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## 591. EUPOMATIA LAURINA

### *Eupomatiaceae*

Martyn Rix and Peter K. Endress

**Summary.** The evolutionary history, taxonomy, pollination biology and cultivation of *Eupomatia laurina* R. Br. (Eupomatiaceae) are discussed. The species is illustrated with a painting and line drawings.

A cursory look at *Eupomatia laurina* growing in the Palm House at Kew, gives the impression that it is a dull evergreen with simple leaves and not very conspicuous, whitish flowers, but a knowledge of the plant in the wild or cultivated within its native range in Australia, and studies of its DNA and floral development have revealed unexpected complexities.

The genus *Eupomatia* consists of three species, all natives of Australia, with *E. laurina* found also in New Guinea. They belong to the monotypic family Eupomatiaceae, which was initially included in the Annonaceae, but is now recognised as a separate family in the Magnoliales, sister to the Annonaceae, and close to Magnoliceae. It is also close to the Himantandraceae, another small family from tropical Australia and the western Pacific, which consists of the two species of the genus *Galbulimima* Bailey, and to the Degeneriaceae, which consists of two species of trees in the genus *Degeneria* Bailey & A. C. Sm., endemic to Fiji. (Soltis *et al.* 2000, Heywood *et al.* 2007).

The subject of this plate, *Eupomatia laurina* R. Br. was described by Robert Brown in the appendix to Matthew Flinders' *Voyage to Terra australis*, published in 1814. It is the most common and widespread of the three species, growing in rainforest and the moister parts of more open forest from South Australia to north-eastern Queensland and eastern New Guinea. In New Guinea it has been recorded from the Jayapura district to the Central district, and has been most frequently collected from the Moroke district (Croft 1978).

Matthew Flinders (1774–1814) led the expeditions which surveyed the coasts of Australia. In 1798 to 1799, on the ship *Norfolk*, he proved that Tasmania was an island and produced its first map. From 1801 to 1803, on the *Investigator*, he circumnavigated Australia, traced the coasts of the continent, and proved that the east, New South Wales, was the same landmass as the west, New Holland.



*Eupomatia laurina*

CHRISTABEL KING

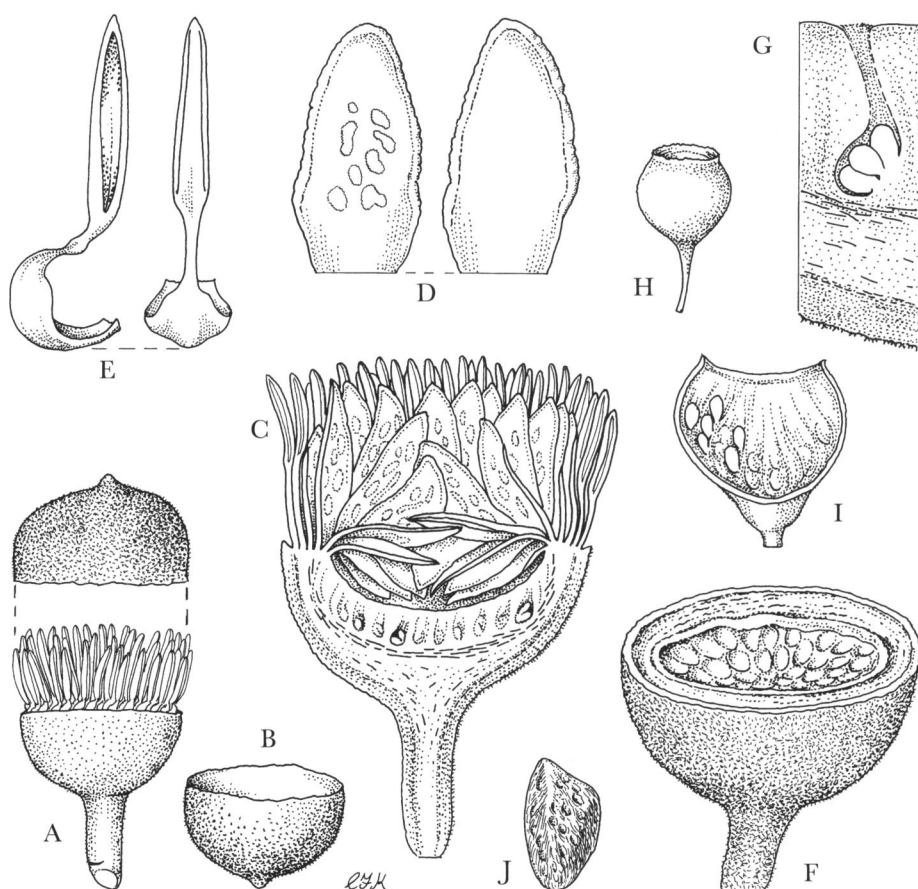
Robert Brown was botanist on the *Investigator* expedition, accompanied by an assistant Peter Good, a foreman gardener from Kew and Ferdinand Bauer as artist, and the three worked together collecting, preserving and illustrating the flora (Hopper 2003). After surveying the south coast, and overhauling and patching the *Investigator* in Sydney, they sailed north, exploring the Gulf of Carpentaria. Here the ship was found to be in such poor condition that they dare not sail for England, and instead returned to Sydney, arriving in June 1803. Brown and Bauer stayed in Australia, Bauer visiting Norfolk Island, while Brown visited Tasmania. Flinders meanwhile, changed ships, was shipwrecked on the Great Barrier Reef, and imprisoned for six years by the French on Mauritius. He died in July 1814, a day or two after publication of his *Voyage to Terra australis*. Further trouble occurred when much of the botanical collection was lost in the wreck of the *Porpoise* en route to England. Brown and Bauer returned safely to England in 1805.

