THE DISTRIBUTION AND ECOLOGY OF SCHEUCHZERIA PALUSTRIS L.

By W. A. Sledge.

During two weeks botanising based on the inn at Rannoch Station, Perthshire, in August 1946, my acquaintance with *Scheuchzeria palustris* on Rannoch Moor was renewed and an opportunity was afforded of making some observations on its local distribution and ecology. In recording these observations it seems appropriate also to bring up-to-date the facts relevant to the history of its occurrence in Britain and its distribution abroad.

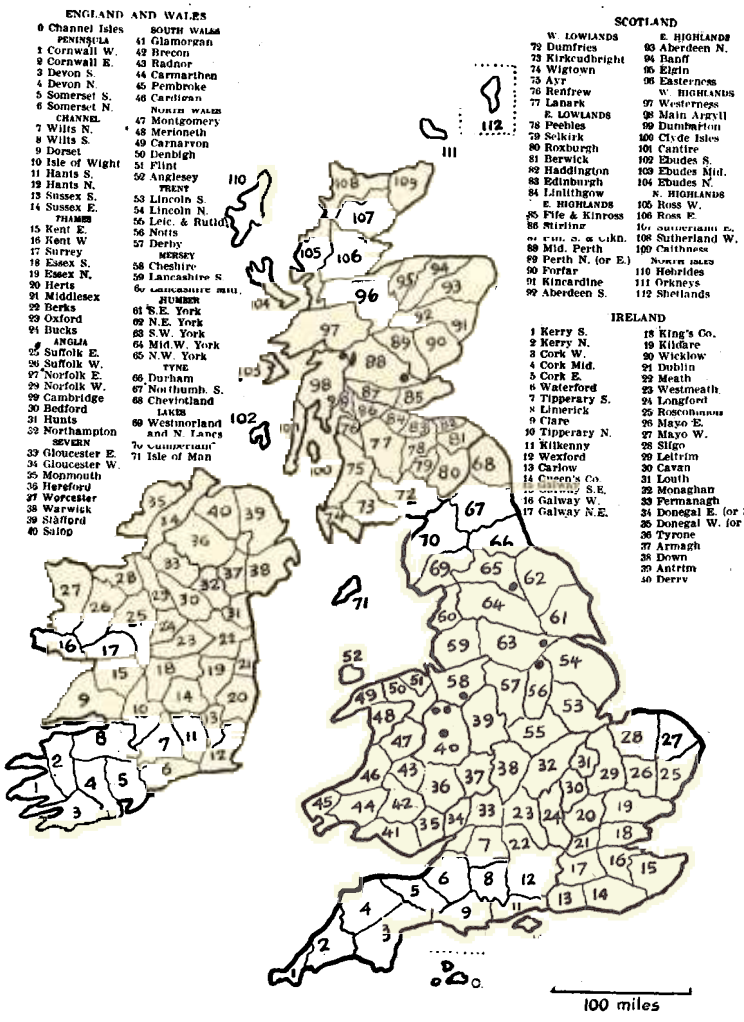
BRITISH DISTRIBUTION

Druce (1932) records *Scheuchzeria* as having formerly occurred in six English counties and nine vice-counties. In Scotland it is cited from Perth and Argyll which now represent its only existing British stations, for, with the exception of one doubtful record, it has not been seen in any English locality for half a century. In 1904 Arthur Bennett collected together all the information then available about the past and present distribution of this species in Britain. Since then new information has accumulated and the following summary of the distributional history of *Scheuchzeria* in Britain is intended mainly to supplement and, where necessary, to correct and amplify the data in that paper. From this it will be seen that of the recorded English counties reliable evidence backed by herbarium specimens is only available for Shropshire, Cheshire, South-West and North-West Yorkshire. The records for South-East and Mid-West, Yorkshire I consider erroneous, and those from Lincolnshire and Northumberland very unsatisfactory.

