

The diversity of *Sorbus* L. (Rosaceae) in the Lower Wye Valley

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ABSTRACT

The diversity of *Sorbus* in the Lower Wye Valley on the border between England and Wales is described. Sixteen *Sorbus* taxa occur in the Lower Wye Valley, including two new species which are described as *S. parviloba* T. C. G. Rich and *S. saxicola* T. C. G. Rich. Diverse, important sites include the Symonds Yat to Great Doward area, and the Pen Moel to Shorn Cliff area. Overall, the Lower Wye Valley is the second most diverse site for *Sorbus* in the British Isles. There is evidence of a minor decline in diversity of a few species at a few sites.

KEYWORDS: England, Wales, new species.

INTRODUCTION

Britain, southern Scandinavia and the mountains of south-east to central Europe are the three main centres of diversity of *Sorbus* L. (Rosaceae) in Europe. Within Britain, the six key areas of diversity are the North Devon and North Somerset coast, Cheddar Gorge, Avon Gorge, the Lower Wye Valley, the Brecon Beacons and Arran. A few other areas such as Morecambe Bay, the Mendips and South Devon also support some endemics. In this paper an account of the diversity and distribution of taxa within one of these, the Lower Wye Valley, is given based on surveys carried out between 1999 and 2006, with the description of two new species. The data contribute towards Target 1 'Understanding

and documenting plant diversity' under the Global Plant Conservation Strategy (Secretariat for the Conservation of Biodiversity 2002).

The Lower Wye Valley is a large, meandering, north-south orientated valley c. 40 km long situated on the border between England and Wales extending from Ross-on-Wye to the Severn Estuary (Fig. 1). At the north end in the Symonds Yat area between English Bicknor and Monmouth, the river meanders between spectacular, large, wooded Carboniferous Limestone cliffs. The river then straightens running south through a broad valley over sandstones, before entering a second series of meanders through another wooded Carboniferous Limestone gorge between Tintern and Bulwark. Three vice-counties are represented in the Lower Wye Valley; v.c. 34 West Gloucestershire and v.c. 36 Herefordshire in England, and v.c. 35 Monmouthshire in Wales. The natural history of the valley has recently been described by Peterken (2008). Significant sites are protected as Sites of Special Scientific Interest and Special Areas for Conservation, and it is an Area of Outstanding Natural Beauty.

In 1999, T. Rich began a project looking at diversity and evolution in *Sorbus* and visited many areas in the Wye Valley. In 2000, the Wye Valley was included in the European Ravine Wood Life Project as part of the Natura 2000 initiative, and English Nature (now Natural England) commissioned abseil access

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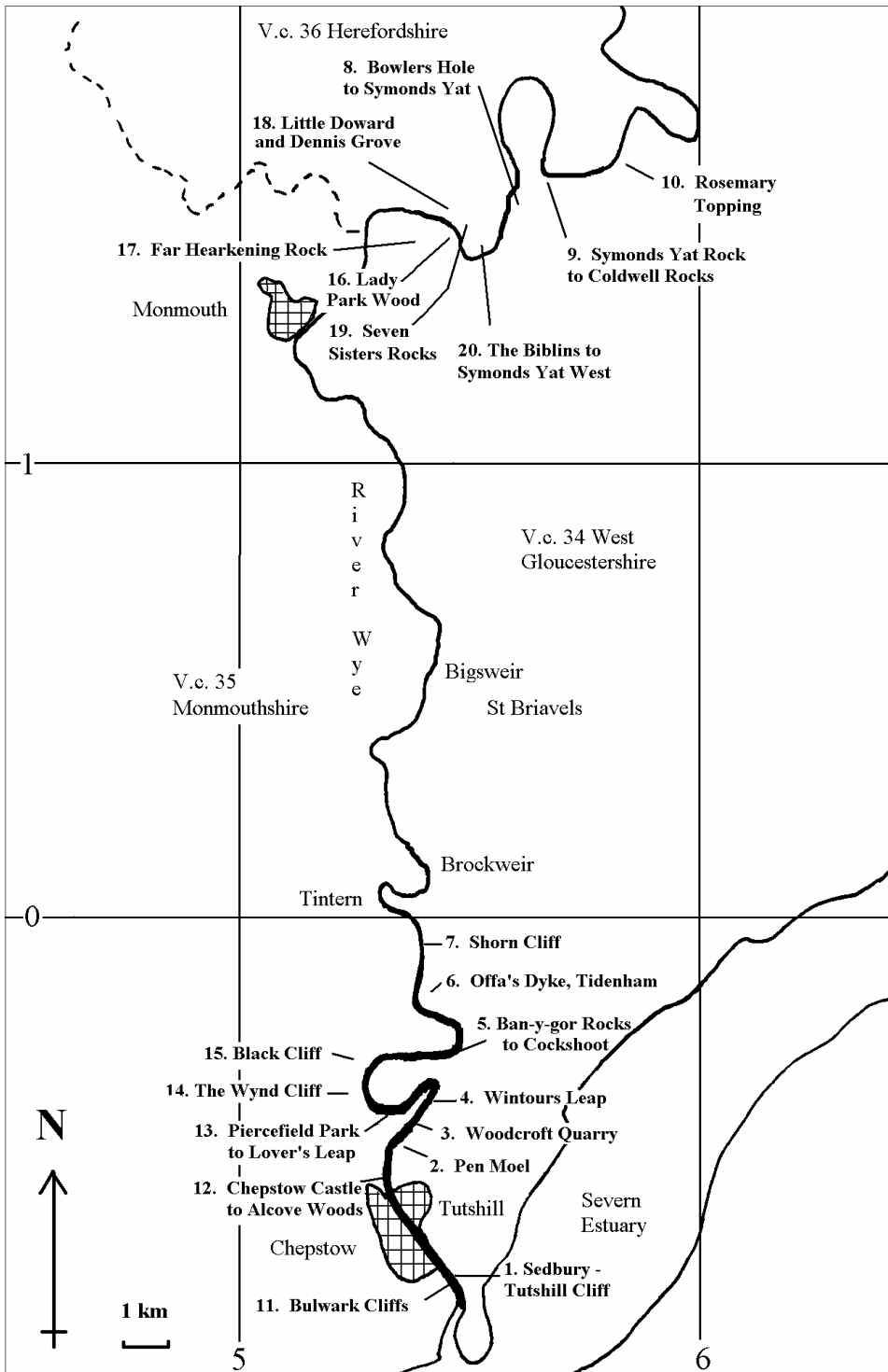