Bauer worked up some of the sketches he had made into full size paintings, and most of these remain, unpublished, in the British Museum (Natural History) in South Kensington; a selection, with text by W.T. Stearn, was published by the Basilisk Press (Stearn 1976). On his return, Brown became clerk and librarian to the Linnean Society, then Librarian to Sir Joseph Banks in Soho Square. He continued to work on Australian plants, publishing *Prodromus Florae Novae Hollandiae* in 1810. Banks bequeathed a life interest in his collection to Brown, who moved, with the collection, to the Museum, to be its first Keeper of the Botany department in 1827. He died in Soho Square in 1858 at the age of 83.

Robert Brown collected the *Eupomatia laurina* in the colony of Port Jackson (today Sydney). Its usual habitat is in rainforest where it is an understorey shrub or small tree to 10 m, and it is also found in moist Eucalypt forest, especially at low altitudes and along streams and gullies. Flowering is generally between October and January, with the fruits ripening from April to June.

A second species, *Eupomatia bennettii* F. Muell., named in 1858, is found only in south-eastern Queensland and north-eastern New South Wales. It is a smaller shrub with underground, starchy tubers and with broad, blunt yellow and red staminodes, giving the flower an overall orange colouring. The calyptra is longer and tapers to a point. Plants produce annual shoots from near the base of the





***Eupomatia laurina*.** A, young flower and calyptra,  $\times 1$ ; B, calyptra,  $\times 1$ ; C, l.s. flower in the intermediate phase, with the stigmas covered by the staminodes and the stamens erect, ready to release their pollen,  $\times 2$ ; D, staminode from both sides  $\times 4$ ; E, stamen, 2 views,  $\times 3$ ; F, gynoecium,  $\times 2$ ; G, l.s. of part of gynoecium,  $\times 4$ ; H, fruit,  $\times 2/3$ ; I, fruit with portion removed longitudinally,  $\times 1$ ; J, seed,  $\times 3$ . A–G from Wormerseley, New Guinea; H, from *H.A. Longman*, Feb. 1911, border of NSW and Queensland. I & J, from *A. Rodd* 3139, NSW. Drawn by Christabel King.

stem, and each produces a single flower at the apex of the shoot. It was this species that was illustrated in *Curtis's Botanical Magazine* in 1855, t. 4848, under the name *E. laurina*.

The third species, *Eupomatia barbata* L.W. Jessup was described from Queensland in 2002 (Jessup 2002). It has large, pale yellow flowers, with broad staminodes bearded on the margins and on the inner face. *Eupomatia belgraveana* F. Muell. is now included in the genus *Galbulimima*, as *G. belgraveana* (F. Muell.) Sprague.

The development, nature and evolution of the calyptra and other floral parts of all three species of *Eupomatia* have been described in detail in an earlier paper (Endress 2003). The flowers are usually produced in the leaf axils on a short shoot, preceded by a number of minute, caducous bracts or bract-like leaves. The calyptra is interpreted as a modified single, amplexicaul bract, and this was supported by subsequent molecular developmental studies (Kim *et al.* 2005). There is no perianth. Stamens and staminodes appear in a regular spiral Fibonacci pattern. The flowers look like small inside-out roses – the outer narrower parts are the stamens, the wider inner parts are petal-like staminodes, which cover the stigmas. In *Eupomatia laurina* each flower lasts only one day. The flowers are strongly protogynous; they shed the calyptra, open and are functionally female in the early morning when the stigmas are receptive; (in the specimens in the greenhouse in Zurich, the female phase lasts from flower opening at ca. 04:30 a.m. till about 7 a.m. During that time the stigmas are exposed). During most of the day they are in an intermediate phase in which the stigmas are covered by the innermost staminodes and the anthers are still closed. Only in the evening do the anthers open and the stamens release their pollen, thus the flowers are in the male phase. Drawings or photographs of flowers are most often made during the day, and then the flowers are in this intermediate phase, as is the case in our plate. (In contrast, the flowers of *E. bennettii* are female on the first day and male on the second.)

