1042. SORBUS ARIA

Rosaceae

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Summary. *Sorbus aria*, COMMON WHITEBEAM, is described and illustrated. It is morphologically and genetically variable, and numerous selected forms are planted. Notes on its role as a parent of hybridogenous species and its historical and potential use are provided.

In the spring and early summer, *Sorbus aria* (L.) Crantz is clearly visible from a distance in mixed woodlands, due to the silvery-white indumentum on the leaves making them contrast with those of other trees. Lousley (1969, p. 18), for example, wrote that although Box Hill (Surrey) is named for the *Buxus sempervirens* L. (BOX) that occurs there, 'other trees are more conspicuous. Of these, the finest contrast is between the very dark green (almost black from a distance) of the yew, *Taxus baccata*, and the silvery foliage of the whitebeam, *Sorbus aria*.' (Plate 1042, Fig. 1). John Evelyn (quoted in Grigson, 1955) wrote that it gave the husbandman 'an early presage of the approaching spring, by extending its adorned buds for a peculiar entertainment'.

Sorbus aria is a widespread species in Central and Southern Europe east to the Balkans, and there are outlying populations on the Black Sea, in North Africa and the Canary Islands (see below). In Britain, it is most common in the south and east, decreasing in frequency to the north and west, where it is largely replaced by polyploid, apomictic members of *Sorbus* L. subgenus *Aria* Pers., including *S. rupicola* (Syme) Hedl. (ROCK WHITEBEAM) (see, e.g., Lousley, 1969).

Sorbus aria is predominantly a diploid (Bailey *et al.*, 2008; Pellicer *et al.*, 2012). However, populations on Tenerife and La Palma (Canary Islands) and some individuals in the Sierra Nevada (Peninsular Spain) are triploid (González-González, Sosa & González-Pérez, 2011; Sosa *et al.*, 2014), and this has an impact on the reproductive biology and levels of genetic variation in these populations.

Curtis's Botanical Magazine 2022 vol. 39 (4): pp. 655–668

Sorbus aria, in the main part of its range, is morphologically variable, and Lousley (1969), for example, wrote that 'the whitebeam is a much more variable tree (than yew) and a whole range of different leaf-shapes may be found within a short distance'. This morphological variation is reflected in the genetic variability found in the species. Chester *et al.* (2007), using plastid microsatellites, identified nine plastid haplotypes in *S. aria*, comparable with ten and seven found in two other sexual diploids (*S. aucuparia* and *S. torminalis*), respectively; as expected, the polyploid apomictic species showed far less variation, many only having one haplotype. Other studies by Proctor *et al.* (1989), Lemche (1999) and Robertson *et al.* (2010), using a range of molecular techniques, also revealed relatively high levels of variability in diploid *S. aria*. These results contrast with those of Sosa *et al.* (2014), who showed that triploid populations of *S. aria* in the Sierra Nevada and Canary Islands, although genetically distinct from diploid *S. aria*, were genetically much more uniform, and that the insular populations shared many alleles with the triploids from Peninsular Spain. On the basis of these results, they hypothesised that the triploids were at least predominantly apomictic. Whether these triploid populations should be treated as a distinct species in *Sorbus* subgenus *Aria* [cf., for example, *S. porrigentiformis* E.F.Warb. (GREY-LEAVED WHITEBEAM); Rich *et al.*, 2022a, this issue] remains to be decided, pending the inclusion of samples from Algeria and Morocco. The study of Sosa *et al.* (2014) used nuclear microsatellites developed for triploid *S. aria* (González-González *et al.*, 2010), and similar markers developed for *S. porrigentiformis* have also proved to be useful in revealing levels of genetic variability in diploid *S. aria* (Piñeiro *et al.*, 2017).

Sorbus aria is directly or indirectly involved in the generation of many hybridogenous species. These can be the result of hybridisation with other taxa in *Sorbus* subgenus *Aria* or with *S. aucuparia* L. (ROWAN, *Sorbus* subgenus *Sorbus*), giving rise to *Sorbus* nothosubgenus *Soraria* Májovský & Bernátová, *S. torminalis* (L.) Crantz [WILD SERVICE TREE, *Sorbus* subgenus *Torminaria* (DC.) C.Koch], giving rise to *Sorbus* nothosubgenus *Tormaria* Májovský & Bernátová, or both,

Plate 1042 *Sorbus aria* FRANCES DOUIE

Fig. 1. Silvery buds of common whitebeam (*Sorbus aria*) standing out from the yew trees (*Taxus baccata*) on the North Downs, Buckland Hills (photograph: T. Rich).

resulting in *Sorbus* nothosubgenus *Triparens* M.Lepší & T.C.G.Rich. In taxa resulting from hybridisation with *S. aucuparia* or *S. torminalis*, *S. aria* (or the parent in the *S. aria* aggregate) has been demonstrated to be the pollen donor in nearly all cases (e.g. Chester *et al.*, 2007). In southwest England, there is a narrow area of overlap between diploid *S. aria* and tetraploid *S. rupicola* and *S. porrigentiformis* in *Sorbus* subgenus *Aria* and the diploids *S. aucuparia* and *S. torminalis*, leading to the origin of a series of apomictic polyploids, resulting from hybridisation [see, e.g., the account for *S. porrigentiformis*; Rich *et al.* (2022a, this issue)].