Shropshire (40)

J. Jeudwine's discovery of *Scheuchzeria* on the moss adjoining Bomere Pool near Shrewsbury in 1824 furnished the second locality for the species in Britain. He is also said to have found it at Shomere adjoining Bomere in the same year but no later reference to this locality is known. At Bomere the plant persisted for over 50 years, the last record of its having been seen there being in 1881. At Welshampton Moss O. M. Fieldon found three specimens in 1866. It had vanished from this station twenty years later but had presumably been seen there by Fieldon on other occasions subsequent to his discovery in view of his statement made in 1898, that he had not seen it there " within the last fifteen or twenty years." Another Shropshire station was added in 1884 when W. E. Beckwith, who knew the plant at Bomere and had been one of those who last saw it there three years previously, discovered it at Ellesmere. No further information is available about this station except that it was searched in vain for *Scheuchzeria* by E. F. Linton in 1892.

Probably *Scheuchzeria* was at one time widespread on the Shropshire mosses, for Hardy (1939) found fairly numerous remains of the stem and rhizomes at Fenn's Moss, embedded in *Sphagnum cuspidatum* near the base of the upper undecayed *Sphagnum* layer, and at Bettisfield one rhizome was found 190 cm. below the peat surface.



DISTRIBUTION OF *SCHEUCHZERIA PALUSTRIS* L.
excluding dubious records.

North Lincoln (54)

Scheuchzeria is not included in Woodruffe-Peacock's *Check List of Lincolnshire Plants* (1909), but in a discussion of its occurrence at Thorne Waste in South-West Yorkshire (1921) he concluded that it probably grew on the Lincolnshire side of the county boundary which crosses the moor on the east side not far from the pools where it formerly grew in some quantity. It is known to have been present in more than one of these pools but, though the probability of its having once grown on both sides of the border is undeniable, no specimens or definite records from Lincolnshire are known. Peat cutting and warping led to its extermination long ago in this district.

Nottingham (56)

The former existence of the plant in Nottingham rests upon a report by M. J. Berkeley sent to H. C. Watson in 1844 recording its occurrence in a marsh—thought to have been Everton Carr—in the north of the county. No later record and apparently no specimens from this locality are known.

Cheshire (58)

In Cheshire it was first found at Wybunbury Bog in 1844 by G. Pinder, and there is a sheet in E. S. Marshall's herbarium at Cambridge collected there in 1895 though it was then already supposed to be extinct. Many botanists have since searched for it there without success.

South-East York (61)

The entry for the East Riding is based on specimens in the Col. Jas. Brodie collection in the herbarium at the Royal Botanic Gardens, Edinburgh, received from James Dalton and localised, apparently in Brodie's handwriting, "Found by Mr Dalton near Malton, Yorkshire." Terrington Carr (which is in v.-c. 62 not 61) was suggested by Bennett as the locality from which these specimens may have come, and this swamp, which at one time yielded the equally rare *Paludella squarrosa*, is certainly the most likely station in the Malton area to have produced *Scheuchzeria*. But the Carr was visited so frequently by botanists, including Richard Spruce, Matthew Slater, J. G. Baker and William Foggitt, before its partial drainage in 1860 led to the disappearance of some species, that it is impossible to believe they all overlooked the plant. As moreover no specimen from any station other than Leckby Carr exists in Dalton's own Collection at the York Philosophical Society and none other of the numerous gatherings distributed by Dalton bears this localisation, the supposed Malton station may surely be disregarded as an error probably caused by the transposition of labels.

South-West York (63)

In Lees' *Flora of West Yorkshire*, S. Appleby is credited with the first discovery of *Scheuchzeria* at Thorne Moor in 1832, but it is uncertain whether Appleby or Robert Harrison was the discoverer as both of them are now known to have collected the plant there in 1831. It was last seen on Thorne Moor in 1870 by F. A. Lees and W. Todd.

