

Sorbus domestica L., new to Wales and the British Isles

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ABSTRACT

The discovery of two native or long-established populations of the mainly southern European tree *Sorbus domestica* L. (Rosaceae) in sea-cliff sites on the coast of southern Wales is reported. The True Service-tree had not been previously known as a native species or persistent introduction in Britain, with the exception of a single tree that formerly grew in the Wyre Forest in central England. Identification characters, including previously undescribed epidermal features, isozyme variation, and its ecology and associates at the two sites are described. Its occurrence and possible history in Britain are briefly discussed.

KEYWORDS: *Sorbus aucuparia*, isozyme analysis, ecology, distribution, disjunction.

INTRODUCTION

In May 1983 Marc Hampton observed a number of wind-stunted trees of a *Sorbus* L. species (Rosaceae) with pinnate leaves, resembling *Sorbus aucuparia* L. but apparently distinct from that species, growing on inaccessible ledges on a south-facing limestone sea-cliff in southern Glamorgan, Wales (v.c. 41). The site is in an area which had been well studied botanically and it seemed unlikely that any long-established but undiscovered species of tree could occur there. During subsequent brief visits to the site he observed several distinctive features of the trees, all consistent with the possibility that they might be *S. domestica* L., notably their strikingly silvery young leaves in early spring and, in some years, their display of flowers 16–18 mm in diameter, larger and more conspicuous than in *S. aucuparia* and with pink-flushed petals. In addition, the branches of the inflorescence, especially the final pedicels, were comparatively lax and straight rather than curved as in *S. aucuparia*, forming a more or less pyramidal inflorescence which differed in shape from the flat-topped corymbs of *S. aucuparia*, and the inflorescences enlarged simultaneously with the leaves, not after them as in *S. aucuparia*. The limestone cliff habitat, with strongly basic soil, would be a most unusual one for *S. aucuparia*, but was similar to the cliff refuges of other *Sorbus* species. It was not possible for M.H. to make a closer study of the population until early 1993, when his searches of similar cliffs in the area revealed another, rather larger population of the same taxon on higher cliffs about 4 km to the east of the first site, again growing on inaccessible ledges, and again apparently overlooked in an area with an even longer history of botanical study. The precise localities of the two sites are here deliberately withheld in order to prevent damage to the sites, but they have been confidentially notified to the relevant vice-county recorders and to the regional and national officers of the Countryside Council for Wales with responsibility for species conservation.

IDENTIFICATION, MORPHOLOGY AND VARIATION

Confirmation of the identity of the taxon forming the Glamorgan cliff populations presented considerable problems. *Sorbus domestica* is similar to *S. aucuparia* in many vegetative characters.

Although several morphological characters of the Glamorgan cliff taxon strongly suggested from the outset that it might be *S. domestica*, this species had not previously been found either in natural habitats or as a persistent introduction in Britain, with the exception of a single ancient tree that formerly grew in the Wyre Forest in Worcestershire (Lees 1867; Amphlett & Rea 1909). The largest trees in the Glamorgan cliff populations are evidently of considerable age (ring-counts suggest possible ages of several hundred years for the larger trunks), but are wind-trimmed, partly prostrate and only c. 3–5 m high. Immature fruits, pyriform and pubescent rather than globose and glabrescent as in *S. aucuparia*, are formed in some years, and a single green, pyriform, mature but seedless fruit was seen on one of the western trees in the autumn of 1991, but full fruiting has not yet been observed and probably takes place only in exceptionally favourable years, if at all. A similar shrub-like habit, with fruiting rare or absent, has been reported for populations of *S. domestica* growing on dry, warm slopes at the northern limit of the range of the species in mainland Europe, which lies in southern Germany (Gerstberger 1980).

