear in the November number.



A NEW *MYOSOTIS* FROM BRITAIN.

By C. E. Salmon, F.L.S.

(Plate 579.)

When botanizing in the North of England—the Cross Fell area—in July 1919, some small examples of a puzzling Water Forget-me-Not were collected in a marsh in Westmorland and duly dried. In some particulars the plant seemed intermediate between *Mysotis cæspitosa* and *M. repens*, and the specimens were put aside to await the opportunity of gathering better material. This opportunity arose in July 1925, when visiting the eastern Lake District and the Cross Fell region with Mr. L. B. Hall, and we were able to obtain good examples of what was evidently the same puzzling plant in several widely-separated localities in Cumberland and Westmorland.

Here was a plant with a somewhat compact habit, a dark bluish-green colouring, short broad blunt leaves, and possessing stolons; the flowers themselves recalled *repens*, but the pubescence was of the *cæspitosa* type! A close examination of calyx and corolla gave other characteristics, and it became necessary to ascertain whether our plant had been previously described upon the Continent; in this process the following came under review:—

M. coronaria Du Mortier, Bouq. litt. Belg. in Bull. Soc. Bot. Belg. vii. 350 (1868).

This was distinguished by its author from *M. palustris* (meaning the plant of Curt. Fl. Lond. fasc. iii. 13) by its short leafless rhizome and pedicels scarcely longer than the calyx. He further segregated it into

α. glabrata, caule glabriusculo strigulis destituto.
β. rosulata, foliis radicalibus congestis, caule brevissimo.
γ. Reichenbachiana, caule piloso.
δ. strigulosa, caule strigulis vestito.

From the synonymy and figures quoted by Du Mortier, all the above are closely allied to *M. palustris*, of which they possess its characteristic short ±triangular calyx-lobes.

M. oraria Du Mortier, *l. c.*

Perennans, caule erecto striguloso, ramis divaricatis, corollæ lobis integerrimis.

This plant, found on the sand-dunes of Flanders, Du Mortier considered either a variety of *M. cæspitosa* or a separate species. A photograph (in Herb. Mus. Brit.), of what may be considered an authentic example of this, clearly shows it to be widely divergent from our plant. See an interesting note by Mr. A. J. Wilmott in this *Journal* for 1923, 214.

M. commutata Roem. et Schultes, Syst. iv. 102 (1819).

Calycibus quinque-dentatis hirtis, pilis rectis, dentibus subæqualibus obtusiusculis corollæ tubo æquantibus, foliis lanceolatis obtusis submucronatis tuberculato-strigosis, strigis appressis, corollarum limbo

calyce vix duplo longiore. . . . . Corolla fere magnitudine *arvensis*, Siccata nigrescit.

An example of this, from Hb. Roemer, is in Herb. Mus. Brit. The specimen has leaves which are certainly very hairy (and the hairs are scarcely "appressis" as the authors described), but with this exception the plant seems to be *M. cæspitosa* Schultz, as Roemer and Schultes themselves suspected (Syst. iv. addenda, 780). It may have been an abnormal form growing, perhaps, in a dry situation.

M. DUMORTIERI Thiélens in Bull. Soc. Bot. Belg. vii. 86 (1868).

Fleurs en grappes assez courtes, dépourvues de feuilles à leur base. *Pédicelles* étalés horizontalement après l'anthèse, grêles, munis de poils appliqués; les inférieurs 2–4 fois plus longs que le calice. *Calice* campanulé, ouvert à la fructification, à divisions profondes. *Corolle* petite, d'un bleu pâle, à limbe plan et de même longueur que le tube; celui-ci plus court que le calice. *Style* très court. *Carpelles* d'un brun assez foncé, luisants, ovoïdes-obtus. *Feuilles* linguiformes, atténuées à la base, presque glabres. *Tiges* dressées dès la base, cylindriques, non anguleuses, assez épaisses, assez rameuses, à rameaux étalés, allongés. *Souche* vivace, verticale, fibreuse. Plante d'une très forte taille.

Obs. Cette espèce diffère du *M. palustris* With. et se rapproche du *M. cæspitosa* C. F. Schultz (*M. lingulata* Lehm.) par sa tige cylindrique, non anguleuse, sa corolle petite, les divisions du calice profondes. Elle diffère du *M. cæspitosa* et se rapproche du *M. palustris* par sa souche vivace, sa forte taille, et ses fleurs en grappes assez courtes.

This seems to be a plant likely to occur in England, so its full description is given above. Its chief points appear to be its perennial root-stock, very robust habit, almost glabrous leaves, rather short spikes of flowers, campanulate calyx with deep segments *, small pale blue corolla with limb equalling tube, and very short style.

M. MULTIFLORA Mérat, Rev. fl. Paris, 204 (1843).

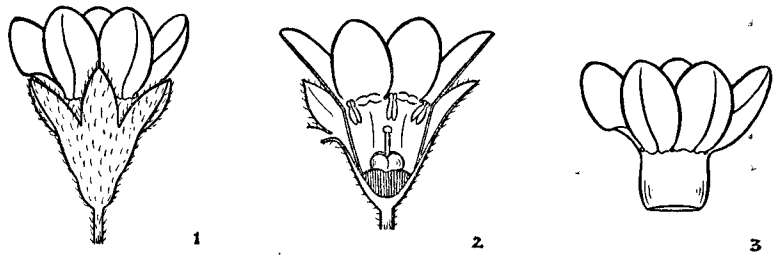
This interesting plant its author considered was perhaps confused with *M. stricta* Link, and gave contrasting characters. It may be known by its tufted habit, large radical leaves, numerous undulate branches with long spikes of flowers, peduncles as long as calyx (which has non-hooked hairs), obtuse calyx-lobes, and small corolla.

De Candolle (Prodr. x. 107, 1846), who had specimens sent him by Mérat, adds the following information:—Whole plant with appressed hairs, 4–10 inches high, hairs of calyx rufescent, whole flower scarcely longer than a line, fruiting-calyx half open.

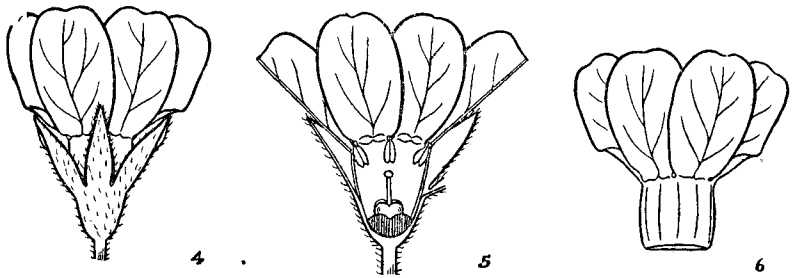
M. PROSTRATA Rouy, Fl. France, x. 321 (1908).

For this plant, Rouy gives as synonyms *M. repens* Reichb. Fl. Excurs. 342, *non* D. Don, and *M. palustris* γ *repens* G. et G., Fl. ii. 529, and states that it differs from Don's plant as follows:—"The

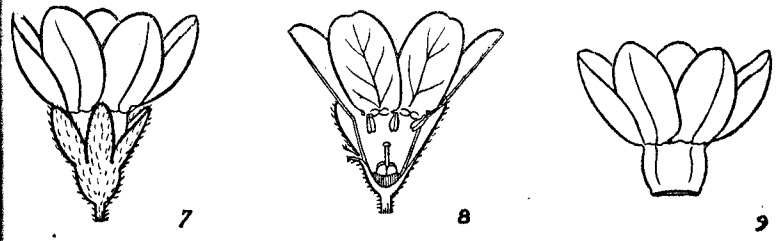
* Du Mortier (*l. c.*) states that the calyx is divided halfway down with lobes very obtuse; also that the plant is cæspitose.



1–3. *M. cæspitosa* Schultz, from Blencarn, Cumberland.



4–6. *M. repens* Don, from Blencarn, Cumberland.



7–9. *M. brevifolia* C. E. Salmon from Hawes Water, Westmorland.
All enlarged six times.

robuste, cylindracée, longᵗ rampante et radicante, fortᵗ veluc ob hérissée infᵗ, à rameaux redressés; calice à dents triangulaires, ob tusiuscules ou subaiguës; corolle à lobes émarginés."

M. REHSTEINERI Wartm.

This beautiful plant was originally described by Gaudin (Fl. Helv. ii. 49, 1828) as *M. cæspitosa* var. *grandiflora*, as follows: " Corollis calyce multo majoribus, pedunculis brevibus, foliis firmi oribus, magis nervosis."

In 1846 De Candolle (*op. cit.* 105) placed it under *M. palustris* and re-named it var. *cæspititia*:—" Caule cæspitoso subrepente brev vissimo, pedicellis brevibus. Corollæ duplo triplove quam in *M. cæspitosâ* majores."

Wartmann (ap. Reuter in Compt. Rend. Soc. Haller. 11 1854–6) raised the plant to the rank of a species under the name *M. Rehsteineri*, and gave it a full description. The following appear to be its chief characters:—Stems dwarf, 2–3 inches high with short subrooting stolons; leaves rather fleshy, shining, ciliate, sparsely hairy; flowers in short simple or bifid spikes; pedicels short, thick scarcely equalling the calyx-tube; calyx campanulate, with lanceolate acute lobes equalling tube during flowering, afterwards accrescent; corolla of a beautiful blue (rarely white or rose), with the lobes rounded and contiguous or overlapping; style equalling calyx-tube.

M. CÆSPITOSA Schultz var. BOREALIS O. Vesterlund in Svensk Bot Tidsk. iv. 81 (1910).

This is a slender plant, 5–17 cm. high, with leaves 1–2 cm. long only 2–4 mm. broad, and all (even the lower) without petioles. The calyx is 2–3 mm. long and the same length as the flowering-pedicel and the corolla 2–3 mm. in diameter. The fruiting-pedicels are almost always unilateral, obliquely erect-patent, but the plant only sparingly produces fruit.

It differs from type in the stronger stem usually simple below the basal leaves not petiolate and the fruiting-pedicels equalling or shorter than the calyx.

M. CÆSPITOSA Schultz var. RADICANS Lange, Haandb. Danske Fl. ed. 3, 164 (1864).

Stems elongated, much branched, ascending, rooting; somewhat angular, calyx-segments divided halfway.

Var. ARRECTA Lange, *op. cit.* ed. 4, 474 (1887).

Much branched, branches rigid, erect, flower-stalks erect, slightly longer than the funnel-shaped calyx, segments erect; all flowers secund, turned into two series (resembles the south European *M. sicula* Guss.).

M. STOLONIFERA Gay ex Durieu Pl. select. Hisp.-lusit. exsicc. 267 (1836).

Habitat in montium Asturicorum occidentalium regione alpina, in paludosis, ad rivulos et scaturigines, nominatim ad lacum montis *pico de Arvas*, ibi medio Augusto florens et fructificans (*Durieu*).

Radix verisimiliter transversa et repens. *Caulis* 2–3-pollicaris, erectus, a basi ad medium usque et ultra foliatus. *Folia* plus minus conferta, plus minus sparsa, ima elliptica, basi parum attenuata, media oblongo-obovata, subspathulata, superiora parva, elliptico-oblonga, omnia viridia, quamvis adpresse pilosa. *Stolones* ex radicis collo foliorumque inferiorum axillis 2–5, humifusi, filiformes, remote foliati, foliis parvis, spathulatis, lineam vix longis. *Caulis* pars superior dimidia vel plus dimidia florifera. *Racemi* aphylli, solitarii vel gemini, inæquales, longior 9–11-florus, pedicellis fructiferis 1 lin. longis, filiformibus, laxis, patentissimis, in arcum sæpe flexis. *Calyx* ultra medium quinquefidus, fructifer longitudine pedicelli, campanulatus, segmentis ovato-oblongis, acutis, fere acuminatis, apicis setulis in penicillum collectis. *Corolla* mediocris, cœrulea, tubo campanulato. *Nuces* calyce triente fere breviores. *Stigma* capitatum. *Stylus* nucibus triente et calyce dimidio brevior, ergo brevissimus. Pili patentes nullibi conspiciuntur. Setæ rigidulæ, omnes adpressæ, infra medium caulem et in foliis sparsæ, in rachi, pedicellis et calycibus, vix tamen candicantibus, desiores.

Obs. Radice sua perenni, et pilis omnibus adpressis, nullisque hamatis, valde affinis *M. M. palustri* et *cæspitosæ*. Differt tamen a priore, quæ non raro stolonifera (et pilis quandoque gaudet omnibus adpressis) caule tereti, non sulcato; calyce non quinquedentato, sed fere quinquepartito, et stylo brevissimo, non calycem subæquante. A *cæspitosa* etiam satis differt radice repente, collo stolonifero, calyce ultra medium fisso, lobis angustioribus, acutatis, non obtusiusculis. Nullam aliam novi descriptam speciem nostræ æquiparandam. Videtur itaque hæc pro nova sumi posse et debere.

The authority for this plant is often given as "Gay, Ann. Sci. nat. ser. 2, vi. 351 (1836)," but there one finds no description, but only a reference to its alpine situation and locality. Publication apparently originated in the issue of the plant in Durieu's set of Spanish and Portuguese specimens, Gay's printed description accompanying the examples.

As this detailed account is not readily accessible, and because this interesting Asturian plant seems more closely allied to our new species than any others enumerated, I have transcribed Gay's careful description.

M. LAXIFLORA Reichb. in Sturm Deutschl. Fl. 42 (1822).

This is a tall slender lax plant, the stems with patent (or erect-patent) pubescence, peduncles 3–4 times longer than the calyx, and the calyx shortly campanulate 5-toothed; its flowers are deep blue, either large or small, with emarginate corolla-lobes and the style long, exserted beyond the calyx-segments.

M. SICULA Guss. Fl. Sic. Syn. i. 214 (1842). As a good account of this annual small-flowered Marsh *Mysotis* was recently given by Mr. Wilmott (Journ. Bot. 1923, 212), it is unnecessary to repeat its characteristics here, particularly as it has little in common with the plant now under discussion.

As our plant could not be classed under any of the foregoing species or varieties, I have ventured to describe it as a new species:

M. brevifolia, sp. nov.

Planta perennis, altitudine mediocri, nigro-cyanatro-viridis, opaca. *Caulis* basi stoloniferus, indumentum caulis uti stolonum e pilis appressis vel basin versus leviter patulo-erectis constitutum. *Folia* brevia, lata, oblonga vel obovato-oblonga, apice obtusissima vel rotundata, pauca infima tantum basi attenuata, appresse hirsutula. *Pedicelli* fructiferi patentissimi vel arcuato-recurvi, calyci æquilongi vel eo duplo longiores. *Calyx* ultra medium fissus; segmenta oblonga, apice rotundata vel obtusa. *Corolla* dilute cærulea circa 5 mm. diam.; limbus integer vel emarginatus. *Stylus* brevissimus circa ·5 mm. longus.

Plant perennial, of medium height (15–23 cm.), occasionally reaching 30 cm., dark bluish-green, opaque. *Stem* producing stolons near the base from the leaf-axils bearing many small leaves and rootlets. *Pubescence* of stem and stolons appressed or, towards the base, slightly spreading-ascending. *Leaves* short, broad and blunt, little more than twice as long as broad, obtuse or rounded at the apex, oblong or obovate-oblong, only the lowest tapering towards the base, pubescence appressed. *Branches* of the inflorescence from below centre of stem, erect-patent. *Pedicels* horizontal or arcuate-recurved in fruit, as long as or twice as long as calyx. *Calyx* narrowly bell-shaped, divided more than halfway down, segments oblong, rounded or blunt at the apex, crateriform in fruit. *Corolla* pale blue, about 5 mm. in diameter, tube ±1 mm. long, limb entire or emarginate. *Style* very short (about ·5 mm. long), only slightly exceeding the base of calyx-segments. *Nutlets* ±1 mm. long, ovate, polished, shining, olive-brown, slightly paler, and less acute, and smaller than those of *M. repens*, which are $1\frac{1}{4}$–$1\frac{1}{3}$ mm. in length.

Distinguished from *M. palustris* and its varieties by its longer calyx-segments, smaller flowers, shorter style, etc.; from *M. cæspitosa* and its varieties by its stolons, shorter blunter leaves, longer calyx-segments, larger flowers, etc.; from *M. repens* by its appressed pubescence, smaller leaves on stolons, blunter calyx-segments, shorter style, etc.; from *M. coronaria* by its stolons, longer pedicels and calyx-segments, etc.; from *M. oraria* by its stolons, less divaricate branches, shape of leaves, etc.; from *M. Dumortieri* by its stolons, broader leaves, longer spikes of flowers, larger corolla, etc.; from *M. multiflora* by its stolons, longer pedicels, larger flowers, etc., from *M. prostrata* by its broader and shorter leaves, longer calyx-segments, etc.; from *M. Rehsteineri* by its taller growth, longer stolons, longer pedicels, non-accrescent calyx, etc.; from *M. laxiflora* by its stolons, appressed pubescence, shorter pedicels, longer calyx-lobes, etc.

The closest ally of *M. brevifolia* would seem to be *M. stolonifera* Gay, small stunted examples of the former having much the same facies. A closer examination shows that Gay's dwarf plant possesses far smaller leaves on the stolons, more spathulate stem-leaves, shorter

fruiting-pedicels, more acute calyx-segments, etc.; well-grown examples of *M. brevifolia* are abundantly distinct.

In spite of Gay's statement respecting the pubescence being appressed, in one example of the type in Hb. Kew. the stem-hairs are irregularly-spreading. There is also a state of *M. brevifolia* which simulates *M. repens* in possessing more or less spreading pubescence *near the base of the stem*; careful examination discloses appressed hairs mingled with the more spreading ones, and the calyx-segments readily distinguish the two plants. *M. brevifolia*, too, seems normally to possess a smaller calyx and shorter fruiting-pedicels than either *M. repens* or *M. cæspitosa*.

