



## TOPIC 23: THE WARATAH AND OTHER PROTEACEAE

### **Did you know that?**

- *Macadamia* is an indigenous Australian tree in the Proteaceae family
- The Waratah, *Telopea speciosissima*, is the state floral emblem of New South Wales
- The Greek sea-god Proteus, able to change shape at will, lent his name to the South African genus *Protea* and our Proteaceae were named, not for the deity, but for the genus. Like Proteus, Proteaceae adopt many different appearances
- Proteaceae probably developed 65 to 135 million years ago when Australia was part of Gondwana. The family is found mainly in the Southern Hemisphere
- Aboriginal people ate the fleshy fruit of *Persoonia* and prepared medicines for sore throats and sore eyes from its flaky red bark

## THE WARATAH AND OTHER PROTEACEAE

### Outline

#### **How do we recognise Proteaceae?**

#### **Characteristics of Subfamilies**

##### **Subfamily Grevilleoideae**

*Telopea*

*Lomatia*

*Lambertia*

*Xylomelum*

##### **Subfamily Persoonioideae**

*Persoonia levis*

*Persoonia lanceolata*

*Persoonia pinifolia*

*Persoonia linearis*

##### **Subfamily Proteoideae**

*Isopogon*

*Petrophile*

*Conospermum*

#### **How do we recognise Proteaceae?**

Plants in the Proteaceae family found in the Ku-ring-gai Wildflower Garden range in form and appearance from rainforest trees to woody shrubs; the leaves may be opposite, alternate or in whorls; the leaves' texture may be leathery or soft, or glabrous or hairy. The leaves are usually [simple](#) but the margins can be [entire](#), lobed, or [toothed](#).

The flowers may occur singly in leaf axils, they may be condensed in a cone-like structure or a [corymbose head](#); they may be [terminal](#), paired, in [racemes](#), in [umbel](#)-like [spikes](#), or in cylindrical spikes.

The fruits can be fleshy [drupes](#), like a cherry or plum. The fruits can be [achenes](#) or [nuts](#), but they are usually woody or leathery [follicles](#).

## The Flower

The answer lies in the structure of the flower. In Proteaceae flowers, instead of the [sepals](#) occurring in a whorl below the petals, there are four petal-like tepals; either free, joined, or partially joined in a tube. There are four [stamens](#) whose filaments either do not exist or are very short, and the anthers are situated in the upper ends of the perianth segments. Conospermum, where one of the four anthers aborts and the flower structure is noticeably different, is an exception among the genera in this topic.

Usually with *Proteaceae* the single [style](#) is long and hooked, and protrudes through the perianth before the [stigma](#) emerges. Just before the flower opens, the [anthers](#) release their pollen which sticks to the end of the style: the stigma is not mature, so fertilisation cannot occur. At this stage, the style **presents** pollen produced by the male anthers, then after the pollen from its own flower is taken away by birds or insects, the stigma matures and can accept pollen from other plants. This discourages self-pollination.

Proteaceae do not exhibit [stipules](#).

So, despite the differences in form of Proteaceae, the flower structure helps us identify it: four flower parts; four petal-like tepals more or less joined in a tube, anthers usually attached to the flower lobes and a long, usually hooked, protruding style. In *Persoonia levis*, (pictured) the anthers are not attached to the perianth segments.



## Characteristics of Subfamilies

In **Grevilleoideae** (Waratah, *Lambertia formosa*, Woody Pear and *Lomatia*) you will see a single bract subtending a **pair** of flowers; the style usually serves as a pollen-presenter; and the fruit is a follicle.

In **Persoonioideae** (which includes all the Persoonias) a bract subtends a **single** flower or the flower occurs singly in the axil of a leaf; the fruit is a drupe. Persoonias do **not** have proteoid roots (see next discussion on Waratahs) and the leaf margins are entire (no teeth, lobes or divisions). You can see the perianth segments rolled back after the flower opens.

Each flower in the **Proteoideae** subfamily (Isopogon, Petrophile and Conospermum) is subtended by a single bract; the style does not act as a pollen-presenter, and the fruit is an achene (a small, dry indehiscent [does not split open] fruit containing one seed. The leaves of Isopogon and Petrophile can be deeply divided.

## SUBFAMILY GREVILLEOIDEAE

### *Telopea speciosissima* Waratah

Erect shrub 2-3 metres high, arising from a [lignotuber](#). It produces two types of roots: a deep growing tap root to seek moisture, with its lateral secondary shoots; and surface feeder roots, called proteoid roots, to adapt to growing in poor soils. See discussion below.