Mid-West York (64)

In the first supplement to *Topographical Botany* (1905), Mid-West Yorkshire was added as a new vice-county for *Scheuchzeria*. This record was based on a specimen in a fascicle of Don's Herbarium Britannicum issued in the early part of 1806, labelled " Marsh near Wetherby. Rev. J. Dalton." But apart from the evidence afforded by Dalton's own collection already referred to, there can scarcely be a doubt that Leckby Carr, which is situated some seventeen miles north of Wetherby, was the locality from which these specimens came. In the later years of the 18th and early part of the 19th century, Wetherby, situated on the Great North Road, was an important road centre where travellers changed stage coaches. " Near Wetherby " would therefore be a legitimate approximation implying, in the travel phraseology of the time, the nearest convenient point from which to start out; much as we should now say " near Thirsk " as indicating the nearest main line railway station of any size to which travellers from a distance would take train for Leckby.

North-West York (65)

Dalton's discovery of *Scheuchzeria* at Leckby Carr near Boroughbridge was the earliest British record for this species. The date of the discovery is given in the first edition of *English Botany*, and elsewhere, as 1787, but it would appear that Dalton did not realise the significance of his discovery until many years later. He evidently sent out neither specimens of nor information about the plant until nearly 20 years later, for no 18th century specimens from here are known and the species is not included in J. E. Smith's *Flora Britannica* (1800-1804). The oldest gathering in Dalton's collection at York is dated 1807. Numerous specimens have been distributed from this locality in which the plant persisted longer than in any of its other English stations. There are specimens from here collected in 1870 in the herbarium of the York Philosophical Society and it was gathered there the following year by George Webster of York. In Slater's *Flora of Ripon* published in 1881 it was stated to be then extinct, and a note on *Scheuchzeria* in one of F. A. Lees' manuscripts gives 1876 as the last year in which it was seen at Leckby.

In F. J. Lewis's ecological survey of the vegetation of the north Pennines (1904), *Scheuchzeria palustris* is listed as a constituent of *Molinia* grass heath near the Hunder Beck in Balderdale. It is somewhat surprising that it should be listed from this community and not from the *Sphagnum* bogs which Lewis describes from higher up the same dale. It is even more surprising that it should be included along with several other species as a " typical " member of this community without any qualifications as to frequency, when rare or infrequent members of other associations listed in the same paper are duly noted as such. These circumstances together with the inclusion of such improbable species from the area dealt with as *Ranunculus parviflorus*, *Ulex nanus* and *Vicia lathyroides*, and the citation of *Sesleria caerulea* as a component of *Nardus* heath in association with *Vaccinium Myrtillus*

and *Juncus squarrosus*, do not inspire confidence in the reliability of Lewis's determination. At the same time it must be conceded that the *Sphagnum* bogs of the Stainmoor region constitute what is probably the most likely area in England in which this species might yet be found.

Northumberland North (68)

I am indebted to Mr G. W. Temperley for the following information relative to the occurrence of *Scheuchzeria* in this county. Jas. Hardy (1889) quotes a letter from T. H. Archer-Hind of Newton Abbot, which appeared in *The Standard* of Feb. 12th, 1889, which runs "I have before me a dried specimen of *Scheuchzeria palustris* which was gathered four or five years ago in Northumberland. For obvious reasons I refrain from specifying the exact locality, but it was growing within a few hundred yards of the sea." A. H. Evans (1916) later wrote "This record is misleading. The present writer's old friend, Mr T. H. Archer-Hind informed him that only a single specimen was found "on a carriage drive at Beadnell Vicarage." How it got there is a mystery." And a mystery it still remains, with no subsequent record either from Beadnell (which is in vice-county 68 not 67 as given in the *Comital Flora*) or elsewhere in the county to support this slender claim for its inclusion in the Northumberland flora.

Mid Perth (88)

In Scotland *Scheuchzeria* was first found in the White Myre of Methven near Perth by Mr Duff in 1833. Here it was at one time abundant and many gatherings were made and distributed by John Sim. He collected it there for the last time in 1874 about which time a large colony of black-headed gulls settled in the bog bringing about a marked change in the vegetation. Herbarium specimens at Edinburgh dated 1877 are the latest known from this station.

