IS *EQUISETUM RAMOSISSIMUM* (EQUISETACEAE: EQUISETOPHYTA) NATIVE TO THE BRITISH ISLES?

F.J. RUMSEY & M. SPENCER
Angela Marmont Centre for UK Biodiversity, Natural History Museum, Cromwell Road, London, SW7 5BD, UK
(Email: F.Rumsey@nhm.ac.uk)

Keywords: *Equisetum × meridionale, Equisetum × moorei*, herbarium, hybrid

**ABSTRACT**
A review of historic collections at BM has revealed a specimen of *Equisetum ramosissimum* collected by Buddle on Hounslow Heath in c.1705. This thermophilous ruderal species has generally been considered a recent introduction in the British Isles, first reported in 1949, its neophyte status having implications for its continuing protection under Schedule 8 of the Wildlife and Countryside Act and other conservation actions. The hybrid with *E. hyemale* (*E. × moorei*) has long been known from the Irish east coast, in the absence of *E. ramosissimum*. Recently its hybrid with *E. variegatum* (*E. × meridionale*) has been recorded from Anglesey. Its recognition prompted a review of specimens of *Equisetum* subgenus *Hippochaete* from the Cheshire/Lancashire coast which showed obvious similarities, most previously regarded as *E. variegatum* or *E. × trachyodon*. The majority show distinctive micro-morphological characters associated with *E. ramosissimum* and are considered to be *E. × meridionale*, or possibly an as yet un-described triploid backcross to *E. variegatum*. Subsequently another overlooked BM herbarium specimen of *E. ramosissimum* from the Liverpool area, collected in the 19th century, was detected. We present a summary of the known occurrences of the species and, in the light of these new discoveries, reassess the species status as “Native or Alien”.

**INTRODUCTION**
As part of the London Natural History Society’s *London Flora Project*, that aims to update Rodney Burton’s (1983) *Flora of the London Area*, Nick Bertrand, John Swindells and MS have been reviewing historic records based upon herbarium specimens in the Sloane Herbarium at the Natural History Museum. Most of this work has resulted in augmentation of data reported in previous county floras (Trimen & Dyer, 1869; Kent, 1975 & Burton, 1983) or the database of the current Middlesex vice-county recorder (MS). So far several interesting pieces of information have come to light, including the re-determination by FJR of a specimen in Herb. Buddle, in the Sloane Herbarium, which has led us to a re-consideration of the status of *Equisetum ramosissimum* Desf. in England. Further herbarium researches (and molecular studies, Tosh *et al.*, in prep.) have provided additional and complementary evidence which considerably strengthens claim for native status for the species.

*Equisetum ramosissimum* is the most abundant, and often the only horsetail present around the Mediterranean region. An extremely variable taxon, it extends as an
unquestionably native plant northwards to the Loire valley in France, the mid reaches of the Rhine in Germany and eastwards through the Czech Republic, Crimea and into Southern Russia.

Prior to the herbarium discoveries reported here, the known history of this plant in the United Kingdom was as follows: it was first reported from an artificially created river bank near Boston, Lincs. (v.c. 53) (Alston, 1949), the plant having been discovered here in some quantity in 1947, by H. K. Airy Shaw. It has persisted to the present day, although in much reduced extent, the greater part of the colony having been destroyed by the extension of a municipal tip. As the habitat had effectively been created in 1884 (Gibbons, 1975) it seemed reasonable to assume that the plant was an introduction, particularly as a plausible potential mechanism - rhizome fragments in dumped ship’s ballast - was proposed.

The species was next reported in 1983, from Ellenborough Park in Weston-super-mare, Somerset (v.c. 6), when Ro Fitzgerald sent Clive Jermy material for confirmation. It became apparent, however, that the plant had long been known at the locality (since at least 1963), but had not been correctly identified (Fitzgerald & Jermy, 1987). The site (Figure1), just inland from the sea front, is situated on an old sand dune system, the grassland within the park being a remnant of dune grassland enclosed over a century ago. Interestingly, the site lies within a few hundred metres of another sandy but once damper area, now developed, that less than a century ago supported the only v.c.6 population of *Equisetum hyemale* L., growing here with a variable population of *E. variegatum* Schleich., Schleicher ex F. Weber & D. Mohr, now only known in the county in very small quantity on the dunes at Berrow (Crouch, pers. comm.).