Leaves: Leathery, broad, oblong and coarsely toothed in the upper parts. The upper leaf surface is dark green and glabrous (without hairs) with conspicuous venation; lower leaf surface is lighter green. Alternate, appearing as in a sparse, random spiral pattern. Compare to *Xylomelum pyriforme*.

Flowers: Brilliant red flower head is a terminal raceme. The inflorescence comprises 250 paired flowers surrounded by a whorl of large, protective red bracts. The flowers open from the bottom, or outside, of the head.

Pollination: Bird-pollinated. In *Telopea* and *Lambertia* nectar exudes from a cup-shaped nectary just below the ovary such that nectar production is remote from pollen production [anthers] and presentation [stigma].

Fruit: A tough, semi-woody follicle 12cm long. The style remains as a rigid, curved appendage at the apex of the follicle which opens widely at maturity and releases two rows of 10 – 20 winged seeds.

Habitat: Sandy soils with brown or yellow clay, often in ephemeral watercourses on sandstone slopes, dry sclerophyll forest.

Range: Ulladulla to the Watagan Mountains and in the Blue Mountains

Flowering: September to October

Name: Greek *telopos* meaning “seen from afar” referring to the brilliant red flowers and Latin *speciosissima* for “most showy” or “splendid”. Waratah is an Aboriginal word also meaning “beautiful”.

The Waratah is the state floral emblem of New South Wales. The Waratah motif is used in colonial furniture, wallpaper, etched and stained glass windows, architectural trim, textiles, ceramics and numerous crests and logos.

**Proteoid roots**, or cluster roots, are dense clusters of short roots that develop after spring rains. They are so named because of being first discovered in Proteaceae. They grow close to the soil surface underneath decomposing leaf litter where organic matter is broken down by soil micro-organisms. The root mass consists of hundreds of tiny rootlets, each covered in fine dense hairs giving maximum contact with organic particles. They only live two or three months, whereas the normal roots will persist. Proteoid roots increase the uptake of phosphorus in the soil, and do not develop where there is a high nutrient level.

Pictured are proteoid roots developing on a *Banksia marginata*.





***Lomatia silaifolia*** Crinkle-bush, wild parsley, fern-leaf lomatia

Understorey shrub to 1.5m with lignotuber

Leaves: conspicuously divided; one, two, or three times pinnate

Flowers: creamy white flowers borne on a long terminal raceme up to 30cm long; higher and longer than the leaves.

Fruit: 25mm follicle, winged seeds, persistent style

Habitat: heath, sclerophyll forest, woodland

Range: coast and tableland, Sydney north to Queensland

Flowering: summer

Name: "Loma" is Greek for fringe or border, referring to the papery wing that surrounds the seed. Silaifolia means similar to the pepper saxifrage plant which is a member of the carrot family having divided lower leaves



***Lomatia myricoides*** River Lomatia

Erect shrub to 5m, willowy appearance, drapes over watercourses

Leaves: 5-20cm long and narrow, entire or shallowly toothed, tapering at both ends, short petiole. The paler lower surface has a raised mid-vein.

Flowers: Small, greenish cream flowers in the upper axils in branched racemes the same length as the leaves. Perianth 8-10mm.

Fruit: 30mm follicle, persistent style

Habitat: along watercourses, shaded gullies

Range: coast and ranges, from Victoria to Sydney west to Wollemi National Park

Flowering February

Name: resembling Myrica, wax myrtle



***Lambertia formosa*** Mountain Devil

Shrub to 1.5m with lignotuber

Leaves: Simple, stiff, sharply pointed, in whorls of 3

Flowers: Brilliant red, surrounded by overlapping, pointed yellow-green bracts; regular, sessile, in terminal clusters of 7. Anthers on a tepal lobe, straight, central style. Rich in nectar, bird pollinated.



Fruit: woody follicle with two upturned horns giving rise to its common name. 2 flat seeds with short wings.

Habitat: sandstone; heath and dry sclerophyll forest

Range: Port Stephens to Braidwood

Flowering: September – October

Name: *Lambertia* after A B Lambert; *formosa* is Latin for beautiful

***Xylomelum pyriforme*** Woody Pear

Shrub 2-4 metres, slow growing. Flaky bark, lignotuber and [epicormic](#) buds, new growth rusty-red

Leaves: opposite; immature leaves deeply serrated, adult leaves entire; conspicuous venation

Flowers: paired with single bract borne on terminal (until the branchlet grows) spikes; reddish to tan

Fruit: 9cm woody, pear-shaped follicle; releases 2 winged seeds after fire or death.

Habitat: dry sclerophyll forest in pockets of deeper soil, on sandstone

Range: coast and ranges, Mittagong to Queensland

Flowering: late spring

Name: Greek words for wood and fruit; *pyriforme* for the pear-shaped follicle



*Xylomelum pyriforme* Juvenile leaves

**SUBFAMILY PERSOONIOIDEAE** Geebungs

Except for one New Zealand species, *Persoonia* are endemic to Australia. Named after Dutch botanist C H Persoon.

