

Notes

ELYTRIGIA REPENS (L.) DESV. EX NEVSKI SUBSP. *ARENOSA* (SPENNER) Á. LÖVE (POACEAE) IN SOUTH-EAST YORKSHIRE (V.C. 61)

The account of *Elytrigia repens* (L.) Desv. ex Nevski subsp. *arenosa* (Spenner) Á. Löve in north-western Europe (Trist 1995) prompted searches for this taxon on the north bank of the Humber estuary, including the Spurn peninsula, during the period 1995–1998. The following new records represent a significant extension to the known distribution on mainland Britain:-

Haverfield Quarry, TA/323.200; Welwick Bank, TA/335.193; Winsetts Bank, TA/380.177; Easington, near Firtholme Clough, TA/398.167; Spurn Bird Observatory, TA/420.148 and Spurn Warren, TA/408.117.

Trist (1995) commented on the variable incidence of awns and both awned and awnless forms of this grass were recorded.

At each location, *E. repens* subsp. *arenosa* occurs on consolidated sand of low salinity, cohabiting with at least four of the following: *Erodium cicutarium* (L.) L'Hér., *Galium verum* L., *Potentilla reptans* L., *Ononis repens* L., *Allium vineale* L., *Carex arenaria* L., *Festuca rubra* L., *Agrostis stolonifera* L., *E. repens* subsp. *repens* var. *aristata* (Döll) P. D. Sell, *E. atherica* (Link) Kerguélen ex Carreras Martinez, *Ammophila arenaria* (L.) Link and, on Spurn only, *Potentilla anserina* L., *Plantago coronopus* L., and *Hippophaë rhamnoides* L. These species indicate established and forming sand dune communities in the National Vegetation Classification SD7 through to SD10.

DISCUSSION

Knowledge of the distribution as presented by Trist (1995) suggests *E. repens* subsp. *arenosa* is rare in Britain and in north-western Europe. However, the ease with which these new records were taken suggests that *E. repens* subsp. *arenosa* may be yet under-recorded.

Taxonomic rank as high as subspecies is considered doubtful by some, e.g. Stace (1991). However, as Trist (1995) shows, the taxon has had a "chequered history" ranging in rank from variety through subspecies to species.

The Welwick Bank, Winsetts Bank and Easington locations, each of an area less than 400 m², represent approximately 50% of the total SD7 to SD10 resource in v.c. 61. Each location is at risk of damage as a result of proposed reconstruction of flood defence structures.

Local rarity of habitat type alone may not be enough to protect these locations, even though they appear to be characterized, in part, by a low-rank taxon which can still be regarded as rare in Britain and north-western Europe.

ACKNOWLEDGMENT

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THE POTENTIAL FOR SEED DISPERSAL BY SEA WATER IN *COINCYA WRIGHTII*
(O. E. SCHULZ) STACE AND *C. MONENSIS* (L.) W. GREUTER & BURDET
SUBSP. *MONENSIS*

The two endemic *Coincya* taxa in Britain have restricted distributions (Rich 1991). *C. wrightii* (O. E. Schulz) Stace is confined to sea cliffs on the island of Lundy in the Bristol Channel. *C. monensis* (L.) W. Greuter & Burdet subsp. *monensis* occurs on maritime sands around the east side of the Irish Sea from the Clyde to the Wirral and on the Isle of Man and has disjunct localities on Mull (extinct) and on the Gower and North Devon (the latter extinct). As both taxa have essentially maritime distributions, it might be expected that their seeds could be dispersed by the sea like other specialised maritime crucifers such as *Cakile maritima* Scop., *Crambe maritima* L. and *Raphanus maritimus* Sm. (c.g. Praeger 1913).

An experiment was set up to investigate the potential for seed dispersal by sea water in the laboratory. In *Coincya* the fruits have two distinct parts which might have different dispersal capacities; the lower part is composed of twin loculi covered by dehiscent valves each with numerous seeds, and the upper part is an indehiscent beak with a few seeds. When the fruits are ripe, the valves dehisce to release the seeds in the loculi whilst the beaks remain intact until the infructescences break up. The experiments investigated the length of time for which individual seeds and beaks floated and the capacity for germination after periods of immersion in sea water and rain water. Only small numbers of seeds were available as both plants are rare.