In a large study of *Sorbus* species and related genera using cloned sequences of the internal transcribed spacers (ITS) of nuclear ribosomal DNA, Creissen (2009) identified 12 major groups (clades) of ITS sequence types (building on an early data set collected by Davis, 2006). See Fay & Rich (2022) for discussion of the relationships between the major groups of *Sorbus* and other genera revealed in this and other studies, but one major

result is, however, relevant to this account of *S. aria*: whereas ITS sequences from the European diploids *S. aucuparia* and *S. torminalis* formed single groups, those for *S. aria* formed two groups that were each more closely related to those from other species/genera. Based on only one region of DNA, these results should be treated with caution, but they do raise the intriguing possibility that *S. aria*, in addition to being the direct or indirect parent of many hybridogenous polyploid species, is itself of homoploid (i.e., with no change in ploidy) hybrid origin.

The wood of *S. aria* is hard and durable, and has been used for wainscotting, wood engraving, gunstocks, and it was historically coppiced for stakes and fuel. Most notably it was used for cogwheels in machinery before cast iron was widely available (see, e.g., Edlin, 1956; Grigson, 1955).

The fruits can be eaten when bletted, like *Crataegus germanica* (L.) Kuntze (=*Mespilus germanica* L., MEDLAR), although Mabey (1972) included them as 'mainly of historical interest' as a food source. More recently, Šavikin *et al.* (2017) and Petkova *et al.* (2020) have studied the chemical composition and antioxidant properties of the fruits, showing them to have potential as low caloric foods and dietary supplements.

CULTIVATION. *Sorbus aria* is a popular tree widely grown in gardens and planted along streets, and there are a number of cultivars (Rehder, 1940; Clarke, 1980; Huxley *et al.*, 1992; Edwards & Marshall, 2019). When the buds burst in spring the white undersides of the leaves make the tree look like candelabra (Fig. 2), and later the mature leaves ripple silver in the wind. There are large corymbs of white flowers in early summer and masses of red fruit (Fig. 3) in the autumn. It is quite tolerant of air pollution (e.g. Edlin, 1956) and of exposure in coastal areas. Edlin (1956) wrote that *S. aria* 'is scarcely ever planted except for ornament', but more recently it has been suggested as a suitable tree for restoration of coal spoil sites in northern England, with trials showing that it grows successfully even when *S. aucuparia* fails (Richardson, 1992).

Fig. 2. Candelabra effect of buds of *Sorbus aria*, Buckland Hills (photograph: T. Rich).

Cultivars include:

'Aurea' (mature leaves golden yellow);

'Chrysophylla' (mature leaves yellow-green);

'Cyclophylla' [=*S. aria* forma *cyclophylla* (G.Beck) Jáv.; leaves orbicular to broadly oval];

'Gigantea' (*S. aria* × 'Majestica'?; like '*majestica*' but with larger leaves to 18 × 10 cm and fruits 17 × 14 mm);

'Longifolia' [*S. aria* forma *longifolia* (Pers.) Rehd.; leaves elliptic to oblong; widely planted and regularly confused with *S. rupicola*];

'Lutescens' (leaves densely silvery when young, upper surface slightly yellow becoming silvery-green. Widely planted as a street tree);

'Magnifica' (crown upright, leaves large, dark waxy green, leaves concealing the red fruits. It originated in Germany);

'Majestica' (*S. aria* var. *majestica* Zabel, probably same as 'Decaisneana'; crown wide-spreading, leaves large to 15 cm, fruits dark orange-red, partly concealed);

'Pendula' (habit pendulous, leaves small);

Fig. 3. *Sorbus aria* in fruit, Leigh Woods, Bristol (photograph: T. Rich).

'Quercoides' (dense compact shrub, leaves oblong, margins in-curled);

and

'Wilfred Fox' (crown dense, branches ascending, leaves to 20 cm, biserrate, glossy, fruit to 20 mm, green later gold with lenticels).

Propagation. For general notes on cultivation and propagation of *Sorbus* species, see the account for *S. bristoliensis* (Rich *et al.*, 2022b, this issue).

Sorbus aria (L.) Crantz, Stirpes Austriacae fasc. 2: 46 (1763).