In contrast, the Wyre Forest tree was tall and apparently fruited freely before it became decrepit (it was locally known as the 'Witty Pear'). It was first described in 1678, became decrepit during the mid-nineteenth century and was finally destroyed by fire in 1862 (Lees 1867; Amphlett & Rea 1909). Although it grew in a remote part of the Wyre Forest it was regarded as a probable introduction (e.g. Clapham, Tutin & Warburg 1962). It has left descendants including one of the two tall (17 m and 24 m, Bean 1980) and free-fruited trees of *S. domestica* cultivated since the mid-nineteenth century in the Oxford Botanic Garden (T. Walker *in litt.*), and could, like similar *S. domestica* trees cultivated in modern arboreta in Britain, have been descended from cultivars grown in mediaeval orchards. Apart from the very obvious distinction provided by the fruits (c. 2–2.5 cm in diameter, greenish-brown and pear- or less often apple-shaped with numerous stone-cells in *S. domestica*, 0.6–0.9 cm in diameter, globose, bright red and soft-fleshed when mature in *S. aucuparia*), the other characters given in Floras for distinguishing the two species are inconsistent and potentially unreliable (Gerstberger 1980), especially for trees growing in exposed habitats. Consequently, non-fruited trees cannot be certainly identified from the keys published in major Floras.

As fruits were not available, a range of other characters, including previously uninvestigated micromorphological and isozyme characters, were investigated in the Glamorgan cliff taxon and compared with cultivated material of *S. domestica* and with wild and cultivated material of *S. aucuparia* during the summer of 1993 (Table 1). This comparison confirmed that the Glamorgan cliff taxon is undoubtedly *S. domestica*. Isozyme comparisons were made by Rosemary John and Sarah Martin. Five of the six trees from which leaf samples were taken, all from the western population, were isozymically identical to one another at the nine loci that were investigated (GOT-1 and 2, G6PDH, IDH, MDH, PGI-1 and 2, PGM, SOD); the sixth was less well characterised, but may have differed at one locus (GOT-1). All were clearly distinct from *S. aucuparia* at several loci.

TABLE 1. CHARACTERS USED TO DISTINGUISH *SORBUS DOMESTICA* FROM *S. AUCUPARIA*

<i>Sorbus domestica</i> (Glamorgan cliff taxon)	<i>Sorbus aucuparia</i>
Styles 5–(6) ¹	Styles 3–4 ¹
Stipules 6–14 mm, forked at or below half-way, soon falling, with little green tissue ²	Stipules 4–8 mm, simple or fan-shaped, persistent and green on long shoots ²
Epidermal cells around stomata on lower leaf epidermis with sinuous median ridges but lacking papillae; stoma with 'collar' ridge ³	Epidermal cells around stomata on lower leaf epidermis with central papillae flanked by radiating ridges, so that 5–6 papillae surround each stoma; no conspicuous 'collar' ridge ³ around stoma.
Buds glabrous and viscid ⁴ , green or pale brown ¹	Buds tomentose ⁴ , brown
Bark on trunk and older branches deeply and narrowly fissured ⁵ , flaking ¹	Bark on trunk and older branches remaining smooth ¹ or with fissures at wide intervals

All characters were determined in fresh material and compared with fresh material of known identity. The Glamorgan cliff taxon agreed with *S. domestica* in all characters that were investigated. Additional characters are described in the first paragraph of this paper. References: ¹Warburg & Kárpáti 1968; ²Gerstberger 1980; ³Kav unpublished; ⁴Burnat 1899; ⁵Stace 1991.

Isozyme comparisons with fresh leaf material of cultivated *S. domestica* trees from Oxford Botanic Garden (single trees of the apple-fruited and pear-fruited varieties) and Mount Pleasant Trees of Berkeley, Gloucestershire (two cultivars, one from a long-established local garden) showed polymorphism within the species at all loci except MDH; the Glamorgan cliff taxon differed from the Oxford trees in PGI and SOD, and from the Gloucestershire garden cultivars in PGI, SOD and GOT-1; PGI alleles differed amongst the cultivars. In practice the leaf epidermis characters (apparently previously unobserved) and (when still present) the stipule characters (Table 1), combined with the bud characters in fresh material, are likely to be most useful for the separation of vegetative material of *S. domestica* from *S. aucuparia*.