FLOATATION EXPERIMENT

100 seeds and 50 beaks of each taxon were placed in separate beakers of sea and rain water, and the number remaining floating recorded with time. The beakers were shaken at irregular intervals to simulate wave action. A small amount of domestic detergent (washing-up liquid) was added to some additional beakers to test if surface tension helped the seeds float.

All beaks of both taxa floated for at least 12 hours, and some for up to four days, but most seeds sank immediately (Table 1). In both cases the proportion of beaks or seeds floating was higher in sea water than rain water as might be expected. Detergent caused all seeds and beaks to sink more rapidly (data not presented).

GERMINATION EXPERIMENT

Sub-samples of ten seeds were taken at intervals from beakers with sea water and fresh water, rinsed and placed on moist tissue paper in beakers to germinate in the light at room temperature. Controls were sown directly onto moist tissue without being immersed in water. Total germination (i.e. emergence of the radicle) was counted after 28 days. A few seeds in rain water went mouldy before germinating.

The number of seeds germinating after immersion in rain and sea water for different periods of time is shown in Table 2. The first seeds germinated after six days when completely immersed in rain water. Seeds which had been immersed in sea water were generally much slower to germinate than seeds immersed in rain water.

Germination was significantly lower in *C. monensis* than *C. wrightii* (ANOVA, all treatments lumped, d.f. = 1, $p < 0.001$). No seeds of either taxon germinated when immersed continuously in sea water for 28 days; dissection of the seeds in sea water showed that they had partially hydrated compared to dry seeds, whilst seeds in rain water appeared to have completely hydrated. There are no significant differences in germination after different periods of immersion in either sea or rain water for either taxon.

CONCLUSIONS

The floatation experiment shows that beaks float for longer periods than seeds in both taxa, and thus dispersal in sea water is more likely to occur by beaks than seeds. However, the length of time for which beaks float is very short, in general up to three tidal cycles (though one beak of *C. monensis* did float for four days in sea water), which may explain why both taxa have restricted distributions.

TABLE 1. NUMBER OF *COINCYA* BEAKS OR SEEDS FLOATING WITH TIME IN BEAKERS OF RAIN AND SEA WATER.

Hours	<i>Coincya monensis</i>				<i>Coincya wrightii</i>			
	Rain water		Sea water		Rain water		Sea water	
	Beaks	Seeds	Beaks	Seeds	Beaks	Seeds	Beaks	Seeds
n	50	100	50	100	50	100	50	100
0	50	17	50	24	50	17	50	34
1	50	3	50	8	50	14	50	26
2	50	1	50	5	50	1	50	19
3	50	1	50	2	50	1	50	3
12	50	1	50	0	50	1	50	1
24	0	0	20	0	48	0	45	0
36	0	0	11	0	7	0	10	0
48	0	0	5	0	0	0	0	0
72	0	0	3	0	0	0	0	0
96	0	0	1	0	0	0	0	0
120	0	0	0	0	0	0	0	0

TABLE 2. NUMBER OF *COINCYA* SEEDS GERMINATING AFTER IMMERSION IN SEA OR RAIN WATER FOR PERIODS OF TIME (N = 10).

Time immersed	<i>Coincya monensis</i>		<i>Coincya wrightii</i>	
	Rain water	Sea water	Rain water	Sea water
0 days (control)		2		10
Continuous sea water		0		0
1 day	4	1	8	9
2 days	3	2	9	7
3 days	3	1	10	9
7 days	2	2	7	5

Seeds will not germinate in sea water, but seeds of both taxa retain viability even after seven days immersed in sea water, over twice the maximum floatation time. Presumably, as in *Cakile* (Hocking 1982), the high sodium chloride levels inhibit germination until seeds are washed ashore and leaching by rain lowers the salt content.

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SOUTHWARD RECOLONISATION BY *MERTENSIA MARITIMA* (L.) GRAY ON THE
COAST OF NORTH-EASTERN SCOTLAND

The distribution of *Mertensia maritima*, a beach plant growing in the strandline zone reached by highest tides, has fluctuated markedly since 1800 in northern Britain (Stewart 1994), with patterns quite different in the half-centuries 1800–1849, 1850–1899, 1900–1949 and 1950–1992. On the east coast between Fraserburgh and Berwick, the range of *Mertensia* contracted sharply after 1900, there being 28 occurrences in 10-km squares for the 1800–1899 period compared to just three occurrences for the 1950–1992 period (Stewart 1994). This author suggests that human recreation and shingle removal are the likely causes of this decline.

