Australian essential oil woody-plant species profile

Broad-leaved peppermint (*Eucalyptus dives*)

- Species: *Eucalyptus dives* Schauer (piperitone variant; traditionally called 'Type')
- Common name: Broad-leaved peppermint
- Principal source of oil: plantations in South Africa

Species description

Broad-leaved peppermint varies from a small to medium-sized tree, 12–25 m tall and up to 0.7 m diameter at breast height (dbh), usually with a large spreading crown. Features:

- bark – rough to small branches, peppermint-type, dark grey or brown, small branches smooth, greyish
- juvenile leaves – opposite and sessile, amplexicaul sometimes connate, ovate, 8–15 cm long, 3–7 cm wide, bluish to pale green
- adult leaves – alternate, petiolate, broad-lanceolate, tapering to a fine point, 7–15 cm long, 1.6–3.3 cm wide, glossy green, concolorous.

(See Figures 1 and 2. Description adapted from Boland et al. (2006). For more details refer to this and other botanical texts given under 'Further Reading'.)

Figure 1: *E. dives* at Urambi Hills Nature Reserve, ACT.

Natural occurrence

The species extends from south of Walcha on the southwestern slopes to the southern tablelands in NSW and is widespread in central and eastern Victoria (Figure 3). Range in elevation is from 150–1400 m.

A sample of provenances where piperitone variant (traditionally called 'Type') oils are prevalent are listed in the Importance of Biodiversity section below.

Figure 2: Herbarium specimen of *E. dives* (Ladiges 1981).

Topography, soils and vegetation

E. dives is found mainly in hilly to undulating country often, but not exclusively, on sunny northern slopes in the mountain ranges and on tablelands of south-eastern Australia. It is commonly found on shallow and stony soils, low in nutrients and free draining derived from such parent materials as granites, slates and sandstone. It usually occurs in open forests or woodlands in association with a wide range of other eucalypt species (Boland et al. 2006).

Importance of biodiversity

E. dives exhibits significant intraspecific variation in its essential oils. Four chemotypes ('Type' and 'Vars A, B and C') were first described by Penfold and Morrison (1927). Composition of 'Type' oils according to these authors feature piperitone (40–60%) and α-phellandrene (20–30%), 'Var A' α-phellandrene (60–80%) and piperitone (2–8%), 'Var B' α-phellandrene, 1,8-cineole (25–40%) and piperitone (12–18%) and 'Var C' principally 1,8-cineole (68–75%) (Brophy and Southwell 2002). Later, the number of chemotypes reported was increased to five (Johnstone 1984) but this work has been largely overlooked with the four Penfold and Morrison (1927) chemotypes still in mainstream usage.

Occurrence of *E. dives* chemotypes is widespread in Australia, but each tends to occur in separate, distinct populations (Weiss 1997). It is very important in acquiring seed for plantation establishment that the seed has been collected from the desired chemotype. Certain provenances have consistently yielded piperitone-rich oils and should be the focus of seed acquisition for production of E. dives (piperitone variant; traditionally called 'Type') oil. They include:

- in NSW: Braidwood, Berrima, Goulburn, Numeralla, Tumbarumba, Tinderry Ranges & Anembo.
- in ACT: Canberra region (e.g. Urambi Hills, Uriarra).
- in Victoria: Very large areas of 'Var A' are growing in conjunction with the 'Type' variety. As a consequence, care will be needed in selecting seedlots of 'Type' from Victoria.

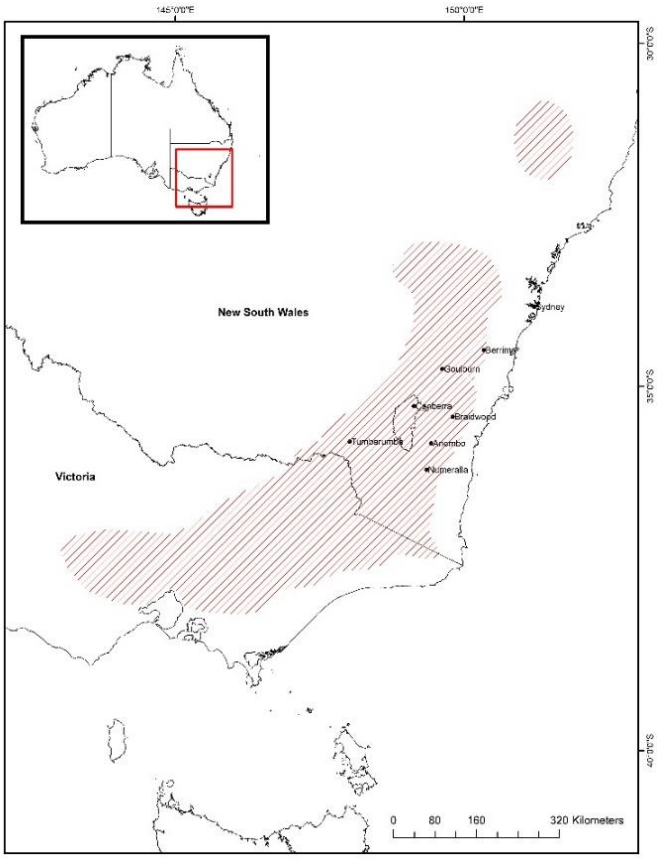

Figure 3: Natural distribution of *E. dives* (hatched area) based on edited points taken from Atlas of Living Australia (www.ala.org.au).