In the two latter species the style (with stigma) is approximately the same length (about ·75 mm.), but owing to the calyx being more deeply divided in *M. repens*, the style is more obvious in this species, coming well above the point of segment-division; in *M. cæspitosa*, on the other hand, the stigma only just protrudes beyond this point. In *M. brevifolia* the style is rather shorter (about ·5 mm.), and protrudes but slightly beyond the point of calyx-division. This feature should be observed when the flower has just fully expanded and not when the corolla has fallen.

The description that has been given of the nutlets of *M. brevifolia* has been taken from the somewhat small amount of material available (the plant does not, apparently, fruit very freely), and may need revision when a more ample supply is obtained from plants now being grown. Their differences from those of *M. repens* have already been stated, and they are distinct, too, from those of *M. cæspitosa*; these are the largest of the three, *averaging* 1·3 mm. long, are practically black, and (like those of *M. brevifolia*) slightly blunter at the apex than those of *M. repens*.

M. brevifolia has been found in the following localities:— *v.c. 69 Westmorland.* Ullswater, West side; Heltondale, near Askham (*L. B. Hall*); near Hawes Water; Cross Fell district (*C. E. Salmon*). *v.c. 70 Cumberland.* Thirlmere, in two localities (*A. H. Wolley-Dod*); Borrodale (*H. C. Watson*); near Melmerby; Cross Fell district (*C. E. Salmon*). *v.c. 72 Dumfries.* Spongy bogs near Moffat (*E. F. Linton*).

I am much indebted to Mr. S. M. Moore for help in the Latin diagnosis, to Dr. B. D. Jackson for the Danish translation of Lange's varieties of *M. cæspitosa*, and particularly to Miss F. E. Strudwick who prepared the beautiful drawing and careful dissections accompanying this paper.

Explanation of Plate 579.

Myosotis brevifolia C. E. Salmon, from Hawes Water, Westmorland; July 1925. About half natural size.

FOURTH INTERNATIONAL BOTANICAL CONGRESS.

By A. B. Rendle, F.R.S.

Under the synonym of the "International Congress of Plant Sciences," the Fourth International Botanical Congress, held at Ithaca, New York State, was eminently successful. Between seven and eight hundred delegates attended, and though, naturally, Americans predominated, overseas countries were well represented. Cambridge, Kew, the British Museum, the Imperial Bureau of Mycology, and the Royal Horticultural Society were represented by one or more members of their staffs, and Scientific Societies and Institutions were also represented. Most of the European states sent representatives, and also did China, Japan, and other extra-European countries; Canadian botanists were present in good number, and it was a pleasure to renew acquaintances made during the British Association Meeting at Toronto in 1924.

The home of the Congress was Cornell University, of which the Campus is picturesquely situated above the town of Ithaca, overlooking the head of the beautiful Cayuga Lake. The various buildings and hostels of the University afforded accommodation for the general and sectional meetings and the housing of the delegates.

The Finger Lakes Region of central New York, of which Cayuga Lake is a part, is noted for its diversity of topography and general scenic beauty. Ithaca is situated in a deep valley at the head of the Lake, and in the immediate neighbourhood innumerable gorges have been carved in the hill-sides. Some of these have been set aside as State Parks, and one, Enfield Ravine, was selected for an afternoon botanical excursion; the flora was rich and varied, but the zeal of the botanists was hampered, though not quenched, by the rain, and the proposed picnic supper in the glen had to be transferred to the Drill Hall at Cornell. The weather, in fact, was the only unfavourable item during the week, and the final long-day excursion to Junius, an interesting marsh-land area, fifty miles north of Ithaca, was spoiled by rain.

At the opening meeting, on the first evening, Monday, August 10, Dr. Farrand, President of Cornell University, and the veteran botanist, Professor L. H. Bailey, President and Chairman of the Congress, welcomed the delegates, and the invitation to meet in London in 1930, for the fifth Congress, was presented by the British botanists and enthusiastically received. The invitation was duly accepted at a general meeting held on the following Thursday.

A reception of the Members and their Guests in the Willard Straight Hall, the headquarters of the Congress, followed the opening meeting. Willard Straight Hall, the Students' Club, formed an excellent business and social centre, providing spacious rooms for rest and social intercourse, and also a large restaurant and Cafeteria, the latter supplying a new experience to some over-seas visitors in the help-oneself service for meals.

The more serious work of the Congress began on the Tuesday

morning, when the different sections met in the rooms assigned to them in the Baker Laboratory of Chemistry or the Goldwin Smith Hall. No fewer than thirteen sections had been arranged, including, besides the more strictly botanical branches: Morphology with Histology and Palæobotany, Ecology, Genetics, Physiology, Taxonomy, Cytology, Mycology, and Pathology—also Bacteriology, Forestry, Horticulture, and Pharmacognosy.

While this extensive subdivision allowed a larger number of papers to be read and discussed than would otherwise have been the case, it had certain obvious disadvantages, and the separation of Morphology, Taxonomy, and Ecology was frequently regretted. Several joint meetings and symposia were however arranged.

Generally, the morning session was occupied by the reading and discussion of invitation papers received in response to specific invitations to individual botanists issued early in the year. The afternoons were devoted to joint meetings of sections, round-table discussions, or occasional field-excursions. Several of the sections resumed work at 9 p.m for symposia or special discussions.

Taxonomy was one of the busiest and best-attended sections, with Dr. C. H. Ostenfeld, of Copenhagen, as Chairman. Its work included a discussion on nomenclature, to which two afternoons and two evenings were assigned. It had been recognized that no legislation on nomenclature should be enacted at the Ithaca meeting, but opportunity should be afforded for exposition of views, general discussion, and passing of resolutions. At Dr. Briquet's suggestion a representative committee of twenty-nine botanists was appointed (with Dr. Briquet as Secretary), whose function should be to receive resolutions and suggestions, and consider and report on these to the Congress in 1930.

The general principles of taxonomy were dealt with by several speakers. Mr. Aven Nelson set forth the advantages of a "dual purpose manual"—a flora of moderate size which would serve both layman and specialist. The flora of any given well-defined area should be issued in two parts: Part I. would suit both laymen and specialists, and contain all general keys leading to all families and all genera of the area covered, with family and generic descriptions. Under each genus, if the species are few, simple keys and adequate descriptions of all the species will be given; if the species are numerous, only the commoner representative species will be treated. This part would meet the needs of the average user, and might be issued separately. Part II. would comprise a complete synoptical treatment, with keys, for all the genera not fully treated in Part I. Page-references in Part I. would lead the user without loss of time or continuity to this fuller consideration. Part II. would not be issued separately, since the general matter contained in Part I. will not be repeated in Part II.; the complete manual will be indispensable to the specialist.

Dr. K. M. Wiegand (Secretary of the Section) regretted the lack of uniformity in group concepts, which militated against the

popularity of the study of taxonomy. A comparison between two Floras of the same area showed respectively differences amounting to 19 and 40 per cent. in names for the same geographic areas. An analysis of the differences indicated that considerably more are due to changes in taxonomic status than to the operation of rules of nomenclature. The taxonomist must serve two masters. Comprehensive groups, since they show the relationship of the included forms, are desired by the general worker; while segregates, often differentiated on such technical and obscure characters as to be impractical for the general worker, are of value to the geneticist, geographer, and others. A solution may be found by making provision for smaller units within the species.

Dr. H. M. Hall discussed, in some detail, the taxonomic treatment of units smaller than species. He deprecated the treatment of all small units as full species, and advocated their arrangement in numbered or lettered lists of minor variations under each of the species or subspecies. The true status of each unit must be determined later by exact methods, especially by experiment; of first importance is the distinction between heritable and non-heritable variations. This is best made by transplant experiments: such are the growth of annual or perennial forms under similar or diverse environments. A series of experiments carried out at the Carnegie Institute of Washington were described.

Dr. P. A. Rydberg, on the other hand, maintained that the most pressing need at present is that all plant-forms should be described, that all plants worth describing should have a name, and that a binominal is preferable to a polynominal.

Dr. Skottsberg, in turn, deprecated "species-splitting," unless justified by a careful study of the forms in question over the whole range of their distribution.

General problems of plant-distribution were the subject of several papers. Dr. Ostenfeld spoke on the flora of Greenland and its affinities. The distribution of the Seed-plants and Pteridophyta along the entire coast is now comparatively well known. The number of species is only 390. A proportion of the more hardy species are supposed to have survived the ice-age in Greenland, but the main part of the flora has come in after the maximum extent of the ice-covering, and the immigration has probably been favoured by a post-glacial warmer epoch. Most of the species have come from arctic North America, and a much smaller number (about 75 species) from Europe. The latter element consists of (1) high-arctic species probably immigrating through Spitsbergen, (2) less-arctic species arriving from Iceland, and (3) species introduced during the time of the old Norse settlements.

Dr. M. L. Fernald, in a paper entitled "Some Relationships of the Floras of the Northern Hemisphere," indicated that the problems of plant-distribution, especially in eastern America and in Europe, are closely interlocked, and that only by co-operation of students in the two continents can the histories and proper identifications of

these floras be satisfactorily worked out. The relations of the Antarctic flora were discussed by Dr. A. W. Hill.

Dr. Briquet's communication, on the intimate structure of the fruit of aquatic Umbelliferæ and its relation to distribution by water, illustrated the difficulty of drawing lines of separation between Morphology, Ecology, and Taxonomy.

An account of some early 18th Century American collections at the British Museum, mainly preserved in the Sloane Herbarium, by Dr. A. B. Rendle, proved of special interest to some of the American taxonomists.

A joint meeting of the sections Taxonomy and Morphology to discuss the phylogeny of Angiosperms was arranged for 9 P.M.; but the lateness of the hour allowed time only for reading the four papers, and there was no discussion. Dr. A. W. Hill communicated Mr. Hutchinson's paper, restating the latter's recently published views, and Dr. Carl Mez explained his genealogical tree based on sero-diagnosis. Dr. A. J. Eames emphasized the importance of the vascular anatomy of the flower for the solution of morphological questions and as an aid to the establishment of phylogenetic lines; and Dr. G. R. Wieland summarized the evidence for the great antiquity of Angiosperms. In the Section on Morphology and Palæobotany (Chairman, Prof. Chodat) a symposium was arranged on "An Evaluation of the Structural Evidences for Genetic Relationship," in which Professors Svedelius (Algæ), C. J. Chamberlain (Archegoniates and Spermatophytes), R. B. Thomson (Vascular Anatomy and Palæobotany), and J. Coulter (general discussion), were the speakers.

Dr. E. Rübel, of Zurich, presided over the Ecological Section, which had a full programme, including joint meetings with the sections for Forestry, Physiology, Horticulture, and Agronomy. One of the best-attended sections was that of Mycology with Dr. E. J. Butler (Imperial Bureau of Mycology) as Chairman.

Limits of space will not allow a full report of the work of the sections, but it is hoped that a volume of Proceedings may be published, including, either in full or in abstract form, all papers presented before the Congress, as well as brief reports of meetings. For the conduct of the Sections the plan followed was to select a visiting botanist as Chairman and a Member of Cornell University as Secretary. The sections not already mentioned had as Chairmen: Agronomy, Charles A. Zavitz of Ontario; Cytology, Georg Tischler of Kiel; Forestry, Tor Jonson of Stockholm; Genetics, Ernst Lehmann of Tubingen; Horticulture, F. J. Chittenden, Royal Horticultural Society; Physiology, W. W. Lepeschkin of Prague; and Pathology, H. M. Quanjer of Wageningen. A democratic practice was followed in the printing of the programme, namely, the omission of all titles from personal names. It was also intimated that formal dress was not required at any function of the Congress.

In addition to the sectional meetings, two evening public meetings were held: at the one, Prof. Went, of Utrecht, gave an address on

"Plant-Movement"; at the other, Dr. Erwin Smith, of the U.S. Department of Agriculture, discoursed on "Fifty Years of Phytopathology." An exhibit of preparations, materials, and apparatus was displayed in several rooms of the Baker Laboratory, and sectional demonstrations of the exhibits were arranged. Each section also managed to find time for a sectional dinner or smoker, and excursions were carried out so far as the inclement weather allowed.

An account of the meeting would be incomplete without reference to the officers and members of the general Committees, who were responsible for the arrangements and the conduct of the Congress. Prof. L. H. Bailey, with his striking personality, genial presence, and remarkable ubiquity, was an ideal Chairman; and Prof. M. Duggar, who, as Chairman of the Organizing Committee, had played an important part in the arranging of the Congress, acted as General Secretary and Chairman of the Executive Committee. The local arrangements were in the hands of Dr. H. H. Whetzel, an incomparable master of ceremonies, and an efficient staff of ladies and gentlemen. A pleasant feature of the local arrangements was the daily service, by ladies, of afternoon tea in the Library of Willard Straight Hall, an especially gracious act of hospitality as, so overseas members were assured, Americans do not make a practice of afternoon tea. A general spirit of friendliness pervaded the meeting, and the welcome accorded to the overseas members could not have been heartier. A pleasant foretaste was experienced by the party of English members who travelled by the 'Caronia.' On reaching New York, invitations were received on board the ship from the English Speaking Union, offering the hospitality of their Club during the stay in New York; this was shortly followed by a personal visit from a lady member of the Committee, the result being that a tedious Sunday morning at the wharf, waiting on the Immigration Officer and Customs Officials, was followed by a delightful social afternoon at the rooms of the Union, and a pleasant drive by the Hudson River, after which Dr. Trelease did the honours of the Columbia College before the party left by the night train for Ithaca.

For botanists who remembered the two previous Congresses, Vienna (1905) and Brussels (1910), the Ithaca meeting afforded an interesting comparison. The American organizing committee had worked on different lines from those followed at the two previous Congresses, and the result was incomparably superior. This was due in great part to the centralising of the activities of the Congress, and to the ideal position selected; everything, including lodging, was at the most within a few hundred yards of everything else, a pleasant contrast with the miles of trudging or tramming between scattered hotels and meeting-places which some of us remember. The Ithaca Congress has set up a standard which will add seriously to the responsibilities of future hosts. The programme of work was also much more extensive; the leading feature of the two earlier congresses, Nomenclature, occupied a subordinate place, but the introduction of the applications of botany, such as agronomy, horticulture,

and pharmaceutical botany added considerably to the programme. There was a feeling among some members that pure botany had been rather over-sectionized, and that it would have been of greater interest if, for instance, morphology, ecology, and taxonomy had been grouped together. The conscientious member felt that he was unduly penalised for sticking closely to his section.

Several excursions were arranged to follow the scientific sessions of the Congress, but reference to these must be deferred until next month.

(To be continued.)

NOTES ON DR. R. F. RAND'S RHODESIAN PLANTS.

[THE specimens, unless otherwise stated, were recently collected by Dr. Rand at Miami, Southern Rhodesia (see "Wayfaring Notes," in the September number of the *Journal*). The specimens are in the British Museum Herbarium, where the collection has been determined.]

LEGUMINOSÆ.

By E. G. BAKER.

Among the more interesting plants of this family are :—

CROTALARIA RANDII, sp. nov. A close ally of *C. Alexanderi* Bak. fil. Section *Sphærocarpæ*. A description appears below (No. 13).

CROTALARIA MINUTISSIMA Bak. fil. Formerly recorded only from the Congo (No. 23.)

CROTALARIA FILICAULIS Welw. An Angolan species (No. 27).

CROTALARIA RHODESIÆ Bak. fil. Rather rare (No. 146).

INDIGOFERA VISCOSA Lam. var. SUBGLABRA Rich. Number 118 is tentatively referred here as the type has not been seen.

TEPHROSIA PSEUDOLONGIPES Bak. fil. An ally of *T. longipes* Meisen., but differing in the pods (No. 144).

ÆSCHYNOMENE MINUTIFLORA Taub. No. 26 is referred here rather than to *A. rhodesiaca* Harms. The specimen has been compared with authentic material of both species.

PSEUDARTHRIA FAGIFOLIA Baker forma. This has rather longer pods than the type. Extension of range (No. 15).

ERIOSEMA RECTUM, sp. nov. Allied to *E. macrostipulum* Bak. fil. It is described below (No. 20).

CASSIA KIRKII Oliv., forma. Compared with type at Kew. The stems are less hairy (No. 19).

Crotalaria (Sphærocarpæ) Randii Bak. fil., sp. nov. *Annua* ramosa humilis; *ramulis* hirtis; *stipulis* subulatis; *foliis* trifoliolatis, petiolatis, petiolis hirtis, foliolis lineari-oblongis, hirtis, intermediis paulo longioribus; *floribus* parvis, axillaribus, luteis; *calyce* extus hirto; dentibus longis, acutis; *vexillo* oblongo, extus hirto; *carina* in rostrum rectum producta; *ovario* hirto, stylo recto, supra sparse puberulo; *legumine* globoso, hirto, multispermo.

Hab. S. RHODESIA: Miami; *Rand*, 13.

Plant under 1 dm. high, much-branched. Leaves on a petiole 4–6 mm. long. Central leaflets ±10 mm. long, ±2 mm. broad. Flowers ±6 mm. long; calyx ±3·5 mm. long, the teeth long, acute; standard ±6 mm. long; carina 5–6 mm. long. Pod 4–5 mm. long, ±10-seeded.

Allied to *C. Alexanderi* Bak. fil., which also has axillary flowers. The pods are much the same size as those of *C. squarrosa* Schinz.

Eriosema erectum Bak. fil., sp. nov. *Herba* erecta; *caulibus* pubescentibus; *stipulis* conspicuis, lanceolatis, acuminatis; *foliis* trifoliolatis, foliolis lanceolatis, subacuminatis, utrinque tenuiter pubescentibus, foliolo terminali quam ceteris paulo longiore, petiolo communi molliter pubescenti; *floribus* mediocribus, deflexis, viridi-luteis, in racemos multifloros, densos, terminales dispositis; *calyce* extus pubescenti dentibus acutis; *vexillo* basi auriculato et unguiculato; *carina* navicularifórmi, obtusa, vexillo subæquilonga; *ovario* dense et longe sericeo-hirto, stylo tenue, curvato; *legumine* ignoto.