![Figure 1](image1.jpg)

*Figure 1. Equisetum ramosissimum* at Ellenborough Park, Weston-Super-Mare, v.c..6 June 2011 (FJR)
**Equisetum ramosissimum** was subsequently found on a brown-field site close to the River Usk in Newport, Gwent (v.c.35) (Evans, 2006), where it was growing close to *Scirpoides holoschoenus* (L.) Soják, another coastal Mediterranean species of questionable British status. Although covering an area of c. 100-150 m² when first found, recent searches at the site (which was scheduled to be redeveloped when the plant was originally discovered) have failed to find the plant (Acock, pers. comm.). Its status in this area is rather more difficult to assess.

**HERBARIUM DISCOVERIES SHOW A LONGER BRITISH HISTORY**

The Sloane herbarium at BM contains a specimen (*Herb. Sloane* 117: 11) (figure 2) annotated by Adam Buddle as ‘*Equisetum nudum ramosum*, Buddle, I gathered it on Hounslow heath’; the specimen is also annotated ‘R.H. 130’ (referencing John Ray’s *Historia Plantarum*, 1686) by Sir Hans Sloane and ‘15’ (referencing Buddle’s unpublished *ethodus nova stirpium Britannicarum* (Sloane manuscript 2975a vol. 6) by Dr Matthew Maty, Librarian of the newly established British Museum). Suspicion by MS that the plant was not *E. palustre* was confirmed by FJR who recognised it to be *E. ramosissimum*, a determination accepted by Pat Acock, the B.S.B.I. referee.

It is probable that Buddle’s Hounslow Heath plant was initially mistaken for *E. hyemale*, which is currently rejected from the Middlesex flora (Trimen & Dyer, 1869: 336; Kent, 2000: 106). The original basis for including *E. hyemale* in the Middlesex flora is based upon references in *Planta Cantabrigensis* (Martyn, 1763: 71) and *Flora Metropolitana* (Cooper, 1836: 113), the latter stating that Edward Forster recorded *E. hyemale* from Hounslow Heath as well as *Baldellia ranunculoides* (L.) Parl.. In the Botany Library of the Natural History Museum there is a copy of *The Botanist’s Guide through England and Wales* (Turner & Dillwyn, 1805) annotated by Dawson Turner; on page 413 the record of *E. hyemale* attributed to Edward Forster has been amended to ‘Buddle’. Subsequently, Trimen and Dyer (1869: 336) commented that these references were mistakes either for *E. fluviatile* (as ‘limosum’) or *E. palustre*. On the same page Trimen and Dyer (1869: 336) stated that the first record for *Equisetum palustre* L. in Middlesex was from “Buddle, about 1705. An unbranched form, *E. nudum ramosum* (III), on a bog on Hounslow Heath, where nothing as yet but this has sprung up after the digging of peat; Budd. MSS. vi and Budd. Herb. cxvii, fol. ii. This we suppose is *E. læve pene nudum* of Pet. Gr. Conc. 238 (see also Dill. in R. Syn. iii. 131)”. This statement by Trimen and Dyer was presumably later taken up by Kent (1975: 136), who stated that the first evidence of *E. palustre* in Middlesex was from “Buddle, c. 1705”. There is no specific indication by Kent that he viewed the Buddle specimen (*Herb. Buddle* 17: 11) or the relevant Buddle document in the Sloane manuscript collection (Sloane 2975a vol. 6).