Crataegus aria L., Species plantarum, 475 (1753) (basionym). Habitat in Suecia, Anglia. Lectotype: Herb. Clifford: 187, *Crataegus* 1. (BM000628615; designated by Aldosoro *et al.*, 2004)

Pyrus aria (L.) Ehrh. Beitr. Naturk. 4: 20. (1789)

Sorbus aria has many other synonyms, in at least 11 genera, reflecting the controversial nature of taxonomy in Rosaceae subtribe Pyrinae. These include (in alphabetical order) *Aria edulis* (Willd.) M.Roem., *Aria alpina* M.Roem., *Aria aria* (L.) Huth, *Aria majestica* Lavallée, *Aria nivea* Host, *Aria tomentosa* (Rouy & E.G.Camus) Bonnier, *Aronia alpina* (M.Roem.) Dippel, *Azarolus aria* (L.) Borkh., *Chamaemespilus aria* (L.)

Fig. 4. *Sorbus aria* leaf rosette, Leigh Woods, Bristol (photograph: T. Rich).

M.Roem., *Crataegus alpina* Gray, *Crataegus pallida* Salisb., *Hahnia aria* (L.) Medik., *Lazarolus aria* (L.) Borkh., *Mespilus aria* (L.) Scop., *Pyrenia aria* (L.) Clairv., *Pyrus alpina* Willd., *Pyrus edulis* Willd., *Pyrus crenata* K.Koch, *Sorbus acutiloba* Gand., *Sorbus alpina* Heynh., *Sorbus ararica* Gand., *Sorbus arioides* (Godet) Michalet, *Sorbus arvernensis* Gand., *Sorbus bellojocensis* Gand., *Sorbus budaiana* Kárpáti, *Sorbus carpatica* (Soó) Kárpáti, *Sorbus controversa* Gand., *Sorbus edulis* (Willd.) K.Koch, *Sorbus glabrata* G.Kirchn., *Sorbus globulifera* Hedl. ex Ridd., *Sorbus huljakii* Kárpáti, *Sorbus oblonga* Gand., *Sorbus pallidifolia* Gand., *Sorbus reverchonii* Gand., *Sorbus sphaerocarpa* Gand. and *Sorbus turbinata* Gand.

Fig. 5. *Sorbus aria* fruit, Grangelands, Buckinghamshire (photograph: T. Rich).

Names also exist in two nothogenera: ×*Aroniaria alpina* (M.Roem.) Mezhenskyj and ×*Sorbaronia alpina* (M.Roem.) C.K.Schneid.

Description. (For material in Britain, based on Rich *et al.*, 2010). *Tree* to at least 20(–25) m tall. Bark of larger trunks light brown to greyish-brown. Leaf buds ovoid, acute, with white hairs on scale margins. Broad *leaves* (Fig. 4) of short sterile shoots (5.0–)6.5–12.5(–150) × (3.0–)4.0–9.5(–11.0) cm, ovate, elliptic, obovate, rotund or narrowly elliptic, (0.98)1.15–2.00(2.35) times as long as wide, widest (22–)39–61(–69)% of the way along the leaf, apex acuminate, acute, obtuse or rounded, base weakly cordate, truncate, round or cuneate, angle of base (38–)45–71(–100)°, margins unlobed or shallowly lobed with rounded or irregular lobes 13–21% of the way to the midrib at the centre of the leaf, margin uni- to biserrate with acute to acuminate teeth, margin nearly untoothed at base, veins (12–)18–28(–33) held at an angle of (22–)29–49(–60)° to midrib at the centre of the leaf, upper surface mid to light green, lower surface densely white-tomentose. *Petioles* (6–)8–20(–23) mm. *Inflorescences* to 15 cm across, domed, crowded, branchlets tomentose. *Sepals* (narrowly) triangular, densely hairy at base, becoming sparsely hairy and greener towards tips, margins eglandular. *Petals* 5.5–10.0 × 4.5–8.0 mm, rotund, elliptic, ovate to broadly ovate, shortly branched, white. *Anthers* yellow, sometimes with hint of pink. *Styles* two, free, pilose at base. Largest *fruits* (9.5–)10.0–15.0(–17.0) × (9.5–)10.0–15.0(–16.0) mm (smallest infertile fruits *c.* 8.0 × 8.0 mm), (0.88–)0.90–1.20(–1.40) times as long as wide, globose or looking wider than long, ripening from green via yellow and orange to red at maturity (R.H.S. colour chart 28A, 32A, 33A, 42A, 44A, 45A, 46A, 53A) without or with few to moderately frequent small to medium-sized lenticels scattered over fruit or more towards the base