Hab. S. RHODESIA: Miami, Apr. 1926; *Rand* 20 (type); NYASALAND: *Buchanan*, 1349.

Stipules conspicuous, 14–20 mm. long. Terminal leaflet 5–8 cm. long, 20–25 mm. broad, lanceolate, subacuminate. Calyx ±5 mm. long, teeth acute. Standard 12–14 mm. long, carina and wings subequal.

Allied to *E. macrostipulum* Bak. fil. and *E. montanum* Bak. fil., differing from both in its narrower leaflets.

POLYPETALOUS DICOTYLEDONS
(EXCLUDING LEGUMINOSÆ).

BY A. W. EXELL.

The following plants are recorded as showing points of interest with regard to their distribution:—

POLYGALACEÆ.

POLYGALA LINIFLORA (Boj.) Chodat. An extension of the range of this species formerly recorded from East Africa, Zanzibar, and the Sudan (No. 28).

P. PETITIANA A. Rich. This has now been recorded from East Africa, Uganda, Portuguese Congo, and Rhodesia (mixed with preceding sp. No. 28).

P. MYRIANTHA Chodat. The species is of particular interest because it seems to have but little relationship with any other African species, but is very close to *P. oligophylla* DC., of India. It was first described from North Cameroons, and has since been collected in Nyasaland by Stolz. We have also specimens in Herb. Mus. Brit. from Uganda and Angola, so that it may now be considered to have a wide distribution throughout Africa (No. 139).

MALVACEÆ.

KOSTELETZKYA BÜTTNERI Gürke. An Angolan species (No. 10).

GERANIACEÆ.

BIOPHYTUM ABYSSINICUM Steud. Apparently not recorded before from Rhodesia (No. 6).

ONAGRACEÆ.

EPILOBIUM BENGUELLENSE Welw. Apparently a new record for Rhodesia, and an extension of the range of this Angolan species (No. 141).

CUCURBITACEÆ.

CUCUMIS MYRIOCARPUS Naud. Probably the most northerly locality yet recorded for this South African and Transvaal species (No. 30).

SYMPETALOUS DICOTYLEDONS.

BY S. MOORE.

COMPOSITÆ.

Vernonia (§ *Lepidella*) **rhodesiana** S. Moore, sp. n. *Herba* erecta, trispithamea; *caule* simplici subtereti perspicue striato puberulo; *foliis* integris lanceolato-oblongis obtusis vel ambitu obovatis et tunc trilobatis lobis lateralibus quam intermedius brevioribus omnibus basi in petiolum brevissimum attenuatis utrinque scabriusculis pag. inf. glandulis immersis inspersis; *capitulis* anguste campanulatis circa 22-flosculosis in corymbos laxos axillares oligocephalos tenuiramosos bracteis paucis foliis similibus sed multo minoribus præditis ordinatis; *involucri* 5-serialis phyllis oblongo-lanceolatis acutis dilute flavo-viridibus apice fuscis dorso appresse pubescentibus intt. quam extt. multo longioribus; *corollæ* exsetæ purpureæ lobis abbreviatis quam tubus multe brevioribus; *achæniis* oblongo-turbinatis basi callosis 5-costatis appresse setulosis; *pappi* squamis brevissimis sed latis erosis setis paucis scabridis pallide stramineis.

Hab. South Rhodesia, Miami, April 1926; *Rand*, 91.

Stem stoutish, 3 mm. in diam., dark green when dry. Leaves ±4 cm. long, the entire ones (sometimes with very slight and infrequent denticulation) 6–10 mm. wide, the others up to 15 mm. with lateral lobes mostly 5–10 × 2–3 mm., the terminal lobe broader and usually 15–20 mm. long. Corymbs up to 12 cm. in length, but usually shorter, arising from almost all the leaf-axils, the branches

less than 1 mm. in width, puberulous and ending usually in 4–8 head on long and slender proper peduncles; bracts narrow-oblong, less than 1 cm. long, the upper gradually smaller. Capitula in flower 10 × 7 mm. Outer involucral leaves 1–2 mm., intermediate 4–5 mm., inner up to 8 mm. long. Corolla-tube 6 mm. long, the lower ⅔ very narrow and colourless, the upper third dilated and purple, ending in triangular lobes little more than 1 mm. long. Achenes (not yet ripe) only 1 mm. long; pappus squamæ ·6 mm., setæ 6 mm. long.

Easily distinguished by the foliage from *V. Poskeana* Vatke & Hildebr., and its allies, including *V. pseudoposkeana* Muschl. The corolla with very short lobes and the very short, relatively broad, erose pappus squamæ are peculiar features.

Vernonia (§ *Lepidella*) **miamensis** S. Moore, sp. n. *Herbacea*; *caule* simplici vix spithameo omnimodo folioso hispidulo-piloso; *foliis* sessilibus oblongo-lanceolatis breviter acuminatis basi obtusis obtusisve brevissimeque amplexicaulibus firme membranaceis utrinque leviter scabriusculis margine ciliatis; *capitulo* mediocri solitario subsessili ∞-flosculoso; *involucri* late campanulati 5-serialis phyllis ext. lineari-subulatis sursum patentibus ceteris longioribus lineari-lanceolatis erectis omnibus herbaceis in acumen apice fuscum extenuatis dorso subtiliter pubescentibus; *corollis* subinclusis puniceis; *achæniis* oblongis basi callosis 5-costatis appresse setulosis; *pappi* setis paucis scabridis argenteis additis squamis paucis subsetiformibus.

Hab. South Rhodesia, Miami, April 1926; *Rand*, 100.

A lowly herb with stem leafy virtually to the top. Leaves somewhat closely arranged, coarsely ciliate at edge, drying light green; the lower mostly 4–5·5 cm. long by 9–13 mm. wide, the upper progressively smaller. Flowering capitulum 1·5 × 2·5 cm. Outer involucral leaves 5–7 mm., intermediate 8–10 mm., inner up to 13 mm. long. Corollas a trifle shorter than the pappus; tube infundibular 6 mm. long, double the length of the narrowly triangular hairy lobes. Achenes 2 mm. long; pappus squamæ very like the setæ, but distinctly flattened, usually 3–4 mm. long, the setæ reaching 10 mm.

This greatly resembles *V. monocephala* Harv.; it differs in the clothing of the leaves, the narrower involucral leaves in more rows, the corollas shorter than the pappus, the hairy 5-ribbed achenes, and the pappus.

Felicia Eylesii, sp. n. *Herba* perennis?, circiter bispithamea; *caule* ramoso stricto pluristriato crebro folioso uti ramuli sat tenues piloso-pubescente; *foliis* sessilibus lineari-oblongis obtusis pilosopubescentibus; *capitulis* mediocribus in axillis foliorum paucorum summorum reductorum solitariis unoque terminali pedunculis pilosopubescentibus sese bene excedentibus fultis; *involucri* campanulati phyllis 3-serialibus lineari-lanceolatis acutis margine hyalinis dorso puberulis exterioribus brevioribus; *ligulis* circa 20 albis vel puniceis; *achæniis* compressis sparsim microscopice puberulis; *pappi* setis paucis scabridis albis disci corallarum longitudine.

Hab. Rhodesia, Rua River near Salisbury, June 1918; *Eyles*, 1335 (Herb. Brit. Mus. et Kew.). Conspecific (at Kew) is *Rogers*, 8108, from Johnston's Farm, near Broken Hill. Dr. Rand's specimens, also undoubtedly conspecific, are small unbranched ones apparently at the beginning of their career.—South Rhodesia, Miami, May 1926; *Rand*, 173.

Leaves mostly 1–3 cm. long, 1–3 mm. wide, the youngest reduced to 5 mm. in length. Peduncles up to 4·5 cm., but usually (often much) smaller. Expanded heads 7 × 10 mm. Outermost involucral leaves ±3 mm., inner 5·5 mm. long. Ligules oblong, the limb 3 mm. long. Achenes 1 mm., pappus 4 mm. long.

This is much like some southern specimens referred to *F. abyssinica* Sch. Bip., notably Welwitsch, 3435 and 3447. From typical *F. abyssinica* it differs in habit, foliage, and achenes.

Gerbera (§ *Lasiopus*) **Randii** S. Moore, sp. n. *Herba*; *foliis* e collo lanoso verisimiliter ortis magnis longipetiolatis anguste obovato-oblongis apice rotundis basi cuneatim angustatis margine undulatis dentibusque paucis parvis callosis ibidem indutis pergamaceis pag. sup. vivide viridibus pag. inf. argyreo-tomentosis; *capitulo* mediocri ∞-flocculoso longissime scaposo pedunculo pubescente apice villosulo; *involucri* subhemisphærici villosuli phyllis 3-serialibus oblongo-lanceolatis acutis herbaceis apice purpureis; *ligulis* ext. flavis breviter exsertis lineari-oblongis brevissime 3-denticulatis (interdum basin usque inæqualiter bipartitis) addito labio minuto integro vel inciso ligulis int. magnopere imminutis; *disci* flosculorum labio antico ovato 3-denticulato nonnunquam inæqualiter bilobato labio postico plerumque bipartito segmentis oblongis recurvis; *stylo* radii flosculorum longe disci breviter exserto; *achæniis* fll. ext. oblongis breviter rostratis pluristriatis subtiliter sericeis fll. int. anguste linearibus verisimiliter sterilibus; *pappi* setis scabriusculis albis.

Hab. South Rhodesia, Miami, May 1926; *Rand*, 179.

Blade of leaves 16–20 × 5·5–7 cm.; side-nerves 6–8 pairs, best seen on the lower face; petioles 8–10 cm. long, except for a little wool at the dilated point of attachment almost glabrous, dark pink when dry. Scape about 35 cm. long, drying dark pink. Head in flower 15 × 22 mm. Outer involucral leaves few, about 4 mm. long; intermediate 7 mm., inmost 9 mm. long. Ligules of outer ray florets (lamina) 1 cm. long. Corolla of inner ray florets 8 mm. long, of disk florets also 8 mm. Style of inner ray florets exserted 2 mm. beyond the corolla. Outer achenes 6 mm. long (the rostrum 1 mm.), of disk florets very narrow and usually a trifle longer than the others. Pappus 5 mm. long.

Affinity with *G. discolor* Sond. and *aurantiaca* Sch. Bip. The large long-stalked leaves green and glabrous above and silvery below, with the lengthy scape bearing a rather small head with yellow rays, are the chief features.

The flowering head of this plant, which shows much variation in the form and extent of division of the corolla-limb, furnished a case

of syncarpy involving two of the disk florets otherwise normal: the united carpels, while presenting a line of division in their upper part, were without even this in the lower half.

SCROPHULARIACEÆ.

Micrargeria sopubioides S. Moore, sp. n. *Herba* erecta, ramosa, virgata, $\frac{2}{3}$ metralis; *caule* sat valido tereti striato ramos tenues ascendenti-erectos minute leprosos gignente; *foliis* plerisque oppositis sessilibus linearibus obtusis integris leprosis tandem fere glabris; *floribus* in axillis foliorum solitariis pedunculatis pedunculis in medio bractearum pari donatis; *calyce* campanulato ultra medium in lobos 4 ovatos obtusos leviter microscopice leprosos margine obscure crenulatos diviso; *corollæ* tubo lato breviter exserto limbo tubo paullulum longiore subæqualiter 4-lobo lobis suborbicularibus; *staminibus* prope basin corollæ insertis loculis æqualibus superne connectivo affixis; *ovario* oblongo glabro; *stylo* crassiusculo incluso glabro; *stigmate* capitato.

Hab. South Rhodesia, Miami, in pools of running water, May 1926; *Rand*, 156.

Lower part of stem 3 mm. thick, leafless, but with the marks of several pairs of leaves. Leaves up to 15 mm. long and 1 mm. broad, but those on the flowering branches much smaller, the youngest only 3 mm. long or even less. Peduncles very slender, mostly 5–9 mm. long, their bracts about 1·5 mm. in length. Flowers white. Calyx 2 mm. long. Corolla-tube 2·5 mm., its lobes 3·5 mm. long. Filaments thickened above; anthers ovate, barely 2 mm. long. Ovary 2 mm., style 2 mm. long. Capsule just before opening 4 × 2·25 mm., 4-valved, *i. e.*, loculicidal and septicidal. Seeds numerous, minute, black.

Looks like a small *Sopubia*, hence the trivial. The tetramerous flowers are peculiar for the genus.

Buchnera candida S. Moore, sp. nov. *Herba* erecta sesquibispithamea; *caule* simplici sat gracili bene folioso sparsim scabriusculo-pubescente; *foliis* sessilibus paucis infimis oppositis sæpe subrosulatis oblongo-obovatis apice rotundis utrinque pilis brevibus basi perspicue albo-bulbosis inspersis scabridis foliis reliquis alternis lineari-oblongis obtusis utrinque scabridis; *floribus* in spicas graciles simplices elongatas pluriflores mox valde interruptas scabridas digestis; *bracteis* oblongo-ovatis obtusis quam bracteolæ oblongæ obtusæ paullulum longioribus; *calyce* bracteam facile superante anguste cylindrico fere glabro hujus dentibus 5 triangularibus acutis; *corollæ* albæ ex calyce eminentis tubo cylindrico levissime incurvo extus fere omnino glabro lobis 5 suborbicularibus microscopice crenulatis; *antheris* acuminatis; *ovario* oblongo-ovoideo stylum crassiusculum paullo breviorem stigmate oblongo coronatum fulciente.

Hab. South Rhodesia, Miami, May 1926; *Rand*, 158.

A slender herb of strict habit, the simple stem only 1 mm. thick. Basal leaves about 10 × 5 mm., the rest mostly about 2–2·5 cm. long and 3 mm. broad, all drying green. Flowers at first close together, but soon separated and ultimately by 2–3 cm. interspaces. Bracts 4 × 1·5 cm.; bracteoles 2·5 × 1 mm. Calyx 6·5 × 1·5 mm. (in the dry state only 1 mm. wide), of which 1·5 mm. belongs to the teeth. Corolla-tube exceeding the calyx by 2 mm., 1 mm. broad when moistened.

ACANTHACEÆ.

Lepidagathis (§ *Eu-Lepidagathis*) **Randii** S. Moore, sp. n. *Suffrutex*; *caulibus* tenuibus sat crebro foliosis sursum pubescentibus mox fere glabris; *foliis* sessilibus anguste linearibus acutis trinervibus coriaceis paucis summis paullo latioribus piloso-pubescentibus exemptis glabris; *cymis* capitatis in axillis superioribus (raro basin caulis versus) sitis; *bracteis bracteolisque* lanceolatis longe fusco-acuminatis villoso-ciliatis; *calycis* segmentis lanceolatis (lateralibus lineari-lanceolatis) postico quam antica paullo latiore omnibus in acumen longum fuscum extenuatis vix usque apicem villoso-ciliatis; *corollæ* tubo calyce breviore sursum deorsumque dilatato parte sup. extus uti intus appresse villoso labio postico late deltoideo bidentato antico latiore lobis ovalibus inter sese subæqualibus; *staminibus* 4 antheris omnibus bilocularibus loculis paullulum inæquialtis; *ovario* compresso ambitu subcirculari glabro; *stylo* inferne piloso ceteroquin glabro; *ovulis* pro loc. 1.

Hab. South Rhodesia, Miami, June 1926; *Rand*, 152. No. 79, with the youngest leaves quite or very nearly glabrous, is conspecific.

A slender-stemmed, rather straggling plant. Leaves up to 8 cm. long, but many only some 6 cm., 2–3 mm. wide (the uppermost some 5 cm. × 4 mm.), drying dark green, the youngest lighter in colour; the three nerves well seen on the underside. Inflorescences ±1·5 × 2·5 cm. Bracts and bracteoles up to 15 mm. long., dark when dry. Calyx-segments up to 13 mm., the lateral 11 mm. long. Corolla light purple; lower part of tube 4 mm. long, 3·5 mm. wide at base, and 2·5 mm. at the constriction, upper part of tube 4·5 mm. long, 6 mm. wide at the throat; upper lip 4 × 4 mm., lower 5 × 8 mm. with its lobes 3 mm. long. Ovary 1·5 × 1·2 mm., style 7 mm. long.

Near *L. lanatoglabra* Clarke, but the uppermost leaves are without white wool, and the segments of the calyx are villous at the margin and not glabrous.

REPRODUCTIVE MECHANISM IN LAND FLORA.

VI. Sporophylls (*continued*).

By A. H. Church, M.A., F.R.S.

With the attainment of a phylogenetic conception of a *leaf*, that of the *sporophyll* necessarily follows, since all such leaf-laminæ (ramuli) must have been originally photosynthetic and reproductive to the limit of their autotrophic possibilities. In this sense all adult leaves were sporophylls, and the limited photosynthetic leaf is so far 'sterile.' Even Bower's historic view of the origin of land-flora may contain a half-truth. But this applies more correctly to the older benthic phase of the sea, rather than to the evolution of

a new sporophyte-vegetation of the land. A photosynthetic leaf which does not attain the full adult habit of tetrad-production is so far 'juvenile,' and may be, as a matter of fact, 'sterile,' but is certainly not 'sterilized.

It also appears evident that the case of the Fern-frond in its adult phase has been quite correctly taken as the typical sporophyll, since it is only among living Ferns and Pteridosperms that the leaves retain their full morphological identity with algal ramuli, as primarily photosynthetic and ultimately reproductive organs still retaining possibilities of extensive ramification; though making no attempt at the consolidation of more or less perennating bud-constructions, within which heterotrophic spore-producing organs are fed at the expense of the rest of the shoot-system—this constituting the essential feature of the *strobilus* of all other phyla of land-vegetation. The autotrophic leaf and sporophyll is thus preferably regarded as more primitive than the more or less heterotrophic and much-modified sporophyll of higher land-flora (*cf.* Conifer stamens, Angiosperm stamens, and carpels).