At Rannoch Moor it was discovered by the late A. H. Evans in 1912, and this locality has since been visited by all who wished to see the living plant. As it may conveniently be seen not far from the road which terminates at Rannoch Station, probably few of the many botanists who have seen it here have troubled to walk further than necessary over this soaking moorland. In view of the large area of the moor and the innumerable lochans and permanently wet bogs situated between Rannoch Station and the south end of Loch Laidon, it seemed improbable that *Scheuchzeria* would be confined to the area adjacent to the road terminus and the opportunity afforded by staying in the vicinity enabled an extended search to be made over the moor. This expectation was soon confirmed for, in suitable habitats it proved to be widespread and indeed a characteristic component of many of the wettest *Sphagnum* bogs. South of the Gearr Ghaoir as far as the Dubh Lochan close to the Perth-Argyll border, it is distributed intermittently but I did not meet with it on the Argyll side of the border, either on the east side of Loch Laidon or on the moor between the two southern forks of the lake.

ARGYLL (98)

The rediscovery of *Scheuchzeria* in Scotland following its disappearance from Methven Bog was made by G. W. Scarth on July 18, 1910. A preliminary note recording its discovery on "Rannoch Moor" was followed by a longer notice (1911) in which the locality is not specified beyond the, no doubt intentionally, vague designation "Rannoch Moor in the Perth-Argyll area." That more precise information was sent to Druce is evident from the addition of Argyll to the note inserted by him in the current issue of this Society's Report (1911). In 1912 Druce distributed specimens through the Exchange Club. These were labelled "Moor of Rannoch, Argyll," and were said to be from Scarth's locality. Mr Chapple informs me that the label on Druce's own sheet of this gathering gives the locality as "Moor near Lochan a Claidheim, Argyll, 1150 ft." It is understandable that at this time security reasons should have prompted so misleading a localisation as that which appeared in Scarth's notes and on the labels of the distributed specimens. The natural assumption would be that the plant was found somewhere to the south of Loch Laidon, but the lochan in question which forms the meeting place of the Perth, Argyll and Inverness boundaries, lies at the head of the Blackwater Valley and only the broadest of interpretations could qualify it for inclusion in Rannoch Moor.

It was between this lochan and the head of the Blackwater Reservoir that Professor I. Manton, Dr E. M. Lind, Mr D. J. B. White and I saw *Scheuchzeria* growing in habitat conditions identical with those at Rannoch. The precise station was probably not the same as that in which Scarth and Druce had collected it. As similar expanses of bogland lie to the north of the Black Water further search between here and Corrour would doubtless establish its presence in Western Inverness.

EXTRA BRITISH DISTRIBUTION

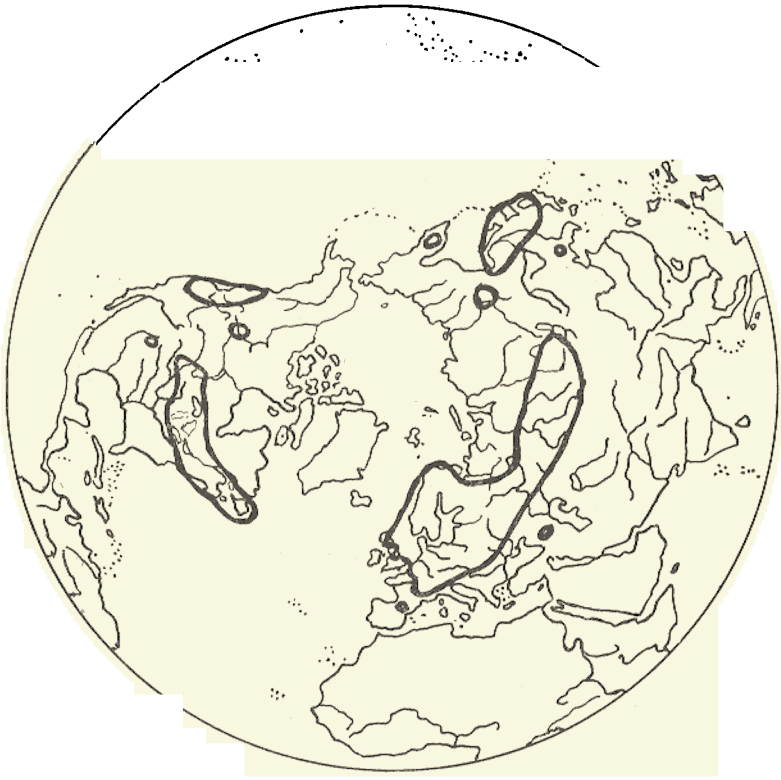
Scheuchzeria has a boreal circumpolar distribution. Its area lies mainly between latitudes 40°-60° N. though in Scandinavia and Finland it spreads north of the Arctic Circle. It is absent from Greenland and Iceland, from a wide area of continental North America and from parts of Eastern Asia.