Since about 1980, *Mertensia maritima* has been recolonising the east Aberdeenshire coast (v.c. 93) (Table 1, Fig. 1). Probably the species was totally extinct after 1950 between Fraserburgh and Aberdeen, since no records were made during the B.S.B.I. Maps Scheme (Perring & Walters 1962), but some stretches of this coast are remote and might not have been thoroughly examined. However, other shores would have been visited often, e.g. Craig Ewan by Peterhead Golf Course, or are in conservation areas (Sands of Forvie National Nature Reserve and Loch of Strathbeg R.S.P.B. Reserve) and got regularly recorded; for some of these shores there is no doubt that *Mertensia* was absent, then one to several plants colonised, and now numerous plants occur (Table 1).

TABLE 1. POPULATION SIZE AND DATES OF RECORDING OF ELEVEN COLONIES OF
MERTENSIA MARITIMA ON A 50 KM SECTION OF THE ABERDEENSHIRE AND
KINCARDINESHIRE COAST

Colony	1 km square	Distance (km) from Craig Ewan	Year of recording	Number of plants (plt) and seedlings* (sdlg)	Recorder
Craig Ewan	NK/12.48	0	1989	40 plts and sdgls	M. Innes
			1991	35 plts and sdgls	M. Innes
			1998	37 plts and sdgls	M. Innes
Gadlc Braes	NK/13.46	1	1994	23 plts and sdgls	M. Innes
			1998	50 plts and sdgls	M. Innes
Sandford Bay	NK/12.43	4	1985	5 plts	D. Welch
			1990	10 plts	D. Welch
			1998	3 plts	D. Welch
Furrah Head	NK/13.43	5	1988	c.10 plts	M. Innes
			1998	c. 840 plts and sdgls	M. Innes
Boddam	NK/13.42	6	1989	7 plts	D. Welch
			1992	16 plts	D. Welch
			1998	absent	D. Welch
Whinnyfold	NK/08.33	16	1992	few plts	C. Millar
			1998	absent	M. Innes
Perthudden	NK/03.28	24	1991	3 plts + 25 sdgls	T. Dargie
			1998	2 plts	D. Welch
Poor Man	NK/03.27	24	1989	1 plt	B. Davis
			1992	14 plts + 83 sdgls	L. Farquhar
			1998	19 plts + 4 sdgls	D. Welch
Broadhaven	NK/03.27	25	1992	9 plts + 32 sdgls	L. Farquhar
			1998	2 plts	D. Welch
Sanync-Rockend	NK/02.26	26	1992	73 sdgls	L. Farquhar
			1998	absent	N. Harding
Nigg Bay	NO/96.04	48	1996	1 plt	B. Ballinger
			1998	1 plt	D. Welch

*seedlings were arbitrarily defined as having <10 leaves and being <10 cm² in area.

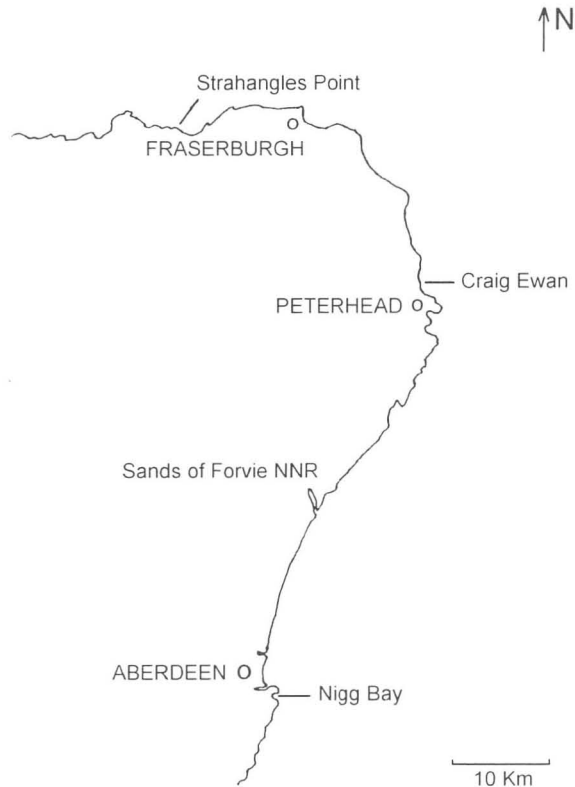


FIGURE 1. Map of the coastal area of north-eastern Scotland showing main towns, the site of the long-standing colony of *Mertensia maritima* at Strahangles Point, and the section of coast between Craig Ewan and Nigg Bay being presently colonised.