That such leaves and sporophylls must have been the normal equipment of transmigrant algæ goes now without saying, and one can now see that the expression *sporophyll* is fully justified. The Fern, on which the conception was based, follows the same rule as the seaweed, and the deduction of Goebel (1880) that sporophylls have the same mode of initiation, primary development, and arrangement as ordinary non-reproductive leaf-members, now increasingly specialized for the functions of photosynthesis and transpiration, is seen to be quite correct, though obtained by ontogenetic examination rather than as a matter of phylogenetic comparison; but consideration of the phyllotaxis-mechanism requires to be added to the data given by the dead plant. The fact that Bower (1894) [1] saw fit to throw over Goebel's ontogenetic evidence in favour of pursuing the *Riccia* myth curiously fixes the date for much obscure speculation on his alternative proposition. Yet, in the more practical discussion of the mechanism of the Fern-frond itself, he has pursued the ontogenetic method with striking success [2]. Possibly no paper published in recent years has proved so rich in morphological interpretation. Once it is seen that the leaf may lag behind the stem in morphological attainment, as also that it may lag behind in one set of factors and not in others, the organization of the Fern-frond affords the key not only to the evolution of all leaf-growth between the Fern and the seaweed, but it points the way to all higher and subsequent specialization of the leaf-members of land-plants, including Angiosperms. For such a purpose, again, the juvenile leaves and sporophylls of the Ferns are peculiarly suitable, since not only is there an entire lack of later strobilus-elaboration, but the ontogeny of young plants may be partially recapitulatory, in that from the first the younger leaves require to be actively photosynthetic, and have to go

[1] Bower (1894), Phil. Trans., *loc. cit.* p. 483.

[2] Bower (1916), 'Leaf Architecture,' Trans. Roy. Soc. Edin. vol. li.

their living from early embryonic stages, there being no intraseminal development or provision of food from an endosperm. Thus the first leaf of *Aspidium*, with 3-times dichotomizing vascular bundle and 4–8-lobed lamina, was prettily figured by Suminski (1848) [1]; but it has been left for Prof. Bower (1916) [2] to interpret the construction as affording evidence of the primitively dichotomous nature of the leaf-ramulus, in which a single vascular strand is developed as conducting mechanism for each ramification.

Dichotomous venation is thus taken to imply the original dichotomy of the leaf-ramulus in a plane tangential to the parent axis [3]; and this may be still pronounced in several living Fern-types (more especially Filmy Ferns, as *Trichomanes*, *Todea*). Or, by a secondary mechanism of congenital growth—'webbing,' to use Prof. Bower's term,—the lamina is extended as a coherent tissue-system, in which the original ramification scheme persists as the *venation* (cf. *Trichomanes reniforme*, *Osmunda*, *Aneimia*). The general conclusion that the earliest Fern-frond was of the nature of a dichotomous leaf-ramulus appears not only unavoidable, but the fact is extremely illuminating, since this implies a distinctly algal type of ramulus [4].

The provision of a many-layered parenchymatous lamina brings with it the essential features of sporangial development, meiotic tetrads, and the emission of spores; but the defects of the dichotomous ramification of a subaerial leaf which now has to acquire a fixed light position and mechanical stability—since now carrying its own weight—are made good by the modification of simple dichotomy to a sympodial construction, which in the limit becomes indistinguishable from monopodial ramification, and may be so described [5]. This last appears as the normal growth-habit in the rachis of many modern Ferns. Within the lamina, the defects of the radiating dichotomous venation are made good, as equalizing the water-supplies of a transpiring member, by bundle end-loops and cross-connections; hence

[1] Leszczyc Suminski (1848).

[2] Bower (1923), *The Ferns*, p. 85.

[3] Or, preferably, 'in the transverse plane of the floral diagram.'

[4] No indigenous alga more clearly expresses this type than the fertile shoots of the Fucoid *Himanthalia lorea*, four times dichotomized, and attaining a length of 3–20 ft.; the thongs bilateral, with palisade mesophyll, conducting internal tissue, and sorus-aggregation of meiotangia in sexual conceptacles. The effect of these shoots when young in spring, standing erect in air until 6 inches high or so, and then falling over by their weight, vividly brings to mind the problem of the transmigrant alga in adapting such a construction to subaerial conditions. With a Fibonnacci series of such shoots borne on a diploid asexual phase, *H. lorea* would constitute a working model of such a hypothetical type.

[5] In *Fucus serratus* the branch-system may be regarded as the sympodial expression of an older dichotomy, or as a monopodial presentation of bilateral ramuli on either side of the main axis. The point is that all these types of ramification are general phenomena of marine benthon. Land-flora may retain archaic factors and soon improve on them; the *leaf* in its way may be as 'conservative' as the crampon root. The addition of venation (vascular bundles) is a subaerial feature, but morphological features of form, apical growth, and leaf-production are older attributes of the algal life, on which incipient land-

reticulate venation is at last interpreted as the final phase of vascular arrangement for all advanced leaf-laminæ [1].

It may be noted, however, that such recognition of *primitive* features and factors is abstracted from existing forms, in which complete sets of primitive factors do not necessarily obtain, since no plant at this time can be wholly *primitive*. Thus a Fern-frond may be remarkably archaic in one respect, and yet fully advanced in others. Ontogeny may be utilized to confirm the deductive methods of comparative morphology, but neither is absolute. The balance of evidence is determined by the consideration of all available data, and by the recognition of the fact that many forms may be regressive (atavistic), or may present varied response to varied environments at different times. More archaic features may persist in vestigial traces, since immaterial to the welfare of the organism. Thus the simple dichotomous ramification and venation of the fronds of Filmy Ferns is undoubtedly as secondary as the filmy character; hence *Trichomanes reniforme* may be in some respects more 'primitive' than *T. radicans*. The apical region of the frond, as also the basal portion, may lag behind in development [2]—a feature of extreme interest and significance, which neatly expresses the gradual transition between the older free-growing leaf-ramulus and the new leaf-'appendage' of the land, correlated in growth and function with associated members [3]. The remarkable epiphytic type of *Platycerium alcicorne*, with six-foot broadly dichotomizing strap-fronds of perfectly Fucoid habit, presents internally a complex system of reticulate venation. The fronds may be regarded as reverting morphologically to the older algal type when they have no longer to attempt the erect habit [4]; but they are certainly not inventing the dichotomous frond *de novo*.

(To be continued.)

vegetation is based. The fact that the Phæophyceæ have obviously no direct connection whatever with Land-flora is sufficient evidence of the parallel evolution of these morphological factors in comparable massive and parenchymatous Green Algæ. Similar evolutionary response is to be expected where, and only so far as, the initial equipment is similar.

[1] Bower, *loc. cit.* p. 94.

[2] Bower, *loc. cit.* p. 102.

[3] *Aspidium* has only one type of leaf-appendage, *Pinus* elaborates ten.

[4] Bower, *loc. cit.* p. 233. The same habit is given by *Ophioglossum pendulum*.

OBITUARY.

William Fawcett

(1851–1926).

William Fawcett was born on February 13, 1851, at Arklow, Co. Wicklow, Ireland. He was educated at Dulwich College, and seems to have taken up teaching forthwith. His former colleague, Mr. Ridley, writes: "Fawcett came as under-master to the private school I was at, at Southborough, near Tunbridge Wells, about 1868. Later he thought to give up scholastic work, and tossed up (so he told me) to decide whether he would go in for mathematics or botany. The lot fell to Botany." He studied at King's College, and took a B.Sc. degree at London University in 1879.

In 1880 he entered the Department of Botany of the British Museum, of which Mr. William Carruthers was then Keeper, Mr. H. N. Ridley entering at the same time. It was the period of transition of the Natural History Collections from Bloomsbury to the Cromwell Road, and Fawcett was deputed to the work of receiving the collections in the new Natural History Museum. He remained at the Museum until December 1886, when he was appointed Director of Botanic Gardens and Plantations in Jamaica, in succession to Daniel Morris, who had been appointed Assistant Director at the Royal Gardens, Kew. Fawcett's time at the Museum was devoted to the incorporation of the collections (he was in charge of the Gamopetalous Dicotyledons) in their new home, but he also made a special study of some of the Balanophoreæ, the results of which were published by the Linnean Society, of which he had been elected a Fellow in 1881. He was also interested in the enlargement of the British Herbarium, and with his colleague Ridley worked specially at the Dorset Flora; "every year," Mr. Ridley writes, "we went to some part of Dorset to help Mansell Pleydell, who was writing his *Flora of Dorsetshire*, and you will see therein many plants Fawcett and I added to the Flora."

On his way to Jamaica, Fawcett visited the United States, and during his time in Jamaica he was in close touch with many of the American botanists; Dr. and Mrs. Britton, of New York, were among these friends. Arrived in Jamaica, Fawcett devoted himself whole-heartedly to his official work; for some years his headquarters were at the Cinchona Gardens, a pleasant hill-station, but in 1897 were transferred to Hope Gardens, Kingston. Shortly after his arrival, in 1887, he founded the *Bulletin of the Botanical Department, Jamaica*, free copies of which were distributed to residents who applied for it. It reported on the cultivation of the six gardens under the Director's charge, on useful plants and on plant-diseases, and also contained notes and essays by various authors. Fawcett edited the Bulletin until his retirement in 1908. In 1888 he paid a short visit to the Cayman Islands, 180 miles north-west of Jamaica, which had till then remained unexplored botanically; his report on the geology and vegetation of the three islands, with a list of the plants (and shells) collected, was published in his *Bulletin* (1889).

In 1891 Fawcett published *An Index to Economic Products of the Vegetable Kingdom in Jamaica*, an enumeration of the endemic and cultivated useful plants found in the island, with descriptive notes. This was prepared in connection with the International Exhibition in Jamaica (1891), "as the originator of which he will ever be remembered in Jamaica" (*Kingston Daily Gleaner*). *A Provisional List of the Indigenous and Naturalised Flowering Plants of Jamaica* appeared in 1893. It is merely a systematic list of genera and species, founded on Grisebach's *Flora of the British West Indies*, with later additions. The issue of this list was preliminary to an investigation of the flora of the island, especially of

the eastern end, in which Fawcett was greatly helped by the late William Harris, Superintendent of the Gardens and an excellent collector. A large series of specimens were sent for determination to Prof. Urban, in Berlin, who was engaged on his *Symbolæ Antillanæ*.

Fawcett also took an active part in public affairs. The writer of an appreciation of his work in *The West India Committee Circular* in 1906 (xxi., Aug. 8), states that, besides being Director of Public Gardens and Plantations, he finds time to perform the duties of nominated Member of the Legislative Council, Deputy Chairman of the Jamaica Agricultural Society, Member of the Board of Agriculture, and of the Board of Governors of the Institute of Jamaica, "he is in constant correspondence with planters in all parts of Jamaica, giving advice and information on every subject connected with tropical agriculture and horticulture." He was also a corresponding Fellow of the Botanical Society of Edinburgh, a corresponding Member of the Royal Horticultural Society and of the Pharmaceutical Society of England. He was associated with the West India Committee until the time of his death.

Towards the end of his residence in Jamaica, changes occurred in the organisation of the Department of Agriculture, which he did not find congenial, and he retired in 1908 before completing his full period of service. Returning to England, he settled with his family at Blackheath and took up work again at the Museum in the Department of Botany. When in Jamaica he had become interested in the Orchids, which are richly represented in the flora, and with the assistance of Mr. William Harris a fine collection was got together. A beautiful series of drawings from the living plants was made, under Fawcett's direction, by Miss Helen Wood. During one of Fawcett's visits to England we agreed to collaborate in a Monograph, and in 1904 published an account of the genus *Lepanthes*. Two years after his return to London a complete account of the Orchidaceæ was issued as a British Museum Monograph; this formed the first volume of a *Flora of Jamaica*, at which Fawcett continued to work steadily until the task was suddenly interrupted by his death. Though the brunt of the labour fell upon him, the work has been one of real co-operation. Fawcett would draft out a genus or group of genera, and then we would work together through the material and literature. Volume V., completing the free-petalled Dicotyledons, was issued three weeks before his death, and some progress had been made on the sympetalous families which would occupy Volume VI. and complete the account of the Dicotyledons.

I had left him at work at the Museum the day before I started for America, and it was a grievous shock to get news of his death, from a severe heart-attack, with the first batch of letters from home. Our co-operation had been very pleasant. He took infinite pains, and was thorough to a degree, but accepted criticism cheerfully.

One of the best-hearted of men, he was always willing to help, and no trouble was too great to answer enquiries more or less remotely connected with the "Flora" or with Jamaican botany. He took an active part in procuring and arranging the exhibition of living plants from Jamaica for the British Empire Exhibition.

In politics he was a strong supporter of Church and State; some would have called him old-fashioned in his views, but he did not obtrude them. He was eminently conscientious and consistent; he resigned his Fellowship of the Linnean Society after the outbreak of the War for reasons which were absolutely cogent to himself; happily he was able to resume the Fellowship before his death.

His friends will cherish the memory of a kindly and courteous gentleman. Our sympathy is extended to his widow and children—a son, a captain in the Indian Army, and a daughter.

A. B. RENDLE.

The following list of Mr. Fawcett's botanical works has been compiled by his former colleague, Mr. A. Gepp, whose notes were also helpful in the preparation of the above memoir:—

(With H. N. Ridley.) Additions to the Flora of Dorset. Journal of Botany, xx. (1882) 246.
Japanese Gentians. *Ibid.* xxi. (1883) 182.
Dialysis and Synanthy in Primula. *Ibid.* xxii. (1884) 151.
Prodromus Floræ Timorensis—Gamopetalæ and Apetalæ in H. O. Forbes's 'A Naturalist's Wanderings in the Eastern Archipelago.' Appendix VI. 1885, 506–18.
An Entomogenous Fungus. Ann. Mag. Nat. Hist. 1886, 316–18.
On New Species of *Balanophora* and *Thonningia*, with a Note on *Brugmansia Lowi* Becc. Trans. Linn. Soc. (Bot.) ser. 2, ii. 233–47 (1886).
Bulletin of the Botanical Department, Jamaica. Nos. 1–50. Kingston, Jamaica. (1887–94.) [Initiated and edited by W. Fawcett.]
Also New Series, Vols. I.–IX. 1894–1902. Continued as the 'Bulletin of the Department of Agriculture,' vols. i.–vi. (1903–08).
Report on the Cayman Islands. Bull. Bot. Dept. Jamaica, 11 (1889).
Economic Plants: an Index to Economic Products of the Vegetable Kingdom in Jamaica, 1891.
Report on the Coco-nut Disease at Montego Bay. Bull. Bot. Dept. Jamaica, 23 (1891), 2.
A Provisional List of the Indigenous and Naturalised Flowering Plants of Jamaica, 1893.
Report on the Coffee-leaf Fungi. Bull. Bot. Dept. Jamaica, 40 (1893), 5.
Two New Orchids from Jamaica. Journ. Bot. xxxiii. (1895), 12.
A Synoptical Arrangement of the Melastomaceæ of Jamaica. Journ. Institute of Jamaica, ii. (1896) 269–77.
Radlkoferella latifolia, n. sp. Notizblatt Berlin Bot. Gart. i. (1897) 321.
The Public Gardens and Plantations of Jamaica. Bot. Gaz. xxiv. (1897) 345–69. (Reprinted in Bull. Bot. Dept. Jamaica, v. (1898) 1–19.
La Culture et le Commerce de la banane à la Jamaïque. Rev. Cult. Colon. Paris, xi. (1902) 368–75.
(With A. B. Rendle.) An Account of the Jamaican Species of *Lepanthes*. Trans. Linn. Soc. (Bot.) ser. 2, vii. 1904.
Guide to the Botanic Gardens, Castleton, Jamaica. 1904.
Guide to Hope Gardens, Kingston, Jamaica.
(With A. B. Rendle.) Some New Jamaica Orchids. Journ. Bot. xlvii. (1909), xlviii. (1910).
Woods and Forests of Jamaica. West India Committee, London, 1909.
(With A. B. Rendle.) Flora of Jamaica, containing Descriptions of the Flowering Plants known from the Island. (Trustees, British Museum.)
Vol. I. Orchidaceæ, 1910.
Vol. III. Dicotyledons, Part I., 1914.
Vol. IV. Dicotyledons, Part II., 1920.
Vol. V. Dicotyledons, Part III., 1926.

(With A. B. Rendle.) New Plants from Jamaica. Journ. Bot. l. (1912) 177–82; li. (1913) 123–5.
The Banana: its Cultivation, Distribution, and Commercial Uses. London, 1914. [Revised Edition. 1921.]
(With A. B. Rendle.) A New *Annona* from Jamaica. Journ. Bot. lii. (1914) 74.
(With A. B. Rendle.) Notes on Jamaican Species of *Capparis*. *Ibid.* 142–4.
(With A. B. Rendle.) Notes on Jamaican Plants. *Ibid.* lv. (1917) 35, 268; lvii. (1919) 271, 312; lix. (1921) 17, 224; lx. (1922) 361; lxiii. (1925) 114; lxiv. (1926) 14, 103, 158.
William Wright, a Jamaican Botanist. Journ. Bot. lx. 330.
(With A. B. Rendle.) Notes on Jamaican Ternstrœmiaceæ. *Ibid.* lxi. (1923) 52, 85.
(With A. B. Rendle.) *Laurus americana*. *Ibid.* lxiii. (1925) 51.

SHORT NOTES.

Melampsoridium Alni Diet. in Ayrshire.—This species has been reported on several previous occasions from localities in Scotland, and appears to have then occurred in small quantities only. At the present time, however, it is remarkably plentiful on *Alnus glutinosa* in this district (especially at West Kilbride), and the teleuto-sori are produced in abundance on the lower surface of the affected leaves. Regarding these sori, Dr. Malcolm Wilson (Trans. Brit. Mycol. Soc. ix. 140) has stated that they are "very inconspicuous," but this can hardly be said of the Ayrshire specimens. It may also be noted that teleutospores of this rust were obtained on leaves of *A. glutinosa* at Culzean Castle, Ayrshire, on 21st September, during an excursion by the Cryptogamic Society of Scotland.—D. A. Boyd.