FIGURE 1. Location of *Sorbus* sites surveyed in the Lower Wye Valley.

surveys of *Sorbus* on the major cliffs to provide information for conservation and management (Houston *et al.* 2001, 2002, 2003, 2004). These abseil surveys provided a wealth of new *Sorbus* material, which significantly augmented what could be collected from cliff tops. The data from both these studies are combined in this paper to give an overview of the diversity of *Sorbus* in the Wye Valley.

METHODS

MORPHOLOGY AND DESCRIPTIONS OF NEW SPECIES

Broad leaves from the short, vegetative shoots in sunlit situations, excluding the oldest and youngest leaf (Aas *et al.* 1994), were measured on herbarium material of the two new taxa in NMW. Fruits were measured on fresh material, and the colours matched against the Royal Horticultural Society colour charts (Royal Horticultural Society 1966).

Conservation status assessments were made for the new species following the IUCN (2001) guidelines.

HISTORICAL INFORMATION AND SURVEYS

Historical information was compiled from herbaria (BM, BRISTM, GLR, K, NMW), the voucher material of Proctor & Groenhof (1992) now held at NMW, and from the literature (e.g. Evans 2007; Riddelsdell *et al.* 1948).

Surveys were carried out between 1999 and 2008, mainly in the autumn when fruits were present helping identification. Two main methods were used:

1. 'Look-see' surveys (Rich *et al.* 2005) were carried out by walking along cliff tops and sometimes cliff bottoms, and noting taxa seen without consistently counting exact numbers of each species. Some material was collected using a long-handled pruner.
2. Abseil or rope access surveys were carried out by abseiling down rock-faces in a series of 'drops' along the cliffs at intervals of 3–10 m according to the frequency of *Sorbus* or presence of hazards such as loose rock. Samples were collected directly from the ropes, or sometimes using a long-handled pruner. Numbers of each species were counted, but due to practicalities of identification some counts are minima. In certain areas only quicker cliff-top or cliff-base 'look-see' surveys were carried out. Full details are given in the survey reports (Houston *et al.* 2001, 2002, 2003, 2004).

Collection of voucher specimens concentrated on the rarer or more difficult to identify taxa. Identifications of voucher material were confirmed by T. Rich, with other material determined in the field. The 755 specimens collected are deposited in the National Museum of Wales (NMW).

Most of the taxa found during the surveys were allocated to existing taxa, but the situation with the *S. eminens* E. F. Warb. group and *S. porrigentiformis* E. F. Warb. group was more complex (see also Proctor & Groenhof 1992). In the *S. eminens* group, plants with orbicular leaves matching the widespread Avon Gorge-Mendips form were called *S. eminens* sensu stricto, and plants with leaves subrhombic in outline with deeper teeth as *S. eminentiformis* T. C. G. Rich, following Rich & Proctor (2009). Proctor & Groenhof (1992) noted that these two species probably belonged to separate taxa, and regarded all the Wye Valley *S. 'eminens'* as belonging to *S. eminentiformis*. Our more extensive collections coupled with analysis of the plastid DNA (Chester *et al.* 2007) indicate both taxa are present throughout the valley. Warburg's type specimen was collected from Offa's Dyke, Tidenham, v.c. 34 West Gloucester-shire (BM; Warburg 1952, 1957) but is a poor specimen which is not clearly referable to either form, but he stated that the description related to plants from the Avon Gorge and Lower Wye Valley. However, an unusual feature of Warburg's description was that his *S. eminens* had fruits up to 2 cm long which were longer than wide; this does not equate to either our observations of *S. eminens* as currently interpreted, or those of Proctor & Groenhof (1992). Searches of Offa's Dyke at Tidenham have failed to reveal any plants with such long fruits, but several plants were found at Shorn Cliff immediately below Offa's Dyke with long fruits which had leaves like *S. eminens* but not identical (NMW); this problem is best dealt with by amending the description of *S. eminens* sensu stricto to having fruits wider than long.

Warburg (1952, 1957) also described *S. porrigentiformis* from Offa's Dyke at Tidenham, and this probably represents the widespread, lowland form (Proctor & Groenhof 1992). Again we have failed to find any plants which clearly match the type, though at least one tree remains with relatively narrow leaves on the banks of Offa's Dyke (this does not have leaves as narrow as *S. saxicola* described below however). As Warburg (1957) pointed out, plants from different locations differ, and we

have recorded plants with small, obovate leaves and fruits wider than long as *S. porrigentiformis* sensu stricto, and similar plants with larger leaves of more variable shape as *S. porrigentiformis* sensu lato.