Hounslow Heath is currently largely inaccessible through its proximity to Heathrow airport and has been heavily modified or destroyed since Buddle’s day; there is one remaining area that survives, although that too has gone through many changes. This area is a designated Local Nature Reserve and still supports some heathland plants including bell heather (*Erica cinerea* L.), dwarf gorse (*Ulex minor* Roth), petty whin (*Genista anglica* L.), dyer’s greenweed (*Genista tinctoria* L. ssp. *tinctoria*), heath rush (*Juncus squarrosus* L.), heath-grass (*Danthonia decumbens* (L.) DC.) and mat-grass (*Nardus stricta* L.). Historically, the heath was much richer and contained a significant list of vice-county and national rarities, most of which are now gone. Additional significant taxa recorded from the site between 1600 and the present day include:
Figure 2. *Equisetum ramosissimum* specimen in *Herb. Sloane* 117: 11(BM) – right detail of apiculate strobilus.

**SUPPORTING EVIDENCE FROM HYBRIDS**

Described from Rockfield, Co. Wicklow (v.c. H20) where it was first found in 1851 (Newman, 1854), Equisetum × moorei Newman, the hybrid of *E. ramosissimum* with *E. hyemale*, is present along a narrow, circa 50 km. long section of the eastern Irish coast, from Ardmore point in Co. Wicklow at the north, to Wexford Harbour, Co. Wexford in the south (Praeger, 1934). *Equisetum × moorei* was also known for many years in Surrey (v.c.17); first recorded (as *E. hyemale*) by Druce (1912), the plant steadily increased until the 1970s in the garden of Lady Victoria Russell at the Ridgeway, Shere (Lousley, 1976). It was initially closely associated with bamboos which had been introduced from one of the family’s other gardens in the French Riviera and this was almost certainly its source. For reasons which are still unclear the plant declined and has not been seen for over 20 years in spite of several searches.

The extensive and clearly natural Irish distribution of *E. × moorei* has, however, been taken as the clearest indication of the past occurrence of *E. ramosissimum* as native in these islands, but other scenarios as to its origin are arguably as plausible and must be considered (see Discussion).

It is only extremely recently that further hybrids involving *E. ramosissimum* have been detected in the British Flora. *Equisetum × meridionale* (Milde) Chiov., the hybrid with *E. variegatum* was first found in coastal dune-slacks near Llyn Penryn, Anglesey, in 2000, but it was initially identified as *E. × trachyodon* A. Braun and not correctly determined until 2009 (Stace, 2010). A single diffuse thriving colony of several hundred stems is growing with one of its parents, *E. variegatum*. Living material from this site cultivated by FJR, while differing in propensity to cone, stature and branching, did not differ significantly in anatomy or micro-morphology from material previously ascribed to *E. × trachyodon* (*E. hyemale × E. variegatum*) from the Wirral coast, also in cultivation, as noted independently by Jepson et al., in prep. In particular the tubercles were not restricted to the angles of the stem ridges but formed continuous fused bands between the rows, a feature demonstrated by *E. ramosissimum* and also present in its hybrids (Lubienski et al. 2010). The hybrid horsetail on the Wirral coast has been contentious for many years; having been called both *E. variegatum* and *E. hyemale*, it
was then identified as the first English occurrence of \textit{E. \times trachyodon} by Chris Page in 1979 (Barker, 1979), but it was noted to differ from typical material in its greater degree of branching. When first reported the plant was recorded as occurring along a 1.3km section of coastline stretching south from Red Rocks, Hoylake (v.c..58). Material from the northern end of the colony, growing with \textit{E. variegatum}, was said to more closely approach that in form, whereas that further south was more robust and was said to be more like \textit{E. hyemale} (Barker, 1979). \textit{Equisetum hyemale} had been recorded in the general area (Dickinson, 1851; Newton, 1971) but in the absence of herbarium specimens these records are doubtful. \textit{Equisetum hyemale} did however occur at Heswell, 7km further south along the Dee estuary in 1871 (BM!) its current extent, ecology and morphology are discussed by Jepson et al., in prep. Examination of specimens of subgenus Hippochaete at BM from the Cheshire and adjacent Lancashire coasts revealed that the majority of specimens (26 sheets) previously determined as \textit{E. variegatum}, while agreeing with it in most particulars, showed the tubercle character associated with \textit{E. ramosissimum}. Interestingly these plants were not just from the Hoylake area but also from New Brighton and Wallasey in Cheshire and Southport and Crosby on the Lancashire coast (see Appendix 1 for specimen details). The earliest dated specimen was from New Brighton, collected by S. Simpson in 1839, although an undated gathering made by W. Borrer from the same site may be earlier.

