

# NUYTSIA

Bulletin  
of the Western Australian  
Herbarium

Vol. 1 No. 1

1970

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Department of Agriculture of Western Australia

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## FOREWORD

Since the establishment of the Western Australian Herbarium in 1928, its Officers have been active in collecting specimens of the State's unique flora, and in recording information about the distribution of plant species and communities.

Although numerous research papers have been published over the years in both local and overseas journals, the first responsibility of the staff was to accumulate specimens and basic information which would facilitate the production of a botanical journal and finally the publication of a "Flora of Western Australia."

Recent additions to the staff and the erection of a modern Herbarium building have increased the output of botanical work to such an extent that additional publishing facilities are now essential, and so the new journal "NUYTSIA" has been launched. The name "NUYTSIA" has been chosen to commemorate one of our most spectacular native plants—the Western Australian Christmas Tree, *Nuytsia floribunda* (Labill.) R.Br. ex Fenzl. Pieter Nuyts, after whom the genus was named, accompanied the Dutch ship "Gulde Zeepard" on one of the first explorations along the south coast, in January, 1627. For more than a century the region from Cape Leeuwin to Nuyts Archipelago was known as "Nuyts Land."

In addition to general botanical notes the journal will contain the results of vegetation surveys, group revisions and descriptions of new species. This material will then be available for use in the production of a "Flora of Western Australia."

It is proposed to produce the flora series as a separate publication, each part to deal with one family. The parts will be numbered according to the Engler and Prantl system and will be issued from time to time as the research work proceeds. It is expected that the series will commence shortly.

T. C. DUNNE,  
Director of Agriculture.  
1st September, 1970.

A TAXONOMIC REVISION OF THE  
GENERA CROWEA, ERIOSTEMON  
AND PHEBALIUM (RUTACEAE)

by

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WESTERN AUSTRALIAN HERBARIUM

DEPARTMENT OF AGRICULTURE OF WESTERN AUSTRALIA

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## SUMMARY

A taxonomic treatment is presented of the genera *Crowea*, *Eriostemon*, and *Phebalium* (Rutaceae, tribe Boronieae, subtribe Eriostemoninae), which except for one New Zealand species are endemic to Australia. These genera, and several others in the Rutaceae, were included under *Eriostemon* by F.v.Mueller (1859, etc.) and by some later authors, or under *Crowea* (Baillon, 1873). They are here kept distinct but with a modified circumscription. One species previously placed in *Eriostemon* has been shown to be a *Pityrodia* (Verbenaceae) and another to be a *Boronia* (Rutaceae).

The following five sections are described as new:—*Eriostemon* sect. *Corynonema*, *Gymnanthos*, *Nigrostipulae*, and *Osmanthos*; *Phebalium* sect. *Gonioclados*.

Fifteen new species and sixteen new infraspecific taxa are described; in addition two new specific combinations and seventeen new infraspecific combinations are made.

## INTRODUCTION

The three genera monographed in this paper are treated together because of their association since their discovery in the late 18th and early 19th century. The included species have frequently been transferred from one of the genera to another, or the genera themselves have been considered congeneric (usually under *Eriostemon*), sometimes with the inclusion of several other members of the Boronieae. These other genera, although closely related to the three considered here, have characters by which they are clearly demarcated, and for this reason I have not felt it necessary to discuss them beyond pointing out relationships and clarifying synonymy. Within the genera *Crowea*, *Eriostemon*, and *Phebalium* the position of many species has varied according to the emphasis placed by botanists on different characters. I am retaining them as separate genera as they appear to show sufficient morphological disjunction to warrant this approach.

All three genera are endemic to Australia and Tasmania (apart from one species of *Phebalium* in New Zealand) and this probably applies to all members of the Boronieae in the strict sense. Several species described from South Africa and New Caledonia have been included in *Eriostemon* but in fact belong to different genera in different tribes.

None of the species in the three genera has a trans-continental distribution although a few Western Australian species are closely related to ones in the eastern states and in the past have been considered conspecific with them.

Normally only a small proportion of the herbarium specimens studied has been cited after the description of the taxa involved. The abbreviations used in the citations correspond to those in *Index Herbariorum* pt. 1 ed. 5 (1964) or as published subsequently in the periodical "Taxon".

## HISTORICAL SURVEY

### **Crowea**

This genus was described as a member of the Rutaceae by J. E. Smith in 1798, the relevant specimens being received from John White, M.D. of Port Jackson and raised from seed in 1790. It was not the custom of Smith to give specific epithets when describing monotypic genera ("a specific difference for a solitary species being evidently a most glaring absurdity" (1808)), it was therefore left to H. Andrews (1800) to provide the first specific epithet (*C. saligna*). A second species, *C. angustifolia*, was described by Smith (1808) from a plant collected in Western Australia; however the publication was passed unnoticed by botanists and the same species was described as new in 1849 by Turczaninow who used the same specific epithet.

In 1855 F. Mueller described a third species, *C. exalata*, from a Victorian plant, and in 1863 G. Bentham described a fourth from a plant collected in Western Australia. Other names have been published based on material in cultivation, but these are all forms of the New South Wales plant, *C. saligna*.

In 1862 Mueller made *Crowea* a section of the genus *Eriostemon* and united the two eastern states species under the name *E. crowei*. This generic union was followed by H. E. Baillon (p. 387, 1873) but subsequently in the same volume (p. 463) he united *Eriostemon* and *Phebalium* under *Crowea*. Apart from differences of opinion among taxonomists as to whether one or two species should be recognised in both east and west Australia there have been no subsequent new moves involving the taxonomy of the genus.

### **Eriostemon**

This genus was described by J. E. Smith in 1798 as a member of the Rutaceae. He appears to have had two species in mind at the time, one of which (*Diosma uniflora*) came from South Africa. However, for the origin of the genus he gives "Australasia", a name which has not apparently been taken to include South Africa. C. H. Persoon named and described the first two species in 1805, an Australian plant which he called *E. australasium*, and a South African plant *E. capense* (a nomen novum for *Diosma uniflora* L.). Smith (1809) later included six species in the genus; of these, two are of South African origin and are now included in the genus *Adenandra*, one (*E. paradoxa*) is now placed in the genus *Boronia*, and another (*E. salsolifolia*) in the genus *Philothea*. A. Jussieu (1825) limited the genus to the Australian plants and in his circumscription, which is accepted in this paper, he recognized six species (two then unpublished).

In 1859 Mueller included in *Eriostemon* the genera *Phebalium*, *Microcybe*, *Asterolasia*, and *Geleznovia*, and subsequently (1862) *Chorilaena* and *Crowea*. Baillon (1873) similarly lumped several genera under *Eriostemon*, but later in the same work united it with *Crowea*. Since that time few basic changes have been made in the circumscription of these genera which were considered distinct by both Bentham (1863) and Engler (1896 and 1931).

Several species from New Caledonia have at one time been included in *Eriostemon*; these however differ markedly in appearance from the Australian species and (according to published descriptions) contain only one ovule in each carpel. They are now usually placed in either *Myrtopsis* or *Halfordia*, which genera should probably be excluded from the tribe Boronieae.

### **Phebalium**

This genus (based on *P. squamulosum*) was described by E. T. Ventenat in 1805 from material collected in New South Wales. He considered the genus to be related to *Baeckea* and *Leptospermum* in the family Myrtaceae. J. E. Smith (1814) transferred it to the family Rutaceae and recognised three species,



*P. squamulosum*, *P. dentatum* and *P. argenteum* (based on *Eriostemon squameus* Labill.). A. P. de Candolle (1824), who was apparently unaware of Smith's account of the genus, recognised only two species. (*P. squamulosum* and *P. anceps* DC.) and retained *E. squameus* in the genus *Eriostemon*. A. Jussieu (1825a) in a monograph of the genus described 8 species, dividing them into three sections (to which he did not give names); the first section contained two species (*P. correaefolium* and *P. hexapetalum*) which are now placed in the genus *Asterolasia* (= *Urocarpus*); the second section contained five species (*P. salicifolium*, *P. billardieri*, *P. anceps*, *P. elaeagnifolium*, and *P. squamulosum*); the third section, "Sp. dubia", contained the single species *P. diosmeum*. Jussieu also appeared to be unacquainted with the account of the genus by J. E. Smith.

F. Mueller (1859) transferred the genus to *Eriostemon* and later (1862) created several sections into which he placed the various species involved; these were sections *Chorilaenopsis*, *Leionema*, and *Phebalium*. Earlier (1855) he had created the genus *Asterolasia* into which (as a section of *Eriostemon*) he later (1862) placed the two species included by Jussieu in his first section of *Phebalium*.

G. Bentham (1863) retained *Phebalium* as a genus and limited it to Mueller's sections *Leionema* (including in it sect. *Chorilaenopsis*) and *Phebalium* (as sect. *Euphebalium*). This circumscription was followed by Engler (1896 and 1931). Baillon (1886) placed *Phebalium* in the genus *Crowea* but this action has not been followed by any other botanist.

## ERIOSTEMON, PHEBALIUM, AND CROWEA AND RELATIONSHIPS WITH OTHER GENERA

*Eriostemon* and *Phebalium* as delimited here exhibit much greater intra-generic morphological diversity than is found in the other genera of the Boroniaceae, and their representative sections sometimes appear to have greater affinity with these genera than with the other sections of their own genus (e.g. *Phebalium* sect. *Phebalium* to *Microcybe*, *P.* sect. *Goniocladus* to *Chorilaena*, and *Eriostemon* sect. *Nigrostipulae* to *Philothea*). However, I have retained the commonly accepted divisions because the morphological diverse sections are linked through intermediates (e.g. *P.* sect. *Phebalium* through sect. *Goniocladus* to sect. *Leionema*), because the segregated genera possess characters which do clearly demarcate them, and because cytological evidence suggests that this is a natural grouping (S. Smith-White, 1954).

These other genera have been included by Engler in the subtribes Eriostemoninae, Boroniinae, and Nematolepidinae. The last sub-tribe was separated on the basis of the stamens being ligulate, a character which appears to separate genera related to each other and independently, to species of *Phebalium* sect. *Goniocladus* and sect. *Eriostemoides*.

**Philothea.** This genus is morphologically similar to *Eriostemon* sect. *Nigrostipulae* with which it shares the same type of anthers, seed and stipular excrescences. It is distinct in having monadelphous stamens and in chromosome number ( $n = 14$ , fide Smith-White, 1954).

**Drummondita** is usually included in the former genus on account of its monadelphous but it has flowers and vegetative characters which are otherwise quite distinct. The anthers are present on only 5 of the filaments and are dorsifixed and immobile (not versatile with a slender attachment); this type of attachment is also found in the genus *Crowea* but there do not otherwise appear to be close morphological similarities between the two genera.

**Microcybe.** This genus is obviously closely related to *Phebalium* sect. *Phebalium* with which it shares staminal and seed characters, and a lepidote indumentum. It differs in the compact heads of flowers, in the free or almost free sepals, in the glabrous petals (or almost so), and in the reduced carpel number.

**Geleznowia**, a monotypic Western Australian genus, has seeds which are the same as those found in *Eriostemon* sect. *Nigrostipulae*. However in staminal characters it is different as the anthers lack a white apiculum and in fact have a retuse apex. Its affinities are uncertain.

**Urocarpus.** In this genus the seed is similar to that found in *Phebalium* sect. *Eriostemoides* which section it also resembles in anther morphology. I see no reason to separate from it the genera *Pleurandropsis* and *Asterolasia*. It is characterized by having flowers developing in succession in clusters, by the minute calyx, by the partially united carpels, and by the massive reflexed stigma.

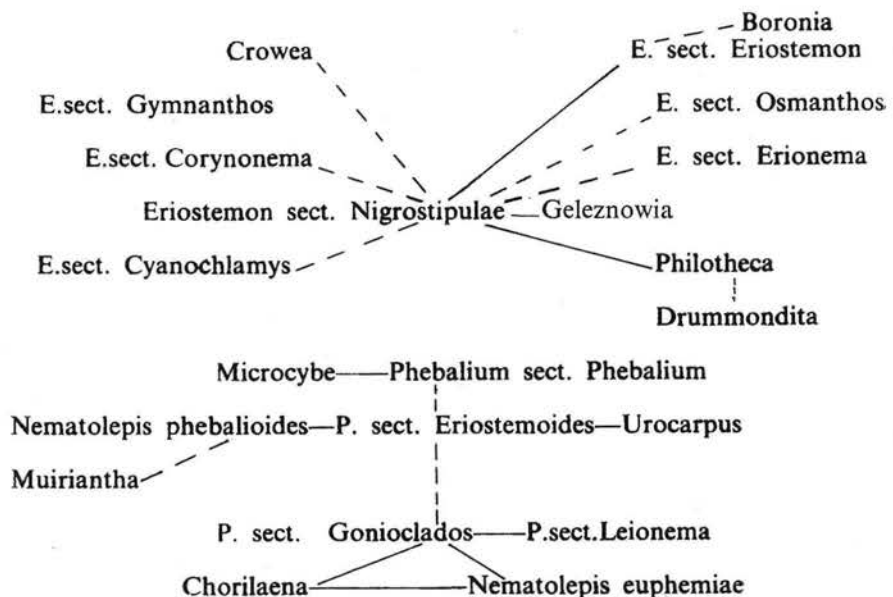
**Chorilaena.** This genus shows strong affinities to *Phebalium* sect. *Goniocladus*. The calyx is patelliform with valvate lobes, the petals are valvate with stellate hairs on the outside, and the anthers have a small acute apex. In all these characters, and in the seed, the relationship is with *P. anceps*. It has been placed in a separate sub-tribe because of the presence of a thickening (ligule) near the base of the staminal filament. This thickening is little different from the tuft of stellate pubescence found in *P. squameum* which species appears to offer in several of its characters a connecting link with some of the ligulate genera.

**Nematolepis.** As currently conceived (i.e. Blackall and Grieve 1959, and Engler 1931) this genus consists of two species, *N. phebalioides* Turcz. (the type) and *N. euphemiae* F. Muell. The former has two sub-floral bracteoles, free imbricate sepals, glabrous petals, and slightly retuse anthers; in these characters and in the seed it is most closely related to *Phebalium* sect. *Eriostemoides*. *N. euphemiae* was included in the same genus because of the presence of ligulate staminal filaments; it has however a cupular, lobed calyx, lepidote petals and anthers with a slightly apiculate apex. In these characters and in the seed it is similar to *Eriostemon* sect. *Gonioclados*; Gardner (1931) placed it in the genus *Phebalium* (where it was also included by Benthham as *P. baxteri*) but it appears to warrant separate generic status.

**Muiriantha.** This genus was included in *Chorilaena* by Mueller (as *C. hassellii*) with which it has much in common, but it is probably more closely related to *Nematolepis* sensu stricto. It has free imbricate sepals and petals, ligulate staminal filaments, and obtuse, glandless anthers. It differs most noticeably from *Nematolepis* in the absence of epidermal scales. In all these characters it shows close affinities to *Phebalium* sect. *Eriostemoides*.

**Rossittia** Ewart et Davies, Fl. N. Territ. 157 t. 15 (1917). This monotypic genus was described by Ewart as being related to *Eriostemon* and *Phebalium* and was included by Engler (1931) in the Eriostemoninae. It is in fact a lepidote species of *Hibbertia* (*H. lepidota* R.Br.)\*

TAXONOMIC AFFINITIES IN THE SUBTRIBE ERIOSTEMONINAE  
AND RELATED GENERA



A solid line indicates probable close relationship while a broken line indicates indefinite affinity.

\* (cf. J. H. Willis, Vict. Nat. 59:72 (1942))

## NOTES ON SOME MORPHOLOGICAL CHARACTERS

**STIPULES.** These organs are often present in *Eriostemon* sect. *Nigrostipulae* but are absent in the other sections of *Eriostemon* and are not observable in *Phebalium* and *Crowea*.

When present the stipules on the young branchlets are at first delicate, multicellular structures about 0.2 mm in length on either side of the petiole; they may bear a few unicellular hairs. As they get older the basal cells become filled with a dark-brown or black, brittle resin-like substance which enlarges and often forms a hemispherical excrescence on either side of the leaf-base.

These stipular excrescences are also found in the genus *Philotheca* (which is closely related to *Eriostemon* sect. *Nigrostipulae*) but apparently are not present in other genera of the Rutaceae which as a family has always been considered to be exstipulate.

**CALYX.** In *Eriostemon* and *Crowea* the sepals are distinct and imbricate and the calyx is clearly demarcated from the pedicel apex. In *Phebalium* the sepals are free (and valvate or open) or united into a patelliform to hemispherical calyx which (except in sect. *Phebalium*) merges into the fleshy apex of the pedicel.

**DISC.** An intrastaminal ring of fleshy tissue is found in *Eriostemon* species. This is usually convex and broader than the ovary into which it may merge or it may be distinct owing to different texture or colour. The carpels are somewhat embedded in the disc and in this portion are joined together. In *Phebalium* the disc is much less distinct and in sect. *Phebalium* is either absent or insignificant. In *P. rude* it forms a short base to the ovary and in *P. anceps* it bulges slightly around the base of the ovary. In *P. squameum* the disc is approximately the same diameter as the ovary but demarcated from it. In the sect. *Leionema* a disc as such is not present but is replaced by a gynophore which is prominent in some species but entirely absent in others (e.g. *P. rotundifolium*). There does not appear to be a sharp demarcation between the gynophore of sect. *Leionema*, the disc of sect. *Gonioclados*, and the apparent absence of disc or gynophore in sect. *Phebalium*.

**OVARY.** The typically 5 carpels are shortly united at the base but are otherwise free. In one species (*E. trachyphyllus*) they are joined (except at apex) by a peripheral membrane (epicarp) but the radial walls remain free. The style is always solitary and is shortly 5-rayed at the base where a branch passes to each of the placentas. The carpels are always biovulate, and are apparently so throughout the Boroniceae, a distinguishing character from those New Caledonian species which have sometimes been included in *Eriostemon* or *Boronia*. The funicles arise collaterally on the axile placenta; however the ovules are sub-collateral or almost superimposed possibly owing to the shape of the loculus. See Fig. 1, 1-2.

The apex of the carpel is usually solid and sterile (not so in *Crowea* and *E. trachycarpus*) and in fruit forms a more or less prominent apiculum or rostrum.

**OVULES.** These are anatropous, 2-integumented, and the micropyles of both of those present in each loculus are directed upwards. Engler (1896 and 1931) described and illustrated the funicles and ovules as being superimposed with the micropyle of the lower ovule directed upwards and of the upper ovule directed downwards; this is not correct.

Normally only one seed develops in each carpel.

FRUIT. The carpels, if fertile, enlarge and separate from the style base; they remain erect or become divaricate. The pericarp becomes separated into two layers, the epicarp and endocarp. The former is coriaceous or woody and usually glandular verrucose (along the radial walls it remains smooth where previously in contact with neighbouring carpels); it dehisces along the axial edge. The endocarp differentiates into two structures; the lateral and abaxial walls of the loculus become elastic and cartilaginous, forming a mechanism for propelling the ripe seeds from the cocci, while the adaxial placental portion remains thin (at least at the margins) and during dehiscence becomes torn from the elastic-endocarp but remains attached to the seed by the funicle. This placental endocarp if membranous soon becomes detached from the dehisced seed, but if it is thick the funicular attachment is also firm and both are usually persistent on the seed. This latter condition is the case with *Eriostemon* sect. *Eriostemon* and sect. *Corynonema*, *Crowea*, and *Phebalium* sect. *Leonema*. The placental endocarp probably represents the "aril" mentioned by some workers as being attached to the seed of the *Eriostemoninae*. A true aril (i.e. an expansion of the funicle) is found in some of the sections (e.g. *Eriostemon* sect. *Erionema* and *Osmanthos*) but is usually dry and insignificant; it is unlikely to be of value in seed distribution by insects. See Fig. 4.

**Rutaceae tribe Boronieae subtribes Eriostemoninae and Nematolepidinae**

KEY TO GENERA

1. No ligule at base of staminal-filaments.
  2. Stamens united for more than half their length.
    3. Stamens all perfect **Philotheca**
    3. Stamens with 5 reduced to staminodes **Drummondita**
  2. Stamens free or slightly united at their base.
    4. Calyx inconspicuous; petals induplicate-valvate, tomentose outside; flowers maturing in succession in clusters **Urocarpus**
    4. Calyx distinct, or if small then petals imbricate.
      5. Calyx shorter than petals.
        6. Anthers with a sterile white apiculum (sometimes minute); stamens erect or inflexed (except *E. deserti*), filaments usually ciliate with simple hairs.
          7. Anthers pilose **Crowea**
          7. Anthers glabrous **Eriostemon**
        6. Anthers with no sterile white apiculum (sometimes with a terminal gland); stamens spreading, glabrous (or with stellate hairs at base).
          8. Ovary bicarpellary; flowers small, sessile in terminal heads; petals glabrous or nearly so **Microcybe**
          8. Ovary 5-carpellary (or if fewer than flowers not in heads), petals lepidote outside or glabrous **Phebalium**
      5. Calyx longer than petals **Geleznowia**
  1. Hairy ligule at base of staminal-filaments.
    9. Flowers in dense reflexed heads **Chorilaena**
    9. Flowers not in heads.
      10. Sepals united into a hemispherical calyx, petals densely lepidote outside **Nematolepis cuphemiae**
      10. Sepals free, imbricate, petals glabrous or almost so.
        11. Branchlets and lower surface of leaves lepidote; petals valvate, connate **Nematolepis phebaloides**
        11. Branchlets and leaves sparsely villous; petals imbricate, free **Muiriantha**

## CROWEA Sm.

J. E. Smith, Trans. Linn. Soc. 4:222 (1798), [named in honour of James Crowe of Lakenham, near Norwich (1751-1807)]; Andrews, Bot. Repos. 2:t.79 (1800); Ventenat, Jard. Malm. t.7 (1803); Persoon, Syn. Pl. 1:465 (1805); Smith in Rees, Cycl. 10: (1808); Jussieu, Dict. Sci. Nat. 12:62 (1818); Nees et Martius, Nova Acta Acad. Leop.-Carol. 11:181 (1823); de Candolle, Prod. 1:720 (1824); Jussieu, Mém. Mus. Hist. Nat. Paris 12:481 (1825); G. Don, Gen. Hist. 1:792 (1831); Spach, Hist. Nat. Veg. Phan. 2:337 (1837), op. cit. 2:60 (1837); Bentham et Hooker, Gen. Pl. 1:293 (1862); Bentham, Fl. Austral. 1:328 (1863); Baillon, Hist. Pl. 4:463 (1873); Engler, Pflanzenfam. 3/4:140 (1896); Engler, op. cit. ed. 2. 19a: (1931); Ewart, Fl. Vict. 704 (1931).

*Eriostemon* sect. *Crowea* (Smith) F. Mueller, Pl. Indig. Col. Vict. 1:119 (1862).

*Crowea* [sect.] *Eucrowea* Baillon, Hist. Pl. 4:464 (1873), nom. illeg.

Woody perennials or shrubs. Branchlets angular, sometimes with decurrent leaf-bases. Leaves alternate, simple,  $\pm$  flat, chartaceous, glandular punctate, glabrous. Flowers axillary, or terminal to a short axillary shoot, pedicellate. Bracteoles persistent and sometimes foliar. Calyx hemispherical; sepals 5, free, imbricate, coriaceous, sub-orbicular. Petals 5, free, imbricate, chartaceous when dry, elliptic or ovate, glabrous, persistent. Stamens 10, free, the antisepalous slightly longer than the antipetalous, pyramidally arranged and incurved over the ovary (apices becoming recurved during anthesis); filaments contiguous or slightly imbricate, linear, abaxial side flat, adaxial convex or keeled, margins pilose; anther dorsifixed by a firm attachment to the filament-apex, oblong-cordate, introrse, dehiscent longitudinally, thecae sparsely pilose and produced upwards into a lanceolate, pilose, sterile appendage 2-3 mm long. Disc intrastaminal, forming a narrow lobed margin around ovary, glabrous. Ovary hemispherical, ca. 0.5 mm above disc, glabrous; carpels 5, free (slightly united at base), embedded in disc, with no sterile apex, biovulate; placentation axile, funicles very short and arising collaterally; ovules  $\pm$  superimposed with the micropyles directed upwards. Style short, inserted near apex of adaxial margin of each carpel, stigma globular. Fruit of up to 5 erect cocci with rounded apices, dehiscence as in *Eriostemon*. Dehiscent seed with placental portion of endocarp firmly attached and persistent, the lower central part of this attached endocarp fleshy, the upper and lateral margins membranous. Seed sessile (the funicle forming a linear aril along adaxial margin, becoming fleshy at lower end next to raphe),  $\pm$  reniform with adaxial margin straight, 2-4.5 mm long; outer testa brown,  $\pm$  coriaceous; sclerotesta thick, black and brittle, smooth or irregularly corrugate; hilum a shallow groove along adaxial margin extending from micropyle (near apex of seed) to raphe; raphe basal, fleshy, covered by the brown outer testa only, chalaza basal; endosperm copious; embryo terete, slightly curved, cotyledons straight, plano-convex, radicle superior. See Fig. 1, 3-5; 5, 1.

Chromosome no.  $n = 19$ , fide Smith-White (1954).

Type species: *C. saligna* Andr.

Three species, one from Western Australia and two from New South Wales and Victoria.

1. Leaves serrulate, the base decurrent as two narrow-denticulate wings along stem.
2. Leaves linear to narrow-oblong, margin recurved when dry, flowers usually pink  
1a. *C. angustifolia* var. *angustifolia*
2. Leaves elliptic to obovate, flat; flowers usually white  
1b. *C. angustifolia* var. *dentata*
1. Leaves entire, not decurrent as a pair of wings.
3. Branchlets glabrous, acutely angular or narrowly winged (a single angle decurrent from each leaf base); leaf  $\pm$  elliptic  
2. *C. saligna*
3. Branchlets puberulous (at least in narrow lines), obtusely angular or  $\pm$  terete; leaves oblong-cuneate to spatulate  
3. *C. exalata*

## 1. *Crocea angustifolia* Sm.

J. E. Smith in Rees, Cyclo. 10:n.2. (1808).

Typification: "Found by Mr. Menzies, near King George's Sound, on the west coast of New Holland." Type not seen.

*C. angustifolia* Turcz. Bull. Soc. Nat. Mosc. 22/2:13 (1849); Walpers, Ann. Bot. Syst. 2:249 (1852); Bentham, Fl. Austral. 1:330 (1863); F. Muell., Fragm. 9:106 (1875); Hooker f., Bot. Mag. 128:t.7870 (1902); Heal, Gard. Chron, III. 69:5.f.2 (1921); Pelloe, Wildfl. W.A. 36 (1921).

Typification: "Nova Hollandia. Swan River. Drum. coll. III. n. 12." Holotypus: KW (photo seen); iso.: K "12. Drummond, Swan River." (King George Sound according to Hooker f., l.c.) (photo seen), MEL 4548, NSW 69928 "Drummond 12, 1845". *Eriostemon turczaninowii* F. Muell., Pl. Indig. Col. Vict. 1:120 (1862), (based on *C. angustifolia* Turcz.).

Woody perennial or undershrub, 0.3–3 m high. Branches slender, glabrous, smooth, terete but with narrow, denticulate wings decurrent from either side of the leaf base. Leaves chartaceous (rarely sub-coriaceous), smooth glabrous, sessile with a broad base, linear to broadly elliptic or obovate, apex rounded to acute, midrib prominent below. Flowers axillary, usually solitary. Pedicel glabrous, 2–5 mm long, narrow at the base but thick and fleshy towards the apex. Bracteoles 2–4, basal or sub-basal, ovate to lanceolate, 0.5–1.5 mm long. Mature bud narrow-ovoid, ca. 8 mm long. Calyx hemispherical; sepals free, imbricate, coriaceous, sub-orbicular, 1.5–2 mm long, glabrous, ciliolate. Petals persistent, thin, ovate, ca. 12 mm long, white to pink, becoming darker with age. Stamens erect, ca. 7 mm long; filaments linear, glandular verrucose towards the apex, sparsely pilose on the margins and adaxial surface; anther thecae 2 mm long, pilose abaxially towards the apex; sterile apiculum thin, pilose, linear-lanceolate, white, ca. 1.5 mm long. Disc purple, forming a narrow, undulate, sloping margin to the ovary. Ovary ca. 0.7 mm high; style  $\pm$  equal to stamens, pilose; stigma globular,  $\pm$  twice style width. Cocci erect rounded at summit, ca. 3.5 mm long. Seed subreniform, 2–2.5 mm long, outer testa coriaceous, reddish-brown, sclerotesta smooth.

### 1a. var. *angustifolia*

Leaves linear to narrow-oblong, margin denticulate and recurved when dry. Flowers usually pink.

DISTRIBUTION: Western Australia, in the extreme south-west.—Map 1.

WESTERN AUSTRALIA: South Bindoon, Barmere 153 (MEL); Kalgan, M. Davis 526 (AD); Two Peoples Bay, C.A. Gardner 3318 (PERTH); King George Sound, Maxwell, July 1858 (MEL); Bow River, H. T. Saw, Jan. 1925 (PERTH); 4 miles east of Oyster Harbour, Albany, E. Wittwer 255 (KINGS PARK).

### 1b. var. *dentata* (Bentham) P. G. Wilson, comb. nov.

*C. dentata* R. Br., ex Benth., Fl. Austral. 1:330 (1863) [dentatus = toothed]; Gardner, W. Austr. 1 Wild Fl. ed. 8. 70 (1951); Gardner, Wildfl. W. Austral. t.79 (1959).

Typification: "W. Australia. King George's Sound, Baxter (Hb. R. Brown)". Holotypus: K (photo seen). *C. angustifolia* Turcz., var. *dentata* (Benth.) Blackall, How to Know W. Austral. Wildfl. 258 (1954), comb. invalid (without full citation of basionym).

*C. angustifolia* Turcz. var. *platyphylla* Benth., l.c.: F. Muell., Fragm. 9:106 (1875).

Typification: "Franklin river, Maxwell." Isotypus: MEL 4549 "On the sloping hills near the entrance of the Franklin River".

Leaves elliptic to obovate, flat. Flowers usually white.

Chromosome no.  $n=19$ , from material collected at Manjimup, Pemberton, fide Smith-White (1954).

DISTRIBUTION: Western Australia, extreme south-west.—Map 1.

WESTERN AUSTRALIA: Nornalup, A.M. Ashby 657 (AD); Walpole, A.M. Baird, 24.xi.1947 (UWA); Nancy's Peak, Porongurup Range, B.G. Briggs, 10.x. 1960 (NSW); Albany, J. Clark, 9.ix.1923 (PERTH); Big Brook, Pemberton, M. Koch 2239 (MEL).



*Crowea angustifolia* was first described in 1808 by J. E. Smith from specimens collected by Archibald Menzies in 1795 at King George Sound. It was described again in 1849 by Turczaninow from specimens collected in 1845 by James Drummond in the same area. Turczaninow used the same specific epithet as did Smith and it is Turczaninow's name which has been taken up by all subsequent authors.

The Drummond collection was stated by Turczaninow to have come from "Swan River"; this is probably intended to mean the Swan River Colony. The holotype at Kiev has only "Nova Hollandia" as a locality. J. D. Hooker, writing in the Botanical Magazine of 1902, i.c., stated that it "is a native of King George's Sound, where it was first collected by James Drummond". The type form of the species is in fact only found in that area.

The species *Crowea dentata* was described by Benthams as being a shrub with coriaceous, broad, obtuse or truncate leaves; the pedicel and petals are described as being slightly hoary. A photograph of the type (from King George Sound) shows it to be the broad-leaved plant commonly known under this name, but all specimens I have seen possess glabrous pedicels and petals. Western Australian authors, e.g. Gardner and Pelloe, have usually considered *C. dentata* and *C. angustifolia* to be distinct species. The former is described as being a shrub up to 10 ft. high growing in Karri forests, with broad leaves and white flowers, while *C. angustifolia* is described as a swamp plant found near Albany, about 2 ft. high with very narrow leaves and pink flowers. Herbarium specimens usually lack information as to habitat, plant habit, or flower colour, but the few notes available suggest that both the broad and narrow-leaved plants are also found in exposed rocky country where they both form small shrubs. Leaf shape and texture and flower-colour are very variable, the white colour often changing to pink or mauve with age. Thus although the morphological extremes have quite distinct aspects there is considerable variability which may have an ecological link; mapping the various forms, as represented in herbarium specimens, does not suggest any marked geographical delimitation. Field work is required on this complex to sort out any possible clinal variation and to decide on the specific or infraspecific status the different phenotypes should have.

The name *Crowea angustifolia* Turcz. var. *platyphylla* Benth. was based on material collected at the "Franklin River" by Maxwell; it is the broad-leaved plant commonly referred to *C. dentata*. Benthams distinguished it from the latter species by the thin acute leaves as against the coriaceous, obtuse leaves of *C. dentata*. These characters break down with greater range of material and the leaf texture may be only a phenotypic response to environment. While "platyphylla" is the earliest varietal epithet for this plant it would be illegitimate (being a later homonym) if transferred to *C. angustifolia* Sm., I have therefore used the epithet "dentata".

## 2. *Crowea saligna* Andr.

H. C. Andrews, Bot. Repos. 2:t.79 (1800) [salignus = willow-like]; Ventenat, Jard. Malm. t.7 (1803); Persoon, Syn. Pl. 1:465 (1805); Smith in Rees, Cycl. 10: (1808); de Candolle, Prod. 1:720 (1824); Sprengel, Syst. Veg. 2:322 (1825); G. Don, Gen. Hist. 1:792 (1831); Benthams, Fl. Austral. 1:329 (1863); F. Muell., Fragm. 9:106 (1875); Maiden et Campbell, Fl. Pl. and Ferns N.S. Wales t.7 (1895); Engler, Pflanzenfam. 3/4:140.t.78 (1896); Engler, op. cit. ed. 2. 19a: 259.t.114 (1931); Ewart, Fl. Vict. 704 (1931). Typification: "New Holland . . . raised from seeds, in the year 1790". Type: tab. 79 (specimen non-existent).

*Eriostemon crowei* F. Muell., Pl. Indig. Col. Vict. 1:119 (1862), p. pte., nom. illeg. (based on *C. saligna*, *C. latifolia*, and *C. exalata*); Stirling, Proc. Linn. Soc. N.S. Wales 11:1057 (1887); Moore et Betche, Handb. Fl. N.S. Wales 45 (1893); Dixon, Pl. N.S. Wales 50 (1906); Beadle et al., Handb. Vasc. Pl. Syd. Dist. 319 (1963).

*E. salignus* (Andrews) Baillon, Hist. Pl. 4:387 sub f. 426 (1873).

*C. latifolia* Loddiges ex G. Don, Gen. Hist. 1:792 (1831); Morren, Ann. Gand 4:t.180 (1848).

Typification: "Native of New Holland". Type not seen.

*C. macrantha* Hort., Horticulture Franc. t.6 (1857) in icon., *C. latifolia* in textu, non vidi, fide Index Londonensis.

*C. saligna* [var.] *major* Hort., Journ. Hort. & Cottage Gardener III. 30:57 (1895).

*C. saligna* [var.] *striata* Hort., l.c.

Small slender shrub to 1.5 m high. Branches smooth, glabrous, with a narrow wing decurrent from each leaf base. Leaves chartaceous, sessile, entire, smooth, glabrous, flat or slightly recurved at margins when dry, narrowly (to broadly) elliptic, 30 x 4 mm to 60 x 13 mm; apex acute to obtuse, apiculate; base narrowly cuneate; midrib prominent below. Flowers solitary, axillary; pedicel terete, 5-grooved, 5-13 mm long, with 2 pairs of basal, bluntly deltoid bracteoles ca. 1 mm long. Calyx hemispherical; sepals free, imbricate, broadly ovate to sub-orbicular, 3-3.5 x 2.5-3 mm, coriaceous with a thin ciliate margin, glabrous. Petals chartaceous when dry, elliptic, 12-20 x 4-7 mm, ciliate otherwise glabrous, pink (rarely white) to purple, apex  $\pm$  inflexed to cucullate. Stamens pyramidally arranged and cohering by their prominently pilose margins, 4-5 mm high (antisealous slightly longer), apices spreading during anthesis; filaments narrow-oblong; anthers ca. 1.5 mm long. Style short and thick, ca. 0.3 mm long, pilose; stigma massive, subglobular ca. 0.7 mm wide. Cocci  $\pm$  erect in fruit, ca. 7 mm high. Seed ovoid-reniform, 3.8-4.5 mm long; sclerotesta irregularly rugulose.

Chromosome no.  $n = 19$ , from material collected at Kuringai, Berowra, fide Smith-White (1954).

DISTRIBUTION: New South Wales, Port Jackson district.—Map 2.

NEW SOUTH WALES: Killara (Sydney suburb), E. Ashby, 25.ix.1915 (AD); Bargo Creek from Yerrinbool, Blakely and Shires, Oct. 1953 (NSW); Terrey Hills, B.G. Briggs, 10.vi.1953 (NSW); Port Jackson, Robert Brown, 1802-5 (NSW); South Kincumber, G. Chippendale, 1.vii.1953 (NSW); Roseville Chase, "in sandstone scrub-forest," L.A.S. Johnson 484 (NSW). VICTORIA: Pine Mountain (near Walwa), Upper Murray, C. Walter, Oct. 1891 (MEL).

This species shows only slight variation in flower size and colour (a white form is reported) and in leaf shape, the latter no doubt partly influenced by environmental factors. It is probably found only in the area around Port Jackson. The single collection from Pine Mountain (near Walwa), Victoria, on the upper Murray was recorded by Ewart and Tovey, Proc. Roy. Soc. Vict. 32: 193 (1920), and cited by McBarron, Contr. N.S.Wales Nat. Herb. 2: 191 (1951). The specimen was correctly determined but I think its natural occurrence in that area is very unlikely.

*C. saligna* has frequently been united, under various names, with *C. exalata*. It may be distinguished by its glabrous branchlets, pedicels, and sepals, and by the single narrow-wing decurrent from each leaf base. In *C. saligna* the leaves are usually elliptic and acute, whereas in *C. exalata* they are spatulate with the apex obtuse to rounded.

As noted previously, the genus *Crowea* was named after James Crowe, a surgeon who was also a keen botanist and especially interested in the genus *Salix* (the willows). According to J. E. Smith (1808) the epithet "saligna" (= willow-like) commemorated this interest of Crowe's. However this specific epithet was actually provided by H. C. Andrews who called the plant the "Willow-leaved Crowea" from which the scientific name is most likely derived.

### 3. *Crowea exalata* F. Muell.

F. Mueller, Trans. Phil. Soc. Vict. 1:11 (1855), [ex = without, alatus = winged]; Bentham, Fl. Austral. 1:329 (1863); F. Mueller, Fragm. 9:106 (1875); Woolls, Proc. Linn. Soc. N.S.Wales 11:929 (1886); Ewart, Fl. Vict. 704 (1931).

Typification: "On the rocky tops of Mount M'Farlane, about 5,000 feet above the sea; on the gravelly banks of the Mitta Mitta and Livingstone River towards Lake Omeo, and on the Boggy Creek in Gipps' Land." Lectotypus: MEL 4410 "Mitta Mitta, ad ripam glareosam

prope junctionem Livingstone." Feb. 1854, leg. F. Mueller. Syntypes: Boggy Creek, 1853, F. Mueller, MEL 4411, K (photo seen); Mount McFarlane, 1853, F. Mueller, MEL 4409 & 4412, K (photo seen).

*Eriostemon crowei* var. *exalata* (F. Muell.) Maiden et Betche, Census N.S. Wales Pl. 115 (1916), nom illeg.; Dixon, Pl. N.S.Wales 50 (1906), "*exaltata*"; Gray, Contr. N.S.W. Nat. Herb. 3:43 (1961); Beadle et al., Handb. Vasc. Pl. Syd. Distr. 320 (1963).

*E. crowei* F. Muell., Pl. Indig. Col. Vict. 1:119 (1862) p. pte., nom. illeg. (based on *C. saligna*, *C. latifolia*, and *C. exalata*); F. Muell., Native Pl. Vict. 1:70 (1879); F. Muell., Key Syst. Vict. Pl. 1:142 (1887); Stirling, Proc. Linn. Soc. N.S.Wales 11:1057 (1887); Moore et Betche, Fl. N.S.Wales 45(1893).

Small shrub to 1 m high. Branchlets glandular, somewhat obtusely angular to  $\pm$  terete, puberulous in sunken lines between the rounded ridges. Leaves chartaceous, entire, narrow-spatulate or rarely oblong elliptic, gradually narrowing to an attenuate base, 15–30 x 1 mm to 50 x 6 mm, glabrous, apex rounded to obtuse and apiculate; surface smooth, flat or with recurved margins, midnerve slightly raised below. Flowers solitary, terminal to a short axillary shoot bearing a few sub-apical leaves or the shoot reduced to a short peduncle (1 mm long or less) and the leaves to 2–5 small bracteoles; pedicel 2–4 mm long, fleshy towards the apex, sparsely puberulous. Calyx hemispherical; sepals strongly imbricate, sub-orbicular to broadly ovate, 2–2.5 mm long, puberulous to glabrous, ciliolate. Petals strongly imbricate, thin, becoming chartaceous and broader in fruit, narrow to broad ovate, (5) 10–12 mm long, pink to pale mauve (sometimes green in fruit). Stamens slightly imbricate, the sterile apices eventually spreading; filaments flattened, (antisepalous convex within), 2.5–3 mm long, pilose on the margins and within, pink; anthers narrow-oblong, acuminate, thecae ca. 1 mm long, sterile appendage ca. 2 mm long; pollen yellow. Disc flat, forming a narrow lobed margin to ovary, dark green. Style short, thick, ca. 0.5 mm long, pilose; stigma globular, glabrous, ca. 0.5 mm wide. Fruit and seed as in *C. saligna*.

DISTRIBUTION: Eastern New South Wales, central and eastern Victoria.—Map 2.

NEW SOUTH WALES: Howell, "A much bushier plant than the Port Jackson form growing many stems of about 1-2 ft. high", J. L. Boorman, Aug. 1905 (NSW); Luemeah, Georges River, "A tall plant of 2-4 ft. high", J. L. Boorman, Aug. 1914 (NSW); Mt. Inlay, nr. Eden, J. L. Boorman, 29.xii.1916 (NSW); Black Andrew Mt., nr. Burringjuck, E. Cheel, Jan. 1912 (NSW); Jigamy Creek, 6 mi. N. of Eden, E.F. Constable, 11.vi.1960 (NSW).

VICTORIA: nr. Mt. Howitt, A. B. Costin, Feb. 1955 (CAMB); between Mt. Tamboritha and The Crinoline, Gippsland, J. Ford, 13-14.vi.1959 (MEL); Eaglehawk, Bendigo district, D. J. Paton, 18.xii.1916.

This species varies considerably in leaf and flower size and in indumentum. In Victoria and southern inland New South Wales the leaves and flowers are smaller than those in the north and east, and the stem is more densely puberulous. In the far north-east of New South Wales it has large leaves and only very slight pubescence; a coastal form found between Nowra and Moruya also has only a sparsely puberulous stem and almost glabrous pedicels and calyx. The larger-flowered New South Wales plants have petals which become broader in fruit and, from herbarium material, appear to become reddish brown in colour, while in Western Victoria the petals remain narrow and change to green in fruit.

## ERIOSTEMON Sm.

J. E. Smith, Trans. Linn. Soc. 4:221 (1798) [erion = wool, stemon = stamen]; Persoon, Syn. Pl. 1:465 (1805); C. F. Gaertner, Fruct. 3:153 (1807); Smith in Rees, Cycl. 13: (1809) p.pte.; Nees et Martius, Nova Acta Acad. Leop.-Carol. 11:180 (1823) "Eriostemum"; de Candolle, Prod. 1:720 (1824); Jussieu, Mém. Mus. Hist. Nat. Paris 12:481 (1825); G. Don, Gen. Hist. 1:792 (1831); Spach, Hist. Nat. Vég. 2:338 (1834); Meisner, Pl. Vasc. Gen. 1:44 (1837); Meisner, op. cit. 2:60 (1837); Endlicher, Gen. Pl. 1155 (1840); Hooker f., Fl. Tasm. 1:64 (1855); F. Muell., Pl. Indig. Col. Vict. 1:118 (1862) p.pte.; Bentham et Hooker, Gen. Pl.

1:292 (1862); Bentham, Fl. Austral. 1:330 (1863); Engler, Pflanzenfam. 3/4: 138 (1896); Rodway, Tasm. Fl. 23 (1903) p.pt.e.; Black, Fl. S. Austral. 341 (1924); Ewart, Fl. Vict. 704 (1931); Engler, op. cit. ed. 2. 19a: 257 (1931); Curtis, Stud. Fl. Tasm. 202 (1956); Beadle et al., Handb. Vasc. Pl. Syd. Distr. 318 (1963).

*Crocea* sect. *Eriostemon* (Smith) Baillon, Dict. Bot. 11: 277 (1886).

Woody perennials, shrubs, or small trees. Branchlets angular or terete, sometimes channelled, glandular punctate, often with glandular verrucosities containing an aromatic oil, glabrous, glaucous, or with simple or stellate indumentum. Leaves alternate, simple, exstipulate (or, in sect. *Nigrostipulae*, with minute subulate stipules which form dark excrescences), shortly petiolate or sessile; lamina terete to flat, fleshy, coriaceous or chartaceous, glandular punctate, often glandular verrucose, glabrous or with simple or stellate hairs. Inflorescence axillary or terminal, loose or compact, in umbels, cymes, or racemes, or with solitary flowers pedicellate or subsessile; bracteoles prominent (and then usually persistent), or minute and caducous, basal or subtending the flower. Flowers pentamerous (rarely tetramerous); sepals free,  $\pm$  imbricate (at least at the base), persistent; petals free, imbricate (rarely valvate), ovate, elliptical, or obovate, thin or firm, with or without a prominent midrib,  $\pm$  glandular punctate, glabrous or with simple, stellate or lepidote indumentum on one or both sides, frequently also papillose within, white to blue, pink, red or mauve. Stamens 10 (8) the antisepalous slightly longer than the antipetalous, usually erect or pyramidally arranged and incurved over the ovary (apices becoming recurved during anthesis); filaments usually firm and  $\pm$  flattened, ciliate or pilose (glabrous in *E. fitzgeraldii*, glabrous and  $\pm$  terete and spreading in *E. deserti*); anthers versatile,  $\pm$  cordate, glabrous, with a small or prominent glabrous white apiculum, dehiscence longitudinal introrse (the antisepalous first). Intrastaminal disc ring-like, or lobed, fleshy, rarely obscure. Ovary  $\pm$  embedded in disc, pyramidal to hemispherical, carpels (3-4) 5, free or slightly united at base (in *E. trachyphyllus* united to near apex by a peripheral membrane), with a solid, sterile apex (absent in *E. trachyphyllus*), unilocular, placentation axillary, biovular, the funicles very short and arising collaterally on the placenta; ovules  $\pm$  superimposed, anatropous, 2-integumented, micropyles directed upwards; style solitary, often short at first but lengthening during anthesis, divided at the base into branches which are inserted about the middle of the adaxial margin of each carpel, pilose, stellate, or glabrous; stigma capitate or shortly 5-lobed. Fruit of up to five cocci which split along adaxial and apical edges; the cocci erect or spreading, usually with an apiculum or beak formed from the sterile apex of the carpel; pericarp of two separate layers, the epicarp coriaceous or woody and often verrucose, the endocarp mostly cartilaginous and elastic with a small membranous or fleshy portion around the placenta; dehiscence is due to endocarp ejecting the usually solitary seed and itself from the carpel. Funicle short and thick. Seed sub-reniform, flattened or pyriform, sessile, or subsessile, at first with the membranous placental portion of endocarp attached, or the placental endocarp thick and persistent; the funicle sometimes forming an aril on adaxial margin of seed, this aril when present linear, thin and membranous or fleshy, continuous at base of seed with raphe; testa with outer layer thin, membranous to sub-coriaceous, inner layer (sclerotesta) thick, crustaceous, black, smooth or sculptured; micropyle oval or linear, towards apex of adaxial margin; hilum in centre of adaxial margin, linear to narrow-elliptical or deltoid, superficial or sunken; raphe massive and fleshy or shrunken and insignificant, superficial or in a prominent hollow, covered by the outer testa or sometimes by a thin or thick crustaceous layer; chalaza on the lower adaxial margin or basal; endosperm fleshy; embryo terete,  $\pm$  axial, slightly curved, cotyledons plano-convex, radicle superior.

Chromosome number  $n = 14$  or  $28$  ( $17$  in *E. australasius*), fide Smith-White (1954). See Figs. 1-5 for seed and anthers.

Type species *Eriostemon australasius* Pers.

DISTRIBUTION: Australia (including Tasmania).

#### KEY TO SECTIONS

1. Stamens slender, spreading, glabrous and eglandular; plant glabrous Sectio 7. *Gymnanthos*
1. Stamens erect or incurved and pyramidally arranged, hirsute [or if glabrous then erect and compact (*E. fitzgeraldii*)]; plant hairy or glabrous.
2. Pedicel with several prominent, rounded imbricate bracteoles; petals closely stellate-lepidote outside Sectio 1. *Eriostemon*
2. Pedicel without prominent bracteoles, or if present then basal; petals glabrous or with simple hairs.
3. Inflorescence a compact head (or cluster) or a terminal raceme; petals thin, glabrous, blue to pink (W.A.) Sectio 6. *Cyanochlamys*
3. Inflorescence axillary or of 1 to a few loose terminal flowers; petals white to pink or red.
4. Stem with hairs in sunken longitudinal lines between raised decurrent tissue; flowers axillary (or sometimes terminal), solitary; petals glabrous Sectio 5. *Corynonema*
4. Stem glabrous or with scattered hairs, or if in longitudinal lines then the petals pubescent.
5. Bracteoles large, imbricate, sub-basal (W.A.) Sectio 4. *Osmanthos*
5. Bracteoles, minute, basal.
6. Hairs on stem (if present) scattered; stipular excrescences absent; flowers axillary or in axillary cymes; petals glabrous (or sparsely hispidulous outside) Sectio 3. *Erionema*
6. Hairs on stem (if present) scattered or in longitudinal lines; stipular excrescences present or absent; flowers terminal or if axillary then with pubescent petals Sectio 2. *Nigrostipulae*

#### Sectio 1. ERIOSTEMON

Only species

1. *E. australasius*

#### Sectio 2. NIGROSTIPULAE

1. Flowers axillary.
2. Leaves terete; flowers erect; petals white, ca. 5 mm long (S.A. and N.S.W.) 2. *E. linearis*
2. Leaves thick, oblong, or if sub-terete  $\pm$  flattened above (W.A.)
3. Flowers nutant, red to white; petals 7-10 mm long.
4. Stem pilosulose in lines between leaf-decurrencies; leaves oblong, flat or  $\pm$  concave below.
5. Flowers red 3. *E. coccineus*
5. Flowers white 3. *E. aff. coccineus*
4. Stem pilosulose all round; leaves sub-terete, flattened above and convex below; flowers pale red 5. *E. nutans*
3. Flowers erect; petals white, ca. 5 mm long; leaves oblong, concave below 4. *E. pachyphyllus*
1. Flowers terminal.
6. Leaves with a pair of black stipular excrescences at base.
7. Petals pubescent outside (at least towards margin).
8. Leaves acicular; petals ca. 9 mm long (N.S.W.) 6. *E. ericifolius*
8. Leaves fleshy and terete to obovate, or thin and flat; petals 6 mm long or less.
9. Leaves terete, sub-terete, or clavate, rounded below (W.A.).
10. Branchlets with broad puberulous lines between glabrous leaf decurrencies; leaves not apiculate 10. *E. gardneri*
10. Branchlets glabrous or glabrescent, without leaf decurrencies; leaves black-apiculate 14. *E. apiculatus*
9. Leaves otherwise (if sub-terete then concave or channelled below) (Eastern States).
11. Leaves fleshy, ovate to rhomboid or subterete,  $\pm$  flat or convex above, concave or channelled below, 4-8 mm long (Q., N.S.W., V.) 7a. *E. difformis* subsp. *difformis*
11. Leaves flat, thin, oblong to broadly elliptic, to 7 mm long (N.S.W. and Q.) 7b. *E. difformis* subsp. *smithianus*

7. Petals glabrous outside.
12. Leaves and sepals with a dark-coloured, gland-like apiculum; staminal filaments evenly attenuate; stipules (if present) minute (N.S.W.) **E. brevifolius.**
12. Leaves and sepals without a gland-like apiculum.
13. Staminal filaments (at least antisepalous) abruptly narrowed near apex to a subulate tip, densely woolly ciliate (S.A. and Eastern States) **9. E. angustifolius**
13. Staminal filaments evenly attenuate, glabrous or sparsely ciliate (W.A.) **10. E. gardneri**
6. Leaves with no stipular excrescences at base.
14. Petals glabrous outside.
15. Branchlets  $\pm$  puberulous (at least in narrow lines); leaves terete.
16. Leaves minutely black-apiculate; sepals sub-orbicular (N.S.W.) **8. E. brevifolius**
16. Leaves not apiculate; sepals acuminate (W.A.) **11. E. falcatus**
15. Branchlets glabrous, leaves variously shaped, not black-apiculate (W.A.).
17. Leaves rhomboid, 2-4 mm long, fleshy; petals glabrous within; young branchlets pale green all round **12. E. rhomboideus**
17. Leaves clavate-terete, 3-5 mm long; petals densely puberulous within; young branchlets with decurrent bands of green tissue **13. E. glaber**
14. Petals pubescent outside (at least towards margin); young branchlets puberulous (W.A.).
18. Branchlets puberulous in narrow lines, densely verrucose; sepals acuminate **11. E. falcatus**
18. Branchlets evenly puberulous all round, smooth or somewhat verrucose.
19. Leaves minutely tomentose **15. E. tomentellus**
19. Leaves glabrous or glabrescent.
20. Leaves and sepals black-apiculate **15. E. tomentellus**
20. Leaves and sepals not black-apiculate.
21. Petals puberulous outside towards margin only, white with broad reddish-brown band on back **16. E. thryptomenoides**
21. Petals densely sericeous outside, evenly pale pink **17. E. sericeus**

### Sectio 3. ERIONEMA

1. Leaf terete to narrow-oblong (or narrow-ovate), concave above or with margins tightly incurved.
2. Stem glabrous (or minutely stellate when young in *E. brucei*).
3. Stem glaucous; pedicel sessile with several basal, broadly ovate, imbricate bracteoles **see 26. E. brucei**
3. Stem not glaucous; pedicel shortly pedunculate with a whorl of small deltoid bracteoles at base **18. E. myoporoides**
2. Stem hispidulous; pedicel shortly pedunculate with a whorl of small deltoid bracteoles at base **19. E. scaber**
1. Leaf oblong to elliptic or obovate, often broadly so, if narrow then with recurved crenulate margins.
4. Plant glabrous.
5. Pedicel normally pedunculate (sometimes very shortly so), with a whorl of bracteoles at base; leaves coriaceous to chartaceous, margins not recurved.
6. Leaves obcordate, to 15 mm long, thick **21. E. verrucosus**
6. Leaves narrow-oblong to ovate, elliptic, or obovate, over 15 mm long **18. E. myoporoides**
5. Pedicel sessile with several small imbricate basal bracteoles; leaves chartaceous, flat or recurved.
7. Leaves broad, flat, over 3 cm long; carpels united at periphery; flowers 5-merous (V. and N.S.W.) **25. E. trachyphyllus**
7. Leaves narrow (obcuneate to elliptic or obovate), under 2 cm long, margin  $\pm$  recurved; carpels free to base; flowers 4-merous (T.) **24. E. virgatus**
4. Plant  $\pm$  hispidulous or puberulous.
8. Leaves  $\pm$  flat, broadly obovate or obcordate, apex not mucronate **22. E. obovalis**
8. Leaf-shape various, apex mucronate.