With both the *S. eminens* group and *S. porrigentiformis* group we suspect that there are a significant number of hybrids with *S. aria* in the Wye Valley, as also recently reported for the Avon Gorge (Rich *et al.* 2009); confirmation of these will have to await DNA analysis. Plants from Symonds Yat discussed as similar to *S. graeca* (Spach) Kotschy by Proctor & Groenhof (1992) are here included in *S. porrigentiformis* sensu lato, and are probably also locally derived apomictic hybrids of *S. aria* and *S. porrigentiformis*.

The sites surveyed are as follows, ordered first by vice-county and second from south to north with approximate grid references (Fig. 1):

1. Sedbury – Tutshill Cliff (ST541939), v.c. 34
These 20–40 m high, W- to SW-facing cliffs are about 1 km long and fall directly to the River Wye with private gardens above. There are scattered *S. aria* trees visible with binoculars, but they have not been surveyed in detail due to difficult access.
2. Pen Moel (ST539955), v.c. 34
Pen Moel cliffs form a series of WNW-facing crags about 30–50 m high and 300 m long above the River Wye, and much, except the very top of the cliffs, has been quarried below and is wooded to the top edge and from below on the old quarry workings. The top has been landscaped in places as a garden.
The cliffs were surveyed by walking in autumn 2003 (Houston *et al.* 2004) and using ‘look-see’ in 2006.
3. Woodcroft Quarry (ST541959), v.c. 34
Northwards from Pen Moel, Woodcroft Quarry has an inner section of W-facing, 40 m high quarried cliffs *c.* 100 m long, behind a WNW-facing out section of 30–50 m cliff (‘Fly Wall’) which drops down to secondary woodland and quarry spoil below. The top part of the outer cliffs has been completely removed, and what remains seems to be the only section of this line of cliffs left unquarried.
The quarried inner section and part of the outer sections were surveyed by rope drops and parts by walking in autumn 2003 (Houston *et al.* 2004) and using ‘look-see’ in 2006.
4. Wintour’s Leap (ST542964), v.c. 34
The huge, quarried, 100 m high, NW- to SW-facing cliffs of Wintour’s Leap continue north for *c.* 500 m from Woodcroft Quarry to Lancaut. They have secondary woodland over quarry spoil below, and private gardens above with a short section of public footpath. The cliffs and woods are part of Gloucestershire Wildlife Trust’s Lancaut Nature Reserve.
The cliffs were surveyed in a series of rope drops in autumn 2003 (Houston *et al.* 2004) and using ‘look-see’ in 2006.
5. Ban-y-gor Rocks – Cockshoot (ST547972), v.c. 34
Ban-y-gor Rocks and Cockshoot form a series of crags about 1 km long with a N- to WNW-aspect. The western crags are 15–20 m high and dip slightly eastwards to give increasingly shaded wooded slopes above until the obvious break of ‘Ladder Gully’. A clear path follows their base. The *c.* 60 m high eastern crags are crossed by a wide vegetated ledge (‘The Terrace’) with most botanical interest above, and are bounded at the top by private gardens.
Nine days were spent surveying the cliffs in autumn 2000 by a systematic series of vertical rope drops (Houston *et al.* 2001). Several subsequent visits were made in 2002 to collect further material.
6. Offa’s Dyke, Tidenham
(including Plumweir Cliff and Devil’s Point) ST547985 to 542001), v.c. 34
Offa’s Dyke, an ancient earthwork *c.* 2–5 m high, has a series of small, SW- to NW-facing limestone crags (such as Pulpit Rock) and rocky slopes associated with it in the Tidenham area, but most is in woodland and some in conifer plantation. Both *S. eminens* and *S. porrigentiformis* were originally described from this area, but it is not known exactly where the type trees were.
Offa’s Dyke has been surveyed using ‘look-see’ in 2001 noting interesting taxa.
7. Shorn Cliff (ST541992), v.c. 34
The Shorn Cliff is an unquarried, natural, 20–35 m high, WNW-facing limestone crag about 600 m long overlooking Tintern Abbey. There is a series of open buttresses and rock faces with more forested sections between. There is dense woodland below the crag with some climbers’ paths up from the forest track, and a very steep, wooded slope above the crag below Offa’s Dyke.

Four days were spent surveying the cliff in a series of rope drops in autumn 2001 (Houston *et al.* 2002). One subsequent visit was also paid in 2002.