Evidence for a southward direction in the recolonisation is given by the first dates of observation in Table 1. At Craig Ewan the 40 plants present in 1989 indicate an initial colonisation c. 1980–1984; at Nigg Bay (v.c. 91) colonisation was almost certainly in 1996, judging from the small size of the single plant in that summer and the regular searching along this shore since 1992 made by botanists checking on a colony of *Lathyrus japonicus*. The source of the sea-borne seed initially producing these colonies could have been the large Orkney populations (Randall 1988; Stewart 1994) or the populations on the northern coast of Aberdeenshire and Banffshire (v.c. 94); the nearest of these populations extant after 1970 is at Strahangles Point, Aberdeenshire (NJ/88.64), where 101 established plants and 66 seedlings were counted in 1987 (John Edelsten, pers. comm.).

Differences in trends between sites over the study period are probably related to the coarseness of their substrate material. The colony at Furrach Head, which has increased spectacularly, occupies rocks and stones that have slumped to the beach from the boulder clay slope above, and at Poor Man the plants grow among large pebbles (mean diameter of c. 20 cm) but rooted in gravel. In contrast, sandy beaches have either not been colonised, e.g. the 22 km of coast between Rockend and Nigg Bay, or their colonies have remained tiny, e.g. at Sandford Bay. Here the three plants grow at the top of the beach, very close to a dense stand of *Leymus arenarius* which perhaps restricts colonisation; these plants may also suffer from being covered by sand during storms.

The few seedlings observed at the Forvie sites in NK/0.2 in 1998 suggest that establishment is difficult and variable between years. At Poor Man the largest plant had a diameter of 1 m in 1998, and the 18 other adult plants averaged about 50 cm diameter, so considerable quantities of seed should have been produced in the previous few years. Perhaps there was more germination in 1998 than was apparent at the September monitoring visit, and the seedlings failed to survive.

Explanations for the observed distribution changes are necessarily speculative in the absence of monitoring on plant growth, longevity, fruiting and dispersion. With the species classified as scarce (Stewart 1994) and a total British population estimate of only c. 11,000 plants and seedlings in the 1980s (Randall 1988; Farrell 1989), determination of the controlling factors is very desirable. Low winter temperatures to stimulate seed germination, and relatively low summer temperatures to avoid drought for juvenile plants, have been put forward as controls on the broad range of *Mertensia* (Randall 1988). At the local scale other factors may be important. For the Nigg Bay colony, so strong in the nineteenth century that 20 separate specimens are known in British herbaria, Trail (1923) considered the cause of extinction was removal of shingle to make concrete for the south breakwater adjoining Aberdeen beach. Randall (1988), from visits to a wide range of colonies, considered that burial by sand in summer, grazing by sheep and rabbits, and trampling by humans could all severely deplete populations. But, with *Mertensia* now increasing at some sites with quite heavy public recreation pressures, it seems that even more factors may be affecting populations. We suggest that variable fruiting in response to climatic trends and shifts in the direction of sea currents also merit investigation as well as the factors advanced by previous workers.

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ERICA CILIARIS L. (ERICACEAE) DISCOVERED IN THE BLACKDOWN HILLS, ON THE SOMERSET-DEVON BORDER (V.C. 3)

Erica ciliaris L. is a European near-endemic, with a world distribution extending from the north-western tip of Morocco northwards through Portugal, western Spain and France, and reaching its northern limit in southern England, with one site in western Ireland. It is a member of the Oceanic Southern-temperate element of the British and Irish flora (Preston & Hill 1997). In Britain it has a curiously disjunct distribution, being almost entirely restricted as a native to the Purbeck area of Dorset (v.c. 9) and Cornwall (v.cc. 1 & 2). Isolated records – usually of just a few plants – from Dartmoor, the New Forest and Anglesey are generally presumed, or known as in the case of Dartmoor, to have been introductions (Ivimey-Cook 1984; Rose *et al.* 1996; L. Spalton,

pers. comm.). In a few locations in the New Forest it is thought to be native and is extending its range naturally into suitable habitat in this area from its Dorset stronghold (Chapman & Rose 1994; Brewis *et al.* 1996).

