Carex muricata L. subsp. muricata (Cyperaceae) - a review of its present status in Britain

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ABSTRACT

The present status of the sedge, *Carex muricata* subsp. *muricata*, critically endangered in Britain, is reviewed and, where relevant, the causes of its decline identified. A brief history of the plant at its few British colonies is also given.

KEYWORDS: Prickly sedge, distribution, rarity, threats, conservation.

INTRODUCTION

It was only following the work of E. Nelmes (Nelmes 1947) that *Carex muricata* subsp. *muricata* was recognised as a British plant, having been included within *C. muricata* s.l. by earlier authors. Nelmes' findings were based on herbarium studies in which he identified the plant in earlier collections made at four widely scattered British sites in Gloucestershire, Denbighshire, Yorkshire and Berwickshire. All other British material which he examined within *C. muricata* s.l. was assigned by him to subsp. *lamprocarpa* (as *C. pairaei*). This plant, whilst locally frequent throughout much of Britain, decreases rapidly moving eastwards in Europe where it is largely replaced by subsp. *muricata*.

A taxonomic description of the two subspecies in Britain has been given by David & Kelcey (1985). Important character differences between them include the more robust habit, rigid, erect flowering stems, the much earlier flowering of subsp. *muricata* and, when immature, dark glumes which are much shorter than the matt green utricles giving the inflorescence a chequered appearance (Fig. 1). This contrast disappears as the fruit ripens, both the glumes and utricles becoming dark brown or even blackish. On the other hand, in subsp. *lamprocarpa* the glumes are initially pale yellow-green and almost the same length as the similarly coloured utricles, so that the chequered contrasting pattern of subsp. *muricata* is initially lacking and not apparent until maturity, when the glumes fade to white and the utricles darken. There are also ecological differences. In Britain, subsp. *muricata* is a plant of calcareous habitats, occurring especially over warm, sloping limestone scree, whereas subsp. *lamprocarpa* prefers an acidic substrate and is more a plant of the lowlands (David & Kelcey 1985).

The present authors, familiar with subsp. *muricata* at its few known localities in northern England, and having recently become concerned about the apparent decline of the populations and the degeneration of the habitat at some localities, decided to investigate further the current status and ecology of the plant. This work was later expanded and incorporated into a country-wide project subsequently sponsored by English Nature. The original investigations were augmented by an assessment of the local distribution and management. Vegetative material was also collected for

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subsequent genetic studies involving DNA sequencing from individual plants at the extant populations, and seed for storage in the Millennium Seed Bank at Kew. Further details relating to this survey and to the location of all known populations are given in a confidential report to English Nature (Foley & Porter 1999).

KNOWN BRITISH LOCALITIES

Nelmes' critical work at **K** led to the initial recognition of subsp. *muricata* in Britain. In 1942 he first identified as such, a specimen in Druce's herbarium which had been collected in 1900 on oolitic limestone at Woodchester, v.c. 34. Subsequently (Nelmes 1947), he identified three other collections as the same taxon from the top of a limestone hill near Wrexham, Denbs., v.c. 50 (1840, Bowman), from the castle grounds at Lauder, v.c. 81 (1878, Brotherston), and from limestone slopes and scree at Gordale, v.c. 64 (1934, Milne-Redhead & Sandwith; 1937, Lousley).

However, his work appeared to generate little interest, until R. W. David and J. G. Kelcey made attempts to refind the plant at the original localities. Initially this was unsuccessful due to the difficulty in locating such a rare, and somewhat insignificant plant in large areas of apparently suitable habitat. However, in 1974 B. M. Mack found an unidentified *Carex* at Nympsfield, Gloucestershire which she sent to David (David & Kelcey 1975) and which was subsequently identified as subsp. *muricata*. Nympsfield is only a short distance from Woodchester, Druce's original locality, and may be the same.

In 1978, at Minera, near Wrexham, the plant was discovered by A. Newton. Despite claims that this was a rediscovery at the original 1840 locality (Anon 1981), there can be no certainty that this was so, as there is much suitable habitat elsewhere in this area.