8. Bowler's Hole – Symonds Yat (SO562158), v.c. 34
This WNW-facing, 20–50 m high series of cliffs and rocky outcrops is about 500 m long. It is very popular with climbers and tourists and is partly fenced. There is steep woodland on scree below, and woodland above.
The cliffs and rocks were surveyed by 'look-see' surveys in autumn 2002 (Houston *et al.* 2003), and have been visited many times using 'look-see' in 1999–2006.
9. Symonds Yat Rock – Coldwell Rocks (SO566158), v.c. 34
This E- to N-facing broken cliff above a meander in the River Wye is about 1 km long, and contains a series of small (10 m) to large (25 m) and massive (50 m) cliffs, spurs and pinnacles. Parts have been quarried (Quarry Rock) and there was a popular Victorian walk along the top, 'Coldwell Walks', which is still visible in places. There is mainly secondary woodland below and tall, dense woodland above. Some cliff top scrub is cut back around Symonds Yat Rock to maintain views.
The cliffs were surveyed in detail in autumn 2002 using abseil drops (Houston *et al.* 2003) and several 'look-see' visits 1999–2006.
10. Rosemary Topping (SO579163), v.c. 34
There are a series of small, poorly accessible, mostly shaded, E- and N-facing cliffs above English Bicknor in dense woodland, in total about 100 m long.
The cliffs were visited using 'look-see' in 2003, but little was found.
11. Bulwark Cliffs (ST538927), v.c. 35
This is a small series of ENE-facing, partly wooded, limestone crags about 400 m long and 20–30 m tall, which have been quarried away on their west side to form the railway cutting, leaving thin, upright slabs of limestone. The east side drops directly into the River Wye. Access is very limited.
The crags have been visited several times using the 'look-see' approach, including once in 2001 with T. G. Evans who has visited them regularly for over 30 years.
12. Chepstow Castle – Alcove Woods (ST532942), v.c. 35
The NE to NW-facing crags below Chepstow Castle are c. 400 m long and c. 30–40 m tall, and fall directly into the River Wye. They are partly vegetated.
One 'look-see' visit in 2005 indicated only *S. aria* was present, so no further surveys were carried out. The record for *S. domestica* L. in Wade (1970) refers to *S. torminalis* (Evans 2007).
13. Piercefield Cliffs – Lover's Leap (ST537963 to 522968), v.c. 35
The NW to E-facing cliffs and very steep wooded slopes of Piercefield Cliffs rise from their low eastern end by the River Wye where they are from 5–20 m tall, to larger cliffs mid-slope, and then 40 m cliffs over woodland at their east end at Lover's Leap, c. 2 km to the west. There are large areas of woodland with relatively limited open areas and a few outcrops.
The cliffs have been surveyed using a 'look-see' approach on four occasions between 2000 and 2005.
14. The Wynd Cliff (ST528974), v.c. 35
This dramatic, mainly S-facing cliff c. 100 m high and 500 m long stands out above the river valley, with woodland below and woodland sloping down to the cliffs at the top.
The cliffs were surveyed using a 'look-see' approach in 2001.
15. Black Cliff (ST532983), v.c. 35
This ENE-facing cliff is about 10–30 m high and 400 m long above the road. Parts have been quarried.
The cliffs were surveyed using a 'look-see' approach in 2001; little of interest was found.
16. Lady Park Wood (SO546145), v.c. 35
The E-facing cliffs of Lady Park Wood are c. 20 m high and 300 m long above the old railway line and the River Wye. At the top the cliffs are fairly accessible but are heavily wooded with *Fagus*. Some areas at the bottom have secondary woodland over old quarry spoil. The woodland is a National Nature Reserve.
The cliffs were surveyed using systematic rope drops in autumn 2003 (Houston *et al.* 2004), and were visited again in 2005 using the 'look-see' method.

17. Far Harkening Rock (SO941151), v.c. 35
Far Harkening Rock is the highest of a series of small (to 5 m) NW-facing rock outcrops about 100 m long in mature woodland, with very limited open rock.

The crags were surveyed in autumn 2005 using the 'look-see' method.

18. Little Doward and Dennis Grove (SO541158), v.c. 36

These low outcrops to c. 5 m high face SW to NE and total about 400 m long. They are mainly set in woodland, with open areas and forestry on the top of the Little Doward.

The crags were surveyed from the top, with one abseil drop in 2002 (Houston *et al.* 2003), and further visits in 2004 and 2005.

19. Seven Sisters Rocks (SO545153), v.c. 36

These SW-facing, 10–35 m high crags form a series of outcrops about 400 m long, above steep wooded scree down to the River Wye, and with woodland above.

The crags have been visited many times between 1999 and 2006, and most of them were systematically surveyed by abseil drops in autumn 2002 (Houston *et al.* 2003).

20. The Biblins – Symonds Yat West (SO555150), v.c. 36

These crags form a series of S-, SE- and ESE-facing cliffs above the Wye about 1 km long, which vary from c. 5 to 25 m in height. Within this length there are a few outcrops with open cliffs, and much partly wooded cliff, and the cliffs have one to three levels.

The cliffs were surveyed using abseil drops at the south end and 'look-see' methods in autumn 2002 (Houston *et al.* 2003) and 'look-see' in 2003.

RESULTS

DESCRIPTIONS OF NEW SPECIES

Sorbus parviloba T. C. G. Rich, **sp. nov.**

HOLOTYPE: Ship Rock, Coldwell Rocks, Symonds Yat, v.c. 34 West Gloucestershire, SO571.156, 4 October 1999, T. Rich & L. Houston (NMW, accession number V.1999.33.523).

Vernacular name: Coldwell Whitebeam

Arbor parva ad 8 m ut minimum, non rhizomatosa; cortex cinerebrunneus. Gemmae ovoideae, acutae. Folia lata brachyblastorum (6.0–)7.0–12.0 × (5.0–)5.5–10.0 cm, (1.05–)1.15–1.5(–1.58) plo longiora quam latiora, late elliptica vel elliptica, ad longitudinis suae (44–)47–63(–68) partes centenas latissima, apice obtuso vel acuminato, basi cuneata (angulo 42–60°), in parte supra lobos manifestos sed non profundos (3–)5–14 partibus centenis ad costam sectos praebentia vel valde biserrata, dentes longos (circa 3–4 mm) acutos vel acuminatos exstantes ferentia, sed parte infima prope petiolum circa 2–3 cm fere integra; pagina superior atroviridis glabra; pagina inferior cinereiviridis tomentosa, venis 17–23(–24) ad angulum 29–38° a costa tentis. Petioli (8–)10–18(–21) mm. Inflorescentia ad 10 cm lata, aggregata, leniter tholiformis, ramulis viridialbis tomentosis instructa. Sepala anguste triangularia, viridula sed ad basin tomentosa, in marginibus sine glandibus. Petala 9–11.5 × 5–7 mm, elliptica, alba. Antherae cremeae, lenissime roseotinctae. Styli 2(–3), discreti vel ad medium conjuncti, ad basin pilosi. Fructus maximi 9–13 × (10.5–)11–14 mm, 1.0–1.22 plo latiores quam longiores, aspectu latiores quam longiores vel ut videtur subgloboso, in maturitate rubri, lenticellis paucis dispersis parvis vel mediocribus praediti.