9. Leaves broad ovate to obovate, flat or slightly concave above, smooth or somewhat verrucose, margin not prominently recurved 20. *E. buxifolius*  
 9. Leaf narrowly obtuse or narrowly obovate, margin glandular-crenate, revolute 21. *E. hispidulus*

Sectio 4. OSMANTHOS

Only species

26. *E. brucei*

Sectio 5. CORYNONEMA

1. Leaves smooth, mucronate; stamens pilose.  
 2. Petals imbricate red (W.A.) 27. *E. pinoides*  
 2. Petals valvate, white, or pink in bud (S.A. and V.) 28. *E. pungens*  
 1. Leaves glandular verrucose,  $\pm$  obtuse; stamens glabrous (W.A.) 29. *E. fitzgeraldii*

Sectio 6. CYANOCHLAMYS

1. Flowers in a terminal, leafless raceme 30. *E. spicatus*  
 1. Flowers in a compact terminal head (the axis sometimes growing out before flowering is over).  
 2. Flower-heads 2-3 cm diam.; sepals narrow-deltoid to linear-lanceolate, 3-4 mm long, sparsely stellate-pilose; petals blue to pink 31a. *E. nodiflorus* subsp. *nodiflorus*  
 2. Flower-heads 1-1.5 cm diam.; sepals narrow-deltoid, ca. 2 mm long, stellate-pilose; petals blue 31b. *E. nodiflorus* subsp. *lasiocalyx*

Sectio 7. GYMNANTHOS

Only species

32. *E. deserti*

Sectio 1. *Eriostemon*

Branchlets minutely stellate; leaves exstipulate. Flowers solitary, axillary; pedicel sessile with numerous, scattered, sepaloid, imbricate bracteoles; sepals coriaceous, imbricate; petals imbricate, stellate-lepidote outside; stamens pyramidally arranged, filaments woolly ciliate, apex verrucose, anthers prominently white-apiculate; carpels with no sterile apex; stigma capitate. Cocci erect, broad and rounded at apex, erostrate. Placental endocarp (on dehisced seed) thick with membranous lateral margins, persistent. Seed sessile, reniform, ca. 6 mm long, adaxial face concave; aril small, fleshy, deltoid-shaped, in centre of adaxial face; outer testa  $\pm$  coriaceous, black, glossy, inner (sclerotesta) smooth; hilum deltoid-shaped, in centre of adaxial face, an orifice in the middle of the hilum opens into the fleshy raphe which occupies a wide, downwardly directed channel ca. 1.5 mm long surrounded internally by the sclerotesta and externally by a thick, brittle, deltoid shaped covering; chalaza at lower end of raphe ca. 1.5 mm above base of seed.

Type species: *E. australasius* Persoon.

This section is monotypic. It has no close affinity to any other section and is distinguished by the bracteolate pedicel, stellate indumentum, and the staminal and ovary morphology. In these characters it shows similarity to many species of *Boronia* and it is possible that phylogenetically the relationship is close.

The seed of sect. *Eriostemon* is unique in the Boroniaceae but could be derived, hypothetically, from the type found in sect. *Nigrostipulae* in which there is a hard, brittle covering to the sunken raphe.

1. *Eriostemon australasius* Pers.

Persoon, Syn. Plant. 1:465 (1805) [Australasia, an early name for Australia].

Typification: "Hab. in Australasia". Type: not seen, possibly described from material received from J. E. Smith; K. F. Gaertner (1807) refers to Joseph Banks' collection from which he presumably described the fruit and seed.

*E. lanceolatus* Gaertner f., De fructibus et seminibus plantarum 3:153, t.210 (1807); de Candolle, Prod. 1:720 (1824); G. Don, Gen Hist. 1:792 (1831); F. Mueller, Fragm. 9:110 (1875); F. Mueller, Nat. Pl. Vict. 1:71 (1879); Moore et Betche, Hand. Fl. N.S.Wales 45 (1893);

Engler, Pflanzenfam. 3/4:139. tab. 77 (1896); Dixon, Pl. N.S.Wales 50 (1906); Engler, Pflanzenfam. ed. 2. 19a.:258.t.112 (1931); Beadle et al., Handb. Vasc. Pl. Syd., Dist. 320 (1963); based indirectly on *E. australasius* Pers.

*E. salicifolius* Smith in Rees, Cyclop., 13: no. 1 (1809); Rudge, Trans. Linn. Soc. 11:304.t.26 (1815); de Candolle, Prod. 1:720 (1824); Sprengel, Syst. Veg. 2:321 (1825); Hooker, Bot. Mag. 55:t.2854 (1828); G. Don, Gen. Hist. 1:792 (1831); Delessert, Ic. Sel. Pl. 3:27. tab. 46 (1837); Bentham, Fl. Austral. 1:331 (1863).

Typification: "Gathered near Port Jackson, New South Wales, by John White, M.D. who communicated dried specimens to us in 1791, . . .".

*Crocea scabra* R. Graham ex W. J. Hooker, Bot. Mag. 55: sub t. 2854 (1829) pro syn. sub *E. salicifolius* Sm.; G. Don, Gen. Hist. 1:792 (1831) pro syn.; Bentham, Fl. Austral. 1:332 (1863) pro syn. This name is stated by Hooker, Don, and Bentham, and by the Index Kewensis to have been published in the Edinb. New Philos. Journ. 174 (1827) but I have not been able to find it in that Journal. All these authors refer it to "*E. salicifolius*".

Erect bushy shrub 1–2 m high. Branchlets angular, smooth, minutely stellate. Leaves coriaceous, narrow-oblong to narrow elliptic (to broad elliptic or obovate), flat, acute, 30 x 3.5–70 x 8 (32 x 14–60 x 14) mm, narrowly cuneate at base and grading into an indefinite petiole, entire, glandular, slightly corrugate (when dry), sparsely and minutely stellate when young, eventually glabrous, faintly 3-nerved. Flowers towards the apex of the branches; pedicel 4–12 mm long, minutely stellate with 5–12 scattered, imbricate, sepaloïd bracteoles. Sepals deltoid-orbicular, ca. 2 mm long, densely stellate-lepidote outside, ciliate; petals pink to red (rarely white or mauve), elliptical, ca. 18 mm long, 3-nerved, apex inflexed in bud; staminal filaments narrowly-oblong and outwardly falcate in lower half, terete and straight above, antipetalous ca. 4 mm long with a large apical verrucosity on abaxial side, antisepalous ca. 6 mm long with a large apical verrucosity on abaxial side and a smaller one on adaxial; anthers ovate, fleshy, reddish brown on back, ca. 1.8 mm long; disc thick, cushion-shaped, rugulose, wider than ovary, pale mauve; ovary broadly pyramidal, glabrous embedded in disc, style pilose  $\pm$  equal to stamens. Cocci ca. 9 mm high.

Leaves narrow-oblong to elliptic (N.S.W. and S.E. Queensld)  
Leaves broad elliptic (N.E. Queensld)

1a. subsp. *australasius*  
1b. subsp. *banksii*

#### 1a. subsp. *australasius*

Leaves narrow-oblong to elliptic, faintly nerved.

Chromosome no.  $n = 17$ , from material collected at Kurringai, Warrah, fide Smith-White (1954).

DISTRIBUTION: East coast of New South Wales and Queensland from Illawarra north to Fraser Island and in the border mountains near Stanthorpe—Map 3.

QUEENSLAND: Pyramid Mt., ca. 30 mi from Stanthorpe, H. Jarvis, 6.xi.1931 (BRI); Fraser Island, Miss S. Lovell, 7.i.1894 (BRI); Lyra, K. N. Shea 119 (BRI); Tin Can Bay, Wide Bay District, C. T. White 12284 (CANB).

NEW SOUTH WALES: Hornsby, G. W. Althofer 96 (MEL); Evans River, Richmond River, North Coast, W. Baeuerlen, June 1897 (NSW); Nelson's Bay, J. L. Boorman, Aug. 1911 (NSW); Mt. Burragorang, R. H. Cabbage 2234 (SYD); Harwood, Clarence R., E. Cheel, Sept. 1916 (NSW); Shoal Bay, Pt. Stephens, C. Davis 11 (NSW); Conjola Ck., ca. 30 mi S of Nowra, Hadley, 27.ix.1937 (NSW).

#### 1b. *E. australasius* subsp. *banksii* (A. Cunn. ex Endl.) P. G. Wilson, stat. nov.

*E. banksii* A. Cunn. ex Endl. in Endl. et al., Enum. Pl. Huegel 15 (1837) [named after Sir Joseph Banks], Walpers, Rep. Bot. Syst. 1:504 (1842); Bentham, Fl. Austral. 1:332 (1863); Britten in Banks and Solander, Illust. Austral. Pl. 1:13.tab.29 (1905).

Typification: "Sandy shore of Endeavour River N.S.W. (A. Cunningham Juli 1819)". Isotype K (photo seen).

Leaves broadly elliptic, to 3.5 x 1.2 cm,  $\pm$  5-nerved, apex rounded.

DISTRIBUTION: North-east coast of Queensland—Map 3.

QUEENSLAND: "New Holland" (Endeavour River), Banks and Solander, 1770 (MEL and NSW); Temple Bay, Cape York Peninsula, J. E. Young, Aug. 1923 (BRI).



The description given by Persoon (1805) for the species repeats that of Smith (1798) with the additional specific diagnosis "fol. lanceolatis subrugosis". K. F. Gaertner (1807) provided a new specific epithet "lanceolatum", presumably derived from Persoon's description, and gave Persoon's specific diagnosis in full with a reference. Subsequently botanists have used either Gaertner's epithet or the later one provided by Smith (1809). A. P. de Candolle (1824) cited "*E. australasium* Sm." in synonymy under *E. lanceolatus* Gaert.f.; this was noted by Bentham (1863) who assumed the epithet "australasium" to be an unpublished one derived from Smith's locality note, which was probably so in the case of de Candolle but it may have led other botanists to ignore Persoon's validly published name.

The two subspecies are clearly very similar and apparently differ only in leaf shape (I have seen only a few collections of subsp. *banksii*, all in bud or sterile; better material may indicate that other characters are involved). They are both found near the coast (with the exception of a collection from near Stanthorpe) and presumably once formed a continuous topocline from north Queensland to near Sydney.

## Sectio 2. *Nigrostipulae* P. G. Wilson sectio nova

[niger = black, stipula = stipule]

*Eriostemon* sect. *Erionema* F. Muell., Pl. Indig. Col. Vict. 1:121 (1862) p.pte., not as to lectotype.

Folia parva saepe minute stipulata. Pedicellus sessilis, basi minute bibracteolatus. Stamina erecta vel incurva; anthera albo-apiculata. Cocci  $\pm$  rostrati, erecti vel leviter divergentes. Semina  $\pm$  reniformia, in sectione tangentiali pyriformia; endocarpa placentae membranacea, alba.

Type : *Eriostemon difformis* A. Cunn. ex Endl.

Leaves often with small, black, globular stipules. Flowers axillary or terminal; pedicel sessile, minutely bibracteolate at base. Sepals free,  $\pm$  imbricate at base; petals imbricate, puberulous or papillose within; stamens erect or incurved, usually shorter than petals; filaments flattened, pilose; anther white-apiculate; carpels with a solid, sterile apex. Coccus  $\pm$  rostrate, erect or slightly spreading. Placental endocarp membranous, white. Seed sessile,  $\pm$  reniform (pyriform tangentially), 2-4 mm long; aril absent; outer testa very thin, transparent; sclerotesta smooth or irregularly rugose or transversely corrugate; hilum small, circular, near centre of adaxial face and usually surrounded by a broad, deltoid-shaped, black, bony layer; raphe filling a deep cavity behind the deltoid covering; chalaza on lower side of cavity.

16 species, 5 in eastern Australia and 11 in Western Australia.

The description of the seed given above applies particularly to the species of the Eastern States. The species found in Western Australia have seed which range from that found in *E. difformis* (which has a deeply sunken raphe covered by a hard, black, crustaceous layer), to forms with a thin superficial raphe and only a thin membranous covering. In *E. gardneri* the hilum is a deltoid area; the raphe occupies a deep concavity beneath and is covered by a thick crustaceous layer on the lower and lateral margins (not completely covered as in *E. difformis*). In *E. tomentellus* the raphe occupies a similar concavity but has only a thin, coriaceous covering. In *E. thryptomenoides* the hilum is narrow-elliptic, the concavity is shallow, and the covering is thin, barely obscuring the chalaza. An extreme form is found in *E. rhomboideus* in which there is no concavity and the raphe, thin and superficial, is found towards the base of the seed on the adaxial surface.

## 2. *Eriostemon linearis* A. Cunn. ex Endl.

A. Cunn. ex Endl. in Endl. et al., Enum. Pl. Huegel 16 (1837) [*linearis* = *linearis*]; Walpers, Rep. Bot. Syst. 1:504 (1842); Bentham, Fl. Austral. 1:334 (1863); Tate, Handb. Fl. Extratr. S. Austral. 24 (1890); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Dixon, Pl. N.S.Wales 50 (1906); Black, Fl. S. Austral. 342 (1924); Black, op.cit. ed. 2. 498 (1948).

Typification: "Barren Ranges on the Lachlan River, N.S.W. (A. Cunningham 22 Juni 1817.)" Holotypus (?): K (photo seen), "Peels Range . . . A. Cunningham no. 161, June, 1817."

*E. halmaturorum* F. Muell., Linnaea 25:376 (1853); C. Mueller in Walpers, Ann. Bot. Syst. 4:412 (1857).

Typification: "Ad summitates lapidosissimas vix adscendendas montium Elders-range dictorum et circum jacentium." Holotypus: MEL 4021; iso: MEL 4023.

Small shrub. Branchlets densely glandular-verrucose, glabrous or minutely puberulous when young. Leaves with small, black, globular stipules; lamina semi-terete, from 0.8 cm long and fleshy with rounded apex up to 2 cm long and slender with acute apex, smooth or glandular verrucose, glandular punctate, glabrous, upper surface  $\pm$  flattened and canaliculate, lower surface rounded. Flowers axillary, solitary; pedicel 4-6 mm long, thicker towards apex, minutely puberulous or glabrous, minutely bracteolate at base. Sepals, open, deltoid, ca. 1 mm long, fleshy, glabrous, ciliolate. Petals narrow-elliptic, 4-6 mm long, glandular, tomentulose inside and on outside towards margin; staminal filaments semi-terete, gradually attenuate, 4-5 mm long,  $\pm$  pilose, more densely so towards base; anthers suborbicular ca. 1 mm long, minutely white-apiculate, pollen deep orange. Disc narrow, slightly broader than ovary. Ovary narrowly pyramidal, ca. 1.5 mm high, pilose towards apex, the sterile apical portion of carpels narrow; style glabrous; stigma minutely to prominently lobed. Cocci spreading, ca. 5 mm long prominently rostrate. Seed subreniform, thicker at the base, ca. 3 mm long.

DISTRIBUTION: South Australia from the Gawler Ranges eastwards and also in the far north in the Everard Ranges; New South Wales from Broken Hill eastwards to Wilcannia—Map 12.

NEW SOUTH WALES: Broken Hill, E. C. Andrews, Dec. 1919 (NSW); Thackaringa, J. E. Carne 7 (NSW); Mootwingie, J. B. Cleland, 6.ix.1962 (AD).

SOUTH AUSTRALIA: Mt. Whyalla, Gawler Ranges, J. M. Black 25.viii.1912 (MEL); Nonning, B. B. Carrodus, Oct. 1959 (AD); Koonamore, C. M. Eardley, 26.viii.1930 (ADW); Mt. Aleck, Elders Range, R. A. Howard, 1.ix.1965 (AD); Mt. Illbillie, Everard Range, J. B. Cleland, 13.iv.1950 (AD).

This species exhibits comparatively little regional variation. The specimens from Eyre Peninsula and from the Flinders Ranges ("*E. halmaturorum*") have short, fleshy and verrucose leaves with rounded apices, while those from the Everard Ranges have long, slender, and smooth leaves. Collections from other localities tend to be intermediate between these extremes.

*E. linearis* may be distinguished from *E. difformis*, with which it was united by Mueller (Fragm. 9: 110 (1875)), by the normally glabrous stems and slender leaves which are canaliculate above, by the flower position (axillary not terminal) and by the slender staminal filaments. It is the only member of sect. *Nigrostipulae* found in the Eastern States which has axillary flowers, and in this, and other characters, it shows close affinity to the Western Australian species *E. coccineus*, *E. nutans* and *E. pachyphyllus*.

## 3. *Eriostemon coccineus* C. A. Gardn.

C. A. Gardner, Hooker's Ic. Pl. 34: t.3378 (1939) [*coccineus* = scarlet].

Typification: "Western Australia. Coolgardie District, near Koorarawalyee, 80 mi west of Coolgardie, fl. Sept. 1931, W. E. Blackall 936."

Undershrub. Branchlets glandular tuberculate, pilosulose in grooves between leaf decurrencies, otherwise glabrous, becoming corky. Leaves shortly petiolate with black globular stipules; lamina flattened-terete, ca.

10 x 1.5 mm, glabrous, markedly glandular-bullate below in two rows, flat and narrowly canaliculate above, apex obtuse and minutely black apiculate. Flowers axillary, solitary, nutant; pedicel recurved, 6-8 mm long, glabrous, minutely bracteolate at base. Bud  $\pm$  cylindrical with rounded apex. Sepals obtusely deltoid, ca. 1.5 mm long, fleshy but with thin, ciliolate margin, glandular, glabrous, apex black-apiculate. Corolla cylindrical, spreading at apex ca. 4 mm diam.; petals broad-oblong, to 10 mm long, keeled, red, tomentulose within and sparsely so outside towards the margin. Staminal filaments linear-attenuate, ca. 10 mm long, margin densely woolly; anthers ca. 1 mm long, very shortly white-apiculate, pollen pale orange. Disc flat, broad, somewhat wider than ovary. Carpels ca. 1.5 mm high, rostrate, spreading outwards in upper sterile half, densely pilose; style  $\pm$  equal to stamens, sparsely pilose; stigma lobes slightly spreading. Cocci slightly rounded at apex, shortly rostrate on outer edge (fide Gardner, l.c.). Seed not seen.

DISTRIBUTION: Western Australia known only from the sand-heaths west of Coolgardie—Map 4.

WESTERN AUSTRALIA: Gilgai siding, T.E.H. Aplin, 1963 (PERTH); east of Southern Cross, A. Ashby 940 (AD); 62 km east of Southern Cross, P. Wilson 3548 (AD).

This species is apparently related to the eastern states species *E. linearis*, as it shares with that plant the axillary flower position and the linear-attenuate stamens. This is one of the three species of *Eriostemon* with red flowers, the others being *E. pinoides* and *E. nutans*.

Two rather similar plants have also been collected in the Coolgardie area, one from 20 mi west of Coolgardie and the other from 90 mi south. It is probable that both have originated from *E. coccineus*, either through mutation and isolation or through hybridization; this cannot be decided in the herbarium. However the plant from west of Coolgardie has been collected on two occasions which suggests that a community of it is present in this locality. For this reason, and because I am not able to suggest the other putative parent, I have treated it as a distinct species, *E. pachyphyllus*. The plant from south of Coolgardie has been collected only on one occasion (Wilson 3143, Herb. AD); it has leaves of a similar shape to *E. coccineus* but only 8 mm long, the flowers are nutant, axillary, with white petals  $\pm$  glabrous within and subglabrous outside. Until further collecting is done in this area the status of this taxon must remain in doubt.

#### 4. *Eriostemon pachyphyllus* P. G. Wilson, sp. nov.

[pachys = thick, phyllon = leaf]

Suffrutex ca. 1 m altus. Ramuli in sulcis angustis minute pilosuli aliter glabri. Stipularum exrescentia nigra, rotundata, prominentia. Folia breviter petiolata; lamina carnosae, breviter oblonga, 3-5 x 1.5-2 mm, apice obtuso, marginibus undulatis, pagina superiore leviter convexa, pagina inferiore anguste concava, lateraliter carnosae. Flores axillares, solitarii, erecti; pedicellus crassiusculus, 2-3 mm longus; petala alba, ca. 6 mm longa; filamenta lineari-attenuata 4-5.5 mm longa, marginibus dense lanatis, antheris ca. 0.6 mm longis, manifeste albo-apiculatis. Holotypus: AD 964251 (ex CBG 065303), 20 mi W of Coolgardie, on highway. Shrub 1.5 m high in sandplain vegetation, 17.ix.1962, M. E. Phillips.

Undershrub ca. 1 m high. Branchlets minutely pilosulose in narrow grooves between leaf-decurrencies, sparsely glandular, developing longitudinal, black, corky excrescences with age. Leaves glabrous with a short petiole ca. 1 mm long; lamina fleshy, shortly oblong, 3-5 x 1.5-2 mm, apex and base obtuse, margin undulate; upper surface slightly convex, smooth; lower surface with a narrow concavity and fleshy, prominently bullate margins. Flowers axillary, solitary, erect. Pedicel with several minute basal bracteoles, glabrous, 2-3 mm long, somewhat fleshy. Sepals deltoid, fleshy, glabrous, ca. 1 mm long; petals imbricate, erect, ca. 6 mm long, white, pilosulose within and

towards margin on outside, keel prominent; staminal filaments linear, attenuate towards apex, 4-5.5 mm long, margins densely woolly; anthers ca. 0.6 mm long with a prominent white apiculum 0.3-0.5 mm long; ovary pyramidal ca. 1.5 mm high, apex pilose; style almost glabrous,  $\pm$  equal to stamens. Fruit and seed not seen.

DISTRIBUTION: West of Coolgardie—Map 4.

WESTERN AUSTRALIA: N. of Bullabulling, in sand-heath, J. S. Beard 3327 (PERTH).

This species is related to *E. coccineus* and may be of hybrid origin. The two collections seen do suggest however, that it is stabilized in the sand-heath about 30 km west of Coolgardie.

#### 5. *Eriostemon nutans* P. G. Wilson, sp.nov. [nutans = nodding]

Fruticulus ramosissimus; ramuli teretes, glanduloso-verrucosi, minute hirtelli. Folia clavato-teretia, obtusa, ca. 11 mm longa, glabra, glanduloso-verrucosa; stipularum excrecentia magna, nigra, globularia. Flores solitarii, axillares, nutantes; pedicellus gracilis, ca. 8 mm longus, sepala late ovata, ca. 2.5 mm longa, coriacea; corolla late cylindrica, ca. 11 x 7 mm, petalis pallido-rubris, pilosulis; stamina erecta, filamentis lineari-lanceolatis, dense lanato-ciliatis; ovarium ca. 1.5 mm altum, dense pilosum, carpellis patentibus apicibus prominente, bilobis; stylus longus, sparse pilosus.

Holotypus: C. A. Gardner 12030, "Sandy flats" 17. viii. 1953, Ninghan (ca. 320 km NNE of Perth), Western Australia (PERTH).

Undershrub, densely branched. Branchlets terete, glandular verrucose, minutely hirtellous all round. Leaves with a pair of prominent black stipuloid excrescences; lamina clavate-terete, obtuse, ca. 11 mm long, glabrous, lower surface rounded and with large glandular verrucosities, upper surface  $\pm$  flattened. Flowers solitary, axillary, nutant; pedicel slender, ca. 8 mm long, recurved, thickened towards apex, minutely bracteolate at base. Sepals broadly ovate, ca. 2.5 mm long, coriaceous, minutely puberulous; corolla broadly cylindrical, (not spreading), ca. 11 x 7 mm, petals imbricate, broadly ovate, pale red, pilosulose on both sides; stamens erect, equal to or slightly exceeding petals, filaments linear-attenuate, densely woolly ciliate, anthers ca. 1.4 mm long, very minutely white-apiculate; ovary broad,  $\pm$  truncate in outline, ca. 1.5 mm high, densely pilose, carpels spreading and with a pair of prominent hollow terminal lobes; style long (even in bud), equal to stamens, sparsely pilose; stigma lobes spreading. Fruit and seed not seen.

DISTRIBUTION—Map 4.

This species is only known from collections at the type locality. It has obvious affinities with *E. coccineus* and *E. pachyphyllus* with which species it shares the solitary axillary flowers, the corolla colour (in *E. coccineus*) and the long pubescent style. It is peculiar in having the carpels terminating in a pair of large spreading hollow lobes which presumably give a characteristic shape to the fruit. Some other species of *Eriostemon* have carpels which are slightly bilobed (but not spreading); these however, are not closely related to each other or to *E. nutans*.

#### 6. *Eriostemon ericifolius* A. Cunn. ex Benth.

A. Cunn. ex Benth., Fl. Austral. 1:335 (1863) [Erica, a heath, and folium = leaf]; Moore et Betche, Handb. Fl. N.S.Wales 46 (1893); Dixon, Pl. N.S.Wales 50 (1906).

Typification: "Skirts of Liverpool Plains, A. Cunningham." Holotypus: K (photo seen), leg. A. Cunningham No. 13, May 1825.

Shrub 1-2 m high, much branched and wide spreading. Branchlets sparsely glandular-verrucose, puberulous all round. Leaves shortly petiolate with small, black, acicular to globular stipules; lamina acicular, 4-8 mm long,

sparsely glandular verrucose, narrowly canaliculate above, glabrous or sparsely and minutely puberulous, apex obtuse. Flowers 1–6 in terminal sessile clusters. Pedicel slender (becoming thicker below flower), puberulous, 2–3 (5) mm long with two pairs of minute triangular bracteoles at base. Bud ovoid with somewhat acute apex. Sepals slightly imbricate, narrow-triangular 1.5–2 mm long, fleshy, glandular, glabrous with ciliolate margin; petals persistent, glandular verrucose, narrowly imbricate, elliptical, ca. 9 mm long, white tomentulose inside and on outside except for the thick, glandular midrib; staminal filaments narrowly oblong, attenuate in upper half, 4.5–5.5 mm long, woolly below and pilose at apex, the antisepalous with a red tuft below anther; anther oblong ca. 1.2 mm long, apex white-apiculate; disc a narrow rim; ovary narrowly pyramidal ca. 2 mm high pilose towards apex; style glabrous; stigma slightly broader than style. Cocci erect, abruptly attenuate into a subulate pilose tip ca. 1.5 mm long, in all ca. 5 mm long. Seed subreniform, thicker at the base, ca. 3 mm long.

**DISTRIBUTION:** Eastern New South Wales, between Peak Hill and Denman—Map 12.

**NEW SOUTH WALES:** GOONOO Forest nr. Mogriguy, G. W. Althofer, 1947 (NSW); Peak Hill Harvey Ranges, J. L. Boorman, Nov. 1905 (NSW); Denman, W. Heron, Oct. 1908 (NSW); Upper Hunter R., Stephenson, Dec. 1886 (MEL); Pilliga Forest, E. H. F. Swain, July, 1913 (AD).

This species is very similar to some forms of *Philothea salsolifolia* (Sm.) Druce (sensu lato), from which it may be distinguished, apart from staminal characters, by the narrow-triangular sepals. From *E. difformis*, which is also similar, it may be distinguished by the above characters and by the acicular leaves. *E. ericifolius* is apparently a rare species, or very local, and is poorly represented in herbaria.

#### 7. *Eriostemon difformis* A. Cunn. ex Endl.

A. Cunn. ex Endl. in Endl. et al., Enum. Pl. Huegel 15 (1837) [difformis = difformed, unevenly shaped]; Walpers, Rep. Bot. Syst. 1:504 (1842); F. Mueller, Pl. Col. Vict. 1:123 (1862) p.pte.; Bentham, Fl. Austral. 1:335 (1863); F. Mueller, Nat. Pl. Vict. 1:72 (1879); F. Mueller, Key Syst. Vict. Pl. 1:143 (1887); Moore et Betche, Handb. Fl. N.S.Wales 46 (1893); Dixon, Pl. N.S.Wales 50 (1906).

Typification: "Sterile country on the Lachlan River. (A. Cunningham 24.Mai 1817, in Oxley's first Expedition.)" Holotypus: K (photo seen) Lachlan River, N.S.Wales, A. Cunningham No. 163, May 1817.

*E. rhombeus* Lindley in Mitchell, J. Trop. Austral. 293 (1848); Walpers, Ann. Bot. Syst. 2:249 (1852).

Typification: Mantuan Downs [= Drummond Range, Queensland], 1st September 1846. Holotypus: CGE (photo seen CANB) "Sub-tropical New Holland, Camp 29, 1.ix.1846, T. L. Mitchell 590."

Undershrub. Branchlets sparsely glandular verrucose,  $\pm$  puberulous all round. Leaves shortly petiolate with small, black, acicular to globular stipules; lamina fleshy, irregularly ovate or rhomboid, ca. 4 x 2 mm, to sub-terete and ca. 8 x 1 mm, glabrous, margin with 1–2 glandular verrucosities on either side, convex above, concave to channelled below, (or coriaceous, oblong to broad-elliptic, ca. 7 mm long, flat), apex rounded and minutely black glandular punctate. Flowers 1–4 in terminal sessile clusters; pedicel minutely bi-bracteolate at base, puberulous, 2–3 mm long. Sepals obtusely deltoid, ca. 1 mm long, fleshy, glandular verrucose, glabrous (or sparsely puberulous), margin ciliolate; petals oblong-elliptical, 4–5 mm long, white in bud and at anthesis, with prominent, thick, glabrous or sub-glabrous glandular midrib, otherwise tomentulose on both sides, staminal filaments narrow-oblong, 4.5–5.5 mm long, narrowed above to a subulate apex, margin woolly becoming pilose in upper half; anther ovate, shortly white-apiculate, in all ca. 0.8 mm long; disc smooth, slightly

wider than ovary; ovary pyramidal 1–2 mm high, sparsely pilose; style glabrous, stigma 5-lobed. Cocci erect, oblong, ca. 5 mm high, apex truncate, verrucose, shortly rostrate. Seed subreniform, thicker at the base, 2.5–4 mm long.

Leaves fleshy, convex above, concave or channelled below  
Leaves coriaceous, flat

subsp. *difformis*  
subsp. *smithianus*

#### 7a. subsp. *difformis*

Leaves fleshy, terete to ovate or rhomboid, concave or channelled below.

DISTRIBUTION: Queensland, south-east region; New South Wales; Victoria, north-west—Map 5.

QUEENSLAND: NNW of Bungunya, S. T. Blake 15851 (BRI); Belah—Brigalow, N.T. Burbidge 5470 (CANB); 6 mi E of Morven, S. L. Everist 1523 (BRI); 23 mi SSE of Rolleston township, Lazarides & Story 52 (AD).

NEW SOUTH WALES: Gobar, L. Abrahams 232 (NSW); Nymagee, R. H. Cambage 213 (NSW); Mootwingie, J. B. Cleland, 5.ix.1962 (AD); Monaro Hill, 75 mi SE of Wilcannia, MacGillivray 760 (NSW); Derriwong, M. Tindale, 3.x.1956 (NSW).

VICTORIA: Sandhurst, R. Thorn, 33 (MEL); Walpeup, H. B. Williamson, Sept. 1913 (MEL).

#### 7b. subsp. *smithianus* (Bentham) P. G. Wilson stat. nov.

*E. difformis* var. *smithianus* Benth., Fl. Austral. 1:335 (1863) [*smithianus*, a manuscript epithet of W. Hill, Brisbane].

Typification: "Queensland. Wide Bay, W. Hill; near Brisbane, Henne, N.S.Wales, Macleay river, Beckler." Lectotypus: MEL. 4094; iso.: K (photo seen), Wide Bay, Queensland, leg. Hill. Syntypes: MEL 4092 (Beckler), MEL 4093 (Henne).

*E. parvifolius* R. Br. ex Benth., Fl. Austral. 1:335 (1863).

Typification: "Queensland, Shoalwater Bay, R. Brown (Herb. R.Br.)." Holotypus: K "Shoalwater Bay passage, mountains." (photo seen); iso. BRI 011385, MEL 4018, NSW 69242.

Leaves oblong to broad-elliptic, ca. 7 mm long, flat (or slightly recurved), coriaceous; margin sparsely glandular-undulate to glandular-crenate.

DISTRIBUTION: Queensland, near the south-east coast; New South Wales, near the north-east coast—Map 5.

QUEENSLAND: Warwick, F. M. Bailey, Dec. 1875 (BRI); Inglewood, J. L. Boorman, Mar. 1911 (NSW); Dunethan Rock, J. Galbraith 16.vii.1962 (BRI); Burrum R., nr. Howard, C. T. White 6285 (BRI).

NEW SOUTH WALES: Macleay R., Dr Beckler (MEL).

*E. difformis* is superficially similar to *E. angustifolius*, especially to the subspecies *montanus*; it differs from that species in the scattered stem pubescence, in the recurved leaf margin, and in the petals being white and tomentulose on the outside.

*E. difformis* subsp. *smithianus* differs from the type subspecies in having flat leaves and in the petals being slightly less tomentulose on the outside. The type subspecies is an inland plant, *E. difformis* subsp. *smithianus* is found nearer the coast; plants which are intermediate in leaf form between the two subspecies are found between Inglewood and Warwick in south-east Queensland, i.e. in a geographically intermediate locality.

Bentham distinguished the species *E. parvifolius* by leaf shape and absence of a conspicuous midrib; however these features are variable and do not provide infallible characters. He also stated that the petals were glabrous in *E. parvifolius* and "usually glabrous" in "*E. difformis* var. *smithianus*"; in fact the petals are tomentulose outside in the types of both of these, although less conspicuously so than in subspecies *difformis*.

## 8. *Eriostemon brevifolius* A. Cunn. ex Endl.

A. Cunn. ex Endl. in Endl. et al., Enum. Pl. Huegel 16 (1837) [brevis = short, folium = leaf]; Walpers, Rep. Bot. Syst. 1:504 (1842).

Typification: "Barren ground at the base of Peel's Range [= Cocoparra Range], interior of N.S.W. (A. Cunningham Juni 1817.)" Holotypus: K (photo seen) labelled "A. Cunningham No. 162 June 1817, Peels Range, N.S.Wales." Compared, by Dr S. T. Blake with a D.W.C. Shiress collection from Griffith (AD 96425185, dupl. of NSW 68909) and found to be the same.

*E. difformis* var. *teretifolius* Benth., Fl. Austral. 1:335 (1863) (excl. S Australian and Western Australian specimens cited), based on *E. brevifolius* A. Cunn.

Undershrub. Branchlets glandular verrucose,  $\pm$  puberulous except beneath leaf insertions. Leaves sessile, exstipulate (or almost so), terete, 2-4 mm long, rounded below, flat and narrowly canaliculate above, glandular verrucose, glabrous or glabrescent, apex rounded and minutely black-apiculate (at least when young). Flowers 1-4 in terminal sessile clusters; pedicel minutely bibracteolate at base, puberulous, 1-3 mm long. Sepals, suborbicular, ca. 1.2 mm long, with fleshy centre, otherwise thin, glabrous, black apiculate, ciliolate; petals ovate, ca. 5 mm long, white to pink, glabrous outside, minutely papillose and glabrous or sparsely pilosulose within, midrib thickened, staminal filaments narrow-oblong, attenuate upwards, pilose; anther suborbicular, 0.9 mm long including the prominent white apiculum; disc shallow, undulate, broader than base of ovary, glabrous; ovary pyramidal, pilose at summit; style glabrous, stigma capitate.

DISTRIBUTION: New South Wales. Known only from a limited area near Griffiths and the Cocoparra Range—Map 2.

NEW SOUTH WALES: Kamarah, W. R. A. Baker, 17.x.1917 (NSW); Barellan, E. Cheel, Apr. 1925 (NSW); Moombooldool, W. A. W. de Benzeville 5 (NSW); Matong, A. T. Driver, Oct. 1931 (NSW); Goolgowi, A. Mitchell, Oct. 1961 (NSW); Cocoparra Range, nr. Yenda, rocky, T. O'Rourke, 16.ix.1913 (NSW); Griffith, D. W. C. Shiress, Aug. 1924 (AD & NSW); 23 mi from Lake Cargelligo, T. & S. Whaithe 2362 (NSW).

Since its original description this species has been confused with the much more widespread species *E. angustifolius*, and also often amalgamated with *E. difformis*. It may be distinguished from *E. angustifolius* by the virtual absence of stipules, the black-apiculate leaves and sepals, and the linear, pilose staminal filaments; from *E. difformis* it may be distinguished by the above characters, by the leaf shape, and by the petals being glabrous outside.

Endlicher described the leaves as being revolute and pubescent below. Bentham states that "I do not find these characters in any of his [i.e. Cunningham's] specimens." Since it was apparently on these specimens that Endlicher based his description I assume that he wrongly described the leaves. All material of this species that I have seen has leaves which are rounded below but channelled above, i.e. involute.

## 9. *Eriostemon angustifolius* P. G. Wilson, sp.nov.

[angustus = narrow, folium = leaf]

*E. difformis* var. *teretifolius* [non Benth.] Benth., Fl. Austral. 1:335 (1863) p.pte., excl. N.S.Wales and Western Australian specimens cited.

*E. difformis* [non Lindley] Tate, Handb. Fl. Extratr. S. Austral. 24 (1890).

*E. brevifolius* [non Endlicher] Black, Fl. S. Austral. 342 (1924); Black, op.cit. ed. 2. 498 (1948).

*E. gracilis* [non Graham] Ewart, Fl. Vict. 705 (1931).

Fruticulus; ramuli glanduloso-verrucosi, in sulcis angustis pilosuli. Folia subsessilia; stipularum excrescentia parva, nigra, globularia vel acicularia; lamina teres vel clavata, 2-10 mm longa, glanduloso-verrucosa, glabra, supra anguste-caniculata, apice acuto, nec apiculato. Inflorescentia terminalis, umbelliformis, 1-4 floralis. Petala extra glabra, intra sparse pilosulosa vel glabra; filamenta lanato-ciliata, apicem versus abrupte subulata.

Holotypus: AD 96415113, South Australia, lower Mt. Lofty Range, roadside scrub nr. Finnis River, 25.viii.1963 D. N. Kraehenbuehl 906.

Undershrub. Branchlets glandular verrucose, pilosulose in narrow grooves between decurrent strips. Leaves sessile with small, black, acicular to globular stipules; lamina terete to clavate, 2–10 mm long, narrowly canaliculate above (fleshy, obovate, flat to concave, ca. 4 x 2 mm in subsp. *montanus*), glandular verrucose, glabrous (or very sparsely puberulous), apex acute to obtuse or rounded, not apiculate. Flowers 1–4 in terminal sessile umbels; pedicel puberulous 0.5–4 mm long, minutely bibracteolate at base. Sepals slightly imbricate at base, suborbicular to deltoid, ca. 1 mm long, fleshy, glabrous, ciliolate or eciliolate; ovate to elliptical, 5–9 mm long, petals white with pink midrib (pink in bud), glabrous outside, papillose and sparsely pilosulose within, midrib thickened and slightly glandular; staminal filaments narrow-oblong, the antisepalous abruptly subulate in upper third, the antipetalous similar or gradually attenuate in upper half; 2.5 (3.5) mm long, densely woolly-ciliate and pilose towards apex; anther  $\pm$  rounded, white-apiculate, in all 1–1.5 mm long, pollen orange; disc reddish-brown smooth, glabrous, rather broader than base of ovary; ovary pyramidal, ca. 2 mm high; carpels smooth and pilose in upper half, the sterile tip darker green than rest of carpel; style glabrous, at first slightly exceeding ovary but lengthening during anthesis; stigma slightly spreading. Cocci erect, ca. 3 mm high, shortly rostrate. Seed subreniform, thicker at base, ca. 2.5 mm long.

Leaf  $\pm$  terete or clavate

subsp. *angustifolius*

Leaf obovate, concave above

subsp. *montanus*

#### 9a. subsp. *angustifolius*

Leaves terete or clavate, 2–10 mm long, narrowly canaliculate above, rounded below. Petals pilosulose within.

Chromosome no.  $n = 28$ , from material collected at Mt. Lofty, S.A., fide Smith-White (1954) as “*E. brevifolius*”.

DISTRIBUTION: southern South Australia, south-east Queensland, western New South Wales (?), western Victoria—Map 5.

QUEENSLAND: SW of Kogan, B. G. Briggs, 4.vi.1961 (NSW); 50 mi W of Dalby, Darling Downs District, S. L. Everist 2161 (BRI).

VICTORIA: 20 mi S of Nhill, J. J. Ackland 16 (MEL); 12 mi NNE of Bendigo, H. I. Aston 30 (MEL); Parish of Catiabrim, Little Desert, Hicks, 11.xii.1950 (herb. Hicks).

SOUTH AUSTRALIA: Middle River, Kangaroo Is., E. Ashby 112 (NSW) North Tusk Gammon Ranges, H. J. Eichler 12741 (AD); Mt. Serle, R. Hill 1413 (AD); Hd. of Senior, D. Hunt 1182 (AD); nr. Black Springs, D. N. Kraehenbuehl 892 (AD); 15 Mile Creek, Yankaninna Range, T. R. N. Lothian 2078 (AD).

#### 9b. subsp. *montanus* P. G. Wilson, subsp. nov.

[*montanus* = *montane*.]

Folia obovata, ca. 4 x 2 mm, crassa, supra concava, levia, subtus convexa, manifeste glanduloso-bullata.

Holotypus: MEL 4507, Victoria, Grampians, NW slopes of Mt. Difficult in watershed of Dead Bullock Ck., “spreading shrub 3 ft. high, buds red, flowers pink to white. On almost bare, gently sloping rock-face”, 12.x.1962, T. B. Muir 2647.

Leaves obovate, ca. 4 x 2 mm, thick; upper surface concave, smooth, lower surface convex, strongly glandular bullate. Petals glabrous (or glabrescent) within.

DISTRIBUTION: Grampians of Victoria—Map 5.

VICTORIA: T. L. Mitchell 265, 18.vii.1936 (MEL); Black Range, P. R. H. St. John, 6.x.1929 (MEL); nr. Mt. Zero, C. Wilhelm (MEL); Mt. Byron, H. B. Williamson, Oct. 1927 (MEL).



The type subspecies shows considerable variation over its area of distribution. In all material, except that from Queensland, the stem becomes corky in the grooves between the decurrent leaf bases. In the Queensland form this cork develops sporadically all over the stem. The flower and leaf size is greatest in specimens from the Northern Flinders Range where some flowers have petals almost twice as long as those from more southern localities; however in other characters they are very similar. Towards the south-east of South Australia and in Western Victoria the leaves are short and thick (ca. 2 mm long); in Queensland the leaves are shortly clavate with rounded apices (not terete with acute or obtuse apices) and the flowers subsessile. However, these regional variations do not appear to warrant infraspecific recognition.

This species has been confused with *E. difformis* and with *E. brevifolius*. From the former species it differs in having glabrous leaf decurrencies, in the leaves being rounded below and canaliculate above and in the petals being glabrous outside. From *E. brevifolius* it differs in having more marked leaf decurrencies, in the absence of an apiculum to the leaves and sepals, and in the abruptly subulate and woolly staminal filaments. I have seen no specimens which suggest introgression between any of these species although the areas of distribution appear to overlap.

*E. angustifolius* subsp. *montanus* is similar to some forms of *E. difformis*; it differs from that species in the petals being glabrous outside, in the stem indumentum, and in the staminal shape and indumentum. Their areas of distribution are very distinct.

#### 10. *Eriostemon gardneri* P. G. Wilson, sp. nov.

[after C. A. Gardner, Government Botanist of Western Australian 1929-60].

*E. difformis* var. *teretifolius* [non Benth.] Benth., l.c., p.pte.

Suffrutex; ramuli puberuli vel sub foliis glabri. Folia minute nigro-stipulata; lamina teretiuscula, 5-8 mm longa, glabra, subtus rotundata, supra plana et canaliculata; apex rotundatus, glande terminali ornato. Flores terminales, saepe solitarii; pedicellus 1-2 mm longus; petala alba, ovata, ca. 6 mm longa, extra glabra vel glabriuscula, intus tomentella, costa crassa prominenti; filamenta anguste oblonga, attenuata, sparse ciliata vel subglabra; ovarium pyramidale, ca. 1.5 mm altum, glabrum (vel apice minute pilosulo).

Holotypus: C. A. Gardner 5006, nr. Jerramungup, Sept. 1939 (PERTH).

Undershrub. Branchlets puberulous but glabrous beneath leaves, becoming corky between leaf decurrencies. Leaves shortly petiolate, minutely black stipulate; lamina semiterete, 5-8 mm long, glandular punctate, glabrous rounded below, flat and narrowly canaliculate above, apex rounded with a small terminal gland. Flowers terminal, usually solitary; peduncle absent; pedicel 1-2 mm long, glabrous. Sepals broadly deltoid, ca. 1 mm long, fleshy with thin ciliolate margin, glabrous, apex obtuse to rounded; petals ovate, ca. 6 mm long, white, glabrous outside (or thinly tomentose towards margin), tomentulose within, mid-rib thick and prominent; staminal filaments inserted immediately below the disc, narrowly oblong-attenuate, ca. 2 mm long, ciliate (prominently so in the antisepalous); disc narrow,  $\pm$  equal to width of ovary, mauve; ovary pyramidal, ca. 2.5 mm high, glabrous (or minutely pilosulose at summit), carpels rounded at apex, the upper-half sterile; style glabrous, stigma slightly spreading. Cocci erect, to 4 mm high, apex truncate and shortly apiculate on outer angle. Seed 2-2.5 mm long, black, sclerotesta irregularly rugose, raphe covered by a thick, brittle layer at base and margin leaving a central deltoid area with thin testa only.

DISTRIBUTION: Western Australia, near the south coast from Cheyne Bay east to beyond Esperance, and north towards Lake King—Map 9.

WESTERN AUSTRALIA: Howick Hill, ca. 65 km east of Esperance, T. E. H. Aplin 2635 (PERTH); "W.A.", J. Drummond No. 55 and 5th Coll. No. 204 (MEL); Mt. Short, ca. 16 km NNW of Ravensthorpe, A. George, 1965 (PERTH); Rocky Brook west side of Mt. Bland, Maxwell (MEL); "On slaty banks Phillips River near the estuary, Fitzgerald River", Maxwell (MEL 4089); Boat Harbour, Cheyne Bay, K. Newbey 794 (PERTH).

This species is very similar to *E. angustifolius*. It differs from that species in the white, not pink, petals, in the narrowly oblong-attenuate staminal filaments (not abruptly notched above) which are sparsely pilose (not woolly) in the lower part, and in the glabrous or subglabrous ovary. From *E. difformis* it differs in having petals glabrous outside and in the stem and leaf morphology. It is somewhat variable in leaf shape; in the north it becomes atypical in having shorter leaves and in the petals being sparsely tomentulose outside. However the material at present available is insufficient for any suggestion of introgression with another species to be confirmed.

Bentham, l.c., included this species under *E. difformis* var *teretifolius* (Drummond 5th coll. no. 204, and Maxwell collections from the Phillips and Fitzgerald Rivers). All these collections cited by him are typical of *E. gardneri*.

### 11. *Eriostemon falcatus* P. G. Wilson, sp. nov.

[falcatus = sickle-shaped]

Fruticulus; ramuli dense verrucosi, sulcis angustis minute puberulis. Folia exstipulata, graciliter teretia, falcata, ca. 6 mm longa, glanduloso-verrucosa, glabra, apice rotundato. Flores solitarii terminales; pedicellus ca. 2 mm longus, minute puberulus; sepala anguste triangularia, ca. 3 mm longa, glabra, apice tenui, carnosio, acuminato; petala elliptica usque 7 mm longa, extra glabra, intra puberula; filamenta anguste oblongo-acuminata, ca. 4 mm longa, pilosa; ovarium anguste pyramidale, apicem versus pilosum.

Holotypus: W. E. Blackall 917, Oct. 1931, Yellowdine, Western Australia (PERTH).

Small much-branched shrub. Branchlets densely glandular verrucose and minutely puberulous in narrow lines. Leaves exstipulate, shortly petiolate; lamina slender-terete, falcate, ca. 6 mm long, glandular verrucose, glabrous, apex rounded. Flowers solitary, terminal. Pedicel ca. 2 mm long, minutely puberulous. Sepals narrowly triangular ca. 3 mm long, with a fleshy, subterete apex, somewhat glandular-verrucose, glabrous; petals elliptic, to 7 mm long, glabrous outside (or minutely puberulous on the margins), puberulous within, the midrib not prominent; staminal filaments ca. 4 mm long, narrowly oblong-acuminate, pilose, anthers minutely white-apiculate; ovary narrowly pyramidal, the upper two-thirds pilose. Fruit not seen.—Map 6.

This species is known only from the type collection made near Southern Cross. In its sepal shape and leaf characters it is quite distinct from any other species of *Eriostemon*. From *E. thryptomenoides*, which also has long sepals, it is distinguished by the verrucose stem, long leaves, and by the absence of a broad dark band on the petals.

### 12. *Eriostemon rhomboideus* P. G. Wilson, sp. nov.

[rhombos = a top, oides = like, after the leaf-shape]

Ramuli sparsi verrucosi, glabri. Folia exstipulata, crassa, late elliptica vel rhomboidea, 2-4 mm longa, glanduloso-bullata, glabra. Flores 1-3, terminales; pedicellus 2-3 mm longus, glaber; sepala obtuse deltoidea, ca. 1.5 mm longa; petala ovata, ca. 5 mm longa, glabra, alba, costa prominenti; filamenta linearia, sursum attenuata, 2-2.5 mm longa, apice sparse piloso; ovarium pyramidale, ca. 1 mm altum, apice sparse piloso.

Holotypus: AD 96445067, Western Australia, 1 km N of Lake King township, bush 1-3 ft. high, flower whitish-pink, 16.ix.1964, P. Wilson 3228.

Small undershrub. Branchlets sparsely glandular, glabrous, without leaf-decurrencies, erupting irregularly in black corky excrescences with age. Leaves exstipulate, shortly petiolate; lamina thick, broad-elliptic to obovoid or rhomboidal, 2-4 mm long, margin  $\pm$  undulate, apex rounded, flat on both sides or rounded and glandular bullate below, glabrous. Flowers 1-3 in sessile terminal umbels; pedicel 2-3 mm long, glabrous, with several minute caducous bracteoles at base. Sepals obtusely deltoid, fleshy, almost smooth to slightly glandular

verrucose, ca. 1.5 mm long; petals ovate, 4.5–6 mm long, white to pale pink, glabrous (or sparsely puberulous within), midrib prominent; staminal filaments linear, attenuate upwards, 2–2.5 mm long, sparsely woolly-pilose towards apex; anther ca. 1 mm long, minutely white-apiculate, pollen pale orange; disc thin, slightly wider than ovary, mauve, undulate; ovary pyramidal, ca. 1 mm high, sparsely pilose towards apex, style glabrous; stigma small. Cocci erect, quadrangular, ca. 2.5 mm high, outwardly apiculate; seed not seen.

**DISTRIBUTION:** Western Australia, south-west—Map 7.

**WESTERN AUSTRALIA:** J. Drummond 2nd coll. no. 55, 1844 (NSW); west of Welbunjin, C. A. Gardner 2756 (PERTH); 17 mi E of Newdegate, A. S. George 283 (PERTH); 10 mi N of Nyabing, K. Newbey 898 (PERTH); Lake King, R. D. Royce 4173 (PERTH).

This species is distinguished from related ones by being completely glabrous except for the inside of the petals, by the broad rhomboid leaves, and by the absence of any leaf decurrency.

### 13. *Eriostemon glaber* P. G. Wilson, sp. nov.

[glaber = without hair]

Fruticulus; ramuli verrucosi, glabri, cum laciniis virentibus ab foliis decurrentibus. Folia semi-teretia vel anguste obovoidea, 3–5 mm longa, obtusa, supra planiuscula et canaliculata, infra rotundata. Flores 1–3, terminales; pedicellus glaber, 1–5 mm longus. Sepala ovata vel suborbicularia, 1.5–2 mm longa, glabra; petala elliptica, 6–8 mm longa, alba, extra glabra, intra puberula, costa prominenti; filamenta oblongo-acuminata, dense lanosa, apicibus antiseptalium pilosis; ovarium late pyramidale, ca. 1 mm altum, glabrum.

Holotypus: NSW 69038, Cowcowing, Western Australia, Sept. 1904, Max Koch 1020. Iso.: AD 96524138, MEL 4084, PERTH.

Small erect undershrub. Branchlets glandular verrucose, glabrous, with prominent green leaf decurrencies and brown intermediate strips which soon become corky. Leaves exstipulate, subsessile, semi-terete to narrow-obovoid, 3–5 mm long, glabrous, glandular verrucose, obtuse, flattened and canaliculate above, rounded below. Flowers 1–3 terminal; pedicel glandular-verrucose, glabrous, 1–5 mm long, with a pair of minute caducous bracteoles at base. Sepals free, imbricate, ovate to suborbicular 1.5–2 mm long, glandular, glabrous, ciliolate, petals, imbricate, elliptic 6–8 mm long, white (tinged with pink), glabrous outside, densely puberulous within, ciliolate, midrib prominent; staminal filaments narrow-oblong  $\pm$  gradually attenuate upwards, ca. 5.5 mm long densely woolly and the antiseptalous pilose-tufted at apex; antiseptalous anther ca. 0.5 mm long with a prominent white apiculum ca. 0.4 mm long, antipetalous anther ca. 1 mm long with a white apiculum ca. 0.2 mm long; disc thin, slightly exceeding ovary, mauve; ovary broadly pyramidal ca. 1 mm high, glabrous; style pilose below; stigma small. Fruit and seed not seen.

**DISTRIBUTION:** Western Australia, from Mullewa (east of Geraldton) south to Cowcowing—Map 7.

**WESTERN AUSTRALIA:** 30 mi NE of Wubin, J. S. Beard 2586 (KINGS PARK); Mullewa to Morawa, W. E. Blackall 719 (PERTH); Mt. Gibson, A. J. Cough 70 (PERTH); NW of Trayning, C. A. Gardner 7626 (PERTH).

This species may be distinguished from similar plants by the glabrous stems, leaves, and outside of petals, by the green decurrent strips on the branchlets with alternating black corky areas, and by the absence of stipules.