The flowers of *Eupomatia laurina* appear in pulses, so that numerous flowers are open at the same time and the strict timing of flowering keeps inbreeding at a low level. This flowering behaviour is interesting because anthesis is synchronous, and the floral organs move during anthesis. Thus the shape of the flowers of *Eupomatia laurina* is very different in the morning (female phase) and in the evening (male phase) (Endress 1984).

The pollination of *Eupomatia* by small weevils of the genus *Elleschodes* was described by A.G. Hamilton (1897). No other pollinators have been observed and *Elleschodes* has only been observed on *Eupomatia* flowers. Masses of these small beetles are attracted to each flower, which serves them as shelter and food; later, after fertilization, the fallen stamens and staminodes provide food for the beetle larvae on the forest floor (Armstrong & Irvine 1990). *Elleschodes hamiltonii* T. Blackburn is the species associated with *E. laurina*.

The root bark of *Eupomatia* has been found to have alkaloids which have potential antifungal and antibacterial activity. A paper quoted on the *Plants for a Future* database ([www.pfaf.org](http://www.pfaf.org)), reported the extraction of sampangine, eupomatine-1, liriodenine and lanuginosine (Khan, Kihara, and Omoloso 2003).

Robert Brown coined the Latin name from the Greek *ευ* – well and *πωματος* – a cover or lid, in reference to the well-developed calyptra, which is such a conspicuous feature of the genus, so the name should be pronounced with a long O!

The vernacular names, BOLWARRA or NATIVE GUAVA, refer to the edible, guava-like fruit. These are sometimes made into jam or eaten mixed with other fruits, as they are rather too strongly-flavoured and aromatic to be eaten alone. Elliott and Jones (1986), describe them as having an unusual sweet flavour with a lingering aftertaste. Another English name, COPPER LAUREL refers to the coppery-red winter leaves.

**CULTIVATION.** *Eupomatia laurina* is commonly cultivated in moist gardens and prefers a protected, semi-shaded site. It is valuable as a dense, glossy-leaved evergreen shrub, whose leaves become coppery-red in winter and spring. Flowering is mainly in summer and the flowers have a very strong fruity scent. It has proved tolerant of a variety of sites, both in full sun and in shade, as a container plant, or even as a houseplant. It will thrive on most soils, provided that the drainage is adequate. It is not tolerant of frost.

It can be propagated from seed or cuttings. The seeds are fine, and should be lightly covered after sowing. Cuttings may be slow to root. Cutting-propagated trees may produce fruit after two years. Seedlings can take four to six years to fruit (Elliott & Jones 1986).

The plant illustrated here was grown in the Temperate Nursery at Kew, with the entry no. 1973–2441 WOMR; it was collected as seed by J.S. Womersley in New Guinea.

***Eupomatia laurina*** R. Br. in Flinders, *Voyage to Terra australis*, 2, App. III: 597, t. 2. (1814). **Type:** Australia. In woods and thickets in the colony of Port Jackson, especially in the mountainous districts, and on the banks of the principal rivers; flowering in December and January.

**DESCRIPTION.** An aromatic, glabrous tall *shrub* or small *tree* to 10 m, often with drooping branchlets. *Bark* brown, corky or scaly; young bark green with white lenticels. *Leaves* alternate, 5–16 cm long, 2.5–5 cm wide, oblong to obovate, shining above, with indented veins, bright green or coppery. *Flowers* 2–2.5 cm across, white or cream, strongly scented, solitary or in groups in

the leaf axils, on pedicels 5–7 mm long. *Calyptra* yellowish-green, shortly conical or hemispherical, falling as the flower opens. *Stamens* 5–10 mm long, in the female phase reflexed, later spreading and becoming erect and incurved, numerous, whitish, linear, consisting mostly of anther, with a short (*c.* 1 mm) filament flattened at the base. *Staminodes* 5–10 mm long, 2–3 mm wide, ovate, obtuse or acute, blunt, petal-like, glabrous, outer ones spreading, inner ones first erect, later incurved, finally all incurved. *Fruit* urn-shaped to goblet-shaped, with a raised rim, 15–20 mm in diameter, glaucous, greenish-blue, becoming yellowish, soft and fleshy when ripe. *Seeds* 3–4 mm across, irregularly-shaped, pale reddish-brown, with numerous small depressions.

**DISTRIBUTION.** Eastern New Guinea, eastern Australia from Queensland south to Victoria and South Australia.

**HABITAT.** Rainforest and moist Eucalypt forest.

**FLOWERING TIME.** October to January.

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