Small tree to at least 8 m, not rhizomatous; bark greyish-brown. Buds ovoid, acute. Broad leaves of short shoots (6.0–)7.0–12.0 × (5.0–)5.5–10.0 cm, (1.05–)1.15–1.5(–1.58) times as long as wide, broadly elliptic to elliptic, widest (44–)47–63(–68)% along leaf length, with apex obtuse or acuminate and base cuneate (angle 42–60°), with distinct shallow lobes (3–)5–14% of way to midrib in upper part to strongly biserrate with long (c. 3–4 mm), acute or acuminate teeth directed outwards, but with the lowest c. 2–3 cm near the petiole nearly entire; upper surface dark green, glabrous; lower surface greyish-green tomentose, with 17–23(–24) veins held at an angle of 29–38° to the midrib. Petioles (8–)10–18(–21) mm. Inflorescence to 10 cm across, crowded, weakly domed with branchlets greenish-white tomentose. Sepals narrowly triangular, greenish but tomentose at base, without glands on margins. Petals 9–11.5 × 5–7 mm, elliptic, white. Anthers cream with a hint of pink. Styles 2(–3), free or joined to middle, pilose at base. Largest fruits 9–13 × (10.5–)11–14 mm, 1.0–1.22 times as wide as long and looking

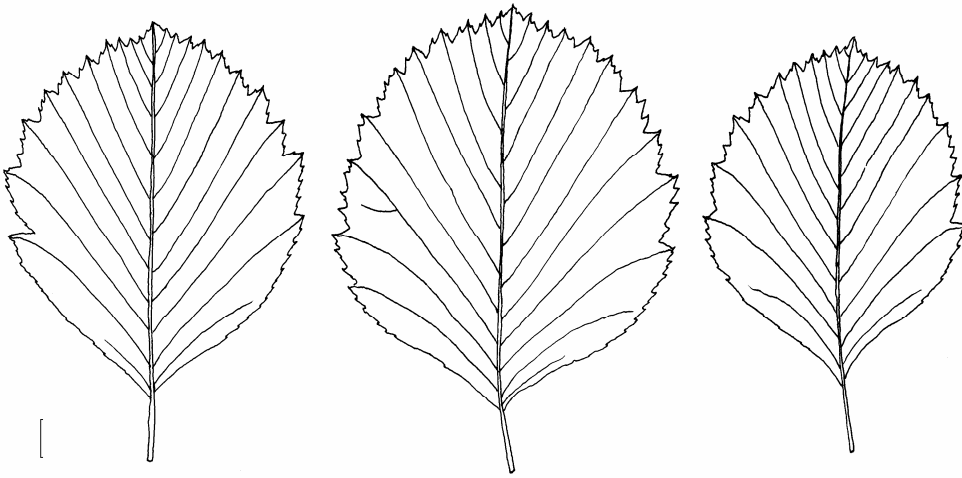


FIGURE 2. Broad leaves of short shoots of *Sorbus parviloba*. Scale bar 1 cm.

wider than long to subglobose, red at maturity (RHS colour 42a), with a few, scattered small to medium lenticles.

Sorbus parviloba is characterized by the broadly elliptic to elliptic leaves with shallow but distinct acute lobes in the upper part of the leaf, a cuneate base and greyish-green undersides, and the small red fruits just wider than long (Fig. 2). It is a member of the *S. aria* group.

Sorbus parviloba is a distinctive species, first found and collected in September 1999 by T. Rich and M. Kitchen. Further trees were found in 2002 (Houston *et al.* 2003). It is endemic to Coldwell Rocks, Gloucestershire (v.c. 34), England, where it occurs from Quarry Rock to Ship Rock on Carboniferous Limestone cliffs and cliff edges in open deciduous woodland with *Fagus sylvatica* L., *Fraxinus excelsior* L. and at least five other *Sorbus* taxa. The altitudes range from c. 100 to 125 m. Only eight trees of this species are currently known (Houston *et al.* 2003), but it is likely that more occur on the cliffs and in the woodlands. The provisional IUCN (2001) conservation status is 'Critically Endangered'.

A similar-looking plant from the Wynd Cliff requires DNA investigation to see if it belongs to the same clone.

***Sorbus saxicola* T. C. G. Rich, sp. nov.**

HOLOTYPE: cliffs on west side of Symonds Yat, v.c. 34 West Gloucestershire, SO562.157, 21 May 2004, T. C. G. Rich (NMW, accession number V.2004.3.116).

