

## Euonymus europaeus in Europe: distribution, habitat, usage and threats

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*Euonymus europaeus* L., known as spindle, is a shrub or small tree, appreciated for its numerous, capsular pink and red fruits and the attractive autumn colouring foliage. It has a wide distribution in temperate regions, generally at low to middle elevations. It is present in Central and Eastern Europe up to the Caucasus as an understorey shrub principally in the mixed broadleaved oak-hornbeam forests. It is used as an ornamental plant and more recently for extracting compounds of medicinal and veterinary value. This species is free from serious threats, but it can be a host of several diseases of agricultural interest.

The spindle tree (*Euonymus europaeus* L.) is a much-branched, non-spiny, deciduous shrub or small tree, growing 2–6 m tall, rarely reaching up to 8 m. The bark is grey in colour and smooth<sup>1</sup>. The young twigs are green, 4-angled, without brown protuberances. New shoots grow vigorously, also 4-angled and winged. The buds are 2–4 mm long, ovoid, sharply pointed. The leaves are simple, opposite, lanceolate or ovate-elliptical, 3–10 cm long and 2–3.5 cm wide, narrowing at tip and base. The leaf margins are crenate and finely saw-toothed and the leaves have a rough surface and are bluish-green beneath. The petioles are 0.5–1 cm long<sup>1–5</sup>. This species is gynodioecious, having female flowers on some individual plants and hermaphrodite flowers on others<sup>1</sup>. The flowers are small, delicate and about 1 cm in diameter. They are arranged in inflorescences of 3–10 flowers in leaf axils, on 1–3.5 cm long pedicels, having 4 elements of each of the floral whorls (sepals, petals, stamens and carpels). They blossom in April–July<sup>4, 6</sup>. The fruits are capsules, 1–1.5 cm wide, with 4 angled lobes, green then dark pink or red when mature. Ripe fruits open through 4 valves, containing 4 whitish seeds covered by a fleshy red-orange layer (pseudo-aril). Fruits ripen in September–October<sup>2–5</sup>.

### Distribution

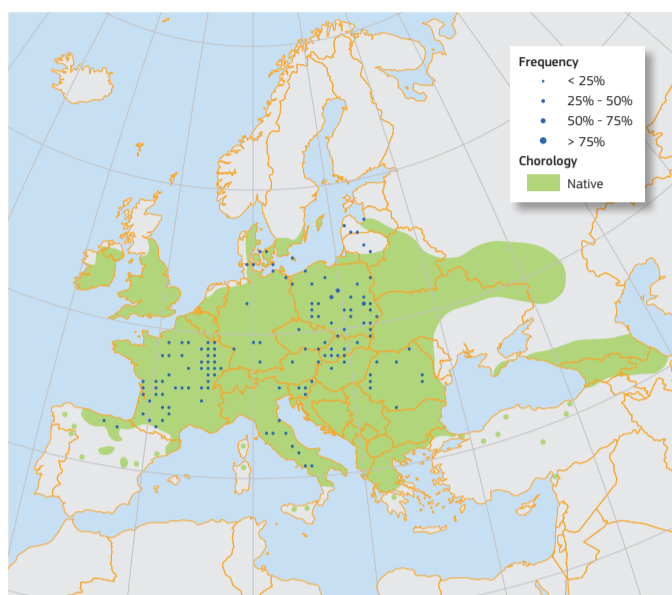
The spindle tree is present in temperate climates, from Central to Eastern Europe (except the extreme north and most of the Mediterranean area), and reaches eastwards the Urals and Caucasus<sup>2–5, 7</sup>. It grows generally at low to middle elevations, from sea level to 1300 m of altitude in Sicily<sup>6, 8</sup>. It has been planted outside its natural range, now naturalised in some areas (e.g. Scandinavia). Exported also to other continents, in northeast United States and in New Zealand it is considered an invasive species<sup>1</sup>.

### Habitat and Ecology

It inhabits mainly forest margins, clearings and open woodlands, preferring medium moisture levels, and well-drained, preferably alkaline soils in full to partial shade<sup>1</sup>. It is frequently found as an understorey shrub, principally in mixed mesophilous forests dominated by deciduous oaks (*Quercus robur*, *Quercus petraea*) and hornbeam (*Carpinus betulus*), forming oak-hornbeam forest communities, along with ash (*Fraxinus excelsior*), field maple (*Acer campestre*), etc.<sup>9</sup>. The pseudo-aril is eaten by a range of animals and its seeds are widely dispersed mainly by birds (robins, blackbirds, blackcap, and song thrush) and rodents, but the seeds are poisonous<sup>1, 10, 11</sup>.

