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cheapness, and also because it avoids the danger of using the excess of alkali to which the latter is subject. In regard to the second process, the quantity of alkali necessary will vary with the season. At the time Dr Hector made his experiments (autumn) 3·5 per cent. of common washing soda, or 1·3 per cent. of the dry carbonate of soda, was found to neutralise the acid substances of the flax. In either case about 1 or 2 per cent. of soap would be necessary.

In conclusion, Dr Hector gives an account of various ways of retting, or separating the fibres, and the process which he recommends is as follows:—

In the first place, there is the absolute necessity that the leaves of the plant should be thoroughly bruised.

Secondly, the bruised flax must be placed in vats or pits of water, till it scrapes clean with the nail, and no longer; it may be found more convenient to hasten the commencement of decomposition by the use of artificial heat. The decomposed leaves should then be washed by being placed in a running stream, after which the flax is ready for scutching in the ordinary way. There can be no doubt as to the success of this process, and the only additional expense over that necessary for the preparation of the ordinary flax is the preliminary bruising of the leaf. When the price of labour in the colony is reduced, and the New Zealand flax plant is systematically cultivated, the above process should allow of the production of a valuable quality of fibre, for which there would be a steady demand with a large profit.

III. *Notes on the British* Batrachian Ranunculi. By Mr JAMES F. ROBINSON. Communicated by Mr SADLER.

I have for several years closely observed and carefully studied the water Ranunculi which occur in Cheshire; my guide-book has been Babington's "Manual of British Botany," but in many instances I have not been content with my own private opinion as to the several species, but to make "sure more sure," I have dried great numbers of specimens, and sent them to botanists who had studied these intricate forms, and in whose judgment I had confidence. It may be better at once to state that the following forms

occur in Cheshire:—*R. heterophyllus*, *R. trichophyllus*, *R. Baudotii*, *R. floribundus*, *R. peltatus*, *R. circinatus*. I have studied *R. fluitans* in its lovely home in the River Severn during the past summer (1870).

History.

About the first reliable account of these species in Britain is by the learned and pious Ray. In his Synopsis, brought out under the supervision of Dillenius in 1724, we have four species mentioned, as follows:—

1. *R. aquatilis*, *aquaticus folio rotundo et capillaceo*. Water-Crowfoot with various leaves.
2. *R. aquatilis omnino tenuifolius*, *aquaticus capillaceus*. Fine-leaved Water Crowfoot.
3. *R. aquaticus albus*, *circinatis tenuissimè divisis foliis*, *floribus ex alis longis pedicellis innixis*.
4. *R. sive Polyanthemo aquatili albo affine millefolium maritimum fluitans*. Fennel-leaved Water Crowfoot.

There can be no doubt that No. 1 is the *heterophyllus*; No. 2, probably *trichophyllus*; No. 3, *circinatus*; and 4, *fluitans* of recent authors.

The next work that I can refer to is an old copy of the "Flora Oxoniensis," by Professor Sibthorp, published in 1744. On pages 175 and 176, the following are described:—

1. *R. heterophyllus foliis submersis capillaceis, emersis reniformibus palmatis*. Various leaved Water Crowfoot.
2. *R. aquatilis, foliis omnibus capillaceis laciniis divergentibus*. Milfoil-leaved Water Crowfoot.
3. *R. circinatus, foliis omnibus capillaceis laciniis circinatis, pedunculis elongatis*. Fine-leaved Water Crowfoot.
4. *R. fluviatilis, foliis omnibus capillaceis, laciniis parallelis longissimis*. Fennel-leaved Water Crowfoot.

These differ in no way from Ray's Synopsis, excepting in being named.

Upon referring to Hudson's "Flora Anglica" I find that he describes at p. 213 only one species with three sub-species or varieties, viz., *R. aquatilis*, β , γ , δ .

Withering describes only one species under the old name of *aquatilis*, and four varieties, one large flowered, *circinatus*, *diffusus*, and *fluviatilis*.

In the earlier editions of the British Flora *R. aquatilis*

includes all the forms ; but in the last edition, whilst *R. aquatilis* retains its place, two varieties are elevated to the rank of species, *R. circinatus* and *R. fluitans*.

The most popular work on British Botany of late years, with the generality of British botanists, is without doubt Professor Babington's "Manual of British Botany." Upon looking over the last edition, we are surprised to find that the old *aquatilis*, without including *circinatus* and *fluitans*, had been divided into no less than eight species, namely,—

1. <i>trichophyllus</i> .	5. <i>Baudotii</i> .
2. <i>Drouetii</i> .	6. <i>floribundus</i> .
3. <i>heterophyllus</i> .	7. <i>peltatus</i> .
4. <i>confusus</i> .	8. <i>pseudo-fluitans</i> .

Upon glancing over the above incomplete history of the Water Crowfoot, we are almost amazed at the rapid division and sub-division that has been made of one species in the short space of about thirty years ; nay, it must force us to one of two conclusions,—either our old forefathers were not sufficiently discriminative as naturalists, in other words, were not observers of the little things of nature ; or we are in this generation wonderfully wise, and can detect slight differences where *they* could not observe any. Who amongst us will say a word against the pious Ray, the industrious and learned Oxford Professor, or the painstaking and persevering Withering ?

Experiments and Observations.

It is to be feared that many of these species have not sufficient and distinctive permanent characteristics to make them into true species ; as, for instance, some are said to have the submersed or capillary leaves "collapsing," or, in other words, forming a pencil-like point when removed from the water. This character is not to be relied upon ; in many cases it is dependent upon the situation in which they grow. However, every one has a perfect right to exercise their own individual opinions, and I don't wish to find fault with any one so doing, but for a long time I had the idea that, if the *heterophyllus* was removed to a running stream or shallow fresh-water river, it would then turn to *fluitans*. Perhaps one reason for my thinking so

was, that I had never seen it except in brackish water or stagnant ponds and ditches.