ECOLOGY AND HISTORY

At the first (western) Glamorgan site, *S. domestica* grows as scattered small trees, branching from the base and up to about 3.5 m in height, on a vertical sea-cliff of horizontally bedded Lias limestone c. 25 m high, with a S.S.W. aspect. The trees are rooted into softer beds of marly calcareous shale which form recessed ledges between harder, projecting limestone strata; 13–14 separate trees can be counted, most on the higher inaccessible ledges. The three westernmost *S. domestica* trees grow in dense cliff-scrub with *Prunus spinosa*, *Hedera helix*, *Clematis vitalba*, *Rubus ulmifolius* and *Crataegus monogyna** forming a thicket 2–2.5 m deep, but most of the other trees grow in more open sites, often with the lower part of the trunk prostrate and appressed to the cliff surface. Trunk diameters at the base of the tree ranged from 10 cm to 23 cm in four accessible trees, with similar dimensions estimated for the trees on the higher inaccessible ledges. Conspicuously fissured, flaking bark (a characteristic of *S. domestica*, illustrated photographically by Step (1905)) covers the lower parts of the older trunks. Several trees show the remains of dead older trunks or branches embedded in the base of the present trunk, suggesting that the living trunks may have arisen as basal shoots from older trunks that are now dead. A section of one of these older dead trunks 6 cm in diameter examined by M.H. showed 85–90 annual rings, indicating an age of about 300–400 years for the largest living trunks. Bean (1980) states that there is little doubt that trees of *Sorbus domestica* can live for 500–600 years. If the trees in the Glamorgan cliff populations have periodically regrown from basal shoots or from suckers after the death and decay of an older main trunk, considerably greater ages seem possible. A pH of 7.55 was found for the stony calcareous marl into which one of the westernmost trees was rooted. Associated species are listed in Table 2. No introduced species grow in association with the *S. domestica* population here, although a number of weedy species grow on or near the cliff-top and on the nearby maritime drift-line. The population extends along about 100 m of cliff-face, bounded to the east by cliffs that are probably now too exposed to salt spray for *S. domestica* to survive and to the west by sloping degraded cliffs covered by denser, largely closed woodland and scrub.

At the second site, 4 km east of the first, *S. domestica* again grows as scattered small trees and shrubs, on the upper, open, vertical or near-vertical part of a south-facing horizontally bedded Lias limestone sea-cliff about 50 m high, with softer strata, into which *S. domestica* is probably rooted, alternating with projecting ledges of harder limestone. The lower part of the cliff here is steeply sloping and fairly densely wooded, with ash, elm and some yew. The largest *S. domestica* trees here are about 5 m high, but most are smaller, spreading along horizontal ledges, and with many apparent saplings or small sucker shoots growing in unshaded and largely unvegetated open vertical areas. A total number of about 70 apparently separate *S. domestica* trees, shrubs and saplings or sucker shoots was estimated, extending along about 230 m of cliff; as at the western site, the population is bounded to the west by denser, closed woodland on less steeply sloping cliffs, and to the east by more exposed and unstable vertical cliffs. The cliffs on which *S. domestica* grows here are entirely inaccessible or, at best, extremely hazardous; voucher specimens could be obtained only from a few trees at the edge of the population. At this second site, the introduced species *Quercus ilex* was present nearby but was not seen growing with *S. domestica* (Table 2).

The south-facing Lias limestone cliffs and valley-slopes of southern Glamorgan provide favourable microhabitats for thermophilous calcicole species, a number of which are at or near the

* All nomenclature follows Stace (1991), except where stated otherwise.

TABLE 2. ABUNDANCE OF SPECIES ASSOCIATED WITH *SORBUS DOMESTICA* AT CLIFF SITES IN SOUTHERN GLAMORGAN, WALES

Species	Site	
	Western site	Eastern site
<i>Sorbus domestica</i>	5	la
<i>Adiantum capillus-veneris</i>	x	x
<i>Brachypodium sylvaticum</i>	.3	lf
<i>Brassica nigra</i>	—	o
<i>Centaurea scabiosa</i>	—	lf
<i>Clematis vitalba</i>	.4	o
<i>Cornus sanguinea</i>	—	lf
<i>Crataegus monogyna</i>	1.4	—
<i>Dactylis glomerata</i>	1.3	—
<i>Daucus carota</i>	—	o
<i>Festuca rubra</i>	1.5	lf
<i>Fraxinus excelsior</i>	—	la
<i>Hedera helix</i>	1.5-8	la
<i>Helianthemum nummularium</i>	—	o
<i>Inula conyzae</i>	—	—
<i>Iris foetidissima</i>	x	—
<i>Ligustrum vulgare</i>	x	—
<i>Lithospermum purpureocaeruleum</i>	x	—
<i>Ononis repens</i>	—	—
<i>Origanum vulgare</i>	—	—
<i>Parietaria judaica</i>	—	—
<i>Pilosella officinarum</i>	—	—
<i>Pimpinella saxifraga</i>	—	—
<i>Plantago lanceolata</i>	—	o
<i>Prunus spinosa</i>	1.5	o
<i>Quercus ilex</i>	—	—
<i>Q. robur</i>	—	—
<i>Rosa canina</i> agg.	1.4	r
<i>Rubia peregrina</i>	4	lf
<i>Rubus ulmifolius</i>	1.4-5	o
<i>Sambucus nigra</i>	—	o
<i>Sanguisorba minor</i>	—	o
<i>Senecio erucifolius</i>	—	o
<i>S. jacobaea</i>	—	o
<i>Taxus baccata</i>	—	x
<i>Teucrium scorodonia</i>	—	o
<i>Ulmus</i> sp.	—	x
<i>Viburnum lantana</i>	—	o