### 14. *Eriostemon apiculatus* P. G. Wilson, sp. nov.

[apiculatus = shortly pointed]

Suffrutex ca. 1 m altus. Ramuli teretes, glabri vel sparse puberuli. Folia anguste clavata, glanduloso-verrucosa, glabra (vel supra sparse hirtella), nigro-apiculata; stipularum excrescentia nigra, prominentia. Flores 1–4 terminales. Pedicellus crassus, 0.5–1.5 mm longus,

glaber. Sepala crassa, anguste deltoidea, 1.5-2 mm longa, nigro-apiculata, ciliolata, aliter glabra; petala anguste oblonga, ca. 6 mm longa, intra pubescentia, extra glabra sed marginem versus pubescentia; filamenta lineari-attenuata, 3-4 mm longa, in dimidio inferiore lanata, superiore hirsuta, antheris ca. 0.8 mm longis, breviter albo-apiculatis.

Holotypus: Norseman, shrub to 120 cm, flowers white, on basaltic lavas, 17 Sept., 1965, J. Bale 185 (PERTH).

Undershrub ca. 1 m high. Branches terete (not sulcate), glabrous or sparsely puberulous. Stipular excrescences large, black. Leaves narrow-clavate, 4-8 mm long, slightly falcate, somewhat convex above, rounded below, glandular verrucose (when dry), glabrous (or sparsely hirtellous above), prominently black-apiculate. Flowers 1-4 in a terminal cluster surrounded by foliage leaves and frequently overtopped by lateral branchlets. Pedicel thick, 0.5-1.5 mm long, glabrous, minutely bracteolate at base. Sepals narrow-deltoid, 1.5-2 mm long, fleshy, glabrous but ciliolate, black apiculate; petals narrow-oblong, ca. 6 mm long, pubescent within and towards margin outside, otherwise glabrous, white (to pink?). Stamens linear, attenuate upwards, 3-4 mm long, woolly in lower half, hirsute in upper; anthers ca. 0.8 mm long, shortly white-apiculate; disc narrow; ovary narrow-pyramidal, ca. 2.5 mm high, apex sparsely hirsute; style shortly exerted from ovary, terete, glabrous.

DISTRIBUTION: Western Australia, near Norseman.

Peninsula, N.E. of Norseman, ultrabasic rocks, 30 Aug. 1967, P. J. Barnes 7159 (PERTH).

This species is known only from the Norseman area where it is apparently confined to outcrops of ultrabasic rocks.

## 15. *Eriostemon tomentellus* Diels

Diels in Diels et Pritzl, Bot. Jahrb. 36:320 tab. 39 G-J (1904) [tomentellus = minutely tomentose]; Engler, Pflanzenfam. ed. 2. 19a:258, f. 113 (1931); Gardner, Enum. Pl. Austral. Occ. 70 (1931).

Typification: "Hab. in distr. Austin a Menzies meridem versus in arenosis flor. m. Oct. (D. 5164a)." Type not seen.

*E. stowardii* S. Moore, J. Linn. Soc. 45:166 (1920).

Typification: "Trayning; Stoward, 291. Nungarin, Id., 794." Syntype: MEL 4547 (Stoward 291).

Undershrub, minutely tomentose with stellate and simple hairs or rarely glabrescent. Branchlets slightly glandular verrucose. Leaves exstipulate, shortly petiolate; lamina clavate to subterete, ca. 3 mm long,  $\pm$  flat above, rounded below, glandular verrucose, sparsely to densely minutely tomentose, apex rounded and minutely black-apiculate. Flowers 1-4 in a sessile terminal cluster. Pedicel 1.5-3 mm long, minutely bracteolate at base. Sepals free, imbricate at base, broadly deltoid to suborbicular, 1 mm long, slightly glandular, puberulous, ciliolate, minutely black-apiculate, petals ovate, 4-5.5 mm long, white with pale red centre outside, puberulous except for outside of prominent, thickened midrib; staminal filaments flattened, linear-attenuate, sparsely pilose, ca. 2.5 mm long; anthers ca. 1 mm long, with a small, white apiculum, pollen bright orange; disc slightly exceeding width of ovary; ovary narrow pyramidal, ca. 1 mm high, densely tomentose, upper half of carpels sterile; cocci ca. 4 mm high, truncate, shortly rostrate; seed black, ca. 2.5 mm long, smooth; raphe massive, sunken, covered by a thin layer of testa only.

DISTRIBUTION: Western Australia, widespread, Cowcowing to Kalgoorlie north to about 28° Lat.—Map 6.

WESTERN AUSTRALIA: Nalkain, T. E. H. Aplin 511 (PERTH); Walgoolan, W. E. Blackall 4008 (PERTH); Southern Cross, R. Erickson, July 1952 (MEL); nr. Sandstone, C. A. Gardner 2502 (PERTH); Comet Vale, C. A. Gardner 11113 (PERTH); Ningham, C. A. Gardner 12005 (PERTH); Victoria Rocks SW of Coolgardie, A. S. George 4239 (PERTH).

*Eriostemon tomentellus* may be distinguished from related species by its minutely tomentose covering, by the shortly clavate leaves, and by the black apiculum to leaves and sepals. The indumentum is almost lacking on some specimens when mature, which form corresponds to the type of *E. stowardii*. In other material from near Comet Vale and Coolgardie the leaves are much longer than normal, somewhat flattened above, and the stem glaucous. Further collecting is necessary to clarify the possibility of clinal variation.

#### 16. *Eriostemon thryptomenoides* S. Moore

Spencer Le M. Moore, J. Linn. Soc. 45:166 (1920); Gardner, Enum. Pl. Austral. Occ. 69 (1931).

Typification: "Nungarin; Stoward, 784". Type not seen.

Undershrub; branchlets smooth, without leaf-decurrencies, pilosulose all round when young, soon becoming minutely appressed arachnoid. Leaves exstipulate, shortly petiolate, clavate, 2-3 mm long, somewhat flattened above, sparsely glandular punctate, glabrous, apex rounded (not glandular apiculate). Flowers terminal, solitary, pedicel thick, 0-2 mm long, puberulous, with two leafy bracteoles at base; sepals ovate, ca. 3 mm long, narrowing into a prominent fleshy tip, glabrescent, ciliolate; petals narrow-ovate, ca. 6 mm long, white with broad reddish-brown medial strip, densely puberulous except for medial strip outside; staminal filaments flattened and broad at the concave base, becoming terete upwards; densely pilose, 3-4 mm long; anthers sub-orbicular, ca. 0.8 mm long, reddish and fleshy on back, minutely white-apiculate, pollen white; disc thin, considerably wider than base of ovary; ovary pyramidal ca. 1 mm high, carpels slightly bilobed, glabrous except for pilose sterile tip; style well exerted from ovary when in bud and exceeding stamens at anthesis, pilose towards base. Cocci erect, ca. 2 mm high, shortly apiculate, surrounded by persistent petals and stamens. Seed narrow-reniform, ca. 2 mm long; sclerotesta minutely longitudinally rugulose; hilum narrow-oblong, superficial; raphe on adaxial margin, thin, covered by thin layer of testa only and not obscuring the chalaza.

DISTRIBUTION: Western Australia, Merredin-Koorda district.—Map 8.

WESTERN AUSTRALIA: Bencubbin to Koorda, W. E. Blackall 3363 (PERTH); Wubin, W. E. Blackall, Sept. 1938 (UWA); Carrabin, C. A. Gardner 1769 (PERTH); White Wells Station, C. A. Gardner 12005 (PERTH); 15 km W of Tandagin, R. H. Kuchel 2036 (AD); Walgoolan, P. Wilson 3472 (AD).

This species may be distinguished by its smooth branchlets without leaf-decurrencies, by the leaf shape, and by the broad dark patch on the outside of the petals. The seed is an extreme form of that found in sect. *Nigrostipulae*; in place of the massive sunken raphe with a thick brittle covering (typical of the eastern species) there is only a narrow shrunken tissue with a thin covering. Intermediate seed forms are present in *E. tomentellus* and *E. gardneri*.

#### 17. *Eriostemon sericeus* P. G. Wilson, sp. nov.

[sericeus = silky]

Ramuli puberuli leves. Folio carnosa, elliptica vel obovata, 1.5-3 mm longa, glabra, supra plana, infra rotundata, apice rotundata. Flores saepe solitarii, terminales; pedicellus brevissimus, ca. 0.5 mm longus; sepala late deltoidea vel suborbicularia, 2.5-3 mm long, apice breviter acuminato, carnosio, viridi; petala pallide rosea, ca. 10 mm longa, utrinque dense sericea; filamenta applanata, attenuata, 5-6 mm longa, dense pilosulosa, basim versus connata; ovarium anguste pyramidale, ca. 2 mm altum, dense pilosulosum. Holotypus: CANB 73237, 15 mi E of Kalli, Ereman Province, Western Australia, 22.vii.1958, "shrub 3-4 ft. high", N. H. Speck 1041. Iso.: AD 96129061, MEL 4042, NSW 69037, PERTH.

Undershrub. Branchlets moderately puberulous all over without leaf decurrencies. Leaves exstipulate, petiole ca. 0.5 mm long  $\pm$  appressed to stem; lamina fleshy, elliptic to obovate 1.5–3 mm long, flat above, rounded below, glandular punctate, glabrous or with ciliolate margin, apex rounded. Flowers terminal, usually solitary; pedicel very short ca. 0.5 mm long, densely puberulous. Sepals broadly deltoid to suborbicular with a fleshy centre, and abruptly narrowed to a prominent green fleshy apex, in all 2.5–3 mm long, thick, smooth or slightly glandular, glabrous, ciliolate; petals ovate, ca. 10 mm long, white to pink, densely sericeous on both sides; staminal filaments united for ca. 1 mm at the broad base, flattened, attenuate upwards, 5–6 mm long, densely pilosulose; anther ca. 1.2 mm long, shortly white-apiculate, pollen white; disc glabrous, thick, wider than ovary, undulate; ovary narrow-pyramidal, ca. 2 mm high, densely pilosulose, upper-half sterile; style sparsely pilosulose; stigma small. Cocci with long erect beak. Seed not seen.

**DISTRIBUTION:** Western Australia, from near Geraldton east to near Sandstone.—Map 7.

**WESTERN AUSTRALIA:** Mt. Talling, J. Galbraith 425 (PERTH); 24 mi W of Sandstone, C. A. Gardner 2514 (PERTH); 33 mi N of Mullewa, J. W. Green 1560 (PERTH); Murchison, R. Oldfield (MEL); 54 mi NW of Cue, on top of breakaway, T. E. H. Aplin 2524 (PERTH).

*Eriostemon sericeus* resembles *E. thryptomenoides* in vegetative morphology and in some floral characters; it differs from that species in having large flowers with petals uniformly white to pink and completely sericeous outside. It is unique in the genus in having the staminal filaments shortly united at the base. In this character it is similar to the eastern states representatives of the genus *Philotheca* which it resembles also in vegetative morphology.

### Sectio 3. *Erionema* F. Muell.

F. Muell., Pl. Indig. Col. Vict. 1:121 (1862) [erion = wool, nema = thread].

Branches glabrous or with scattered simple hairs, sometimes glaucous. Leaves small or large, usually coriaceous, exstipulate. Flowers axillary, solitary or in cymes. Pedicel pedunculate or rarely sessile, with two or more basal bracteoles. Sepals free, imbricate, coriaceous. Petals imbricate, glabrous (occasionally sparsely hispidulous outside), minutely papillose within. Stamens incurved, shorter than petals; filaments flattened, abruptly narrowed in upper third, pilose; anther glandular beneath the white apiculum, pollen orange. Carpels with a solid sterile apex. Cocci oblong, erect or slightly spreading rostrate. Seed flattened-ellipsoidal, 3.5–5 mm long; placental endocarp (on dehisced seed) membranous, easily detached; aril a narrow, fleshy cord along adaxial margin; outer testa somewhat coriaceous, smooth brown to black, glossy; sclerotesta smooth; hilum a prominent linear groove on adaxial edge from micropyle to seed base where it broadens at commencement of raphe; raphe basal fleshy, prominent, covered by a thin black crustaceous layer; chalaza basal near abaxial side.

Lectotypus: *E. myoporoides* DC.

Eight species of which seven are found in eastern Australia and one in Tasmania.

The species of this section have a uniform appearance in stem, leaf and flower morphology and differ from sect. *Nigrostipulae* most noticeably in the seed. This is flattened, with a linear hilum and coriaceous outer testa; in sect. *Nigrostipulae* it is thick, with a deltoid shaped hilum and thin outer testa.

### 18. *Eriostemon myoporoides* DC.

A. P. de Candolle, Prod. 1:720 (1824) [*Myoporum*, a genus of trees and shrubs, oides = like]; Sprengel, Syst. Veg. 2:321 (1825); G. Don, Gen. Hist. 1:792 (1831); Delessert, Ic. Sel. Pl. 3:27, tab. 47 (1837); Hooker, Bot. Mag. 59: tab. 3180 (1832); F. Muell., Pl. Col. Vict. 1:122 (1862); Bentham, Fl. Austral. 1:333 (1863); F. Muell., Nat. Pl. Vict. 1:71 (1879); F. Muell., Fragm. 9:110 (1875); F. Muell., Kev Syst. Vict. Pl. 1:143 (1887); Stirling, Proc. Linn. Soc.

N.S.Wales 11:1058 (1887); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Engler, Nat. Pflanzenfam. 3/4: 139. tab. 77 (1896); Dixon, Pl. N.S.Wales 50 (1906); Bailey, Queensld. Fl. 1:191 (1899); Hamilton, Austral. Nat. 2/16: (Oct. 1913); Hamilton, Proc. Linn. Soc. N.S.Wales 40:394 (1915); Ewart, Fl. Vict. 706 (1931); Beadle et al., Handb. Vasc. Pl. Syd. Dist. 320 (1963).

Typification: "in Nova Holl. orientali". Holotypus: G-DC, labelled "Nouv. Holl. côte orient, Mus. de Paris 1821" (photo seen).

*E. cuspidatus* A. Cunn. in Field, Geogr. Mem. N.S.Wales 331 (1825); G. Don, Gen. Hist. 1:792 (1831); Maund, Botanist 1:t.4 (1837); Walpers, Rep. Bot. Syst. 1:504 (1842) "cuspidatum".

Typification: "Rocky Hills, Cox's River. Flowers in October." Holotypus: K, "A. Cunningham No. 54 Oct. 1822" (photo seen).

*E. neritifolius* Sieb. ex Spreng., Syst. Veg. 4/2:164 (1827); G. Don, Gen. Hist. 1:792 (1831). Typification: "Nov. Holl." Isotypes: K, MEL 4190, 4337, labelled "Fl. Novae Holl. No. 306. Sieber."

*E. lancifolius* F. Muell., Trans. Vict. Inst. 1:32 (1855).

Typification: "On the stony summit of Mount McFarlan, at an elevation of nearly five thousand feet on Mount Tambo and the Upper Mitta Mitta". Syntypes: (Mt. Tambo) K, MEL.

*E. amplifolius* F. Muell., Australasian Chem. and Drug. 7:64 (Dec. 1884); F. Muell., Key Syst. Vict. Pl. 1:139 (1887); Moore et Betche, Handb. Pl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1906); Ewart, Proc. Roy. Soc. Vict. 31:372 (1919).

Typification: "on the Upper Genoa some years ago an *Eriostemon* was discovered by Mr. C. Walter". Type not found.

*Phebalium amplifolium* (F. Muell.) Maiden et Betche, Census N.S.Wales Pl. 116 (1916).

I have not seen the type of *E. amplifolius* and Ewart (then Curator of the National Herbarium of Victoria) in a note in the Proc. Roy. Soc. Vict. (1919), stated that he also was unable to find it. There is however a specimen (MEL 4310), collected in September 1902 by C. Walter from Gippsland, which was determined by him as *E. amplifolius*; this specimen agrees with Mueller's description (which was based on sterile material), and probably came from the type locality. It is distinctive in having a slight purplish tinge to the leaves, a character noted by Mueller.

Shrub to 2 m high. Branchlets terete, glandular verrucose (to smooth), sometimes glaucous, glabrous. Leaves sessile, chartaceous to coriaceous, oblong to broadly elliptic or broadly obovate, 15 to 110 mm long, entire, surface with numerous small glandular verrucosities (when dry), glabrous, apex acute to rounded, shortly mucronate, base narrow, midrib prominent below. Flowers in axillary, pedunculate clusters of (1) 4-6 flowers (rarely more); peduncle robust, angular, 0.5-20 mm long, glabrous; pedicels similar to the peduncle, 2-10 mm long, with a small deltoid bract and often 2 minute basal bracteoles. Sepals broadly deltoid to semi-orbicular, ca. 1 mm high, 1.5-2 mm wide, coriaceous, glabrous; petals broad-elliptic, ca. 8 mm long, glabrous, white, keel prominent and glandular towards apex; staminal filaments narrow oblong, 3-5 mm long, sparsely ciliate to densely woolly on margins, often pilose towards apex, the antisealous abruptly or gradually narrowed in upper third, the antisealous narrowed just below apex; anthers broad-oblong, ca. 1 mm long, minutely biglandular at apex, shortly white-apiculate, pollen orange; disc prominent, slightly broader than and  $\pm$  continuous with ovary; ovary narrowly pyramidal, ca. 1.5 mm high, the upper third sterile, carpels sparsely ciliate along central margin otherwise glabrous; style glabrous; stigma  $\pm$  equal in width to style; cocci erect or slightly divaricate, narrowed towards apex, ca. 7 mm long, rostrum straight or curved, ca. 3 mm long; seed narrowly lenticular, 4-4.5 mm long.

1. Stem  $\pm$  densely verrucose.
2. Leaves flat, over 2.5 cm long.
3. Leaves coriaceous or if chartaceous then narrowly oblong-elliptic, 3-11 cm long, apex rounded to acute; peduncle prominent with more than three flowers

18a. subsp. *myoporoides*

3. Leaves chartaceous, oblong-obcuneate, (2)2.5-3.5 cm long, apex rounded; peduncle short, 1-flowered (Glasshouse Mts, Q.) **18f. subsp. leichhardtii**
2. Leaves  $\pm$  concave (at least when dry), 2-4 cm long; peduncle short, 1-3 flowered.
  4. Leaves oblong-elliptic, acute to obtuse, to 4 cm long; peduncle 1-3 flowered; staminal filaments ciliate and pilose towards apex (central N.S.W.) **18b. subsp. acutus**
  4. Leaves obovate, to 3 cm long, apex rounded; peduncle very short, usually 1-flowered; staminal filaments very shortly ciliate and sparsely pilose (or epilose) at apex (NE of N.S.W. and adjacent area in Queensld) **18c. subsp. epilosus**
1. Stem almost smooth.
  5. Leaves coriaceous, elliptic, conduplicate and falcate when dry; peduncle thick, short, 1-4-flowered (NE of N.S.W. and adjacent area in Queensld) **18d. subsp. conduplicatus**
  5. Leaves chartaceous, narrow-elliptic to narrow-obovate, 1.5-2.5 cm long, deeply concave above; peduncle slender, short, 1-flowered (coastal SE Queensld) **18e. subsp. queenslandicus**

### 18a. subsp. myoporoides

Stem moderately to faintly verrucose; leaves oblong to broad-elliptic or broadly obovate, apex rounded to acute, 2-11 cm long. Peduncle 0.5-20 mm long with (2) 3-8 pedicels; staminal filaments ciliate or woolly-ciliate, slightly pilose towards apex.

Chromosome no.  $n = 14$ , from material collected at the Nepean R., fide Smith-White (1954).

DISTRIBUTION: Queensland, extreme south-east, far eastern New South Wales; eastern Victoria—Map 10.

QUEENSLAND: Mt. Barney, 2,500-4,700 ft., S. L. Everist 1390 (BRI); Mt. Lindesay, 3,000 ft., N. Michael 2067 (BRI).

NEW SOUTH WALES: Burragorang, T. V. Alkin (NSW); nr. Picton, C. Barnard, Sept. 1941 (CANB); Cox River, W. F. Blakely, Oct. 1899 (AD); Sugar Loaf Mt., Braidwood, W. F. Blakely, Oct. 1890 (NSW); Tinderry Range, E. of Michelago, N. T. Burbidge 6658 (CANB); Bargo R., Tahmoor, C. Burgess, 31.viii.1963 (CBG); Growee Ck., W of Rylstone, H. S. McKee, Sept. 1952 (NSW); Happy Jack R. gorge, nr. Junction Shaft, 3,800 ft., Snowy Mts., I. G. Filmer, 26.ii.1957 (NSW).

A.C.T.: Upper Cotter Dam, E. Gauba, 14.x.1958 (CBG).

VICTORIA: Bogong Ranges, nr. head of West Kiewa River, J. H. Willis, 12.1.1947 (MEL); Mt. St. Bernard, C. Walter, Jan. 1887 (MEL); high mountains nr. Omeo, F. Mueller, 1854 (MEL); nr. Port Phillip, F. Reader 2 (MEL); Mt. Hotham, E. Gauba, 9.ii.1955 (GAUBA).

### 18b. subsp. acutus (Blakely) P. G. Wilson stat. nov.

*E. myoporoides* var. *acutus* Blakely, Contr. N.S.Wales Nat. Herb. 1:124 (1941) [*acutus* = acute, referring to the leaf shape].

Typification: "Shrub 2-3 feet high and about the same across", 10 mi north of Grenfell, R. H. Cabbage, 1.5.1900." Holotypus: NSW 68728.

*E. affinis* Sprague, Gard, Chron. III. 33:307 (1903).

Typification: "This new *Eriostemon* has been cultivated at Kew for some considerable time...". Holotypus: K (photo seen).

*E. myoporoides* var. *minor* [non Benth.] Benth., Fl. Austral. 1:333 (1863), p.pte. (Lachlan River specimen).

Branchlets densely verrucose; leaves narrow-elliptic, 27 x 4 mm to 40 x 6 mm,  $\pm$  concave above when dry, apex acute to obtuse, mucronate; peduncle 0-5 mm long with 1-4 pedicels 1-10 mm long; staminal filaments ciliate (sometimes sparsely so) somewhat pilose at apex; fruiting cocci spreading with a long, acuminate rostrum.

DISTRIBUTION: Central New South Wales—Map 3.

NEW SOUTH WALES: Kamarah, W. R. A. Baker, 17.x.1917 (MEL); Grong Grong Range, F. S. Barnes, 16.ix.1952 (NSW); Beelangra Slopes nr. Griffith, N. T. Burbidge 6424 (CANB); Rankins Spring, R. Jordan, Aug. 1953 (AD).



**18c.** subsp. *epilosus* P. G. Wilson, subsp. nov.

[epilosus = without hairs, referring to the staminal filaments]

Ramuli dense verrucosi; folia obovata, ca. 20 x 7 mm apice obtuso vel rotundato, recurvo, mucronato. Flores plerumque solitarii; pedunculus 1-2 mm longus; pedicellus 2-4 mm longus; filamenta staminalia sparse hipida, apice fere glabro.

Holotypus: NSW 69255, Wallangarra, Queensland, Nov. 1906, S. L. Boorman. Isotypus: NSW 68741.

Branchlets densely verrucose; leaves obovate, ca. 20 x 7 mm, apex obtuse to rounded, recurved, mucronate. Flowers predominantly solitary; peduncle 1-2 mm long, pedicel 2-4 mm long; staminal filaments sparsely ciliate with short, stiff bristles, epilose or with a few hairs at apex.

DISTRIBUTION: Border mountains near Stanthorpe between New South Wales and Queensland—Map 11.

QUEENSLAND: Stanthorpe, J. L. Boorman, July 1904 (NSW); Amiens, T. J. Bowen, 21.xi.1956 (BRI); Wyberba, F. D. Hocking, 1961 (BRI).

NEW SOUTH WALES: Wilsons Downfall, E. C. Andrews 13 (NSW); Drake, J. L. Boorman, Oct. 1901 (MEL); base of Bald Mt., 15 mi N of Tenterfield (NSW).

**18d.** subsp. *conduplicatus* P. G. Wilson subsp. nov.

[conduplicatus = folded together lengthwise, i.e. the leaf margins]

Ramuli fere leves; folia elliptica, 4-7 mm longa, obtusa vel acuta, levia, in statu siccato conduplicata, falcata. Pedunculus crassus, 0-4 mm longus; pedicelli 1-4, crassi, 2-4 mm longi. Holotypus: NSW 68742, Howell, New South Wales, Aug. 1905, J. H. Maiden and J. L. Boorman.

Branchlets almost smooth; leaves elliptic 4-7 cm long, obtuse to acute, smooth, in the dried state conduplicate and falcate, peduncle thick, 0-4 mm long; pedicels 1-4, thick, 2-4 mm long; sepals and petals tinged with red; staminal filaments moderately ciliate, apex sparsely pilose.

DISTRIBUTION: North-east New South Wales and near Stanthorpe in Queensland—Map 3.

QUEENSLAND: Mt. Jibbinbar, Darling Downs, L. C. Ball 94 (BRI); Stanthorpe, L. A. Beenays (BRI); Wyberba, F. D. Hockings 3 (BRI).

NEW SOUTH WALES: Howell, E. N. McKie 480 (NSW); Tenterfield, J. F. Thomas, Oct. 1918 (NSW).

**18e.** subsp. *queenslandicus* (C. T. White) P. G. Wilson, stat. et comb. nov.

*E. queenslandicus* C. T. White, Proc. Roy. Soc. Queensld. 53:207 (1942) [queenslandicus = of Queensland].

Typification: "Caloundra, very common on sandy wallum flats, S. L. Everist, No. 454 (type: flowers), August, 1933 (low shrub or subshrub, flowers pink) . . .". Holotypus: BRI 011386.

Branchlets sparsely and minutely verrucose; leaves narrow-elliptic to narrow-obovate, 15-25 x 1.5-3 mm, obtuse, to acute, shortly mucronate, smooth or slightly verrucose, concave above. Peduncles slender, 0.5-3(5) mm long; pedicel solitary, 3-6 mm long. Staminal filaments woolly-ciliate, long-pilose towards apex; fruiting cocci  $\pm$  erect, bluntly apiculate (to shortly rostrate).

DISTRIBUTION: south-east Queensland, Wide Bay district—Map 11.

QUEENSLAND: Caloundra, L. J. Brass, on Wallum flats, Oct. 1934 (CANB); Tin Can Bay, Mrs M. S. Clemens, Sept. 1946 (BRI); Coondoo Ck., W. D. Francis, Dec. 1919 (BRI); Beerwah to Landsborough, in open situations, C. E. Hubbard 3114 (BRI); Lake Cotharaba, J. Keys (BRI); Noosa R., J. Staer, Dec. 1911 (NSW).

**18f. subsp. leichhardtii** (Benth.) P. G. Wilson, stat. et comb. nov.

*E. trachyphyllus* var. *leichhardtii* Benth., Fl. Austral. 1:333 (1863) [after Ludwig Leichhardt, the explorer].

Typification: " 'From Brroa' (N.S. Wales?), Leichhardt." [= Mt. Beerwah, Glasshouse Mts., Queensland]. Holotypus: K (photo seen); iso.: MEL 4536 " Brroa, 2. Septbr. 43".

*E. glasshouseiensis* Domin, Bibl. Bot. 89:286 (1926).

Typification: " Queensland; Glasshouse Mts., C. T. White 1909." Isotypus?: BRI 042441 " Glasshouse Mountains (Slopes of Mt. Coonowrin) C. T. White, F.N.C. Excursion. Sept. 1909."

*E. myoporoides* var. *minor* [non Benth.] Benth., Fl. Austral. 1:333 (1863) p.pte., as to Queensland specimen cited.

*E. scaber* [non Paxton] Benth., op. cit. 334, p.pte. (Queensland specimen); Bailey, Queensland Fl. 1:91 (1899).

Branchlets  $\pm$  densely verrucose; leaves oblong-obcuneate, 20 x 6–35 x 8 mm, flat or somewhat incurved (when dry), apex rounded to truncate, abruptly apiculate. Flowers sparse; peduncle 0–2 mm long; pedicel solitary, slender, to 9 mm long. Staminal filaments woolly-ciliate, conspicuously long-pilose towards apex. Cocci erect, prominently rostrate.

DISTRIBUTION: Found near the summits of the Glasshouse Mountains, Queensland—Map 11.

QUEENSLAND, Glasshouse Mts.: Mt. Ngun-gun, S. T. Blake 18765 (BRI); Cruickneck, on upper portion of mountain, D. A. Goy, 24.v.1935 (BRI); Mt. Beerwah, D. A. Goy 59 (BRI); Mt. Coonowrin, alt.c.600 ft., C. E. Hubbard 4129 (BRI).

*Eriostemon myoporoides* may be distinguished from related species by its being completely glabrous, by the leaves ending in an almost cuspidate point, and by the presence of axillary peduncles (sometimes very reduced) bearing at the apex up to 5 (sometimes more) flowers. It may be divided into several fairly distinct morphological groups which occupy separate geographical areas (except at one point where two of them may overlap). These morphological groups I have distinguished as the following subspecies:—

Subspecies **myoporoides**. This subspecies is extremely variable, however the variability is largely confined to the foliar morphology and, from study of herbarium material, often appears to grade from one form to another. The type form is found in New South Wales from near Denman in the North to Batemans Bay in the South; it has long, narrowly oblong-elliptic leaves and prominent peduncles which bear several flowers. In the Blue Mountains of New South Wales, in the A.C.T., and in the mountains of eastern Victoria, is found a form with coriaceous, broadly elliptic leaves; this mountain form could be given infraspecific recognition; however the flowers are very similar to those of the type form. On this 'mountain form' were based the species *E. cuspidatus* A. Cunn. (described from the Blue Mountains) and *E. lancifolius* F. Muell. (from the Victorian Alps). In eastern Victoria this mountain plant sometimes has thick, very broadly elliptic leaves with the edges purple tinged; a sterile collection of this form from the Upper Genoa (eastern Victoria) made by C. Walter was described by Mueller as a new species, *E. amplifolius*. At Mt. Lindsay and Mt. Barney on the New South Wales-Queensland border, is found a form with broadly obovate leaves, rounded at the summit, with the staminal filaments only shortly ciliate and sparsely pilose. This is the only form of subsp. *myoporoides* found in Queensland.

Although normally considered as a small to medium sized bush it may, according to J. H. Willis, Austral. Encycl. 3:400 (1958), "attain tree size in Victorian mountain gullies".

Subspecies **acutus**. This subspecies, which is found in inland New South Wales, differs from the type subspecies in having much smaller, usually oblong-elliptic leaves which in the dried state are frequently concave above. The peduncle is usually very short and 1–3 flowered. It is very similar to subsp.

*epilosus*, which is found in the far north-east of New South Wales, but may be separated on the leaf-shape, length of pedicel and peduncle, and the form of the staminal filaments.

Subspecies *epilosus*. As noted above this is very similar to subsp. *acutus* and was included in it by Blakely. It is found in the same region as subsp. *conduplicatus* but possibly occupies different ecological habitats; I have seen no herbarium specimens showing any suggestion of intergradation between the two.

Subspecies *conduplicatus* may be distinguished in the dried state by the conduplicate leaves which are then falcate in shape (I have not seen fresh material), and by the almost smooth branchlets.

Subspecies *queenslandicus* is a near-coastal plant of south-east Queensland; it has almost smooth branchlets, solitary flowers, and woolly-ciliate staminal filaments. It approaches in distribution and in morphology the following:— Subspecies *leichhardtii*, which has only been collected from near the summits of several of the Glasshouse mountains, is distinguished by its densely verrucose stem, leaf shape, long-pilose staminal filaments, and prominently rostrate cocci.

Hybrids occur between *E. myoporoides* subsp. *myoporoides* and *E. hispidulus* where the two species grow together as in the Blue Mountains and at Tahmoor. Intergradation with *E. scaber* is considered under that species.

#### 19. *Eriostemon scaber* Paxton

J. Paxton, Mag. Bot. 13:127 et tab. (pre July 1846); Bentham, Fl. Austral. 1:334 (1863) excl. Queensld. specimen cited; F. Muell., Fragm. 9:111 (1875); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Engler, Nat. Pflanzenfam. 3/4: 139 (1896); Dixon, Pl. N.S.Wales 50 (1906); Engler, op. cit. ed. 2. 19a:258 (1921).

Typification: "... in the collection of the Messrs Loddiges, of the Hackney Nursery, who imported seeds from Sidney, New South Wales, many years ago."

*E. scaber* Gerard, Hort. Univ. 7:131 (1846).

Typification: No mention of origin.

*E. scaber* A. de Candolle, Dixième notice sur les plantes rares cultivées dans le jardin Botanique de Genève 8 (1847), non vidi, reprinted in Mém. Soc. Phys. Hist. Nat. Genève 11/2:432 (1848); Schldl., Bot. Zeit. 6:342 (1849), non vidi; Walpers, Ann. Bot. Syst. 2:249 (1852).

Typification: "Cette espèce introduite dans les jardins de Belgique, a été présentée par M. Muzy dans une exposition de fleurs, le 22 avril 1846, à Genève." Type not seen.

*E. linearis* [non Endl.] F. Muell., Pl. Col. Vict. 1:123 (1862).

It is possible that the name *E. scaber* of Gerard antedates the *E. scaber* Paxton both of which appeared in 1846. I have not been able to find a more precise date for either of the works involved, apart from a reference to Paxton's name in the Horticultural Cabinet and Florists' Magazine vol. 14 no. 162 p.210, dated 1st July 1846. According to a note received from Mr. M. Lazarides, Kew, the final article in vol. 7 of L'Horticulteur Universel was dated "Dec 1845"; thus Gerard's name may have been published early the following year.

Undershrub to 60 cm high. Branchlets terete, verruculose to almost smooth,  $\pm$  hispidulous. Leaves sessile, semiterete due to conduplicate margins (to narrowly oblong-elliptic), acute, mucronate, 10–15 (25 mm long, smooth and deeply concave above, verruculose and rounded below, minutely hispidulous. Flowers axillary, solitary; peduncle hispidulous; 0.5–2 mm long; pedicel glabrescent, 2–5 mm long with 2 pairs of minute bracteoles at the base. Sepals broadly deltoid to semi-orbicular, ca. 1 mm high and wide, fleshy with thin margins, glabrous; petals elliptic, 7–8 mm long, white to pink, glabrous, keel thickened and glandular; staminal filaments flattened, linear, abruptly subulate towards apex (shortly so in antipetalous), ca. 3 mm long, margin long-ciliate especially near apex; anther broad-oblong, ca. 1 mm long, apex minutely biglandular and with a short, attenuate, white apiculum; disc narrow, slightly exceeding ovary, smooth; ovary narrow-pyramidal, ca. 2 mm high, glabrous, upper third sterile, style glabrous. Ovary and seed as in *E. myoporoides*.

Stem  $\pm$  smooth, hispidulous, leaf terete

19a. subsp. *scaber*

Stem verrucose, minutely hispidulous to glabrous, leaf oblong-elliptic

19b. subsp. *latifolius*

### 19a. subsp. *scaber*

Stem smooth, hispidulous; leaves subterete due to conduplicate margin, hispidulous.

DISTRIBUTION: New South Wales, east coast, near Port Jackson—Maps 12, 13. NEW SOUTH WALES: Como, Georges R., J. L. Boorman, Sept. 1916 (NSW); Oatley, J. H. Camfield, Aug. 1893 (AD); Panamia—Picnic Pt., L. A. S. Johnson 806 (NSW); nr. Liverpool, L. Leichhardt (MEL); Kurnell, J. L. de Souza, 2.x.1950 (NE).

### 18b. subsp. *latifolius* P. G. Wilson, subsp. nov.

[latus = broad, folium = leaf]

Ramuli prominenter verrucosi, minute hispiduli (vel glabri); folia coriacea, leviter verrucosa, oblongo-elliptica, ca. 12 x 3 mm, supra concava, glabra (vel sparse hispidula).

Holotypus: NSW 68808, Bundanoon, dry sclerophyll forest, 27.ix.1957, J. C. R. Holford 259.

Stem markedly verrucose, minutely hispidulous (to glabrous); leaves coriaceous, slightly verrucose, oblong-elliptic, ca. 12 x 3 mm, concave above, glabrous (or sparsely hispidulous).

DISTRIBUTION: New South Wales, south-east, from Nowra south to Nerriga—Maps 12, 13.

NEW SOUTH WALES: Clyde Mts., W. Baeuerlen 33 (MEL); Bundanoon, E. Cheel, 14.xi.1925 (NSW); Mt. Bulee, 7 mi NE of Nerriga, E. F. Constable, 28.x.1957 (AD).

### *E. myoporoides*-*E. scaber* subsp. *latifolius*

NEW SOUTH WALES: Nerriga, J. L. Boorman, Jan. 1915 (NSW); 3 mi S of Sassafras, E. F. Constable, 20.ix.1961 (NSW); Mt. Bulee, E. F. Constable, 28.x.1957 (NSW); Conjola, W. Heron 34 (NSW).

The type subspecies hybridizes with *E. buxifolius* where the two grow together between Botany Bay and Waterfall. Further south, near Bulli, have been collected plants which match the putative *E. buxifolius* x *scaber* cross and, although I have seen no herbarium material of either parent species from this area, I consider it possible that the Bulli plants are of the same origin.

The subspecies *latifolius* apparently grades into *E. myoporoides* in the Pigeon House Range, and near Jervis Bay with *E. buxifolius*. Near Nowra some collections I have seen suggest that the two subspecies of *scaber* grade into each other, the typical subspecies developing to the north and subsp. *latifolius* to the south.

In its glabrous form subsp. *latifolius* resembles *E. myoporoides* subsp. *queenlandicus* which also has narrow concave leaves and solitary flowers. The latter may be distinguished by its smooth stems and densely pilose staminal filaments; the two taxa occur in quite distinct regions.

The subspecies *latifolius* may be distinguished from the hybrid *E. buxifolius* subsp. *buxifolius* x *scaber* subsp. *scaber* by the smooth leaves of subsp. *latifolius* which are narrowed towards the base, the less hispidulous stem, and the sparsely pilose staminal filaments.

I was at one time of the opinion that the name *E. dolabratus* Reichenb. applied to this species. However I am now confident that it does not and that the plant described under that name is most likely *E. verrucosus*. All herbarium material determined by me before 1967 as *E. dolabratus* should therefore be referred to *E. scaber* Paxton.

## 20. *Eriostemon buxifolius* Sm.

J. E. Smith in Rees, Cycl. 13: (1809) [Buxus = the box tree, folium = leaf]; A. P. de Candolle, Prod. 1:720 (1824); Sprengel, Syst. Veg. 2:321 (1825); G. Don, Gen. Hist. 1:792 (1831); Spach, Hist. Nat. Veg. Phan. 2:338 (1834); Delessert, Ic. Sel. Pl. 3:27. tab. 45 (1837); Hooker, Bot. Mag. 7:t 4101 (1844); Bentham, Fl. Austral. 1:333 (1863); F. Muell., Fragm. 9:111

(1875); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Britten in Banks and Solander, Illust. Austral. Pl. 1:13. tab. 30 (1905); Dixon, Pl. N.S.Wales 50 (1906); Maiden et Betche, Census 115 (1916); Beadle et al., Handb. Vasc. Pl. Syd. Distr. 320 (1963).

Typification: "Gathered near Port Jackson, by Dr. White." Lectotypus: Variety with the leaves "broadly elliptical, heart-shaped, and embracing the stem at their base generally even and entire at their edges, though occasionally furnished, in the very same manner, with blunt glandular teeth." Type not seen.

Undershrub to 1.3 m high. Branchlets terete,  $\pm$  longitudinally costate (in the dried state), not verrucose, hispidulous. Leaves sessile, coriaceous, orbicular to broadly elliptical or obovate, 6–12 mm long,  $\pm$  flat to concave above and smooth, keeled and somewhat glandular below, glabrous or subglabrous, margins entire or glandular crenate, sometimes slightly recurved, base cuneate to cordate, apex rounded and apiculate. Flowers axillary, solitary, not exceeding the leaf; peduncle 0–2 mm long, hispidulous; pedicel 2–4 mm long glabrous or hispidulous, minutely 4-bracteolate at base. Sepals broadly deltoid, 1–1.5 mm high, 1–5–2 mm wide, fleshy with thin margin, glabrous; petals broad elliptic, 8–15 mm long, white (to pink outside in bud), glabrous, sparsely glandular on thickened keel; staminal filaments flattened, linear and ciliate in lower two-thirds, abruptly narrowed above and sparsely long-pilose, 2.5–3.5 mm long; anthers ca. 1 mm long, the apex minutely biglandular and shortly white-apiculate; disc thin, smooth, mauve, slightly exceeding ovary in width; ovary narrowly pyramidal, glabrous ca. 2 mm long, upper third sterile; carpels slightly emarginate at apex, style glabrous, stigma small. Fruit and seed as in *E. myoporoides*.

Chromosome no.  $n = 14$ , from material collected at National Park, Kuringai, fide Smith-White (1954).

Leaves orbicular to broadly elliptic, base cordate

20a. subsp. *buxifolius*

Leaves obovate, base cuneate

19b. subsp. *obovatus*

### 19a. subsp. *buxifolius*

*E. buxifolius* var.  $\beta$ , DC., Prod. 1:720 (1824), based on lectotype.

*E. buxifolius* var. *ellipticus* G. Don, Gen. Hist. 1:792 (1831), based on lectotype.

Leaves orbicular to broadly elliptical, margin entire, base cordate; pedicel glabrous (or rarely hispidulous).

DISTRIBUTION: New South Wales, near the east coast between Broken Bay and Port Hacking and also near Jervis Bay—Maps 13, 14.

NEW SOUTH WALES: Dee Why, top of sandstone cliff, G. Rodway, 20.x.1934 (NSW); Manly, J. W. Audas, Sept. 1906 (MEL); Port Jackson, R. Brown, 1802-4 (MEL); Watsons Bay, Mossman 45 (BRI); Dobroyd Pt., Balgowlah, exposed sandstone headland, L. A. S. Johnson, 5.viii.1951 (NSW); Point Perpendicular, Jervis Bay, on exposed headland nr. sea, sandstone, E. F. Constable, 28.ii.1960 (NSW).

### 20b. subsp. *obovatus* (G. Don) P. G. Wilson, stat. nov.

*E. buxifolius* var. *obovatus* G. Don, Gen. Hist. 1:792 (1831).

Typification: No reference given or material cited for the variety *obovatus*; however the reference "Smith in Rees" is given for the species, and the description is a translation of that given by de Candolle for *E. buxifolius* var.  $\alpha$ . This is itself based on the description given by Smith, l.c., for the variety in which "the leaves are obovate, narrow at the base, bluntly crenate and glandular at the edges". It was collected by Dr. White near Port Jackson and can be considered to be the type. Type not seen.

*E. buxifolius* var.  $\alpha$ , de Candolle, Prod. 1:720 (1824). For typification see above.

Leaves obovate ca. 12 x 4 mm, sparsely hispidulous; apex rounded and mucronate; base narrow, cuneate, margin strongly verrucose-crenate; midrib indented above, very prominent and glandular verrucose below. Pedicel sparsely hispidulous.

DISTRIBUTION: New South Wales, east coast, near the north side of Broken Bay—Maps 13, 14.

NEW SOUTH WALES: Wondabyne, F. W. Blakely and D. W. C. Shiress, 10.vi.1923 (NSW); Calga, D. O. Cross, 28.viii.1945 (AD); Ulladulla, R. M. Cambage 4067 (NSW); S of Woy Woy, M. Foote, 19.ix.1952 (NSW); Frenchs Forest, Sandstone heath, M. Tindale, 7.x.1946 (NSW).

*E. buxifolius-E. scaber*

NEW SOUTH WALES: "New Holland", Banks and Solander, 1770 (MEL); National Park, E. F. Constable, 22.ix.1955 (NSW); Waterfall Road, J. J. Fletcher, 1.viii.1888 (NSW); Bulli, A. Morris, 25.ix.1927 (ADW); Huskisson, Jervis Bay, F. A. Rodway 1144-6 (NSW).

As lectotype of *E. buxifolius* I have chosen the unnamed variety described by Smith as having elliptical leaves; this corresponds to de Candolle's "var.  $\beta$ " and to G. Don's var. *ellipticus*, the description in each case being based on that given by Smith. In its typical form it is found from just south of Broken Bay to just south of Port Hacking. Around Jervis Bay a form occurs with longer leaves and flowers and with hispidulous pedicels.

To the north of Broken Bay *E. buxifolius* has narrower leaves and forms the subspecies *obovatus*. This subspecies appears to represent a cline between *E. buxifolius* subsp. *buxifolius* in the south and *E. hispidulous* in the north. The subsp. *obovatus* is therefore very variable and could equally well be considered as a subspecies of *E. hispidulous*, or the name of the plant could be expressed by a formula, e.g. "*E. buxifolius-E. hispidulus*". This latter alternative, although representing the situation involved, is unsatisfactory from the practical stand point, and in the field the plant evidently exhibits considerable constancy of morphological features over a wide area (fide L. A. S. Johnson in sched.).

Around Botany Bay and Port Hacking *E. buxifolius* grades into *E. scaber*, and at Jervis Bay into *E. scaber* subsp. *latifolius*, the form taken by the plant being dependent on the morphology of the parents and the degree of introgression. Considerable variability is therefore present in herbarium material.

*Eriostemon buxifolius* Sm. x *myoporoides* DC.

? *E. intermedius* Hort. ex W. J. Hooker, Bot. Mag. 75: tab. 4439 (1849); Marnock, Floricult. Mag. and Misc. Gard. 4: tab. 49.f.3 (Apr. 1840) (without an analysis or a description); Planchon, Fl. der Serres 5:t.443 (March 1849) (a copy of Bot. Mag. tab. 4439); Walpers, Ann. Bot. Syst. 2:249 (1851).

Typification: "from Robert Barclay, Esq., of Knotts Green, Leyton". Holotypus: K (photo seen).

*E. myoporoides* var. *minor* Bentham, Fl. Austral. 1:333 (1863), based on *E. intermedius* Hort., not as to specimens cited.

Hooker considered that *E. intermedius* might be a hybrid between *E. buxifolius* and *E. myoporoides*. The illustration appears to be that of a small-leaved, single-flowered form of the latter species; however the branchlets are described as being pubescent and this points to a hybrid origin as suggested by Hooker. I have seen no herbarium specimens from the wild which agree with both Hooker's illustration and description.

The hybrid *E. buxifolius* x *myoporoides* is reported by Beadle et al., Handb. Vasc. Pl. Syd. Dist. 320 (1963), to occur in the lower Hawkesbury area. I have not seen any herbarium material from that area which suggests a hybrid origin, but, since both *E. buxifolius* subsp. *obovatus* and *E. myoporoides* occur there, such hybrids could be expected.

The specimens cited by Bentham under "*E. myoporoides* var. *minor*" are referable either to *E. myoporoides* subsp. *leichhardtii* or to *E. myoporoides* subsp. *acutus*, q.v.

## 20. *Eriostemon hispidulus* Sieb. ex Spreng.

Sieber ex Sprengel, Syst. Veg. 4/2: 164 (1827) [*hispidulus*, diminutive of *hispidus*]; G. Don, Gen. Hist. 1:792 (1831); Bentham, Fl. Austral. 1:333 (1863); F. Muell., Fragm. 9:110 (1875); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Dixon, Pl. N.S.Wales 50 (1906); Hamilton, Proc. Linn. Soc. N.S.Wales 40:394 (1915); Maiden et Betche, Census 115 (1916); Beadle et al., Handb. Vasc. Pl. Syd. Distr. 320 (1963).

Typification: "Nov. Holl." Isotypes: K, MEL 4286 and 4534, all of Sieber 305.

Undershrub ca. 1 m high. Branchlets terete, slightly verrucose, hispidulous. Leaves sessile, narrow-obovate to subspatulate or narrow-obcuneate, 10–20 (35) mm long, 3–4 mm wide, smooth and hispidulous above, sparsely hispidulous below, apex obtuse to rounded, mucronate, margin glandular crenate, revolute, midrib slightly impressed above, very prominent and glandular-verrucose below. Flowers axillary, peduncle hispidulous, 1–5 (15) mm long, pedicel usually solitary (rarely two or three), 3–5 mm long, hispidulous with a whorl of 4 small deltoid bracteoles at base. Sepals broadly deltoid to semi-orbicular, ca. 1 mm long and wide, fleshy with thin margin, glabrous or sparsely hispidulous, ciliolate; petals broad-elliptic, ca. 6.5 mm long, white to pale pink, keel prominently glandular and sometimes sparsely hispidulous, petal otherwise glabrous; staminal filaments flat, narrow-oblong, abruptly slender-subulate above (more prominently in antisepalous stamens), ca. 2.5 mm long, margin ciliate, subulate portion sparsely long-pilose, anther broad-oblong, ca. 1 mm long, apex minutely biglandular and with a shortly attenuate white apiculum; disc narrow, smooth, slightly exceeding width of ovary; ovary narrow-pyramidal, glabrous, ca. 2 mm high, upper third sterile; style glabrous. Fruit and seed as in *E. myoporoides*.

Chromosome no.  $n = 14$ , from material collected at Springwood, fide Smith-White (1954).

DISTRIBUTION: New South Wales, near the east coast, from Cole Vale in the south, north through the Blue Mountains to the Mellong Range and Wisemans Ferry—Maps 13, 14.

NEW SOUTH WALES: Glenbrook, J. L. Boorman, Dec. 1917 (NSW); "Grose's Head", Blue Mts., R. Brown (MEL); Burragarang, R. H. Cambage 2315 (NSW); Lawson, J. M. Camfield, Oct. 1896 (NSW); Mellong Rd., 15–20 mi S of Putty, L. A. S. Johnson, 20.ix.1951 (NSW); Wisemans Ferry, A. Smith 11 (NSW).

### *E. hispidulus* x *myoporoides*

NEW SOUTH WALES: Tahmoor, C. Burgess, 2.vi.1962 (NSW); Lapstone Hill, "natural hybrid, several shrubs in association with the two species", C. Burgess, 25.x.1962 (CBG); Glenbrook, O. D. Evans, Sept. 1925 (SYD); Linden, A. A. Hamilton, Sept. 1914 (AD); Faulconbridge, A. A. Hamilton, Sept. 1914 (NSW).

This species is generally found further inland than are *E. buxifolius* and *E. scaber* which are more coastal in distribution. From Port Jackson to north of Broken Bay is found a plant which is intermediate between *E. hispidulus* and *E. buxifolius*; it is evidently part of a cline between the two species. However since it is morphologically fairly constant over a wide area I have included it under *E. buxifolius* as subsp. *obovatus*. In the Blue Mountains and at Tahmoor, where *E. hispidulus* and *E. myoporoides* grow together, hybrids have been collected; these appear to be fertile.

*E. pulchellus* Hort. ex Lemaire, Le Jardin Fleuriste 4: tab. 396 (1854); C. Mueller, Walpers Ann. Bot. Syst. 4:412 (1857).

Typification: "dans les serres de M. Auguste Van Geert, . . . un charmant *Eriostemon* qu'il avait recu d' Angleterre, comme un hybride, obtenu par une fécondation croisée." This plant, from the illustration and description, was evidently a hybrid with *E. hispidulus* as one of the parents.

## 22. *Eriostemon verrucosus* A. Rich.

A. Richard, Voyage de découvertes de L'Astrolabe pt. 2. Atlas tab. 26 (1833) (with analysis), Sertum Astrolabianum 74 (1834) [verruca = wart-like]; Hooker, J. Bot. Hooker 2:417 (1840); Walpers, Rep. Bot. Syst. 1:504 (1842); Hooker f., Fl. Tasm. 1:64 (1855); Hooker f., op. cit. 2:358 (1860); Mueller, Pl. Col. Vict. 1:123 (1862); Anon., Gard. Chron. III. 3: fig. 16 (1888); Curtis, St. Fl. Tasm. 103 (1956); Eichler, Suppl. Black's Fl. S. Austral. (1965) 206.

Typification: "Crescit in Nova-Hollandia loco dicto baie Morton." Morton Bay is in Queensland, however the plant illustrated must have come from Tasmania. Dumont D'Urville, commander of the corvette L'Astrolabe, visited Hobart in December 1827 when it could have been collected. Type not seen.

? *E. dolabratus* H. G. L. Reichenbach, Ic. Bot. Exot. Cent. 2:36 (1828).

Typification: "E Nova Hollandia". Type not seen.

*E. obcordatus* A. Cunn. ex Hook., J. Bot. Hooker 1:254 (1834); Hooker, Ic. Pl. 1:tab. 60 (1836); Walpers, Rep. Bot. Syst. 1:503 (1842).

Typification: "About Hobart Town—Mr. Cunningham, Mr. Lawrence, 1831, (n.153) Mr. Gunn, (n.14)." Syntype: K (Cunningham specimen no. 17, photo seen).

*E. obovatis* [non A. Cunn.] Benth., Fl. Austral. 1:334 (1863), p.pte.; F. Muell., Fragm. 9:110 (1875) excl. Leichhardt specimen; F. Muell., Nat. Pl. Vict. 1:72 (1879); F. Muell., Key Syst. Vict. Fl. 143 (1887); Tate, Handb. Fl. Extratrop. S. Austral. 24 (1890); Rodway, Tasm. Fl. 24 (1903); Black, Fl. S. Austral. 342 (1924); Ewart, Fl. Vict. 705 (1931); Black, op. cit. ed. 2:498 (1948).

Shrub 0.3–0.6 (3) m high. Branchlets terete, prominently glandular verrucose, glabrous. Leaves sessile, coriaceous, narrowly to broadly obcordate, 6 x 4 to 15 x 7 mm, entire,  $\pm$  flat to conduplicate, smooth above, glandular verrucose below, glabrous. Flowers axillary; peduncle 0.5–2 mm long, glabrous; pedicel solitary (rarely 2–3), 1–3 mm long, glabrous; bracteoles 4 at base of pedicel, deltoid, 0.5–1 mm long, often caducous. Sepals semi-orbicular 1 x 1–1.5 mm, fleshy with thin ciliate margins, otherwise glabrous; petals elliptic, ca. 6 mm long, white (pink in bud), glabrous; staminal filaments flattened, narrow-oblong, attenuate in upper third, ca. 3.5 mm long, sparsely woolly-ciliate; anther orbicular-cordate, ca. 1 mm long, apex biglandular and minutely white-apiculate; disc prominent, slightly broader than ovary; ovary pyramidal 1–1.5 mm high, glandular, glabrous, upper third sterile; style glabrous, stigma slightly spreading; cocci somewhat spreading, ca. 6 mm long, rounded above, apiculate; seed similar to that of *E. myoporoides*, ca. 4.5 mm long.

**DISTRIBUTION:** South Australia (northern Mt. Lofty Range), Victoria and Tasmania—Map 15.

**TASMANIA:** Fingal Ck., A. Simson 1162 (MEL); Swan Port, C. Stuart 694 (MEL); Mt. Amos, Freycinet Peninsula, M. E. Phillips, 31.i.1962 (AD).

**VICTORIA:** Between Hayfield and Seaton, Gippsland, W. Cane, 19.iii.1956 (MEL); Murderer's Hill, Dunolly, M. E. Phillips, 20.ix.1961 (AD); Spring Gully Reservoir, S of Bendigo T. B. Muir 2555 (MEL); Mt. Difficult Rd., Grampians, T. B. Muir 2603 (MEL).