On 27th August 1998, during a routine visit to a Site of Special Scientific Interest (S.S.S.I.) in the Somerset part of the Blackdown Hills, the writer noticed a strange-coloured heather looking like *E. ciliaris*. A careful search revealed that *E. ciliaris*, along with *Erica tetralix* L., was the commonest dwarf-shrub species over about 0.5 ha of wet heath and mire. The colony was clearly a long-established one, many plants being 0.4–0.6 m tall with shoots probably 15–20 years old. The total population of *E. ciliaris* was difficult to estimate, but was thought to be in the order of 1,000–10,000 plants.

The following day the author returned to the site with Paul Green and Ian Green, B.S.B.I. recorders for v.c. 5 and 6 respectively, who confirmed that it was indeed *E. ciliaris*. Many plants of the hybrid between *E. ciliaris* and *E. tetralix* (*E. × watsonii* Benth.) were noted, with considerable variation in flower colour and foliage. Specimens of both *E. ciliaris* and *E. × watsonii* were sent to D. McClintock, who confirmed the identifications.

Is it possible that *E. ciliaris* is native at this site, representing a geographical “missing link” between its strongholds in Dorset and Cornwall? The site is at an altitude of 210 m A.O.D., which makes it higher and further north than any other “native” English site. There is no evidence of *E. ciliaris* having been introduced – indeed, to those of us who have seen it there, the plant has every appearance of being native, occurring in an area of high-quality mire vegetation, with *Molinia caerulea* (L.) Moench., *E. tetralix*, *Eriophorum angustifolium* Honck., *Succisa pratensis* Moench., *Narthecium ossifragum* (L.) Hudson and *Sphagnum* spp. as common associates. In phytosociological terms the vegetation is mainly *Narthecium ossifragum* - *Sphagnum papillosum* valley mire (M21) with *Potamogeton polygonifolius* - *Hypericum elodes* soakways (M29), grading into *Molinia caerulea* - *Cirsium dissectum* fen-meadow (M24) on slightly drier ground (Rodwell 1991). This appears to be similar to the kinds of vegetation in which *E. ciliaris* occurs in Dorset (Rose *et al.* 1996).

It is surprising that such a large and evidently long-established population of *E. ciliaris* could have been overlooked for so long. However, there may be several good reasons for this. Firstly, the general area is seldom visited by natural historians as it is not obviously *en route* to any of the region’s well-known botanical hunting grounds. Secondly, the site has no public access, and is not visible from any public right of way. Thirdly, even supposing one had the good fortune to visit the site, the difficult terrain and tussocky nature of the vegetation would cause many fieldworkers to avoid the area in which *E. ciliaris* grows. Even so, it is extraordinary that the plant has been missed until now, given that over the last 15 years - during which time it *must* have been present - the site has received several visits from experienced field botanists, including Nature Conservancy Council and English Nature staff. On more than one occasion the area was visited in late August-early September, at a time when *E. ciliaris* should have been *in flower!*

If, as suspected, its occurrence on this S.S.S.I. is a truly native one, there is a possibility that *E. ciliaris* will be recognised elsewhere in this region. There is other suitable-looking habitat in the Blackdown Hills, in both S. Devon (v.c. 3) and S. Somerset (v.c. 5), as well as on the East Devon Pebblebed Heaths, near Budleigh Salterton (v.c. 3).

The newly discovered site for *E. ciliaris* lies close to the Somerset-Devon border, in a part of Somerset that actually falls within v.c. 3 (S. Devon). The site is on privately owned farmland, and the owners have requested that details of its exact location should not be published. Anyone wishing to visit the site should contact the writer at the address below.

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GENTIANELLA ULIGINOSA (WILLD.) BÖRNER (GENTIANACEAE) REDISCOVERED
IN NORTH DEVON

Dune Gentian *Gentianella uliginosa* (Willd.) Börner is a European endemic and regarded as a “priority species” within the UK Biodiversity Action Programme. Rich (1996) reported previously unknown herbarium specimens collected at Braunton Burrows in North Devon (v.c. 4) prior to 1849 and in 1927 (all in **BM**), and suggested that it should be searched for again. Elsewhere in Britain it is known at five sites in south Wales (Kay 1972; Ellis 1983) and three on the island of Colonsay off western Scotland (Gulliver 1998; Rose 1998).