Essential oils

Rectified oil from steam distillation of leaves and twigs is clear, pale yellow to orange-red liquid, mobile at 20°C (GRD 2017).

Leaf oil concentration ranges from 3.0–4.0 % (Fresh Weight) (Penfold and Willis 1961).

The following datasheet gives the percentage for compounds in a typical commercial *E. dives* (piperitone variant, traditionally called 'Type') oil and gives the oil physical properties.

Uses

In South Africa between the 1960s to 1990s, about 150–180t of the piperitone-rich oil was produced annually for production of l-piperitone which in turn was used for the production of synthetic l-menthol (Coppen and Hone 1992). Although not used for this purpose currently, it

continues to be distilled for flavour, fragrance and aromatherapy applications and is also useful as a general-purpose solvent (Webb 2000, Coppen 2002).

Oil Quality

No official standards are in place pertaining to *E. dives* (piperitone variant; traditionally called 'Type') oil. Specifications on composition are negotiated between buyer and seller and are mostly based on the presence of piperitone which should be >40% of total oils (range in the order of 39–68%) with levels of α-phellandrene ideally <20% (range in the order of 1-27%).

Production and markets

Most oil of *E. dives* piperitone variant (traditionally called 'Type') is produced from plantations in South Africa where the species grows well in the high-veld (Coppen 2002). Annual production presently is unknown to the authors but it is likely to be less than in the period between the 1960s and 1990s. The main markets are EU countries such as France and Germany.

The very large production (up to 500 t annually) of *E. dives* (piperitone variant; traditionally called 'Type') oil from native stands mainly in southern NSW was finished by the 1970s due largely to competition from producers outside of Australia and an inability to mechanise the harvesting and distillation processes in difficult terrain (Davis 2002). Production of modest amounts ('Farmers-Market' quantities) of *E. dives* (piperitone variant; traditionally called 'Type') oil from native stands in NSW by independent distillers continues (Figure 4) but this is neither substantial nor regular.

Figure 4: Plantation of *E. dives* left to regrow (top) and a coppicing stand over 20 years old (bottom) at Nerriga, NSW (D. Spencer 2024).

Plantations for oil production

South Africa – The regular silviculture in plantations in Africa for the production of *Eucalyptus* oils is described by Jacovelli (2002). *Eucalyptus dives* is described there as possessing high and medium frost and drought tolerance, respectively, with moderate susceptibility to pests and diseases. It is propagated by seed with an average germination rate after 56 days of cold, moist stratification of 80 germinants per gram of seed and chaff (Gunn 2001). Standard forestry techniques for ground preparation and silviculture are usually employed. Most *Eucalyptus* oil plantations in southern Africa were established at a spacing of 2.74 m x 2.74 m (stocking of 1332 stems/ha) allowing mowing for weed control between trees. In more recent years closer spacings (e.g. 3.0 m x 1.5 m, 2222 stems/ha) are being employed.

Harvesting, average yields and distillation times

Harvesting techniques vary between growers. Jacovelli (2002) reports that one grower of *E. dives* piperitone variant (traditionally called 'Type') allows trees to grow on for 4–5 years before harvesting at knee height with harvest of coppice regrowth at 15–18 month intervals. Annual oil yields are likely to be in the range of 50–150 kg of oil per ha (estimated from Jacovelli 2002). Extraction times for variant are commonly 5 to 6 hours.

Research

Doran *et al*. (2005) in an experiment aimed at ranking provenances of the peppermint eucalypts for their frost tolerance found that a *E. dives* (piperitone variant; traditionally called 'Type') seedlot from Tumbarumba was less frost tolerant than most of the *E. radiata* subsp. *radiata* seedlots in the trial. This was a surprise result as Tumbarumba is at an altitude of >600 m with frosts and snow falls common in winter. It was speculated that *E. dives* might require a particular environment for hardening if it is to reach its full frost tolerance potential.

Eucalyptus dives Essential Oil Data Sheet

1. Chemical composition of *E. dives* (piperitone variant also called 'Type') oils.

Compound	Relative abundance in total oil*
α-pinene	1.1
myrcene	tr
α-phellandrene	19.5
α-terpinene	2.2
limonene	0.3
β-phellandrene	1.7
1,8-cineole	0.5
γ-terpinene	0.8
β-*trans*-ocimene	0.4
p-cymene	3.4
terpinolene	2.0
linalool	0.4
trans-menth-2-en-1-ol	0.3
terpinen-4-ol	4.0
β-caryophyllene	0.1
cis-menth-2-en-1-ol	0.2
cryptone	0.1
cis-piperitol	0.2
α-terpineol	0.7
α-terpinyl acetate	0.5
piperitone	52.3
trans-piperitol	0.3
globulol/viridiflorol	6.0
spathulenol	0.1
γ-eudesmol	0.3
α-eudesmol	0.3
β-eudesmol	0.1

*Oil from trees in the Tinderry Ranges NSW (Boland *et al*. 1991)

2. Physical properties of *E. dives* (piperitone variant traditionally called 'Type') (GRD 2017).

Specific gravity at 20°C	0.885 to 0.906
Refractive index at 20°C	1.4769 to 1.4814
Optical rotation at 20°C	-73.5° to -43.8°
Flash point (GRD spec*)	+48°C
Solubility in 70% Ethanol [% by volume]	0 to 4.5

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Further reading

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