**SOUTH AUSTRALIA:** Black Springs, J. W. Wilkinson, 12.x.1893 (ADW); Tothill Range, D. N. Kraehenbuehl 1091 (AD).

This species shows only slight morphological variation throughout its area of distribution. In Tasmania the leaves normally tend to be narrower than found on the Australian mainland. However on Freycinet Peninsula a plant with broad, imbricate leaves (to 12 x 9 mm) is found, considerably larger than in the mainland form.

*E. verrucosus* is normally a low bush although in Gippsland it is recorded as growing to a height of eight feet.

In the past this species has been confused with *E. obovatus*, a plant found only in the Blue Mountains. Its affinities lie, however, more with *E. myoporoides* as is shown by the stem, leaf, and inflorescence characters, and the similar anthers. I have not been able to trace any specimen seen by Reichenbach on which he could have based his species *E. dolabratus*. The H. G. L. Reichenbach collection in Dresden was partly destroyed in the revolution of 1848–1849, and the remainder, housed in the Institut für Botanik der Technischen Univer-



sitüt, was destroyed in the bombing of 1945. No relevant specimen could be found in the Naturhistorisches Museum, Wien, where the herbarium of Reichenbach filius is housed. The description given by Reichenbach continues on after that of "Philotheca Reichenbachiana Sieb." and is as follows:—

"Proximi generis nova species memorabilis videtur: *Eriostemon dolabratus*: foliis conduplicato-dolabriformibus externe verrucosis. Rchb. Folia interne laevis, externe verrucosis magnis contiguis obsita circiter 4. lin. longa, alabastra florum includentia, flores demum liberi, illis E. buxifolii simillima.—E Nova Hollandia."

The description of the leaf agrees well with that of *E. verrucosus* as do the brief details of the inflorescence. The country of origin "E Nova Hollandia", if referring to mainland Australia would at that time have been incorrect as Tasmania was the only place in which the plant had then been discovered. However this is probably of little significance as in the early 19th century locality references for Australian plants were extremely vague.

While I consider it probable that the names *E. verrucosus* and *E. dolabratus* apply to the same species I have retained the commonly accepted nomenclature rather than introduce an earlier name for which the identity cannot be substantiated.

At the time I was placing determinavit labels on herbarium material of this genus I thought it probable that the name *E. dolabratus* applied to the species commonly known as *E. scaber*. This I am now certain is incorrect and therefore all material determined by me before 1967 under the former name should be referred to *E. scaber* Paxton.

### 23. *Eriostemon obovalis* A. Cunn.

A. Cunn. in Field, Geogr. Mem. N.S.Wales 331 (1825) [ob = inversely, ovalis = egg-shaped referring to the leaf shape]; G. Don, Gen. Hist. 1:792 (1831); Endlicher, Enum. Pl. Huegel 15 (1837) "obovatum"; Bentham, Fl. Austral. 1:334 (1863) p.pte; F. v. Mueller, Fragm. 9:110 (1875) as to Leichhardt specimen cited; Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Dixon, Pl. N.S.Wales 50 (1906); Hamilton, Proc. Linn. Soc. N.S.Wales 40:314 (1915); Beadle et al., Handb. Vasc. Pl. Syd. Distr. 320 (1963).

Typification: "Verge of the Regent's Glen, Blue Mountains". Holotypus K (photo seen); isotypes: BRI 014176, MEL 4532, all labelled "Eriostemon obovale mss. Blue Mountains, New South Wales, A. Cunningham, No. 45 Oct. 1822"

Small shrub to 1m high. Branchlets terete, tomentulose, not or scarcely verrucose. Leaves shortly petiolate broadly cuneate-obcordate, ca. 7 x 4–6 mm, coriaceous, smooth above, slightly verruculose below, glabrous or with a slightly puberulous margin. Flowers axillary, solitary; peduncle absent; pedicel 2–3 mm long, becoming thicker upwards, glabrous, with six small bracteoles at base. Sepals broadly deltoid, 0.7–1 mm high, 1–1.4 wide, glabrous, minutely ciliolate; petals imbricate, elliptic, ca. 6 mm long, white tinged with pink, glabrous, midrib thickened; staminal filaments flattened, narrow-oblong, ca. 3.5 mm long,  $\pm$  pilose (especially on margin), abruptly narrowed in upper third; anther cordate, ca. 0.8 mm long, with a minute, white, glandular punctate apiculum; disc thin, slightly exceeding ovary in width; ovary 3 (4)-carpellary, hemispherical, to broad-pyramidal, glandular-punctate, smooth, ca. 1 mm high; carpels with a short, rounded, sterile apex; style very short, glabrous; stigma slightly wider than style. Cocci erect ca. 4.5 mm long with horizontal costae, terminating in a short, rounded, apiculum. Seed similar to that in *E. myoporoides*.

Chromosome no.  $n = 14$ , from material collected at Blackheath, fide Smith-White (1954).

DISTRIBUTION: Blue Mountains, New South Wales—Map 15.

NEW SOUTH WALES, Blue Mts: Blackheath, Betche, June 1883 (NSW); nr. Hartley Vale, W. F. Blakely, 7.vi.1921 (NSW); Wolgan Gap, B. G. Briggs, 13.xi.1960 (NSW); Mt. Wilson, L. A. S. Johnson, 22.ix.1949 (NSW).

*E. obovalis*, in seed characters, shows evident affinities with other members of the section *Erionema*. It is probably most closely related to *E. virgatus* which has a similar anther and ovary shape and also has a reduced number of carpels. It shows very little morphological variation and does not appear to intergrade with any other species.

For some time the species *E. obovalis* had been confused with *E. verrucosus* and its own identity lost. For this reason Mueller (1875) loc. cit., regarded a specimen collected by Leichhardt from the Blue Mountains as a pubescent variety of *E. obovalis*, whereas it was in fact the true species. It may be clearly distinguished from *E. verrucosus* by its smooth, pubescent branches and by the absence of a peduncle to its solitary flowers.

#### 24. *Eriostemon virgatus* Hook. f.

Hooker f., J. Bot. Hooker 2:417 (1840) [virgatus = twiggy]; Walpers, Rep. Bot. Syst. 1:504 (1842); Hooker f., Fl. Tasm. 1:64 (1855); Bentham, Fl. Austral. 1:332 (1863); F. Muell., Fragm. 9:111 (1875); Rodway, Tasm. Fl. 24 (1903); Curtis, Stud. Fl. Tasm. 103 (1956).

Typification: "Rocky Cape, Mr. Gunn (n.485, 1837)—New Holland, Mr. Cunningham." ["New Holland" was in error, the correct locality is Macquarie Harbour, Tasmania, fide Hooker f., Fl. Tasm. 1:65 (1855).] Lectotypus: Gunn no. 485 (1837), K (photo seen); iso. ? NSW. Syntypus: A. Cunningham, "rocky shores of Macquarie Harbour", K (photo seen).

Slender woody perennial. Young branchlets bluntly triangular, becoming terete, sparsely to densely verruculose, glabrous. Leaves sessile, narrow-obcuneate to oblong-elliptic or narrow-obovate, 10 x 2 mm to 20 x 4 mm, subcoriaceous, glabrous, obtuse to rounded or truncate, mucronulate, margin slightly glandular crenate and slightly recurved, upper surface glandular punctate, lower surface smooth to slightly glandular verruculose, midnerve somewhat prominent below. Flowers solitary in the axils of the terminal leaves, tetramerous; peduncle absent; pedicel slender, 4–6 mm long with 4 or more small basal bracteoles. Sepals  $\pm$  semiorbicular, ca. 1 mm high and wide, fleshy with thin ciliolate margin, glabrous; petals broad elliptic ca. 5.5 mm long, minutely and sparsely glandular, white or pale pink, glabrous; staminal filaments flattened, oblong-elliptic, ca. 3 mm long, ciliate and sparsely pilose near apex; anthers cordate, ca. 1 mm long, apiculum rounded, fleshy and minutely glandular-punctate; pollen orange; disc slightly exceeding and  $\pm$  continuous with ovary; ovary hemispherical, ca. 1 mm high, smooth, glabrous, carpels narrowed at apex to a short sterile apiculum. Cocci slightly spreading ca. 5 mm high, apex rounded to truncate, shortly rostrate. Seed similar to that in *E. myoporoides*, ca. 3 mm long.

DISTRIBUTION: Tasmania, near the coast—Map 33.

TASMANIA: Port Davey, J. Bufton, 1893 (MEL); nr. Remine, W. V. Fitzgerald, Nov. 1893 (NSW); Rocky Cape, R. Gunn 485 (NSW); Coles Bay, H. J. King, 16.ix.1961 (MEL); between Arthurs R. and Circular Head, F. Mueller, 1875 (MEL); Strahan, F. A. Rodway 1155 (NSW).

This species is different from all other members of the genus *Eriostemon* in having a consistently tetramerous flower. Its anther is also peculiar in the apiculum being fleshy and minutely gland-dotted. It shows closest affinities to *E. obovalis* which has similar anthers and has a reduced number of carpels.

#### 25. *Eriostemon trachyphyllus* F. Muell.

F. Muell., Trans. Phil. Soc. Vict. 1:99 (1855) [trachys = rough, phyllon = leaf]; F. Muell., Pl. Col. Vict. 1:121 (1862); Bentham, Fl. Austral. 1:332 (1863); F. v. Muell., Fragm. 9:110 (1875); F. Muell., Key Syst. Vict. Pl. 1:142 (1887); Stirling, Proc. Linn. Soc. N.S.Wales 11:1057 (1887); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Maiden et Betche, Proc. Linn. Soc. N.S.Wales 24:640 (1899); Dixon, Pl. N.S.Wales 50 (1906); Ewart, Fl. Vict. 706 (1931).

Typification: "On the mountains at the Snowy River, near the Pinch Range, on rocks." Holotypus: MEL 4531; iso.: K (photo seen).

Shrub or small tree 2-7 m high. Branchlets terete, verrucose, somewhat glaucous, glabrous. Leaves sessile, chartaceous, oblong-elliptic to elliptic or narrow-obovate, gradually narrowed at base, to 53 x 9 mm, flat with the margin slightly recurved, rugulose, due to small verrucosities, glabrous, midrib slightly prominent below, apex acute to rounded, mucronulate. Flowers axillary, solitary or in clusters of 3; peduncle absent; pedicels slender, 6-12 mm long (slightly longer in fruit), glandular, glabrous, with several small, deltoid, basal bracteoles. Sepals broadly deltoid, ca. 1 mm high and wide, fleshy and glandular with a thin margin, glabrous, ciliolate; petals elliptic, 6-7 mm long, glabrous, glandular along rib but without a prominent keel; staminal filaments flattened, linear, gradually attenuate in upper-half, 3-5.5 mm long, pilose; anther cordate, ca. 1 mm long, apex with a subterminal gland and a minute, blunt, white apiculum; disc thin, continuous with and slightly exceeding ovary; ovary hemispherical, 1-1.5 mm high, glabrous, smooth (slightly costate in centre of and between carpels), apex rounded; carpels united at base and also along their outer margin by a thin layer of pericarp, free at summit and along radial walls, terminal third solid but not apiculate; style glabrous with the stigma  $\pm$  equal in width. Capsule at first somewhat spherical, ca. 5 mm high, the cocci later splitting apart and slightly spreading, not apiculate. Seed similar to that in *E. myoporoides*, ca. 3 mm long.

DISTRIBUTION: South-east Victoria and near the east coast of New South Wales as far north as Singleton—Map 3.

NEW SOUTH WALES: Eden, W. A. W. de Beuzeville 24 (NSW); Araluen, "tall frutescent plants of 8-12 ft. growing in rich rocky soil on the banks of creeks in the mts.", J. L. Boorman, Nov. 1911 (NSW); Darley Ck., S. of Singleton, C. Burgess, 13.vii.1960 (CBG); Evans Crown, Tarana, H. S. McKee 7041 (CANB).

VICTORIA: Omeo, J. J. Fletcher (NSW); Tambo R., nr. Bruthen, E. Gauba, 19.xi.1954 (CBG); Mt. Tingiringi, on geodetic border with New South Wales, far east Gippsland, alt.  $\pm$  4,000 ft., very wide-spreading bushes about 8 ft. high, J. H. Willis, 30.xi.1962 (MEL).

This species is almost constant in its morphology throughout its geographical range. Slight differences in leaf shape or number of flowers in axils are unrelated to distribution and vary on the same plant. It shows evident affinities to *E. myoporoides* in leaf and stem characters and in absence of indumentum, but differs from all other *Eriostemon* species in having partially united carpels and in their rounded (not apiculate) apices. The pedicel arrangement is peculiar to this species; normally 3 buds form in each leaf axil: these may all develop into flowers, or one bud (normally the central one) may be vegetative. In this case it is possible to have, in the same leaf axil, a branch with a flower on either side.

#### Seccio 4. *Osmanthos* P. G. Wilson sectio nova

[osme = fragrance, anthos = flower]

Ramuli glauci vel stellato-puberuli; folia parva, glabra vel stellato-puberula, exstipulata, Flores solitarii, axillares; pedicellus sessilis, bracteolis imbricatis, late ovatis; stamina incurva, applanata, anthera minute albo-apiculata. Cocci  $\pm$  erecti, breviter rostrati. Semen rugulosum; hilum lineare, superficiale.

Type: *E. brucei* F. Muell.

Branches glaucous or stellate-puberulous; leaves small, glabrous or stellate-puberulous, exstipulate. Flowers solitary, axillary; pedicel sessile with several imbricate, broadly ovate bracteoles near the base; sepals imbricate, suborbicular; stamens incurved, anthers minutely white-apiculate; cocci  $\pm$  erect, shortly rostrate. Seed thick,  $\pm$  narrow-reniform; aril a narrow, fleshy cord along adaxial face; outer testa thin, sclerotesta verrucose; hilum linear, superficial; raphe basal, fleshy, surrounded by outer testa and partly (at chalazal end) also by a thin smooth crustaceous layer; chalaza basal.

One species, found in Western Australia.

This section has some of the characters of sect. *Eriostemon*, e.g. stellate indumentum and imbricate bracteoles, but differs markedly in seed and ovary morphology. It is also superficially similar to sect. *Erionema* in which section it was originally included by F. Mueller, but apart from the characters noted above it differs also in the anthers which in sect. *Erionema* are glandular beneath the white apiculum.

## 26. *Eriostemon brucei* F. Muell.

F. Muell., *Fragm.* 7:38 (1869) [Named in honour of Lt. Col. John Bruce]; Engler, *Nat. Pflanzenfam.* 4:139 (1896); Diels et Pritzel, *Bot. Jahrb.* 35:320. fig. P-F (1904); Engler, *Nat. Pflanzenfam.* ed. 2. 19a: 258 fig. 113 P-F (1931); Gardner, *Enum. Pl. Austral. Occ.* 69 (1931). Typification: "In vicinia lacus Barleei; J. Forrest." Holotypus: MEL 4533.

Undershrub to 2 m high. Branchlets erect closely glandular verrucose. Leaves sessile, (obovoid ca. 2 mm long, minutely stellate to) slender-terete, acute, to 16 mm long, recurved towards apex, canaliculate to concave above, rounded below, glandular verrucose, glabrous, glaucous, (to narrow oblong, 18 mm long smooth and concave above rounded and verrucose below, densely stellate-puberulous). Pedicel 0.5-4 mm long, glabrous to stellate-tomentose. Sepals ca. 1 mm long, fleshy, glabrous, with scarious, ciliate margins; petals broadly ovate, ca. 4.5 mm long, white to pink, glabrous; staminal filaments flattened, narrow-oblong, gradually to abruptly attenuate towards apex, 1.5-3 mm long, subglabrous to pilose and woolly ciliate; anthers suborbicular, 0.6-1 mm long, disc thick, fleshy, much broader than base of ovary, pale mauve; ovary pyramidal, ca. 1 mm high, glabrous or sparsely pilose at the short sterile tip; style glabrous, ca. 0.5 mm long, stigma lobes slightly spreading. Cocci, oblong, ca. 6 mm long, almost smooth, shortly divaricate-rostrate; funicle forming a linear attachment to seed along adaxial margin (aril), which becomes fleshy near attachment to raphe. Seed thick ca. 4.5 mm long.

1. Leaves sub-terete to narrow-oblong, 5-18 mm long.
2. Leaves sub-terete, glabrous (at least when mature) 26a. subsp. *brucei*
2. Leaves oblong, concave above, densely stellate-tomentose 26c. subsp. *cinereus*
1. Leaves sub-orbicular (sometimes caducous) to 1.5 mm long, densely stellate-tomentose 26b. subsp. *brevifolius*

### 26a. subsp. *brucei*

Leaves sub-terete, acute, 5-18 mm long, glabrous.

DISTRIBUTION: Western Australia, between lat. 27° and 31° S. from about 50 to 500 mi east of the west coast—Map 16.

WESTERN AUSTRALIA: N of Bullabulling, Sandheath, J. S. Beard 3315 (KINGS PARK); 15 mi W of Coolgardie: B. G. Briggs 29.ix.1960 (NSW); Menzies, W. D. Campbell Aug. 1899 (PERTH); nr. Lake Barlee, J. Forrest 1869 (MEL); Mt. Singleton, C. A. Gardner 12138 (PERTH); Gibraltar, A. S. George 2698 (PERTH); 54 mi N of Mullewa, J. W. Green 1570 (PERTH).

### 26b. subsp. *brevifolius* P. G. Wilson, subsp. nov.

[brevis = short, folium = leaf]

*E. brucei* var. *aphyllus* Blackall, nom. invalid. How to know W. Austral. Wildfl. 258 (1954), without a latin diagnosis or citation of type.

Ramuli et folia dense stellato-puberuli; folia interdum caduca, late elliptica vel suborbiculata usque ad 1.5 mm longa et lata, supra concava. Flores brevissime pedicellati, gemmis palido-purpureis.

Holotypus: J. W. Green 1618, 34 mi E of Mt. Magnet, "erect shrub 50 cm high, flowers bluish-white", 27.viii.1957 (PERTH).

Stem and leaves densely stellate-puberulous; leaves broadly elliptic to suborbicular, to 1.5 mm long and wide, concave above, sometimes caducous. Flowers very shortly pedicellate, corolla mauve in bud.

DISTRIBUTION: Western Australia, Paynes Find to Sandstone, western Eremaean province—Map 16.

WESTERN AUSTRALIA: 20 mi W of Paynes Find, T. E. H. Aplin 2558 (PERTH); Sandstone, C. A. Gardner, 23.vii.1927 (PERTH); 34 mi E of Mt. Magnet, J. W. Green 1618 (PERTH).

26c. subsp. *cinereus* P. G. Wilson, subsp. nov.

[*cinereus* = ashy]

Ramuli, folia, et pedicelli dense stellato-tomentosi. Folia oblonga, ca. 15 x 2 mm, supra profunde concava. Pedicellus 1-3 mm longus. Gemmae florales pallido-purpureae.

Holotypus: S. J. J. Davies, 2.vi.1961, Ejah, between Mileura and Nookawarra Stations, ca. 360 km NE of Geraldton, Western Australia (PERTH).

Branchlets, leaves, and pedicels densely stellate-tomentose. Leaves oblong, ca. 15 x 2 mm, deeply concave above. Pedicel 1-3 mm long. Sepals mauve, petals mauve in bud, white at anthesis (in dried state).

DISTRIBUTION: Western Australia, upper Murchison R. area—Map 16.

WESTERN AUSTRALIA: Ejah, Mileura Station, top of breakaways shrub 2 ft. flowers mauve with lavender smell, S. J. J. Davies, 18.vi.1965 (PERTH), Bebele Stn., J. Elkington 343 (PERTH).

The type subspecies is fairly uniform in appearance although there is some variation in the amount of indumentum on stem and leaves. These range from being completely glabrous to densely puberulous (on the young plants); the leaves tend to be slender, acute, and curved at the tip in the glabrous form, while in the puberulous plant they are thicker and obtuse. The length of pedicel and the degree of pilosity of the staminal filaments also varies, both the longer pedicel and the greater pilosity being found in the forms with more glabrous stems.

*E. brucei* subsp. *brevifolius* occurs within the geographical distribution of the type subspecies. This region has not been thoroughly investigated botanically and further collecting may indicate intergradation between the two; of this there is no suggestion in the herbarium material I have examined.

The subspecies *cinereus* is interesting in that it combines the densely stellate indumentum of subsp. *brevifolius* with the leaf size (but not shape) of the type subspecies. The only collections I have seen of it are from over 100 miles north of any locality record for the other subspecies and were made on lateritic breakaways that are scattered through this part of the State. The plant may therefore be expected to occur locally over a considerable area of this botanically little known region of Western Australia.

#### Sectio 5. *Corynonema* P. G. Wilson sectio nova

[*coryne* = club, *nema* = thread]

Ramuli in sulcis angustis pilosuli, folia teretia vel linearia. Flores axillares vel terminales, solitarii; pedicellus sessilis; petala intra minute papillosa, cetera glabra; filamenta staminalia sparse pilosa, crassa, apice abrupte apiculato; anthera minute albo-apiculata. Cocci divaricati, breviter rostrati. Semina subtiliter longitudinaliter striata; endocarpus-placentae subcoriaceae, persistens; hilum lineare, breve.

Type: *E. pungens* Lindl.

Branchlets pilulose in furrows between leaf-decurrencies. Leaves exstipulate, linear or terete. Flowers solitary, axillary or terminal; pedicel sessile, minutely bracteolate at base. Sepals free, imbricate; petals minutely papillose within, glabrous; staminal filaments erect or inflexed, thick, abruptly

apiculate at apex, glabrous or pilose; anthers minutely white-apiculate. Cocci divaricate, shortly rostrate. Seed somewhat reniform, plump, 2-4 mm long, with the attached (placental) endocarp sub-coriaceous and persistent; testa black, longitudinally striate, not easily separable into two layers, sclerotesta dominant; hilum short, narrow-oblong in centre of adaxial face; aril absent; raphe fleshy, passing from hilum to seed-base and covered with a glossy crustaceous layer; chalaza sub-basal towards adaxial margin (seed of *E. pinoides* not known).

Three species, two from Western Australia, one from South Australia and Victoria.

The three species included in this section show morphological diversity in several characters but they have a general similarity to each other which is greater than that to species in any other section.

The two species *E. fitzgeraldii* and *E. pungens* have both at one time been included in the genus *Phebalium*, the former on account of its glabrous filaments (and apparently non-apiculate anthers), and the latter because of its valvate petals. It is apparent that single characters are not sufficient to assign species to genera and certainly the character of valvate petals in *E. pungens* must have arisen quite independently to that found in *Phelalium* sect. *Leionema* as the two sections have otherwise no close morphological similarity. Chromosome counts for the three species are unknown.

## 27. *Eriostemon pinoides* P. G. Wilson, sp. nov.

[Pinus, the pine, oides = like]

Fruticulus: ramuli cum sulcis puberulis inter sulcos verrucosi et glabri. Folia acicularia, ca. 1 cm longa. leviter torta, levia, glabra, subtus  $\pm$  rotundata vel triangularia, supra canaliculata. Flores 1-3, terminales; pedicellus 4-7 mm longus, basi minute bracteolata; sepala imbricata, late obtuso-deltaidea, usque ad 1.5 mm longa, carnosae, glabra; petala obovata ca. 6.5 mm longa atro-rubra, glabra; filamenta petalina dimidio inferiore ovata, superiore tereti, ca. 3.3 mm longa; filamenta sepalina dimidio inferiore applanata, dimidio superiore crassiusculo, cum duobus cavis lateralibus profundis, ca. 4.5 mm longa; anthera late oblonga, ca. 1 mm longa, minute apiculata.

Holotypus: C. A. Gardner 9408, Summit of Mt. Peron, Western Australia, 26.viii.1949 (PERTH).

Small undershrub 0.3-0.6 m high. Branchlets minutely glandular verrucose in strongly demarcated glabrous leaf decurrencies, puberulous in the intermediate sunken strips. Leaves shortly petiolate; lamina acicular, somewhat pungent, ca. 1 cm long, slightly twisted, smooth, glabrous,  $\pm$  rounded to triangular below, canaliculate above. Flowers 1-3, terminal; pedicel 4-7 mm long, glabrous. Sepals broadly and obtusely deltoid, to 1.5 mm long, fleshy, glabrous; petals imbricate, obovate, ca. 6 mm long, dark red; staminal filaments dissimilar, the antipetalous ovate below and  $\pm$  terete above, ca. 3.3 mm long, sparsely pilosulose and abruptly apiculate, the antisepalous flattened below, becoming thicker above with two deep lateral concavities and a ventral medial ridge, ca. 4.5 mm long, pilose above; antipetalous anthers broadly oblong, ca. 1 mm long, antisepalous deltoid, pollen pale yellow; disc very thin and confluent with ovary; ovary bluntly pyramidal ca. 2 mm high, carpels rugulose on back, narrowed into a smooth, sterile apex; style slender, glabrous  $\pm$  equal to stamens; stigma small, no wider than style. Fruit and seed not seen.

DISTRIBUTION: Western Australia; west coast, between Coorow and the Hill River—Map 6.

WESTERN AUSTRALIA: 21 mi W of Winchester on Eneabba road, A. C. Beaglehole 12121 (Beaglehole herb.); Lateritic hill South of Hill River, C. A. Gardner 7058 (PERTH); 25 mi SW of Three Springs, gravel, K. Newbey 2273 (PERTH).

This species is unique in the genus *Eriostemon* both in the form of the staminal filaments and in the colour of the petals. Its relationship to *P. pungens* and *P. fitzgeraldii* is suggested by the stem and leaf morphology and by the staminal characters. Unfortunately the seed, which might help more in this regard, is unknown.

#### 28. *Eriostemon pungens* Lindl.

Lindley in Mitchell, Three Exped. E. Austral. 2:156 (1838) [*pungens* = pungent]; Walpers, Rep. Bot. Syst. 2:823 (1843); F. Muell., Pl. Col. Vict. 1:125 (1862); F. Muell., Fragm. 9:110 (1875); F. Muell., Nat. Pl. Vict. 1:72 (1879); Tate, Handb. Fl. Extratr. S. Austral. 24 (1890); Moore et Betche, Handb. Fl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1906).

Typification: "On its summit [i.e. Mt. Hope] we found also a remarkable new species of *Eriostemon*, forming a scrubby, spiny bush, with much the appearance of a *Leptospermum*". Leg. T. L. Mitchell, Mt. Hope, Northern Victoria, 28.vi.1836. Holotypus: CGE, Mitchell No. 202 (photo seen CANB); iso.: MEL 4902.

*Phelalium pungens* (Lindley) Bentham, Fl. Austral. 1:338 (1863); Black, Fl. S. Austral. 342 (1924); Ewart, Fl. Vict. 707 (1931); Black, op. cit. ed. 2:498 (1948).

Undershrub to ca. 60 cm high. Branchlets with strongly marked  $\pm$  glabrous leaf decurrencies, intermediate strips puberulous or scabridulous. Leaves shortly petiolate; lamina acicular, pungent, 8–12 (25) mm long, glabrous or scabridulous, minutely glandular, upper surface flat, smooth, lower surface with very prominent midrib. Flowers axillary, present for some length along the branchlets, normally solitary; pedicel 3–5 mm long, glabrous, with several basal, lanceolate bracteoles ca. 1 mm long. Sepals broadly ovate, ca. 0.8 mm long, fleshy, glabrous, ciliolate, with rounded apex; petals valvate, ovate, ca. 4 mm long, fleshy, without midrib or obvious venation, white (pink at tips outside), tip inflexed; staminal filaments thick, flattened towards base (anti-sepalous becoming  $\pm$  terete above), apex rounded and abruptly apiculate, glandular punctulate and sometimes with glandular hairs at summit, sparsely ciliolate towards base; anther dark-red,  $\pm$  square, ca. 1 mm long with a short, rounded apiculum, pollen yellow; disc prominent, smooth, dark green, wider than ovary; ovary obtusely pyramidal ca. 1 mm high; carpels smooth, glabrous, the upper third rounded, sterile, and demarcated from rest; style glabrous lengthening during anthesis; stigma slightly broader than style. Cocci strongly divaricate and  $\pm$  horizontal, 4–6 mm long, apiculate, usually only 1 or 2 maturing, seed narrowly reniform, 2.5–4 mm long; sclerotesta of two layers, the outer with coarse and fine longitudinal corrugations, the inner smooth; attached endocarp coriaceous, rugose.

DISTRIBUTION: South Australia, southern section; Victoria, western and central region—Map 2.

VICTORIA: 22 mi N of Serviceton North, J. Ackland 49 (AD); Mt. Abrupt and Mt. Sturgeon, F.v.Mueller, Nov. 1853 (MEL); Hopetown, M. B. Williamson 580 (MEL).

SOUTH AUSTRALIA: Streaky Bay to Talia, Eyre Peninsula, J. B. Cleland, 23.ix.1957 (AD); Daniell, Lower Yorke Peninsula, E. D. Carter, 31.x.1960 (ADW); Horsnells Gully, Mount Lofty Range, J. B. Cleland, 11.x.1943 (AD); Western Flat to Bordertown, D. Hunt 304 (AD).

In having valvate petals this species resembles those in the section *Leionema* of *Phelalium*. However, in all other characters, stem, leaf, floral and seed, it is quite distinct and is best placed with *E. fitzgeraldii* and *E. pinoides* which have similar stamens and fruit. I have not been able to compare the seed of this species with *E. pinoides*; however it is similar to that of *E. fitzgeraldii*. *E. pungens* and *E. fitzgeraldii* both have glandular hairs on the staminal filaments which are thick at their apex. The petals of both are fleshy with strongly inflexed tips, and in both the cocci are divaricate.

#### 29. *Eriostemon fitzgeraldii* C. R. P. Andr.

C. R. P. Andrews, J. W. Austral. Nat. Hist. Soc. no. 1:37 (May 1904) [Named after W. V. Fitzgerald]; Gardner, Enum. Pl. Austral. Occ. 69 (1931).

Typification: "I found this species in flower on sand plains north of Esperance in October 1903." Holotypus: PERTH; iso.: NSW 69246.

*E. apricus* Diels in Diels et Pritzel, Bot. Jahrb. 35:321 (6.x.1904); Gardner, l.c.  
Typification: " Hab. in distr. Coolgardie pr. Gilmores . . . (D.5267)." Isotypus: PERTH.

*Phebalium apricum* (Diels) Ewart et Rees, Proc. Roy. Soc. Vict. ser. 2. 25:111 (1912).

*E. gibbosus* Luehmann ex Ewart, Proc. Roy. Soc. Vict. ser. 2. 20:79 (1907).  
Typification: " Norseman, W. A., J. Batt. 1897." Holotypus: MEL 4719.

Small compact undershrub 30–60 cm high. Young branchlets with strongly demarcated, glabrous, verrucose leaf decurrencies, minutely puberulous in the narrow, sunken, intermediate strips which become corky with age. Leaves shortly petiolate; lamina semiterete, 3.5–5 x 1 mm, glabrous, rounded and verrucose below, flattened, smooth, and sometimes channelled above, apex obtuse to be rounded. Flowers terminal or axillary, solitary; pedicels 1–2 mm long, glabrous, bracteoles ca. 6, basal, triangular, ca. 0.5 mm long, glabrous. Sepals obtusely deltoid, ca. 1 mm long, coriaceous, glabrous, ciliate; petals thick, slightly imbricate, ovate, ca. 4 mm long, without obvious venation or midrib, white, apex inflexed; staminal filaments erect, contiguous, fleshy, angular terete, ca. 2 mm long, becoming thicker towards apex, truncate and shortly apiculate just below the anther, sparsely glandular punctate, glabrous or with a few terminal glandular hairs; anther  $\pm$  square, ca. 0.5 mm long, very minutely white-apiculate; disc extending slightly beyond base of carpels and not confluent with them; ovary bluntly pyramidal ca. 1 mm high; carpels with the upper third narrowed into a rounded sterile apex, glabrous; style thick  $\pm$  equal to stamens, glabrous, broadened at apex into a flat, slightly lobed stigma. Cocci strongly divaricate, ellipsoidal, ca. 3.5 mm long, apiculate. Seed narrowly reniform, ca. 2 mm long; testa with one layer only apparent (the sclerotesta), longitudinally striate; attached endocarp smooth, somewhat coriaceous.

DISTRIBUTION: Western Australia; between Esperance and Norseman—Map 9.

WESTERN AUSTRALIA: 20 mi N of Salmon Gums, W. E. Blackall 994 (PERTH); On sandy ridges between Eyres Relief sand hummocks and the Bank, Maxwell (MEL); 40 km W of Daniell, P. Wilson 3167 (AD).

This species is peculiar in having glabrous petals and thick, glabrous, staminal filaments which differ from those found in *Phebalium* in their shape and in their erect, not spreading, habit. In these characters, and in the fruit and seed, it comes morphologically closest to *E. pungens*. The latter species has valvate petals; in *E. fitzgeraldii* they are slightly imbricate.

## Sectio 6. *Cyanochlamys* (Bartl. ex F. Muell.) F. Muell.

F. Muell., Fragm. 9:110 (1875).

*Eriostemon* subgen. *Cyanochlamys* Bartl. ex F. Muell., Pl. Indig. Col. Vict. 1:119 (1862) [cyanos = dark blue, chlamys = mantle].

*Cyanochlamys* Bartling in Lehmann, Pl. Preiss. 1:171 (1845), nomen provisorium.

Branchlets with stellate hairs. Inflorescence a terminal cluster or raceme; pedicel with (or without) a pair of basal bracteoles. Petals imbricate, thin, glabrous; staminal filaments flattened, pilose; anther white-apiculate; disc a narrow ring around base of ovary. Cocci erect, apiculate or shortly rostrate. Seed sub-reniform, abaxial margin convex, adaxial margin straight; attached (placental) endocarp thin, white, caducous; aril slender, linear, along adaxial face, firmly attached to placental-endocarp and easily separated from seed; outer testa membranous; sclerotesta smooth; hilum superficial, linear; raphe small, sub-basal, covered by only a thin integument; chalaza near base of adaxial margin and visible through raphe.



Type: *E. spicatus* A. Rich.

Two species, both from Western Australia.

The seeds of *E. nodiflorus* and *E. spicatus* are almost identical and support other morphological characters in suggesting a close link between these two species and a clear separation from other sections in the genus.

### 30. *Eriostemon spicatus* A. Rich.

A. Richard, Voyage de découvertes de L' Astrolabe pt. 2. Atlas t.27 (1833), Sertum Astrolabianum 76 (1834) [spicatus = spicate]; Walpers, Rep. Bot. Syst. 1:504 (1842); Bartling in Lehmann, Pl. Preiss. 1:171 (1844-45); Bentham, Fl. Austral. 1:336 (1863); F. Muell., Fragm. 9:110 (1875); Engler, Pflanzenfam. 3/4: 139 (1896); Diels et Pritzel, Bot. Jahrb. 35:322 (1904); Engler, Pflanzenfam., ed. 2. 19a: 258 (1931); Gardner, Enum. Pl. Austral. Occ. 70 (1931); Gardner, W. Austral. Wild. Fl. ed. 8. t.69 (1951); Gardner, Wildfl. W. Austral. tab. p.80 (1959).

Typification: "Crescit in Nova-Hollandia". Type not seen.

*E. racemosus* Endl. in Endl. et al., Enum. Pl. Huegel 15 (1837); Walpers, Rep. Bot. Syst. 1:504 (1842).

Typification: "Swan-River (Huegel)". Type not seen.

*E. ebracteatus* Endl., l.c.; Walpers, l.c. "ebracteatum".

Typification: "King George's Sound (Huegel)". Type not seen.

*E. effusum* Turczaninow, Bull. Soc. Nat. Mosc. 22/2:14 (1849); Walpers, Ann. Bot. Syst. 2:248 (1852).

Typification: "Nova Hollandia occidentalis. Gilbert Coll. n. 94". Holotypus KW (photo seen).

Slender, erect, woody perennial, 30–60 cm high. Branchlets smooth sparsely stellate-lanate or glabrous. Leaves sessile, linear to narrow-elliptic, 6–20 mm long, acute, concave above, glandular punctate, sparsely lanate to glabrous. Inflorescence a terminal simple raceme to 15 cm (or more) long, sparsely (to densely) lanate; bracts broad-elliptic ca. 4 mm long, sparsely lanate, caducous; pedicel slender, ca. 7 mm long, very minutely bibracteolate at base (or these absent). Sepals free, imbricate, deltoid, ca. 1.5 mm long, glandular, sparsely woolly, ciliate; petals broad elliptic, ca. 4.5 mm long, white to pink, pale mauve, or blue, glabrous (or rarely sparsely woolly along midrib outside); staminal filaments, linear-attenuate 2–2.5 mm long, glandular on outer side near summit; anthers suborbicular, ca. 0.8 mm long, pollen orange; ovary hemispherical ca. 1 mm high, glabrous, carpels compact with bifid sterile apices; cocci ca. 3 mm high, apex obtuse and bidentate; seed sub-reniform, ca. 2 mm long.

Chromosome no.  $n = 28$ , from material collected at Kings Park, Perth, fide Smith-White (1954).

DISTRIBUTION: Western Australia, near the south-west coast as far north as the Hill River—Map 8.

WESTERN AUSTRALIA: Geraldton, A. H. S. Lucas, July 1928 (NSW); Cockleshell Gully, nr. Mt. Lesueur, W. E. Blackall 3576 (PERTH); Swan R. nr. Perth, Preiss 2021 (MEL); Yarloop, Hj. Eichler 16143 (AD); Cape Naturaliste, B. G. Briggs, 14.x.1960 (NSW).

This species shows only slight variation throughout its geographical range. Collections from the northern limits of distribution tend to have broader leaves than those from the south and some flowers show slight stellate-woolliness on the outside of the petals (along the midrib, not towards the margins as in other species). This latter character also occurs sporadically in the southern specimens.

### 31. *Eriostemon nodiflorus* Lindl.

Lindley, Edwards' Bot. Reg. App. xvii (1839) [nodus = a node, florus = flowered]; Walpers, Rep. Bot. Syst. 1:504 (1842); Bartling in Lehmann, Pl. Preiss. 1:171 (1844-45); Bentham, Fl. Austral. 1:336 (1863); F. Muell., Fragm. 9:110 (1875); Engler, Pflanzenfam. 3/4:139 (1896); Engler, op.cit. ed. 2. 19a:258 (1931); Gardner, Enum. Pl. Austral. Occ. 70 (1931).

Typification: From Swan River Colony. Holotypus: CGE (photo seen CANB) "Swan River, Drummond, 1839".

*E. calycinus* Turcz., Bull. Soc. Nat. Mosc. 22/2:14 (1849).

Typification: "Nova Hollandia. Drum. IV. n. 93". Holotypus: KW (photo seen); iso.: NSW 69247, MEL 3934, K (photo seen).

Undershrub; branches erect, smooth, sparsely stellate-sericeous when young. Leaves sessile, slender and semiterete, 7-15 mm long, glabrous or sparsely pilose when young, acute to obtuse,  $\pm$  concave above, rounded below, glandular-punctate. Flowers in compact terminal heads 1-3 cm diam. Bracts foliar and herbaceous, or scarious, suborbicular and ca. 2 mm long; pedicel 2-4 mm long, stellate-pilose; bracteoles 2, basal, naviculiform, 2-4 mm long, scarious, stellate-pilose; sepals free, imbricate, narrow deltoid to linear-lanceolate, acute, 2-4 mm long, stellate-pilose; petals broad-elliptic to broad-obovoid, 5-6.5 mm long, thin, glabrous, blue to pink, apex slightly thickened and sometimes cucullate; staminal filaments linear-attenuate, 4-5 mm long; anther suborbicular, minutely white-apiculate, ca. 1 mm long, pollen pale orange; ovary pyramidal, 1-1.5 mm high with a short, sterile, apical portion, stellate-pilose along axial margin otherwise glabrous; style short, glabrous; stigma  $\pm$  truncate, slightly wider than style. Cocci shortly rostrate, in all to ca. 3 mm long. Seed subreniform, ca. 2 mm long.

Flowerheads 2-3 cm diam.; sepals linear-lanceolate, 3-4 mm long, sparsely pilose or glabrous

**31a. subsp. nodiflorus**

Flowerheads 1-1.5 cm diam.; sepals narrow-deltoid, ca. 2 mm long, stellate pilose

**31b. subsp. lasiocalyx**

### **31a. subsp. nodiflorus**

*E. nodiflorus* var. *subglabriflorus* Domin, Mém. Soc. Sci. Bohême 2:54 (1923). Type not indicated.

Flowers in terminal heads which often become lateral due to the continued growth of the branchlet, 2-3 cm diameter. Pedicels (1.5) 2-4 mm long. Sepals either linear-lanceolate, ca. 4 mm long and sparsely stellate-pilose, or narrow-deltoid, ca. 3 mm long and glabrescent; petals 6-6.5 mm long, blue to pink; carpels almost glabrous.

DISTRIBUTION: Western Australia, Darling Range—Map 17.

WESTERN AUSTRALIA: 70 mi N of Perth on Geraldton road, A. Ashby 459 (AD); Lyndhurst, Wagin, C. A. Gardner 6493 (PERTH); Toodyay to Bindoon, C. A. Gardner 8707 (PERTH).

### **31b. subsp. lasiocalyx** (Domin) P. G. Wilson, stat. nov.

*E. nodiflorus* var. *lasiocalyx* Domin, l.c. [lasios = woolly].

Typification: "Cranbrook to Warrungup, sandy plains; Mt. Toolbrunup, A. A. Dorrien-Smith." Holotypus: K (not seen).

Flowers in compact terminal heads 1-1.5 cm diameter. Pedicels very short, 1-2 mm long. Sepals narrow-deltoid ca. 2 mm long, stellate-pilose; petals ca. 5 mm long, blue; carpels densely stellate-pilose on adaxial margin.

DISTRIBUTION: Western Australia; near the south coast—Map 17.

WESTERN AUSTRALIA: Mt. Toolbrunup, Stirling Range, T. E. H. Aplin 2051 (PERTH); West Mt. Barren, C. A. Gardner, Sept. 1939 (PERTH); 12 km N of Albany, R. Hill 1460 (AD); nr. Cape Arid, Maxwell 1875 (MEL); Manjimup, R. D. Royce 2362 (PERTH); Cape Naturaliste, J. C. Wiburud, Sept., 1904 (NSW).

*E. nodiflorus* was described from material collected by Drummond in 1839 probably from near the Swan River. The photograph of the holotype shows the plant to have large flowerheads through which the branches have grown. The specimens from the Swan River area which I have seen correspond to this photograph in habit and have much larger and longer pedicellate flowers than those from further south or south-east; they also have a less pilose calyx and an almost glabrous ovary. Bentham (1863) commented on the variation in flower size but considered the extremes to be connected by intermediates. Domin (1923) also noted the variation and described two varieties, the one

(var. *lasiocalyx*) based on material from the Stirling Range area, and the other (var. *subglabriflorus*) without citation of specimens, but which from the description is the same as the type subspecies.

I have included within the type subspecies two forms between which there is no indication of intergradation from the few collections I have seen. The type form has large flower-heads (2–3 cm diam.) with narrow-lanceolate, sparsely pilose sepals (ca. 4 mm long); the other form, on which the name *E. calycina* was based, has smaller flower heads (ca. 2 cm diameter) with glabrous or subglabrous sepals (ca. 3 mm long). Both have flowers which are mostly pink in the dried state. The type form has been collected in recent years from near Toodyay on the Swan River and also from about 120 km north of Perth; the only recent collections of the glabrous form I have seen come from near Wagin. All these localities are north of the known occurrence of *E. nodiflorus* subsp. *lasiocalyx*.

### Sectio 7. *Gymnanthos* P. G. Wilson sectio nova

[gymnos = bare, anthos = flower]

Planta glabra; folia exstipulata, teretia. Flores solitarii, axillares; pedicellus sessilis, base minute bracteolato; sepala leviter imbricata; petala imbricata, glabra; stamina aliquanto divaricata, filamentis glabris; discus latus,  $\pm$  applanatus. Cocci erecti, apiculati. Semen levis, testa exteriore membranacea, hilo brevissimo, elliptico, raphe tenui, chalaza adaxiali. Type : *E. deserti* Pritz.

Plant glabrous; leaves exstipulate. Flowers axillary, solitary; pedicel sessile. Sepals free, slightly imbricate; petals imbricate, glabrous; stamens spreading, glabrous, anthers minutely white apiculate; disc very broad,  $\pm$  flat. Seed reniform, attached (placental) endocarp thin, white; aril absent; outer testa membranous, sclerotesta smooth; hilum very short (ca. 0.3 mm long), elliptical, in centre of slight concavity on adaxial face; raphe very thin and covered by only a thin membranous layer; chalaza on lower half of adaxial face and visible through thin covering of raphe and outer testa. Only one species, found in Western Australia.

This section differs from all other sections of *Eriostemon* in having glabrous, spreading stamens, which are typical of *Phebalium* sect. *Leionema*, from which section it differs in most of its other floral characters. The seed has a very short hilum and the raphe is very thin, not obscuring the adaxial chalaza; here it is similar to *Eriostemon* sect. *Nigrostipulae* (e.g. at the extreme form found in *E. rhomboideus*) which resemblance may be of phylogenetic significance.

#### 32. *Eriostemon deserti* Pritz.

E. Pritzel in Diels et Pritzel, Bot Jahrb. 35:320, tab. 39 A-C (1904) [deserti = of the desert]; Ewart, Proc. Roy. Soc. Vict. ser. 2. 20:131 (1908); Engler, Pflanzenfam. ed. 2. 19a:258 tab. 113 (1931).

Typification: "Hab. in distr. Coolgardie pr. Southern Cross in fruticetis arenosis flor. m. Nov. (E. Pritzel Pl. Austr. occ. 868)." Isotypus: AD 96350140, K (photo seen), MEL 4674 and 4678, NSW 69249.

*Phebalium deserti* (Pritzel) Ewart et Rees, Proc. Roy. Soc. Vict. ser. 2. 25:111 (1912); S. Moore, J. Linn. Soc. Bot. 45:166 (1920).

*Eriostemon intermedius* Ewart, Proc. Roy. Soc. Vict. ser. 2. 19:40 (1907), nom. illeg. non Hooker (1849).

Typification: "Cowcowing, M. Koch, 1904; W.A., between Upper Blackwood R and L. Lefroy, Miss Cronin, 1893." Syntypes: M. Koch no. 1168, Aug. 1904 (AD, MEL, NSW), Cronin s.n. (MEL).

Erect undershrub 1–2 (3) m high. Branchlets when young with green faintly glandular leaf decurrencies, intermediate strips brown and soon becoming corky. Leaves narrow subulate (0.6) 2–3 cm long, glandular verrucose,

narrowly canaliculate above, glabrous. Flower: pedicel 0.5-5.5 mm long with several small, basal bracteoles; sepals deltoid-orbicular, ca. 1 mm long, fleshy with broad scarious margin, minutely ciliolate, glabrous; petals spreading, ovate, ca. 3 mm long, thin with thickened midrib, white; staminal filaments, narrow-linear becoming terete upwards, ca. 2.5 mm long; anthers sub-orbicular, ca. 0.7 mm long, minutely white-apiculate, pollen pale orange; ovary somewhat embedded in disc, glabrous, broadly pyramidal, at first small but enlarging during anthesis to 0.5 mm high (above disc); style glabrous, ca. 1.3 mm long, stigma slightly broader than style. Cocci  $\pm$  erect, ca. 2.5 mm long, truncate and shortly apiculate. Seed plump, reniform, ca. 2 mm long.

DISTRIBUTION: Western Australia, from Kalgoorlie north-west to the Yalgoo area—Map 9.

WESTERN AUSTRALIA: 30 mi NE of Wubin, J. S. Beard 2587 (KINGS PARK); Dromedarie, W. E. Blackall 3440 (PERTH); Ghooli, C. A. Gardner 2078 (PERTH); S of Welbungin, C. A. Gardner 2747 (PERTH); 15 km E of Southern Cross, R. H. Kuchel 2104 (AD); Nun-garin, J. J. Veitch 4 (MEL).

This species is peculiar in the genus in having slender glabrous staminal filaments which are spreading (not erect) at anthesis. On the basis of these staminal characters Ewart referred it to the genus *Phebalium*. It shows however a stronger resemblance to the genus *Eriostemon*; it has free, imbricate, sepals, a broad prominent disc, and minutely white-apiculate anthers. In the flower position, presence of bracteoles, and in the external stem morphology it shows characters found in *Eriostemon* but not in the genus *Phebalium*. It thus appears to be a rather anomalous species showing no close affinity with any other section of *Eriostemon* or to any section of *Phebalium*.

#### PHEBALIUM Vent.

Ventenat, Jard. Malm. 2:102 (1805), [from phibaleon, a name used by some Greek poets for the myrtle (*Myrtus communis* L.)]; J. E. Smith in Rees, Cycl. 27: (1814); Nees et Martius, Nova Acta Acad. Leop.-Carol. 11:181 (1823); de Candolle, Prodr. 1:719 (1824); Jussieu, Monographie du genre Phebalium, Mem. Soc. Hist. Nat. Paris 2:125-137, t.10-12 (1825); Jussieu, Mém. Mus. Hist. Nat. Paris 12:479 (1825); Poiret, Dict. Sc. Nat. 39:463-465 (1826); G. Don, Gen. Hist. 1:791 (1831); Meisner, Pl. Vasc. Gen. 1:44 (1837), op. cit. 2:60 (1837); Endlicher, Gen. Pl. 1155 (1840), p.pt.; Hooker f., Fl. Nov. Zel. 1:44 (1852); Hooker f., Fl. Tasm. 1:63 (1855); Bentham et Hooker, Gen. Pl. 1:292 (1862); Bentham, Fl. Austral. 1:336 (1863); Engler, Pflanzenfam. 3/4:140 (1896); Black, Fl. S. Austral. 342 (1924); Engler, op. cit. ed. 2. 19a:259 (1931); Ewart, Fl. Vict. 706 (1931); Curtis, Stud. Fl. Tasm. 103 (1956); Beadle et al., Handb. Vasc. P. Syd. Dist. 319 (1963).

*Eriostemon* [non Smith sensu stricto] Poiret, Dict. Sc. Nat. 15:198 (1819); F. Muell. p.pt., Pl. Indig. Col. Vict. 1:125-132 (1862).

*Crocea* sect. *Phebalium* (Ventenat) Baillon, Dict. Bot. 11:277 (1886).

Undershrubs, shrubs, or small trees. Leaves alternate, exstipulate, simple, terete or  $\pm$  flat, fleshy to coriaceous or chartaceous, glandular punctate and often with prominent verrucosities, glabrous or with simple or stellate hairs or lepidote. Inflorescence axillary or terminal, of umbels or cymes, or the flowers solitary; flowers sessile or pedicellate; bracteoles small, obscure or wanting, persistent or caducous. Flowers pentamerous (to 8-merous in *P. nottii*). Calyx entire and hemispherical or  $\pm$  lobed, or of distinct (not imbricate) sepals, frequently merging into the thickened pedicel apex. Petals free (or rarely united), valvate or imbricate, thin or thick, glabrous or the outside lepidote, white, yellow, or various shades of red or green, the tip frequently thickened and inflexed. Stamens 10, free, spreading; filaments subulate or filamentous, glabrous (stellate-lepidote towards base in *P. squameum*); anthers versatile or basifixed, cordate, introrse, dehiscing longitudinally, with or without a terminal gland. Intrastaminal disc narrow, continuous with or distinct from ovary, sometimes forming a gynophore, or inconspicuous or absent. Gynoecium spherical to pyramidal, apex sterile and solid; carpels (2) 5 (8), free or slightly

united at the base, biovulate, placentation collateral, ovules anatropous, superimposed; embryo, fruit and seed as in *Eriostemon*; style simple, inserted near middle of adaxial margin of each carpel, usually  $\pm$  equal to stamens (at anthesis), glabrous or pubescent; stigma minute or capitate or with slightly radiating lobes.

Chromosome no.  $n = 16$  or  $32$ , fide Smith-White (1954). See Figs. 3-5 for seed and anthers.

Type: *P. squamulosum* Vent.

DISTRIBUTION: Australia and Tasmania, and North Island of New Zealand.

Ventenat described and figured the ovary as consisting of five united carpels which was presumably why he considered the genus to be a member of the Myrtaceae. The choice of the name *Phebalium* was due to this. He derived it as follows: "Nom employé par quelques Poètes Comiques Grecs pour designer le Myrte. Voyez J. Bauhin. Hist. Plantar. vol. 1 pag. 509". The work mentioned by Ventenat is "Historia plantarum universalis" by J. Bauhin and J. H. Cherler; in vol. 1: 509 (1650) they refer to the Myrtle (*Myrtus communis* L.), which was called by the Greek comic-poets "phibaleon". J. E. Smith (1814) recognised that the generic description provided by Ventenat applied to several plants which he had received from Australia and he correctly placed the genus in the Rutaceae.

#### KEY TO SECTIONS

1. Anthers prominently glandular apiculate; calyx truncate to deeply lobed; stem, leaves, and outside of petals lepidote; inflorescence a terminal umbel **Sectio 1. Phebalium**
1. Anthers not glandular apiculate.
  2. Plant  $\pm$  silvery lepidote; inflorescence of axillary cymes (sometimes reduced to one flower).
    3. Petals imbricate, glabrous; calyx with free sepals **Sectio 2. Eriostemoides**
    3. Petals valvate, lepidote outside; calyx shortly lobed **Sectio 3. Gonioclados**
  2. Plant not lepidote; inflorescence axillary or terminal; petals valvate, glabrous (rarely sparsely hispidulous) **Sectio 4. Leionema**

#### Sectio 1. *Phebalium* Western Australian Species

1. Flowers sessile, solitary.
2. Leaves narrow-oblong or terete, closely revolute, sparsely lepidote **1. P. ambiguum**
2. Leaves abruptly clavate (peltate), silvery lepidote **2. P. clavatum**
1. Flowers pedicellate, usually 2 or more forming a terminal umbel.
3. Leaves  $\pm$  filiform, mostly over 1 cm long.
  4. Petals pink within; branchlets tuberculate; leaves glossy silvery-lepidote all over, usually canaliculate above **3. P. canaliculatum**
  4. Petals yellow (or white); branchlets smooth; leaves dull silvery-and ferruginous-lepidote, upper surface  $\pm$  glabrous, not canaliculate **4. P. filifolium**
3. Leaf-shape various (not filiform).
5. Stem smooth.
  6. Leaf 3-5 mm long, not medially sulcate above.
  7. Leaf strongly recurved to revolute; calyx small, ca. 1 mm high **5. P. microphyllum**
  7. Leaf not strongly recurved.
    8. Leaf convex and glossy above; pedicel deeply ferruginous lepidote; calyx ca. 2 mm high **7b. P. lepidotum var. obovatum**
    8. Leaves flat to slightly concave and dull-green above; pedicel silvery lepidote; calyx ca. 1 mm high **8. P. drummondii**
6. Leaf 10-20 mm long, medially sulcate above **7a. P. lepidotum var. lepidotum**
5. Stem verrucose.