On 28 August 1998 *G. uliginosa* was rediscovered at Braunton Burrows (SS/4.3) during a survey of all the slacks of this extensive dune-system. Over 130 plants of *G. uliginosa* were found in an area of several square metres in part of one dune-slack. A series of voucher specimens was collected (NMW) and numerous photographs were taken. The plants identified as *G. uliginosa* were 2–4 cm tall, some reaching 6 cm, with one or two (rarely three) internodes; they all showed the long terminal pedicel (> one-half of total height to pedicel apex), and calyx lobes often of uneven size and spreading away from corolla, that are characteristic of this species.

About 60 plants of *Gentianella amarella* (L.) Börner were growing intermixed with the *G. uliginosa*, and this species is widespread in numerous dune-slacks and grassland elsewhere at Braunton Burrows. Compared to *G. uliginosa*, *G. amarella* had much shorter terminal pedicels and mostly appressed calyx lobes that were all of similar size; they also included much larger plants (up to 21 cm tall) with more numerous internodes (4–10). However, at least seven plants of *Gentianella* associated with the population of *G. uliginosa* appeared intermediate between that species and the closely adjacent *G. amarella* in respect of pedicel length, number of internodes and calyx characters. The latter were judged to be hybrids between *G. amarella* and *G. uliginosa*, as were small numbers of plants seen during 24–30 August 1998 in other dune-slacks at Braunton Burrows accompanying *G. amarella* but not *G. uliginosa*. Hybrids with *G. amarella* are known from most colonies of *G. uliginosa* in south Wales, where they are reported to be fertile and to show “all grades of intermediacy” (Stace 1991), but they have not hitherto been reported from England.

G. anglica (Pugsley) E. F. Warb. and its hybrids with *G. amarella* also occur in the same dune system (Rich *et al.* 1997), although in different slacks to *G. uliginosa*. Since Braunton Burrows is the only locality with both *G. anglica* and *G. uliginosa*, both of which grow alongside *G. amarella*, and the flowering seasons of all three species partly overlap, the possibility exists of other hybrids. Further investigations of the intermediate plants at Braunton Burrows are therefore planned.

The *G. uliginosa* plants at Braunton Burrows were growing in almost closed cover of low vegetation (mainly c. 3 cm, tallest stems to 10 cm), on the nearly flat, humic sand of the floor of the dune-slack. The turf had numerous grasses and herbs, the commonest being *Agrostis stolonifera* L., *Leontodon saxatilis* Lam., *Lotus corniculatus* L., *Holcus lanatus* L. and *Hydrocotyle vulgaris* L.; only sparse *Salix repens* L. was present. Grazing by rabbits appears to be important at present in

maintaining the short sward at this location. However, rabbit numbers at Braunton Burrows have been much reduced over recent decades by myxomatosis and the consequent reduction in grazing has contributed to loss of much of the herb-rich turf for which this S.S.S.I. is famous (Breeds & Rogers 1998). Monitoring of *Gentianella* populations at Braunton Burrows is therefore needed to ensure timely management intervention where grazing pressure from rabbits declines.

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RUBUS CAMPANIENSIS WINKEL EX BEEK (ROSACEAE) IN BRITAIN

In 1977 I came across a large population of an unfamiliar glandular bramble with cupped pink flowers and distinctive leaf shape and prickle development on an overgrown old common near Emsworth, S. Hants., v.c. 11. A. Newton, to whom a specimen was shortly afterwards submitted, did not recognise it as any named species known to him, suggesting that it was perhaps a hybrid of *R. sprengelii* Weihe. Subsequent discovery of what was clearly the same bramble in two further localities in that district, however, rendered that suggestion less likely.

Around 1982 a search of CGE brought to light a series of specimens matching this Hampshire plant from Hosey Common, near Westerham, W. Kent. v.c. 16, labelled as *R. adornatiformis* Sudre, a species recorded as frequent in that locality by Watson (1958). That name, however, was known to have been applied by Watson to British material doubtfully correctly; moreover, specimens from other localities in south-east England in **BM**, **NMW** and **SLBI** so determined by him are not only all different from his Hosey Common plant but mostly from one another as well. Eedes & Newton (1988) were clearly well justified in relegating the taxon to an appendix listing names applied to British Isles *Rubi* dubiously at best.