In Europe it is found throughout Scandinavia, Finland and the Baltic countries southwards in often widely scattered localities through Belgium, Alsace, the Vosges, Jura, Dauphiné and Auvergne to the Pyrenees, and eastwards through south Tyrol, Hungary, north Rumania to the Ukraine, and thence, with a southern outlier in the Caucasus, to the Urals and into Asiatic Russia as far as Lake Baikal. A gap east of Lake Baikal may represent discontinuity in distribution or merely inadequate information about its eastern Siberian range.

In the far east it is recorded from Kamtchatka, the mountains of north and south Manchuria, the Amur Province, Sakhalin and the northern islands of Japan, Hokkaido and north Honshu, and the Southern Kurile Islands.

In America its area extends from Newfoundland west to Manitoba and in Central Alberta and south to New Jersey, Pennsylvania, Northern Ohio, Northern Illinois, Northern Iowa and Nebraska, with an outlier in New Mexico, and in Pacific N. America in British Columbia, Washington and California.

The accompanying map is based on that published by Hultén (1937) and shows the approximate limits of its world distribution. Within the areas delimited there exist many minor discontinuities.



ECOLOGY

Scheuchzeria palustris is always a plant of permanently wet bogs on peaty moors at low or moderate elevations. Its high and constant water requirements preclude its growth in any habitat subject to drying out during any part of the year and it is therefore one of the first species to disappear on drainage.

At Rannoch it grows in depressions on the undulating surface of the moor filled with spongy expanses of *Sphagnum* bog or open pools of water fringed by semi-floating mats of bog-moss and sedge. In such places *Scheuchzeria* is a frequent and characteristic species, usually on ground occupied by a continuous *Sphagnum* cover and very often partly submerged by the sides of runlet channels draining through the swamps, but sometimes growing on bare, black, semi-liquid, organic mud round the edges of peaty pools. The species most frequently associated with it are *Drosera anglica, D. rotundifolia, Menyanthes, Narthecium, Scirpus caespitosus, Eriophorum angustifolium, Carex lasiocarpa, C. limosa, C. pauciflora* and *C. rostrata* with *Sphagnum inundatum* and *S. papillosum*. A complete list from nine localities is given in the table appended. My thanks are due to Professor W. H. Pearsall, F.R.S., for supplying some of the data and for the identifications of the *Sphagna*. In 1, 4 and 8 an open substratum of black mud predominated. No *Sphagnum* collections were made from 7 and 9.

	1	2	3	4	5	6	7	8	9
Drosera rotundifolia		+	+		+	+	+		+
D. anglica		+	+	+	+	+	+		
Calluna vulgaris									+
Erica Tetralix		+							
Menyanthes trifoliata	+	+		+	+			+	+
Myrica Gale		+		+		+			
Narthecium ossifragum		+	+			+	+	+	+
Juncus bulbosus									+
Scheuchzeria palustris	+	+	+	+	+	+	+	+	+
Potamogeton polygonifolius	+								
Scirpus caespitosus						+	+	+	+
Eriophorum angustifolium	+		+		+	+		+	+
Rhynchospora alba							+		
Carex rostrata		+	+		+				+
C. lasiocarpa	+	+		+					
C. limosa	+	+	+	+	+	+	+	+	
C. curta							+		
C. echinata							+		
C. pauciflora			+		+		+		
Agrostis canina							+		
Equisetum limosum	+								
Sphagnum cuspidatum var. *plumosum*		+	+						
S. cymbifolium					+				
S. imbricatum		+	+		+				
S. medium					+				
S. papillosum		+	+		+	+		+	
S. amblyphyllum						+			
S. rubellum			+						
*S. inundatum**	+	+	+	+	+	+		+	
S. tenellum			+						

*Including vars. *robustum* and *cristatum*.