Just prior to this in 1977, F. J. Roberts had found a small population growing on wooded limestone pavement in upper Ribblesdale, v.c. 64. In the following year plants were seen at the same locality and their identity confirmed by R. W. David but there was some doubt as to whether this was Roberts' original population (David 1979). At the previously known Yorkshire locality at Gordale, searches were initially unsuccessful, but subsp. *muricata* was eventually refound there in 1984 by P. Jepson. His locality is probably slightly different to that of the earlier collections of both Milne-Redhead & Sandwith and of Lousley. Up to the present, the original 1930s Gordale localities have still not been refound and may now be extinct as this is a very popular area with walkers and climbers who may have inadvertently eliminated the plant. Nevertheless, Gordale has a large area of suitable, often inaccessible habitat where the plant may perhaps still remain undetected.

When D. Millward was surveying for the Flora of Wensleydale in 1987, she discovered a population of an unusual *Carex* in lower Swaledale. The plants were subsequently confirmed as subsp. *muricata* by R. W. David and occurred in a fairly open habitat at the base of limestone scree, the locality being some appreciable distance from other known sites. In 1999, S. J. Whild and A. Lockton discovered another locality near Nantmawr, Shropshire, v.c. 40, in a rather similar habitat to that at Swaledale and almost 30 km to the south of the Minera population.

Of Nelmes' original four localities, it is only at Lauder where the plant has not been refound at least within the general vicinity. However, here the habitat is not calcareous and appears to be quite unsuitable. It is possible that Brotherston's specimen may have been mis-labelled or, perhaps more likely, may represent an accidental or even deliberate introduction. This will be discussed later.

HISTORY AND PRESENT STATUS IN BRITAIN

In addition to Nelmes' original localities, at least three others have been found relatively recently in separate geographical areas, whilst the populations at Nympsfield and Minera may also be new finds. The recent history of all of these and a description of the present habitat and status of the populations are discussed below, largely in the sequence in which the populations were refound. The information is also summarised in Table 1. It should be borne in mind that the plants often occur in "clumps" so that it is difficult to decide whether one or several plants are present. Such "clumps" are considered here to be a single plant.

Locality	v.c.	First found	Original habitat	Present habitat	No. of flowering plants (and inflorescences)		Threat	Conservation status	Suggested management
					originally	in 1999			
Nantmawr Salop.	40	1999	S-facing, open, lightly vegetated limestone scree slope, 30–40°	unchanged	×	c.100 (several hundred inflorescences)	no apparent threat, thriving	Local nature reserve	regular monitoring
Nympsfield W. Gloucs.	41	1973*	cleared woodland over oolitic limestone slope, 25–30°	somewhat overgrown and wooded	21	0(0)	presumed extinct	Nil	clearing of trees, light grazing, regular monitoring
Minera Denbs.	50	1978**	hazel scrub over loose, limestone, scree, S-facing slope 15–20°	heavily wooded, closed canopy, scree obscured by humus and ground flora	20+	3(9)	severely threatened (± closed canopy)	Nil	removal of tree cover, exclusion of cattle, regular monitoring
Gordale Mid-W. Yorks.	64	1984***	steep consolidated scree, S- facing slope 45–60°	rather heavily grassed but otherwise open	4	36(185)	slightly overgrown, but otherwise satisfactory	S.S.S.I.	regular monitoring
Upper Ribblesdale Mid-W. Yorks.	64	1977	upper surface of fairly open, lightly vegetated limestone pavement, level	little apparent change	4	2(19)	stable but extremely small	N.N.R.	close monitoring
Swaledale N.W.Yorks.	65	1987	SW-facing, lightly vegetated limestone scree slope, c. 30°	immediate vicinity of plants becoming overgrown by grasses	7	7+(19)	rather overgrown	S.S.S.I. (M.O.D. property)	grazing Autumn– Spring
Lauder Berwicks.	81	1878	acidic area, mainly parkland?	parkland	?	0(0)	extinct (not native?)	Nil	none

TABLE 1: CAREX MURICATA SUBSP. MURICATA LOCALITIES IN BRITAIN - HABITAT, STATUS AND THREAT

* known nearby in 1900 - probably a different site ** known near Wrexham in 1840 - probably a different site *** known in 1934 at a slightly different site

Full grid references for all known sites have been lodged with English Nature.