A further match was then made with two Dutch specimens in **BM** labelled as *R. drymophilus* Mueller & Lef., and a further one queried as *R. granulatus* Lef. & Mueller, all collected in 1951 and sent by Kern & Reichgelt to F. Rilstone in an exchange. Again, however, neither of those names were judged to be applied correctly. The discovery that the plant was evidently present in the Low Countries nevertheless suggested that it would be worth sending specimens to the Belgian specialist in the group, H. Vannerom, and this was accordingly done in 1992. Vannerom at once recognised it as a bramble well known to batologists there. It had first passed for some years under

one or other of the two names used by Kern & Reichgelt and later put into wider currency by Beyerinck (1956), but, those having been found to be erroneous, the epithet *campaniensis* – after the Kempens district which bestrides the Dutch-Belgian border in the vicinity of Antwerp, where the bramble had turned out to be rather common – had been adopted instead. In the confident expectation that it would shortly be described as a new species by J. van Winkel, that name had already made at least one informal appearance in print (Vannerom 1986). Having examined a large number of sheets of the plant in 1986 in the Rijksherbarium at Leiden (L), I felt similarly safe in subsequently introducing the manuscript name into the British literature, attributing it to van Winkel (Allen 1996). In the event, however, van Winkel died before realising his intention, and it has fallen to van de Beek (1998) to publish the description. The holotype has been deposited in L, and an isotype donated to BM.

Although van de Beek refers *R. campaniensis* to ser. *Radula* (Focke) Focke, the markedly variable expression of the armature, including its near-total suppression, seem to make it more appropriately placed in ser. *Anisacanthi* H. E. Weber (as in Allen 1996). In addition to the Kempens district the distribution is described as extending to Gelderland and Zeeland in the Netherlands, though much more thinly, and to Kent (locality unspecified) in England. However, as the following list of British exsiccatae indicates, its range in south-east England is actually much wider than that:

- v.c. 11, S. Hants.: abundant in chestnut plantations, Emsworth Common, SU/74.08, 23 July 1977 (BM), 19 June 1983 (herb. D.E.A., herb. H. Vannerom), 19 July 1992 (BM, BON), D. E. Allen. One patch, Havant Thicket, SU/715.113, 9 July 1977, D. E. Allen (BM). (The Emsworth Common population extends a short way into v.c. 13, W. Sussex).
- v.c. 15, E. Kent: east part of Denstead Wood, near Canterbury, TR/091.570, 14 July 1964, B. A. Miles, indet. (CGE).
- v.c. 16, W. Kent: Hosey Common, TQ/45.52, 13 Aug. 1905, anon. (but in handwriting of C. E. Britton), det. W. M. Rogers as *R. pallidus* var. *leptopetalus* forma, det. A. Newton 1977 as possibly *R. praetextus* (BM); 12 July 1934 (NMW), 21 July 1938 (CGE, SLBI), 6 July 1949 (CGE, NMW), 28 Aug. 1951 (SLBI), W. C. R. Watson, all as *R. adornatiformis*; 2 July and 10 Aug. 1954, 13 July 1955, 16 July 1957, W. H. Mills, all as *R. adornatiformis* (CGE); 2 July 1961, B. A. Miles as *R. adornatiformis* (CGE).
- v.c. 17, Surrey: Tilburstowhill Common, TQ/355.505, 16 July 1962, B. A. Miles (CGE).

Hosey Common and Tilburstowhill Common are both on the Lower Greensand within 10 km of each other. It should be noted that specimens collected on the former by J. E. Woodhead in 1948 and 1951 and labelled *R. adornatiformis* (CGE), and on the latter by C. Avery in 1951 and labelled *R. rotundifolius* (SLBI), are not *R. campaniensis* but represent other, unnamed morphotypes.

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SEPARATION OF *CAREX VULPINA* L. AND *C. OTRUBAE* PODP. (CYPERACEAE)
USING TRANSVERSE LEAF SECTIONS

A rare plant in Britain, *Carex vulpina* is listed as vulnerable (Wigginton 1999) and is thought to have significantly declined in the last 20 years (Stewart *et al.* 1994). In recognition of its threatened status an Action Plan has been produced (Anon 1995) as a framework to prevent further decline and plan for recovery. *C. vulpina* is superficially very similar to *Carex otrubae* and both are in the same subgenus *Vignea* (Stace 1997). The taxonomy of these two species in Britain was not elucidated until relatively recently (Nelmes 1939), but their separation remains problematical. Several morphological characters have been used to distinguish between the two species (Rich & Jermy 1998; Jermy, Chater & David 1982), but these can be variable, leaving the botanist with a degree of doubt over the plant in question. Hitherto, one of the most reliable characters has been the shape of the adaxial epidermal cells of the utricles, but even here there is some overlap between *C. vulpina* and *C. otrubae* and often material is difficult to place.