9. Leaf channelled above, oblong to cuneate-oblong, over 8 mm long.  
 10. Calyx short (to 1.5 mm high), smooth; leaf narrowly cuneate-oblong, margin scarcely recurved **9. P. brachycalyx**  
 10. Calyx large (over 3 mm high), verrucose; leaf broadly cuneate-oblong, margin recurved **6c. P. tuberosum subsp. megaphyllum**  
 9. Leaf not channelled above, oblong or deltoid, to 7 mm long, margin strongly recurved or revolute **6. P. tuberosum**

### South Australian, Eastern Australian, and Tasmanian Species

1. Calyx lobed.  
 2. Leaf closely revolute and  $\pm$  terete, smooth, calyx with prominent deltoid lobes ca. 2 mm long **11. P. lowanense**  
 2. Leaf not closely revolute (or if revolute then surface verrucose).  
 3. Leaf with midrib impressed (often deeply sulcate).  
 4. Leaf linear-cuneate to narrowly oblong-cuneate.  
 5. Leaf ca. 5 mm long, linear-cuneate, margin glandular crenate; calyx almost patelliform **12b. P. glandulosum subsp. angustifolium**  
 5. Leaf over 10 mm long, narrowly oblong-cuneate.  
 6. Upper surface of leaf smooth; calyx hemispherical.  
 7. Leaf flat or somewhat conduplicate, margin bullate, not recurved (S.A. and V.) **10. P. bullatum**  
 7. Leaf flat or slightly convex above, margin entire and recurved, apex emarginate or shortly bilobed (T.) **14. P. daviesii**  
 6. Upper surface of leaf  $\pm$  glandular, convex; calyx hemispherical to cupular or turbinate **12a. P. glandulosum subsp. glandulosum**  
 4. Leaf  $\pm$  elliptic, over 2 cm long, chartaceous or subcoriaceous.  
 8. Leaf smooth, without prominent glands.  
 9. Calyx large (5 mm diam. or more), cupular, (5) 6-8-lobed; petals pink to purple (inland plant) **17. P. nottii**  
 9. Calyx 2-3 mm diam., 5-lobed; petals white (to pink).  
 10. Calyx lobes broad-deltoid, ca. 0.5 mm high **13c. P. squamulosum subsp. longifolium**  
 10. Calyx lobes narrow deltoid, ca. 1.5 mm high **14. P. woomye**  
 8. Leaves with prominent glands above; branches glandular-tuberculate **13g. P. squamulosum subsp. verrucosum**  
 3. Leaf with no apparent midrib.  
 11. Leaf narrowly oblong-cuneate, convex above **12. P. glandulosum**  
 11. Leaf obovate to orbicular to 10 mm long, margin  $\pm$  recurved; calyx hemispherical, truncate or with shallow deltoid lobes **13k. P. squamulosum subsp. ozothamnoides**  
 1. Calyx truncate or undulate on margin.  
 12. Leaf linear, linear-cuneate, narrow-oblong, or closely revolute and  $\pm$  terete.  
 13. Midrib strongly impressed above.  
 14. Leaf linear, 10-25 mm long, entire, smooth above **13f. P. squamulosum subsp. lineare**  
 14. Leaf narrow-oblong or linear-cuneate, 5-10 mm long, margin glandular undulate.  
 15. Leaf margin slightly recurved; leaf linear-cuneate; calyx very shortly hemispherical (almost patelliform), slightly lobed **12b. P. glandulosum var. angustifolium**  
 15. Leaf margin not recurved; leaf narrow-oblong; calyx shortly hemispherical, truncate **13e. P. squamulosum subsp. parvifolium**  
 13. Midrib not apparent above; leaf revolute and  $\pm$  terete **19. P. stenophyllum**  
 12. Leaf narrow-to broad-elliptic, obovate, obcordate, or suborbicular.  
 16. Leaf obovate, obcordate, or suborbicular,  $\pm$  coriaceous, midrib not impressed above.  
 17. Leaf 2-3.5 mm long, apex rounded to truncate or obcordate; petals ca. 2.5 mm long **18. P. obcordatum**  
 17. Leaf 7-11 mm long, apex rounded; petals ca. 4 mm long **13k. P. squamulosum subsp. ozothamnoides**  
 16. Leaf narrow to broad-elliptic or oblong-elliptic.  
 18. Leaf narrowly oblong-elliptic or narrow-elliptic, 6-20 x 1-2.5 mm.  
 19. Leaf oblong-elliptic, to 12 mm long, apex rounded, margin slightly recurved, thinly lepidote above when young (Vict. Alps) **13i. P. squamulosum subsp. alpinum**

19. Leaf narrowly oblong-elliptic or narrow-elliptic, 6-20 mm long, apex rounded to acute, margin not recurved, glabrous above when young (inland N.S.W. and SE Queensld.) 13d. *P. squamulosum* subsp. *gracile*
18. Leaves elliptic (7) 10-70 mm long.
20. Flowers large, petals ca. 9 mm long (Q.-N.S.W. border) 15. *P. whitei*
20. Flowers smaller, petals 2-5 mm long.
21. Leaves stellate-lepidote above when young, chartaceous, apex rounded; calyx and petals silvery lepidote (coastal N.S.W.) 13c. *P. squamulosum* subsp. *argenteum*
21. Leaves glabrous above when young, chartaceous to coriaceous, apex rounded to acute, calyx and petals silvery to ferruginous lepidote.
22. Leaves coriaceous, slightly conduplicate or flat, silvery-lepidote below with scattered rufous scales (Warrumbungle Mts., N. S.W.) 13b. *P. squamulosum* subsp. *coriaceum*
22. Leaves sub-coriaceous to chartaceous, flat or rounded above, silvery to ferruginous-lepidote below 13a. *P. squamulosum* subsp. *squamulosum*

### Sectio 2. *Eriostemoides*

1. Ovary glabrous; bracteoles minute, caducous, usually in lower half of the  $\pm$  terete pedicel; inflorescence usually 2 or more flowered 20. *P. squameum*
1. Ovary lepidote.
2. Petals lepidote, inflorescence 2-8-flowered 20. *Phebalium* sp. aff. *squameum*
2. Petals glabrous; bracteoles 2, ovate, 1-1.5 mm long, inserted just below flower and grading into sepals, persistent; pedicel strongly flattened; inflorescence 1(3)-flowered (N.S.W.) 21. *P. ovatifolium*

### Sectio 3. *Gonioclados*

- Leaves elliptical, chartaceous, 7-12 cm long; branches strongly angular 22. *P. anceps*
- Leaves linear to obovate, obcordate, or suborbicular,  $\pm$  coriaceous, 0.7-3.5 cm long; branches terete or angular 23. *P. rude*

### Sectio 4. *Leionema*

1. Petals 8 mm long or more,  $\pm$  erect; stamens considerably exceeding petals.
2. Petals united into a cylindrical, greenish-yellow corolla; plant glabrescent 43. *P. sympetalum*
2. Petals free.
3. Branchlets glabrous, strongly angular 42. *P. ralstonii*
3. Branchlets pilose or tomentose,  $\pm$  terete.
4. Leaves divaricate  $\pm$  triangular, ca. 1 cm long, apex obtuse; stem pilose 41. *P. carruthersii*
4. Leaves not obviously divaricate, oblong elliptic, ca. 2-4 cm long, apex bilobed; stem closely stellate-tomentose 44. *P. viridiflorum*
1. Petals to 5 mm long,  $\pm$  spreading; stamens  $\pm$  equal to or slightly longer than petals.
5. Leaves large, 6-10 cm long, base amplexicaul 39. *P. ambiens*
5. Leaves smaller, base not amplexicaul.
6. Underside of leaves minutely white stellate-puberulous.
7. Leaves oblong-elliptic to sub-terete due to the revolute margin, 8-17 mm long, entire; axillary cymes small and compact, mostly sub-terminal.
8. Ovary spherical, white stellate-puberulous (rarely glabrous) (Snowy Mts. and V.) 27. *P. phyllicifolium*
8. Ovary narrowly ovoid, glabrous, carpels with a long sterile apex (Blue Mts., N.S.W.) 28. *P. lachnaeoides*
7. Leaves narrow-oblong to narrow-obovate, 4-8 cm long, margin denticulate; axillary cymes slender; ovary glabrous 26. *P. dentatum*
6. Underside of leaf glabrous, pilose, or coarsely stellate.
9. Leaves pilose or coarsely stellate beneath; flowers in a terminal compact head; carpels with a long, sub-terete, sterile apex 29. *P. diosmeum*
9. Leaves glabrous beneath; carpels with no sterile apex.
10. Branchlets strongly angular, glabrous; leaves chartaceous, 2.5-7 mm long.
11. Leaves elliptic, 5-7 cm long, apex acute 38. *P. coxii*

11. Leaves narrow-elliptic to spatulate, 2.5-5 cm long, apex obtuse to rounded  
31. *P. obtusifolium*
10. Branchlets  $\pm$  terete, leaves less than 3 cm long.
12. Leaves terete, fleshy; flowers on short pedicels in upper leaf axils (T.)  
24. *P. montanum*
12. Leaves neither terete nor fleshy.
13. Leaves coriaceous, oblong to oblong-elliptic, to 10 cm long, entire; flowers in  $\pm$  compact terminal heads.
14. Flowers solitary within the leaf or bract; pedicel fleshy (T.)  
25. *P. oldfieldii*
14. Flowers mostly in clusters of 2-3 on an axillary peduncle; pedicel slender (Snowy Mts.)  
27. *P. phylicifolium*
13. Leaves chartaceous or if coriaceous then not oblong-elliptic or entire.
15. Leaves narrowly to broadly obovate, flat, chartaceous, 1.5-3 cm long, apex obtuse to rounded  
30. *P. elatius*
15. Leaf shape variable but not as above.
16. Leaves oblong-elliptic, ca. 2 cm long, flat, apex rounded, margin minutely crenulate all round  
40. *P. nudum*
16. Leaves smaller or with recurved margin or  $\pm$  truncate apex.
17. Branchlets pilosulose in lines between decurrent ribs, verruculose; leaves elliptic, ca. 5 mm long, apex rounded (Q.)  
32. *P. gracile*
17. Branchlets stellate-hairy, sometimes minutely so, smooth or verrucose.
18. Leaf-apex  $\pm$  truncate or bilobed; carpels 2-3(4).
19. Leaf entire, slightly scabridulous above; anthers pink (S.A.)  
34. *P. hillebrandii*
19. Leaf denticulate or serrate, smooth above; anthers yellow (V. & T.)  
33. *P. bilobum*
18. Leaf-apex acute to rounded; carpels 5.
20. Stem smooth, stellate  $\pm$  all round or glabrous.
21. Leaves broadly obovate to orbicular, 6-10 mm long, flat, glabrous,  $\pm$  imbricate when dry  
37. *P. rotundifolium*
21. Leaves ovate to sub-cordate, 3-5 mm long, flat or convex above, often scabridulous (S.A. and V.)  
35. *P. brachyphyllum*
20. Stem verrucose, pubescent in longitudinal lines; leaves elliptic to broadly obovate or sub-orbicular, entire or minutely erose (V. and N.S.W.)  
36. *P. lamprophyllum*

### Sectio 1. *Phebalium*

*Phebalium* sectio *Eriostemoides* Endl., Gen. Pl. 1156 (1840), p.pte., not as to lectotype; Endl., Enchir. Bot. 612 (1841).

*Phebalium* sectio *Lepidotia* Reichenbach, Repert. Herb. sive Nomencl. Gen. Pl. 1:197 (1841), p.pte., nomen.

*Eriostemon* sectio *Phebalium* (Ventenat) F. Muell., Pl. Indig. Col. Vict. 1:129 (1862), p.pte.

*Phebalium* sectio *Euphebalium* Bentham, Fl. Austral. 1:337 (1863), p.pte., nom. illeg.; Engler, Pflanzenfam. 3/4:141 (1896), ed. 2. 19a:260 (1931).

Leaves lepidote (at least on lower surface when young). Inflorescence a terminal umbel (or rarely flowers solitary); bracteoles normally absent or insignificant. Calyx truncate to deeply lobed; petals imbricate, lepidote outside, glabrous within; stamens  $\pm$  equal to or longer than petals, filaments  $\pm$  filiform, glabrous, anther glandular apiculate, yellow, basifixed; disc not apparent; ovary lepidote (rarely glabrous), with or without a small sterile apex; stigma capitate with slightly spreading lobes. Cocci erect. Seed oblong-reniform, usually thicker at the base, 2-3.5 mm long, adaxial margin  $\pm$  straight; attached endocarp thin, translucent, caducous; aril linear, short, thin; outer testa very thin and inconspicuous; sclerotesta finely or coarsely longitudinally rugulose; hilum linear, superficial; raphe small, shrunken, covered only by membranous layer; chalaza towards base of adaxial face and visible through raphe.

Type: *P. squamulosum* Vent.



Nineteen species, nine from Western Australia and ten from South Australia, Tasmania and the Eastern States.

The section *Phebalium* is a homologous assemblage of species with no close ties to any of the other sections in the genus. It is however, closely related to the genus *Microcybe* which differs principally in having sessile heads of flowers and a reduced carpel number.

None of the species in this section is found in both east and west Australia, although *P. bullatum*, a South Australian plant, appears to be more closely related to some Western Australian species than to any found in the Eastern States. As this is the only section having representatives in all States it possibly evolved its distinctive characters earlier than the other sections, which have more limited distributions, and did so at a time when spread of species between east and west was still possible.

In the seven Western Australian species, *P. canaliculatum* to *P. brachycalyx*, intermediate forms are often found where two or more of these occur in the same area. Field observations have confirmed that hybridization is a fact in some cases, in others it is assumed to have taken place from the study of herbarium material. Between some of these species (eg. *P. tuberosum* and *P. filifolium*) hybridization is partially prevented by different (but overlapping) flowering times; in other cases, involving e.g. *P. canaliculatum*, distinct flower colour may deter insect cross-pollination. An interesting point is that the early collections made in Western Australia were nearly always of the putative parent species; in the late 19th and early 20th century collections of apparent hybrids were relatively much more common. This suggests that general land disturbance encouraged the production of hybrid swarms which may have been furthered by honey bees, also of recent introduction.

### 1. *Phebalium ambiguum* C. A. Gardn.

C. A. Gardner, J. Roy. Soc. W. Austral. 27:180 (1942) [ambiguus = doubtful].

Typification: "*Microcybe pauciflora* var. *uniflora* D. A. Herbert. Carrabin, in arenosis lutosi fl. m. Oct. Gardner; pr. Yellowdine, W. E. Blackall 1937; pr. Hatter's Hill, Blackall 1867; in distr. Avon juxta Ballidu in fruticetis, Gardner." Lectotype: Blackall, Oct. 1937 (PERTH), the specimen selected as type by Gardner in the herbarium.

*Microcybe pauciflora* var. *uniflora* D. A. Herbert, J. Roy. Soc. W. Austral. 8:37 (1922).

Typification: "Sandplain at Westonia." leg. Herbert and Wilson 111, Nov. 1920. Isotypus: MEL 4540.

Undershrub to 50 cm high. Branchlets smooth, silvery to ferruginous lepidote. Leaves shortly petiolate; lamina closely revolute and  $\pm$  terete, 4-6 x 0.8 mm, obtuse, upper surface sparsely lepidote when young becoming glabrous, smooth to scabridulous, lower surface stellate-lepidote. Flowers solitary terminating short branchlets, sessile, subtended by several foliage leaves; mature bud sub-spherical, ca. 3 mm high; calyx very shortly hemispherical, ca. 0.5 mm high and 1.5 mm wide with short, broadly deltoid lobes, smooth, ferruginous lepidote outside; petals pale yellow, almost valvate, thick, elliptical, ca. 3.5 x 1.8 mm, silvery to ferruginous lepidote outside; anthers suborbicular, ca. 1 mm long, yellow; ovary sub-spherical, ca. 1 mm high, silvery to ferruginous lepidote, 3 (-4) carpellate, with the carpels erect and rounded at summit; style glabrous; stigma minute, equal in width to style apex. Cocci ca. 3.5 mm high, apex rounded. Seed ca. 2.5 mm long, slightly longitudinally corrugate.

DISTRIBUTION: Western Australia, south-west, in the Dalwallinu-Lake Grace area—Map 25.

WESTERN AUSTRALIA: Lake Hope to Mt. Hatter, W. E. Blackall 1267 (PERTH); Koorda, C. A. Gardner 2739 (PERTH); 65 mi E of Hyden, A. S. George 4314 (PERTH); 1 mi N of Lake King, R. D. Royce 4171 (PERTH).

*Phebalium ambiguum* may be distinguished from all other species of *Phebalium* by its solitary sessile flowers and strongly revolute, sub-terete leaves. It is peculiar in having a reduced number of carpels, normally 3 but occasionally 4: in the latter case one is reduced in size. The almost valvate petals appear to be an extreme form of the  $\pm$  imbricate condition found in the sect. *Phebalium*.

This species shows only slight morphological variation and no hybrids between it and any other species have been observed.

From *Microcybe*, in which genus it was first placed, it may be distinguished by the solitary flowers, the more prominent calyx, and the lepidote petals.

## 2. *Phebalium clavatum* C. A. Gardn.

C. A. Gardner, J. Roy. Soc. W. Austral. 27:181 (1942) [clavatus = clubbed].

Typification: "Hab in distr. Coolgardie, in arenoso-lutosis, prope Widgiemooltha, flor. m. November, Gardner." Holotypus: PERTH.

Bush to 1.3 m high. Branchlets terete, glandular verrucose with pale red glands, closely silvery lepidote. Leaves clustered on short branchlets; petiole terete 1.5–2 mm long, closely silvery lepidote; lamina broadly peltate, (sub-spherical), ca. 1.5 mm diameter, containing a large spherical gland; apex almost truncate, smooth and becoming glabrous; sides smooth, closely silvery lepidote, and passing into the petiole. Flowers solitary, terminal on short branchlets, sessile, subtended by two lepidote linear bracteoles ca. 1 mm long; mature bud sub-spherical, ca. 3.5 mm long, apex truncate; calyx broadly obturbinate 2.5–3 mm high including the deltoid-acuminate teeth ca. 1.5 mm long, closely silvery lepidote; petals obovate to broadly elliptical, 4 x 2.5–5.2 x 3.7 mm, white, silvery lepidote outside; stamens slightly exceeding petals, anthers oblong, ca. 1 mm long, pale yellow; ovary ca. 1.3 mm high, densely silvery lepidote, carpels slightly spreading with a small apical boss; style exceeding stamens, glabrous; stigma minute, equal in width to style. Cocci erect, 2.5–3 mm high, apex rounded. Seed (immature) slightly longitudinally corrugate.

DISTRIBUTION: Western Australia, Coolgardie district—Map 25.

WESTERN AUSTRALIA: Scabill Sandalwood Reserve nr. Londonerry, J. M. Frank, 3.viii.1929 (PERTH); 15 km south-east of Londonderry, nr. Coolgardie, bush to 4 ft., P. Wilson 3126 (AD).

This species is the most distinct of the Western Australian species in the section *Phebalium*. The morphological uppersurface of the leaf is probably represented by its apparent truncate apex, while the solitary gland occupies much of the interior. The flower is peculiar in being solitary and sessile and in constantly possessing two linear bracteoles.

## 3. *Phebalium canaliculatum* (F. Muell. et Tate) Willis

J. H. Willis, Vict. Nat. 74:169 (1958).

*Eriostemon canaliculatus* F. Muell. et Tate, Trans. Roy. Soc. S. Austral. 16:337 (1896), in note under *E. tuberculatus* [canaliculatus = with a longitudinal groove].

Typification: "This particular plant with almost terete and channelled leaves, was collected during Giles' third expedition towards Ularing. Drummond's specimen has some of the leaves fully one inch long."

Lectotypus (Willis, loc. cit.): "Between Victoria Springs and Ularing, 7–9 Oct. 1875." Leg. Jess Young (Giles' 4th Expedition), MEL 4631. (At this time Giles was travelling between the Mulgabbie Salt Lake to the south, and Lake Rebecca to the north.) Syntypus: Western Australia, J. Drummond (MEL 4632).

*Phebalium tuberculatum* [non (F. Muell.) Bentham sensu lectotypica] Diels et Pritzel, Bot Jahrb. 35:323 (1904).

Bush to 2 m high. Branchlets with numerous small glandular verrucosities, closely silvery and ferruginous lepidote. Leaves very shortly petiolate; lamina straight or slightly falcate, terete or slightly flattened above, ca. 25 x 1 mm, glandular verrucose, shining all over with a close silvery squamose indumentum (rarely becoming sub-glabrous above), canaliculate above. Inflorescence a terminal sessile umbel; pedicels 4-7 mm long; bud spherical. Calyx small, ca. 1 mm high including the deltoid lobes ca. 0.5 mm long, closely lepidote outside, glabrous within; petals slightly imbricate, elliptical, ca. 4-5 x 2-3 mm, dark-pink to pale-mauve, silvery lepidote outside, glabrous within; staminal filaments pale mauve; anthers well exerted, oblong, ca. 1.5 mm long, yellow; ovary narrowed above to a short, solid apex; style glabrous; stigma with five shortly spreading lobes. Fruit and seed not seen.

**DISTRIBUTION:** Western Australia, Wongan Hills to east of Kalgoorlie (Queen Victoria Spring)—Map 18.

**WESTERN AUSTRALIA:** 15 mi W of Coolgardie, B. G. Briggs, 29.ix.1960 (NSW); Comet Vale, G. E. Brockway, 7.x.1947 (CANB); S of Bullabulling, A. J. Cough 133 (PERTH); nr. Victoria Rocks 30 mi SW of Coolgardie, C. F. Davies, 1.ix.1962 (PERTH); Laverton, J. H. Maiden, Sept. 1909 (NSW); 62 km E of Southern Cross, P. Wilson 3549 (AD).

#### *P. canaliculatum-P. tuberosum*

**WESTERN AUSTRALIA:** 23 mi S of Coolgardie, T. E. H. Aplin 1882 (PERTH); Comet Vale, J. T. Jutson 100 (NSW); 4 mi E of Anketell, J. W. Green 1642 (PERTH); 4 km SE of Londonderry, P. Wilson 3121 (AD); 9 km E of Yellowdine, growing with *P. tuberosum* and *P. canaliculatum*, P. Wilson 3542 (AD).

The correct application of the name "*Phebalium canaliculatum* (Muell. et Tate) Willis" is rather involved. Bentham, Fl. Austral. 1:343 (1863), under the name *Phebalium tuberosum* published a description based on a Maxwell specimen from Fitzgerald River and Drummond no. 63. Mueller and Tate (1896) observed that Bentham's description did not apply to the plant that Mueller had in mind when he first described the species (as *Eriostemon tuberosus*), and assumed that the two collections to which they now wished to put a name belonged to the same species as the plants seen by Bentham. Mueller and Tate therefore provided a new name for the assumed *P. tuberosum* of Bentham, this name being *Eriostemon canaliculatus*. The two specimens seen by Mueller and Tate were an unnumbered Drummond collection and a specimen collected on Giles' Fourth Expedition ("Giles' Third Expedition towards Ularing"). Since they assumed that they were only providing a new name, their description of the plant was extremely scant ("This particular plant with almost terete and channelled leaves"); however, Willis loc. cit. has assumed that in fact they intended to describe a new species and has chosen as lectotype the plant collected on Giles' expedition.

The Maxwell collection from the Fitzgerald River cited by Bentham, is probably the one in the Melbourne herbarium (MEL 5115) from "S.W. Austr." which was seen by Bentham; it is in fact the true *P. tuberosum* (sensu lectotypica). The Drummond collection No. 63, also cited by Bentham, has been compared by Dr. S. T. Blake with material of several species and found to match *P. brachycalyx*. It was mainly on this latter specimen that Bentham's description of "*P. tuberosum*" was based.

Mueller and Tate, loc. cit. refer to a Drummond specimen in their herbarium, which they assumed to be the No. 63 cited by Bentham. Reference to the Melbourne herbarium shows that an unnumbered Drummond specimen (MEL 4632) has been annotated by Mueller "This must be Drum. N. 63" which in fact it is not, but it does match the specimen collected on Giles' trip which was chosen by Willis as the lectotype of *P. canaliculatum*.

Since the article by Mueller and Tate was written in an ambiguous manner I have retained Willis' interpretation and his choice of lectotype.

*Phebalium canaliculatum* differs from *P. filifolium* in having the leaves canaliculate above, and in the flowers having pink petals and spreading stigma arms. The scales of the indumentum have a more silvery appearance than is found in *P. filifolium*.

In the area around Coolgardie and west to Yellowdine plants intermediate in form between *P. canaliculatum* and *P. tuberosum* occur. These show all gradations between the two species and may be recognised by the leaf shape (narrow-oblong, flat to recurved, frequently lepidote above), the calyx size, and the pale pink flowers. About 70 miles north of Coolgardie at Comet Vale and 240 miles to the north-west between Sandstone and Anketell are found similar plants which appear to show a morphological range between these two species; however, I have seen no true *P. tuberosum* from this area. Putative hybrids between *P. canaliculatum* and *P. maxwellii* var. *obovatum* are represented by N. T. Burbidge 2627 (CANB), 22 mi S of Coolgardie and C. L. Webster (NSW 69577) from Coolgardie. These specimens have a leaf shape intermediate between the two species but with the silvery indumentum of *P. canaliculatum*, and with flower characters similar to those of *P. maxwellii* var. *obovatum*.

The most westerly record for *P. canaliculatum* is one made by M. Koch from "Cowcowing". His material matches that collected from near Coolgardie. I have not seen any other collections from this area and it is possible that the locality is incorrect.

#### 4. *Phebalium filifolium* Turcz.

Turcz., Bull. Soc. Nat. Moscou 25/2:259 (1852) [filum = thread, folium = leaf; Bentham, Fl. Austral. 1:344 (1863); Diels et Pritzel, Bot. Jahrb. 35:323 (1904); Engler, Nat. Pflanzenfam. ed. 2. 19a:260 (1931).

Typification: Drummond "sub. n. 206". Holotypus: KW (photo seen); iso.; K "Swan River to Cape Riche, (5th colln.) Drummond 206" (photo seen), MEL 4707.

*Eriostemon filifolius* (Turcz.) F. Muell., Fragm. 9:108 (1875).

Rounded shrub to 1.3 m high. Branchlets slender, smooth, closely lepidote. Leaves subsessile; lamina slender, sub-terete (bluntly triangular in cross-section), ca. 15 x 1 mm; upper surface smooth, glossy, glandular punctate, glabrous; lower surface with prominent midrib, closely silvery to ferruginous lepidote. Inflorescence a 3-8-flowered terminal umbel; pedicel ca. 7 mm long, mature flower-bud sub-spherical, ca. 3.5 mm high. Calyx short, 1-1.5 mm high including the deltoid lobes of ca. 0.6 mm, closely ferruginous-lepidote outside, glabrous within; petals broadly elliptical, 3.5-5.5 x 2.5-3.5 mm, pale to bright yellow (rarely white), ferruginous-lepidote outside, glabrous within; staminal filaments shortly exceeding petals; anthers broad-oblong, ca. 1.5 mm long, yellow; ovary sub-spherical, 1 mm high, silvery and ferruginous lepidote, carpels slightly spreading with a small apical boss; style  $\pm$  equal to petals, glabrous; stigma capitate, slightly broader than style. Cocci erect, 2-2.5 mm high, apex rounded with a small sub-apical boss. Ripe seed not seen.

DISTRIBUTION: Western Australia, south-west—Map 36.

WESTERN AUSTRALIA: nr. Lake Lefroy, E. Cronin, 1893 (MEL); 80 km W of Daniell, P. Wilson 3204 (AD); 10 km E of Lake King township, P. Wilson 3233 (AD); 25 km NE of Dumbleyung, P. Wilson 3399 (AD); Booraan Siding, A. Ashby 928 (AD); Naremben, E. Ashby, Sep t. 1930 (ADW); Wongan Hills, E. H. Ising 104 (AD).

#### *Phebalium filifolium*-*P. maxwellii*

WESTERN AUSTRALIA: Esperance Bay to Fraser Range, Dempster, 1876 (MEL); Coolgardie, C. Walter (NSW); 17 mi S of Norseman, N. T. Burbidge 2698 (BRI).

*P. filifolium x tuberculosum*

WESTERN AUSTRALIA: Kulin (growing with parent species), A. Ashby 61 (PERTH); 80 km W of Daniell (growing with parent species), P. Wilson 3207 (AD); 17 km N of Kondinin (growing with parent species), P. Wilson 3445 (AD); 28 km NE of Dumbleyung (growing with parent species), P. Wilson 3404 (AD).

*P. filifolium x tuberculosum* var. *megaphyllum*

WESTERN AUSTRALIA: Merredin (growing with parent species), J. B. Cleland, 31.viii.1926 (AD); 3 mi E of Carrabin, J. W. Green 1710A PERTH); 16 km E of Southern Cross (growing with parent species), P. Wilson 3520 (AD).

This species is distinguished from *P. canaliculatum* by (1) the general absence of a medial channel and of squamae on the upper surface of the leaves, (2) the smooth, not tuberculate, stem and leaves, (3) the small stigma, and (4) the yellow petals. From other members of the *P. microphyllum* group it differs in having filiform leaves, and in addition, from *P. tuberculosum*, in having a small calyx.

*P. filifolium* occurs over much of its geographical range in association with other Western Australian members of sect. *Phebalium* and with some of these it readily hybridizes so as to form a complex series of intermediate specimens. This is difficult to evaluate in the herbarium where one is usually dealing with only a single collection made from a putative hybrid swarm.

Intergrades between *P. filifolium* and *P. tuberculosum* var. *megaphyllum* have been collected near Merredin and near Southern Cross, and others between *P. filifolium* and *P. brachycalyx* have been collected near Kulin. Since all grades of back-crossing are found the morphology of this group can be very variable.

Near Champion (north of Lake Brown) is found a plant having smooth, narrow-oblong leaves with strongly recurved margins (Gardner 2762, Blackall 853, Royce 2060, all PERTH). These may represent an intergrade between *P. filifolium* and another species, or it may deserve independent recognition. This cannot be decided until further collections are made and the possible relations with other species are cleared up.

**5. *Phebalium microphyllum* Turcz.**

Turcz., Bull. Soc. Nat. Moscou 25/2:159 (1852) [micros = small, phyllon = leaf]; Bentham, Fl. Austral. 1:343 (1863) p.ptc.

Typification: Drummond "sine num." Holotypus: KW (photo seen); iso. (?): MEL 4809 and 4813.

*Eriostemon tuberculosus* var. *microphyllus* (Turcz.) Ewart, Proc. Roy. Soc. Vict. ser. 2. 19:40 (1907) comb. illeg.

*E. tuberculosus* var. *laevis* F. Muell., Fragm. 9:108 (1875). Typification: "... in collectione Drummondii...". Isotypes: MEL 4809 and 4813. (These specimens are probably also isotypes of *P. microphyllum*.)

Small shrub. Branchlets smooth, closely lepidote. Leaves divaricate, shortly petiolate; lamina coriaceous, oblong, 3-4 x 1.5 mm, revolute and slightly crenulate; apex rounded; upper surface rounded  $\pm$  smooth, glabrous, without an impressed midrib; lower surface smooth, closely lepidote. Inflorescence a terminal, sessile, 3-6-flowered umbel; mature bud spherical; pedicel slender, 3-6 mm long. Calyx small, ca. 1 mm high including the deltoid teeth of ca. 0.5 mm, smooth, closely ferruginous lepidote outside, glabrous within; petals elliptical, ca. 3.5 mm long, yellow, ferruginous lepidote outside, anthers ca. 1 mm long yellow; ovary ca. 1 mm high, ferruginous lepidote, carpels slightly spreading, apex rounded and with a small boss; style glabrous; stigma capitate, slightly broader than style. Cocci erect, ca. 3 mm high, apex rounded with an apiculum on outer angle. Seed longitudinally corrugate, black.

DISTRIBUTION: Western Australia, south-west—Map 2.

WESTERN AUSTRALIA: Borden to Pingrup, R. Hill 1463 (AD); 15 km NE of Kukerin, R. H. Kuchel 2018 (AD); 14 km W of Pingrup, P. Wilson 3283 (AD).

*Phebalium microphyllum* resembles *P. filifolium* in flower characters and in the lack of glandular tubercles on stem and leaves; in leaf shape it comes closest to *P. tuberosum* from which it differs markedly in calyx size and in having a smooth stem. It has a restricted distribution and, from the few collections seen, appears to intergrade with some other species in the section *Phebalium*. Further collections and field data are required to confirm this.

The correct application of the name *P. microphyllum* has been confused over the past 100 years; this was partly due to the fact that the Drummond specimen cited by Turczaninow did not have a number and it has only recently been possible to verify its identity. A further cause for confusion was that Turczaninow cited another Drummond collection (no. 208) as being possibly a variety of *P. microphyllum*; this is however a fruiting specimen (and the type) of *P. lepidotum*. In 1862 Mueller published the name *Eriostemon tuberosus*, giving a short description. This name was taken up by Bentham who assumed it to represent a new species (although his conception of the species differed from that of Mueller's); however it would appear that Mueller intended it to be a nomenclatural synonym of *P. microphyllum* (the epithet "microphyllum" being preoccupied in the genus *Eriostemon*), for in a later publication (Trans. Roy. Soc. S. Austral. 16 (1896) 337), he with R. Tate when discussing *E. tuberosus* wrote:—"This is the true *Phebalium microphyllum* of Turczaninow, as is clear from the original description, but the specific name given by him was preoccupied in the genus *Eriostemon* for the *P. brachyphyllum* of Bentham". This synonymy was accepted by Diels and Pritzel, Bot. Jahrb. 35: 323 (1904), who placed *E. tuberosus* F. Muell. ("tuberculatus") in synonymy under *P. microphyllum*, but kept "*Phebalium tuberosum* Benth." as a distinct species (*P. canaliculatum*). In both cases they applied the names in the sense adopted by Mueller, not in the original sense (for *P. microphyllum*) nor of my lectotypification (for *P. tuberosum*).

I have seen a photograph of the holotype of *P. microphyllum*, and I have seen probable isotypes in herb. MEL which agree with Turczaninow's description. I have also seen material which Mueller determined as *E. tuberosus* and I have come to the conclusion that they should be treated as distinct species. In order to avoid creating new names I have accepted Bentham's assumption that Mueller intended *E. tuberosus* to be a new species (and there is nothing in Mueller's original publication to indicate otherwise) and I have chosen as lectotype a specimen so determined by Mueller, and which is also probably one of the specimens cited by Bentham under *P. tuberosum*.

I am not sure whether "*E. tuberosus* var. *laevis*" was intended by Mueller to be taken as a validly published variety; the name was applied by Mueller to an unnumbered Drummond collection and he has so annotated two herbarium sheets. The specimens are however *P. microphyllum* sensu stricto and may be isotypes of that species as they appear to be identical with the holotype at Kiev.

#### 6. *Phebalium tuberosum* (F. Muell.) Benth.

Bentham, Fl. Austral. 1:343 (1863), not as to description.

*Eriostemon tuberosus* F. Muell., Pl. Indig. Col. Vict. 1:130 (1862) [tuberculum = a little tuber, an allusion to the warty stem and leaves].

Typification: "South-Western Australia again furnishes an almost conspecific representative in *Eriostemon tuberosus* . . ." No specimens cited. In the Melbourne herbarium there are six sheets which could have been seen by Mueller at the time of its publication, and which have been so determined by him; these are four unnumbered J. Drummond collections, Drummond no. 97, and a Maxwell specimen. Lectotypus: MEL 5115, "S.W. Austr." leg. G. Maxwell.

*P. microphyllum* [non Turcz.] Diels et Pritzel, Bot. Jahrb. 35:323 (1904).

Shrub to 2 m high. Branchlets prominently glandular verrucose, closely lepidote. Inflorescence a 1-6-flowered umbel; pedicel 1-6 mm long. Calyx hemispherical, deeply deltoid-lobed, verrucose, ferruginous-lepidote; petals broadly elliptic, white to pale yellow, ferruginous lepidote outside; stamens slightly exceeding petals, anthers yellow; ovary  $\pm$  hemispherical, ca. 1 mm high, lepidote; style sparsely stellate towards base; stigma capitate with slightly spreading lobes. Cocci erect, rounded at summit ca. 3.5 mm high. Seed ca. 2.5 mm long, irregularly longitudinally corrugate, black.

Leaves closely revolute.

Leaves shortly petiolate, 4-7 mm long

6a. subsp. *tuberculosis*

Leaves sessile, ca. 2.5 mm long

6b. subsp. *brachyphyllum*

Leaves oblong-cuneate, 7-15 mm long, slightly recurved

6c. subsp. *megaphyllum*

#### 6a. subsp. *tuberculosis*

Leaves very shortly petiolate; lamina oblong or almost terete due to the closely revolute margins, 4-7 x 0.7-1.5 mm, apex rounded; upper surface rounded, glandular verrucose, not medially sulcate, glabrous (lepidote when young). Umbels (1)3-4-flowered; mature bud spherical ca. 3 mm high; pedicels short, 1-2.5 mm long. Calyx (2)3-4 mm high including the deltoid-acuminate lobes which are  $\pm$  equal to the tube, glabrous within; petals broadly elliptic, 3 x 2-4.5 x 3.3 mm, anthers shortly oblong, ca. 1 mm long.

Chromosome no.  $n = 32$ , from material collected between Morawa and Mullewa, fide Smith-White (1954) as "*P. microphyllum*".

DISTRIBUTION: Western Australia, south-west—Map 19.

WESTERN AUSTRALIA: Tarin Rock, A. Ashby 442 (AD); Bondi to Boorabbin, T. E. H. Aplin 1918 (PERTH); 15 mi W of Coolgardie, B. G. Briggs, 29.ix.1960 (NSW); Southern Cross, Mrs. J. D. Carter, 1894 (MEL); Goomalling, C. A. Gardner 644 (PERTH); Mt. Short, N of Ravensthorpe, A. S. George 5701 (PERTH); Wongan Hills, E. H. Ising, 5.viii.1925 (AD); 90 mile tank, ca. 80 km W of Daniell, P. Wilson 3185 (AD).

It is uncertain whether Mueller intended the name "*Eriostemon tuberculosis*" to be that of a new species or whether it was intended to be a new name for *Phebalium microphyllum*. Bentham assumed the former and I have followed him, choosing as lectotype a specimen annotated by Mueller and which is probably also one of the two collections cited by Bentham under *P. tuberculosis*. Bentham's description was mainly based on the other collection ("Drummond no. 63") which I have distinguished as a new species *P. brachycalyx*.

Mueller and Tate (Trans. Roy. Soc. S. Austral. 16: 337 (1896)), realised that Bentham's description did not apply to *P. tuberculosis* sensu lectotypica, and assumed it to have applied to a plant to which they gave the name "*Eriostemon canaliculatus*". For a discussion of the confusion involved see under this latter species.

The species nomenclaturally and taxonomically confused with *P. tuberculosis* are fairly distinct. *P. canaliculatum* has a slender, terete leaf canaliculate above, and pink flowers. *P. brachycalyx* has a linear-cuneate leaf, slightly conduplicate or at least deeply sulcate above, and yellow flowers. *P. microphyllum* has smooth stems and yellow flowers with a very short calyx; the leaves are similar to *P. tuberculosis*.

*P. tuberculosis* grows in many localities in association with *P. filifolium* but it flowers earlier, which possibly explains why the two usually retain their distinctive characters. Hybrids do however occur and intergrades between the two species may be found where they grow together. Apart from the calyx and leaf shape a change also occurs in petal colour. In *P. filifolium* it is usually bright yellow and in *P. tuberculosis* it is white. The hybrids show intermediate shades. (See also notes under *P. filifolium*.)

**6b. subsp. brachyphyllum** P. G. Wilson, subsp. nov.

[brachys = short, phyllon = leaf]

*Eriostemon tuberculatus* [non F. Muell. sensu stricto] F. Muell. et Tate, Trans. Roy. Soc. S. Austral. 16:337 (1896).

Folia sessilia, cuneata, revoluta, ca. 2.5 x 1.5 mm, supra glabra et fere levia. Umbellae 1-3-florae; pedicelli 2-3 mm longi. Calyx ca. 2.5 mm altus, profunde dentatus, intus stellato-lepidotus.

Holotypus: AD96350150, Victoria Desert, camp 59, near Victoria Spring (ca. 190 km ENE of Kalgoorlie), Western Australia, 22.ix.1891, R. Helms. Iso.: MEL 4811, NSW 69582.

Leaves sessile, cuneate, closely revolute, ca. 2.5 x 1.5 mm, glabrous and almost smooth above, not medially sulcate. Umbel 1-3-flowered; pedicel 2-3 mm long. Calyx ca. 2.5 mm high, deeply dentate, ferruginous-lepidote outside, stellate-lepidote within.

**DISTRIBUTION:** Western Australia, only known from the type locality NE of Kalgoorlie—Map 19.

**WESTERN AUSTRALIA:** Vicinity of Queen Victoria Spring, A. R. Main, 25.viii.1960 (PERTH).

**6c. subsp. megaphyllum** (Ewart) P. G. Wilson, comb. et stat. nov.

*Eriostemon tuberculatus* var. *megaphyllus* Ewart, Proc. Roy. Soc. Vict. ser. 2. 19:39 (1907) [megas = large, phyllon = leaf].

Typification: "Cowcowing, 1904". Holotypus: MEL 4545 p.pt. "M. Koch no. 1330". Iso.: AD 96350166, NSW 69580.

Leaves shortly petiolate, oblong-cuneate, 7-15 x 2-4 mm, apex obcordate, slightly recurved, base cuneate; upper surface slightly rounded, smooth to glandular scabridulous, medially sulcate, glabrous (even when young), margin recurved and glandular-crenulate, lower surface with a prominent glandular-verrucose midrib, closely silvery lepidote. Umbel (1) 3-6-flowered; mature bud spherical; ca. 4 mm high; pedicel 4-6 mm long. Calyx hemispherical, 3.5-4.5 mm high including the prominent deltoid lobes 2-2.5 mm long, glandular verrucose, silvery to ferruginous-lepidote outside, silvery stellate-lepidote within; petals white, broadly elliptical, 5-6 x 3 mm; anthers oblong, 1-1.6 mm long.

Chromosome no.  $n = 32$ , from material collected between Mullewa and Geraldton, fide Smith-White (1954) as "*P. drummondii*".

**DISTRIBUTION:** Western Australia, Cowcowing-Southern Cross area—Map 19.

**WESTERN AUSTRALIA:** Koorda, W. E. Blackall, Aug. 1924 (PERTH); Bullabulling, W. E. Blackall 4062 (PERTH); Merredin, J. B. Cleland, 31.viii.1926 (AD); Yilgarn, nr. Mt. Moore, H. S. King & De Courey Lefroy, 1889 (MEL); Southern Cross to Ghooli, E. Salisbury 63 (PERTH).

Max Koch collected this subspecies twice from Cowcowing in 1904, nos. 1083 and 1330. The separate original (?) labels are attached to two specimens mounted on the same sheet in the Melbourne herbarium (MEL 4545) of which the specimen number 1330 corresponds to Ewart's description; the other specimen, no. 1083, being a form (mentioned by Ewart) which appears to grade into *P. filifolium*. I have therefore taken the Melbourne specimen with no. 1330 attached as the holotype. Also in Melbourne is another sheet (MEL 4544) with a label "M. Koch 1083" containing both the type plant and the intermediate form. In Sydney a sheet (NSW 69580) bears number 1083 which contains only the type plant, and similarly in Adelaide (AD 96350166). In Perth herbarium the same number is attached to the intermediate form. It is therefore uncertain to which plants the two numbers originally belonged.



This variety shows considerable morphological variation throughout its geographical range. The type has leaves which are almost smooth and very narrowly canaliculate above. In other forms it is more verrucose above and more prominently sulcate. It apparently intergrades with *P. brachycalyx* and with *P. filifolium*, as is illustrated by series of specimens collected from the same locality by P. G. Wilson 3453 nr. Tandagin (with *P. brachycalyx*) and by J. B. Cleland, 31.viii.1924, at Merredin (with *P. filifolium*).

**7. *Phebalium lepidotum* (Turcz.) P. G. Wilson, comb. nov.**

*Boronia lepidota* Turcz., Bull. Soc. Nat. Mosc. 36/1:596 (1863), [lepidotes = covered with small scales].

Typification: "Nova Hollandia, ad flumen cygnorum, Drummond coll. 1849 No. 208." Holotype: KW (photo seen); iso.: K (photo seen), MEL.

*Eriostemon maxwellii* F. Muell., Fragm. 9:108 (1875).

Typification: "In collibus arenosis ad extremitatem occidentalem sinus Great Bight locis Eyre's Relief dicto et Israelite-Bay, G. Maxwell; in vicinia promontorii Cape Arid, J. Forrest." Syntypes: MEL 4798, K (photo seen), MEL 4800, MEL 4799.

*P. maxwellii* (F. Muell.) Engler, Nat. Pflanzenfam. ed. 2. 19a:260 (1931).

Small shrub. Branchlets smooth, closely lepidote. Leaves shortly petiolate; lamina coriaceous, oblong to obovate, 5 x 1.5–15 x 2 mm, upper surface flat or convex, glabrous; lower surface silvery lepidote. Inflorescence a 3–6-flowered terminal umbel; mature bud spherical. Calyx 1.5–2.5 mm high with deltoid lobes 0.7–1 mm long, ferruginous lepidote outside, glabrous within; petals broadly elliptical, 4–5 x 3–3.5 mm, white, ferruginous lepidote outside; ovary ca. 1 mm high, ferruginous-lepidote, carpels with a small solid boss at summit. Cocci erect, ca. 3 mm high, rounded at summit with a small apiculus. Seed not seen.

Leaves narrow-oblong ca. 10–15 x 4 mm. canaliculate above; pedicels slender 4–8 mm long

**7a. var. lepidotum**

Leaves obovate, thick ca. 5 x 1.5 mm, not sulcate above; pedicels 1.5–2.5 mm long

**7b. var. obovatum**

**7a. var. lepidotum**

Leaves narrow-oblong, 10–15 (25) x ca. 2 mm, entire, slightly recurved, apex obtuse to acute, base obtuse; upper surface  $\pm$  flat or slightly rounded, canaliculate, smooth, glabrous. Pedicels slender, 4–8 mm long. Calyx hemispherical, ca. 1.5 mm high including the deltoid lobes of ca. 0.7 mm, smooth.

DISTRIBUTION: Western Australia, south and south-east of Coolgardie—Map 36.

WESTERN AUSTRALIA: N of Esperance, C. R. P. Andrews, Oct. 1903 (NSW); Salmon Gums, N. H. Brittan, 10.viii.1951 (UWA); NW base of Mt. Ragged, Miss S. Brooks, 1894 (MEL); 62 km N of Kalgoorlie, F. Lullfitz 1544 (KINGS PARK); nr. the Lort River ca. 40 mi W of Esperance, F. Lullfitz 3577 (PERTH).

*Phebalium lepidotum*-*P. tuberosum*

WESTERN AUSTRALIA: 98 mi E of Norseman, T. E. H. Aplin 1741 (PERTH); Salmon Gums, G. E. Brockway 24 (PERTH).

*Phebalium lepidotum* var. *lepidotum* may be distinguished from related species by the flat, oblong leaves which are medially sulcate above, the small calyx, and the white petals. It is variable in leaf shape and appears to intergrade locally with populations of *P. tuberosum* and *P. filifolium*.

The type specimen (Drummond 208) was originally noted by Turczaninow in 1852 when he considered it to be a form of *P. microphyllum*. Both Mueller and Bentham, assumed that the specimen no. 208 represented the latter species *sensu stricto* (partly because the type specimen was unnumbered). Later (1863)

Turczaninow based a new species, *Boronia lepidota*, on this same collection but did not mention its former inclusion under *P. microphyllum*. This last paper was published too late for Bentham to include the names in the Rutaceae section of *Flora Australiensis* and possibly for this reason it has been subsequently ignored.

About 30 to 50 km north of Esperance is found a form with broad, recurved leaves, strongly glandular-repand at the margin. This plant may warrant specific or infraspecific recognition and I have seen no specimens to suggest that it intergrades with any other form or species; however as I have seen only two collections of the plant (Wilson 3006, and N. H. Brittan, 11.viii.1951), and as in flower characters it agrees with *P. lepidotum*, I have not given it separate status.

**7b. var. obovatum** P. G. Wilson, var. nov.

[ob = inversed, ovatus = egg-shaped]

Folia obovata, crassa, ca. 5 x 1.5 mm, integra, apice rotundato; pagina superior leviter convexa, levis, nitida, nec sulcata; pagina inferior convexa, costa prominenti. Pedicelli brevi, 1.5-2.5 mm longi. Calyx obturbatus, ca. 2-2.5 mm altus, dentibus deltoideis 1 mm longis includentibus.

Holotypus: MEL 4801 "Between Israelite-Bay and Pt. Culver", G. Maxwell.

Leaves narrow-obovate (to obovate or elliptic), thick, ca. 5 x 1.5 mm, entire, apex rounded; upper surface convex, smooth, glossy (without midrib); lower surface convex with prominent midrib. Pedicels short, 1.5-2.5 mm long. Calyx obturbinate, ca. 2-2.5 mm high including the deltoid teeth of ca. 1 mm.

DISTRIBUTION: Western Australia, towards the western extremity of the Great Australian Bight—Map 36.

WESTERN AUSTRALIA: "Near the Western extremity of the Great Bight", leg. Carey, 1877 (MEL); between Esperance Bay and Frasers Range, leg. Dempster, 1876 (?) (MEL).

I have included this plant as a variety of *P. lepidotum* as it is similar in flower character and as the two varieties appear to grade into each other. It is also similar to *P. drummondii* but may be distinguished by the leaves being glossy and convex above (not dull and concave), by the short, ferruginous-lepidote pedicel, and by the larger calyx. As its status and affinities are uncertain I am considering it at only varietal rank. Further collecting is required in the area where it occurs.

**8. Phebalium drummondii** Benth.

Bentham, Fl. Austral. 1:343 (1863) [named after the collector, James Drummond].

Typification: "W. Australia, Drummond, n. 13". Holotypus: K, "Swan R." (photo seen). *Eriostemon benthamii* F. Muell., Fragm. 9:108 (1875).

Branchlets smooth, closely lepidote. Leaves shortly petiolate; lamina coriaceous, narrow to broad-elliptic or obovate, 3-5 x 1-2 mm, entire, apex obtuse to rounded, base obtuse, upper surface flat or slightly concave, dull green (when dry), smooth, without midrib, glabrous, lower surface flat, smooth, closely silvery lepidote. Inflorescence a terminal 3-6-flowered umbel; pedicels 2-5 mm long; mature bud spherical, ca. 3 mm high. Calyx shortly hemispherical, ca. 1 mm high including the short deltoid lobes ca. 0.5 mm long, smooth, silvery- to ferruginous-lepidote outside; petals elliptical, ca. 4 x 2.5 mm, bright yellow, silvery- to ferruginous-lepidote outside; ovary ca. 1 mm high, rufous lepidote, carpels with a small subapical boss; stigma minute,  $\pm$  equal in width to style apex. Fruit and seed not seen.

DISTRIBUTION: Western Australia, south-west—Map 18.

WESTERN AUSTRALIA: Koorda to Mollerin, B. Rosier 100 (PERTH); Dowerin and Bonnie Rock-Wialki district, F. Spark, Nov. 1961 (PERTH).

*Phebalium drummondii* appears to be closely related to *P. filifolium* and *P. microphyllum*, all three have similar flowers with small calyces and smooth stems. It differs markedly from these two in leaf shape.

### 9. *Phebalium brachycalyx* P. G. Wilson, sp. nov.

[brachys = short, calyx = covering, calyx]

*P. tuberosum* [non (F. Muell.) Benth.] Benth., Fl. Austral. 1:343 (1863) p.pte.

Ramuli lepidoti, verrucosissimi. Folia anguste oblongo-cuneata, 10–15 x 1.5 mm, apice rotundato vel emarginato, margine bullato-crenulato; pagina superior plana vel leviter conduplicata, manifeste medio sulcata, glabra; pagina inferior convexa, costa verrucosa prominenti. Pedicellus gracilis, 4–8 mm longus. Calyx minimus, ca. 1 mm altus, levis, lobis deltoideis ca. 0.5 mm longis.

Holotypus: A. S. George 71, south end of the Wongan Hills,  $\pm 2\frac{1}{2}$  miles from town, gravel soil, shrub 3–4 ft., flowers cream (PERTH).

Shrub; branchlets with numerous small glandular verrucosities, lepidote. Leaves shortly petiolate; lamina narrowly oblong-cuneate, 10–15 x 1.5 mm, apex rounded to emarginate; margin bullate-crenulate; upper surface flat or slightly conduplicate, prominently medially sulcate, glabrous; lower surface with a prominent verrucose midrib, silvery to ferruginous lepidote. Inflorescence a 3–6-flowered terminal umbel; pedicel slender, 4–8 mm long; mature bud spherical, ca. 2.5 mm high. Calyx very small, patelliform, ca. 1 mm high, including the deltoid lobes ca. 0.5 mm long, smooth, closely ferruginous lepidote outside, glabrous within; petals broadly elliptical, ca. 4 x 2 mm, white, silvery to ferruginous lepidote outside; ovary ca. 1 mm high, ferruginous lepidote; style glabrous, stigma scarcely broader than style. Cocci erect, ca. 3 mm high, apex rounded. Seed not seen.

DISTRIBUTION: Western Australia, Wongan Hills—Southern Cross area—Map 18\*  
WESTERN AUSTRALIA: between Rankin and Southern Cross, leg. Cronin, 1893 (MEL); "W.A.", J. Drummond 43 (MEL); Wongan Hills, E. H. Ising, 5.viii.1925 (AD); ca. 13 km E of Tandangin, P. Wilson 3457 (AD).

It appears that *Phebalium brachycalyx* takes part in introgressive hybridization with *P. filifolium* and *P. tuberosum* for between Kulin and Kondinin various intergrades between these three species have been collected. Other collections, showing characters intermediate between *P. brachycalyx* and *P. filifolium*, have been made at York, Southern Cross, and Merredin.

*P. brachycalyx* is allied to *P. microphyllum* in flower-characters and to *P. tuberosum* var. *megaphyllum* (into which it may grade) in stem and leaf characters. In leaf character it is also very similar to *P. bullatum*.

It is evident that Bentham confused this species with *P. tuberosum* and one of the numbers cited by him (Drummond 63) has kindly been compared at Kew, by Dr. S. T. Blake, with material of *P. brachycalyx*; he found them to be the same. It differs from *P. tuberosum* var. *tuberosum* very obviously in leaf and calyx shape. In the latter variety the leaf is revolute, rounded above and not medially sulcate, while the calyx is longer and strongly verrucose. In *P. brachycalyx* the leaf is flat or conduplicate, markedly medially sulcate, and the calyx is very small and almost smooth.

The Drummond specimen cited by Bentham (no. 63), and those present in Melbourne (MEL 5116–5119), are without locality notes. However the type of this species is almost identical to them in leaf and flower morphology, and it is therefore probable that they also were collected from near the Wongan Hills.