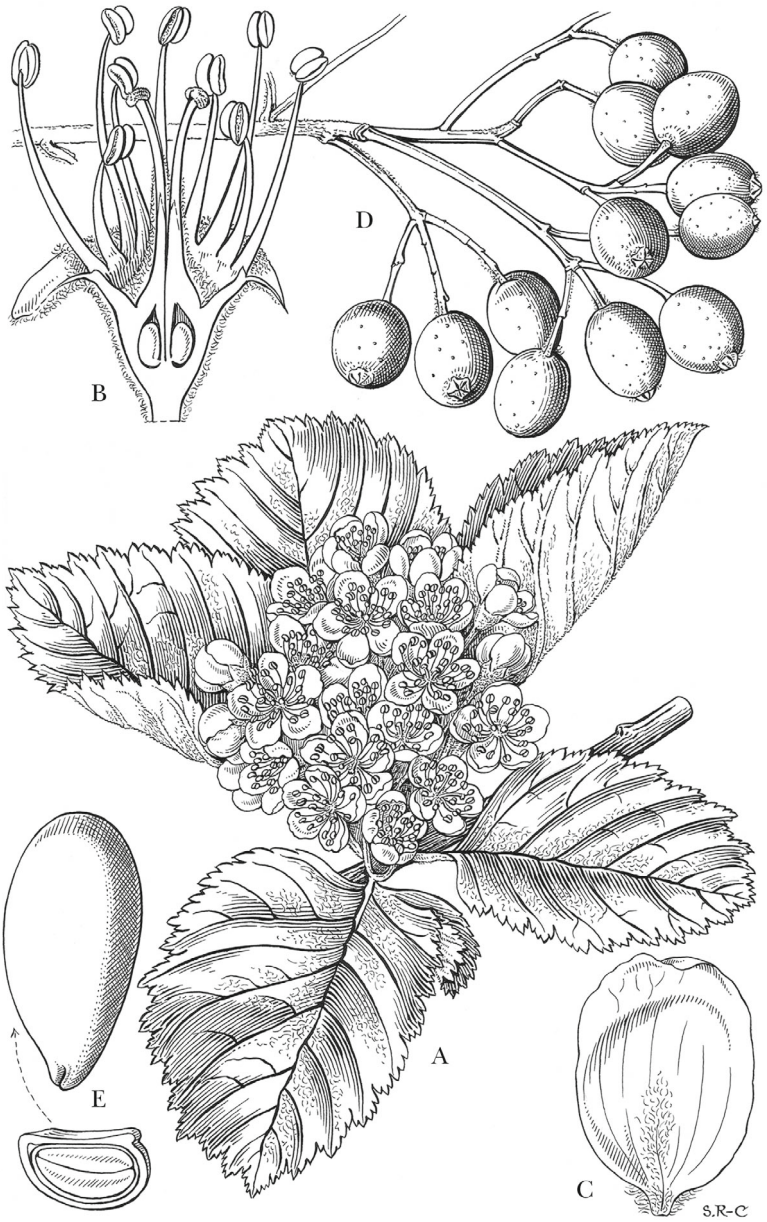

Fig. 6. **Sorbus aria**. A, flowering branch; B, l.s. flower, petals removed; C, petal; D, infructescence; E, seed and t.s. seed. Drawn by Stella Ross-Craig, for Plate 32 in *Drawings of British Plants, part IX Rosaceae* (2) 1956. Scale: A & D × 1; B, C. & E × 6; the original image is 120 mm wide.

(Fig. 5). Chromosome number $2n = 2x = 34$. (The line drawing, Fig. 6, shows fewer veins in the leaves than is typical for this species).

Distribution. Widespread in Central and Southern Europe its full range extends to southern Britain North Africa and the Black Sea coast. In Britain, its native range is predominantly in the South and East, but it is widely planted outside this range. Its status as a native in Ireland has been debated (see, e.g., Rich *et al.*, 2010), but Parnell & Curtis (2012) reported that it is 'rare as a native, but locally frequent in County Galway, scattered as an obvious introduction elsewhere'.

Habitat. Mostly in scrub and open woodland on chalk and limestone, but it can also be found in acid soils. It also occurs in old quarries, and abandoned pastures and on cliffs, walls and woodland edges.

Flowering Time. Late April to early June.

Conservation Status. It has been assessed as "Least Concern" on the Global Red List (Beech & Rivers, 2016) and on the European Red List of Trees (Rivers *et al.*, 2019).

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[Note: Frances Mary Elizabeth Douie (1866–1965) was a botanist and prolific botanical artist. She was born in Amritsar where her father, Sir Charles Roe became Chief Justice. She married Sir J.M. Douie (1854–1935), and they remained in the Punjab until 1911. Lady Douie was a keen botanist, friend of Claridge Druce and contributed to his Flora of Oxfordshire (1927). Her plant drawings are at Kew and in Oxford. Plate 1042 Library, Art & Archives, RBG, Kew.]