It is an interesting coincidence that on 18th March I found a fine plant of *Corydalis claviculata* DC. in full flower at Dunsford (v.c. 3; Devon bot. distr. 6). This is only a day later than Mr. I. A. Williams's recent note of it (Journ. Bot. 1926, 250) as in flower near Newark Priory, Surrey. On Dartmoor, sheltered by the boulders amidst which it there usually grows, I have not infrequently found the plant in good flower both earlier and later than the months given in the botanical manuals as its normal period of flowering.—C. Ethelinda Larter.

Tarenna versus *Cupi*.—In Journ. Bot. 1913, 58, a sketch of the generic history of *Tarenna* Gaertn. (1788) was given by Wernham, who arrived at the conclusion that the correct name for the genus under the International Rules was *Cupi* Adans. (1763), but at the same time recommended that the name *Tarenna* should be retained—presumably by means of adding it to the list of "nomina conservanda." Fortunately, however, this has proved to be unnecessary, since *Cupi* Adans. (1763) is a "nomen abortivum," being a superfluous name for *Rondeletia* L. (1753). The two genera included the same two species, namely, *Rondeletia americana* (*Rondeletia* Plum.) and *R. asiatica* (*Cupi* Rheede), and the publication of *Cupi* Adans. was therefore contrary to the provisions of Art. 50 of the International Rules.—T. A. Sprague.

REVIEW.

Life of Plants. By Sir Frederick Keeble, Professor of Botany in the University of Oxford. Crown 8vo, pp. xii, 256, frontispiece and 51 figs. Clarendon Press, 1926. Price 5*s*.

This handy little volume is one of the Clarendon Science Series, issued under the general editorship of Professor Julian Huxley and and D. Ll. Hammick. Sir Frederick Keeble has a facile style, and, though in his preface he disclaims success in the task he has set himself, as one beyond his powers, namely, "to suggest that Science is more than a doctrine—an illumination of life," he has written an eminently readable and informative handbook on plant-life. The point of view is, naturally, that of physiology. In an introductory chapter on the part which plants play in the world, the various problems are set before the reader, and in the succeeding chapters are discussed and expounded in clear language. The illustrations are a helpful addition to the text; they consist of line-drawings of details of plant-structure or descriptive of experiments illustrating plant-physiology, and of photographs, mainly of plants of some special interest or of preparations showing internal structure.

The book is one which may be read with profit by the student or the general reader who has an elementary knowledge of botany.

BOOK-NOTES, NEWS, etc.

Forestry Commissioners.—The Sixth Annual Report for the year ending Sept. 30, 1925, may be obtained from H.M. Stationery Office (price 9*d*.). The general position in regard to forest policy is summarized, and an account is given of the operations during the Forest Year 1924–25. The operations include the acquisition of land &c., cultural operations, education, including the work of the Imperial Forestry Institute, Oxford, research and experiment, and various special services. An Appendix shows in tabular form the amount of imports of timber, wood-manufactures and pulp-wood during the year, and a map indicates the number and position of the areas already acquired in Great Britain.

Forest Survey of Illinois.—The Third Report, by Clarence J. Telford, issued by the State Natural History Survey, March 1926 (*Bulletin*, xvi. Art. 1, pp. 102, with maps), deplores the forest destruction in Illinois, and emphasizes the urgent need for educating both owner and public for the protection of the present forests, to balance growth and cut, and bring them to their fullest possible production. The report is divided into three parts, namely: I. Description of the forests at the present day, and a brief account of the

far more extensive original forests; II. Growth and yield studies, including studies of growth-rates of individual trees and studies of yields of different types; III. Proposed State forest policy.

THE FLORA OF BRECONSHIRE.—Prof. R. W. Phillips contributes to a handbook entitled *The Breconshire Border, between Wye and Usk, with Notes on its Geology, History, Folk-lore, &c.* (published by D. J. Morgan, Central News Depôt, Talgarth, 1926, price 2*s.* 6*d.*), a short account of the flora of Breconshire (84–88) and a list of the Flowering Plants and Ferns (Appendix I., pp. i–xxxiv). The list (dated October 1921) is as complete as it has been possible to make it from the available records. It follows the sequence of the tenth edition of the *London Catalogue of British Plants* (1908). Only one locality is usually given after each plant, and when the plant is found in all, or almost all, Watson's vice-counties no locality is given. No attempt has been made to deal adequately with such genera as *Rubus*, *Rosa*, *Hieracium*, and *Salix*; the available records are, however, quoted.

ESSAYS ON MANCHURIAN FLORA, by Prof. J. Ohga. This is a booklet of 70 pages, "published by the South Manchuria Railway Co." (Darien, August 1923), of which Prof. Ohga states that only one hundred copies were printed and privately distributed. It contains four articles as follows, in English:—I. "Botanical History of Manchuria"; II. "On Flora of Shantung and Manchuria"; III. "Vegetation of Fenghuangshan"; IV. Vegetation of Kwantung Leased Territory"; and also V. "A Phænological Table indicating the Flowering Seasons at Mukden of 126 Species of Plants." The booklet contains in small compass a good deal of information, based on personal observation, on the vegetation of areas little known botanically. A copy may be consulted in the library of the Department of Botany, British Museum.

ROYAL HORTICULTURAL SOCIETY.—The foundation-stone of the new Hall was laid by Lord Lambourne, President of the Society, on October 19th. The new Hall in Elverton Street, Westminster, almost adjoins the present one and will provide twice the expanse of floor-area. It is hoped that it may be ready for use in sixteen months' time, before the Society celebrates its 125th anniversary.

ALBANIAN HERBARIUM.—The Trustees of the British Museum have purchased the important herbarium of Prof. Antonio Baldacci, of Bologna. Prof. Baldacci from 1891 onwards made no less than ten expeditions for plant-collecting in the mountains of Albania and Montenegro, and his herbarium will add greatly to our knowledge of an area difficult of access and botanically little known.

CORRECTION.—Mr. Pugsley points out that a typographical error in his note on *Hieracium decolor* in the Report of the Watson Botanical Exchange Club has been copied into the last number of the *Journal*—p. 285, line 8 from bottom, *for* radical *read* panicle.

FOURTH INTERNATIONAL BOTANICAL CONGRESS.

BY A. B. RENDLE, F.R.S.

(Concluded from p. 301.)

THE Western Field-trip arranged and conducted by Dr. George D. Fuller, of Chicago University, was the most extensive of the excursions. The twenty-one botanists who took part represented twelve nationalities, and included Dr. Rübel of Zurich, Dr. Briquet of Geneva, Prof. Wettstein of Vienna, Dr. Skottsberg of Gothenburg, Dr. Domin of Prague, Dr. Borza of Cluj (Roumania), Dr. Maximow from Leningrad, and representatives from Holland, Italy, Poland, and Jugo-Slavia. Great Britain was represented by Mr. Carleton Rea, Dr. T. W. Woodhead, and the writer. An afternoon was spent at Niagara, visiting the Falls and Gorge, on the way from Ithaca to Chicago. Arriving at Chicago the party was welcomed by Dr. Sherff and other botanists, and driven to the Field Museum, a fine building in classic style on the Lake Front with very spacious halls, corridors, and exhibition galleries, all new and conceived on a grand scale. The botanical section has a fine collection of woods (from the "World's Fair"), an economic gallery, and a large hall devoted to the representation of plant-families by means of wax models of natural size. The exhibition was arranged by the late Dr. Millspaugh, and it is to be regretted that his death prevented the completion of this very beautiful and instructive series. The afternoon and evening were spent at the University, where the party were the guests of Professors Cowles and Chamberlain and other members of the botanical staff. Prof. Chamberlain showed his wonderful collection of living Cycads, which includes hybrids raised from seed between species of *Zamia*, and also bi-generic hybrids of *Zamia* and *Ceratozamia*. Cultivation had produced some interesting results, bearing on the limits of supposed natural species.

The summer session of the University was still in progress, and a meeting had been arranged between the overseas botanists and the students. The former were introduced, with a greeting, by Dr. Cowles, and replies were given by Prof. Wettstein in German, Dr. Briquet in French, and Dr. Rendle in English.

Leaving Chicago by the Los Angeles night express, we were passing next morning through Iowa, open country with small farms sheltered by low trees, and fields of Indian Corn, thence crossing the Missouri river to Omaha and the State of Nebraska, the prairie continues, with miles of Indian Corn, varied by grazing-land, patches of small trees, and scattered little townships. Temperature rises as we travel west, and after lunch the thermometer in the car stands at 92° F.; and as the country gets drier the corn-stalks are shorter. Next morning we are in Wyoming State and the Rocky Mountains, a wonderful country of great buff-coloured rocks, often fantastically shaped, sand, small hills, and sandy creeks; later we pass through salt patches marked by *Salicornia*, *Kochia*, and other characteristic vegetation—where the ground is less salt the sage-brush (*Artemisia*

tridentata) covers it. Occasionally there are open basins with thin pasture. *Juniperus scopulorum* is a characteristic low tree of the rocky valleys through which we pass at intervals. A long pass flanked by rocky heights, broken by lateral valleys giving glimpses of piled-up rounded hills and mountain-peaks, leads to the romantic Weber Canyon, and shortly afterwards we reach Ogden (Utah) and the Great Salt Lake Basin and alight at Salt Lake City. Here, again, the botanists are waiting for us, under Prof. Garrett. It is the hottest day of the year, and we are driven in the blazing sunshine through the fine broad streets to the Temple enclosure, where Dr. Levi Young, a nephew of the famous Brigham, Professor of History in the University and a charming host, shows us the Tabernacle (with its wonderful organ), Assembly Hall, and other objects of interest. The position of the town at the foot of the mountains which girdle the great basin is a beautiful one, and fine views across the basin are obtained from the Capitol and University, both of which overlook the town. A trip was taken about twelve miles out to a typical saline formation near the Lake shore. In addition to the familiar genera *Salsola*, *Salicornia*, and *Atriplex*, we find the woody *Sarcobatys* (grease-wood), and patches of prickly pear. In spring several Crucifers flower—*Malcomia*, *Draba*, *Lepidium*; and mosses are also to be found—*Funaria hygrometrica* and *Bryum*.

After a pleasant supper with our hosts we take train again in the comparative cool of the evening, and next morning are ascending through dense woods of *Pinus Murrayana* (Lodge-pole pine) to the West Yellowstone entrance of Yellowstone Park, where we meet Dr. Henry Conard, Professor of Botany at Grinnell University, but for the long summer vacation Head Ranger-Naturalist of the Park and our guide during our stay in the Yellowstone. The Yellowstone is the largest of the National Parks, and has an area of 3348 square miles, in which are to be found more geysers than in all the rest of the world together, innumerable hot pools, mud-volcanoes, terraces, and other accompaniments of hot-spring formations, and a canyon second only in size to the Grand Canyon of Arizona. The Yellowstone river enters the Canyon by two lofty falls, the lower exceeding 300 feet in height, and runs for several miles between walls 1000 to 1200 feet high, of decomposed rhyolite, the coloration of which is magnificent; from the pine-topped brink of the canyon to the edge of the rushing blue water, varied hues of orange, red, purple, and sulphur-yellow are irregularly blended in one confused scheme, and the beauty is enhanced by the marvellous carving and fretting of the steep sides by frost and erosion. The views from selected spots, such as Artist's Point and Inspiration Point are indescribably beautiful.

The National Parks are playgrounds, and ample facilities are provided for their legitimate use. Excellent automobile roads connect the various "Camps," where there are hotels or less expensive camps generally picturesquely constructed from the native pine. A number of free camping-grounds are also provided. Trails through the woods are indicated, and in the hot-spring areas geysers, springs, &c., of

special interest are indicated and, if necessary, protected. Destruction or disturbance of animal and plant life is prohibited, but "flowers may be gathered in small quantities when in the judgment of the superintendent, their removal will not impair the beauty of the park." The most active geyser and hot-spring area is the central plateau, at an elevation of about 8000 ft.; surrounding it are mountain-ranges with culminating peaks and ridges rising from 2000 to 4000 feet above the general level. The whole region is of volcanic origin. The Yellowstone lake, with a shore-line of 100 miles, and numerous small lakes, rivers, streams with frequent waterfalls and cascades supply a wonderful variety of landscape, and almost everywhere up to the timber-line, except where hot springs have destroyed the vegetation, is the dense Coniferous forest. The most common tree is *Pinus Murrayana* (Lodge-pole Pine), especially at low and middle altitudes, which, with a Spruce, *Picea Engelmannii*, Fir, *Abies lasiocarpa*, and *Pseudotsuga Douglasii* (Douglas Fir), form the bulk of the forest at middle altitudes; the Pine yields to the Spruce and Firs at higher levels. On dry rocky ridges, as at Mammoth Springs, *Pinus flexilis*, a smaller tree, occurs; and about the timber-line, *Pinus albicaulis* (White-bark Pine), a low stunted tree, is occasionally found. *Juniperus scopulorum* also occurs on rocky slopes; and the Creeping Juniper (*J. sibirica*) is common at middle altitudes. The only common deciduous tree is the Aspen (*Populus tremuloides*), a graceful slender tree frequent on moist slopes at lower altitudes. The Water-Birch (*Betula fontinalis*) grows along streams, but is rarely more than a shrub, as is also the Alder in similar localities. Though the season, end of August, is late for the flowers, there was ample among the undergrowth along the trails or on the steep banks of the streams to keep the botanists busy.

A trip was made to Mt. Washburn, 10,317 ft., in the north-east of the Park, a remnant of the volcano of early Tertiary times which played an important part in changing a depressed basin into the present elevated plateau. Two months before our visit the summit had been brilliant with an alpine flora, of which only few traces remained, the most conspicuous being two species of Lupin and a Sedum. *Picea Engelmannii* struggled up almost to the top in a mat-formation, a dense growth about two feet high, illustrating the effect of the snow-covering on the growth. A little lower down were examples of what Dr. Fuller called "spire-mat formation"—some of the shoots had grown up a few feet above the mat, but had been "cut" just above snow-level by the drifting snow; above the level of the "cut" they retained their green character. This effect of the snow-blast was not infrequently observed at the higher levels in the Park; above the lower branches, which are protected by the snow during the winter, a few feet of the stem bore broken or dead branches, above which the branches were again regular and unharmed.

Another interesting excursion was to the petrified forest on Specimen Ridge. A drive across a patch of open grass country, where a buffalo grazed quietly, undisturbed by our approach, brings

us to the foot of the ridge, the approach to which is strewn with the discarded antlers of the elk. The ridge rises about 2000 feet, and contains the remains of a series of buried forests. The area within which the fossil forests are found was apparently originally a flat basin, on the floor of which grew the first forest. This was buried by a volcanic outpouring of ashes, mud-flows, and other material, but so gradually that the trees were submerged in an erect position. On the new floor after a time a new forest came into existence to be engulfed in turn, and so on through the period represented by the 2000 feet of similar beds. As the beds have remained practically horizontal, the fossil forests, as they are being gradually uncovered by erosion, still stand upright. The trunks have become completely silicified by infiltration from the acidic lavas in the matrix, and so perfect has been the replacement of vegetable matter by silica that exposed sections show the structure of the wood as clearly as in a recent tree. The fossil trunks, being usually harder than the surrounding matrix, have more firmly resisted erosion, and now project above the general level. On the steep slopes of Specimen Ridge many stand twenty or thirty feet above the ground; some are bare, others show remains of bark. As we scrambled down the uneven slopes we counted a dozen or more of successive forest-beds. Ninety-five per cent. of the trunks are those of three Conifers, a redwood, *Sequoia magnifica*, scarcely separable from the modern redwood, *S. sempervirens*, of the Pacific slope; and two species of *Pinus* (*Pityoxylon*). Seven species of deciduous trees have been described, allied to the recent Laurel, *Persea*, *Platanus* (two species), Buckthorn, and Oak (two species). The fine ash and volcanic mud in which the forests were buried contain numerous plant-impressions, representing in all about 150 species, indicating that this flora of Miocene age, which included species of Fig, Bays, and Cinnamons, was very different from the present flora of the Park, and required a warm temperate climate not unlike that of Virginia or the Carolinas at the present day.

Vegetation of a lower organization has played an important part in the configuration of the hot-spring areas. The soil is a siliceous sinter formed from the silica brought to the surface in solution by the hot springs; around the basins the sinter or "geyserite" shows remarkable colorations, which form a striking contrast with the blue-green, azure, or sapphire colours of the pools. In the Upper Geyser Basin water boils at 198° F., and algæ (Myxophyceæ) appear at about 185° F. They occur in nearly all pools, springs, and running water upon the plateau, wherever boiling waters cool to the latter temperature. With the lowering of temperature on exposure to air more highly organized forms come in; the optimum temperature is about 140° F. Many forms flourish between restricted ranges of temperature, and the different species possess characteristic colours and habits of growth. After a little experience, it is quite possible, upon noting the nature of the plant-life, to conjecture the temperature of the water. As water in the geyser-pools and cauldrons frequently stands at or near boiling-point, no life exists at the centres of discharge, but with a rapid lowering of temperature algæ appear, with corresponding

changes of colour, in the shallow pools and overflow-channels. In the geyser-basins the first evidence of vegetation in an overflow-stream consists of creamy-white threads, passing into light flesh tints, then to deep salmon. With increasing distance from the hot pool the prevailing colours pass from bright orange to yellow, yellowish green, and emerald, and in the still cooler waters various shades of brown. The algæ form gelatinous threads or masses in which the organism is embedded, and the variety of form assumed by the incrustations or deposits is no less striking than their colour. When the alga dies on disappearance of the water, the mass gradually disintegrates to a fine deposit of sinter. The hot springs on the plateau are derived from the highly acidic lavas, and the deposit is therefore siliceous, but at the Mammoth Springs in the north-west portion of the Park the heated waters rise through mesozoic limestone and reach the surface heavily charged with carbonate of lime in solution. The deposit here is an almost pure calcite, "travertine." The algæ by abstraction of carbon-dioxide cause separation of the calcium carbonate, and the terrace-formations, over which heated water is still streaming, show a similar range of colour-effects to that described in the case of the geyserite. When deprived of the water-supply the travertine slopes lose their brilliant colours, which fade to a chalky white, darkening on exposure to a light grey.