### Importance and Usage

The spindle tree is used mainly as an ornamental shrub for its impressive autumn display of orange, red and purple leaves, accented by magenta pink to red fruits with orange to red pseudo-arils. For example, the cultivar 'Red Cascade' in autumn has red leaves and abundant red fruits with rose pseudo-arils<sup>12</sup>. The wood of the spindle is homogenous, white or yellowish, and easy to work. It is used, more in the past, for plywood and toothpicks<sup>4</sup>, knitting needles, combs, and for making spindles, from which the common name derives<sup>13</sup>; the wood is also heat resistant and it was used in making tobacco-pipes<sup>13</sup>. Charcoal from its wood is used for drawing, and to make charcoal powder. The red pseudo-aril was also used in the past to make dyes<sup>4</sup>. The bark, the leaves and the seeds were used as a purgative, but they are toxic, with similar cardio-stimulant



Map 1: Plot distribution and simplified chorology map for *Euonymus europaeus*. Frequency of *Euonymus europaeus* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *E. europaeus* is derived after several sources<sup>7, 20–25</sup>.

effects to foxglove (*Digitalis* spp.). Dried, powdered fruits and seeds mixed in butter were used to deter lice<sup>4</sup>. Antifungal chitin-binding proteins have been isolated from bark and leaves<sup>14–16</sup>. The whole plant contains compounds of medicinal and veterinary value<sup>1, 10, 11</sup>.

### Threats and Diseases

There are no serious threats for this species<sup>1</sup>. The spindle tree is the primary overwintering host of the black bean aphid (*Aphis fabae*) which feeds on field beans (*Vicia faba*) and sugar beet (*Beta vulgaris*) and the peach potato aphid/green peach aphid (*Myzus persicae*), a widespread pest of a large number of crops<sup>1, 17–19</sup>. As a measure against black bean aphid, in the past spindle trees have been removed from hedges and woodlands (e.g. England), although



Shrub form of spindle in late autumn in a rural area along the Upper Rhine valley (Hockenheim, South-West Germany). (Copyright AnRo002, commons.wikimedia.org, CC0)



Fleshy orange fruit ripening inside the four-valved red capsule. (Copyright Aldo De Bastiani, www.actaplantarum.org, AP)

the current populations appear stable<sup>1, 17–19</sup>. This species can be a host of other diseases, such as a strain of cucumber mosaic virus, strawberry latent ringspot and in some countries, a strain of cherry leaf roll virus<sup>1</sup>. Despite its toxicity, scales and aphids can adapt to survive its otherwise 'insecticidal' chemistry<sup>1, 10, 17–19</sup>.



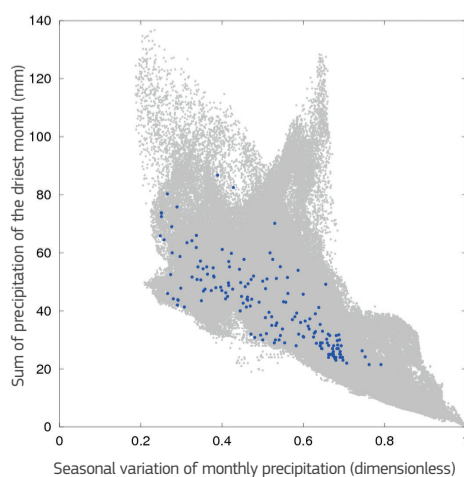
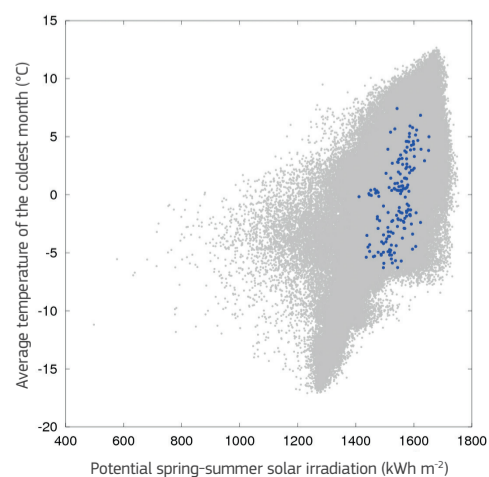
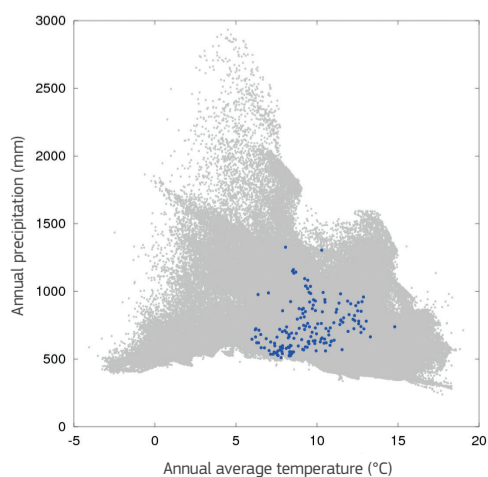
Blossoming hermaphrodite flower with 4 green petals, sepals and 4 yellow stamens. (Copyright Franco Rossi, www.actaplantarum.org, AP)

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Field data in Europe (including absences) ● Observed presences in Europe ●

Autoecology diagrams based on harmonised field observations from forest plots.



This is an extended summary of the chapter. The full version of this chapter (revised and peer-reviewed) will be published online at <https://w3id.org/mtv/FISE-Comm/v01/e01c0ac>. The purpose of this summary is to provide an accessible dissemination of the related main topics.

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