## 10. *Phebalium bullatum* Black

Black, Trans. Roy. Soc. S. Austral. 40:460. tab. 47 (1916) [bullatus = blistered]; Black, Fl. S. Austral. 344 (1924); Ewart, Fl. Vict. 710 (1931); Black, op. cit. ed. 2. 500 (1948).  
Typification: "South Australia: River Murray (Tate Herbarium, labelled "Eriostemon lepidotus F.v.M., var. amiefolius"); Ninety-mile Desert (Tate Herbarium, collector, J. Gudge, labelled "Eriostemon sediflorus, F.v.M."); Wilkawatt (T. G. B. Osborn); between Murray Bridge and Callington; Karoonda (J. M. Black)." Lectotypus: AD96514040, "Scrub between Murray Bridge and Callington," 5.x.1906, in Herb. J. M. Black. Syntypus: AD 96514003 "Murray, Eriostemon lepidotus (var. amiefolius)" ex Herb. MEL (probably a syntype of *P. sediflorum* F. Muell.).

*P. glandulosum* var. *bullatum* (Black) Court, Vict. Nat. 73:174 (1957).

*P. sediflorum* [non F. Muell.] F. Muell., Trans. Vict. Inst. 1:30 (1855) pro pte., not as to lectotype but as to the following syntypes: MEL 4764 "Lake Koorong" 25.x.1948, F. Mueller; MEL 4722, Murray scrub, Oct. 1848, F. Mueller; MEL 4728, "Murray River, towards the Wimmera", anon; AD96514003 (ex MEL) "Murray", anon.

*E. lepidotus* [non Sprengel] Tate, Handb. Fl. Extratr. S. Austral. 24 (1890).

*P. glandulosum* [non Hooker] Bentham, Fl. Austral. 1:342 (1863) pro pte., as to S. Australian collection cited.

Shrub to 2 m high. Branchlets terete, sparsely glandular verrucose, closely silvery to ferruginous lepidote. Leaves shortly petiolate; lamina thick, straight or curved, narrowly oblong-obcuneate, 6–12 mm long, 1.5–2 mm wide at retuse apex, margin glandular undulate; upper surface flat to conduplicate and acutely channelled, smooth, glabrous, and glossy; lower surface convex, closely silvery lepidote, somewhat verrucose over the prominent mid-nerve. Inflorescence a sessile terminal umbel; pedicels ca. 5 mm long; mature flower-bud spherical. Calyx hemispherical, ca. 1 mm high, 2–3 mm wide, glandular verrucose, closely lepidote, margin with broad, low, deltoid teeth; petals yellow, spreading, broadly elliptical, ca. 3 x 2 mm, silvery to ferruginous lepidote outside; ovary ca. 1.3 mm high, lepidote, the carpels spreading slightly at apex; style curled in bud,  $\pm$  equal to stamens, stellate-lepidote in lower half; stigma minute, equal in width to style apex; fruiting cocci erect, ca. 3 mm high,  $\pm$  rounded at apex; seed narrowly sub-reniform, 2–2.5 mm long, testa finely longitudinally corrugate.

Chromosome no.  $n = 16?$ . The collection cited by Smith-White (1954) as "*P. sp* SA52/21" probably refers to this species, but I have been unable to find the voucher specimen which came from Pt. Lincoln.

**DISTRIBUTION:** South Australia, southern districts from Eyre Peninsula eastwards; Victoria, far west—Map 24.

**VICTORIA:** Ellam, W. R. A. Baker, 12.x.1912 (MEL); SW of Lake Hindmarsh, E. French, Sept. 1887 (NSW); NW of Lake Albacutyn, C. French, 1887 (CANB); 13 mi N of Ouyen, T. B. Muir 1188 (MEL); nr. Annuello, J. H. Willis, 5.ix.1945 (MEL).

**SOUTH AUSTRALIA:** 24 mi N of Pinnaroo, S. L. Everist 5779 (BRI); Kinchina, J. W. Green 154 (AD); Moonta, Yorke Peninsula, E. Ashby, 25.ix.1893 (AD); 13 mi N of Koonibba, Eyre Peninsula, D. E. Symon, 30.ix.1959 (ADW).

This species is similar to *P. glandulosum*. However throughout its geographical range, from western Victoria to Eyre Peninsula in South Australia, it exhibits only slight morphological variation and does not intergrade with any other species. In leaf character its resemblance is closest to the Queensland form of *P. glandulosum* (the type form), although it differs noticeably in shape of the calyx (hemispherical not obturbinate); from the southern forms of *P. glandulosum* it differs in having a conduplicate leaf with a deep, narrow, medial channel, and no recurved margin.

F. Mueller had this plant mainly in mind when describing *P. sediflorum*. However in order to retain the accepted nomenclature I have chosen as lectotype of *P. sediflorum* that portion of the syntype material which is *P. glandulosum*.

The specimen cited by J. M. Black from "River Murray" is possibly one of the syntypes of *P. sediflorum* F. Muell., it having been sent to Tate by Mueller. The spelling cited by Black as a manuscript name "var. *amiefolius*" is a copying error of "var. *cuneifolius*", an unpublished varietal epithet sometimes used by Mueller when labelling collections of this species.

This species, which extends further west than any other eastern-Australian *Phebalium*, is morphologically similar to the Western Australian plant *P. tuberosum* subsp. *megaphyllum* and in leaf characters also to *P. brachycalyx*. The former sub-species shows great variation in leaf and flower form and intergrades with some other Western Australian species in sect. *Phebalium*. I think it probable that *P. bullatum* is of Western Australian origin, coming from the same ancestral stock as *P. tuberosum* subsp. *megaphyllum*, and that only one form of the latter penetrated to South Australia before inter-communication across the present Nullarbor Plain and Great Victoria Desert ceased. This would explain its westerly extension in South Australia, its similarity to some Western Australian species, its uniform appearance over its whole geographical range, and the absence of any suggestion of hybridization with other eastern-State species of sect. *Phebalium* where their geographical distribution coincides.

#### 11. *Phebalium lowanense* J. H. Willis

J. H. Willis, Vict. Nat. 73:196 (1957) [named after the Victorian County of Lowan, where the species is found].

Typification: "Big Desert, on mallee sandhills along the South Australian border fence, about 11 miles north of Serviceton." Holotypus: MEL 4794; iso.: AD96313080.

Small shrub to 0.6 m high. Branchlets densely silvery to ferruginous lepidote. Leaves spreading, subsessile, almost terete due to the strongly revolute margins, 4-12 x 1 mm, obtuse, upper surface smooth or slightly scabridulous, glabrous, mid-nerve not impressed, lower surface stellate-lepidote. Inflorescence a terminal umbel, 1-6-flowered; pedicel stout, 3-7 mm long; mature bud broadly ellipsoidal to spherical, the calyx lobes reaching nearly to the apex. Calyx broadly obturbinate, 3-4 cm high, thickly stellate-lepidote, silvery at base, dark red towards apex, glabrous within, lobes large, deltoid, ca. 2 mm long; petals obovate, ca. 5 x 2.5 mm, yellow, silvery and ferruginous lepidote outside; anthers exsert, oblong, 1.2-1.7 mm long, yellow; ovary sub-spherical ca. 1 mm high, thickly silvery lepidote; style coiled and recurved in bud and remaining so during and after anthesis, ca. 2 mm long, densely ferruginous stellate-lepidote in lower two-thirds; stigma minute. Cocci erect, 2.5-3 mm high, transversely corrugate, apex rounded.

DISTRIBUTION: Western Victoria and adjacent area in eastern South Australia—Map 28.

VICTORIA: N of Lillimur on fringe of Big Desert, A. J. Hicks, Sept. 1954 (MEL); 6 mi NW of Yanac in Big Desert, "on mallee sandhills in open heath", R. Melville 1088 (MEL).

SOUTH AUSTRALIA: 23 km N of Keith, N. N. Donner 147 (AD); ca. 20 km N of Bordertown, D. Hunt 988 (AD); northern boundary of Hd. of Shaugh on old Bordertown-Pinnaroo Rd, M. C. R. Sharrad 1072 (AD).

This species is restricted to a small area of Victoria and South Australia in which it exhibits no obvious morphological variation. Although evidently related to other members of the *P. squamulosum* group I have seen no suggestion of hybridization or of introgression with other species.

A peculiarity of *P. lowanense*, which I have not observed in any other species of *Phebalium*, is that the style remains coiled (with the stigma near the base) after the flower has opened and even following anthesis. It would be interesting to know whether pollination still takes place or whether the seeds are produced parthenogenetically.

In his private herbarium J. M. Black confused this species with *P. stenophyllum*; however he apparently only received material after the publication of

pt. 2 of the second edition of his Flora (the part containing the Rutaceae). Therefore although the description and locality reference "near Bordertown" given under *P. stenophyllum* could equally apply to *P. lowanense*, there is no evidence to suggest that he had the latter species in mind. I have seen no herbarium record for the occurrence of *P. stenophyllum* in South Australia.

## 12. *Phebalium glandulosum* Hook.

Hooker in Mitchell, Journ. Exped. Int. Trop. Austral. 199 (1848) [*glandulosum* = with glands]; Bentham, Fl. Austral. 1:342 (1863); Walpers, Ann. Bot. Syst. 2:250 (1852); Bailey, Queensld. Fl. 1:193 (1899); Engler, Nat. Pflanzenfam. 3/4:141 (1896). Engler, op. cit. ed. 2. 19a:260 (1931); Ewart, Fl. Vict. 110 (1931); Black, Fl. S. Austral. 344 (1924); Black, op. cit. ed. 2:500 (1948).

Typification: collected on 16th June 1846, ca. 11 miles south of Mt. Owen near the Murrumbidgee River. Holotypus: T. L. Mitchell 331 "Sub-tropical New Holland, stony ravines", K (photo seen); iso.: MEL 4751.

*Eriostemon lepidotus* var. *glandulosus* (Hook.) F. Muell., Fragm. 9:107 (1875) comb. illeg.

*P. sediflorum* F. Muell., Trans. Vict. Inst. 1:30 (1855) pro pte. sensu lectotypica.

Typification: "In the Mallee Scrub, at the Murray River, Lake Lalbert, and Lake Tyrrell." Lectotypus: MEL 4720 "Lake Lalbert and Lake Tyrrell Desert, 1854, Ferd. Mueller." Syntypes: MEL 4735 "Murray River", anon.; MEL 4738 "Mallee scrub", F.v.Mueller; MEL 4723 "Lake Tyrrell", C. Wilhelmi; MEL 4731 "On the road to Lake Tyrrell, very handsome sand ridges" and "Murray River", anon. (For further syntypes see under *P. bullatum*).

*E. sediflorus* (F. Muell.) F. Muell., Fragm. 1:102 (1859); C. Mueller in Walpers, Ann. Bot. Syst. 7:521 (1868); F. Muell., Key Syst. Vict. Pl. 1:142 (1887); Moore et Betche, Handb. Fl. N.S. Wales 44 (1893); Dixon, Pl. N.S. Wales 49 (1906).

Shrub; branchlets terete, minutely to prominently glandular verrucose, closely silvery to ferruginous lepidote. Leaves shortly petiolate; lamina linear to narrowly or broadly oblong-cuneate, 5 x 1-30 x 3 mm, margin  $\pm$  glandular undulate, slightly to strongly recurved, apex truncate to emarginate or obtuse; upper surface smooth to rugulose between normally prominent hemispherical glandular verrucosities, plane or deeply channelled along mid-nerve,  $\pm$  rounded; lower surface plane or with a prominent midrib, lepidote. Inflorescence of terminal sessile or shortly pedunculate umbels; pedicels 2-5 mm long. Calyx obturbinate to shallowly or deeply hemispherical, 0.8-1.5 mm high,  $\pm$  glandular verrucose, lepidote, margin undulate to deeply deltoid-dentate; petals erect or spreading at anthesis, elliptical, to 3 x 2 mm, pale to bright yellow; anthers suborbicular to broad-oblong, 0.5-1 mm long; ovary subspherical, silvery lepidote; style slender, curled in bud, glabrous or stellate-lepidote towards the base; stigma globular, slightly wider than style. Cocci erect 3-4 mm high, rounded at apex and minutely apiculate on outer edge. Seed narrowly sub-reniform, ca. 2 mm long, testa finely longitudinally corrugate.

Leaf with mid-nerve strongly impressed above.

Leaf narrowly oblong-cuneate, ca. 2 (3) mm wide at apex. Calyx obturbinate to deeply hemispherical **12a. subsp. glandulosum**

Leaf linear-cuneate, ca. 1 mm wide at apex. Calyx shortly hemispherical **12b. subsp. angustifolium**

Leaf without impressed mid-nerve.

Calyx shortly hemispherical, ferruginous lepidote, teeth broadly deltoid, very obtuse **12c. subsp. eglandulosum**

Calyx deeply hemispherical, silvery lepidote, teeth shortly acuminate **12a. subsp. glandulosum**

### 12a. subsp. *glandulosum*

Lamina narrowly oblong-cuneate 5 x 1.5 to 30 x 1.5-2.5 mm (to broadly oblong-cuneate and ca. 3 mm wide), apex truncate to retuse or obtuse, margin undulate, recurved to revolute; upper surface smooth or rugulose between prominent hemispherical verrucosities, stellate when young, plane to

deeply impressed over mid-nerve. Calyx obturbinate to deeply hemispherical, 0.8–1.5 mm high 2–2.5 mm wide, margin undulate or with prominent deltoid-acuminate teeth, verrucose.

**DISTRIBUTION:** Southern Queensland; New South Wales; western and extreme eastern Victoria, southern South Australia—Map 24.

**QUEENSLAND:** Roma, C. T. White 11061 (BRI); nr. Mt. Playfair Station, Tambo area, L.H. Cockburn 53 (BRI); ca. 30 mi S of Mitchell, S. L. Everist 5918 (BRI).

**NEW SOUTH WALES:** GOONOO Forest nr. Dubbo, G. M. Althofer, 1.vi.1943 (NSW); Wyalong, 2 ft. high, pyramidal in habit, J. L. Boorman, Sept. 1918 (NSW); Mulgowen Station, 35 mi S of Bourke, E. F. Constable, 15.iv.1963 (NSW); Head of Tooraweerak Ck., Warrumbungle Range, L. A. S. Johnson and E. Constable, 18.iv.1952 (NSW); Snowy River near Tombong, W. Forsyth, May 1908 (NSW).

**VICTORIA:** Nhill, St. Eloy D'Alton, 1896 (MEL); Dimboola, St. Eloy D'Alton, 1901 (NSW).

**SOUTH AUSTRALIA:** Ardrossan, Yorke Peninsula J. G. O. Tepper, Nov. 1879 and 28.viii.1880 (AD); Hoyleton, Mt. Loftly Range, S. Dixon, July 1884 (AD).

In Queensland this subspecies has a long, narrow leaf with a deeply impressed mid-nerve; the calyx is obturbinate and the petals erect. In southern New South Wales, western Victoria, and in South Australia the leaf is short, scarcely or not at all impressed above, the calyx deeply hemispherical and the petals spreading. These two forms may warrant recognition; however intermediates occur which do not make precise delimitation possible. In the Warrumbungle Range (New South Wales) is found a form with large leaves (to 21 x 5 mm) which in other respects resembles the southern New South Wales plant. A somewhat similar plant, with leaves varying in size from the normal to that found in the Warrumbungles, has been collected at Mulgowen Station, south of Bourke.

**12b. subsp. angustifolium** P. G. Wilson, subsp. nov.

[angustus = narrow, folium = leaf]

Ramuli minute et sparse verrucosi. Folia lineari-cuneata, 5–8 x 0.5–1 mm, apice truncato et retuso, marginibus bullato-undulatis, leviter recurvatis; pagina superior verrucosa, manifeste sulcata. Flores parvi; calyx patelliformis, ca. 1 mm altus, 2 mm latus, verrucosus.

Holotypus: AD96434184 (ex NSW 18472), Honeysuckle Creek, Murrumbidgee to Kerrabee, New South Wales, "Local but common in rather open tallish forest on floor of gully, bushy shrubs 5–6 ft., flower bright, light yellow, 19.ix.1951, L. A. S. Johnson. Isotypus: SYD.

Branchlets minutely and sparsely glandular verrucose. Lamina linear-cuneate, 5–8 x 0.5–1 mm, apex truncate and retuse, margin glandular undulate and slightly recurved, upper surface glandular verrucose, mid-nerve deeply impressed. Pedicels slender, ca. 4 mm long. Flowers small; calyx very shortly hemispherical (patelliform) ca. 1 mm high, 2 mm wide, glandular verrucose, silvery lepidote.

Chromosome no.  $n = 16$ . The collection cited by Smith-White (1954) "cult. Dripstone", is probably this subspecies.

**DISTRIBUTION:** New South Wales; Murrumbidgee—Cox's Gap—Kerrabee area—Map 24.

**NEW SOUTH WALES:** Cox's Gap, Rylstone Road, E. F. Constable, 12.ix.1948 (NSW); Murrumbidgee, R. T. Baker, Oct. 1893 (NSW).

**12c. subsp. eglandulosum** (Blakely) P. G. Wilson, stat. nov.

*P. glandulosum* var *eglandulosum* Blakely, Contr. N.S.Wales Nat. Herb. 1:124 (1941) [e = not, glandulosus = with glands].

Typification: "Torrington, R. H. Cambage, No. 1723, 29.9.1907." Holotypus: NSW 69660, "Low plant on bare acid granite rocks."

Branchlets minutely glandular verrucose, closely ferruginous-lepidote. Leaves narrowly oblong-cuneate ca. 5 x 1–2 mm; apex truncate and retuse; margin revolute; upper surface convex, smooth and sparsely glandular verrucose, mid-nerve not impressed; under surface concave, smooth. Pedicel ca. 3 mm long. Calyx shortly hemispherical, ca. 0·8 mm high, 1·5 mm wide, margin with broad, deltoid lobes, closely silvery and ferruginous lepidote; petals spreading, broadly elliptical, ca. 3 mm long, silvery and ferruginous lepidote outside.

DISTRIBUTION: north-east New South Wales—Map 24.

NEW SOUTH WALES: Torrington, J. L. Boorman, Oct. 1911 (AD); *ibid.*, R. Thomas, 16.x.1932 (NSW).

This subspecies is characterized by its smooth branchlets, short leaves (which have no impressed mid-rib), and by the very low, deltoid calyx lobes. A plant somewhat intermediate between this subspecies and the small-leaved form of *P. squamulosum* subsp. *gracile* has been collected at Warialda. It has smooth branchlets, small oblong-cuneate leaves which are scarcely recurved but are prominently glandular verrucose, the flowers are small and the calyx truncate. It is possibly a remnant of a previous cline between *P. glandulosum* subsp. *eglandulosum* and *P. squamulosum* subsp. *gracile*; at any rate the specimen suggests that at this point the tenuous specific distinction between *P. glandulosum* and *P. squamulosum* breaks down.

### 13. *Phebalium squamulosum* Vent.

Ventenat, Jard, Malm. 2:tab. 102 (1805) [squama = a scale]; Smith in Rees, Cycl. 27: no. 1 (1814); de Candolle, Prod. 1:720 (1824); Jussieu, Mém. Soc. Hist. Nat. Paris 2:132 (1825); Poirét, Dict. Sc. Nat. 39:464 (1826); Sprengel, Syst. Veg. 4 pt. 2:164 (1827); G. Don, Gen. Hist. 1:791 (1831); Bentham, Fl. Austral. 1:342 (1863); Engler, Nat. Pflanzenfam. 3/4:141 (1896); Bailey, Queensld. Fl. 1:193 (1899); Engler, op.cit. ed. 2. 19a:260. tab. 115 (1931). Typification: "Arbrisseau d'un bel aspect, originaire de la Nouvelle Galles, et croissant sur les montagnes." "Nouvelle Galles" was the name given to the east coast of Australia. Type not seen.

*Eriostemon lepidotus* Spreng., Syst. Veg. 2:322 (1825) nom. illeg.; F. Muell., Fragm. 1:104 (1859); F. Muell., Pl. Col. Vict. 1:130 (1862); F. Muell., Fragm. 9:107 (1875), based on *P. squamulosum*.

*P. aureum* A. Cunningham in Field, Geogr. Mem. N.S.Wales 331 et tab. (1825); G. Don, Gen. Hist. 1:791 (1831); Walpers, Rep. Bot. Syst. 1:505 (1842). Typification: "Blue Mountains." Syntypes K (photo seen) "No. 26, 1822", MEL 5072 and BRI 042548 "no. 60, Oct. 1818."

*P. elaeagnifolium* A. Jussieu, Mém. Soc. Hist. Nat. Paris 2:132. tab.11.fig.2 (1825); Poirét, loc. cit.; Sprengel, op. cit. 4 pt. 2:164 (1827); G. Don, loc. cit.; Walpers, loc. cit. Typification: "Vidi sp. siccam in herb. Mus. Par., ex portu Jackson." Type not seen.

*E. elaeagnifolius* (A. Jussieu) Baillon, Hist. Pl. 4:388 (1873).

Shrub to 3 m high (to slender tree 7 m high). Branchlets ferruginous lepidote, becoming glabrous, smooth (or rarely sparsely and minutely tuberculate). Leaves with petiole 0·5–4 mm long; lamina chartaceous to coriaceous, linear to elliptical or obovate, entire (or somewhat crenulate), 7 x 1·5 mm to 70 x 8 mm, flat or with recurved or revolute margin, glabrous or sparsely stellate above, densely silvery to reddish-brown stellate-tomentose or lepidote below, apex acute to rounded, truncate, or retuse. upper surface smooth (or rarely scabridulous) with or without small verrucosities, mid-rib slightly to deeply impressed above, prominent below. Inflorescence of sessile or shortly pedunculate terminal umbels; pedicels 3–8 mm long with a minute basal bract; mature bud sub-spherical. Calyx shortly hemispherical or sub-turbinate, 0·5 x 1·5 to 1·2 x 2 mm, smooth or somewhat verrucose, lepidote outside and glabrous within, margin truncate to undulate (or rarely deltoid toothed); petals elliptic, 2·2 x 1 to 4·5 x 2·2 mm, silvery to reddish-brown lepidote outside, glabrous and yellow to cream inside; ovary spherical, 1·5 mm high,



silvery to rufous lepidote; style glabrous (or rarely stellate-lepidote towards base), straight in bud, somewhat shorter than stamens; stigma minute or capitate. Cocci erect, ca. 3.5 mm high, truncate or slightly rounded at apex. Seed ca. 3 mm long, black, longitudinally corrugate.

*P. squamulosum* as here delimited shows considerable morphological variation. It is a species not sharply separated from related ones and it would be feasible to enlarge it so as to include *P. glandulosum* and possibly also *P. woombye*. This procedure does not seem appropriate as it would then contain plants of extremely diverse form and the step would logically also necessitate the consideration of other species in the section with the possible eventual amalgamation of most of the eastern states representatives. An alternative procedure would be to raise the subspecies to the species level. This would mean that the species then showed less variability but it would also mean that a large number of plants would be somewhat intermediate in character, not due to hybridization, but to the clinal nature of the populations.

1. Leaves coriaceous, oblong-obovate to broad-obovate, to 11 mm long, margin recurved, loosely stellate-lepidote below **13k. subsp. ozothamnoides**
1. Leaves coriaceous to chartaceous, linear to oblong or elliptic, 5–70 mm long.
2. Leaves linear and up to 25 mm long, or oblong to narrow-elliptic and up to 10 (15) mm long, closely lepidote below.
3. Leaves linear or narrow-oblong, ca. 1 mm wide.
4. Leaves linear, 10–25 mm long, entire, smooth **13f. subsp. lineare**
4. Leaves narrow-oblong, ca. 6 mm long, prominently verrucose **13e. subsp. parvifolium**
3. Leaves oblong or narrow-elliptic, 2 mm or more wide.
5. Leaves oblong or oblong-elliptic, apex rounded, 7–10 (12) mm long, slightly recurved, midrib slightly impressed, upper surface thinly lepidote when young, calyx undulate **13i. subsp. alpinum**
5. Leaves narrow-oblong or narrow-elliptic, 7–15 mm long, upper surface glabrous when young, midrib fine, impressed; calyx  $\pm$  truncate **13d. subsp. gracile**
2. Leaves elliptic or broadly elliptic usually over 15 x 2 mm.
6. Stem, leaves, and calyx verrucose **13g. subsp. verrucosum**
6. Stem and leaves (and usually calyx) smooth.
7. Leaves chartaceous, stellate-lepidote above at least when young.
8. Leaves elliptic to obovate, with apex rounded, underside of leaves and flowers silvery lepidote **13c. subsp. argenteum**
8. Leaves narrow-oblong, obtuse to truncate or retuse, usually  $\pm$  ferruginous lepidote **13a. subsp. squamulosum**
7. Leaves chartaceous to coriaceous, glabrous above even in bud.
9. Leaves narrow-elliptic, obtuse, 2–7 cm long, calyx prominently dentate (Queensland) **13h. subsp. longifolium**
9. Leaves narrow to broad-elliptic, calyx truncate to undulate.
10. Leaves coriaceous, oblong-elliptic, obtuse, flat or conduplicate; calyx prominently undulate (Warrumbungle Range) **13b. subsp. coriaceum**
10. Leaves chartaceous (or sub-coriaceous), apex rounded to acute, calyx truncate **13a. subsp. squamulosum**

### **13a. subsp. squamulosum**

Leaves oblong to elliptic, 15–50 mm long, chartaceous or sub-coriaceous, apex acute to obtuse, truncate or retuse, upper surface smooth (rarely scabridulous), not glandular verrucose. Calyx  $\pm$  truncate, smooth.

Chromosome no.  $n = 16$ , from material collected at Kuringai, Blackheath, New South Wales, fide Smith-White (1954).

DISTRIBUTION: SE Queensland, eastern New South Wales, eastern Victoria—Map 20.

QUEENSLAND: Kingaroy, A. W. Long, Mar. 1933 (MEL); Mt. Ballow, Moreton District, alt. 3,600 ft., shrub 2-3 m on top of mt., C. T. White 11101 (BRI); Amiens, nr. Stanthorpe, L. Pedley 1488a (BRI).

NEW SOUTH WALES: Torrington, J. L. Boorman, Oct. 1911 (NSW); Clarence R., Dr Beckler (MEL 5010); Peak Hill, Porto Bay, W. F. Blakely and D. W. C. Shires, 7.viii.1927 (NSW); Barrington Tops, L. R. Fraser et al., 7.i.1934 (SYD); National Park, Pt. Hacking Dist., 10 ft. bushy, E. F. Constable, 31.viii.1948 (NSW); Ulladulla, W. Baeuerlen, 1883 (MEL).

VICTORIA: Howe Range, extreme SE Victoria, "a slender tree to 20 ft. high", J. H. Willis and N. A. Wakefield, 24.x.1948 (MEL); Baw Baw Rd., J. Galbraith, 20.ix.1958 (MEL); Wilsons Promontory, leg. Pitcher, 1.x.1914 (MEL).

This subspecies as here delimited, includes several different forms which may warrant recognition, but as some of these forms are known only from single collections it appears unwise at the moment to further fragment the species. There are two principal forms which are fairly widespread in New South Wales and are well represented in herbaria. The first, which includes the type of *P. squamulosum*, has leaves elliptic, acute to entire, chartaceous or sub-coriaceous, and glabrous above. It occurs near the New South Wales coast from Botany Bay north to Patonga. The second form includes the types of *P. aureum* and *P. elaeagnifolium*; the leaves are thin, oblong, with the apex bluntly retuse, the margin slightly undulate, and the upper surface often has small scattered glandular tubercles. It is found east of the Great Dividing Range from Jervis Bay north to near Castlereagh; from field notes on some herbarium sheets it would appear that this form is frequently found near streams. In Victoria is found a form similar to the second one and with the leaf slightly lepidote above.

Near Stanthorpe, on the Queensland-New South Wales border is found a form similar to the type form found near Sydney, but with the leaves oblong and obtuse. This plant matches *P. whitei* in appearance but is much smaller in all its parts, and since the two are found in the same general region it seems likely that *P. whitei* evolved from such a form of *P. squamulosum*.

The style is normally glabrous; however in specimens from near Yarra Junction, Victoria, it is stellate-lepidote towards the base. The calyx, truncate in the typical form, is also not constant in shape: at Bairnsdale on the south-east coast of Victoria, it is broadly deltoid-toothed as in subsp. *longifolium* (from which it markedly differs in leaf-shape and in the stigma); it is otherwise similar to the Victorian forms of the type subspecies.

Most herbarium notes on habit refer to this plant as being a shrub. However in the mountains of south-east Victoria it develops into "a slender graceful tree to 20 ft high" (fide J. H. Willis in sched.).

### 13b. subsp. *coriaceum* P. G. Wilson, subsp. nov.

[coriaceous = leathery, referring to the leaf texture]

Folia coriacea, late oblongo-elliptica, ca. 2.5 x 0.5 cm, plana vel parum conduplicata (haud recurvata), supra levia et pallido-virida, apice obtuso vel rotundo. Flores numerosi; calyx undulatus; corolla flava, extra argenteo et rufo-lepidota.

Holotypus: AD 96425099 (dupl. of CBG 005299) between Camp Pincham and Camp Wombelong, Warrumbungle Mts., New South Wales, 28.viii.1961, leg. M. E. Phillips.

Leaves coriaceous, broadly oblong-elliptic, ca. 2.5 x 0.5 cm, flat or tending to conduplicate (not recurved), obtuse to rounded, smooth and drying pale green above, closely silvery lepidote below. Flowers numerous in pedunculate umbels; calyx undulate, corolla silvery and rufous lepidote outside, bright yellow within.

DISTRIBUTION: New South Wales, Warrumbungle Range—Map 22.

NEW SOUTH WALES: Beloungery Split Rock, Warrumbungle Range, alt. 2000 ft., shrub 120 cm, B. G. Briggs, 31.iii.1961 (NSW); Gooraweenah Ck., Warrumbungle Mts., 1800 ft., basalt, bushy shrub 3 ft., L. A. S. Johnson and E. Constable, 18.iv.1952 (NSW).

This subspecies is restricted to the Warrumbungle Range. It differs from subsp. *squamulosum* in the shape of the leaf and also in it being slightly concupitate, in the undulate calyx, and in the bright yellow corolla.

A similar plant, but with a chartaceous leaf, is found in the Gibraltar Range, New South Wales.

**13c. subsp. argenteum** P. G. Wilson, subsp. nov.

[argenteus = silvery]

Folia chartacea, oblongo-elliptica, late-elliptica, vel oblongo-obovata, 15 x 3—20 x 10—70 x 10 mm, apice rotundato; pagina superior in statu juvenili stellato-lepidota, leviter canaliculata; pagina inferior argenteo stellato-lepidota. Calyx corolla ovariumque argenteo-lepidotus.

Holotypus: CANB 66538, Wreck Bay, A.C.T. (Jervis Bay enclave), cliff headland, "large shrub 8 ft. tall", 19.ix.1959, J. Campbell 80.

Leaves chartaceous, oblong-elliptic to broadly elliptic or oblong-obovate, 15 x 3—20 x 10—70 x 10 mm, apex rounded, upper surface stellate-lepidote when young with shallow mid-rib, silvery stellate-lepidote below. Calyx, petals, and ovary silvery lepidote.

DISTRIBUTION: New South Wales, near the east and south-east coasts; Victoria, extreme east—Map 22.

NEW SOUTH WALES: Port Stephens, J. L. Boorman, Sept. 1911 (AD); Gorie Beach, National Park, clayey banks nr. beach, bushy shrub 3–4 ft., E. F. Constable, 22.ix.1955 (NSW).

A.C.T.: Jervis Bay, on the roof of cliffs, E. Gauba. 1.ix.1955 (GAUBA).

VICTORIA: Gabo Island, leg. Maplestone (MEL 5108).

This subspecies may be distinguished from subsp. *squamulosum* by the presence of stellate hairs on the upper surface of the young leaf and by the shallow mid-rib indentation in which the epidermal cells are not different from the surrounding ones. The undersurface indumentum consists of stellate-hairs or of forms intermediate between these and squamae, silvery or with a few rufous scales.

It has evident affinities with subsp. *ozothamnoides*, as both subspecies have similar leaf indumentum and calyx shape. Near Port Hacking River and Georges River it grades into the thin-leaved form of subsp. *squamulosum*.

**13d. subsp. gracile** P. G. Wilson, subsp. nov.

[gracilis = slender]

Folia parva, oblonga, ca. 7 x 2 mm, apice rotundato vel obtuso; pagina superior levis, glabra tenuiter canaliculata.

Holotypus: CANB 72859, 19 miles east of Ulan, New South Wales, on macchia on sandstone hills, 5 ft. shrub, yellow flowers going brown with age, dull-green discoloured leaves, 9.x.1959, R. Story 6800. Isotypes: NSW, PERTH.

Leaves small, oblong, ca. 7 x 2 mm, apex rounded to obtuse; upper surface smooth, glabrous, with a fine, impressed mid-nerve.

DISTRIBUTION: north-east New South Wales—Map 21.

NEW SOUTH WALES: Baradine rd., 11 mi from Coonabarabran, shrub 4 ft., G. W. Althofer 13 (MEL); Gungal nr. Merriwa, "Tall plants 6–8 ft high all over the hills on fairly moist places, making very large tree-like plants, in some cases the stems are 4–6 ins. diameter and 10 ft. or more high", J. L. Boorman, 20.ix.1904 (AD, NSW).

**13e. subsp. parvifolium** P. G. Wilson, subsp. nov.

[parvus = small, folium = leaf]

Ramulus glanduloso-verrucosus. Folia anguste oblonga vel sub-teretia, 6 x 1—10 x 0.7 mm, apice acuto; margo integer vel glanduloso-crenatus; pagina superior convexa, nitida, verrucosa, in medio profunde sulcata. Calyx truncatus, 0.7 x 1.5 mm, fusco-lepidotus.

Holotypus: MEL 4741, Kildary, New South Wales, 10.x.1917, W. R. A. Baker.

Stem glandular verrucose. Leaves narrow-oblong to sub-terete, 6 x 1–10 x 0.7 mm, margin entire or glandular crenate, apex rounded, upper surface rounded, glossy, glandular verrucose, deeply sulcate, lower surface smooth and  $\pm$  plane to convex or rounded. Calyx truncate, 0.7 x 1.5 mm, closely brown-lepidote.

DISTRIBUTION: Central New South Wales—Map 21.

NEW SOUTH WALES: Yalgoglin, "a plant of 2–3 ft., densely foliated to the ground", J. L. Boorman, Sept. 1918 (NSW); Cobar, I. M. Curran 10 (MEL); nr. Beckom, ca. 30 mi from West Wyalong, A. Mitchell, Sept. 1959 (NSW).

This subspecies approaches some forms of *P. glandulosum* in having large glands on the leaves. However in that species the leaves are recurved and the calyx lobed.

Compared with the typical subspecies this plant would appear to warrant specific recognition; there is not however any large morphological discontinuity between the two subspecies. *P. squamulosum* subsp. *parvifolium* is allied to subsp. *lineare* (but occupies a distinct geographical region and does not intergrade); this merges into subsp. *gracile* which in its extreme eastern form is similar to subsp. *squamulosum*.

**13f. subsp. lineare** P. G. Wilson, subsp. nov.

[linearis = linear]

Ramuli leves. Folia linearia, 10–25 x 1 mm, integra, supra levia, profunde sulcata; truncata vel obtusa. Flores numerosi, graciliter pedicellati; calyx brevissimus, truncatus vel undulatus, rufo-lepidotus.

Holotypus: NSW 69862, Scone, N.S.W., 31.viii.1907, R. H. Cabbage 1671; iso.: CANB, SYD.

Branchlets smooth. Leaves linear, 10–25 x 1 mm, entire, smooth and strongly channelled above, apex truncate to obtuse. Flowers numerous on slender pedicels; calyx very short, truncate or undulate, rufous lepidote.

DISTRIBUTION: eastern New South Wales, from Denman north to Murrurundi—Map 21.

NEW SOUTH WALES: South of Murrurundi, sandstone conglomerate, R. H. Cabbage, 1.x.1907 (SYD); Shoalhaven R. above Badgerys Crossing, W. Forsythe and A. A. Hamilton, Sept. 1899 (NSW).

**13g. subsp. verrucosum** P. G. Wilson, subsp. nov.

[verrucosus = warty]

Ramuli verrucosi, folia chartacea, plana vel marginibus leviter recurvatis, oblongo-elliptica, 15–25 x 2.5–30 x 6 mm, apice rotundo vel truncato vel leviter retuso, pagina superior verruculosa, in statu juvenile stellato. Calyx profunde hemisphaericus, manifeste dentatus, verrucosus.

Holotypus: NSW 69872, Tia Falls, New South Wales, Oct. 1900, W. Forsyth.

Branchlets glandular-verrucose. Leaves chartaceous, flat or with slightly recurved margins, oblong-elliptic, 15–25 x 2.5 mm to 30 x 6 mm; apex rounded to truncate or slightly retuse; upper surface stellate when young with numerous small glandular verrucosities, lower surface smooth. Calyx deeply hemispherical, prominently and acutely dentate, glandular-verrucose, silvery lepidote; petals silvery lepidote outside.

DISTRIBUTION: north-east New South Wales—Map 21.

NEW SOUTH WALES: Walcha, sources of the Namoi R., A. R. Crawford 92 (MEL); Wolloomombi Gorge, low shrub, J. B. Williams 962 (NSW).

This subspecies may be distinguished by the presence of glandular-verrucosities on the stem and leaves and by the deeply hemispherical, lobed calyx. The absence of ferruginous scales is also characteristic. It appears to be morphologically intermediate between *P. glandulosum* and *P. squamulosum* subsp. *squamulosum*. However I have seen no collections of either of these taxa from near the area in which *P. squamulosum* subsp. *verrucosum* has been recorded; this suggests that it should be considered as a distinct taxon. I have included it in *P. squamulosum* on the basis of leaf morphology; the floral characters correspond more to *P. glandulosum* subsp. *glandulosum*.

**13h.** subsp. *longifolium* (S. T. Blake) P. G. Wilson subsp. et stat. nov.

*P. longifolium* S. T. Blake, Proc. Roy. Soc. Queensld. 70:44 (1959) [longus = long, folium = leaf].

Typification: "About W. of Ingham, near Wallaman Falls, . . . Aug. 1954, Blake 18809. Holotypus: BRI 15054.

Shrub to 3 m high. Leaves narrow-elliptic 2–7 x 4–10 mm, obtuse, entire; upper surface flat, smooth, glabrous, mid-nerve impressed; lower surface smooth, closely ferruginous lepidote, with prominent mid-nerve. Calyx hemispherical, ca. 1.5 x 2 mm, verrucose, ferruginous lepidote outside, glabrous within, prominently dentate. Petals white, ferruginous lepidote outside. Stigma capitate.

DISTRIBUTION: Queensland, north-east—Map 22.

QUEENSLAND: Tully Falls, A. Fielding 12546 (PERTH); near Paluma, G. M. Gittans 605 (BRI); Atherton to Herberton, B. Hyland 1870 (BRI); Millet Farm, Ravenshoe, C. J. Samundsett 20 (BRI).

*P. squamulosum* subsp. *longifolium* is the most northerly representative of the species. In south-east Queensland and north-east New South Wales is found a plant with similar foliage but with the calyx character approaching that of the typical subspecies. In leaf and floral characters it is also similar to *P. woombye* and may represent a northern form of that species which, however, has the calyx lepidote within, not glabrous as in subsp. *longifolium*.

**13i.** subsp. *alpinum* (Benth) P. G. Wilson stat. nov.

*P. squamulosum* var. *alpinum* Benth, Fl. Austral. 1:343 (1863) [alpinus = alpine], based on the following.

*P. podocarpoides* F. Muell., Trans. Vict. Inst. 1:31 (1855); Ewart, Fl. Vict. 710 (1931).

Typification: "On the rocky alpine summit of Mount Buller and the Mitta Mitta Ranges." Lectotypus: MEL 4859, Mt. Buller, March 1853, F. Mueller.

*Eriostemon alpinus* F. Muell., Fragm. 1:103 (1859) nom. illeg. based on *P. podocarpoides*; F. Muell., Key Syst. Vict. Pl. 1:142 (1887); Stirling, Proc. Linn. Soc. N.S.Wales 1:1056 (1887); Moore et Betche, Handb. Fl. N.S.Wales 45 (1893); Dixon, Pl. N.S.Wales 49 (1906).

*P. alpinum* (Benth) Maiden et Betche, Census N.S.Wales Pl. 116 (1916), nom. illeg., a superfluous name.

Small compact shrub ca. 1 m high, lower branches frequently prostrate. Leaves coriaceous, oblong to oblong-elliptic, entire, 7 x 1.5–12 x 2.5 mm, apex obtuse to rounded, upper surface smooth, glossy (thinly lepidote when young), lower surface closely silvery to ferruginous lepidote. Umbels sessile, ca. 5-flowered, pedicel 2–3 mm long. Calyx shortly hemispherical, ferruginous-lepidote, margin undulate and minutely dentate. Petals white to yellow, ferruginous lepidote outside.

DISTRIBUTION: eastern Victoria (and south-east New South Wales)—Map 20.

VICTORIA: near Rocky Valley, Bogong High Plains, shrub 1 ft. high and 2 ft. wide, Helen I. Aston 198 (MEL); Lake Catani, Mt. Buffalo, shrub 2–3½ ft., B. G. Briggs, 21.xii.1952 (NE); Mt. Wellington area, alpine plain, T. B. Muir 3049 (MEL); Cobungra, H. B. Williamson, Dec. 1928 (MEL).

*P. squamulosum* subsp. *alpinum*—subsp. *ozothamnoides*

NEW SOUTH WALES: Three Mile Dam, Snowy Mts., K. M. Cooper, Nov. 1964 (NSW); Mt. Coree, P. J. Darbyshire 530 (NE).

A.C.T.: Snowy Flats nr. Mt. Gingera, 5,500 ft., R. Pullen 2338 (CANB).

This subspecies in its typical form is restricted to Victoria; in the Snowy Mts. of New South Wales is found a plant intermediate in character between it and subsp. *ozothamnoides*, with which it appears to intergrade. I have normally referred the intermediate form to subsp. *ozothamnoides* since it appears to be geographically isolated from the typical form of subsp. *alpinum*.

A form of *P. squamulosum* subsp. *gracile* found between Dubbo and Narrabri in New South Wales is very similar to subsp. *alpinum*. However the leaf in the former has a prominent filiform depression over the midrib in which the epidermal cells are different; it is glabrous above even when young, and the calyx is smaller and almost truncate.

The character of the upper leaf surface of subsp. *alpinum* (non differentiation of epidermal cells over midrib and pubescent upper surface of young leaf) is shared also with subsp. *ozothamnoides* and subsp. *argenteum* with which taxa subsp. *alpinum* is probably most closely related.

**13k.** subsp. *ozothamnoides* (F. Muell.) P. G. Wilson, comb. et stat. nov.

*P. ozothamnoides* F. Muell., Trans. Vict. Inst. 1:31 (1855), [Ozothamnus, a genus of Asteraceae, oides = like]; Bentham, Fl. Austral. 1:342 (1863); F. Muell., Key Syst. Vict. Pl. 1:141 (1887); Ewart, Fl. Vict. 709 (1931); Beadle et al., Handb. Vasc. Pl. Syd. Dist. 319 (1963). Typification: "On the gravelly banks of the Mitta Mitta and Livingstone River." Lectotypus: MEL 4876 "Upper Mitta Mitta, 4,000 ft.", F. Mueller; iso.: K (photo seen).

*E. ozothamnoides* (F. Muell.) F. Muell., Fragm. 1:103 (1859); F. Muell., op. cit. 9:107 (1875); Stirling, Proc. Linn. Soc. N.S.Wales 11:1055 (1887); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906).

Compact shrub 1–2 m high. Leaves coriaceous, oblong-obovate to broadly obovate, cuncate, or suborbicular, 11 x 3.5 to 7 x 6 to 9 x 7 mm, entire, apex rounded, margin recurved to revolute; upper surface sparsely stellate to glabrous (always stellate when young), smooth or scabridulous, midrib not impressed; lower surface smooth, stellate. Inflorescence a sessile umbel of 2–5 flowers, pedicel 4–5 mm long. Calyx hemispherical ca. 1 x 2 mm, silvery or silvery and ferruginous lepidote outside, margin truncate to shortly lobed; petals silvery- to ferruginous-lepidote, yellow.

Chromosome no.  $n = 32$ , from material collected at Mt. York, New South Wales, fide Smith-White (1954).

**DISTRIBUTION:** north-eastern Victoria, eastern New South Wales—Map 20.

NEW SOUTH WALES: Macdonald R., Ingulba, nr. Walcha, on slate, 2½ ft. compact shrub, B. G. Briggs, 23.xii.1953 (NE); Hassons Walls nr. Lithgow, C. Burgess, 8.x.1961 (AD, CBG); Kiandra Dist., E. Betche, Feb. 1897 (NSW).

A.C.T.: Top of Mt. Coree, E. D'Arney 243 (CANB).

VICTORIA: Cobungra, H. Morgan, Nov. 1927 (MEL); along margins of Mitta Mitta and Big Rivers, up to 3,000 ft., J. Stirling 127 (MEL).

This subspecies has leaves which are stellate above, at least when young, and which have an inconspicuous midrib. These characters it shares to some extent with the subspecies *alpinum* and *argenteum*.

It shows a considerable degree of variation over its geographical range; in Victoria the calyx is truncate, in the Snowy Mountains it becomes more or less lobed, in the Blue Mountains it is again truncate; however farther north near Backwater (north-east of Guyra) the calyx is deeply lobed, obturbinate in outline, and approaches the southern form of *P. woombye* (which however has the leaves glabrous above). From near Guyra also comes a specimen of

*P. squamulosum* (E. F. Constable, 24.v.1947) with narrow-oblong, revolute leaves, sparsely stellate above, that suggests affinities with both subsp. *squamulosum* and subsp. *ozothamnoides*. Further collecting in that area is needed to clarify the relationships of this plant.

In the Mt. Kosciusko area a plant intermediate between subsp. *ozothamnoides* and subsp. *alpinum* is found. This grades into the former subspecies and it is with that subspecies I have normally placed herbarium specimens.

#### 14. *Phebalium daviesii* Hook. f.

J. D. Hooker, Fl. Tasm. 2:358 (1859) [named after the collector, R. N. Davies]; Curtis, Stud. Fl. Tasm. 104 (1956).

Typification: "Hab. East Coast, near St. Helen's Bay, R. N. Davies, Esq. (Herb. Archer)". Holotypus: K (photo seen, "R. H. Davies" on label).

*P. glandulosum* var. *daviesii* (Hook. f.) Benth., Fl. Austral. 1:342 (1863).

*Eriostemon daviesii* (Hook. f.) F. Muell., Proc. Roy. Soc. Tasm. 1879:6 (1880); Rodway, Tasm. Fl. 24 (1903).

Shrub; branchlets terete, smooth or minutely glandular verrucose, closely lepidote. Leaves shortly petiolate; lamina narrowly oblong-cuneate, to 2 cm long, apex retuse to obcordate and 1-3 mm wide, margin entire, revolute; upper surface smooth or sparsely glandular and verruculose, glabrous, midrib deeply sulcate; lower surface smooth, densely silvery lepidote, midrib prominent. Inflorescence of sessile terminal umbels; pedicel ca. 4 mm long. Calyx shortly hemispherical 1-1.5 x 2 mm, slightly glandular verrucose, closely lepidote, margin with low, broadly deltoid teeth; petals broadly elliptic, ca. 3 x 2 mm, silvery and ferruginous lepidote outside; ovary spherical, ca. 1 mm high, silvery lepidote; style glabrous, stigma minute. Fruit and seed not seen.

DISTRIBUTION: north-east Tasmania—Map 30.

TASMANIA: George Bay, Augustus Simson 684, Oct. 1876 (MEL); Constable Creek, George Bay, L. Rodway, Oct. 1892 (HO).

This species is closely allied to both *P. glandulosum* and *P. squamulosum*. It differs from *P. glandulosum* in the absence of prominent hemispherical glandular verrucosities on branches and leaves and also in having low-deltoid (not acuminate) calyx teeth: from *P. squamulosum* it differs in leaf shape and in the revolute margins. It could evidently be united under this latter species but as it is geographically isolated, and shows consistently distinct characters, I am retaining its status as a separate species.

#### 15. *Phebalium whitei* P. G. Wilson, nom. et stat. nov.

[named after C. T. White, the author of the variety]

*P. squamulosum* var. *grandiflorum* C. T. White, Proc. Roy. Soc. Queensld. 50:69 (1939). Typification: "Wyberba, Mrs N. Gunn, Sep. 1932 (shrub, flowers bright yellow)." Holotypus: BRI 011388.

Shrub; branchlets closely silvery and ferruginous lepidote. Leaves shortly petiolate; lamina oblong-elliptic, to 6 x 1 cm, entire, somewhat recurved at margins, narrowly canaliculate, apex rounded, base broadly cuneate, upper surface smooth, glabrous, closely silvery lepidote below. Inflorescence a terminal, sessile, 1-4(6)-flowered umbel; pedicel short, thick, 2-4 mm long; mature bud ovoid, ca. 6 mm long. Calyx hemispherical, truncate (or almost so), 2.5 x 3.5 mm, closely silvery and ferruginous lepidote, petals elliptical, or obovate (some asymmetrical), ca. 8 x 3 mm, bright yellow, silvery lepidote in lower half, ferruginous lepidote in upper half; anthers oblong, 2.5-3 mm long, yellow; ovary 1.5-2 mm high, with a thick covering of silvery squamae, carpels acute; style glabrous; stigma equal in width to style.

DISTRIBUTION: south-east Queensland, border mountains—Map 23.

QUEENSLAND: Wyberba, 3 ft., F. D. Hocking, 1961 (BRI); Lyra, Stanthorpe District, W. R. Petrie, June 1921 (BRI); Wallangara border mountains, G. Ward, 4.ix.1964 (AD).

This species has the largest (single) flowers of any *Phebalium*. It resembles *P. squamulosum*, and a form of the latter found at Stanthorpe has a similar but smaller leaf, thus suggesting a possible connection between the two species.

The petals vary in shape according to their position in the bud. They are elliptical when on the outside and are then entirely lepidote; if overlapped at both margins they are obovate with the margins forming glabrous wings; if overlapped on one side only they are asymmetrical, only one margin extending as a glabrous wing.

#### 16. *Phebalium woombye* (Bailey) Domin

Domin, Feddes Repert. 12:133 (1913).

*Asterolasia woombye* Bailey, Queensld. Agric. Journ. 3:281 (1.x.1898) [named after the type locality]; Bailey, Queensld. Fl. 1:195. t.8 (1899).

Typification: "Woombye, N. Coast Railway, W. French." Isotypus: K (photo seen).

*A. woombye* var. *intermedia* Bailey, Queensld. Agric. Journ. 16:189 (1905). Typification: "Mount Coolam, W. Fawcett-Story." Isotypus: K (photo seen).

*A. woombye* var. *parvifolia* Bailey, loc. cit. Typification: "Mount Coolam, W. Fawcett-Story." [= Mt. Coolum] Isotypus: K (photo seen).

Shrub to 2m high; stem stellate-lepidote. Leaves shortly petiolate; lamina chartaceous (rarely coriaceous), oblong-elliptic to broad-elliptic, 15 x 2–60 x 9–15 x 11 mm, entire, apex obtuse to rounded, base narrow cuneate to rounded, upper surface flat (or rarely convex and then with recurved margins), smooth, glabrous, canaliculate, lower surface smooth with prominent midrib, silvery lepidote. Inflorescence of terminal 4–10-flowered umbels; pedicels 4–15 mm long; mature bud shortly cylindrical to obovoid, ca. 5 mm long. Calyx obturbinate, ca. 3 mm long, including the narrow-deltoid teeth of ca. 1–5 mm, silvery to silvery and ferruginous lepidote on both sides; petals obovate, to 6 x 2.5 mm, white (to pink in inland form), ferruginous lepidote outside; stamens equal to petals, inclined to one side of flower, anthers oblong, 1.2–2 mm long, yellow; ovary sub-spherical, ca. 2 mm high (including indumentum), style glabrous or very sparsely lepidote at base; stigma peltate, ca. twice as wide as style. Cocci slightly spreading, ca. 4 mm high, apex rounded. Seed ca. 2.2 mm long, finely longitudinally corrugate, black.

DISTRIBUTION: near the south-east coast of Queensland—Map 23.

QUEENSLAND: Noosa Heads, sandy soil, in wallum scrub, bushy shrub 3 ft. high and 2 ft. wide, Helen I. Aston 98 (BRI, MEL); Pt. Cartwright, Jean Galbraith, 14.viii.1962 (MEL); Coolum Beach, E. N. McKie and R. S. McNab, 20.vii.1935 (BRI); Fraser Is., on sandhill nr. sea, C. E. Hubbard 4430 (BRI); Bribie Is., shrub to 6 ft., leaves aromatic (rather like cinnamon), C. E. Hubbard 2577 (BRI).

#### *P. woombye*, approaching *P. nottii*

QUEENSLAND: Mt. Wheeler, Rockhampton, Thozet, Nov. 1869 (MEL); Biggenden, fls. pink, C. T. White 7332 (BRI); Glenbar via Tiaro, petals white, S. F. Kajewski 1523 (MEL); Gundiah, Back Creek, Canungra, flowers at first white turning pink, C. T. White 7799 (BRI); Miles, fls. pink, D. M. Gordon (BRI).

*P. woombye* shows considerable morphological variation over its geographical range. In the typical form the leaves are smooth and glabrous above, and the petals are white. This form is found at or near the coast of south-east Queensland from Bustard Head, Middle Island, in the north to Morton Island in the south. Somewhat inland, from Rockhampton in the north to Biggenden, Gundiah, Glenbar and Canungra in the south, is found a form in which the upper surface of the leaves is wrinkled (when dry) and stellate (when young), the lower surface is stellate rather than lepidote, and the petals



are white to pink. Stellate upper-surface of leaf and pink flowers are characters associated with *P. nottii* and it is possible that this form is an easterly remnant of a topocline between the two species.

Near Miles (south-east Queensland) is found a form intermediate in flower character between the two species but with leaves similar to the New South Wales form of *P. nottii*, i.e. narrow-oblong with recurved to revolute margins. The specimens from Canungra (the southernmost locality record) are also interesting because here the calyx is only sparsely lepidote within. This suggests an approach to *P. squamulosum* subsp. *argenteum*; the northernmost record of this taxon (Pt. Stephens) has a lobed calyx and similar leaf characters to the Canungra plant.

The Rockhampton collection mentioned above was seen by Mueller who noted that it showed an approach from "*Eriostemon lepidotus*" to *P. nottii* [Fragm. 9: 107 (1875)].

The closest affinities of *P. woombye* are evidently to *P. nottii*, noticeable in the internal indumentum of the calyx and in the peltate stigma. There also appears to be some affinity to *P. squamulosum* subsp. *longifolium* (which is found much further to the north) e.g. in the stigma shape and lobing of calyx.

The variation in leaf shape found in this species, on which character the two varieties were based, does not appear to warrant infraspecific delimitation.