The lists are composite estimates for the areas in which *S. domestica* grows. Because of the inaccessibility of the greater part of both populations, some less conspicuous species are likely to have been missed. At the eastern site, frequencies of the species growing on vertical cliffs were estimated from a range of c.80-200 m using binoculars. The figures for the western site show Domin cover-abundance scores. Letter abbreviations: la, locally abundant; lf, locally frequent; o, occasional; r, rare; x, present nearby but not seen with or under *S. domestica*.

limits of their European ranges, for example *Adiantum capillus-veneris*, *Campanula glomerata*, *Cirsium eriophorum*, *C. acaule* and *Lithospermum purpureocaeruleum*. Elsewhere in the Bristol Channel area, the hard Carboniferous Limestone cliffs of the Gower Peninsula in western Glamorgan and of the Avon Gorge, Brean Down and the southern Mendip Hills in Somerset have acted as refuges for a greater number of calcicole species, including the vast majority of the British apomictic *Sorbus* microspecies (Proctor & Groenhof 1992; Stace 1991). However, the friable, marly calcareous shales which are interbedded with the Lias limestone strata provide special cliff microhabitats which do not occur in these Carboniferous Limestone districts, and the Lias

limestone itself is relatively soft, maintaining a higher pH in the soils of cliff-tops and valley-slopes than on Carboniferous Limestone. The warm, south-facing ledges on which *S. domestica* grows are an exceptionally favourable environment for a thermophilous calcicole species at the northern limit of its range; the Mediterranean species *Adiantum capillus-veneris* grows as an undoubted native on the same ledges, in places where water seepages emerge from the permeable calcareous marl.

It seems quite possible that *S. domestica* may be native in the Glamorgan sites. Ring-counts indicate that the oldest trees at both sites are a minimum of several hundred years old, and introduced species are absent from the cliff refuges on which *S. domestica* grows, with the exception of *Quercus ilex* at the eastern site, where it was not seen with *S. domestica* (Table 2). There are no records of past cultivation or planting of *S. domestica* in southern Wales. Similar disjunctions between Continental and British populations occur in the European ranges of other calcicole species with outlying localities in the Bristol Channel area, for example *Arabis scabra*, *Draba aizoides* and *Koeleria vallesiana*. The full extent of the native distribution of *S. domestica* in Europe is hard to determine, because it has been widely cultivated for its fruits in the past, especially in Germany and France, and often occurs as scattered, isolated trees which seem likely to be descended from cultivated trees (e.g. Burnat 1899; Hegi 1922). It typically grows on calcareous soils. Wild populations are apparently widespread in southern Europe from Spain to the Balkans (Hegi 1922; Warburg & Kárpáti 1968), and also in Turkey (Davis 1972), extending northwards to southern Germany, where *S. domestica* is an indicator species of thermophilous mixed-oak woodland (*Quercetalia pubescenti-petraeae*) on dry slopes (Gerstberger 1980). In France, *S. domestica* is often of doubtful spontaneity, but occurs in possibly native populations in woods and hedgerows and calcareous soils in the Midi and in central and western France as far north as Morbihan (Coste 1901). The discovery of *S. domestica* in Glamorgan suggests that it could have been similarly overlooked or confused with *S. aucuparia* at other possible refuge sites in southern Britain and perhaps elsewhere in north-western Europe. The close superficial vegetative similarity between *S. domestica* and *S. aucuparia* has apparently not been realised by most botanists working in the British Isles, and non-fruiting populations of pinnate-leaved *Sorbus* on south-facing calcareous cliffs or open limestone slopes, if found, should be critically examined.

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