Of the flowering plants associated with *Scheuchzeria, Carex limosa* was particularly noticeable. Only once was the former found without the sedge, and it very soon became evident that it was unprofitable to look for *Scheuchzeria* where *C. limosa* was not present. The constant

association of these two species is not only a feature of the existing Scottish stations but also applied to the former localities at Leckby Carr, Thorne Moor, Wybunbury Bog and Bomere: indeed the essentially identical ecological nature of all the British stations for *Scheuchzeria* is indicated by the recurrence of the same species in all its scattered stations as shown in the following table:—

	Bomere.	Wybunbury.	Thorne.	Leckby.
Drosera rotundifolia	+	+	+	+
D. anglica		+	+	+
Menyanthes trifoliata	+	+	+	+
Narthecium ossifragum	+	?	+	?
Rhynchospora alba	+	+	+	+
Carex rostrata	+	+	+	+
C. lasiocarpa	+	+*	+	
C. limosa	+	+*	+	+

*Recorded by Druce (1907), not in *Flora*.

These species invariably accompany *Scheuchzeria* in its continental stations, and none more constantly than *Carex limosa* and *Rhynchospora alba*: Hegi (1906) adds "especially *C. limosa*" to his list of associates, and all save *Narthecium* are regular co-partners in the *Sphagnum* bogs of Central Russia, described by Katz (1926). Rannoch Moor is somewhat exceptional in that *Rhynchospora* is a rare plant which was only seen there in small quantity in one bog.

The disappearance of *Scheuchzeria* from all its English stations, though greatly accelerated by human interference, and especially by drainage, is probably not solely due to this cause but in part to the normal successional changes in the *Sphagnum* bogs it inhabits resulting from the accumulation of organic matter and consequent development of relatively dryer habitat conditions, and also partly perhaps to post-glacial climatic changes. This is attested by the occurrence already referred to of stems and rhizomes in two Shropshire mosses, in one of which the remains were found over six feet beneath the present peat surface. Clapham and Godwin (1918) have recently found it in abundance in the peat of the Somerset levels where it must formerly have been extremely common and an important peat-forming plant. In Denmark, also, where *Scheuchzeria* is now a plant of great rarity, Jessen (1935) has described peat deposits in north Jutland in which remains of the plant are so abundant as to form "*Scheuchzeria* peat" at an horizon attributed to sub-Atlantic age. Other *Scheuchzeria*-peat deposits have been described from Holland (Eshuis, 1946), north-west Germany (Overbeck and Schneider, 1938), southern Bavaria (Paul and Ruoff, 1927), Württemberg (Bertsch, 1930) and Baden (Broche, 1929).

The extreme rarity of *Scheuchzeria* in Britain makes any further ecological comparison of its habitats impossible and we must look abroad for further information as to its requirements and associates. Nordhagen's (1943) recent ecological survey of Norwegian mountain vegetation contains some interesting data relating to *Scheuchzeria* which he regards as a characteristic species of very oligotrophic acidophil