The considerable morphological similarity with \textit{E. variegatum} (which is still present at the majority of these sites) suggests the possibility that some of these plants might represent a triploid hybrid resulting from the mating of a diplospore (unreduced gamete) from \textit{E. \times meridionale} with a normal gamete from \textit{E. variegatum}. Bennert et al., (2005) have shown this mechanism has given rise to three hybrid combinations in the subgenus Hippochaete in central Europe, although this hybrid combination of genomes (VVR) has not hitherto been reported. Further work is needed to establish the ploidy level of these plants. What is obvious, however, is that by the mid 19th century plants containing \textit{E. ramosissimum} genes were already spread along almost as extensive a length of the English coast as were their \textit{E. \times moorei} counterparts on the other side of the Irish Sea.

During the herbarium study a single specimen “nr. Liverpool, H. Seebohm Ex herb. J. Carroll (See figure 3) was identified as being \textit{E. ramosissimum}. Henry Seebohm (1832-1895) was a wealthy industrialist and amateur natural historian particularly remembered for his oological studies. This find demonstrates the past occurrence of \textit{E. ramosissimum} in the area and suggests that some earlier unsupported records of \textit{E. hyemale} may well have been of this species.

**DISCUSSION**

Whilst as a thriving port Liverpool might be expected to harbour weedy introduced ruderal taxa like \textit{E. ramosissimum}, which could perhaps explain the newly found Seebohm specimen, the extent of the distribution of \textit{ramosissimum} genes along the Cheshire and Lancashire coasts by the mid 19th century suggest a much longer history in the area. That this species was present to act as parent also influences considerations as to how these hybrid plants have originated.

The Irish and Welsh hybrids may have formed \textit{de novo} possibly from the fertilisation of \textit{E. ramosissimum} gametophytes developed from spores dispersed from continental Europe, these becoming “swamped” by antherozoids from more numerous native \textit{E. hyemale} or \textit{E. variegatum} gametophytes, rather than having been derived from
Figure 3. *Equisetum ramosissimum* specimen from “Near Liverpool” H. Seebohm. BM – far left on mixed sheet.
native *E. ramosissimum* populations now lost. Both *Equisetum* hybrids (*E. × moorei*, *E. × meridionale*) demonstrate very low spore fertility. The great majority of spores in British and Irish plants are abortive, with most having poorly developed elaters. The degree of fertility is, however, variable, and small number of gametophytes of both *E. × meridionale* and *E. × moorei* from Central Europe have been raised under experimental conditions (Krahulec et al., 1996). Even so, colonisation by this means is highly unlikely. Colonisation by vegetative material cannot, however, be ruled out; experimental evidence suggests that shoot and root fragments of *E. × moorei* and other *Hippochaete* hybrids can survive at least 10 days immersion in sea water (Page, 1997). It does, however, seem unlikely and to have occurred at three localities even more so. Perhaps the greatest obstacles to the view that *E. ramosissimum* is native is in explaining its current absence in areas occupied by its hybrid and in the lack of history of its most apparently natural British occurrence. In answer to the former the greater cold-hardiness demonstrated by the hybrids could explain their ability to persist in a changed climate at the northernmost extents of range of their thermophilous parent (Page, 1997). Concerning the Somerset site, how plausible is it that the other *Equisetum* species were found locally very early in the 20th century but not the now abundant *E. ramosissimum*, or indeed, that very early observers such as Sole, who found other local rarities would have missed the plant? The evidence presented here suggests that in both its pure and hybrid forms this very variable and frankly rather nondescript plant is very easily over-looked!