Animal and bird life abounds in the Park. Black and brown bears are common, and frequent the garbage-heaps of the hotels and camps, and bolder individuals beg from passing automobiles; grizzlies are also fairly numerous. Bison, moose, elk, antelope, mule and white-tailed deer may be seen in less-frequented parts. Squirrels and chipmunks are abundant in the woods, and the houses and dams of the beavers in most of the streams. Porcupines are common, and evidence of their presence is seen in the peeled bark where they have fed. When botanizing in a marshy spot away from the trail we came upon a pair of great blue herons—beautiful creatures, and larger than a goose.

Everything possible is done to interest the visitor in the natural products of his playing-ground. At the camps, half-hour after-dinner talks on natural history are given by the rangers, and short nature-study trails have been carefully worked out, near the camps, in which objects of interest are indicated by labels. A useful series of pamphlets has been issued by the "Department of the Interior," describing the Geological History of the Park, the Geysers, the Fossil Forests, &c.; these may be bought for ten cents apiece. A feature of the service in the Park is that it is performed almost entirely by University Students, young men and women, who spend their long summer vacation at the "Camps" or on the transport service. They are a cheery lot and help to maintain a holiday atmosphere.

Leaving the Park by way of the romantic Sylvan Pass, a long day's drive through forest, valley, and the magnificent canyon of the Shoshone river, brings us to Cody, a modern town on an open plain, which is very sparsely cultivated by means of irrigation, and hot and dusty withal. Then after a day and night on the train

we reach Fort Collins, Colorado, where we are the guests of the President (Dr. Laurie) and botanical Staff of the Agricultural College. Fort Collins is a pleasant town, fifty years old, at 5000 ft. elevation and about four miles east of the foot-hills of the Rocky Mountains, at the meeting-place of the plains and mountain vegetation. The broad streets are planted with *Populus occidentalis*; the trees, about 35 years old, are tall and shady. The annual rainfall varies from 7 to 22·5 inches and the average is about 15 inches. Most of the precipitation occurs during the growing season between the last spring and the first autumn frosts, May 10–15 to September 15–20. The College is well equipped and has an efficient staff under Drs. L. W. Durrell and H. C. Hanson.

An important item of their work is the study of irrigated pastures, dryland pastures, and foot-hill pastures as regards grass mixtures, succession, and natural seeding. We are driven out about twelve miles to the short grass prairie, which illustrates the results of over-grazing on the original prairie. Dr. F. E. Clements, who has come to meet us at Fort Collins, maintains that the long grasses were the primitive condition generally on the prairie and that the sage-brush and short grasses came in after the bison had grazed off the long grasses. This and other topics are warmly debated by the ecologists of the party. We also visit the experimental grazing plots, where Dr. Hanson demonstrates the results of his work on the effect of enclosing small areas for one or two seasons.

Leaving Fort Collins a three-hour drive through the foot-hills, up the course of the Thomson River and through its beautiful rocky canyon, brings us to Estes Park at the entrance to the Rocky Mountain National Park, an area of about 400 square miles in Northwest Colorado. It is a wild district of deep forest-grown valleys, lakes, and mountain-peaks.

Our home for a few days is a small inn, very picturesquely situated at an altitude of 9000 feet on the slopes of Long's Peak, which rises behind us to 14,255 feet. The arrangements are as usual in these mountain camps. Dining and Common rooms form the main structures; the guests are accommodated in small cabins, for two, scattered around on the hillside, and distinguished, in this case, by the picture of a bird. Professor Wettstein and I share the Ptarmigan, near by is the Blue Jay.

The "Park" is described as a "a primer of glacial geology" and a "garden of wild flowers" (which it is forbidden to pick), and even as late as the time of our visit, early September, there was plenty to be seen. The noted Blue Columbine (the State flower of Colorado) was over, and also the Larkspur and Monkshood, but Gentians were still blooming, several brilliant Castilleijas (Indian Paint Brush), and *Pedicularis grœnlandica* (Red Elephant), and on the higher levels a number of alpines were still in flower. *Picea Engelmanni* forms extensive forests in the subalpine region, *Pinus Murrayana* prevails at middle altitudes especially in secondary growths, and in the lower valleys the Yellow Pine (*Pinus ponderosa*), a large spreading tree. *Pinus flexilis* is also found, especially in high rocky places

Douglas Fir is widely distributed, and the beautiful Colorado Blue Spruce (*Picea pungens*) occurs in the moist lower valleys.

Dr. Fuller is very much at home in the Park, and the few days pass pleasantly and profitably under his guidance. Here, too, we meet the Forest Ranger, Mr. Small, who accompanies us on a long day-trip to an alpine level and allows us to botanize, and also gives an interesting evening lecture on the plant and animal life, illustrated by a very beautiful series of coloured lantern-slides.

We make an early start from the inn for the 75 miles' drive to Denver, descending the beautiful valley of the South St. Vrain River and emerging on the open plateau. As we descend the Lodge-pole gives place to the Yellow Pine, which lingers as small scattered trees along the hill-side. The road across the plateau runs parallel with the foot-hills, and the plateau is broken by long low hills continuous with these and showing old lake terraces. The road-sides are bright with Sun-flowers and Maize-cultivation begins again. Denver, the mile-high city and capital of Colorado, is reached at noon. Denver is a fine city with broad tree-shaded streets and some good buildings. Our party begins to break up, there are only thirteen at dinner, after which we celebrate our return to civilization by a visit to the "movies" before leaving by the midnight train for the long ride back to Chicago.

Three days later a few of us who remain enjoy a day on the sand-dunes on the lake-shore about 40 miles from Chicago with Dr. Cowles, the pioneer of the sand-dunes, and Drs. Fuller and Sherff. A characteristic of the fore-dune association is the Sand-cherry (*Prunus pumila*), which gets right down on to the shore, other excellent sand-binders are a Willow, a little Spurge (*Euphorbia polygonoides*), and the grasses *Psamma* and *Calamovilfa*. The dominant tree on the moving dunes is *Populus deltoides*, which owes its success to its capacity for producing roots from the buried trunk and adventitious shoots from its uncovered roots. A great "blow-out" supplies an interesting case of an advance of the sand-dune upon the mesophytic forest on the landward side. A grove of pines has been killed and the weathered trunks are still standing or lying prone. The Poplar referred to still persists, as also does the American Lime (*Tilia americana*) which produces huge leaves from the portion still projecting above the sand. Some of the dead trees are still draped with vines. Dr. Cowles has estimated the advance here at about three feet per year. The damp woods, through which we make our way back, emphasize once more to the European botanist the great difference between the temperate American forest and our own in the remarkable variety of genera and species of trees, shrubs, and herbs which characterize the former.

Before leaving New York on the return journey, there was time for a visit to Washington, where Mr. F. V. Coville, Chief Botanist at the National Museum, puts himself at our service and shows the various Scientific Institutions, Museums, and Washington generally and its environment. Truly a great day. Then to Boston, where Dr. Robinson waits to welcome my travelling companion (Dr. T. W. Woodhead) and myself, and shows the Gray Herbarium, recently rebuilt and rearranged. Compared with our own it is a small herbarium, but

very well arranged, with well-fitting steel cases and many excellent labour-saving devices. There is also a complete card-catalogue of American genera and species. At the Arnold Arboretum the veteran Dr. C. S. Sargent welcomes us; he is 86 years of age, but still keenly interested in the work of the Arboretum. Mr. Wilson, the Assistant Director, and Dr. Rehder show us the wonderful Arboretum, many of the species of *Pyrus*, *Cratægus*, *Cornus*, &c., are in full fruit; and then drive us through the country to a marsh where Cranberries (*Vaccinium macrocarpa*) are cultivated and to the Blue Hills.

The New York Botanic Garden, where we enjoyed the hospitality of Dr. and Mrs. Britton, is a beautiful park-like area, including many acres of original woodland containing a great variety of trees, and running through it is the Bronx river. In the more open places it has been laid out as a formal botanic garden. The soil is rocky in places, and the alpine garden is tastefully arranged on an outcrop of the natural rock. The Museum is a very fine building with spacious herbarium and exhibition-rooms, but Dr. Britton already complains of overcrowding! We meet again Dr. Barnhart and Dr. Gleason and make the acquaintance of other members of the Staff.

Here, as elsewhere, our kind friends regret that our time is so short, but we can only express the hope that we may come again some day.

NOTES ON SOME MINOR VARIETIES OF BRITISH PLANTS.

By C. E. Britton.

Ranunculus sardous Crantz.—The usual representative of this species in Britain is the plant described by Curtis as *R. hirsutus*, which has the carpels furnished with low tubercles in one series concentric to the margins. The *London Catalogue*, ed. xi., includes two varieties, *parvulus* (Linn.) (which, perhaps, being merely a reduced form, should be deleted) and *inermis* Babey, with smooth carpels. A third form should be recognised among native plants, with the carpels showing the flat surfaces covered with distinct tubercles. This is var. *tuberculatus* Celak. A plant in the herbarium of the South London Botanical Institute (No. 45623), collected by Joseph Woods at Lewes, Sussex, shows the carpels with the character specified, and similar plants, no doubt, await recognition elsewhere.

Viola Riviniana Reichb. var. nemorosa N. W. M.—This does not find a place in the London Cat. ed. xi., but, judging by its well-marked characters, it merits inclusion. The tint of the petals recalls the flowers of *V. silvestris* Lam., which it also resembles in the smaller calycine appendages, narrow petals, the lower with a distinct deeper patch of purple at the base, and slender purple distinctly furrowed spur. This form suggests the hybrid *V. Riviniana* × *silvestris*, but, as the pollen appears uniformly normal, hybridity in this case is scarcely likely. It is a frequent form, in some places completely replacing ordinary *V. Riviniana*, as in some Surrey localities.

Viola Riviniana Reichb. and V. silvestris Lam.—In the discrimination of these two species, British botanists fail to give attention to the characters afforded by the stigma-beak, which in *V. Riviniana* is glabrous or papillose rather than hairy, decurved, but not to such an extent as in *V. silvestris*, which is also distinctly pubescent. The style of the former species appears to be longer and to project more above the anther-appendages than in *V. silvestris*. Whilst *V. silvestris* is usually accompanied by its ally, the latter is frequently met with alone in open situations. On the borders of woods, when both are together, intermediate forms appear to be always present, and sometimes may be more abundant than one of the parent species. These hybrid forms are intermediate in foliar characters; the flowers are much larger than those of *V. silvestris*, with the petals narrower than in *V. Riviniana*, purplish-lilac, not blue, the lower petal white at the base, with many-branched veins, below a crescentic patch of deeper purple. Deep patches of purple also appear at the bases of the lateral petals. The stigma-beak is usually distinctly hairy, but not to the same extent as in *V. silvestris*. The pollen shows a large proportion of aborted grains, in some cases a preponderance. The contrast, under the microscope, between the pollen of the hybrid and that of *V. Riviniana* and *V. silvestris* is very striking, as in both the latter the pollen-grains are large, subglobose, and perfectly normal. Hybrid plants, transplanted into the garden, bore a succession of barren cleistogamous flowers during the summer and a few large-petalled flowers in the autumn, the latter flowers producing scanty pollen consisting of a mixture of well-formed and aborted grains.

Beck (Fl. Nieder.-Œster. ii. 1, 522, 1892) divided *V. Riviniana* × *silvestris* into four series: (1) *subsilvestris*, resembling a strongly-developed *V. silvestris* with a stouter crenated spur and less fringed stipules; (2) *semi-silvestris*, also resembling *V. silvestris*, but with white, or at the extremity bluish-white, entire spur; (3) *semi-Riviniana*, resembling *V. Riviniana*, but with whitish-yellow spur; (4) *pseudo-silvatica*, having the aspect of *V. Riviniana*, but with bluish spur. Most of the Surrey plants observed in the spring of 1926 would presumably come under (4), but some few appeared to agree with the characters of (2) *semi-silvestris*.

Hypericum montanum L.—This species is usually described as glabrous, but really occurs in two forms—var. *typicum* Beck, with leaves glabrous, and var. *scabrum* Koch, with the leaves scurfy beneath. The latter form appears to be the common plant throughout Europe, including the British Isles, judging by herbaria, though Fournier regards var. *typicum* as the common French form. It is not quite certain that var. *typicum* occurs in Britain, though a plant

in Herb. Mus. Brit., collected by Mr. C. E. Salmon on the Downs above Abinger, Surrey, appears to represent it.

CARDUUS NUTANS L. var. SIMPLEX Coss. Germ. Fl. Env. Paris, 387 (1845).—Plants agreeing with this description occur on the North Downs in Surrey: Riddlesdown (*A. Beadell*) and Banstead Downs. The chief features are the simple stem terminating in a solitary capitulum with the spinescent phyllaries erect or spreading-erect, instead of spreading or reflexed. It may be considered to be but a form showing arrested development, but, seen apart from the normal form, it seems strangely unfamiliar, and does not readily suggest *C. nutans*. Probably common.

VERONICA SERPYLLIFOLIA L.—In the herbarium of the South London Botanical Institute is a remarkable form of this collected by Beeby, "somewhere between Hind Head and Frensham," 7.5.82. The leaves are orbicular, mostly entire, but the lower apparently slightly crenate-serrate, as are also the lower bracts. The inflorescence is about 3 in. in length. It presumably comes under var. *rotundifolia* Beck rather than var. *integerrima* Beck, and shows a closer agreement with Beck's description of the type-specimen of Schrank's *V. rotundifolia* in the Vienna Herbarium.

VERONICA OFFICINALIS L. var. HIRSUTA (Hopkirk).—Mr. F. N. Williams (*Prodromus*, 297) referred specimens from several localities to this variety. Dr. Druce ("Plant Extinctions since 1597," Report B. E. C. 1919) rightly dissented from this identification, and has since applied the new varietal name of *integra* (Report B. E. C. 1925) to the plants referred by Williams to var. *hirsuta*. Cultivated specimens of the true *hirsuta* contained in the British Museum Herbarium represent a very dwarf form of *V. officinalis* with numerous erect or ascending flowering-stems and oblanceolate leaves, and are quite unlike the specimens referred to by Williams. Such plants, with the capsules triangular and not notched, appear to be not rare. In addition, there occurs in Surrey a small form with the capsules varying from triangular-obovate to broadly obovate.

VERONICA CHAMÆDRYS L.—What Buchenau termed "eine merkwürdige Var." is the form described by Beck (Fl. Nord. Oest. ii. 2, 1052 (1893)) as "*lamiifolia* [Hayne in Mag. naturf. Freunde Berlin, vii. 132 (1815) als Art.—*V. divaricata* Tausch in *Flora*, 1821, 561] Blätter der blühenden Stengel kurz, doch deutlich gestielt, gekerbt oder eingeschnitten gekerbt. Trauben verlängert reichblütig, bald paarig (*V. lamiifolia*) bald einzeln und abwechselnd (*V. Rudolphiana*) Hayne, *l. c.* 133." Most continental authors who recognize this variety describe it in similar terms. In the paper of Hayne, entitled "Two New Species of *Veronica*" in the publication cited, diagnoses are given of restricted *V. Chamædrys* and of *V. lamiifolia* and *V. Rudolphiana*, followed by notes enumerating secondary characters, and contrasting the three species. After consulting this paper, the impression formed by the writer is that if the two latter forms really exist in nature, then, at the least, they constitute well-marked Jordanian species. From the description given by Tausch, *V. divaricata* would appear to be a luxuriant form of *V. lamiifolia* Hayne. As described by Beck, var. *lamiifolia* seems a frequent form in the British Isles, judging by material in Herb. Mus. Brit., and has been seen and collected in several Surrey localities. Most descriptions do not state the length of the petioles; Hegi (Illust. Fl. Mittel-Eur.), however, gives the length as from 5–10 mm. Surrey plants show petioles of the flowering-stems reaching a length of 7–8 mm. Native plants approximate to *V. Rudolphiana* in leaf-characters and alternate racemes and to *V. lamiifolia* in leaf-characters, but differ from both in the stalked lower leaves.

LAMIUM.—In this genus, the *London Catalogue* is probably in error concerning two included names, *hybridum* × *purpureum* and *purpureum* b. *decipiens*. The grounds for the inclusion of the first-named are not known to the writer, though the late E. S. Marshall suggested this origin for a Surrey plant found at Ewell. In any case, such an identification is very doubtfully correct, in view of the opinion held by some that *hybridum* is itself a cross—*L. purpureum* × *amplexicaule*. As to var. *decipiens*, although placed by Koch under *purpureum*, the correct position appears to be where Rouy placed it under *hybridum*. Criticisms passed upon plants contributed to the Botanical Exchange Club as *L. hybridum* var. *decipiens* (*Report*, 1923, 401) suggest that the distinctions between *L. purpureum* and *L. hybridum* are perhaps not fully appreciated. Besides the features of the form and incision of the leaves, there are important differences in the dimensions of the calyx-teeth, character of the corolla-tube, and inflation of the throat of the corolla, etc. In all these characters, var. *decipiens* agrees with *L. hybridum* rather than with *L. purpureum*. Buchenau saw the chief distinctions between the two species to lie in the more robust growth of *L. hybridum*, the deeper incisions of its leaves, and the globose-inflated throat of corolla. The tube of the corolla in *L. hybridum* is more slender, and passes more abruptly into the more inflated throat than is the case with *L. purpureum*.