Fundamental to the delivery of the conservation objectives is the ability to reliably distinguish this species from *C. otrubae*. Using material determined as *C. vulpina*, a comparison was made with *C. otrubae*, investigating a number of potentially useful morphological characters. It was noted that internal leaf anatomy, observed in transverse sections about half way up the leaf, differed markedly between the two species. Leaf sections were cut by hand with a double-edged razor blade using the tip of the forefinger as a cutting guide. Sections were mounted in water and observed under a compound microscope. An examination of many specimens, collected from Oxfordshire and Kent, showed that these differences remained constant.

Leaf anatomy, as seen in transverse sections of the lamina, has been used extensively in taxonomic investigation of the Cyperaceae, including *Carex*, and many of the characters can be used for diagnostic purposes at the species level (Metcalf 1971). Metcalf's book should be consulted for an explanation of the terms used in this note. The most useful anatomical feature in separating the two plants are the bulliform cells that overlie the midrib. In *C. vulpina* (Fig. 1) they are only slightly inflated, up to 70 μm long (usually less), and are 3-tiered (sometimes 4-) and not strongly differentiated from the neighbouring chlorenchymatous cells. In *C. otrubae* (Fig. 2) the bulliform cells are strongly inflated, up to 85 μm long, extending from the adaxial epidermis to the median vascular bundle, and arranged in a single tier forming a quite distinct group. In addition, the adaxial (upper surface) epidermal cells in *C. vulpina* are relatively small, about 20 μm wide, whilst those in *C. otrubae* are larger, about 40 μm wide. These and further differences are summarised below.

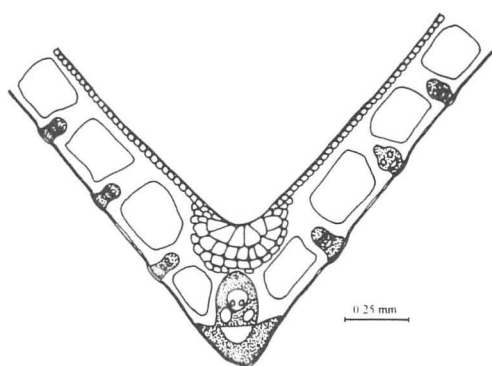


FIGURE 1 *Carex vulpina*, Otmoor, Oxfordshire 1998. T.S. of keel region of leaf (sclerenchymatous tissue stippled).

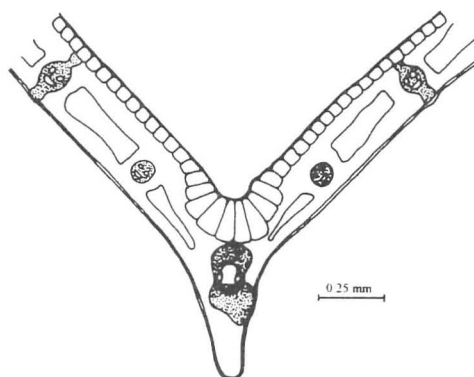


FIGURE 2 *Carex otrubae*, Otmoor, Oxfordshire 1998. T.S. of keel region of leaf (sclerenchymatous tissue stippled).

<i>Carex vulpina</i>	<i>Carex otrubae</i>
bulliform cells numerous, not strongly inflated and at least 3-tiered	bulliform cells few, strongly inflated and single tiered extending from adaxial epidermis to median vascular bundle
adaxial epidermal cells small, 20 µm wide	adaxial epidermal cells about twice as large, 40 µm wide
air cavities within mesophyll ± quadrate	air cavities ± elongate
sclerenchyma associated with median vascular bundle sits evenly in keel	sclerenchyma associated with median vascular bundle offset
sclerenchyma girders usually positioned abaxially	sclerenchyma girders usually span width of lamina
margin often incurved and filled with sclerenchymatous tissue in extreme lamina margin	margin flat and sclerenchyma not in extreme leaf margin
keel blunt	keel sharp

Leaf sections are easy to prepare and provide an unequivocal way of distinguishing between *C. vulpina* and *C. otrubae*. Furthermore, vegetative plants can be named obviating the need for inflorescences. Other large sedges sometimes grow with *C. vulpina*, including *C. riparia* Curtis and *C. acutiformis* Ehrh. These two species are morphologically distinct, particularly in ligule shape, but if there is any doubt they can be separated on leaf anatomy, both plants having a papillose abaxial epidermis seen most easily in transverse section.

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