Sphagnum-rich grassmoors developed on topographically determined moorlands with a high water table. Nordhagen classifies the Norwegian grassmoors into five types, viz., three eutrophic-mesotrophic and two mesotrophic-oligotrophic types; the former developed on relatively fertile, base-rich soils, the latter on soils poor in nutrients, poor in calcium and strongly acid in reaction. These mesotrophic-oligotrophic types, collectively referred to as *Scheuchzerietalia* or, popularly, as waste grass moors (ødegrasmyrer), and which correspond to the Swedish high moor (högmossar), are distinguished as " black moor " or *Stygio-Caricion limosae*, and " pale moor " or *Leuko-Scheuchzerion*. Species characteristic of *both* types of moorland are:—*Scheuchzeria palustris*, *Rhynchospora alba*, *Carex limosá*, *C. paupercula*, *C. lasiocarpa*, *C. rostrata*, *Eriophorum angustifolium*, *Drosera anglica*, *Menyanthes*. The first two species occur principally at lower elevations, being near their climatic limits in the subalpine zone. Species with an increased concentration in the *Stygio-Caricion limosae* and regarded as distinguishing species for this formation are, in the lower regions, *Rhynchospora fusca*, *Drosera longifolia*, *Lycopodium inundatum* and *Utricularia intermedia*; and from the lowlands to the mountains, *Juncus stygius*, *Carex livida* and *C. chordorrhiza*. Most typical of the *Leuko-Scheuchzerion* are *Eriophorum vaginátum*, *Scirpus cæspitosus*, *Carex pauciflora* and *Rubus Chamaemorus*.

The type of vegetation in which *Scheuchzeria* occurs in Norway and the plants associated with it are thus closely parallel to those in Britain. The general features of a *Scheuchzeria* moor are strikingly brought out in the following descriptive passage (p. 519) by Nordhagen. " Linné, who had great talent at expressing the habitats of plants in striking Latin words, used the adjective *stygius* for individual moor plants which occur in desolate and frightening, often dangerous moors. The word is derived from the Styx, the river of the underworld, and in using the same word for the name of the formation I have done so because the most characteristic formations undoubtedly affect the beholder in the same way that they did Linnaeus. Peculiar and mysterious like no other moorland, often black or dark brown in colour, with striking species of undoubtedly high geological age (*Scheuchzeria palustris*, *Rhynchospora* spp., *Lycopodium inundatum*, etc.) these grass moors affect the imagination of the investigator more strongly than many a flowery meadow." Those who have traversed the sodden wilderness of Rannoch Moor will know how well the description fits!

The American *Scheuchzeria palustris* is varietally distinct from the European, differing in its longer follicles and larger seeds. Fernald (1923) has distinguished it as var. *americana*. The differences, however, appear to be exclusively morphological, for ecological accounts of bogs in which *Scheuchzeria* grows in eastern North America reveal a very close similarity both in edaphic conditions and associated species as compared with the habitats of the old world type. Thus in G. E. Nichols' (1918) account of the vegetation of northern Cape Breton

Island, Nova Scotia, *Scheuchzeria* is cited as characteristic of undrained *Sphagnum* bogs associated with *Sphagnum cuspidatum*, *S. pulchrum*, *Heleocharis*, *Carex limosa* and *Menyanthes*. Other species mentioned as growing with *Scheuchzeria* in peaty swamps fringing the low-lying margins of lakes include *Rhynchospora alba*, *R. fusca*, *Carex lasiocarpa*, *Scirpus caespitosus*, *Drosera longifolia* and *Lycopodium inundatum*.

Moore and Taylor's (1927) account of the vegetation of Mount Desert Island, Maine, depicts an essentially similar community of plants in undrained *Sphagnum* bogs. Here, on a *Sphagnum* cover in which *S. papillosum*, *S. pulchrum* and *S. Warnstorfii* are the dominant species, *Scheuchzeria* grows in company with *Rhynchospora alba*, *Scirpus caespitosus* var. *callosus*, *Carex rostrata*, *Drosera rotundifolia*, *D. longifolia* and other (non-British) species.

REFERENCES.

Bennett, A.; 1904: *Scheuchzeria palustris* L.; *Trans. Caradoc and Severn Valley Field Club*, **3**, (4), 118-121.

——; 1905: Supplement to Topographical Botany; *Journ. Bot.*, **43**.

Bertsch, K.; 1930: Beitrag zur Waldgeschichte Württembergs; *Veroff. d. staatl. St. f. Naturschutz b. Württ. Landesamt f. Denkmalspflege*, 7, 127-155.