Early in the spring of the year 1867, I removed two very good roots of *heterophyllus*,—one I placed in a shallow sandy brook in which the water was continually flowing, the other was planted carefully in a deep muddy stream. A fine plant of *circinatus* was placed under similar circumstances. These plants I carefully watched and minutely examined from time to time during the whole of the summer, as opportunity permitted, with the following results :—The plant of *heterophyllus* placed in the shallow brook grew very rapidly, the stems in July were perhaps three times their average length. The submersed leaves were of a lighter green colour, and more collapsing than usually met with, but the segments were no longer than when growing in the stagnant water. For a time I thought it would not produce any floating leaves, but at length they appeared ; afterwards it flowered rather sparingly, the petals being much larger than I have ever seen on the ordinary plant.

Through a heavy flood I unfortunately lost the plant in the deep stream. The *circinatus* became a large branched plant, but the leaves preserved their peculiarly interesting circinate or roundish outline ; the only noticeable difference was in the larger flowers, and the leaf segments lost their rigidity. Without the trouble of transplanting I had other opportunities for observing the other species.

R. Baudotii I have seen with its submersed leaves both rigid and collapsing on the same stem ; the floating leaves and carpels can seldom be recognised with certainty from some forms of *heterophyllus*.

R. peltatus I first found in deep water, I think, in 1865. The pond remaining undisturbed for three or four years, it increased rapidly, until it covered the surface of the pond in many places. The plant, which was named *peltatus* of Fries by one or two competent botanists, was afterwards named *heterophyllus* by the same parties, simply because the submersed leaves in deep water were not collapsing, thus far agreeing with the description in the Manual ; but in shallow water they became collapsing. The floating leaves differed very much.

Then, in the case of *floribundus*, which is said to be intermediate betwixt *Baudotii* and *peltatus*, after carefully studying the form so named, both living and dried, I cannot call it even a good variety of *heterophyllus*. Here, again, great stress is laid upon the "rigid submersed leaves."

In reference to *trichophyllus*, another species not uncommon in many parts of England, I have studied it under varying circumstances, having met with it growing in deep muddy ditches, clear fresh-water ponds, and in salt-water ditches, but have never observed any great difference. I have also a good series of specimens collected in many parts of England and Ireland agreeing in every particular. I have never seen *Drouetii*, and have but one poor specimen of *confusus*. However, judging from the descriptions, they are not far removed from *heterophyllus*.

Last summer, in the long evenings, when walking along the banks of the River Severn, I observed large quantities of the *fluitans*, and not only was it growing profusely where the stream was flowing rapidly, but in little pools of still water on the margin of the river, although the stems were not as long, yet it had the same characteristic, long, almost parallel, blunt leaf segments and large flowers. It was at once recognised from the *heterophyllus* often seen by its side.

I have examined attentively the carpels of most of the species beneath the microscope, but no distinctive features of importance can be gleaned from them, the inner edge is more often straight than otherwise, and the great majority are laterally pointed.

After much thought I cannot come but to one conclusion, namely, that there are only four true species of British *Batrachian Ranunculi*, which may be distinguished by the following characters:—

1. *R. heterophyllus*, Sibth. Upper leaves floating, often long stalked, mostly tripartite; segments, wedge-shaped, notched; submersed leaves, *light green*, divided into capillary segments, sometimes slightly rigid; flowers, large, star-like.
2. *R. trichophyllus*, Chaix. Floating leaves, seldom present; submersed leaves, *dark green*, with rigid, rather short capillary segments; segments, apiculate; flowers, small.
3. *R. circinatus*, Sibth. Floating leaves, none; submersed leaves,

sessile ; segments, forked, blunt, rather rigid, light green, circinate, or "all placed in one roundish plane;" flowers, in British specimens, mostly small. *R. rigidus*, Hoffm. *R. divaricatus*, Koch.

4. *R. fluitans*, Lam. Stem, long ; floating leaves, none ; submerged leaves, rigid ; segments, very long, linear, almost parallel, blunt ; flowers, large.

So far as our British flowering plants are concerned they ought to be recognised at a glance, not as is now the case with many of our genera requiring minute examination, and even then to be undecided as to what to name it, because the plant of one author may not be so of another. This, however, cannot be so with the four species described above ; when once they are known, they can afterwards be recognised with ease, without having to turn over the pages of some work on British Botany every time a specimen is found, and even then to be left in doubt.

My thanks are especially due to Professor Balfour for permitting me to look over the good series of specimens in the Society's Herbarium.

IV. *Report on the Open Air-Vegetation at the Royal Botanic Garden.* By Mr M'NAB.

Before giving a list of the periods of the flowering of certain open-air spring plants, it may be necessary to state that the long-continued frost of the past winter has retarded the early spring vegetation very much, when contrasted with ordinary seasons. During the early part of the winter, the various species of Hellebores were to be seen in bloom, as well as stray flowers of many of the primroses in sheltered situations. The frost set in about the beginning of November, and from that period up to the present time, numbering one hundred and twenty-nine days, the thermometer has registered no less than seventy-six mornings below the freezing point. During November, on twenty mornings, the lowest points being on the 2d, 8th, 9th, 10th, 22d, and 23d, indicating respectively, 29°, 26°, 25°, 29°, 27°, and 26°. During December, on eighteen mornings, the lowest points being on the 16th, 23d, 25th, 27th, 28th, and 31st, indicating respectively 26°, 9°, 20°, 12°, 17°, and 20°.