

AN INTRODUCTION TO THE BRITISH SPECIES OF CALLITRICHE

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Fools rush in . . . ; but our picture of this genus has become so much clearer in the last few years, notably as a result of Dr. H. D. Schotsman's study of *Callitriche* in Holland*, that it seems a pity no news of these advances should reach the amateur botanist until the angels have made up their minds on all the details.

The genus *Callitriche* falls into two sections, *Callitriche* (*Eu-Callitriche*) and *Pseudo-Callitriche*, the latter being readily distinguishable by the leaves on each plant being all of one form, thin and transparent in texture, and lacking stomata, by the flowers arising directly in the leaf axils, without bracts (in the other section the flower is always contained within a pair of bracts, though these may be early deciduous), and by the four lobes of the fruit becoming easily separable when ripe.

Two species of section *Pseudo-Callitriche* occur in Britain. One, *C. truncata* Guss., is a very rare plant of mid and southern England (south of latitude $53\frac{1}{2}^{\circ}$ N); the other, *C. hermaphroditica* L. (*C. autumnalis* L.), is restricted to the north of this line, but is there more frequent, in canals and lakes. *C. truncata* I have seen in Kent, Sussex, Somerset and in the Channel Islands, and once seen it is unforgettable for the rich, translucent quality of the leaves, bright deep green, shot with something approaching peacock-blue. At first sight the plant has the appearance almost of an alga. The leaves are very uniform, about a centimetre long or less and two millimetres wide, more or less parallel-sided until they taper suddenly to a slightly notched apex. In the wild *C. truncata* seems to make only small tufts, hugging the bottom of the stream, but Mr. J. P. Savidge, who has cultivated it at the Hartley Botanical Laboratories, Liverpool, tells me that it elongated rapidly there, and bore fruit. This it is usually very shy to do. I have once found a single fruit, and this was small (little more than one millimetre), and in general outline round. The lobes were neatly edged with a blunt rim but were in no sense winged. The whole fruit showed a tendency to blacken as it ripened.

The northern plant, *C. hermaphroditica*, is much bigger, with leaves much longer (up to 2 cm.) but not much broader than

*A Taxonomic Spectrum of the Section *Eu-Callitriche* in the Netherlands, *Acta Bot. Neerl.*, 3, 313-384.

those of *C. truncata*, tapering from their base to the more deeply emarginate apex, and usually of a yellowish or bronzy green. In contrast to the southern plant, *C. hermaphroditica* fruits more freely and regularly than any other *Callitriche*, and these fruits are large (2 mm.) and very broadly winged.

It is with the other section, *Callitriche*, that the complications begin. Five species have been traditionally recognised as British: *C. stagnalis* Scop., *C. obtusangula* Le Gall, *C. intermedia* Hoffm. (*C. hamulata* Kütz. ex Koch), *C. palustris* L. (*C. verna* L.) and *C. polymorpha* Lönnr., but the identifications (as the examination of any herbarium material will show) have been quite extraordinarily haphazard. The reason for this is that the main distinguishing marks have been the leaf-form and the shape of the fruit. Now each species has at least three "forms", according to whether it is growing in deep or shallow water, or on land; and the genus as a whole is extremely shy-fruited except under certain conditions. With the exception of *C. intermedia* no species in this section can achieve fertilisation when submerged, and only those plants that can get their heads into light and air have any chance of fruiting. It is therefore very difficult to construct a key that will cover all states, including the barren.*

Schotsman (1954) provides new clues to what the author herself calls "this family of somewhat shady reputation", and there is now no longer any excuse for calling "every *Callitriche* with spatulate leaves *C. stagnalis*, every *Callitriche* with linear leaves *C. autumnalis* or *C. intermedia*, every small land-form *C. palustris*".

