An unknown *Didymodon*, our latest "must see" moss

△Fig.1: The river Camlad and its bank at Gaer Bridge. M Lawley

Mark Lawley reports a new moss from the river Camlad in Wales

The Montgomeryshire Flora Group met on a warm summer's day in August 2015 at Lymore Pools (SO 2396) near Montgomery to explore the pools' margins, before going on to examine plants along the bank of the River Camlad at Gaer Bridge (SO 2199).

At Lymore we found *Epilobium roseum*, *Rorippa amphibia*, *Rumex maritimus*, *Scrophularia umbrosa* and *Tilia platyphyllos*. *Orthotrichum lyellii* and *Syntrichia papillosa* were best of the bryophytes on trees by the pools, although the most unusual discovery was a human skull lying half-submerged at the edge of one pool (but showing no sign of John Ray's elusive *Muscus ex cranio humano*). It may have been from someone who met his end in the Civil War, for Lord Herbert owned nearby Montgomery Castle at the time of the Civil War (Lawley, 2015) and the district witnessed violent exchanges between Royalists and Parliamentarians. Another skull had turned up when the pool was dredged about ten years previously.

After a leisurely picnic we drove a couple of miles north to Gaer Bridge to botanise beside the River Camlad, reputedly the only river that flows from England into Wales. While my fellow botanists tormented themselves trying to identify hybrid mints, I puzzled over an unfamiliar acrocarp growing in dispersed patches on bare soil in the upper part of about 100 metres of riverbank at the edge of a pasture.

This moss was duller and darker than its neighbours (*Bryum gemmiferum*, *B. klinggraeffii*, *Dicranella varia*, the rare *Ephemerum cohaerens* making its Welsh début, *Hennediella stanfordensis*, *Kindbergia praelonga*, *Pohlia melanodon* and *Tortula truncata*). It was tiny too, barely a couple of millimetres high, with round-tipped, slightly concave leaves and sub-cucullate apices. The longest leaves were 1-1.25 millimetres long and 0.35 millimetres wide, with plane margins or slightly recurved in mid-leaf. Its size and leaf-shape reminded me of *Gyroweisia tenuis*, but on microscopical examination the laminal cells proved to be rather larger, isodiametric (8-12 microns wide in mid-leaf) and papillose. Many leaves also had a stronger nerve (as much as 70-80 microns wide at the base of some well developed leaves) that nevertheless petered out

△Fig.2: Close-up photographs of patches of dry and moist plants with *Tortula truncata* in the background towering over the *Didymodon*. G Thomas, FRPS

below the leaf-tip. And, of course, the Camlad plant also differed from *G. tenuis* in growing on soil rather than base-rich stone.

Many leaves were nerved as I have just described, but in fact the length and strength of the nerve varied greatly between leaves. A few well developed leaves lacked a nerve altogether, some had weakly developed nerves, while others had developed their nerve right to the tip, and even beyond, with red-brown, finger-like processes resembling pseudo-archegonia projecting from their tips. Some plants possessed true archegonia, but I did not find any males.

I sent my gathering to Tom Blockeel, who was also mystified by the strange plant's identity and its odd processes projecting from the leaves. Tom sent the material on to Jan Kucera, who very kindly analysed nucleotide sequences in the plant's DNA. These identified the moss as a species of *Didymodon*, although not corresponding to other species in the genus. The gene encoding the ribosomal protein 'rps 4' in its chloroplasts indicated affinity with the Antipodean moss *Tridontium tasmanicum*, whose own nucleotide sequences place it within the genus *Didymodon*. Like the strange moss from beside the Camlad, *T. tasmanicum* grows beside watercourses and has leaves with rather rounded tips, but *T. tasmanicum* is considerably larger than the Camlad moss, with leaves over 2 millimetres long and shoots more than 1 centimetre long. Jan also commented that some *Globulinella* species visually resemble the Camlad's moss, but differed in their nucleotide sequences.

▽Fig.3: Single shoots of *Didymodon* with leaf processes. G Thomas, FRPS

The new moss is interesting not only in itself, but also because it confirms how rewarding it can be to examine the flanks and banks of rivers, many of which nevertheless seem to be under-explored for bryophytes. Riversides may provide very varied (and variable) habitats, particularly where periodic flooding and drying of rock, soil and wood offer varied and challenging conditions for wildlife. While flowing water delivers oxygenated nutrients to the surfaces of soil, stone and wood, solid particles suspended in the water abrade and excoriate the plants. And at other times, when the river is low, its banks may become much drier and warmer. These great variations in and unusual combinations of conditions are the reasons why numerous scarce

△Fig.4: Row of leaves diseccted off shoots showing the variation in strength and length of nerves. G Thomas, FRPS

species are found mainly or exclusively in or beside rivers.