Broche, W.; 1929: Pollenanalytische Untersuchungen an Mooren des südlichen Schwarzwalds und der Baar; *Ber. der naturf. Ges. Freiburg i. Br.*, **29**, 1 and 2.

Clapham, A. R., and Godwin, H.; 1948: Studies of the Post-Glacial History of British Vegetation. VIII. Swamping Surfaces in Peats of the Somerset Levels; *Phil. Trans. Roy. Soc. Lond., B.*, **233**, 233-249.

Druce, G. C.; 1907: Plants of Wybunbury, Cheshire; *Journ. Bot.*, **45**, 33-34.

——; 1911: *Rept. Bot. Soc. and E.C.*, **2**, 509.

——; 1932: *The Comital Flora of the British Isles*; Arbroath.

Eshuis, H. J.; 1946: *Palynologisch en stratigrafisch onderzoek van de Peelvenen*; Utrecht.

Evans, A. H.; 1916: Notes on Plants found in the district worked by the Berwickshire Naturalists' Club; *Hist. Berwicks. Nats. Club*, **23**, 217-235.

Fernald, M. L.; 1923: The American variety of *Scheuchzeria palustris*; *Rhodora*, **25**, 177-179.

Hardy, E. M.; 1939: Studies of the Post-Glacial History of British Vegetation, V. The Shropshire and Flint Maelor Mosses; *New Phytologist*, **38**, 4, 364-396.

Hardy, J., 1889: New Plants for Northumberland; *Hist. Berwicks. Nats. Club*, **12**, 394.

Hegi, G.; 1906: *Illustrierte Flora von Mitteleuropa*, **1**, 147.

Hultén, E.; 1937: *Outline of the History of Arctic and Boreal Biota during the Quaternary Period*; Stockholm.

Jessen, K.; 1935: Archaeological dating in the history of north Jutland's vegetation; *Acta Archaeol.*, **5**, 185-214.

Katz, N. J.; 1926: Sphagnum bogs of Central Russia: Phytosociology, Ecology and Succession; *Journ. Ecol.*, **14**, 177.

Lewis, F. J.; 1904: Geographical Distribution of Vegetation of the Basins of the Rivers Eden, Tees, Wear and Tyne; *Geographical Journal*, **23**, 313-331.

Moore, B., and Taylor, N.; 1927: Vegetation of Mount Desert Island, Maine, and its environment; *Brooklyn Botanic Garden Memoirs*, **3**, 135.

Nichols, G. E.; 1918: The Vegetation of Northern Cape Breton Island, Nova Scotia; *Trans. Conn. Acad. Arts and Sci.*, **22**, 249-467.

Nordhagen, R.; 1943: Sikilsdalen og Norges fjellbeiter. En plante-sosiologisk monografi; *Bergens Museums Skrifter, Nr. 22.*

Overbeck, F., and Schneider, S.; 1938: Mooruntersuchungen bei Lüneburg und bei Bremen und die Reliktnatur von *Betula nana* L. in Nordwestdeutschland. (Zur Geschichte der Moore, Marschen und Wälder Nordwest-deutschlands. VI); *Zeitschr. für Bot., 33.*

Paul, H., and Ruoff, S.; 1927: Pollenstatistische und stratigraphische Mooruntersuchungen im Südlichen Bayern. 1. Teil. Moore im ausseralpinen Gebiet der diluvialen Salzach-, Chiemsee- und Inngletscher; *Ber. der Bayerischen Bot. Ges. zur Erforschung der heimischen Flora, 19.*

Scarth, G. W.; 1910: *Scheuchzeria palustris* on Rannoch Moor; *Ann. Scot. Nat. Hist.*, 253.

——; 1911: *Scheuchzeria palustris* L. Its occurrence as a British plant, with a fresh record; *Notes Roy. Bot. Gard. Edinb., 22*, 57-59.

Woodruffe-Peacock, Rev. E. A.; 1909: A Check-list of Lincolnshire Plants; *Trans. Lincs. Nats. Union*, Pt. 1.

——: 1921: The Ecology of Thorne Waste: *Naturalist.* 22-24.