Vernacular name: Symonds Yat Whitebeam

Frutex ad 5 m ut minimum, non rhizomatosus; cortex dilute cinereibrunneus. Gemmae ovoideae, acutae. Folia lata brachyblastorum 7.0–11.0 × (4.5–)5.0–7.0 cm, (1.47–)1.5–1.85 (–2.05)plo longiora quam latiora, anguste obovata, ad longitudinis suae (53–)55–61(–65) partes centensimas latissima, apice acuminato vel aliquando acuto, basi cuneata (angulo 30–43°), in parte supera lobos non profundos obtusos 0–15(–17) partibus centensimis ad costam sectos praebentia vel non praebentia, marginibus dentes parvos acutos leniter biserratos prorsum projectos ferentibus, sed parte infima prope petiolum circa 1–4 cm fere integra; pagina superior atroviridis glabra; pagina inferior cinereialba tomentosa, venis 15–22 ad angulum 23–32(–36)° a costa tentis. Petioli (7–)9–17(–21) mm. Inflorescentia ad 9 cm lata, aggregata, leniter tholiformis, ramulis viridialbis tomentosis instructa. Sepala triangularia, viridula sed ad basin inque marginibus tomentosa, in marginibus sine glandibus. Petala 6–9 × 5–6 mm, elliptica vel late elliptica, cupulata, alba, ad basin pilosa. Antherae roseitinctae. Styli 2–3, fere ad basin fissi, ad basin pilosi vel glabri. Fructus maximi (8)9–11(–12) × (9.0–)9.5–11.5 mm, 0.9–1.05plo longiores quam latiores, aspectu globoso, in medio latissimi, in maturitate rubri vel atrorubri, lenticellis paucis dispersis parvis vel mediocribus praecipue prope basin praediti.

Shrub to at least 5 m, not rhizomatous; bark light greyish-brown. Buds ovoid, acute. Broad leaves of short shoots 7.0–11.0 × (4.5–)5.0–7.0 cm, (1.47–)1.5–1.85(–2.05) times as long as wide, narrowly obovate, widest (53–)55–61

TABLE 1. SUMMARY OF RECORDS OF *SORBUS* IN WYE VALLEY

	<i>S. anglica</i>	<i>S. aria</i>	<i>S. aucuparia</i>	<i>S. emihens s.s.</i>	<i>S. eminentiformis</i>	<i>S. intermedia</i>	<i>S. parviflora</i>	<i>S. porrigentiformis sensu lato</i>	<i>S. porrigentiformis sensu stricto</i>	<i>S. rupicola</i>	<i>S. saxicola</i>	<i>S. tormindis</i>	<i>S. whiteana</i>	<i>S. × thuringiaca</i>	<i>S. × tomentella</i>	<i>S. aria</i> backcrosses	Number of extant species
1. Sedbury – Tutshill Cliff		P							4			P	(1?)			P	1
2. Pen Moel	[P]	37+					8(+4?)		5								5
3. Woodcroft Quarry		66			7		1										4
4. Wintour's Leap		257+	1	1 (+3?)	1 (+1?)		1(1+3?)		3			7+		21	4		9
5. Ban-y-gor Rocks – Cockshoot	19+	308		5+	5+		11+	19+				50+	15	2			10
6. Offa's Dyke, Tidenham	LA	LA		P	P		P	[P]				P		P			5
7. Shorn Cliff	15	120+	16	3+	6		10(+2?)	10				2+	53+	1			10
8. Bowlers Hole – west of Symonds Yat Rock	9	25+	1	4 (+3?)	P		6	1 (+1?)				LA		8+	3		12
9. Symonds Yat Rock – Coldwell Rocks	16	67+			11 (+2?)		8	1 (+1?)				LA		22+	5+		11
10. Rosemary Topping		P													P		2
11. Bulwark Cliffs	9	P						1		P		LA					5

TABLE 1. SUMMARY OF RECORDS OF *SORBUS* IN WYE VALLEY CONT...

	<i>S. anglica</i>	<i>S. aria</i>	<i>S. aucuparia</i>	<i>S. emihens s.s.</i>	<i>S. eminentiformis</i>	<i>S. intermedia</i>	<i>S. parviflora</i>	<i>S. porrigentiformis sensu lato</i>	<i>S. porrigentiformis sensu stricto</i>	<i>S. rupicola</i>	<i>S. saxicola</i>	<i>S. torminalis</i>	<i>S. whitiana</i>	<i>S. × thuringiaca</i>	<i>S. × tomentella</i>	<i>S. aria</i> backcrosses	Number of extant species
12. Chepstow Castle – Alcove Woods		LA										P					2
13. Piercefield Cliffs – Lover's Leap	P	LA	P		P							LA		P	P		7
14. The Wynd Cliff	[P]	LA			1	(1?)		1				P		[P]		4(+1?)	
15. Black Cliff		P										P				2	
16. Lady Park Wood		38	1	4	5+		1	1				LA	(1?)	2+		8(+1?)	
17. Far Harkening Rock		P			1					P	1					4	
18. Little Doward and Dennis Grove		16+			4 (+3?)			1			4	4+				6	
19. Seven Sisters Rocks	1[+P]	31+			LA		13			4	3 (+2?)	LA			2	8	
20. The Biblins –Symonds Yat West		90+		3 (+2?)	1 (+1?)		1	4 (+5?)		7	5	LA	1	4	5	10	
Number of extant sites	8	20	5	6	13	1	1	10	6	6	5	16	2(+2?)	4	8	7	

The table is a mixture of qualitative and quantitative data. 1, 2 etc. = number of confirmed plants. (1?, 2?, etc) = number of unconfirmed plants. P=present. [] = historic records not seen recently. + =more present but not counted. LA = locally abundant. The location of the sites is shown in Figure 1.