Other examples of how bryologically rewarding rivers may be include the discovery of *Bruchia vogesiaca* new to Britain on a soil bank in Cornwall in 2006 (Holyoak, 2007), *Tortula amplexa* on soil by the River Stour in Worcestershire in 2007 (Lawley, 2008a), and *Anomodon attenuatus* and *Thamnobryum angustifolium* by the River Eden in Cumbria in 2008 (Lawley, 2008b). Of other scarce riverine mosses, *Cinclidotus riparius* (a speciality of the River Teme in the Welsh Marches, discovered by Arthur Weyman at Ludlow in 1890) comes to mind, as well as a medley of rare *Bryum*, *Ephemerum* and *Fissidens* species (*Bryum cyclophyllum*, *B. gemmiparum*, *B. mildeanum*, *B. riparium* and *B. uliginosum*, *Ephemerum cohaerens*, *E. hibernicum*, *E. sessile* and *E. spinulosum*, *Fissidens fontanus*, *F. monguillonii*, *F. polyphyllus*, *F. rivularis*, *F. rufulus* and *F. serratulus*), in addition to *Dialytrichia saxicola*, *Dicranella crispa*, *Discelium nudum*, *Seligeria carniolica* and *Thamnobryum cataractarum*, while trees in the flood-zone may offer the bryologist *Dendrocryphaea lamyana*, *Myrinia pulvinata*, *Orthotrichum rivulare* and *O. sprucei*. A bryologist in Scotland might also look out for *Hygrohypnum duriusculum*, *H. smithii* and *Pohlia scotica*.

Compared with mosses, rather few leafy liverworts brave the brutally unpredictable rough and tumble of life beside flowing water, their foliage and fruits perhaps too delicate to withstand alternating abrasion and drying. Even so, *Porella pinnata* favours flowing water, while soil banks are worth searching for *Cephaloziella turneri*, *Scapania curta*, *S. lingulata*, *Solenostoma caespiticium* and *S. confertissimum*. Rocks by water in Scotland might support *Scapania praetervisa*, and watercourses in sheltered, humid localities along the Atlantic seaboard may harbour rare Lejeuneaceae and *Radula* species. Of thallose liverworts, *Dumortiera hirsuta* also likes the extreme west, and *Riccia canaliculata* lives on mud in an oxbow near the River Tay in Perthshire (Lawley, 2004). These and other notable mosses and liverworts distinguish rivers and their banks as highly rewarding bryological habitats.

How did this *Didymodon* reach the Camlad? Was this by natural dispersal? Or did someone living upstream tip out a foreign plant from their garden, enabling the moss to spread to the nearby riverbank? Why was it not found until 2015? How long has it been living beside the Camlad? Was it not found until 2015 because it only recently evolved into a distinct species? Or did it only arrive in Britain recently? Or has it been long overlooked in Britain either because it's so small and inconspicuous, or because it's rare, or both? Alternatively, have bryologists hitherto missed this moss because they have neglected riverbanks as rewarding places to explore? Indeed, is the Camlad *Didymodon* confined to riverbanks, or will it also turn up in other habitats, as *Tortula amplexa* has done?

The River Camlad's banks look much like those of many other watercourses, yet the Camlad has 'previous form' for producing unexpected botanical interest. In 1632 George Bowles found *Impatiens noli-tangere* new to Britain at Merrington, further upstream along the Camlad. What might the Camlad's banks possess that other riverbanks do not? But of course, just as the *Impatiens* is now known elsewhere in Britain,

perhaps the new *Didymodon* will turn up in other places too, now that we are aware of its existence and what it looks like and where it might occur. For instance, the Camlad flows into the River Severn less than a mile downstream of where the *Didymodon* grows, so does our new moss also grow on the banks of the Severn? Ratty liked nothing better than pottering by the river with Mr Toad … and he still has many more banks to explore.

Indeed, with repeated flooding of low-lying land and property in recent years, planning agencies are looking ever harder for ways to prevent or reduce flooding in future. These measures will very probably alter conditions on riverbanks, so we'd better get on with recording them more diligently than hitherto, before their character and wildlife have changed forever.

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