To begin with, Dr. Schotsman shows that the label "*C. stagnalis*" has hitherto covered two quite distinct species, the true *C. stagnalis* Scop. and *C. platycarpa* Kütz. When, moreover, English specimens, both newly collected and herbarium sheets, that seemed to answer her description of *C. platycarpa* were submitted to Dr. Schotsman in Holland, she confirmed the identification; and it is clear that *C. platycarpa* is as common in Britain as in the Netherlands. To this species, indeed, belong most of the specimens labelled "*C. verna*" and "*C. polymorpha*" in British herbaria.

C. stagnalis Scop. is perhaps the commonest of the mud-forms, though it often takes to the water too; when it does so, however, it never produces the long, linear lower leaves so characteristic of the other species in this situation, but continues to carry throughout its length a more or less uniform series of rounded or rhomboidal leaves, often markedly asymmetrical, and with a tendency to bronze in the colouring, especially on acid soils. There is also a land-form, with much smaller but still rounded

*The key to both water forms and land forms given by Schotsman (1954) is reprinted in *Proc. B.S.B.I.*, 1, 341 (1955).—ED.

leaves (f. "*serpyllifolia*"), that is sometimes common in the sort of place where you might expect to find *Radiola* or "*Centunculus*" but more of this later. *C. stagnalis* fruits readily wherever it can emerge above water. The fruits are largish (1.5 mm. or more) with a very pronounced wing which generally acquires a battered and crumpled appearance as the fruit ages. The persistent styles, which are comparatively short (2 mm.), sturdy, and at first simply recurved, tend with age to become twisted and broken. The pollen-grains are regularly oval-globular ($1\frac{1}{4}$ times as long as broad).

C. platycarpa Kütz., in what I will call its typical form, carries, like *C. stagnalis*, a terminal rosette of broad leaves, but below this the leaves become linear, sometimes as much as two centimetres long, parallel-sided, and emarginate at the apex with straight points on either side of the notch. The rosette-leaves are usually much more elongated than in *C. stagnalis*—a long, regular oval. This species seems to set fruit much more rarely than does *C. stagnalis*. When fruits appear they are similar in general appearance to those of the other, but much neater; and, since the long styles (4 mm.) remain more or less upright throughout, the fruits never acquire the battered look so common in *C. stagnalis*. The pollen of *C. platycarpa* is mixed, for though the major part is almost round, triangular grains are frequent.

The deeper the water the more the linear leaves predominate, and in such situations it is with *C. hamulata* and *C. obtusangula* that confusion arises rather than with *C. stagnalis*. Even in the land-form of *C. platycarpa* there is a tendency for the lower leaves to be narrower than the upper, but here an additional criterion is available, for land-forms of *C. stagnalis* and *C. obtusangula* will almost certainly be fruiting and fruit provides definite identification. The most difficult case is a shallow-water plant with the lower leaves not noticeably different from the upper, and neither flowering nor fruiting. This might be either *C. stagnalis* or *C. platycarpa* and the only test is a chromosome count; for whereas in *C. stagnalis* $2n=10$, in *C. platycarpa* $2n=20$.

C. obtusangula Le Gall is typically, like *C. platycarpa*, a plant with two contrasting leaf-types, linear below the water but with a terminal rosette of broader leaves on the surface; there is a land-form, however, which is very close to the form "*serpyllifolia*" of *C. stagnalis* and has the leaves all broad. The common water-form is similar in general habit to *C. platycarpa*, but neater, with the submerged leaves usually shorter, more tightly packed, and often rather tapering. This is particularly noticeable when the plant is in its winter resting-form, for then the close-packed starry rosettes (all submerged) are very characteristic. The surface leaves are in a crowded but neatly imbricated rosette.

They are usually symmetrically rhomboidal in outline, thicker in texture than those of *C. platycarpa*, and often strongly ribbed. It would seem that the rosette exerts considerable pressure on the water, for when the plant is lifted out the surface-leaves tend to recurve as if on a spring and become appressed to the stem. I have not noticed this trait in any other species. The whole plant has often a somewhat glaucous tinge and this alone may enable one to identify it on sight.