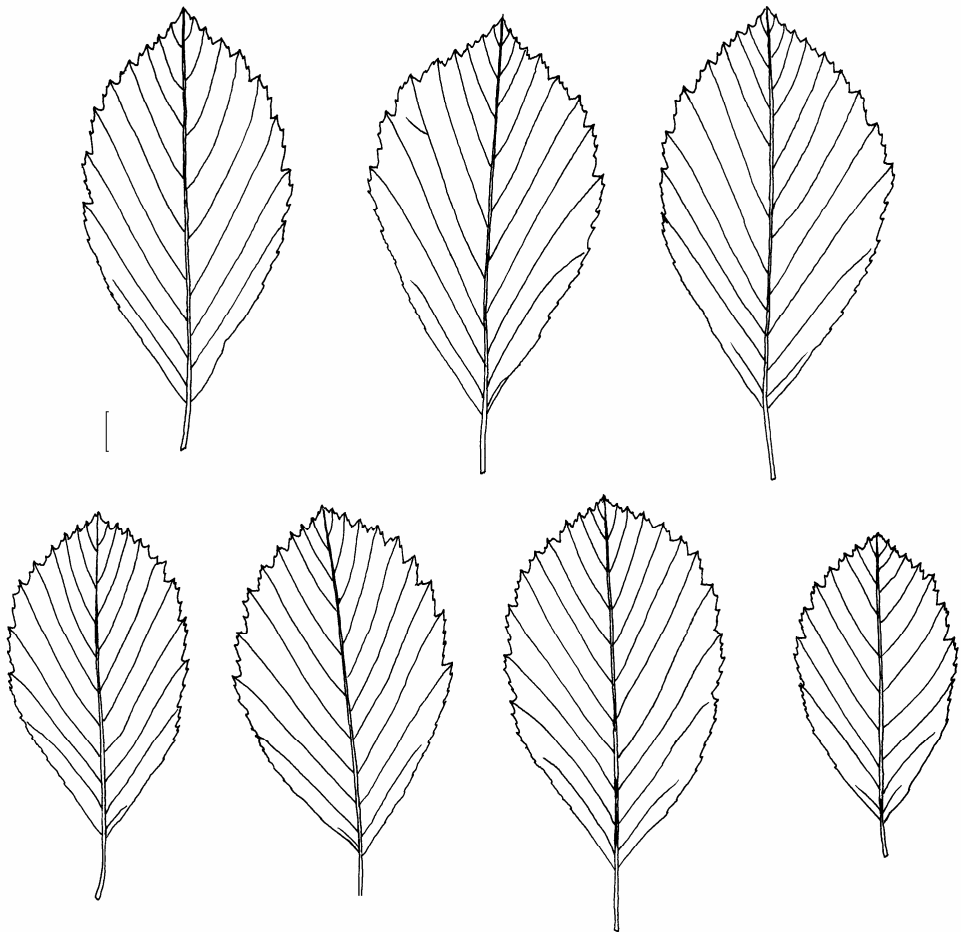


FIGURE 3. Broad leaves of short shoots of *Sorbus saxicola*. Scale bar 1 cm.

(-65)% along leaf length, with apex acuminate or sometimes acute and base cuneate (angle $30-43^\circ$), with or without shallow, obtuse lobes $0-15(-17)\%$ of way to midrib in upper part; margins with small, acute, weakly biserrate teeth directed forwards, but with the lowest *c.* 1-4 cm near the petiole nearly entire; upper surface dark green, glabrous; lower surface greyish-white tomentose, with 15-22 veins held at an angle of $23-32(-36)^\circ$ to the midrib. Petioles (7-9-17(-21) mm. Inflorescence to 9 cm across, crowded, weakly domed with branchlets greenish-white tomentose. Sepals triangular, greenish but tomentose at base and on margins, without glands on margins. Petals $6-9 \times 5-6$ mm, elliptic to broadly elliptic, cupped, white, pilose at base. Anthers pink-flushed. Styles 2-3, split nearly to the base,

pilose at base or glabrous. Largest fruits (8)9-11(-12) \times (9.0-9)9.5-11.5 mm, 0.9-1.05 times as long as wide and looking globose, widest at the middle, red to dark red at maturity (RHS colour 45a), with a few, scattered small to medium lenticels mainly near base.

Sorbus saxicola is characterized by the narrowly obovate leaves with or without shallow obtuse lobes in the upper part of the leaf, a usually acuminate apex and a cuneate base, greyish-green underneath with 15-22 veins, and the small, globose, red fruits (Fig. 3). It is a member of the *S. aria* group. *Sorbus rupicola* has larger leaves with fewer veins and obtuse apices, and larger fruits wider than long. *Sorbus porrigentiformis* has broader leaves 1.25-1.65 times as long as wide, and fruits wider than long.

Sorbus saxicola was first found and collected in September 1999 by T. Rich and L. Houston, and has since been more widely found in surveys in the Symonds Yat and Doward areas (Houston *et al.* 2003).

Sorbus saxicola is endemic to the Wye Valley around Symonds Yat and the Great Doward, in Gloucestershire (v.c. 34), Monmouthshire (v.c. 35) and Herefordshire (v.c. 36), England. It has been recorded from Dennis Grove (4 plants), Seven Sisters Rocks and King Arthur's Cave (4, possibly 6, plants), Far Harkening Rock (1 plant), on the cliffs above the west side of Symonds Yat (at least 9 plants), the Yat Rock area (at least 3 plants) and at Coldwell Rocks (1 plant). It occurs on Carboniferous Limestone cliffs and cliff edges in open, deciduous woodland with *Fagus sylvatica*, *Fraxinus excelsior* and many other *Sorbus* taxa. The altitudinal range is c. 75 to 175 m.

Only 23 trees of this species are currently known (Houston *et al.* 2003, with updates), but there are probably more on the extensive cliffs in this area. The provisional IUCN (2001) conservation status is 'Critically Endangered'.