#### 17. *Phebalium nottii* (F. Muell.) Maiden et Betche

Maiden et Betche, Proc. Linn. Soc. N.S.Wales 23:773 (19 May 1899); Bailey, Queensland Fl. 1:193 (Dec. 1899); Maiden et Betche, Proc. Linn. Soc. N.S.Wales 35:789 (1911); Bailey, Compreh. Cat. Queensld. Pl. tab. 58 ter (1913).

*Eriostemon nottii* F. Muell., Fragn. 6:22 (1867) [after Dr Noit who supported an expedition in search of L. Leichhardt]; F. Muell., op. cit. 9:107 (1875).

Typification: "in montibus Newcastle-Range. J. Sutherland." Holotypus: MEL 4816, "No. 98, shrub 8 ft. to 10 ft. h. Dev. ranges Flinders and Burdekin." Iso.: BRI 042581, K (photo seen).

*Crocea nottii* (F. Muell.) Baillon, Hist. Pl. 4:463 (1873).

Shrub 1 to 3 m high. Branchlets terete, closely silvery to ferruginous lepidote. Leaves with petiole 2–4 mm long; lamina oblong-elliptic to elliptic, 20 x 4 to 35 x 13 to 50 x 9 mm, entire, flat or slightly recurved, apex rounded, base obtuse to cuneate; upper surface smooth, narrowly channelled, glabrous; lower surface smooth, closely silvery stellate-lepidote, mid-nerve prominent. Inflorescence of terminal, sessile, 1–6-flowered umbels; pedicels 2–5 mm long; mature bud spherical (to ovoid with rounded or flattened apex in southern form), ca. 5 mm high, the calyx enveloping the bud. Calyx cupulate, 5 x 5 to 8 x 6 mm (including the 5–8 deltoid to narrowly triangular teeth of 2–3 mm), silvery to ferruginous stellate-lepidote inside and outside (sometimes with lepidote excrescences), enlarging in fruit; petals 5–8, erect, narrow-obovate to spatulate or unguiculate with an oblong claw 1/3 to 1/2 petal length, 8–12 x 3–4 mm, pink to deep mauve (fading to white with age?), acute to truncate, ferruginous lepidote outside (except on claw), glabrous within; stamens 10–16, inclined towards one side of flower, anthers included or slightly exsert, oblong, 2–2.5 mm long, yellow; ovary spherical, 1.5–2 mm high, ferruginous lepidote, 5–8-carpellate; style stellate-lepidote below or almost glabrous, straight in bud, ± equal to stamens, stigma small. Cocci erect, ca. 5 mm high, rounded at apex and enclosed in the enlarged calyx. Seeds to 4 mm long, longitudinally corrugate, black.

DISTRIBUTION: eastern Queensland and north-east New South Wales—Map 23.

QUEENSLAND: Expedition Range, F. M. Bailey (NSW); Edenvale nr. Kingaroy, "open shrub to 5 ft.," N. T. Burbidge 5443 (CANB); 14 mi W of Bauhinia Downs on sandy and stony ridge," shrub to 3 ft., R. W. Johnson 2465 and S. L. Everist (BRI).

NEW SOUTH WALES: Upper Copmanhurst, "found in rough sandstone at high elevations of 1–2,000 ft.," J. G. Boorman, Oct. 1909 (AD, MEL); Peak Hill, Harvey Ranges, "3–4 ft. high", J. L. Boorman, Nov. 1905 (AD).

*P. nottii* is characterized by its deeply cupulate calyx, with up to 8 lobes, accompanied by an equivalent number of petals, stamens and carpels. The petals are narrow, sometimes clawed, and are pink to mauve in colour.

In the presence of internal indumentum to the calyx, and in the petal colour, it shows affinities with *P. woombye*, which species differs most obviously in having a smaller and turbinate calyx. Another feature not apparent on herbarium material, but noted by two collectors, is that the stamens bend to one side, a character also shared with at least some forms of *P. woombye*.

*P. nottii* inhabits mountainous country and appears to have a rather disjunct distribution. Over its geographical range it shows considerable morphological variation both in leaf and flower form, with generally speaking an increase in flower size from south to north. With this goes a change in petal shape from narrow-obovate to unguiculate, and a change in bud shape from ellipsoidal with flattened apex in the south to spherical in the north. The number of floral parts varies between different flowers on the same plant and it is difficult to make accurate counts on herbarium specimens. However in the south (near Peak Hill) the flowers appear to be predominantly 5- or 6-merous while in the north (Expedition Range) they are normally 7- or 8-merous.

The typical form of *P. nottii* is found in mountain ranges 100–200 mi from the sea, whereas *P. woombye* is coastal. In the intervening country in southern Queensland are found plants intermediate between the two species; these may represent remnants of a cline which is at present known from only a few collections, e.g. from Gundiah, Biggenden and Miles (see also notes under *P. Woombye*).

The type locality of *P. nottii* was given by Mueller as being in the Newcastle Range; the type specimen bears a collectors label with the information "Dev. ranges Flinders & Burdekin", possibly indicating the ranges between the upper reaches of these two rivers.

#### 18. *Phebalium obcordatum* A. Cunn. ex Benth.

A. Cunn. ex Benth., Fl. Austral. 1:342 (1863) [ob = inversely, cordatus = heart-shaped]; Ewart et Tovey, Proc. Roy. Soc. Vict. ser. 2. 32:202 (1920); Ewart, Fl. Vict. 709 (1931).

Typification: "SW of St George's Range, A. Cunningham." Holotypus: K "A. Cunningham No. 164, June 1817." (photo seen): Iso.: MEL 4770. The "St. George's Range" is probably one of the ranges north of Griffith, New South Wales.

*Eriostemon mortonii* F. Muell., Fragm. 9:108 (1875); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906), based on *P. obcordatum* [non *E. obcordatus* Hook. (1834)].

Undershrub 0.7–1.3 m high. Branchlets smooth (or slightly glandular verrucose), closely ferruginous lepidote. Leaves shortly petiolate; lamina broadly obovate to obcordate, 2 x 1.5–3.5 x 2.5 mm, apex rounded to truncate and retuse or obcordate, base cuneate, upper surface either flat and slightly sulcate in middle (no definite midrib) with 2–8 hemispherical glandular pustules, or slightly convex (not medially sulcate) and glandular punctate, glabrous, lower surface densely silvery lepidote, margin entire. Inflorescence of small sessile terminal umbels, frequently on short lateral branchlets; pedicel 2–3 mm long. Calyx shortly hemispherical, 0.5–1 mm high, 1–2 mm wide, smooth, closely silvery to ferruginous lepidote, margin undulate to truncate; petals elliptic, to 2.5 x 1.5 mm, white to pale yellow, silvery and ferruginous lepidote outside; anthers broadly oblong, ca. 1 mm long, yellow; ovary subspherical ca. 1 mm high, silvery lepidote; style slightly shorter than stamens, glabrous or with a few basal scales; stigma small. Cocci erect or slightly spreading, 3–4 mm high, verrucose, apex rounded. Seed 3 mm long, black, irregularly longitudinally corrugate.

DISTRIBUTION: western Victoria, south central New South Wales—Map 35.

NEW SOUTH WALES: Wyalong, ca. 15 ins. high, R. H. Cambage 618 (NSW); Cobbora, P. Althofer, ca. May 1946 (NSW); Mt. Binya nr. Griffith, Devonian sandstone ca. 700 ft., above the Riverine Plain, L. Jones, Sept. 1963 (NSW).

VICTORIA: "Grampians", Miss M. Howard, Oct. 1928 (MEL) 4627; nr. Bendigo, whipstick scrub, G. W. Knight, 6.ix.1913 (MEL); Painswick, nr. Dunolly, M. E. Phillips, 18.iii.1961 (AD).

This species has been recorded from a few localities near Bendigo in Victoria (and also doubtfully from the Grampians), and from several places in south-eastern New South Wales from Binya north-east to Cobbora. The Victorian specimens have obovate leaves, slightly convex above and glandular punctate, with rounded apices. In New South Wales the leaves are obcordate, the upper surface medially sulcate with a few large hemispherical glandular pustules. The indumentum in the two areas is also different. In Victoria the calyx and corolla are ferruginous-lepidote outside, whereas in New South Wales they are mainly silvery-lepidote with only a few reddish brown scales.

Although similar to some forms of *P. glandulosum* and *P. squamulosum* (e.g. subsp. *parvifolium* and subsp. *alpinum*) I am retaining it as a distinct species as I have seen no evidence to suggest that intergradation takes place with other species even where areas of distribution overlap.

#### 19. *Phebalium stenophyllum* (Benth.) Maiden et Betche

Maiden et Betche, Census N.S. Wales Pl. 116 (1916); Black, Fl. S. Austral 344 (1924); Ewart, Fl. Vict. 711 (1931); Black, op. cit. ed. 2. 500 (1948).

*P. squamulosum* var. *stenophyllum* Benth., Fl. Austral. 1:343 (1863) [stenos = narrow, phyllon = a leaf].

Typification: "In the Grampian Mountains and desert of the Tattiarra country towards the Murray river, F. Mueller." Lectotypus: MEL 4847, Mt. Abrupt, Grampians, leg. Dallachy (specimen seen by Bentham). Syntypes: MEL 4848, "N.W. Victoria," leg. Lockhart Morton; MEL 4857, "Tattiarra country", leg. J. Woods no. 7.

*E. stenophyllum* (Benth.) F. Muell., Sec. Syst. Census 19 (1889); Moore et Betche, Handb. Fl. N.S. Wales 45 (1893).

Shrub ca. 1 m high. Branchlets closely fulvous to ferruginous-lepidote. Leaves shortly petiolate; lamina narrow-oblong, sub-terete, 4–20 x 0.8–2 mm, obtuse, upper surface rounded, smooth, with no visible midrib, glabrous or glabrescent (lepidote when young), recurved to tightly revolute; lower surface smooth, stellate-lepidote, often obscured. Inflorescence a 3–10-flowered, terminal, sessile umbel; pedicels slender, 3–8 mm long; mature flower bud sub-spherical 2–3 mm high. Calyx hemispherical, 1 x 2 mm, smooth, silvery to ferruginous lepidote, margin truncate (or undulate in New South Wales form); petals elliptical, 3.5–4.5 x 2 mm, lepidote outside (ferruginous in upper half, silvery in lower), yellow; ovary spherical, ca. 1 mm high, pale ferruginous lepidote; style glabrous,  $\pm$  equal to stamens; stigma minute. Fruit and seed not seen.

DISTRIBUTION: western Victoria, central New South Wales—Map 35.

NEW SOUTH WALES: Warrumbungle Ranges, W. Forsyth, Oct. 1899 (NSW); nr. Coonabarabran, on road to Warrumbungle Mts., on rocky slope, M. E. Phillips, 27.viii.1961 (AD, CBG).

VICTORIA: 20 mi S of Nhill, buckshot gravel, shrub to 4 ft., J. J. Ackland 25 (AD, MEL); Dimboola, St. Eloy D'Alton 22 (NSW); 14 mi NE of Goroke, J. W. Green 3086 (NE); Little Desert, ca. 6 mi N of Mitre Lake, undulating sandhills, sparse erect shrub 7 ft. high, T. B. Muir 2565 (MEL).

Although this species is evidently closely related to *P. squamulosum* (from which it differs principally in leaf form) I have not seen any material to suggest that intergradation or hybridization takes place between them,

The form of *P. stenophyllum* found near the Warrumbungle Range in New South Wales closely resembles that from western Victoria but specimens from the former locality have leaves slightly glandular pustulate and a calyx which is undulate (not truncate); the flowers are also slightly larger.

In some collections (e.g. from near Dimboola, western Victoria) the leaves are narrow-oblong with only moderately recurved margins. These approach in appearance some Victorian forms of *P. squamulosum* subsp. *squamulosum*, which however are found much farther to the east and differ in midrib indentation and in indumentum.

J. M. Black in his Flora of S. Australia ed. 2 (1948), recorded this species from near Bordertown, but I have seen no specimens so annotated. The lectotype, collected by J. Dallachy, is stated to have come from Mt. Abrupt in the Grampians; this is the only collection I have seen which is unequivocally stated to have come from this Range. The two other collections labelled "Grampians" are without collector's name or date, while in addition, one of them is on a sheet consisting of mixed material.

## Sectio 2. *Eriostemoides* Endl.

Endl., Gen. Pl. 1156 (1840); Endl., Enchir. Bot. 612 (1841).

*Phebalium* sectio *Lepidotia* Reichenbach, Repert. Herb. sive Nomencl. Gen. Pl. 1:197 (1841), p.pte., nomen.

Branches and leaves lepidote. Inflorescence of axillary cymes (sometimes bearing only one flower); pedicel bibracteolate near middle or towards apex, passing into fleshy base of calyx. Sepals free, slightly imbricate in bud; petals imbricate, glabrous, white; staminal filaments somewhat flattened, glabrous or stellate near base; anther suborbicular, slightly retuse; disc prominent; ovary with a short, solid, sterile apex; stigma  $\pm$  equal in width to style, not lobed. Seed broadly ellipsoidal to sub-reniform, 2-2.5 mm long, adaxial margin straight; attached (placental) endocarp thin, translucent, caducous; aril membranous, linear, along adaxial face; outer testa thin, smooth, glossy, dark-brown; sclerotesta smooth; hilum superficial, narrowly elliptic, ca. 1.5 mm long; raphe small, thin, covered by outer testa only; chalaza on adaxial face towards base, slightly obscured by raphe.

Lectotypus: *Eriostemon squameus* Labill.

Two species, from the eastern states and Tasmania.

The relationships of this section are with *Phebalium* sect. *Gymnoclados* and (probably more directly) with *Nematolepis phebaliioides* which is technically separated generically on the basis of having ligulate staminal filaments. It is interesting that in *P. squameum* the position occupied by the ligule in *N. phebaliioides* is taken by a stellate tuft of hairs, again suggesting a relationship between the two.

## 20. *Phebalium squameum* (Labill.) Engler

Engler, Nat. Pflanzenfam. 3/4:141 (1896); Druce, Bot. Exch. Club Rep. 1916:639 (1917); Ewart, Fl. Vict. 708 (1931); Curtis, Stud. Fl. Tasm. 104 (1956); Beadle et al., Handb. Vasc. Pl. Syd. Dist. 319 (1963).

*Eriostemon squameus* Labill., Nov. Holl. Pl. Sp. 1:111.tab.141 (1806) [squama = a scale]; de Candolle, Prod. 1:720 (1824); Poiret, Dict. Sci. Nat. 15:199 (1819); Sprengel, Syst. Veg. 2:322 (1825); F. Muell., Fragm. 1:104 (1859); F. Muell., Pl. Col. Vict. 1:129 (1862); F. Muell., Fragm. 9:107 (1875); F. Muell., Nat. Pl. Vict. 1:74 (1879); F. Muell., Key Syst. Vict. Pl. 1:141 (1887); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Rodway, Tasm. Fl. 24 (1903). Typification: "Habitat in capite Van-Diemen." Isotypes (?): MEL 5025 and 5026.

*P. argenteum* Smith in Rees, Cyclop. 27:n.3 (1814) as to name only, nom. illeg. (*E. squameus* was cited as a synonym).

*P. billardieri* A. Jussieu, Mém. Soc. Hist. Nat. Paris 2:134 (1825) "Billardierii", nom. illeg. based on *E. squameus* Labill.; Sprengel, Syst. Veg. 4/2:164 (1827); G. Don, Gen. Hist. 1:791 (1831); Hooker, Comp. Bot. Mag. 1:177 (1836); Hooker, Journ. Bot. Hook. 2:418 (1840); Walpers, Rep. Bot. Syst. 1:505 (1842); Hooker f., Fl. Tasm. 1:63 (1855); Bentham, Fl. Austral. 1:344 (1863); Bailey, Syn. Queensld. Fl. Third Suppl. 11 (1890).

*P. elaeagnoides* Sieber ex A. Jussieu, op. cit. 136, nomen, pro syn. sub *P. billardieri*.

*P. elatum* A. Cunningham in Field. Geog. Mem. N.S.Wales 331 (1825); G. Don, Gen. Hist. 1:791 (1831); Walpers, Rep. Bot. Syst. 1:505 (1842). Typification: "in shaded declivities in the vicinity of Spring Wood". Holotypus: K (photo seen).

Shrub, or tree to 12 m high. Branchlets angular or terete. Leaves shortly petiolate; lamina coriaceous to chartaceous, narrowly to broadly elliptical, 1.8 x 0.8–10 x 2.2 cm, flat, entire, upper surface smooth, glabrous and glossy green, lower surface closely silvery lepidote, midrib impressed above and prominent below, apex acuminate to obtuse, rounded, or retuse. Inflorescence of compact or loose axillary cymes 1/3 to 1/2 length of leaf, (1) 3–20-flowered; peduncle and pedicels angular, closely silvery lepidote; floral bracts lanceolate, 1–7 mm long, silvery lepidote below, caducous; pedicel 1.5–5 mm long, with 0–2 minute caducous bracteoles in lower half; mature bud bluntly ellipsoidal, 4–5 mm long. Sepals deltoid, ca. 1 mm long, thick, glandular, glabrous; petals elliptical 4–5 mm long, thin, gland-dotted; stamens  $\pm$  equal in length to petals, filaments linear, slightly broadened at the base and becoming terete above, sparsely to densely stellate or hirsute in lower half or glabrous, anther, ca. 0.8 mm long; disc thick, ca. 0.3 mm high,  $\pm$  equal in width to ovary, mauve (?); ovary broadly pyramidal to subspherical, ca. 1 mm high, glandular, glabrous; style  $\pm$  equal to stamens, glabrous or rarely sparsely pilose towards the base. Cocci slightly spreading, ca. 3 mm high, apex slightly rounded and minutely apiculate on outer angle, glandular verruculose. Seed broadly ellipsoidal, 2–2.5 mm long.

Branchlets smooth; leaf apex acute to rounded.

Leaves to 10 cm long (or more), chartaceous, obtuse to acuminate; cymes (3)5–20-flowered  
**20a. subsp. squameum**

Leaves to 2 cm long coriaceous, apex rounded; cymes (1)2–4(6)-flowered  
**20b. subsp. coriaceum**

Branchlets sparsely glandular-verrucose; leaves chartaceous, to 3 cm long, apex frequently retuse; cymes 2–3(5)-flowered  
**20c. subsp. retusum**

#### **20a. subsp. squameum**

Tree to 12 m high. Branchlets angular, smooth, leaves chartaceous, elliptic, to 10 x 2.2 cm, obtuse to acuminate. Cymes (3)5–20-flowered; staminal filaments sparsely to densely stellate or hirsute in lower half (rarely glabrous).

Chromosome no.  $n = 14$ , from material collected in the National Park, Tasmania, and at Springwood, New South Wales, fide Smith-White (1954).

DISTRIBUTION: south-eastern Queensland; near the coast of New South Wales; Victoria; Tasmania—Map 26.

QUEENSLAND: Quoin Is., T. Y. Stead (NSW 69970); Springbrook, Macpherson Range, W. Rudder 4007 (BRI).

NEW SOUTH WALES: Tweed Heads, slender shrub, J. Keys 4 (BRI); Yamba, "tree 25 ft. high, stem diameter 6 ins. often shrubby, or tall and whip-stick like when crowded, bark light or putty colour, fairly smooth", J. King 6 (BRI); Forster, small tree 12 ft., J. N. Simpson 1 (NSW); nr. Port Jackson, Siemssen 283 (MEL); Springwood, E. Betche, Oct. 1881 (NSW).

VICTORIA: nr. Warrnambool, T. M. Allan (MEL 4994); Otway Dist., between Lavers Hill and Ferguson, alt. 1,600 ft., tree 9 ft. high, Helen I. Ast-n 449 (MEL).

TASMANIA: 3 mi N of Dover, shrub 4–6 ft., N. T. Burbidge 3138 (CANB); Bond Bay, Port Davey, tree 25 ft. "locally known as 'Tallow-wood', 'Cheese-wood' and 'Dog-wood'", M. Davis 1285 (MEL); King Is., Lieut. Stanley (MEL 5027).

**20b.** subsp. *coriaceum* P. G. Wilson, subsp. nov.

[coriaceous = leathery]

*E. ovatifolius* [non (F. Muell.) F. Muell.] F. Muell., Pl. Col. Vict. 1:131 (1862) p.pt.; F. Muell., Nat. Pl. Vict. 1:75 (1879); F. Muell., Key Syst. Vict. Pl. 1:141 (1887).

*P. ovatifolium* [non F. Muell.] Benth., Fl. Austral. 1:345 (1863) p.pt.; Ewart, Fl. Vict. 709 (1931) p.pt.

Fruticulus ramulis levibus. Folia coracea, late ovata usque ad late elliptica, usque 1.8 x 0.8 cm, apice rotundato. Cymae breves, (1)2-4(6)-florae; filamenta staminales glabra.

Holotypus: MEL 4833 "Between Hardinger Range and Mount Wellington", March 1861, F. Mueller; Iso.: K (photo seen).

Shrub with smooth branchlets. Leaves coriaceous, broadly ovate to broadly elliptic, to 1.8 x 0.8 cm, apex rounded. Cymes short, (1)2-4(6) flowered; staminal filaments glabrous.

**DISTRIBUTION:** known only from the mountains near the head of the Macallister River in eastern Victoria—Map 26.

**VICTORIA:** "Source of the Macallister R.", F. Mueller (MEL 4834); "On quartz rocks towards the head of the E. branch of the Macallister R. Mueller (MEL 4835).

**20c.** subsp. *retusum* (Hooker) P. G. Wilson, stat. et comb. nov.

*P. retusum* Hooker, Journ. Bot. Hooker 1:254 (1834) [retusus = blunted (notched)]; Hooker, Comp. Bot. Mag. 1:276 (1836); Hooker, Journ. Bot. Hooker 2:418 (1840); Walpers, Rep. Bot. Syst. 1:505 (1842).

Typification: "Dr. Scott. Mr. Lawrence, 1831". Syntypes: K (photo seen).

*P. billardieri* var. *retusum* (Hook.) Hook. f., Fl. Tasm. 1:63 (1855).

Shrub to 4 m high. Branchlets glandular-verrucose. Leaves chartaceous, oblong-ovate, to 3 x 0.8 cm, apex rounded to truncate and retuse. Cyme short, 2-3(5)-flowered, staminal filaments glabrous or sparsely stellate near base.

**DISTRIBUTION:** north-eastern Tasmania—Map 26.

**TASMANIA:** Prosser R., shrub 6-8 ft., Dr. Story (MEL); Rocky places on the south Esk, Launceston, S. Hannaford 31 (MEL); Fingal Ck., A. Simson 1176 (MEL); Mt. Barrow, M. E. Phillips, 16.xi.1960 (AD).

The geographical range of the typical subspecies is from southern Tasmania to the Macpherson Ranges in southern Queensland. Throughout its distribution it exhibits little morphological variation. Compared with the mainland plant, in the southern Tasmanian form the leaves are smaller and less acute, and the cymes shorter; the staminal filaments also change from being sparsely stellate or glabrous in Tasmania to densely long-hirsute in Queensland. In Tasmania it is known as "Lancewood" or "Satinwood" and in the north-west of that State grows to a height of 12 m and provides timber for telegraph poles (fide W. M. Curtis, op. cit.).

*P. squameum* subsp. *retusum* is found in north-east Tasmania. The type has no indication with it as to place of origin in that State; however material from Fingal Creek matches it very well. It evidently grades into the typical subspecies.

*P. squameum* subsp. *coriaceum* is superficially similar to *P. ovatifolium*. It differs from that species in the absence of sub-floral bracteoles and in the glabrous (not lepidote) ovary. It was on this subspecies that Mueller, Bentham, and Ewart, all based their records for the occurrence of *P. ovatifolium* in Victoria.

**Phebalium** sp. aff. *squameum*

Branchlets terete, verrucose, silvery lepidote. Leaves shortly petiolate, elliptical, ca. 4 x 1 cm, obtuse; upper surface smooth, glabrous except for scattered scales along midrib; lower surface closely fulvous-lepidote, smooth. Inflorescence of axillary, 2-8-flowered cymes up to 1/2 length of leaf; pedicels ca. 7 mm long, lepidote, with two small sub-opposite bracteoles. Sepals  $\pm$  free, not imbricate, deltoid, ca. 1 mm long, lepidote outside. Petals imbricate, elliptical, 4-4.5 mm long, white (?), lepidote outside. Staminal filaments linear-acuminate, ca. 4 mm long, sparsely stellate near base; anther sub-orbicular, ca. 1 mm long, not apiculate. Ovary subglobular; silvery lepidote; style ca. 2 mm long, sparsely stellate-lepidote towards base; stigma narrow.

DISTRIBUTION: known only from a single collection made at Woods Point, Goulbourne River, New South Wales, leg. W. F. Gates no. 12 (1892) (MEL 4350).

This plant is very similar to *P. squameum* but differs from that species in having lepidote sepals, petals, and ovary. From *P. ovatifolium* it differs in having lepidote petals, in leaf shape, and in size of inflorescence. More material is required before this can be satisfactorily dealt with.

A similar specimen (sterile) has been collected at Nimitybelle nr. Kybean, New South Wales, R. H. Cabbage no. 1862, 9.ii.1908 (NSW 69234). This differs from the former collection in having retuse leaves and therefore closely resembles the Tasmanian plant *P. squameum* var. *retusum*.

**21. Phebalium ovatifolium** F. Muell.

F. Muell., Trans. Phil. Soc. Vict. 1:99 (1855) [ovatus = egg-shaped, folium = leaf]; F. Muell., J. Bot. Kew Misc. 8:36 (1856) "ovalifolium"; Bentham, Fl. Austral. 1:345 (1863) pro pte.; Ewart, Fl. Vict. 709 (1931), excl. Victorian localities.

Typification: "in the rocky or scrubby parts of the Australian Alps, at the sources of the Murray and Snowy River." Lectotypus: MEL 4828 "In the alpine parts of the Munyang Mountains". Syntypes: MEL 4828, 3830, 4832, NSW 69548 "Munyang Mountains Dr. Ferd. Mueller"; K, "In montibus Munyung Mountains . . . Jan 55" (photo seen).

*Eriostemon ovatifolium* (F. Muell.) F. Muell., Fragm. 1:103 (1859); F. Muell., Pl. Col. Vict. 1:131 (1862); F. Muell., Nat. Pl. Vict. 1:75 (1879); F. Muell., Key Syst. Vict. Pl. 1:141 (1887); Stirling, Proc. Linn. Soc. N.S.Wales 11:1056 (1887); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Engler, Nat. Pflanzenfam. 3/4:141 (1896); Dixon, Pl. N.S.Wales 49 (1906); Engler, op. cit. ed. 2. 19a:260 (1931); all excluding Victorian specimens.

Low compact shrub. Branchlets slightly angular to terete, sparsely glandular verrucose, closely pale-ferruginous lepidote. Leaves shortly petiolate, coriaceous, broadly ovate to broadly elliptical, 9 x 5-10 x 8-11 x 7 mm, entire, flat; upper surface glandular punctate, smooth glabrous (even in bud), glossy; lower surface smooth and densely silvery lepidote; apex obtuse to rounded, base rounded. Inflorescence of congested axillary 1 (rarely 3)-flowered cymes; peduncle and pedicel thick and strongly flattened, together 2-4 mm long, with 1 or 2 oblong-ovate bracts 1-1.5 mm long and 2 similar bracteoles just below the flower, these grade into the sepals; mature flower-bud bluntly ellipsoidal, ca. 4 mm long; flower base fleshy and continuous with pedicel. Sepals thick, sub-erect, slightly imbricate at base, deltoid, 2 mm long, glabrous (one normally lepidote); glandular punctate; petals imbricate, elliptical, ca. 4 mm long, glandular punctate, white (pink outside in bud), glabrous, tip inflexed; stamens slender, sub-terete, glabrous, slightly shorter than petals, anthers cordate-orbicular, rounded or slightly retuse at apex, ca. 0.8 mm long; disc thick ca. 0.5 mm high, equal in width to ovary, mauve; ovary broadly and obtusely conical, ca. 1 mm high, silvery lepidote, carpels with a small sterile apex; style glabrous, stigma  $\pm$  equal in width to style. Cocci erect, ca. 3 mm high,  $\pm$  truncate and with a short rounded apiculum on outer angle. Seed broadly sub-reniform or broadly ellipsoidal, ca. 2.2 mm long.

DISTRIBUTION: New South Wales, Snowy Mts.—Map 26.

NEW SOUTH WALES: Charlotte Pass, Mt. Kosciusko, A. M. Ashby 1410 (AD); Lake Albina, Mt. Kosciusko area, alt. ca. 1920 m, H. Eichler 13592 (AD); Munyang Ranges, 6,000 ft., E. Gauba, 17.xii.1952 (GAUBA).

The cymes in *P. ovatifolium* are usually one-flowered; sometimes however the bracts on the peduncle also bear flowers. The two bracteoles grade downwards into the (usually) sterile bracts and upwards into the sepals. Occasionally the uppermost bracteole will appear in the same series as the calyx to give the appearance of six sepals, or it may be placed immediately below a sepal; the true sepal is then very reduced in size. The lowest sepal (i.e. the one following in the spiral phyllotaxy of bracts and bracteoles) is lepidote on the outside, whereas the others are glabrous.

This species has only been recorded from the Snowy Mountains in New South Wales, all collections being from within a distance of 12 miles of Mt. Kosciusko. The Victorian localities given in several works for *P. ovatifolium* all refer to the similar alpine plant *P. squameum* subsp. *coriaceum*; this differs from *P. ovatifolium* in having no sub-floral bracteoles, a more slender cyme, and in the glabrous ovary.

### Sectio 3. *Goniocladus* P. G. Wilson sectio nova

[gonia = angled, cladus = branch]

Ramuli et folia lepidota. Flores cymosi vel solitares et axillares; pedicellus in dimidio inferiore bibracteolatus. Calyx patelliformis vel hemisphaericus, undulatus; petala valvata, extra lepidota, alba; filamenta staminum applanata, glabra; anthera alba, acuta; discus brevis; ovarium apice sterili brevi. Cocci erecti, obtusi vel breviter rostrati. Semen leve, latere adaxiali nec concavo; hilum anguste ellipticum.

Type: *P. anceps* DC.

Branches and leaves silvery lepidote. Flowers in cymes or solitary and axillary; pedicel bibracteolate in lower half. Calyx patelliform or hemispherical, undulately lobed; petals valvate, lepidote outside, white; staminal filaments flattened, glabrous; anthers white, obtuse and apiculate; disc short; ovary with a short sterile apex. Cocci erect, blunt or shortly rostrate. Seed narrow-reniform or bluntly ellipsoidal with a straight adaxial margin, attached (placental) endocarp thin and translucent; aril linear, fleshy, situated between two cartilaginous strands, easily detached; outer testa thin, dark-brown; sclerotesta smooth; hilum superficial, narrow-elliptical; raphe shrunken, sub-basal, covered by outer testa only; chalaza sub-basal,  $\pm$  obscured by raphe.

Two species, both endemic to Western Australia.

This section is evidently related to sect. *Eriostemoides* from which it may be separated by several floral characters and by the seed. This seed is peculiar in having two persistent cartilaginous strands on the adaxial face between which the aril is attached. Similar seeds are found in the genus *Chorilaena* and in *Nematolepis euphemiae*, both of which in other characters also show evident relationship (e.g. in the hemispherical calyx, lepidote petals, and acute anthers).

## 22. *Phebalium anceps* DC.

de Candolle, Prodr. 1:719 (1824) [anceps = two-headed, referring to the angular branchlets]; Jussieu, Mem. Soc. Hist. Nat. Paris 2:133, tab. 12.f.2 (1825); Poiret, Dict. Sci. Nat. 39:464 (1826); Sprengel, Syst. Veg. 4/2:164 (1827); G. Don, Gen. Hist. 1:791 (1831); Bartling in Lehmann, Pl. Preiss. 1:171 (1844-45).

Typification: "in Nova-Holl. orientali." Holotypus: G-DC (photo seen), "Nouvelle Hollande, cote orientale, Mus. de Par. 121." [Jussieu, Mem. Soc. Hist. Nat. Paris 2:134 (1825), gives the following reference to the type (?) specimen "Vidi sp. sicc. in herb. Mus. Par., ex Nova-Hollandia occidentalis (Port du Roi Georges)."]



*Eriostemon anceps* (DC.) Spreng., Syst. Veg. 2:322 (1825); F. Muell., Fragm. 1:103 (1859); F. Muell., op. cit. 9:108 (1875).

*P. argenteum* [non Smith] Smith in Rees, Cyclop. 27: (1814); Benth, Fl. Austral. 1:344 (1863); Engler, Pflanzenfam. 3/4:141 (1896); op. cit. ed. 2. 19a:260 (1931); Gardner, Enum. Pl. Austral. Occ. 70 (1931). [Smith cited *E. squameus* Labill. (an Eastern States plant) as a synonym although his description applies to the Western Australian plant (*P. anceps*). Smith's name is therefore an illegitimate nomenclatural synonym of *P. squameum* (Labill.) Engl.]

Slender shrub to 3 m high. Branchlets strongly angular smooth. Leaves shortly petiolate; lamina chartaceous, elliptical, 7 x 1.1–12 x 3.3 cm, smooth, thinly silvery lepidote at first, becoming glabrous, apex obtuse to acute and often mucronulate. Inflorescence of axillary and terminal cymes 3–5 cm long with the branches angular and silvery lepidote, bracts ovate, acute 10–12 mm long, decreasing in size towards apex, caducous; pedicels 4–12 mm long with a pair of minute, persistent bracteoles near the middle; mature flower-bud spherical, 4–5 mm long. Calyx shortly hemispherical, ca. 1.5 mm high, divided half-way into broadly deltoid lobes, smooth, silvery lepidote outside, glabrous within; petals broadly elliptical, ca. 6 x 3 mm, white, closely silvery lepidote outside, glabrous within; stamens almost equal, somewhat shorter than the petals, ca. 3–5 mm long, filaments narrowly lanceolate, acuminate, broad at base, with a few stipitate glands; anthers oblong-cordate ca. 1.2 mm long, obtuse and minutely apiculate, pollen white; disc or gynophore massive, equal in width to and continuous with base of ovary, ca. 0.3 mm high; ovary hemispherical to broadly conical, 1–2 mm high, silvery lepidote, sterile apex of carpels obtuse to acuminate; style at first short but lengthening during anthesis; stigma slightly wider than style. Cocci erect or slightly spreading, 3–3.5 mm high, apex truncate to rounded, with or without a short spreading apiculum, smooth. Seed bluntly ellipsoidal, ca. 2.5 mm long, smooth, brown.

DISTRIBUTION: Western Australia, south-west—Map 25.

WESTERN AUSTRALIA: Napier R. north of Albany, A. Ashby 11 (AD); Bunbury, Miss Bunbury 8 (MEL); S. Walpole, Boggy Lake, D. Churchill, Nov. 1956 (UWA); Cottesloe nr. Perth, J. B. Cleland, Aug. 1908 (NSW); Wanneroo, W. V. Fitzgerald, Nov. 1901 (NSW); Karridale, A. Lea, Oct. 1898 (PERTH).

*Phebalium anceps* exhibits little variation throughout its geographical range and it does not appear to hybridize in the field with any other species. It is a shrub of creek margins and swamps and does not grow far from the coast. This species has the common name "Blister Plant" owing to the effect its sap has on the skin of some people.

### 23. *Phebalium rude* Bartl.

Bartling in Lehmann, Pl. Preiss. 1:172 (1844–45) [rudis = rough]; Walpers, Rep. Bot. Syst. 5:389 (1845); Bentham, Fl. Austral. 1:345 (1863); Engler, Pflanzenfam. 3/4:141 (1896); Engler, op. cit. ed. 2. 19a:260 (1931); Gardner, Enum. Pl. Austral. Occ. 70 (1931).  
Typification: "In calcareis tergi montis Baldhead 16 Oct. 1840. Herb. Preiss. nr. 2038." Isotypes: MEL 4981, 4960.

*P. bilobum* Bartling, loc. cit., nom. illeg. non Lindley (1838).

Typification: "In rupestribus planitie collium Konkoberuphills (Kent) 19. Nov. 1840. Herb. Preiss. No. 2039." Isotype: MEL 4979.

*Eriostemon bilobum* F. Muell., Fragm. 1:102 (1859); F. Muell., op. cit. 9:108 (1875). (Based on *P. bilobum* Bartl. and *P. rude* Bartl.)

Small shrub. Branchlets angular. Leaves chartaceous to coriaceous, entire (linear to) obovate, obcordate, or suborbicular, 7–35 mm long, ± coriaceous smooth, thinly silvery lepidote when young, becoming glabrous, apex rounded or retuse to bilobed with rounded lobes, base rounded to narrowly cuneate and then grading into the short petiole. Flowers axillary, solitary; pedicel angular, 3–10 mm long, silvery lepidote, 2(4)-bracteolate; bracteoles linear, 0.5–1 mm long, persistent, sub-opposite or alternate in upper half of pedicel and often shortly below calyx; mature bud spherical (to bluntly ellipsoidal) 3.5–7 mm long. Calyx patelliform, 0.7–1.5 mm high, undulate on

margin or with short deltoid lobes; petals elliptical 4.5 x 2.5-6.5 x 3 mm, white; stamens shorter than petals, 3-5.5 mm long, filaments flattened, narrowly elliptical to oblong and shortly subulate at apex, anthers cordate-orbicular 0.7-1 mm long, minutely apiculate with glandular tissue, white; disc equal in width to and  $\pm$  continuous with ovary, very short, ca. 0.1-0.3 mm thick, dark green (?); ovary 1-1.5 mm high, rounded with the carpels appressed to style base, glabrous or silvery lepidote, style short (0.5-1 mm), glabrous; stigma  $\pm$  equal in width to style. Cocci erect ca. 5 mm high, almost smooth, apex truncate to rounded, blunt to shortly apiculate. Seed bluntly ellipsoidal, ca. 3 mm long, smooth, dark-brown.

Ovary lepidote; branchlets prominently angular; leaves narrowly obovate to sub-orbicular

**23a. subsp. rude**

Ovary glabrous.

Leaves cuneate-obcordate to broadly obovate

**23b. subsp. amblycarpum**

Leaves linear, apex rounded

**23c. subsp. lineare**

### **23a. subsp. rude**

Branchlets prominently angular when young; leaves obovate to sub-orbicular 7 x 5-35 x 17-10 x 10 mm; ovary lepidote; cocci often shortly rostrate.

DISTRIBUTION: near the south coast of Western Australia between Pt. Irwin and Cape Arid—Map 27.

WESTERN AUSTRALIA: Barker Inlet, straggling shrub 2 ft. high, J. S. Beard 2291 (KINGS PARK); Mt. Groper, N. H. Brittan, l.xi.1958 (UWA); Summits of Ravensthorpe Range, C. A. Gardner, Nov. 1935 (PERTH); Bald Island, Maxwell (MEL 4963); "Goose Isd. Bay" [= Middle Island, Recherche Archipelago], R. Brown, 16.i.1802 (MEL 4977); Miles Island Point on Middle Is., "dense bushes to 5 ft. high", J. H. Willis, 22.xi.1950 (MEL 4976).

### **23b. subsp. amblycarpum** (F. Muell.) P. G. Wilson, stat. et comb. nov.

*Eriostemon amblycarpus* F. Muell., Fragm. 1:102 (1859) [amblys = blunt, carpos = fruit]; C. Mueller in Walpers, Ann. Bot. Syst. 7:520 (1868).

Typification: "In locis apricis ad flumen Fitzgerald River." Holotypus (?): MEL 4556, "935 Fitzgerald R., 1 to 2 ft.", iso.: K (Maxwell specimen, photo seen).

*Phebalium amblycarpum* (F. Muell.) Benth., Fl. Austral. 1:345 (1863); Gardner, Enum. Pl. Austral. Occ. 70 (1931).

Branchlets slightly to prominently angular when young. Leaves narrow-cuneate to broadly obovate 15 x 4-17 x 9 mm. Ovary glabrous; apex of cocci rounded, sometimes bluntly rostrate.

DISTRIBUTION: South-west of Western Australia, from Nyabing east to Cape Arid—Map 27.

WESTERN AUSTRALIA: West River, C. Andrews, Oct. 1903 (NSW); 20 mi E of Jerramungup, shrub 2 ft. F. Lullfitz 3619 (KINGS PARK); nr. Cape Arid, Maxwell, 1875 (MEL).

### **23c. subsp. lineare** (C. A. Gardn.) P. G. Wilson, stat. et comb. nov.

*P. lineare* C. A. Gardn., J. Roy. Soc. W. Austral. 27:180 (1942) [linearis = linear].

Typification: "Hab. in distr. Eyre, ad montem Ragged prope Israelite Bay, in lapidosis frutucetis, flor., m. Oct. Gardner 2864". Holotypus: PERTH.

Branchlets angular when young; leaves thick, linear, narrowing slightly towards the base, ca. 20 x 1-1.5 mm, apex rounded; cocci  $\pm$  truncate, minutely apiculate.

DISTRIBUTION: Western Australia, near Israelite Bay—Map 27.

WESTERN AUSTRALIA: Mt. Ragged, W. E. Blackall 1154 (PERTH).

The subspecies *rude* and *amblycarpum* grade into each other in branch, leaf, and fruit characters but generally retain the association of leaf shape with either a glabrous or lepidote ovary. They also occupy separate but adjacent areas of distribution. The subspecies *lineare* may be only an extreme form of subsp. *amblycarpum*; however collections do not suggest that they now form a continuous cline.

#### Sectio 4. *Leionema* (F. Muell.) Benth.

Bentham, Fl. Austral. 1:337 (1863); Engler, Pflanzenfam. 3/4:140 (1896); Engler, op. cit. ed. 2. 19a:260 (1931).

*Eriostemon* sect. *Leionema* F. Muell., Pl. Indig. Col. Vict. 1:125 (1862) [leio = smooth, nema = thread].

*Eriostemon* sect. *Chorilaenopsis* F. Muell., op. cit. 131, based on *Phebalium diosmeum* A. Juss. as "*Eriostemon phyllicoides*".

Branchlets and leaves glabrous or with simple or stellate hairs. Inflorescence various, frequently cymose; pedicel usually with a pair of bracteoles towards the base. Sepals valvate or open, slightly united at the base and continuous with the fleshy pedicel apex; petals valvate, usually glabrous; stamens usually longer than petals, filaments terete, glabrous; anthers deeply retuse; gynophore narrower than ovary, shorter than to as long as carpels (or sometimes forming a disc or absent); ovary apex sterile; style well-developed in mature bud; stigma minute. Seed sub-reniform, ca. 3 mm long, adaxial margin  $\pm$  straight; attached (placental) endocarp, thick and coriaceous towards base but with thin lateral margins, persistent; aril absent; outer testa thin, dull or glossy, smooth; sclerotesta smooth; hilum linear to narrow-elliptic; raphe fleshy basal or sub-basal with a thin coriaceous to crustaceous glossy covering; chalaza basal or sub-basal, obscured by raphe.

Lectotypus: *Phebalium bilobum* Lindl.

Twenty-one species from South Australia, Eastern States, Tasmania, and New Zealand.

This section shows no close affinities with any other section of *Phebalium* or with any other genus. The fleshy placental endocarp is typical, for although thick placental endocarps are also found in some sections of *Eriostemon* in these cases the seeds themselves are morphologically very different.

Mueller apparently segregated the section *Chorilaenopsis* on the basis of its rough indumentum and long calyx lobes, characters which at this level are not of significance. Both Mueller and Bentham included *Eriostemon pungens* in sect. *Leionema* on account of its valvate petals, however in other floral characters, and in its seed, it is quite distinct, while the petals themselves are different in texture, shape and anatomy. Its affinities are obviously with members of the genus *Eriostemon*.

#### 24. *Phebalium montanum* Hook.

Hooker, J. Bot. Hooker 1:255 (1834) [montanus = montane]; Hooker, Ic. Pl. 1:t.59 (1837); Hooker, J. Bot. Hooker 2:418 (1840); Walpers, Rep. Bot. Syst. 1:505 (1842); Hooker f., Fl. Tasm. 1:63 (1855); Bentham, Fl. Austral. 1:338 (1863); Engler, Nat. Pflanzenfam. 3/4:140 (1896); Engler, op. cit. ed. 2. 19a:260 (1931); Curtis, Stud. Fl. Tasm. 103 (1956).

Typification: "Mr. Lawrence, (n.321): on the western mountains at an elevation of 3,500 feet above the level of the sea. Mr. Gunn, (n. 223)." Syntypes: K (photo seen); NSW 70105 (Gunn no. 283, 1833). It seems probable that the Gunn no. was incorrectly cited by W. J. Hooker, as in Fl. Tasm. 1:63 (1855), J. D. Hooker. gives it as no. 283.

*Eriostemon montanus* (Hook.) F. Muell., Pl. Indig. Col. Vict. 1:129 (1862); F. Muell., Papers and Proc. Roy. Soc. Tasm. 1874: 76 (1875); F. Muell., Fragm. 9:109 (1875); Rodway, Tasm. Fl. 24 and tab. (1903).

Small compact shrub. Branchlets terete, stellate-puberulous in lines between the prominent, somewhat decurrent leaf-bases. Leaves crowded; petiole short, flattened, ca. 0.5 mm long; lamina fleshy, terete to 1 cm long,  $\pm$  flattened and somewhat sulcate above, rounded below, smooth, glandular punctate, apex obtuse. Flowers solitary in the axils of the uppermost leaves, pedicel 1.5–3 mm long, fleshy and swollen beneath the calyx, glabrous or sparsely stellate-puberulous; bracteoles 2–3, close to the calyx, sepaloïd (when 3 then the lowest sub-foliar); mature flower bud bluntly obovoid, 3–4 mm long. Calyx lobes deltoid ca. 0.7 mm long, fleshy, glabrous; petals elliptic, ca. 4 mm long, white, glabrous, tip prominently inflexed; stamens slightly exceeding petals, filaments slender-terete; anther sub-orbicular ca. 0.8 mm long; gynophore short (ca. 0.2 mm high) narrower than ovary, purple (?); ovary sub-spherical, ca. 1 mm high, irregularly corrugate, glabrous; carpels with upper third sterile; style  $\pm$  equal to stamens, glabrous. Cocci erect, ca. 4 mm high, apex rounded and shortly rostrate on outer angle. Seed ca. 2–3 mm long.

DISTRIBUTION: Tasmania, mountains of the north-east region—Map 28.

TASMANIA: Western Mountains alt. 3,500 feet, R. C. Gunn 283, 20.xii.1843 (NSW, HO); Summit of Ben Lomond, "low-thick-shrub", Dr. Milligan 1056 (MEL); Mt. Barrow, plateau at summit, H. M. R. Rupp 38 (NSW).

This species has evident affinities with *P. oldfieldii* which has similar sculpturing on the ovary, and a similar white, stellate-puberulous indumentum; in this latter character it also resembles *P. phyllicifolium* and *P. dentatum*. It differs from these and all other species in the section *Leionema* in having terete leaves.

## 25. *Phebalium oldfieldii* (F. Muell.) F. Muell. ex Benth.

F. Muell. ex Benth. Fl. Austral. 1:340 (1863); Curtis, St. Fl. Tasm. 104 (1956).

*Eriostemon oldfieldii* F. Muell., Fragm. 1:3 (1858) [named after the collector, Augustus Oldfield]; F. Muell., Pl. Col. Vict. 1:125 (1862); C. Mueller in Walpers, Ann. Bot. Syst. 7:520 (1868); F. Muell., Fragm. 9:109 (1875); Rodway, Tasm. Fl. 24 (1903).

Typification: "Mount Laperouse, Tasmaniae. Oldfield et Stuart." Holotypus: MEL 4822, Oldfield and Stuart 1875, "base of Mt. de la Perouse" Feb. 27, 1857; iso.: K (photo seen).

Compact shrub ca. 1 m high; branchlets terete or slightly angular when young, stellate-puberulous all round. Leaves shortly petiolate, lamina coriaceous, oblong to oblong-cuneate 7 x 2.5–15 x 6 mm, flat or with slightly recurved margin, apex rounded or slightly retuse, base cuneate, margin entire or minutely crenulate towards the apex, glabrous, glossy, midrib impressed above and slightly prominent below. Inflorescence a compact terminal cluster; pedicel fleshy, glabrous, glossy, ca. 2.5 mm long, with two short glabrous bracteoles (ca. 0.5 mm long) inserted towards the base; mature flowerbud ellipsoidal, ca. 4 mm long, with rounded apex. Calyx fleshy, glabrous, lobes deltoid ca. 0.5 mm high, petals elliptical, ca. 4 mm long, pale pink to white, slightly glandular, tip inflexed; stamens slightly exceeding petals, filaments slender-terete, anthers orbicular-cordate, ca. 0.6 mm long; gynophore short, ca. 0.3 mm high, ovary sub-spherical, ca. 1.2 mm high, corrugate, glabrous, carpels with upper third sterile; style glabrous,  $\pm$  equal to stamens. Cocci slightly spreading ca. 2.5 mm high, rounded above and shortly outwardly rostrate; seed not seen.

DISTRIBUTION: Tasmania—Map 28.

TASMANIA: Near Mt. La Perouse, F. A. Rodway, Dec. 1898 (NSW); St. Clair, C. Elliott, 2.i.1947 (HO); Hounslow Heath, Cradle Mt. "In dense dwarf shrubbery on exposed moor, ca. 4,800 feet, small erect branched bushy shrub under 1 foot", H. D. Gordon, 12.i.1942 (HO).

*Phebalium oldfieldii* is similar to *P. phyllicifolium*, especially to the glabrous form found near Mt. Kosciusko. It differs from that species, apart from the indumentum, in leaf shape, in the solitary axillary flowers (not pedunculate and in threes), and in the sculpturing on the ovary. The flower colour is white (with pink tips in the bud) whereas in *P. phyllicifolium* it is yellow.

## 26. *Phebalium dentatum* Sm.

J. E. Smith in Rees, Cyclo. 27: (1814) [dentatus = toothed]; Bentham, Fl. Austral. 1:339 (1863); Hamilton, Proc. Linn. Soc. N.S.Wales 40:394 (1915); Penfold, J. Roy. Soc. N.S.Wales 40:340 (1927); Ewart, Fl. Vict. 708 (1931) as to description only; Beadle et al., Vasc. Pl. Sydn. Dist. 319 (1963).

Typification: "Brought by Gen. Grose from some part of New Holland, and communicated to us by A. B. Lambert Esq." Type not seen.

*P. salicifolium* A. Jussieu, Mém. Soc. Hist. Nat. Paris 2:134. tab. 12.f.1 (1825); Poiret, Dict. Sci. Nat. 39:46 (1826); Sprengel, Syst. Veg. 4. pt. 2:164 (1827); G. Don, Gen. Hist. 1:791 (1831); Walpers, Rep. Bot. Syst. 1:505 (1842). Typification: "Vidi sp. sicc. in herb. Mus. Par. e portu Jackson." Type not seen.

*Eriostemon umbellatus* Turcz., Bull. Soc. Nat. Moscou 22/2:15 (1849); Walpers, Ann. Bot. Syst. 2:248 (1852); F. Muell., Fragm. 1:104 (1859); F. Muell., Pl. Col. Vict. 1:128 (1862) p. pte.; F. Muell., Fragm. 9:109 (1875); Moore et Betche, Handb. Fl. N.S.Wales 43 (1893). Typification: "Nova Hollandia, 125 mill. a Sydney legit d. Stephenson." Type not seen (not found in KW).

*P. umbellatum* (Turcz.) Turcz., op. cit. 25/2:160 (1852).

Shrub or small tree to 6 m high. Branchlets  $\pm$  terete, minutely stellate when young. Leaves with flattened petiole ca. 2 mm long; lamina chartaceous, (linear to) narrow-oblong to narrow-elliptic or narrow-obovate (50 x 1) 40 x 2-45 x 8-80 x 5 mm; margin recurved to revolute, dentate or denticulate; apex truncate to retuse and bidentate; upper surface smooth, glossy glabrous or minutely stellate along impressed midrib; lower surface smooth, white stellate-puberulous, with prominent midrib. Inflorescence of ca. 10-flowered axillary cymes arranged along the branch; peduncle angular, glabrous or sparsely stellate-puberulous, 2-8 mm long; pedicel slender, ca. 4 mm long with a small caducous bract and two minute, persistent bracteoles in lower half. Mature bud obovoid with rounded apex, ca. 3 mm long. Calyx lobes broadly deltoid ca. 0.3 mm high, fleshy,  $\pm$  glabrous; petals elliptic, ca. 3.5 mm long, gland-dotted, pale yellow to white, glabrous, tip inflexed; stamens shortly exceeding petals, filaments slender-terete, anthers orbicular-cordate, ca. 1 mm long; gynophore much narrower than ovary, ca. 0.2 mm high; ovary spherical, ca. 1 mm high, smooth, glabrous, carpels with a short rounded, sterile apex; style glabrous, slightly shorter than stamens. Cocci erect, ca. 3.5 mm long, apex rounded and very shortly and acutely outwardly apiculate. Seed reniform, ca. 2.5 mm long, dark reddish brown.

Chromosome no.  $n = 16$ , from material collected at Lane Cove R., Warrah, fide Smith-White (1954).

DISTRIBUTION: New South Wales, near the coast from Illawarra in the south to Pt. Stephens in the north, also the Gibraltar Range in the north-east of the State—Map 29.

NEW SOUTH WALES: Illawarra District, Weber, 1800 (NSW); Port Jackson, R. Brown, ca. 1802 (BRI); Campbelltown, "erect shrub 6-7 ft. fls. yellow", N. Ford, 5.ix.1945 (NSW); Northbridge, on rocky sandstone slope, tall shrub 12 ft., L. A. S. Johnson 15.vii.1956 (NSW); Port Stephens, anon. 17 (MEL); Gibraltar Range, 35 mi E of Glen Innes, alt. 3,300 feet, "shallow sand over granite, bushy shrub 4 ft." J. B. Williams and K. Winterhalder 628, 5.x.1958 (NSW).

*Phebalium dentatum* is closely related to *P. phyllicifolium* which is the only other mainland species with white, stellate-puberulous indumentum on the underside of the leaves. It differs from the latter species in having longer,

dentate, leaves, much larger axillary cymes, and a glabrous ovary. It is apparently restricted in its distribution to near Sydney on the east coast of New South Wales (with one record from further north in the Gibraltar Range). Mueller (1862) treated *P. phylcifolium* as being conspecific with *P. dentatum*, but from his description it appears that he regarded only the short leaved plant with a puberulous ovary (i.e. *P. phylcifolium*) as being found in Victoria. However in the Second Syst. Census, Mueller lists the two species separately and records both from Victoria. I have seen no specimens of *P. dentatum*, on which Mueller could have based this record. Ewart, in Fl. Vict. (1931) 708, correctly described the plant but gives as its distribution the Grampians; again there are no specimens in Herb. MEL to support this statement. I have seen two herbarium specimens purported to have come from Victoria: one is labelled "Port Fairy" (Herb. NSW) and the other "East Gippsland (1897)" (Herb. MEL). Both records I consider doubtfully authentic unless from cultivation.

The solitary collection from the Gibraltar Range is intriguing and, assuming the details are correct, represents an interesting case of disjunct distribution.