1. NYMPSFIELD (V.C. 34)

It is not clear whether the population discovered here in June 1973 by B. M. Mack is the same as that known to Druce in 1900 (described as Woodchester) but is quite possibly so. It was recorded at Dingle Wood, Nympsfield, on a warm slope (hanger) over oolitic limestone, when 21 plants appeared after woodland clearance and re-planting. However, in 1976, it was described as hard to find but was still there in 1979. The population declined further as the site became overgrown so that there were only four plants in 1982. Fruitless searches were made thereafter and the site was cleared in 1986 in the hope that plants would regenerate. None emerged during the following spring and so subsp. *muricata* was considered extinct. Later that year (1987), three plants were introduced to the site (grown at Cambridge Botanic Gardens from seed originating from Dingle Wood) and whilst these persisted for a short while they rapidly declined in vigour and eventually died. A single, caged plant survived until 1989 but the unattended cage became choked with vegetation and the Carex succumbed. Material thought to originate from this site was grown on in S. C. Holland's garden and two plants were transferred to that of M. Kitchen after her death. Further reintroductions within the area have been considered but have not yet been carried out. The authors feel that the provenance of such material should be checked to ensure that it is of Nympsfield origin.

2. MINERA, NEAR WREXHAM (V.C. 50)

When discovered in 1978, the habitat comprised light scrub with c.20 plants of subsp. *muricata*. Shortly afterwards more were found close by and observations made soon afterwards referred to good numbers occurring on loose limestone scree with associates which included *Teucrium scorodonia*, a plant often indicative of stony habitats. In 1987 over 40 plants were reported but this was reduced to 27 in 1992. Since then, the site has declined rapidly, the original *Corylus* scrub developing into closed-canopy woodland. In consequence, litter and humus have accumulated and the original loose scree is now completely obscured and a ground flora is present in which *Geranium robertianum* and *Sanicula europaea* dominate. However, *Hedera helix*, which at one time was a problem, is no longer present. The *Carex* population is much reduced in size and vigour, the few plants surviving being in heavy shade and mainly vegetative. They also have to compete with the gradually increasing ground flora. Flowering spikes are few and utricles rarely seem to reach maturity. Typical associates of the *Carex*, such as *Teucrium scorodonia*, which were present in the original, more open habitat, have also been eliminated.

When surveyed (1999) only three flowering plants were found, these possessing a total of eleven inflorescences between them, most of which were weak and depauperate. A few probable (but unconfirmed) seedlings were also present but seem unlikely to reach maturity unless conditions are improved by a drastic reduction of the tree cover. At the time of the survey it was also noted that cattle had broken through the protective fence and trampling had occurred. It is remarkable how rapidly this site has deteriorated and this illustrates the need for regular monitoring and management.

3. UPPER RIBBLESDALE (V.C. 64)

This locality on partly shaded, vegetated limestone pavement appears to be unique in Britain, all other localities being, or having been, on sloping limestone scree. David (1979) questioned whether the population from which he confirmed the plant in 1978 was the same as that first discovered by Roberts in the previous year. However, his subsequent searches revealed only two additional isolated plants and it is more-or-less certain that the two records were for the same population.

Initially there were only four plants, two in each of two populations in close proximity. An additional plant was found by David some few hundred metres to the south but has not been seen since. Meanwhile, the original colony was decreasing. The northernmost population lost one plant in 1979 and the second by 1984 although an additional seedling was found situated between the two populations; this could not be detected in 1987. The other two plants (probably those first found in 1977) still survive. One of these is partially caged but still suffers from grazing by rabbits which often remove the flowering spikes. An additional seedling was found very close to these in 1999. The plants occur in an open area within this relatively heavily wooded site, closely

associated with such species as: Anthoxanthum odoratum, Dactylis glomerata, Geranium robertianum, G. lucidum, Veronica chamaedrys, Filipendula ulmaria, Saxifraga hypnoides, Silene dioica, Mercuralis perennis, Asplenium scolopendrium and A. trichomanes. Such associates correspond closely to those seen by David in 1978, suggesting that conditions here have changed little in the intervening period, in contrast to what appears to have happened at some other sites, and especially at Minera. The upper Ribblesdale locality is situated within the Ingleborough N.N.R.