The yellow flowers are regular, borne singly in a leaf axil or in unbranched racemes. The perianth is a tube, often swollen at the base and tapered at the apex when in bud. The 4 segments (lobes or tepals) roll back individually when the flowers open. The anthers are free, not embedded in the perianth segments as in *Grevilleoideae*. The style does not become a pollen presenter.

The fruit is a drupe. Leaf margins are entire. *Persoonias* do not form proteoid roots.

***Persoonia levis*** Broad-leafed Geebung

Shrub to 4 metres, distinctive papery black bark which peels to reveal a bright red trunk. Trunk smooth when young.

Leaves: Broad, from falcate to lanceolate to obovate, often insect-bitten; 6-14cm long; 13-80mm wide. Smooth, bright green contrasting with surrounding duller foliage. Longer, thinner in the forest form.

Flowers: Yellow, single; 2cm.



Fruit: [Drupe](#)

Habitat: dry sclerophyll

Range: coast and mountain in New South Wales

Flowering: late spring

Name: Levis, Latin for smooth, referring to the leaves

***Persoonia lanceolata*** Lance-leaf Geebung

Erect shrub to two metres, can spread to 2m. Smooth, hard, greyish persistent bark, with dense, felt-like greyish hairs on young growth. White hairs on young branchlets and flower stalks.

Leaves: flat, green or yellowish, 3-7cm long, 1-2cm wide; oblanceolate with distinct mucro (sharp, stiff point).

Flowers: erect, yellow, in leaf axil on short stalk

Fruit: erect globose drupe, flattened laterally, persistent style

Habitat: heath; coastal sand and sandstone

Range: Sydney to Blue Mountains to North Coast

Flowering: summer; most of year



***Persoonia pinifolia*** Pine-leaved geebung

Beautiful, common shrub to 2-4m. Smooth bark.

Leaves: crowded and pine-like in appearance but soft to touch. 3-4cm long, 0.5cm wide and near [terete](#). Grooved beneath with a short, recurved brown point. Shorter at ends of branchlets

Flowers: Yellow, axillary; crowded at ends of branches within much-shortened leaves. The inflorescence is a dense terminal raceme, at a distance appearing as a geometric cone shape.

Fruit: in bunches of drupes hanging like grapes weighing down the branches; these may be seen for most of the year. Remains green while on the tree. Turns red when ripe and falls

Habitat: Sheltered open forest or heath on sandstone

Range: Broken Bay to Royal National Park; lower Blue Mountains

Flowering: Summer and autumn (seems to respond to heat and sunlight)



***Persoonia linearis*** Narrow-leaved Geebung

Shrub to 5m, usually 3m. Outer bark black and papery, revealing red inner bark. Downy hairs on new growth. Considered common, but not easily located in the bush. Hybridises with *P. levis*



Leaves: longer, flatter and sparser than *P. pinifolia* partially concealing the flowers. Tapering to a sharp point.

Flowers: Yellow, near ends of branchlets

Fruit: Yellow to reddish drupe with striations

Habitat: forests; often in association with other Proteaceae in this lecture.

Range: coast and mountains in NSW

Flowering: late summer, to July

Name: linearis refers to thin and straight leaves



### **SUBFAMILY PROTEOIDEAE** *Isopogon*, *Petrophile* and *Conospermum*

Plants in the subfamily Proteoideae may have deeply divided leaves; the style does not usually act as pollen presenter; proteoid roots are not present; the flowers of *Isopogon* and *Petrophile* are actinomorphic (can be bisected symmetrically in several planes) while the flower of *Conospermum* is zygomorphic (irregular); perianth lobes are separated perianth lobes are separated; the fruit is a small, hairy [achene](#) protected by a bract. *Isopogon*, *Petrophile* and *Conospermum* do not have nectar glands.

*Isopogon* Greek "iso" and "pogon" meaning "equal" and "beard" referring to the hairs of more or less equal length surrounding each achene.

#### ***Isopogon anethifolius*** Dill-leaved isopogon

Woody Shrub 1 to 3 metres forming a lignotuber. If not in flower and cone-like structures not present, can be distinguished from *Petrophile* by its tan stem; *Petrophile pulchella* has a pink stem.