SURVEYS

The results of the surveys are summarized in Table 1. Collecting vouchers of the rare taxa, or those difficult to identify in the field, from parts of the cliffs not previously surveyed has resulted in a much more detailed knowledge about the distribution and frequency of each taxon, and allowed recognition of new taxa. The number of sites for each species, and number of species for each site, are still dependent on the quality and detail of the survey which is inconsistent between sites, but these are the best available data which are unlikely to be bettered in the foreseeable future.

The commonest and most widespread species are the diploids *S. aria* and *S. torminalis*, the former often the commonest species present. The diploid *S. aucuparia* is much rarer on the limestone cliffs and thus infrequent in our surveys, but is common in the associated woodlands on sandstone (Peterken 2008). Their hybrids *S. × thuringiaca* (Ilse) Fritsch (= *S. aria* × *S. aucuparia*) and *S. × tomentella* Gand. (= *S. vagensis* Wilm., *S. aria* × *S. torminalis*) are both scattered through the valley, the latter locally frequent in the

Symonds Yat area where it backcrosses with *S. aria* (Price & Rich 2007).

The next most widespread taxon is *S. eminentiformis* which is most abundant at the northern end of the Lower Wye Valley, but also occurs more locally at the southern end. *Sorbus eminentis* sensu stricto is also scattered through the valley but is rare at the northern end. *Sorbus porrigentiformis* sensu stricto is quite rare with only small numbers of plants, whilst plants attributed to *S. porrigentiformis* sensu lato are more frequent and also more widespread.

Sorbus anglica Hedl. is quite widespread, though it has not been recorded recently in two sites and has declined at another, and *S. rupicola* (Syme) Held. and *S. whiteana* T. C. G. Rich & L. Houston occur in a few sites. *Sorbus parviloba* and *S. saxicola* are both restricted to the northern end of the Lower Wye Valley as described above. The alien *S. intermedia* has only been recorded in one site, not too far from Tutshill where it grows as a street tree.

The sites vary in diversity, which is only partly related to their size (Table 1). The two richest sites are site 8 Bowler's Hole – Symonds Yat, and site 9 Symonds Yat Rock – Coldwell Rocks (Fig. 1) which have extensive cliffs with good populations. Site 20 The Biblins – Symonds Yat West immediately west of this area on the opposite north side of the River Wye is also very rich with ten taxa, though the whitebeams are more scattered. Site 16 Lady Park Wood and site 19 Sevens Sister's Rocks are very diverse for small areas. At the southern end of the Lower Wye Valley, site 4 Wintour's Leap, site 5 Ban-y-gor Rocks and site 7 Shorn Cliff are diverse with ten taxa each. Not all cliffs are rich in species, for example Rosemary Topping and Black Cliff are poor, perhaps due to limited outcrops, tall woodland or quarrying.

Both the northern area around Symonds Yat and the Doward, and the southern end from Chepstow to Shorn Cliff, have 14 *Sorbus* taxa recorded.

DISCUSSION

It is inevitable given the large areas of the Lower Wye Valley investigated, the scale of the cliffs and the difficulty of access to the cliffs with or without ropes, that the surveys are incomplete. It is also often difficult to see

the trees for the wood. Nonetheless 16 *Sorbus* taxa have been recorded, of which three are endemic to the Lower Wye Valley (*S. eminentiformis*, *S. parviloba* and *S. saxicola*) and three endemic to Britain (*S. eminens* sensu stricto, *S. porrigentiformis* and *S. whiteana*). Both the northern area around Symonds Yat and the Doward, and the southern end from Chepstow to Shorn Cliff have 14 taxa recorded. Overall, the Lower Wye Valley is the second most diverse site for *Sorbus* in the British Isles, second only to the Avon Gorge which hosts about 22 taxa. If hybrids and alien species are excluded from the comparison (the former are much better studied in the Avon Gorge), both the Wye Valley and Avon Gorge support 12 species.

The key factor for the diversity is the presence of extensive areas of open or partly shaded, limestone rocks and cliffs with little disturbance or grazing. These open rocks provide ideal habitat for members of the *S. aria* group such as *S. rupicola* and *S. porrigentiformis* which are small, light-demanding trees and shrubs. Historically the woodlands were managed to the cliff edges by coppicing as high forest, as shown in old photographs (Helme 1989; Rainsbury 1989; Peterken 2008), and this may have provided conditions for colonization along the cliff edges. Other areas were managed as wood pasture, the grazing probably limiting the regeneration except on the cliffs. Plantations rarely affected the cliffs directly. In some places these cliff edges are now overgrown, forcing normally small trees such as *S. anglica* to grow to 10 m or more tall to keep their leaves in sunlight. As these edges become shaded by trees once more, the whitebeams may become more restricted to the

cliff faces. The exception to this is *S. eminentiformis*, which grows readily in closed woodland as well as on open rocks; for example, there are extensive colonies on the east side of the Great Doward in the wood around the old mines (not surveyed here).

There are only minor threats to maintenance of the *Sorbus* diversity. Most sites are protected by legislation as Sites of Special Scientific Interest or Special Areas for Conservation, and specific conservation management is neither required nor practical in most sites. At Symonds Yat, whitebeams are regularly cut back to maintain scenic views, but the trees regrow from the base. At least two whitebeam trees have been damaged and lost in an area heavily used by outdoor educational groups at Symonds Yat.

In general there is little evidence from historical records for anything other than a minor decline in diversity of sites or species. Some losses have occurred at Pen Moel and Wintour's Leap, probably due to the extensive quarrying. Losses at the Wynd Cliff may be due to increased shading by tall woodland. The failure to refind *S. eminens* on Offa's Dyke could be due to forestry operations replacing broad-leaved woodland with conifers, but the location of the type tree is not known.

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