LAMIUM GALEOBDOLON Crantz.—The variations of this common plant have received little attention from native botanists. Williams (Prodr. 393) remarked that "the English plant differs slightly from the common Continental plant in the uppermost leaves usually (but not invariably) passing into bracts, and is the var. *montanum* of German floras." The comment that follows seems to indicate that this author failed to appreciate the distinctions that exist between the two British forms that correspond to *Galeobdolon vulgare* Persoon and *G. vulgare* β. *montanum* Persoon. In the first-named the lower stem-leaves are ovate-cordate obtuse, the lower bracts triangular-cordate acute, the upper bracts ovate, whereas in var. *montanum* the lower stem-leaves are ovate-cordate, acute, the lower

bracts ovate-acuminate and gradually decrease above, becoming lanceolate-acuminate or linear-lanceolate-acuminate. In this var. there is a tendency to biserration of the leaves and bracts. Other distinctions between these two forms are that the verticils in the first are crowded with more numerous flowers, which appear to have larger, more erect corollas, and shorter calyx-teeth than in var. *montanum*. As we do not use the generic name *Galeobdolon*, presumably the correct names for the two forms under the name *Lamium Galeobdolon* would be var. *typicum* Beck and var. *montanum* Beck. The former occurs in Surrey in company with the more frequent var. *montanum*.

POLYGONUM HYDROPIPER L.—On a patch of formerly cultivated ground, in a wooded district near Brox, Surrey, closely covered in September and October last by a dense growth of *Polygonum Persicaria*, an allied form attracted attention, suggesting in its habit a hybrid into which *P. nodosum* entered. Examination, however, showed that the affinity of the plant was with *P. Hydropiper*, and that none of its characters indicated the influence of a second species. The plants were about 80 cm. in height, much-branched, with the terminal spikes compact and pendent, and below these were crowded glomerules of flowers in the axils of most of the leaves. This form, which was fruiting abundantly, agrees very well with the short description given by Alex. Braun in *Flora*, vii. 352 (1824), of his *P. Hydropiper* L. var. *densiflorum*, characterized as follows:—"β. *densiflorum* mihi, elatum, spica terminali cylindrica densa, floribus axillaribus confertis," and is said to be distinguished from the typical plant by its taller stem, many spreading branches, broad leaves, and very compact green inclined spikes. It is stated to occur rarely in ditches and marshy woods. This interesting plant, which does not readily suggest *P. Hydropiper*, was abundant, and examples will be distributed through the Exchange Clubs.

AGROPYRON REPENS Beauv.—It is possible that too much attention has been given in this country to the discrimination of varieties based upon the relative lengths of awns and glumes, to the neglect of other characters. Blytt, Beck, Buchenau, Ascherson, Graebner, and others, make a primary division, founded upon whether the lower leaf-sheaths are glabrous or are hairy, features which do not seem to have appealed to British botanists. The hairy sheathed plant is var. *cæsium* Beck, a tall glaucous form with the lower sheaths hispid with shorter or longer hairs, found growing in thickets, borders of woods, and hedges. It has quite a long list of synonyms, *Triticum cæsium* Presl, *Agropyrum cæsium* Presl, *T. repens* var. *cæsium* Hackel, etc., but does not appear identical with the plant described by Rouy as *A. cæsium*. Ascherson and Graebner say that it is a very peculiar race, which in its typical development very much recalls *A. caninum*, and that it remains constant in cultivation. A form with clear green leaves was described by Marsson as var. *virida*. Both var. *cæsium* and its green variation occur in Surrey.

NOTES ON THE GENUS *POTAMOGETON* OF THE 'LONDON CATALOGUE.'

BY ARTHUR BENNETT, A.L.S.

THE question of what to include, and what to omit, in a *British Catalogue of Plants* is a difficult one. With this genus it was possible nearly to double the names, and perhaps I have not gone far enough? To obviate this somewhat, I have noted some further names, hybrids, &c.

P. POLYGONIFOLIUS Poir. v. CANCELLATUS Fryer. Shetland. Mr. Beeby, the finder, always contended that it was a hybrid. The difficulty is, with what species? Hagström notes: "If not a hybrid, it might be considered a form of var. *lancifolius*. I cannot see how it can be so referred; in it we have a translucent leaved form, in *lancifolius* a thick opaque one. It has been named "*P. coloratus* Horn.," and the habit &c. suggests a hybrid with this, but it is not on record for Shetland. Hagström gets over this in one case by suggesting "that *nodosus* might formerly have occurred in Denmark." This seems hardly a scientific way out of the difficulty.

P. NATANS L. There are two peculiar forms of this occurring in Suffolk. One in a pond on Wortham Long Green, between Mellis and Redgrave, Aug. 5, 1880, *A. B.* This has quite the look of the American *P. pulcher* Tuck., in the leaves, fruit, and especially the roots, which have the "colour warts" on the surface, exactly as in *pulcher*; they are bright, like little pieces of steel let in.

The other from Barningham, Suffolk, July 10, 1886, *Rev. E. F. Linton*. This has the leaves 10 cm. × 6 cm., with 29 nerves; the stipules 13 cm. × 1·5 cm. apiculate. The fruits (dry) are surrounded by a ring, but this may not be so when fresh. I know of no specimen of *P. natans* from any part of the world like this.

P. COLORATUS Hornem. × PUSILLUS L. So named by Hagström as × *P. perpygmæus*. This is the Irish plant that I named *P. lanceolatus* Sm. var. *hibernicus*. I do not agree with Hagström's reference (see Trans. Bot. Soc. Edinb. xxix. 46, 1924).

P. ALPINUS × CRISPUS = × P. VENUSTUS Baagøe. Unfortunately, I omitted this. It occurs in Aberdeen (*Trail*), and near Perth (*Barclay & Matthews*). At present it is only known elsewhere from Denmark.

P. HETEROPHYLLUS Schreb. v. HIBERNICUS Ar. Benn. I have for many years considered the Irish plant not the same as ours, and I have not been able to match it from any part of the world.

"Var. MAXIMUS." The authority for this should be Morong.

P. FALCATUS Fryer. Dr. Hagström refers Fryer's Nos. 1086, 1265, 1275 of above to *heterophyllus* Scheb.; and the No. 1265 he again names "f. *typicus* of *P. nitens* Weber"—a slip, no doubt.

P. VARIANS Morong & Fryer. Hagström merely quotes as a synonym of *heterophyllus*. But there is something different in them, and it should be retained as a var. of *heterophyllus*.

P. LUCENS L. var. CORIACEUS M. & K. *P. coriaceus* of Fryer, who considered this was entitled to rank as a species. Mertens and Koch and Nolte always referred it to *lucens* as a variety. Koch, sending specimens to C. de Candolle in 1824, labelled it "*P. lucens* var. *coriaceus* fl. nostr. a *Ducatus lauenbergii*." But it is an *angustifolius* B. & P. (*P. Zizii* Roth) form, as no *lucens* has floating leaves.

P. LUCENS L. var. ACUMINATUS Fries. Neither Fryer nor Hagström so consider it, but as merely a form; its most extreme state occurs at Buckingham Ferry, Norfolk, with leaves 2 dm. × 1 cm. and apiculate.

P. LUCENS × NATANS = × P. CRASSIFOLIUS Fryer. Hagström accepts the Westmoor specimens, and also 422 and 423 from Cambridge, but doubts the Mepal plant.

P. DECIPIENS Nolte! Hagström divides this into three varieties by the length and breadth of the leaves. A most misleading way, as in May this species will be one variety and in July and August another.

P. ANGUSTIFOLIUS Bertch & Presl (*P. Zizii* Roth). Hagström remarks: "I am persuaded that *P. Zizii* very rarely, if ever, reproduces itself by seed." In ditches near Mepal, in Cambridgeshire, Mr. Fryer pointed out dozens of specimens which he had watched from seed-leaves to flower.

P. PRÆLONGUS Wulf. Varies but little; besides *angustifolius* Hook., there is *brevifolius* Celak.!, *elegans* Tis.!, with leaves 3 dm. × 2 cm., *latifolius* Alpers! with leaves 8 cm. × 4·5 cm. Wulfen's types in the Vienna Herbarium are about our usual plant.

P. PERFOLIATUS L. One of the most variable species in the genus. Three varieties may be named as occurring in Britain: (1) var. *macrophyllus* Blytt!; (2) var. *gracilis* C. & S. (in Britain the species varies with leaves 12 cm. × 1·75 cm.—W. Sutherland-to 1 cm. × 7 cm.—Inner Hebrides); (3) var. *pseudodensus* A. & G. Loch Brotachan, S. Aberdeen, at 2300 ft. 1892, *E. S. Marshall*!

P. ACUTIFOLIUS × PUSILLUS = × P. SUDERMANICUS Hagstr. Sussex, *C. E. Salmon*. Only known elsewhere from one station in Sweden.

P. OBTUSIFOLIUS M. & K. We have a species here that differs in the leaf-apex, from truncate in April to semi-acute in September; yet species have been made on this difference.

P. OBTUSIFOLIUS × FRIESII = × P. SEMIFRUCTUS Ar. Benn. Clunie Loch, E. Perth, v.c. 89, *A. Sturrock*.

P. PUSILLUS L. β. LACUSTRIS Pearsall. Mr. Pearsall made this a subsp., and I quite agree with him.

P. RUTILUS Wolfg. The specimens from Shetland, *G. C. Druce*, closely resemble the *P. cæspitosus* Nolte! This is contained in Nolte's Herbarium (Hansen Herb. Slesv. Holst. 1007) at the British Museum. The Orkney specimens are like Wolfgang's plant!, *Col. H. H. Johnston*, and so are specimens I named *P. pusillus* var. *rigidus* from Orkney. Four counties can now be recorded for this, namely: Stafford!, Anglesea!, Orkney!, and Shetland!

P. FRIESII × PUSILLUS = × P. PUSILLIFORMIS Hagstr. *P. intermedius* Fischer. Stirling, v.c. 86 (named *P. acutifolius*), *Col. Stirling & Mr. Kidston*, 1891; and another specimen from them named "*P. Friesii*? or *pusillus*?"

P. PUSILLUS × PANORMITANUS = × P. DUALIS Hagstr. Pond, Wharfeside, M. W. York, 1890, *J. Jackson*. A difficult plant to identify, but, once seen, it has a facies that shows its origin. Hagström records it from "Shropshire, *Beckwith*, 1886," Herb. Stockholm.

P. PUSILLUS × TRICHOIDES = × P. FRANCONICUS Fischer. Hedge Court Mill Pond, Surrey, *Beeby*, 1886! Accepted by Hagström. What is now wanted is that all British botanists should see whether they possess *pusillus* or *P. panormitanus* Biv. Bern. The best difference is that the stipules (ligules of Hagström) are connate their whole length in the latter, while those of *pusillus* are open.

P. TRICHOIDES C. & S. A curious reference is made by Hagström to our plant:—"Such varieties as *Trimmeri* Casp. and *capillaris* Fischer, recorded as three-nerved, and by this fact separated from the main form, are probably hybrids." *Trimmeri* is our *trichoides*. Then he quotes under the type: "England, Surrey, *Beeby*; Norwich, *Babington*," thus contradicting his own reference.

P. VAGINATUS Turcz., the specimen so named from Shetland, Hagström named *P. filiformis* × *pectinatus* = × *P. suecicus* Hagstr. With this I do not agree, as I doubt the Swedish specimens named "*vaginatus*" being so, as they bear no resemblance to two specimens I possess from the St. Petersburg herb., from the author himself.

× P. SUECICUS Hagstr. I have specimens from Loch of Boardhouse, Orkney, Sept. 1913, *Col. H. H. Johnston*.

P. FILIFORMIS Pers. f. CRINISIMILIS Hagstr. Is a very small specimen of the type, with hair-like leaves. Hagström says, "like a tuft of hair." Loch of Swartmill, Westay, Orkney, 1913, *Col. H. H. Johnston*." This Loch is close to the sea-shore, being only 7 ft. above O. D. in 59° 17′ N. lat. and 2° 55′ W. long. This species and *pectinatus* are very variable, no less than thirty-seven forms being described under the two species. *P. pectinatus* L. is the only species that is recorded from all the botanical divisions of the world.

REPRODUCTIVE MECHANISM IN LAND FLORA.

VI. Sporophylls (*concluded*).

By A. H. Church, M.A., F.R.S.

In this way, given the clue of the leaf originating as a dichotomous ramulus, in which the dichopodium is replaced by a sympodium, and the latter by a monopodium, while the dichotomous venation of the first phase may be replaced by reticulated vascular bundles, the general morphology of early sporophylls is at last placed on a firm basis. Since it is increasingly evident that sporophylls are really the adult stage of the older photosynthetic leaf, and hence all leaves of Land Flora have come much the same way from their diploid algal transmigrants, however diverse these phyla may have been in some respects, as shown in their very characteristic details of vascular anatomy and reproductive gametes. For example, the same line of argument explains the leaf-morphology of the Sphenophyllales, as it does that of the Equisetineæ; the single-veined leaves of Calamites tracing back to a reduction of the 4-times dichotomizing leaf of *Archæocalamites*[1]; while it is equally evident that the sporophylls of these types once followed the same rules, but have long since deteriorated in correlation with their specialization of strobilus-constructions. Much the same applies to the case of Lycopods, the vegetative leaves of which present predominantly one median vein; but a trace of dichotomy is described for vegetative leaves of some Sigillarias (*Sigillariopsis sulcata*)[2], on lines again directly paralleling the double bundle of *Pinus* leaf, which is accepted as the last phase of the dichotomous venation still perfectly retained in *Ginkgo*. Such equally perfect examples of the retention of an older order of dichotomous venation are seen in the sporophylls of Cycads (*Stangeria* ♀, *Encephalartos* ♀), that it is evident that the same rules for leaf-evolution have been independently worked out in Cycads, however advanced in other respects may be the present pinnate fronds of *Cycas* and *Dioon*[3]. Finally, it is sufficiently indicated that the typical leaves of Angiosperms are but the end-phase of monopodial ramification and reticulate venation—*e.g.*, the midrib and alterni-pinnate venation of the leaf of the Cherry Laurel is seen vaguely to recapitulate phases of the sympodial extension of the Fern-frond, and in a manner which does not readily admit of any other explanation[4].

On the other hand, it is important to note that these cases exemplify morphological parallelism in working out a closely similar

[1] Scott (1920), *Studies in Fossil Botany*, i. p. 63.

[2] *Loc. cit.* p. 207.

[3] Coulter and Chamberlain (1910), *Gymnosperms*, 130.

[4] The typical Angiosperm foliage-leaf reduces to a scale-like member, as persisting in non-photosynthetic bud-scales and perianth-segments, but may be greatly complicated by secondary growths as marginal, apical, and intercalary extensions. Principles of the Leaf-architecture in the Flowering Plant are still very vaguely determined.

solution of biological problems, starting with much the same initial equipment. They afford no evidence of direct affinity whatever. Pteridosperms are shown by their anatomy to be wholly distinct from Ferns, yet they work out similarly compound fronds, and attain the monaxial habit, but do not produce strobili. *Cycads* with more advanced frond-leaves and monaxial stems build the finest strobili in the plant-kingdom. Nor does the retention of dichotomous venation in *Ginkgo*, or its vestige in *Pinus*, indicate any genetic affinity whatever with Ferns, other than that they may both have come from similar Algal transmigrants with dichotomous leaf-ramuli. All these cases of parallel adaptation to subaerial conditions can only trace back to separate ancestry in the benthic phase of the sea[1]. Angiosperms, again, as indicated by their special anatomy, have no necessary relationship whatever to either Conifers or Pteridosperms or Filicineæ; they have come the same way, in the same time, and their progression has been carried to further extremes; but mere morphology (of stem and leaf) is no more guide to genetic affinity than the fact that they have equally with Gymnosperms attained the seed-habit, and must have, at one period of their past history, been as freely homosporous as are Eusporangiate Filicineæ to-day[2].

Subsequent morphological changes in these spore-producing members are so closely bound up with wholly new phenomena of heterospory and strobilus-organization, in the ultimate attainment of the dominion of the land, that all such cases may be left for further examination. So far, one can only take notice of sporophylls which retain their original foliar and spore-producing habit, as illustrated by modern Ferns and fossil Pteridosperms, in which the sporophyll is but the culminating phase of the photosynthetic leaf-member. In later stages of plant-progression marked differentiation of members ensues; and in process of strobilus-elaboration the sporophylls deteriorate by the progressive loss of photosynthetic tissue, as they receive food from the rest of the shoot-system. In the last phase, they become mere heterotrophic reproductive appendages, so specialized for the function of maturing and liberating spores, or even protecting the products of germination, that their original status may be wholly masked—or as visible entities they may completely disappear from shoot-morphology (*e.g.*, in many syncarpous ovaries). Hence older land-morphologists, beginning at the modern Phanerogamic end of the story, have persistently confused the issue.

[1] Like looking for the end of the rainbow, the question of origin is being continually pushed further back in the remote past, as morphology deals with life-problems and their solution. The fossil period is much too modern to admit of any claim for views of 'homogenetic' relationship. The obsession for direct 'derivation,' which followed the early misunderstanding of Darwinian doctrine, still cumbers much discussion of plant-morphology; it takes some time for the disciples of derivation to grasp that there is no such thing possible in the present world as tracing a homogenetic line of descent.

[2] The systematist is still handicapped in his search for the 'affinities' and 'cross-affinities' of a past age as wholly pre-Darwinian conceptions: *cf.* Hooker (1873) in Le Maout and Decaisne, Eng. trans., p. 994, on his metaphor of the necklace of parti-coloured beads.

Phenomena of differentiation are, however, to be traced even among homosporous Filicineæ, affording special cases which illustrate the possibilities of further organization even at this horizon :—

(1) The restriction of sporangia to sorus-clusters, which merely continues to a higher degree the initial segregation of meiotangia to build the 'sporangium' itself, may be further effective in relegating the sori to limited tracts of the surface of the leaf-segment or lamina, *e.g.*, commonly marginal or distal, possibly in relation to the optimum position for dispersal of the spores.