4. GORDALE (V.C. 64)

The history of the plant at this site is a little confusing as the complex topography makes it difficult to establish the precise whereabouts of early records. In 1985, the year after it had been refound by P. Jepson, only four plants were recorded in an area of 4×4 m, two of which were flowering poorly. These were on a steep, rocky apron at the base of a limestone cliff but were not thought to be of the same population as those recorded in the 1930s which were apparently above the waterfall. Subsequently, rumours circulated that the plants had gone from Gordale, but they were refound by Jepson in 1997. In 1999 the present authors confirmed a thriving population on the "apron". Here there were at least 25 plants bearing a total of 128 flowering spikes, whilst a short distance to the south, on the sides of a steep buttress, a further eleven plants (57 flowering spikes) were found. The 45-60° sloping apron, whilst of an open, sunny aspect, was heavily grassed, mainly with Sesleria caerulea, Dactylis glomerata, Brachypodium sylvaticum and Festuca ovina, although the sedge still appeared to be flourishing there. Other close associates included Glechoma hederacea, Torilis japonica, Hypericum hirsutum and Centaurea nigra with a little Thymus, Teucrium scorodonia, Geranium robertianum and Campanula rotundifolia. On the nearby steep buttress there was less competing vegetation and the sedge grew in close proximity to plants typical of a more open habitat such as the last four mentioned above. On the "apron", the grasses are apparently becoming more dominant since there is little evidence of grazing with only the occasional sheep roaming the area. There is, however, a great deal of other apparently suitable habitat at Gordale where subsp. muricata may occur, but most of it is difficult and even dangerous to explore. Past and present localities benefit from S.S.S.I. protection.

5. SWALEDALE (V.C. 65)

Carex muricata subsp. muricata was first found here in 1987 near the foot of a S.W. facing, 30-35° vegetated scree slope below steep limestone crags. Initially there were about 15 plants, seven of which had fruiting spikes, all occurring in an area of only a few square metres. The general habitat was, and still is, open and sunny with scattered Sambucus shrubs, but latterly invasive grasses strongly compete with the *Carex* with the result that, in 1999, the authors were able to find only seven plants. A little distance above these plants, the vegetation of the slope quickly changes and it becomes clothed in a dwarf, grazed, herb-rich community with Thymus, Pilosella officinarum, Leontodon hispidus and Linum catharticum the dominant species. Here a few small flowering plants of subsp. muricata are regenerating, apparently as a result of a reintroduction, despite the fact that at the time (1994) the existing population was not under threat. Unfortunately, it also appears that local plants were not used for this purpose and as a result the genetic make-up of this isolated population will ultimately be affected. The dwarf, herb-rich community described above would appear to be a more ideal habitat for subsp. *muricata* and was probably similar to that present when the original, currently overgrown, population was first discovered. An associated plant list given for 1990 appears to confirm this, as it includes such species of well grazed habitats as Thymus and Galium sterneri, both of which are now absent from the immediate vicinity of the native population. The increased competition here, probably resulting from a sharp reduction in grazing in an area now enclosed for the sedge's protection, gives some cause for concern. This locality, which is situated on M.O.D. property, has S.S.S.I. protection.

6. NANTMAWR (V.C. 40)

This population was identified during the Spring of 1999 during a routine survey of an existing local nature reserve. It had been noted as early as 1982 but had been wrongly referred to subsp. *lamprocarpa*. The plant is locally very abundant here on open, sunny, lightly vegetated, limestone scree with scattered *Taxus* and covers an area of approximately 20×30 m. The angle of the slope is c.30–40°. Plants occur both singly and in relatively large clumps in minimal competition. They

appear to be thriving and free flowering with abundant fruit set. It is very difficult to assess the number of plants present since many grow close together, but there may be up to 100 which produce several hundred inflorescences so making this the largest known British population. Typical close associates at this lightly vegetated habitat include *Teucrium scorodonia, Campanula rotundifolia, Helianthemum, Thymus, Plantago lanceolata, Galium verum* and *Festuca ovina.* Very close by, in a similar open habitat, is a small population of the locally rare *Galeopsis angustifolia*, a plant of loose stony substrates.