The Somerset locality is worthy of further consideration. Ellenborough Park appears to be an area of some phytogeographical interest; alongside a suite of uncommon species such as *Trifolium suffocatum* L. and *Medicago polymorpha* L., it also supports populations of *Herniaria glabra* L. (first recorded by Sole in 1791 but for a long time dismissed as an error) at its only persistent western British location (Green et al., 2000). On its seaward side occur thriving populations of another Mediterranean ruderal species of questionable status, *Cynodon dactylon* (L.) Pers. (Bermuda grass). With an, until now, longer British history, (being first recorded in Ray, 1724) this grass has found greater acceptance as a possible native (e.g. Walls, 1999, but see Preston et al., 2002). The close association of the horsetail on the north Somerset coast with a distinctive thermophilous arenicolous flora similar to that of natural occurrences on the French coast suggests that at worst it was a natural colonist, a fact recognised by its legal protection under Schedule 8 of the Wildlife and Countryside Act, 1981. Classification as a neophyte in Preston, et al. (2002) inevitably has had the consequence of reducing its perceived importance with implications for future conservation activities.

The specimen from Hounslow Heath is significantly earlier than any other British record (approximately 150 years before Seebolm’s record and at least 250 years before the 20th century discoveries). It is worth noting that in its prime Hounslow Heath had a floristic diversity comparable with or exceeding the species-rich plant communities found on the plains of the New Forest today, many of which have a distinctly southern/Mediterranean flavour. It is also worth noting that the Buddle Herbarium has also proved invaluable in helping in evaluate the status of *Cystopteris diaphana* (Bory) Blasdell in the UK (Murphy & Rumsey, 2005; Rumsey 2007).

While no one strand of this evidence conclusively supports a native status for *E. ramosissimum*, in combination they do form a more compelling case and together suggest that dismissing the species as a neophyte is unwise. While somewhat unsatisfactory we recommend the listing of *E. ramosissimum* as “Native or Alien” as
the best solution.

ACKNOWLEDGEMENTS
The authors would like to thank Helena Crouch for information relating to the Somerset site, Pat Acoc for information on the Monmouth site, Trevor Dines for material from Anglesey and Ian Bonner for information on that site and Alison Paul for assistance with herbarium material at BM.

REFERENCES
MARTYN, T. (1763) Plantae Cantabrigienses: or, a catalogue of the plants which grow wild in the County of Cambridge: disposed according to the system of Linnaeus. Herbagees Cantabrigienses: or, Directions to the places where they may be found, comprehended in thirteen botanical excursions. To which are added, lists of the more rare plants growing in many parts of England and Wales. J. Beecroft, London.
APPENDIX 1.
Specimens of *E. × meridionale* (or triploid hybrid) at BM
v.c..58 Cheshire
New Brighton, Cheshire, June 1839, ex. herb. S. Simpson
Sandhills, New Brighton, on the shores of the Mersey near Liverpool. 18 June 1842, J.B.W.
New Brighton, 10/1842 ex herb. Silvanus Thompson.
New Brighton, Cheshire, 1843 S. Thompson
Nr New Brighton, Cheshire 1843 ex herb. W.C. Barton
New Brighton, Cheshire, 30 July 1849, J. Sansom
New Brighton Cheshire, July 1850, ex herb. J. Dickinson
New Brighton, Cheshire, 1869, H.J. Fisher
Wallasey, sand hills, 9/[18]71, H. Fisher
Coast sandhills, Wallasey, Cheshire 30/V/1874, J. Harbord Lewis
Sandhills, Wallasey, Cheshire, 1 Oct. 1891, S.W. Woodhead
Wallasey sandhills, Sept. 1905, E.D [mixed sheet with E. palustre]
v.c..59 S. Lancashire
Crosby, Lancashire 25.VI. [18]70, J. Harbord Lewis
Southport, Lancashire, 1883, H. Searle
Sandhills, Southport, Lancashire, 6.[18]84, H. Searle