(2) A more interesting, if less understood, method follows the phenomena indicated by Bower[1], according to which the basal and distal ends of fronds may be of less specialized order—lagging behind, as it were, the maximum progression seen in the development of the best segments of the middle frond. These ends may be differently utilized, admitting two possibilities, which will be found to have a wider significance in the later specialization of megasporophylls. Thus photosynthetic tissue is diminished and ultimately suppressed in distal pinnules, which are then reduced to mere sporangia-producing ramifications (*Osmunda, Lygodium*), or the same may be effected in the basal pinnules (*Aneimia*, Rhizocarps).

(3) In the limit, whole fronds may be so more or less set apart for the two functions, and *dimorphy* is increasingly established (*Blechnum, Platycerium*).

(4) Of special interest is the case of Ophioglossaceæ, in which one-half of the adult spore-producing leaf is so affected, with the added proviso that the first dichotomy takes place in the *median* plane of the floral diagram, and it is the posterior segment which is utilized for spore-production. Very comparable phenomena, involving dichotomies in planes different from that adopted in what passes as the normal leaf, were characteristic of Palæozoic Zygopterids[2].

The initiation of dimorphism cannot, however, be regarded as a process of 'sterilization.' It is true the vegetative frond loses its sporangial production, but the sporangial tracts equally lose their chlorenchyma. But such dimorphism prepares the way for further specialization of the vegetative (sterile) leaves for other special functions (as bud-scales, perianth-segments, etc.), and admits the recognition of the fact that all the leaves of higher plants, however many in different types of form and function, are all equally derivatives of the primary leaf-ramulus which was spore-producing in the adult and final phase. In the beginnings of land-flora, there was but one type of leaf, that now discerned behind the frond of the Fern.

It would so far appear that older views of the primary morphology of stem, leaf, and root, prevailing to the end of the nineteenth century, were gained wholly empirically from the consideration of higher land-flora alone; while, owing to lack of any precise definition for these organs, there was always a vague impression that other organs of similar primary value might exist, as structures equally *sui generis* (sporangia, emergences, trichomes).

[1] Bower (1923), *The Ferns*, p. 102.

[2] Scott (1920), *Fossil Botany*, Part I., *Stauropteris, Metaclepsydropsis.*

The issue remained wholly confused so long as it was conceived possible for such organs and members to arise somehow, wholly *de novo*, in an intercalated post-sexual sporophyte phase of the land.

The primary relations of stem, leaf, and even root are much more fundamental; they were established definitely in an older phase of marine algal existence. Hence on attaining the dominion of the land, such subaerial sporophytes have had to make the best of their algal equipment, because there was no other possibility. The highest land-plants still express themselves in algal terms of stem, leaves, and root-ramuli; the leaf-ramulus being the member particularly adapted for subaerial photosynthesis, and originally a 'sporophyll' in the adult reproductive condition. However much 'sterile' (juvenile) members may be specialized for other functions (bud-scales, perianth-members), they remain leaf-units, originating in a phyllotaxis-construction. There is no question of any other type of member being ever evolved. Emergences and trichomes are merely minor surface-growths of subsidiary importance: the former representative of older 'adventitious' ramuli produced at any time and at any point, without rule; the latter residual from the filamentous ramalia of the more massive algal somata. Sporangia repeat sori of meiotic tetrads, restricted to photosynthetic laminæ, as the latter attain the dominant position in the plant-body.

While in advanced Algæ the leaf-member is distinctly a lateral ramulus of more or less limited growth, often with considerable capacity for dichotomous ramification[1], to an extent fully comparable with any ferns of modern land-flora[2] and reproductive in the adult condition :—

In Angiosperms the leaves are fully dimorphic, greatly simplified to primary scale-appendages, in which the attributes of the quasi-circle primordium are increasingly emphasized in bud-construction. Stages of phylogenetic recapitulation are lost in favour of direct development. Features of secondary ramification and the correlation of growth-rates in different regions are the means of further complication of the adult photosynthetic member. The sporophylls are heterotrophic, as well as heterosporous, and reduced to limiting expressions.

On the other hand, the special interest of the Fern-frond centres in the fact that it is so strikingly intermediate between these extremes;

[1] The issue is confused by the use of the term 'Phylloclade': *cf.* Oltmanns (1922), *Algæ*, p. 203.

[2] Oltmanns (*loc. cit.*), p. 200: *Landsburgia, Anthophycus, Turbinaria.*

Those unfamiliar with the marvellous range of growth and form attained in the frond-morphology of sea-weeds may compare the *Phycologia Australica* of Harvey (1860) for fronds of Florideæ or leaf-ramuli of Sargasseæ—*cf.*:

Sargassum decurrens, cxlv., with bipinnate fronds of fern-habit, the dichotomy giving the 'fertile' continuation in the same plane as the basal photosynthetic lamina.

S. lacerifolium, ccviii., fronds 2–4 ft. long, giving bilateral ramifications, the lateral segments of which may be forked 25 times (scorpioid dichopodium) in the 'fertile' tract: the basal ramification gives a photosynthetic lamina and pneumatocyst; end-ramuli ('fertile') are triquetrous segments of an older order.

bridging the gap between them, by emphasizing the oldest methods of dichotomous ramification, the attainment of the monopodial habit and a compacted lamina with reticulate venation. Existing examples present all gradations of variation, size, ramification, progression, and even reversion, or again a mingling of factors of different grade, which marks them out as affording the clue to all the older prototypes of the leaf-members of Land-Flora.

SHORT NOTE.

Ranunculus hyperboreus Rottb. in Pleistocene Beds at Bembridge, Isle of Wight.—Some peaty material sent by the late Mr. F. Morey from a sewer-trench near Bembridge, Isle of Wight, yielded the following plant-remains:—*Ranunculus hyperboreus* Rottb., *Rubus Idæus* L., *Betula* (*alba* L.?), *Picea excelsa* L., *Scirpus* sp., *Amblystegium* (? *A. filicinum* L. or *A. serpens* L.).

The *Picea* was determined, from wood, by Mr. W. N. Edwards, and the *Amblystegium* by Mr. H. N. Dixon, who stated that the range of this moss was a very wide one.

The predominating species was *Ranunculus hyperboreus*, an essentially arctic or sub-arctic plant, which does not descend below the Dovrefjeld Mountains in Europe and Labrador in America. The other species listed have a more southern range, but all overlap *R. hyperboreus* at their northern boundaries.

The presence of *R. hyperboreus*, therefore, affords evidence of a former climate in the Isle of Wight comparable with that of Lapland or Northern Russia at the present day. The fact of a cold climate is in itself sufficient to place the deposit in the Pleistocene.

A fuller account of the flora is published in the *Proceedings of the Isle of Wight Natural History Society*, vol. i. pt. v. 1925, pp. 292–4.—E. M. Reid and M. E. J. Chandler.

REVIEWS.

Wilhelm Hofmeister: the Work and Life of a Nineteenth Century Botanist. By Dr. K. Von Goebel, with Biographical Supplement by Frau Professor Ganzenmüller (*born* Hofmeister). Translated into English by H. M. Bower, M.A., and edited botanically by Professor F. O. Bower, F.R.S. 8vo, pp. xii, 202, with portrait, facsimile letters, and three figs. Ray Society: London, 1926.

This volume represents the annual Monograph for the eighty-second year (1925) issued by the Ray Society, which, in 1862, made available for English readers Hofmeister's classical work, the *Comparative Researches on the Germination, Development, and Fruit-formation of the Higher Cryptogams and the Seed-formation of the Conifers*. The original German edition of the *Work and Life* appeared in 1923. Dr. Von Goebel is the last surviving pupil of Hofmeister's; he worked under him at Tübingen, where Hofmeister spent the last few years of his professional life. "The endeavour in some degree to discharge a debt of gratitude is the author's motive in writing this book" is the opening sentence of the original edition. And, apart from the personal relationship, no botanist could more appropriately review the work of Hofmeister and rightly estimate its value and influence than the recognised leader in modern botanical morphology. Equally appropriate was it that Professor F. O. Bower, whose high admiration for Von Goebel and his work is well known to British botanists, should play an important part in the presentation in English of the biography.

Biologists, as well as botanists, will welcome this appreciative and critical review of Hofmeister's work, and none the less because they may be familiar with its general results.

Hofmeister began publishing in 1847, and Von Goebel in a useful introductory chapter describes the position of botany at that period. Schleiden's *Grundzüge der Botanik* had shown the way to the study of structure and developmental history, and this work supplied Hofmeister with his inspiration; the form of the ovule, the details of fertilization, and the method of seed-formation in the Angiosperms were elucidated, and, as the Bowers remark in their preface, "Hofmeister leapt into fame by solving a much-agitated question—the Genesis of the Embryo in the Phanerogams." In each chapter, dealing successively with the various phases of Hofmeister's work—Embryogeny, the "Comparative Researches" already referred to, which revealed the striking analogy between the higher Cryptogams and the Conifers, the developmental history of the lower Cryptogams, Causal Morphology, Cell-doctrine, and experimental-physiological works,—Von Goebel briefly recalls previous work on the same subject and the views current at the time, thus recreating the contemporary atmosphere for the picture he is about to sketch. A brief concluding chapter gives an estimate of Hofmeister as a teacher. To the many who wanted merely a smattering of the subject his lectures did not appeal, but for him who loved his science they were not only a gain but a delight. "He offered an uncommon wealth of material—too rich for the 'many,'—giving it clearly and objectively as in his writings." In making preparations he had fabulous skill; with a remarkably strong but short sight, he spurned the use of a lens and would make wonderful preparations from a single ovule picked out from an ovary and held between finger and thumb.

Of very great interest is the sketch of her father's life, given by Frau Professor Ganzenmüller, the seventh in order of his nine children. Hofmeister was born at Leipzig in 1824; at the age of fifteen he took a post in a music-shop at Hamburg, but two years later (1841) joined his father's business (that of a publishing bookseller), and turned his attention to botany as an occupation for his leisure. The fact that six years later, though still actively engaged in business, he published the first of his important papers on fertilization and embryology, indicated his remarkable power of work and brilliant mental equipment; these publications were followed in 1851 by the epoch-making *Comparative Researches*.

His holidays were merely opportunities for closer application to

botanical work away from his business, as well as for making acquaintance with new scenes and the prominent botanists of his day. His letters to his wife during these absences are full of interest. At the age of thirty-nine (1863) the bookseller botanist was called to the Chair of Botany at Heidelberg, and nine years later accepted a call to Tübingen, where he succeeded Hugo von Mohl. The later years of his time at Heidelberg were clouded by the prolonged illness and death of his wife, and the few years of his life at Tübingen were saddened by the loss of three of his children. Endeavouring to find solace in unremitting work, he wore himself out and after two seizures in the spring of 1876 was compelled to resign his professorship, and a few months later died in his fifty-third year. Of his nine children only three daughters survived him; to his great grief, he left no son to carry on his name. A. B. R.

A Catalogue of British Scientific and Technical Books. Supplement. Arranged by DAPHNE SHAW. Demy 8vo, pp. viii, 166. British Science Guild: London, 1926. Price 2*s.* 6*d.* net.

THE original Catalogue, published in 1925 (see *Journal of Botany*, 1925, 343), contained the titles of 9,515 books in current Catalogues of British publishers at the end of 1924; the Supplement gives 2,258 additional titles of books published in 1925. It has been compiled from lists issued monthly as Supplements to *Nature*. If sufficient support is forthcoming to justify the issue of future Supplements annually, arrangements will be made for their publication about March of each year. The sections are arranged alphabetically, from Agriculture to Zoology, and the titles in each section are in alphabetical order under names of authors. A table of contents and an Index of authors enables a book to be found without difficulty. Though not quite complete, to judge from the section in Botany, which contains forty-one entries, the list is a useful one.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY. The Annual Dinner was held at the Criterion Restaurant on Wednesday, October 27th; the attendance numbered about 80 Fellows and guests. It was followed by a reception by the President, Dr. A. B. Rendle, at the Rooms of the Society in Burlington House. A large number of Fellows and guests were present. Some interesting exhibits were shown in the Library, and a lecture was given by Prof. H. Graham Cannon on "H. C. Sorby as a Zoologist." The lecture was illustrated by a series of Sorby's lantern-slides, comprising beautifully-prepared mounts of marine invertebrate animals.

The first General Meeting of the session was held on Thursday, Nov. 4. Mr. G. Tandy gave an account, illustrated with diagrams, of abnormal fruiting branches of Sweet Chestnut (*Castanea vulgaris*), found by Mr. W. P. J. Le Brocq, F.L.S., near Brecon.

The specimens showed catkins which were wholly female, whereas usually only a few female flowers are found at the base of an androgynous catkin. The occurrence of such catkins has been recorded several times, and certain trees have been found consistently to produce them.

Mr. T. A. Sprague made a communication, illustrated by lantern-slides, summarizing the results of three visits paid to Wistman's Wood, Dartmoor, in May 1926. Several additions were made to the flora, as recently recorded. *Salix cinerea* was found in the northern wood, a large patch (about 25–30 × 15 ft.) of *Salix aurita* was found in the central wood, and a hybrid between these two species occurred by the river-bank below the wood. A single small bush of *Corylus Avellana* was discovered in the central wood.

Among the epiphytic lichens collected were *Ramalina fastigiata* and *Cladonia Floerkeana* var. *carcata*, which are additional to those recorded by Miller Christy. Among those growing on boulders or on the ground were *Cladonia Floerkeana* and *Sticta fuliginosa*, which are also additional. The dark cavities between the boulders contained a varied Cryptogamic flora including the two filmy ferns, *Hymenophyllum tunbridgense* and *H. peltatum*, six mosses, *Eurhynchium prælongum*, *Mnium hornum*, *Plagiothecium elegans*, *P. undulatum*, *Pterygophyllum lucens* and *Polytrichum formosum*, a liverwort, *Diplophyllum albicans*, and a lichen, *Platysma glaucum* var. *fallax*.

Pyrus Aucuparia is much more abundant than has been indicated, and might be described as subdominant, at least in the southern and central woods. It occasionally occurs as an epiphyte on the oaks. The *Sedum*, which is so common in the wood and on the open moor around it, is *S. anglicum* (as recorded in Rowe's 'Perambulation of Dartmoor,' ed. 3, p. 203). It has recently been erroneously listed as *S. acre*. *Athyrium Filix-femina*, the occurrence of which was questioned by Miller Christy, was found to be fairly abundant. *Corydalis claviculata* was extremely abundant on boulders throughout the wood.

The data obtained in three visits to the wood were sufficient to show that it would well repay more intensive floristic and ecological study than has hitherto been devoted to it.

In the discussion that followed the reading of Mr. Sprague's paper, the President asked if there was any evidence of the wood decreasing in area. Dr. D. H. Scott suggested the possibility of the wood being a relic, spared, on account of its comparative inaccessibility, from the ravages of tinners. Mr. H. N. Dixon referred to the luxuriant growth of the moss *Antrichia curtipendula* in the wood, and its abundant fruiting.

Mr. H. N. Ridley pointed out that Wistman's Wood was an island of wood, of which all the trees were brought by birds, rooks, crows, or pigeons. The pedunculate oak was remarkable, and Clement Reid had shown that rooks generally carried its acorns by a twig, as the easiest way to carry them. Nuts may have been brought to the wood by pigeons chased and killed by hawks before they got deep

enough into the wood. Dr. Dalziel remarked that hawks and pigeons were observed in the wood, but only carrion-crows nested in it.

Mr. J. Ramsbottom showed a series of lantern-slides of photo-micrographs of orchid seedlings:—*Epidendrum*, *Stanhopea*, *Vanda*, *Calanthe*, *Miltonia*, *Bletia*, *Disa*, and *Odontoglossum* together with some bigeneric hybrids. All of these showed fungal infection of the same type—a restricted distribution of fungus with characteristic growth and "clumping."

Census Catalogue of British Mosses.—Mr. J. B. Duncan has prepared for the British Bryological Society a second edition of the *Census Catalogue of British Mosses*, with list of the Botanical Vice-Counties and their boundaries, and lists of sources of records. The list shows the comparative frequency of each species and variety by means of a census indicating its distribution through the 112 Watsonian Vice-County Divisions of Great Britain, and R. Lloyd Praeger's 40 county divisions of Ireland, also the Channel Islands.

Mr. H. N. Dixon supplies an Introduction in the form of some explanatory notes, in which he refers to the hope expressed on the issue of the First Edition (1907) that "in the course of a few years it may be possible to compile a fairly accurate and complete statement of Moss Distribution in Britain." This hope has not been realized, as there are still several Vice-Counties of which our knowledge of the Moss Flora is very incomplete.

Mr. Sherrin has prepared, in the form of a Supplement, a list of the Sphagna arranged on Warnstorf's system.

Copies of the Catalogue (price 2*s.*, or 2*s.* 6*d.* interleaved) may be had from Mr. W. R. Sherrin, A.L.S., South London Botanical Institute, 323 Norwood Road, London, S.E. 24.

The Study of Vegetation.—Under this title, Dr. E. Pickworth Farrow has reprinted, with additions, in the form of a booklet (Blackie & Son, 1926, price 2*s.*) an article published in *Discovery* (September 1925). The purpose of the article was to stimulate readers to undertake research work upon any area of natural vegetation, similar to that described by the author in his recent book on Breckland (*Plant Life on East Anglian Heaths*). The author gives suggestions for starting work *de novo*, and incidentally illustrates the far-reaching effect of one factor—in this case, rabbits—on the alteration of the flora of a given area. The proceeds from the sale of the booklet go towards the maintenance of the Coastal Research Laboratory and Bird Sanctuary at Blakeney Point, Norfolk.

We are pleased to note that the President and Council of the Royal Society have awarded the Darwin Medal to Dr. D. H. Scott for his contributions to palæophytology, particularly in relation to the Coal-period. The Darwin Medal, which is awarded every alternate year, was initiated in 1890. In 1906 Dr. Scott was awarded a Royal Medal.

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For Classified Articles, see—Obituary; Reviews. New genera, species, and varieties, and new names are distinguished by an asterisk.

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Supplements.

(The Editor acknowledges the help of Mr. J. ARDAGH, Department of Botany, British Museum, in preparing the Index.)

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