Leaves: [terete](#); pinnately divided once or twice; slender leaf segments are held erect

Flowers: Hundreds of small yellow flowers open spirally from the bottom of a terminal woody cone-like structure (not a true cone because conifers are not flowering plants) whose bracts are closely [imbricate](#). The 4 anthers are borne at the tip of each perianth segment. Bracts are deciduous, releasing the achenes upon death or fire



Fruit: hairy achene

Habitat: heath and dry sclerophyll on Sydney sandstone

Range: Sydney sandstone, coast and ranges

Flowering: September to November

#### ***Isopogon anemonifolius*** Anemone- or daisy-leaved isopogon

Shrub to 1.5m

Leaves: Flat; 5 to 10cm in length. The [petiole](#) occupies about a third of the leaf, which is then divided into 3 linear segments and these are



pinnately divided into few or many lobes, some of which may be forked at the ends.

Flowers: as for *I. anethifolius*

Fruit: achene

Habitat: coastal sandstone; dry sclerophyll, heath

Range: Southern NSW to Queensland; coast and ranges

Flowering: September to November

### ***Petrophile pulchella***

Shrub to 2m; one or more slender stems arising from a small lignotuber

Leaves: terete leaf segments are first pinnately divided, then divided further, and held erect like those of *Isopogon anethifolius*

Flowers: numerous, tubular, cream to yellow; club-shaped in bud, like the *Persoonia*. An egg-shaped conelike inflorescence and the persistent bracts distinguish it from our local *Isopogon*

Fruit: achene

Habitat: dry heath on sandstone

Range: coast and ranges of NSW

Flowering: December to March

Name: Petro + phile, Latin for rock-loving; Latin 'pulcher' means beautiful



### **CONOSPERMUM** Smokebush

The genus *Conospermum* does not resemble other Proteaceae. There is a perianth tube but it is short and irregular, and splits into 4 unequal lobes; the lower 3 are narrow, the upper lobe broad and spreading. It is often described as "two-lipped" with the lower lip divided into 3 lobes. The lowest anther aborts.

The flowers are white and small; the inflorescence is a corymb (flowers arise at different levels on the stem, but lower ones having a longer stem, the flowers appear to be at the same height). Leaves are alternate, crowded and simple with entire margins.

Name: Greek *konos* and *sperma* for cone and seed, referring to the cone shaped fruit.



### ***Conospermum longifolium***

A common undershrub to 1.5m; finely hairy

Leaves: Erect, 10-25cm, undulate, tapered, glabrous, linear to oblanceolate with long petiole

Flowers: Panicle inflorescence; 10-40cm long peduncle raises flower heads above the leaves



Pollination: When insect approaches, anthers release pollen suddenly; style elongates

Fruit: 2–3mm cone-shaped achene with a ring of hairs on the open top side

Habitat: sandy or rocky, dry sclerophyll woodland and heath

Range: Sydney north of Port Jackson and Blue Mountains

Flowering: Spring, before *C. ericifolium*

Name: Longifolium: long leaves



### ***Conospermum ericifolium***

Erect shrub to nearly 1 metre with [virgate](#) branches. It flowers in the spring.

It grows in heath and shrubby woodland.

Leaves: small 5-15mm, crowded, ascending to spreading, [hoary](#) and [tomentose](#), linear and almost [terete](#)

Flowers: cream to white, perianth 6–7mm long, inflorescence paniculate like *C. longifolium*; peduncles ascending, 3–6cm long

Pollination: insect-pollinated as for *C. longifolium*

Fruit: cone-shaped 2–3mm achene with a ring of hairs on the open top side

Habitat: sandy or rocky, woodland and heath

Range: wet coastal sandstone, Sydney area

Flowering: spring; noticeable after *C. longifolium*

Name: ericifolium: erica-leaved



### **REFERENCES AND ACKNOWLEDGEMENTS**

Blombery A M & Maloney B *The Proteaceae of the Sydney Region* Kangaroo Press 1992

Edmonds T and Webb J *Sydney Flora* 2<sup>nd</sup> ed 1998 Surrey Beatty & Sons, Chipping Norton

Fairley A & Moore P *Native Plants of the Sydney District* Kangaroo Press 1989

Nixon P *The Waratah* Kangaroo Press 1997

Robinson L *Field Guide to the Native Plants of Sydney* 3<sup>rd</sup> ed Kangaroo Press 2003

Wrigley J W & Fagg M *Banksias, Waratahs & Grevilleas and all other plants in the Australian Proteaceae Family* Harper Collins, Sydney 1995

### **Acknowledgements**

Text and photos are by M. Street 2012

These notes contain hyperlinks to materials, including images, illustrations, plant descriptions and a glossary from PlantNET, with the courtesy of The Royal Botanic Gardens & Domain Trust, 2011.

For general access to [PlantNET](http://plantnet.rbgsyd.nsw.gov.au/) see also <http://plantnet.rbgsyd.nsw.gov.au/>

Produced 2012/MS for Australian Plants Society North Shore Group, Walks and Talks Program