C. obtusangula may fruit freely, but more than any other species it requires light and air to do so. Plants in mid-stream are nearly always barren, and the collector must look for a specimen stranded on a mud-bank or in some shallow backwater. It would also seem to fruit later than other species, and it is not much good hoping for anything identifiable before late July. When fruit is present it instantly settles the question of identity. It is as large as that of *C. stagnalis* but almost globular, the lobes being no more than bluntly angled and the clefts between them shallow (sometimes one or more of the cells may be aborted, but even then the rounded, wingless edge is unmistakable). It tends to go blackish on drying. The styles are long (3 to 4 mm.), at first arching out of the unusually large and conspicuous bracts that enclose the carpel, later neatly parted and recurving over the fruit, finally deciduous. The pollen-grains are uniform and rounded, but more oblong than in *C. stagnalis* (two, to two and a half times as long as broad).

I suspect (others do not agree) that *C. obtusangula* prefers strongly alkaline conditions. Certainly it is the predominant species in the Hampshire chalk-streams and in the Derbyshire dales, and if a *Callitriche* is found in a salt-marsh probably it will be this.

If *C. obtusangula* is the calcicole of the genus, its opposite is *C. intermedia*. I have never yet found the two growing together, though all other combinations are frequent. The water-form of *C. intermedia* has linear leaves beneath the surface, in length and in shape much like those of *C. platycarpa* but often widening at the tip to produce an open claw, likened by Clapham. Tutin and Warburg to a bicycle spanner. This—you are warned—is not a constant feature, but if the plant is *C. intermedia* and growing in water a close examination will certainly discover at least a few leaves with spanner-like tips. The floating leaves are few, in an irregular rosette, often of varying shapes but with short oval predominating. The fruit is small (1.2 mm.) with a neat, sharp rim (hardly a wing); the long styles fall at a very early stage. The pollen is globular.

There are two very distinct land-forms. The commonest, a plant of moorland splashes, and lakes in mountain districts, has uniformly linear leaves often less than a centimetre long, deeply

and irregularly notched, but seldom expanded, at the tip. The fruiting pedicels have a tendency to elongate, so that the mature fruits are no longer sessile but protrude from the axils on hair-thin stalks. I have seen a plant on which one of these was two centimetres in length. This is the form "*C. pedunculata*", which some botanists have separated as a distinct species though it is clear that the stalked fruit is no more than a variation due to environment.

The other land-form I have seen growing on the lock-gates of the Basingstoke Canal (which is full of the water-form). Here all the leaves are oval, so that the plant looks like *C. stagnalis*. This form does not appear to fruit, but a chromosome count gives $2n=38$, a number confined to *C. intermedia*.

C. palustris L. (*C. verna*) is frequent in some parts of Holland in what Dr. Schotsman calls "cowpuddles" and we should perhaps call "splashes". There is no reason why it should not occur in Britain, and indeed Dr. Schotsman quotes a record from Petersham. This has been checked, however, and shown to be an error (*Proc. B.S.B.I.*, 2, 135), and so far not a single specimen of the genuine plant has been found in any British herbarium. In habit *C. palustris* might be described as intermediate between the moorland form of *C. intermedia* and *C. stagnalis* forma "*serpyllifolia*", the leaves being for the most part oval, often with some linear ones below. But the fruits, which are abundantly produced, are very distinct, being only a millimetre or less in diameter, not winged though the upper part is sharply rimmed, observedly narrowed towards the base, and with a marked tendency to go black on ripening. Male and female flowers are usually together in the same leaf-axil, whereas in the other species they are almost always separate.

The last on the British list has still to be confirmed. It seems that *C. polymorpha* does not occur in Holland, and British specimens so named are all referable either to *C. platycarpa* or to *C. obtusangula*. Sweden appears to be the headquarters of the plant, but it is doubtful whether even there it is more than a local variant of the hitherto neglected *C. platycarpa*. The only distinguishing features are the smaller fruit and the very long, persistent, recurved styles. If anyone finds such a plant, or a really likely candidate for *C. palustris*, I am sure that the specialists would be very glad to see it.