7. LAUDER (V.C. 81)

An examination of the parkland habitat at, and in the vicinity of, Lauder Castle confirmed that there is no suitable, calcareous habitat present and that the 1878 record by Brotherston is either a result of an error in specimen labelling or, if genuine, represents a plant or plants deliberately introduced into the castle grounds. The latter would seem to be quite likely as other species, including sedges, which are outside their normal area of distribution in Britain, have been recorded at the castle (pers. comm. M. Braithwaite). The planting of aliens and exotics in estate woodlands was fashionable in the past and it is likely that from such a source has come the Lauder record. It should be considered only as a deliberate introduction here unless unequivocal confirmation can be established otherwise.

CONCLUSIONS

Examination of the plant at its few known British sites suggests that it thrives best on sunny, dry, limestone scree slopes in the presence of only minimum competition and shading. At the centre of its distribution (Scandinavia/continental Europe) it is able to tolerate a wider variety of soils as well as some shading (B. Jonsell, pers. comm.; B. G. Johannson, pers. comm.) but here in Britain, on the edge of its range it appears to be more exacting in its demands. Where ideal conditions occur such as at Nantmawr, robust clumps of plants exist which produce a large number of inflorescences, whose fruits ripen readily. Smaller, apparently younger, fruiting plants also occur on the open scree and on small ledges. Somewhat similar conditions occur at both Gordale and Swaledale, although there the habitat appears to be changing through invasion by coarser grasses. These populations should be examined annually in order to monitor for adverse change. In contrast, the Minera site has deteriorated rapidly in less than ten years and is now severely overgrown with *Corylus* woodland. In the area where the plants grow, sunlight is severely reduced and humus has accumulated over the scree so that a dense ground flora now competes with the sedge. In consequence, the few plants have become weak and appear unwilling to set much fruit. This site is in need of immediate attention.

The other extant British locality is on limestone pavement at Upper Ribblesdale. This population has never been known to contain more than a few plants and is now reduced to just two flowering clumps together with a few seedlings. Rabbit grazing has been considered a problem elsewhere but is probably not the cause of loss here. Investigations into the plant's autecology in this unique habit would be worthwhile.

Reintroductions are currently being considered at Nympsfield and Upper Ribblesdale. At the former site, the authors feel that if the trees could be cleared from the original area it would then be suitable for the plant which might even regenerate naturally from dormant seed. At both sites, however, in order that genetic diversity is maintained, it is important that only seed or cultivated plants originating from the site in question is used when this is attempted. During this survey, seed from most of the extant sites was placed in the Kew Seed Bank, partly for this purpose. Leaf tissue for DNA analysis has also been collected.

Unlike the commoner subsp. *lamprocarpa*, subsp. *muricata* is considered a very rare Red Data Book plant in Britain and is listed as critically endangered (Roberts 1999). However, its widely scattered, but very local, distribution (Gloucestershire to Yorkshire) suggests there may be undiscovered populations. Much apparently suitable ground occurs on the Craven limestones of Yorkshire, as well as in south Cumbria, Derbyshire, the Welsh borders and the Cotswolds and the plant may be overlooked. It may also wrongly recorded, perhaps as subsp. *lamprocarpa* or *C. spicata*, as this latter plant can also favour a similar habitat and grows with the Swaledale population.

Any plant of the *Carex muricata* aggregate found on warm, open limestone scree should be carefully examined in case it is this taxon. *C. muricata* subsp. *muricata* is best recognised by its relatively rigid, upright flowering spikes which appreciably exceed the leaves, and by the (initially) contrasting dark glumes and lighter utricles (see Introduction). On maturity the inflorescences may become decumbent and the fruiting head almost black. The utricles of subsp. *muricata* are both more flanged and smaller than in subsp. *lamprocarpa* and *C. spicata* whilst the female spikelets are more rounded. To help in identification, typical plants and fruiting heads of both subspecies are shown in the accompanying drawing (Fig. 1).



Figure 1. Comparative sketches of *Carex muricata* subsp. *muricata* (above) and subsp. *lamprocarpa* (below): habit (\times 1/5), inflorescences (\times 2). A: Immature utricles and glumes (\times 6) in June. B: Mature utricles and glumes (\times 6) in August.

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