Penfold, l.c. records the odour given off by the crushed leaves as being similar to that of *P. coxii* "a pleasant passion-fruit odour".

## 27. *Phebalium phylcifolium* F. Muell.

F. Muell., Trans. Vict. Inst. 1:32 (1855) [Phyllica = a genus of Rhamnaceae, folium = leaf]; Bentham, Fl. Austral. 1:339 (1863); Ewart, Fl. Vict. 707 (1931).

Typification: "on the highest peaks of the Cobboras Mountains, and on the sources of the Mitta Mitta." Lectotypus: MEL 4888, "Munyang Mountains 4-5,000 feet also on the Snowy River, Jan. 55. Dr. Ferd Mueller", another label on same sheet "Mitta Mitta 4,000 feet"; iso.: K (photo seen). Syntypes: MEL 4886 "In rupibus altissimis montis Cobra 6,000 feet. Frutex ample expansus 2 ft-3 ft. alt. Febr. 1854. Dr. Ferd. Mueller", NSW 69938.

*Eriostemon phylcifolius* (F. Muell.) F. Muell., Fragm. 1:105 (1859); F. Muell., Census 11 (1882); F. Muell., Key Syst. Vict. Pl. 141 (1887); Stirling, Proc. Linn. Soc. N.S.Wales 11:1055 (1887); Moore et Betche, Handb. Fl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1906).

*E. phylcoides* [non (Spreng.) F. Muell.] F. Muell., Sec. Gen. Rep. 10 (1854).

*E. umbellatus* [non Turcz.] F. Muell., Pl. Col. Vict. 1:128 (1862) p.pt.; F. Muell., Nat. Pl. Vict. 1:73 (1879).

A compact shrub to 1.5 m high. Branchlets slightly angular when young, stellate-puberulous in broad strips between decurrent leaf-bases. Leaves with erect, flattened petiole 0.5-1 mm long; lamina  $\pm$  spreading, coriaceous, entire, oblong-elliptic to subterete due to the slightly recurved to revolute margins, 8 x 2.5-17 x 1.5 mm, upper surface smooth, glabrous, lower surface smooth, white stellate-puberulous (or rarely glabrous). Inflorescence a compact shortly cylindrical terminal cluster, the short peduncles in the axils of the uppermost leaves and bearing 1-3 flowers; peduncle glabrous 1-3 mm long; pedicels glabrescent,  $\pm$  fleshy, 1-3 mm long with an ovate, ciliolate caducous bract ca. 0.4 mm long and a pair of minute sub-basal bracteoles; mature flower-bud obovoid, ca. 3 mm long, apex rounded. Calyx obturbinate, fleshy, glabrous, lobes deltoid, ciliolate 0.5 mm high; petals narrow-elliptic, 3.5-4 mm long, gland-dotted, pale yellow; stamens about  $1\frac{1}{2}$  times length of petals, filaments filamentose, anthers cordate-orbicular, 0.7-1 mm long; gynophore inconspicuous, ca. 0.2 mm high; ovary obovoid to sub-spherical, ca. 1 mm high, white stellate-puberulous or rarely glabrous, carpels compact with a short, solid, rounded apex; style  $\pm$  equal to stamens, recurved in bud, glabrous; stigma minute. Cocci suberect, ca. 3 mm high, apex rounded, outwardly very shortly rostrate. Seed (not ripe) sub-reniform ca. 2.5 mm long.

DISTRIBUTION: Mountains of eastern Victoria and of the extreme south-east of New South Wales—Map 13.

NEW SOUTH WALES: Tuross R., Miss M. A. Arnott, Feb. 1928 (NSW); junction of Thredbo and Little Thredbo Rivers, A. B. Costin, Aug. 1949 (NSW); Mt. Kosciusko, J. McLuckie, Feb. 1928 (AD).

VICTORIA: Dargo High Plains, Howitt 658 (MEL); Haidinger Range, F. Mueller, Mar. 1861 (MEL); Mt. Buller, C. S. Sutton, Nov. 1906 (MEL); Mt. Wellington, J. M. Whaite, 11.i.1949 (NSW); Cobungra, H. B. Williamson, Dec. 1928 (MEL).

The more usual form of this species is the one with a close white stellate indumentum on the ovary and on the underside of leaves. From Mt. Cobboras in eastern Victoria and from the Mt. Kosciusko district in New South Wales has been collected a form in which the carpels and sometimes also the leaves are glabrous; it appears to grow in the same locality as, and is otherwise similar to, the puberulous form. At Kybean (extreme south-east N.S.W.) the leaves are glabrous beneath whereas the ovary is stellate-puberulous. The syntypes cited by Mueller included plants of both forms and I have chosen as lectotype a collection in which the ovaries and leaves are both stellate-puberulous.

Apart from indumentum this species also varies in size of inflorescence, in shape of ovary, and in the degree in which the leaf margin is recurved. It is possible that the variation will be found sufficient to warrant infraspecific distinction. However the few collections as yet available do not suggest that any clear division could be made.

This species was at one time included by Mueller under *P. dentatum* (as *Eriostemon umbellatus*) but may be clearly distinguished in leaf size and form, and in the compactness of the inflorescence, as well as in general habit. With that species it shares the close, white, stellate puberulous indumentum on the leaves, a character which suggests close relationship between the two species. The confusion with *P. dentatum* was probably partly due to the supposedly "type" material of *P. lachnaeoides* which Mueller had seen and which was thought to have all come from the Blue Mountains of New South Wales. This is further discussed in notes under the two species.

## 28. *Phebalium lachnaeoides* A. Cunn.

A. Cunn. in Field, Geographical Memoirs of N.S.Wales 332 (1825) [*Lachnaea*, a genus of Thymelaeaceae, oides = like]; G. Don, Gen. Hist. 1:791 (1831) "*lachnoides*"; Walpers, Rep. Bot. Syst. 1:505 (1842) "*lachnoides*"; Bentham, Fl. Austral. 1:339 (1863) "*lachnoides*"; Hamilton, Proc. Linn. Soc. N.S.Wales 40:394 (1915); Maiden et Betche, Census N.S.Wales Pl. 116 (1916).

Typification: "Blackheath, Blue Mountains." Holotypus: K (photo seen), "Tall handsome shrub, bare rocky situations"; iso.: BRI 042585 "A. Cunningham No. 56, Oct. 1822", MEL 4781 p.pt. and 4782 p.pt.

*Eriostemon phyllicifolius* var. *lachnaeoides* (A. Cunningham) F. Muell. ex Moore, Handb. Fl. N.S.Wales 43 (1893) "*lachnoides*".

*E. phyllicifolius* [non (F. Muell.) F. Muell.] F. Muell., Fragm. 9:109 (1875).

Tall shrub. Branchlets slightly angular when young, white stellate-puberulous, soon becoming glabrous. Leaves with flattened, erect petiole ca. 1 mm long; lamina coriaceous, closely revolute and almost terete, ca. 8 x 1 mm, slightly curved upwards, upper surface smooth, lower surface (usually obscured) smooth and white stellate-puberulous, apex acute. Flowers solitary in the upper leaf axils; peduncle ca. 1.5 mm long, sparsely stellate-puberulous; pedicel ca. 2 mm long, fleshy, glabrous, with a pair of small puberulous bracts and a pair of bracteoles at the base. Calyx passing into the fleshy pedicel apex, lobes deltoid, ca. 5 mm long, glabrous, petals narrow-elliptic, ca. 5 mm long, glandular-punctate, glabrous, tip inflexed; stamens not seen in mature flower but probably exceeding the petals, filaments slender terete, glabrous, anther orbicular-cordate, ca. 1 mm long; disc short cylindrical, ca. 0.5 mm high; ovary narrow-ovoid, ca. 2 mm long, glabrous, carpels narrow with the upper two-thirds sterile; style glabrous, stigma minute. Fruit and seed not seen.

DISTRIBUTION: Known only from the type gathering at Blackheath in the Blue Mountains, New South Wales—Map 30.

This species is superficially very similar to *P. phyllicifolium* from which it differs in having more closely revolute leaves, solitary flowers, and glabrous, attenuate carpels. It is known only from the one collection made by Allan Cunningham in 1822 in the Blue Mountains and, as these mountains are botanically well-known, the absence of further collections is curious. There is the possibility however, that *P. lachnaeoides* is a hybrid between *P. diosmeum* and *P. dentatum*; it possesses the leaf-shape and ovary character of the former species, and the calyx, anthers, and indumentum of the latter. Without the support of field observations, or of experimental data, the possible hybrid origin for the plant must remain in doubt.

F. Mueller considered *P. lachnaeoides* to be conspecific with *P. phyllicifolium* [cf. *Fragm.* 9:109 (1875)]. However the material he received from Robert Heward, which was supposed to be part of the authentic Cunningham collection of *P. lachnaeoides*, contained mixed with it portions of *P. diosmeum* and of *P. phyllicifolium* (the latter being the fruiting specimen mentioned by Mueller), all in herb. MEL. The *P. phyllicifolium* specimen could not have been gathered by Cunningham as he never visited the Snowy Mts. where it grows (nor had any European by 1822, the date on the labels), so one must assume some confusion of material at a later date.

## 29. *Phebalium diosmeum* Juss.

A. Jussieu, *Mém. Soc. Hist. Nat. Paris* 2:135 tab. 11. f.3 (1825) [Diosmeae, a tribe in the Rutaceae]; Bentham, *Fl. Austral.* 1:341 (1863); Beadle et al., *Handb. Vasc. Pl. Syd. Dist.* 319 (1963).

Typification: "Vidi sp. sicc. a D. Gray communicatam, e portu Jackson." Isotypus: K (photo seen).

*P. phyllicoides* Sieber ex Sprengel, *Syst. Veg.* 4 pt. 2:1640 (1827), nom. illeg. superfluous name, (the name *P. diosmeum* A. Juss. being cited in synonymy); A. Jussieu, *Mém. Hist. Nat. Paris* 1:136 (1825) nomen, pro syn. sub *P. diosmeum*; G. Don, *Gen. Hist.* 1:791 (1831); Walpers, *Rep. Bot. Syst.* 1:505 (1842).

*Eriostemon phyllicoides* (Spreng.) F. Muell., nom. illeg. *Fragm.* 1:107 (1859); F. Muell., *Sec. Gen. Rep.* 10 (1854) nomen, with no reference to a previous publication; F. Muell., *Pl. Col. Vict.* 1:131 (1862); F. Muell., *Fragm.* 9:107 (1875); F. Muell., *Nat. Pl. Vict.* 1:76 (1879); Moore et Betche, *Handb. Fl. N.S. Wales* 44 (1893); Dixon, *Pl. N.S. Wales* 48 (1906).

*Chorilaena angustifolia* F. Muell., *Trans. Phil. Soc. Vict.* 1:10 (1855) "angustifolia"; F. Muell., *J. Bot. Kew Misc.* 8:37 (1856). Typification: "occurring in the interior of New South Wales". Holotypus: MEL 4680, Argyle County (i.e. Goulburn district), New South Wales, no. 826; iso.; MEL 4812, K (photo seen).

Small shrub to 2 m high. Branchlets angular when young, hirtellous with simple (rarely stellate) hairs. Leaves with a short flattened petiole ca. 1 mm long; lamina chartaceous, sub-terete due to the strongly revolute margins (or rarely ovate), (11 x 4) 4 x 1-18 x 1.5 mm, obtuse; upper surface glabrous to sparsely pilose or rarely stellate-scabridulous; lower surface sparsely pilose (to stellate-tomentose). Inflorescence a terminal compact head, the flowers in the axils of slender, linear bracts ca. 5 mm long; pedice! fleshy, 1-2 mm long, pilosulose, with two linear bracteoles 2-3 mm long inserted towards the summit; mature flower bud broadly ellipsoidal or obovoid, ca. 5 mm long, with rounded apex. Calyx obturbinate (2) 2.5-3 mm long, passing downwards into the thickened pedicel, pilosulose, deeply divided into linear-lanceolate lobes (1.2) 2-2.5 mm long; petals narrow-obovate, 4-7 mm long, creamy-yellow (pale red outside towards apex), sparsely pilose towards apex or glabrous, sparsely glandular, with a prominent linear midrib, apex inflexed; stamens to 1½ times length of petals, yellow, filaments filamentose, anthers oblong-cordate, ca. 1.5 mm long; gynophore absent; ovary pilosulose, more densely so towards base; carpels separated from each other and slightly spreading, sub-terete (2) 2.5-3.7 mm long, the upper ¾ sterile; style ± equal to stamens, glabrous; stigma minute. Cocci erect ca. 4 mm high almost smooth, sparsely pilosulose, apex rounded with an erect subulate rostrum 4-5.5 mm long arising from the outer angle. Seed reniform, ca. 2.5 mm long, glossy and dark reddish brown; raphe sub-basal, small.



Chromosome no.  $n = 16$ , from material collected at Heathcote, fide Smith-White (1954).

DISTRIBUTION: New South Wales, near the south-east coast, and in the extreme east of Victoria—Map 30.

NEW SOUTH WALES: Upper Georges R. nr. Appin, 500 ft., erect small shrub, O. D. Evans 1524 (SYD); Sublim Pt. C. Barnard 41 (CANB); nr. Green Cape, South Coast M. E. Phillips 8.x.1961 (AD).

VICTORIA: Genoa River, Barren sandy flats, E. Reader 15, 23.v.1880 (MEL).

*Phebalium diosmeum* is peculiar in the section *Leionema* in having no gynophore and in the carpels being separated from each other (that is not touching) for much of their length, the upper  $\frac{3}{4}$  of which is narrowed into a terete sterile appendix. In this latter character it resembles *P. lachnaeoides*, a species described from the Blue Mountains and which is possibly a hybrid between *P. diosmeum* and *P. dentatum*. It is superficially similar in appearance to *P. carruthersii* which also has an obturbinate calyx with long lobes. *P. carruthersii* has however a prominent gynophore and a compact shortly cylindrical ovary.

*Chorilaena angustifolia* was described from a specimen collected "in the interior of New South Wales". The holotype (herb. MEL) has the additional locality "Argyle County". The type material of *C. angustifolia* differs from the common form of *P. diosmeum* in having a stellate-indumentum on the stem and leaves. Specimens of *P. diosmeum* collected from near Wingello and Tallong match it fairly closely. However there is a gradation between the stellate and the simple-hirsute forms, and I think that Hooker (1856) was correct in considering them conspecific, a point of view followed by all subsequent authors.

### 30. *Phebalium elatius* (F. Muell.) Benth.

Benth. Fl. Austral. 1:340 (1863); Bailey, Syn. Queensld. Fl. 1st Suppl. 11 (1886); Bailey, Queensld. Fl. 1:193 (1899); Maiden et Betche, Census 116 (1916).

*Eriostemon elatior* F. Muell., Fragm. 1:181 (1859) [elatior = taller]; C. Mueller in Walpers, Ann. Bot. Syst. 7:520 (1868); F. Muell., Fragm. 9:109 (1875); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906).

Typification: "In tractu elato New England prope Tenterfield C. St." Holotypus: MEL 4700 "Mts. 1,000 ft." C. Stuart 153 (flowering); iso.: K (photo seen), MEL 4698.

Shrub to 5 m high. Branchlets angular or terete, smooth to glandular verrucose, glabrous or stellate. Leaves shortly petiolate, lamina chartaceous, narrow-spatulate to narrow-oblong to broad obovate, 15 x 3–30 x 6–20 x 10 mm, glabrous, flat, minutely crenulate towards the obtuse to rounded and  $\pm$  retuse apex; base narrow-cuneate; upper surface smooth, glossy; midrib prominent below. Inflorescence terminal, cymose, scarcely exceeding the leaves; peduncle and pedicels slender, smooth to glandular-verrucose, minutely stellate; pedicel ca. 3 mm long with a minute caducous bract and a pair of minute bracteoles in lower half; mature flower-bud ellipsoidal or obovoid with rounded apex, 3–4 mm long. Calyx lobes fleshy, broadly deltoid, ca. 0.5 mm high, sparsely stellate, ciliolate; petals oblong-elliptical, 3–4.5 mm long, glandular, white, tip inflexed; stamens slightly exceeding petals; filaments slender-subulate; anthers oblong-cordate 0.6 mm–1 mm long, white; gynophore short-cylindrical ca. 0.4 mm high; ovary sub-spherical, rounded at apex, 1–1.5 mm high, smooth or rugulose; carpels with a very small to large sterile spical region; style  $\pm$  equal to stamens, glabrous. Cocci  $\pm$  spreading when mature ca. 4 mm high corrugate, outwardly short-rostrate or erostrate. Seed reniform ca. 2 mm long.

Leaves narrow-obovate, ca. 15 x 3 mm; carpels with only a small sterile apical region; cocci erostrate

30a. subsp. *elatius*

Leaves obovate to broadly obovate, 30 x 6–20 x 10 mm; carpels with the sterile apical region ca.  $\frac{1}{3}$  of total length; cocci outwardly short-rostrate

30b. subsp. *beckleri*

**30a. subsp. elatius**

Small shrub ca. 2 m high. Branchlets glandular-verrucose. Leaves narrow-obovate, ca. 15 x 3 mm, apex obtuse to rounded (rarely slightly retuse). Mature flower bud obovoid, ca. 3 mm long. Ovary sub-spherical, compact, ca. 1 mm high, rugulose; carpels with only a small apical sterile region. Cocci rostrate, slightly spreading.

DISTRIBUTION: New South Wales, extreme north-east—Map 31.

NEW SOUTH WALES: Upper Copmanhurst, on side of river in gravelly deposits, small shrubs 4-6 ft., J. L. Boorman, Oct. 1909 (NSW); "New England", anon. (C. Stuart) (MEL 4702).

**30b. subsp. beckleri (F. Muell.) P. G. Wilson, comb. et stat. nov.**

*Eriostemon beckleri* F. Muell., Fragm. 9:109 (1875) [named after the collector H. Beckler]; Moore et Betche, Handb. Fl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1903). Typification: "Prope originem fluminis Clarence River; Dr. H. Beckler." Holotypus: MEL 4589 "McLennan's Creek, Clarence River, Beckler." with the name "*Eriostemon Beckleri*" written over the name "*Eriostemon erosus*"; iso.: NSW 69929.

*P. beckleri* (F. Muell.) Engler, Nat. Pflanzenfam. 3/4:141 (1890); Maiden et Betche, Census N.S.Wales Pl. 116 (1916); Engler, op. cit. ed. 2. 19a:260 (1931).

*Eriostemon erosus* F. Muell., nom. illeg. (proposed in anticipation of its future acceptance) Pl. Indig. Col. Vict. 1:121 (1862). Typification: "In Dr. Beckler's collection of plants from the Clarence River occurs a Rutaceous plant. If this plant should prove referable to *Eriostemon* it may receive the name *E. erosus*". The specimen referred to is the type of *E. beckleri* F. Muell.

Shrub to 5 m high. Branchlets almost smooth. Leaves obovate to broad-obovate 30 x 6-20 x 10 mm, apex rounded and  $\pm$  retuse. Mature flower bud ellipsoidal, ca. 4 mm long. Ovary sub-hemispherical, ca. 1.5 mm high, rugulose towards apex; carpels with a broad, flat outer face, the upper third sterile. Cocci divaricate, shortly rostrate.

DISTRIBUTION: New South Wales near the north-east coast and in the extreme south-east of Queensland—Map 31.

QUEENSLAND: Springbrook, Macpherson Range, 300 ft. C. E. Hubbard 4225 (BRI); Dave's Creek country, Binna Burra, fern forest, erect shrub up to 6 ft., sweet scent, R. Jones 241 (BRI); Mt. Lindesay, summit, alt. 4,100 ft. R. Stewart, 10.x.1932 (BRI).

NEW SOUTH WALES: Brunswick Heads, J. C. Wibur, Sept. 1937 (NSW); Dorrigo, W. Heron, Oct. 1931 (NSW); Comboyne, E. C. Chisholm, June 1934 (NSW); Port Stephens, J. L. Boorman, May 1912 (NSW).

*Phebalium elatius* subsp. *elatius* is only represented in herbaria by a few collections, two made by Charles Stuart near Tenterfield, and a collection from near Copmanhurst. Collections made in the Lamington National Park approach it morphologically and suggest that the type collection represents the extreme form of the more widespread plant subsp. *beckleri*. This latter subspecies I have separated arbitrarily from the typical at a point where there is an apparent break in the cline between the two. It is possible that after further collecting, particularly in the Clarence River-Tenterfield area, there will be no disjunction and the arbitrary division will then break down. However, for the present the subspecific nomenclature is useful for distinguishing morphological extremes.

*P. elatius* is evidently closely related to *P. obtusifolium* and *P. gracile* which also are found in the extreme south-east of Queensland. From these it differs in the leaf shape and the almost terete stem. The nature of the distribution of these three species, and the variation in form of *P. elatius*, suggests that they have only recently evolved through geographic isolation from a common stock.

**31. *P. obtusifolium* P. G. Wilson, sp. nov.**

[obtusus = blunt, folium = leaf]

Ramuli manifeste acuto-angulosi, minute verrucosi, saepe rubidi, nitidi, glabri. Folia anguste elliptica vel spathulata, 25 x 3—50 x 6 mm, levia, glabra, nitida. Inflorescentia corymbosa, terminalis, 10–20-flora. Calyx hemisphaericus nitidus, lobis late deltoideis, 0.25 mm altis; petala flavido-alba, ca. 4 mm longa; gynophorum breviter cylindricum, ca. 0.5 mm altum; ovarium sub-sphaericum, ca. 1 mm altum, minute rugulosum, apice-sterile minuto.

Holotypus: BRI 042851, south-east Queensland, upper reaches of Alice Ck. about 8 mi N of Helidon, shrub to about 4 ft., August 1963, leg. F. D. Hockings.

Shrub ca. 1 m high. Branchlets with prominent acute angles, minutely glandular verrucose, often reddish, glossy, glabrous. Leaves sessile, chartaceous, narrow-elliptic to spatulate, 25 x 3–50 x 6 mm, smooth, glossy, glabrous, apex obtuse to rounded, base narrow-cuneate, margin slightly recurved, minutely crenulate towards the apex, midrib impressed above and prominent below. Flowers in a terminal corymb of 10–20 or more flowers; peduncle angular, glossy, glabrous, ca. 5 mm long; pedicels slender 4–8 mm long, glossy, glabrous, subtended by a minute caducous bract and with minute caducous bracteoles towards the base; mature bud ellipsoidal with rounded apex, ca. 3 mm long. Calyx hemispherical, glossy, glabrous, lobes broadly deltoid 0.25 mm high; petals valvate, narrow-obovate, ca. 4 mm long, gland-dotted, yellowish-white; stamens  $\pm$  equal to petals; filaments slender-terete glabrous, anthers cordate-orbicular, 1 mm long, white (?); gynophore shortly cylindrical, ca. 0.5 mm high; ovary sub-spherical ca. 1 mm high, minutely rugulose, glabrous; carpels with only the extreme apex sterile; style equal to stamens, glabrous; stigma minute. Fruit and seed not seen.

DISTRIBUTION: extreme south-east Queensland—Map 31.

QUEENSLAND: Helidon, Moreton Dist. H. W. Caulfield, July 1963 (BRI); *ibid.* G. Ward, Nov. 1964 (NSW); Fairy Dell, Murphy's Ck. Dist., A. W. S. May, Sept. 1956 (BRI).

This species has been found only in a small area of the Moreton District of Queensland. It is morphologically similar to *P. dentatum* and *P. elatius*; from the former species it differs in being completely glabrous and in the position of the inflorescence, from the latter in being glabrous, in its acutely angular stem, in leaf shape, and in having only a minute sterile-apex to the carpels.

**32. *Phebalium gracile* C. T. White**

C. T. White, Proc. Roy. Soc. Queensld. 50:69 (1939) [*gracilis* = slender].

Typification: "Mount Greville, alt. 2,000 ft., common on rocky cliffs, C. T. White, No. 9947 (type; buds, flowers, and nearly ripe cocci)"; Holotypus: BRI 011387.

Slender shrub ca. 1 m high. Branchlets slightly angular, glandular verrucose, shortly hirsute with stellate and simple hairs in lines between the glabrous decurrent leaf bases. Leaves with petiole erect, ca. 1 mm long; lamina  $\pm$  spreading, chartaceous, oblong to elliptic, 5 x 2–7.5 x 1.5–10 x 2.5 mm, entire, glandular punctate, upper surface convex (or the margin revolute), glabrescent lower surface glabrous, apex obtuse to rounded, base rounded. Inflorescence an apical cluster, the flowers axillary to the terminal leaves; pedicel angular, ca. 4 mm long, glabrous or sparsely pubescent towards the base, thickened at the apex near the middle with a pair of opposite, filamentose, caducous bracteoles, ca. 0.5 mm long; mature flower bud narrowly obovoid, somewhat acute, ca. 4 mm long. Calyx lobes deltoid, ca. 0.5 mm long, glabrous; petals oblong, ca. 5 mm long, acute, glandular, white, the tip prominently inflexed; stamens  $\pm$  equal to petals, filaments filamentose, glabrous; anthers cordate-oblong, 1.2–1.4 mm long, pink, gynophore shortly cylindrical, ca. 0.5 mm

high, red; ovary cylindrical ca. 1.5 mm high, glabrous, apex  $\pm$  truncate, carpels with the upper third sterile; style  $\pm$  equal to stamens, glabrous. Cocci divaricate, ca. 4 mm long, rugulose, rounded at apex, outwardly short rostrate. Seed broadly reniform, ca. 3 mm long.

DISTRIBUTION: extreme south-east Queensland, apparently confined to a few neighbouring mountains—Map 31.

QUEENSLAND: Mt. Greville, S. L. Everist 7243 (BRI); *ibid.*, "It grows in crevices of cliff rocks and also in crevices of flat rocks on the top of the mountain. It is a thin bush from 2-4 ft. high", E. J. Smith, 20.iv.1938 (BRI); Mt. Moon "on the Teviot a main tributary to the lagoon", B. Scortechini 441 (MEL).

This species was first recognised as being a distinct taxon by F. Mueller who made the following note in *Melbourne Chemist and Druggist* 7: 64 (Dec. 1884) (under *Eriostemon coxii*):—"The Rev. B. Scortechini, now zealously engaged in the phytologic exploration of Peral, gathered on Mount Moon, in Queensland, an *Eriostemon* allied to *E. elatior*, but with narrower leaves, revolute at the margin, with mostly solitary pedicels and abbreviated peduncles. As a species or variety, it should bear his name." The collection referred to by Mueller is Scortechini no. 441, collected in 1883 (MEL 4783).

### 33. *Phebalium bilobum* Lindl.

Lindley in Mitchell, *Three Exped.* 2:177 (1838) (not seen) [bilobus = 2-lobed]; Lindley, *op. cit.* ed. 2. 2:178 (1839); Walpers, *Rep. Bot. Syst.* 2:823 (1843); Bentham, *Fl. Austral.* 1:340 (1863) excl. South Australian specimens cited; Engler, *Pflanzenfam.* 3/4:140 (1896); Ewart, *Fl. Vict.* 708 (1931); Engler, *Pflanzenfam.* ed. 2. 19a: 260 (1931); Curtis, *Stud. Fl. Tasm.* 104 (1956); Willis, *Vict. Nat.* 73:195 (1957).

Typification: "We found upon the mountain [i.e. Mt. William] a most remarkable species of *Phebalium* with holly-like leaves and bright red flowers, resembling those of a *Boronia*. It was related to *P. phyllicifolium*, but quite distinct." July 15, 1836. Holotypus: CGE (photo seen CANB) "Mount William no. 249"; iso.: K (photo seen), MEL.

*Eriostemon hillebrandii* F. Muell., *Trans. Phil. Soc. Vict.* 1:10 (1855), nom. illeg. [*P. bilobum* Lindl. cited as a synonym]; F. Muell., *Journ. Bot. Kew Misc.* 8:37 (1856); F. Muell., *Pl. Col. Vict.* 1:127 (1862); F. Muell., *Fragm.* 9:109 (1875); Rodway, *Tasm. Fl.* 24 (1903).

*P. hillebrandii* (F. Muell.) Engler, *op. cit.* ed. 2. 19a:260 (1931) pro syn. sub *P. bilobum*.

*E. hillebrandii* B. longifolius F. Muell., *Trans. Phil. Soc. Vict.* 1:10 (1855) F. Muell., *Journ. Bot. Kew Misc.* 8:37 (1856) "var. longifolius". Typification: "On the rocky summit of Mount William, 5,000 feet above the level of the sea". Syntypes: MEL 4608 and 4616 "Anthers yellow (pale), Nov. 53"; MEL 4617.

*P. truncatum* Hooker f., *Fl. Tasm.* 1:64 tab. 9; (24. x. 1855); Hooker f., *op. cit.* 2:358 (1860); C. Mueller in Walpers, *Ann. Bot. Syst.* 7:522 (1868). Typification: "(Gunn, 1947)" "Hab. Flinders Island, in Bass' Straits, and Schouten Island, East Coast, Gunn." Syntypus: Flinders Island, R. C. Gunn 1947 (HO).

*E. serrulatus* F. Muell., *Fragm.* 1:4 (1858); Hooker f., *Fl. Tasm.* 2:358 (1859); F.v. Mueller, *Pl. Col. Vict.* 1:128 (1862); C. Mueller in Walpers, *Ann. Bot. Syst.* 7:521 (1868). Typification: "In vallibus silvaticis ad originem fluvii Bunip-Bunip Creek." Holotypus: MEL 4620; iso.: K (photo seen), MEL 4622 p.pte.

Small shrub ca. 1 m high (to small tree 4 m high). Branchlets slender, terete or slightly angular when young, smooth, minutely or coarsely stellate. Leaves with a short erect petiole, lamina spreading, chartaceous, shortly ovate-oblong and constricted below apex (obpandurate) (in the Grampians and Tasmania) or narrowly elliptic-oblong or oblong (in Gippsland), 12 x 4-20 x 8-55 x 10 mm, flat, or with slightly recurved margins (Grampians), slightly to strongly serrate, truncate to strongly retuse, minutely glandular punctate, sparsely stellate to glabrous, midrib slightly impressed above, prominent below. Inflorescence a terminal compact cyme with the flowers in the axils of small terminal bracts or in short pedunculate clusters; pedicel slender, 4-8 mm long, red (Grampians), minutely stellate, minutely bibracteolate in lower half. Mature bud narrow-obovoid, ca. 4 mm long, red (Grampians) or pale green to white (Gippsland and Tasmania). Calyx sparsely stellate, lobes deltoid, 0.5-

0.7 mm long; petals narrow-elliptic, 3–5 mm long, red (especially towards apex) to white, tip strongly inflexed; stamens  $\pm$  equal to petals, filaments slender-terete, glabrous, anther cordate-orbicular 0.5–0.8 mm long, "yellow", disc short-cylindrical, 0.2–0.4 mm high, red (at least in Grampians); ovary 1–1.9 mm high, red (Grampians) or green (Gippsland and Tasmania); carpels 2–3 (4), erect, narrowed into a short, blunt, sterile apex. Cocci divaricate, ca. 5 mm long, narrowed at apex and with a terminal rostrum ca. 1 mm long, smooth. Seed not seen.

**DISTRIBUTION:** Victoria in the Grampians and in west Gippsland; Tasmania on the east coast and on some islands in the Bass Strait—Map 33.

**TASMANIA:** Flinders Island, R. C. Gunn 1947 (HO); Cape Barren Is., J. Milligan 619, 22.x.1844 (HO); Schouten Is., Story (MEL 4625); Blue Tier, L. Rodway (HO).

**VICTORIA:** Powelltown area, Gippsland, shrub or small tree up to 10–12 feet, E. D'Arnay, 3.ix.1963 (CANB); Warburton, Miss Cowle, Oct. 1904 (MEL); near the Pinnacle, Grampians, B. G. Briggs. Aug. 1958 (NSW).

*P. bilobum* has evident affinities with *P. hillebrandii* which also has a reduced carpel number. It may be distinguished from that species by its larger size, its serrate leaves, yellow anthers, absence of abrupt apiculum on carpel, and by the fruit shape.

In the three major areas of distribution a morphologically distinct race is found. The Grampians plant [*P. bilobum* s.s.] has short, broad, slightly serrate leaves with recurved margins, and reddish flower buds; in Gippsland [*E. serrulatus*] the leaves are much longer, strongly serrate, flat, and the flower buds are white; in Tasmania [*P. truncatum*] the leaf-shape tends more toward the Grampians form, however the flower-bud colour (from the few herbarium specimens seen) appears to be white. The specimens I have seen from Gippsland and Tasmania do not suggest that infraspecific delimitation is warranted. However with a more complete knowledge of habit and range of variation this view may require modification.

The ovule position varies according to the number of carpels in the ovary. When bicarpellary the ovules are placed side by side (collateral), if quadricarpellary they are situated one slightly above the other. It therefore appears that the normal position of ovules in the Boronieae (superimposed) is at least partly dependent on the space factor, since the funicles always arise collaterally.

### 34. *Phebalium hillebrandii* J. H. Willis

J. H. Willis, Vict. Nat. 73:195 (1957) [named after Dr. Wilhelm Hillebrand].

Basic name: *Eriostemon hillebrandii* A. brevifolius F. Muell., Trans. Phil. Soc. Vict. 1:10 (1855) nom. illeg.; F. Muell., J. Bot. Kew Misc. 8:37 (1856) "var. brevifolius".

Typification: "On the rocky banks of rivulets in the Victoria Ranges" [An error for "Mt. Lofty Ranges"]. Lectotypus: (cf. J. H. Willis, l.c.) MEL 4590 "Mt. Lofty Ranges, Dr. Ferd. Mueller". Syntypes: MEL 4592, 4593, 4597, 4600.

*E. hillebrandii* F. Muell., Pl. Col. Vict. 1:127 (1862) pro pte., nom. illeg.; Tate, Handb. Fl. Extratr. S. Austral. 24 (1890).

*P. bilobum* [non Lindley] Bentham, Fl. Austral. 1:340 (1863) pro pte.; Black, Fl. S. Austral. 342 (1924); J. M. Black, op. cit. ed. 2. 499 (1948).

Note: The name *Eriostemon hillebrandii* F. Muell. is illegitimate as Mueller cited the name *Phebalium bilobum* Lindley as a synonym. The latter is conspecific with Mueller's *E. hillebrandii* var. *longifolius*.

Small slender woody perennial 30–60 cm high. Branchlets slender, terete, minutely and sparsely stellate. Leaves shortly petiolate, spreading, lamina chartaceous, shortly cordate-obcuneate to ovate or oblong (rarely sub-orbicular) (3 x 2.5) 5 x 2.5–17 x 2 mm, apex truncate and mucronate to acutely bilobed or retuse, margin frequently recurved (when dry), entire, upper surface smooth and glabrous to minutely scabridulous, lower surface glabrous. Inflorescence terminal in a cyme or umbel, the (2) 4–10 (16) flowers usually

solitary in the axils of the terminal leaves or bracts; pedicel slender, minutely bibracteolate in lower half, 4–10 mm long, mature bud pale red, narrow-obovoid, 4–5 mm long. Calyx obturbinate passing into the pedicel apex, lobes deltoid, ca. 0.5 mm high, sparsely and minutely stellate; petals narrow-elliptic, 3.5–5 mm long, white with pink outside towards apex, tip inflexed; stamens  $\pm$  equal to petals, filaments slender-terete; anthers orbicular-cordate, ca. 0.5 mm long, pink; pollen very pale yellow; gynophore cylindrical, 0.4–0.6 mm long, red; ovary 2–4-carpellary, ca. 1 mm high, glabrous, carpels erect, plump, abruptly narrowed at apex into a short cylindrical apiculum ca. 0.3 mm long; style slender  $\pm$  equal to stamens. Cocci erect, obovoid, 4 mm high, apex rounded and shortly rostrate on outer angle. Seed reniform, ca. 3 mm long.

DISTRIBUTION: South Australia, in the Mt. Lofty Ranges and on Kangaroo Island—Map 33.

SOUTH AUSTRALIA: Cox's Creek, Bridgewater, D. N. Kraehenbuehl 322 (AD); Waterfall Gully, Mt. Lofty Ranges, R. Tate, 13.viii.1881 (AD); Kingscote-Penneshaw rd., Kangaroo Is., G. Jackson 328 (AD).

*Phebalium hillebrandii* is closely related to *P. bilobum* (with which it shares a reduced carpel number), *P. brachyphyllum*, *P. lamprophyllum*, and *P. rotundifolium*. It may be distinguished from *P. bilobum*, with which it was at one time united, by the pink anthers and the leaf shape, and from other related species also by the reduced carpel number.

The Kangaroo Island form (of which I have seen only one specimen in flower) has small, broadly orbicular leaves and has non-apiculate carpels. It may be more closely related to *P. brachyphyllum* but I have not included it in that species as it has a reduced carpel number and retuse leaves, characters found in *P. hillebrandii*.

### 35. *Phebalium brachyphyllum* Benth.

Benth., Fl. Austral. 1:341 (1863) [brachys — short, phyllon — leaf]; Black, Fl. S. Austral. 344 (1924); J. M. Black, Trans. Roy. Soc. S. Austral. 55:140 (1931) and 58:178 (1934); J. M. Black Fl. S. Austral. ed. 2. 499 (1948).

Typification: "Encounter Bay and near Coffin Bay, F. Mueller". Syntypes: K "Spencer's and St. Vincent's Gulf on the low coast ranges" (photo seen), MEL 4628 "In montibus humilibus calcariis prope Coffin-bay, febr. 52" leg. C. Wilhelm? and "Encounter-bay. Sch. Sept. 27" (?) leg. H. Behr?.

*Eriostemon brachyphyllus* (Benth.) Tate, Handb. Fl. Extratr. S. Austral. 24 (1890), without indication of basionym.

*E. microphyllus* F. Muell. [non *P. microphyllum* Turcz. (1852)], Trans. Phil. Soc. Vict. 1:99 (1855); F. Muell., J. Bot. Kew Misc. 8:37 (1856); F. Muell., Pl. Col. Vict. 1:129 (1862); F. Muell., Fragm. 9:109 (1875).

Typification: "On the low coast ranges of Spencer's and St. Vincent's Gulf." Syntypes as for *P. brachyphyllum*.

Small undershrub. Branchlets terete, smooth, minutely stellate (rarely glabrous). Leaves spreading, very shortly petiolate, coriaceous, flat or when dry with recurved or incurved margins, minutely stellate-scabridulous or glabrous, entire, ovate to very broadly ovate or subcordate, 4 x 2–5 x 3–3 x 4 mm, apex obtuse to rounded. Inflorescence a small terminal cluster with the flowers axillary to the terminal leaves or bracts, or sometimes 2–3 on a short peduncle; pedicel (2) 3–4 mm long, minutely bibracteolate; mature bud bluntly obovoid, 3–4 mm long. Calyx fleshy, glabrous, lobes deltoid, ca. 0.5 mm long; petals narrow, obovate, ca. 4 mm long, minutely glandular, white tinged with pink in bud, tip slightly inflexed; stamens equal to petals; filaments slender-terete; anther cordate-orbicular, ca. 0.8 mm long, pink; gynophore ca. 1 mm high; ovary sub-spherical to ovoid, ca. 1 mm high, glabrous: carpel with a short rounded sterile apex. Cocci slightly spreading, ca. 4 mm high, apex rounded and apiculate on outer angle. Seed thick, reniform, ca. 3 mm long.

**DISTRIBUTION:** South Australia, southern region from Eyre Peninsula eastwards, Victoria, far west—Map 32.

VICTORIA: nr. Natimuk, W. Cane, Oct. 1958 (MEL).

SOUTH AUSTRALIA: 10 mi N of Naracoorte, D. Hunt 33 (AD); 10 mi E of Tintinara, R. Hill 118 (AD); Malinong, M. C. R. Sharrad 235a (AD); Warooka, Yorke Peninsula, leg. Pritchard, 1930 (AD).

*P. brachyphyllum* is closely related to *P. hillebrandii* from which it differs principally in leaf shape and texture, and in carpel number. It is also very similar to the New South Wales form of *P. lamprophyllum* which has rounded leaves and which itself grades into the typical form of *P. lamprophyllum* from Victoria; it differs most noticeably from this last species in having a more prominent gynophore and smooth branchlets.

### 36. *Phebalium lamprophyllum* (F. Muell.) Benth.

Bentham, Fl. Austral. 1:340 (1863); Ewart, Fl. Vict. 708 (1931).

*Eriostemon lamprophyllus* F. Muell., Quart. J. Pharm. Soc. Vict. 2:43 (1859) [lampros = bright, phyllon = leaf]; F. Muell., Pl. Col. Vict. 1:126 (1862); F. Muell., Fragm. 9:109 (1875); F. Muell., Nat. Pl. Vict. 1:73 (1879); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906).

Typification: "On the rocky summits of some mountains, at the M'Allister River, Gippsland." Holotypus: MEL 4784 "In summitibus rupestribus montium ad fl. M'Allister River." leg. F. Mueller; iso.: MEL 4318 and 4785, AD 96350153, K "Jan. 59" (photo seen), NSW 70228. Bentham gives the locality as "Mount Nigar" presumably based on a personal communication from Mueller.

Compact shrub to 2 m high. Branchlets terete or somewhat angular when young, prominently verrucose, minutely pubescent with stellate and simple hairs in longitudinal lines between glabrous leaf-decurrencies, or (in central New South Wales form) pilose all round. Leaves very shortly petiolate; lamina subcoriaceous to chartaceous, elliptic to broadly obovate or suborbicular 10 x 3–3 x 3 mm flat or convex when dry, entire or minutely erose near apex, smooth, glabrous, glossy above, midrib impressed or plane, apex acute to rounded. Inflorescence a terminal cluster, the flowers solitary in the axis of terminal leaves and bracts or 1–3 on short peduncles; pedicel slender or somewhat fleshy, 2–3.5 mm long, sparsely stellate and minutely bibracteolate in lower half; mature flower bud obovoid, ca. 3 mm long. Calyx fleshy, lobes deltoid ca. 0.5 mm high, valvate, narrow-elliptic, 3.5–4.5 mm long, petals white with pink tips on outside, glandular punctate; stamens equal to or slightly exceeding petals, filaments slender-terete; anthers cordate-orbicular, 1 mm long, pale pink or yellow; gynophore short-cylindrical ca. 0.3 mm high, red; ovary sub-spherical to  $\pm$  cylindrical, 1–1.8 mm high, glabrous, upper 1/3 to 1/2 sterile; style curved or coiled in bud, equal to stamens. Cocci spreading, ca. 3 mm high, shortly rostrate (in type) to minutely apiculate on outer angle. Seed narrowly ovoid, ca. 2.5 mm long, raphe basal with a thin, crustaceous, glossy covering.

**DISTRIBUTION:** The mountains of eastern Victoria north along the Dividing Range to Rylstone in New South Wales—Map 32.

NEW SOUTH WALES: 1 mi SE of Currant Mtn. Gap, Rylstone District, "compact erect shrub 7 m high (plants seen to 1.3 m)" B. Briggs, 6.viii.1961 (AD); Morts gully, Lithgow, J. L. Boorman, Jan. 1914 (AD); Pine Mountains, Ournie, Jephcott, Nov. 1877 (MEL).

A.C.T.: Brindabella Range, L. Pryor, May 1937 (NSW).

VICTORIA: Brisbane Ranges, northern end, ca. 1.5 km S of Spring Ck., alt. 1250 ft., T. B. Muir 816 (MEL); Mt. Wellington foothills, toward Licola, E. Simmonds, 7.i.1950 (MEL).

As delimited in this paper *P. lamprophyllum* is an extremely variable species, this variability taking the form of a topocline from Rylstone, New South Wales, in the North to Victoria in the South.

In the type (a fruiting specimen) the stem is prominently verrucose and pubescent in lines, the leaves are thin, elliptic and acute, and the fruit strongly rostrate. In southern New South Wales the stem character is similar but the leaves are thicker and obovate, and the fruit only minutely apiculate. In the form from Lithgow to Rylstone and district the stem is stellate all round, and the leaves sub-orbicular; the fruit is not known to me but from the ovary morphology it is probably similar to that from southern New South Wales. The Rylstone form closely resembles *P. brachyphyllum*, but differs from that species, and agrees with the type of *P. lamprophyllum*, in having a verrucose stem, smooth, glabrous leaves, and a short gynophore. Owing to this apparent cline I am retaining these forms under the one species and have not attempted to create arbitrary infraspecific entities. The morphological approach to *P. brachyphyllum* in the northern form is, I consider, only superficial.

### 37. *Phebalium rotundifolium* (A. Cunn. ex Endl.) Benth.

Bentham, Fl. Austral. 1:341 (1863); Bailey, Queensld. Fl. 1:193 (1899); Gray, Contr. N.S. Wales Nat. Herb. 1:44 (1961).

*Eriostemon rotundifolius* A. Cunn. ex Endl. in Endl. et al., Enum. Pl. Huegel 15 (1837) [rotundus = round, folium = leaf]; Walpers, Rep. Bot. Syst. 1:504 (1842); Moore et Betche, Handb. Fl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1906).

Typification: "Hunters River (A. Cunningham, 1827)." Holotypus: K, "A. Cunningham no. 55, August 1827. Mount Dangar, Hunters River, New South Wales" (photo seen); iso.?: MEL 4954.

Dense bushy shrub to 2 m high. Branchlets terete, smooth, minutely stellate. Leaves shortly petiolate, erect and somewhat imbricate (at least in dried state), lamina sub-coriaceous, broadly obovate to orbicular, 6 x 6–10 x 6 mm, entire or minutely erose towards the rounded apex, smooth, glabrous. Inflorescence a terminal compact, globular raceme, the flowers usually solitary in the uppermost leaves or bracts; pedicel short, fleshy towards summit, ca. 1.5 mm long (rarely with a peduncle 3 mm long and 1 (3) pedicels), minutely and sparsely stellate, with two sub-basal caducous bracteoles; mature flower bud bluntly obovoid, 4–5 mm long. Calyx obconical, passing into fleshy pedicel apex, lobes broadly deltoid, ca. 0.5 mm high, glabrous; petals narrowly elliptic, 4.5–6 mm long, white to pale-yellow, glandular punctate, tip inflexed; stamens shortly exceeding petals, filaments slender-terete; anthers broad oblong, (1) 2 mm long, yellow; gynophore absent; ovary cylindrical, ca. 2 mm high, glabrous, carpels with apical 1/2–2/3 sterile; style slender ± equal to stamens. Cocci spreading when mature, 4–6 mm high, shortly rostrate. Seed broadly reniform ca. 3.3 mm long.

**DISTRIBUTION:** extreme north-east New South Wales and South-east Queensland—Map 32.

**QUEENSLAND:** Ballandean, dense growing shrub to 2m high, on hills amongst granite boulders, C. T. White 9425 (BRI); nr. Stanthorpe, T. M. Whaitte 303 (NSW); Wallangarra, J. L. Boorman, July 1912 (BRI).

**NEW SOUTH WALES:** Torrington, "in crevices of acid granite outcrop", J. B. Williams, 6.xii.1964 (AD); Howell, "large bushy plants of 3–6 ft. high and of similar width, usually growing in clumps", J. L. Boorman, Aug. 1905 (NSW).

The type of *Eriostemon rotundifolium* is recorded as having been collected near the Hunter River (north eastern New South Wales). I have not seen any specimens of this species from that area. However material collected from near the New South Wales-Queensland border compares well with the holotype at Kew (photo seen), with a possible isotype in Melbourne, and also with the description given by Bentham which was based on the type. All material studied differs from the original description in having stellate-puberulous branchlets (not glabrous), but this character may have been overlooked by Endlicher. It is possible that Cunningham collected the plant near the Darling



Downs from which he had just returned in August 1827 (the date given on the type) when he was near the Hunter River, and that confusion of localities occurred.

This species differs from *P. lamprophyllum* in having a smooth stem, and from *P. brachyphyllum* and *P. lamprophyllum* in the leaf shape, compact inflorescence, absence of gynophore, and in the carpel shape.

### 38. *Phebalium coxii* (F. Muell.) Maiden et Betche

Maiden et Betche, Census N.S.Wales Plants 116 (1916).

*Eriostemon coxii* F. Muell., Australasian Chemist and Druggist 7:64 (Dec. 1884) [named after Dr. J. C. Cox of Sydney]; Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906); Penfold, J. R. Soc. N.S.Wales 60:331-340. tab. 27 (1927).

Typification: "At the sources of the Clyde, about 3,500 feet above the level of the sea; W. Baeuerlen." Holotypus: MEL 4649, Baeuerlen no. 199; iso.: NSW 70184.

Erect pyramidal shrub 1-3(6?) m high. Branchlets strongly angular, minutely glandular, glabrous. Leaves chartaceous narrowly elliptic, 5.5 x 1.5-7 x 1 cm, smooth, serrulate towards the apex, glabrous, glossy above, midrib sunken above and prominent below, apex acute, base narrowly cuneate. Inflorescence a terminal corymb of 10-30 flowers the branches strongly flattened and glabrous or sparsely puberulous; pedicel ca. 5 mm long, minutely bibracteolate towards the base; mature bud obovoid, ca. 5 mm long with rounded apex. Calyx lobes thick, broadly deltoid ca. 0.8 mm high glabrous, petals narrowly ovate ca. 5 mm long, gland dotted, creamy to yellowish white, apex inflexed; stamens slightly shorter to slightly longer than petals, filaments slender terete; anthers broadly oblong 1.5 mm long; disc short-cylindrical, ca. 0.5 mm high; ovary doleiform, ca. 2 mm high, minutely rugulose, glabrous; carpels erect, narrow, upper half narrowly cylindrical and sterile. Cocci erect, not corrugate, ca. 5 mm high, apex outwardly rostrate. Seed reniform, to 4 mm long.

DISTRIBUTION: New South Wales; Clyde River apparently limited to the summit of a single mountain near Braidwood—Map 29.

NEW SOUTH WALES: Sugar Loaf Mtn. nr. Braidwood, W. Baeuerlen, Dec. 1889 (NSW); Clyde Mtn. nr. Nelligen, "found only on the very summit, about 3 ft. high, possessed of a very distinct odour." J. L. Boorman, Mar. 1909 (NSW); summit of Sugar Loaf Mtn., "large frutescent plants of 6-8 ft. high, compact and pyramidal in habit," J. L. Boorman, Sept. 1915 (AD).

This species is conspicuous owing to its leaf shape and pyramidal habit. Baeuerlen in 1886 records it as reaching 20 ft but other collectors suggest less than half this height. Its leaves have a distinct odour for which reason apparently it was at first thought by Mueller to have valuable medicinal properties. A. R. Penfold l.c., notes that "The leaves on crushing between the fingers, readily emit a delightful fruity odour, which very closely resembles that of the luscious passion fruit (*Passiflora edulis*)."

### 39. *Phebalium ambiens* (F. Muell.) Maiden et Betche

Maiden et Betche, Census N.S.Wales Plants 116 (1916) [ambiens = surrounding, referring to the leaf base]; Blake, Proc. Roy. Soc. Queensld. 70:43 (1959); Gray, Contr. N.S.Wales Nat. Herb. 344 (1961).

*Eriostemon ambiens* F. Muell., Fragm. 6:166 (1868), Fragm. 9:110 (1875); Moore et Betche, Handb. Fl. N.S.Wales 43 (1893); Dixon, Pl. N.S.Wales 48 (1906); White, Proc. Roy. Soc. Queensld. 47:5 (1936).

Typification: "In rupibus graniticis juxta Timbarra et loco Poverty Point. C.St." Lectotypus: MEL 4552, plant 4-6 feet, "granite rocks nr. Timbarra" November, C. Stuart 570. Syntypes: MEL 4551 and NSW 69516, Timbarra, plant 3 feet, granite rocks, "scent very powerful when growing", December, C. Stuart 184; MEL 4550, Poverty Point, plant 8-10 feet, October, C. Stuart 519.

Shrub to 2.5 m high. Branchlets terete or slightly angular, smooth, glabrous, leaves sessile, chartaceous, amplexicaul, broadly oblong-elliptic, 6 x 2.5–10 x 4 cm, flat, smooth, glandular punctate, glabrous, apex obtuse to acute, base with rounded lobes margin serrulate, midrib prominent below. Inflorescence a terminal compound cyme, sometimes glaucous, 20–200 or more flowered; pedicel angular, ca. 2 mm long, minutely bibracteolate towards the base; bract ca. 1 mm long, caducous; mature flower bud broadly ellipsoidal, ca. 3.5 mm long, apex rounded. Calyx fleshy smooth, glabrous, lobes broadly deltoid, ca. 0.5 mm long, minutely ciliolate; petals narrowly obovate, ca. 4.5 mm long, white, tip inflexed; stamens  $\pm$  equal to petals; filaments slender-terete; anthers oblong-cordate, 1.5–2 mm long; disc short (ca. 0.2 mm high), narrower than ovary; ovary subspherical, ca. 1.2 mm high, smooth, glabrous; carpels erect, the upper third sterile. Cocci  $\pm$  erect, ca. 3 mm high, rounded at apex and very shortly rostrate on outer angle. Seed reniform ca. 2.5 mm long, smooth, black.

**DISTRIBUTION:** extreme north-east New South Wales and adjacent area in Queensland. Apparently confined to mountainous country—Map 15.

**QUEENSLAND:** Mt. Norman nr. Wallangarra, ca. 4,500 ft., M. S. Clemens, 10.xi.1944 (BRI); Bald Mt., 4,100 ft. bushy shrub 4 ft., E. F. Constable 9.v.1961 (NSW); Wyberba, Mrs N. Gunn, Sept 1932 (BRI).

**NEW SOUTH WALES:** Bismuth nr. Deepwater, A. McNutt, Aug. 1913 (NSW).

This is the only species of *Phebalium* with an amplexicaul leaf. It has a restricted area of distribution and within it shows practically no morphological variation.

#### 40. *Phebalium nudum* Hook.

Hooker, Ic. Pl. 6: tab. 568 (1843) [nudus = bare]; Walpers, Rep. Bot. Syst. 2:823 (1843); Hooker f., Fl. Nov. Zeland. 1:44 (1852); Hooker f., Handb. N. Zeal. Fl. 39 (1864); Kirk, Stud. Fl. N. Zeal. 85 (1899); Cheeseman, Man. N. Zeal. Fl. 93 (1906); Cheeseman, Ill. Fl. N. Zeal. 1: tab. 26 (1914); Engler, Nat. Pflanzenfam. 19a:260 (1931); Allan, Fl. N. Zeal. 1:424 (1961). Typification: "New Zealand; Owaie, on the east coast of the northern Island, nr. Colenso, 1838 (n.56). Hokiangia, Edgerley." Syntype: K, Colenso 56 (photo seen). According to Allan, loc. cit., the Colenso specimen came from Owai near Whangaroa, North Island. *Eriostemon nudus* (Hook.) F. Muell., Fragm. 1:181 (1859); F. Muell., Pl. Indig. Col. Vict. 1:127 (1862).

Shrub or small tree, branchlets slightly angular when young, minutely stellate-puberulous. Leaves with flattened petiole ca. 2 mm long; lamina somewhat coriaceous, oblong-elliptic, 15 x 5–25 x 6 mm, flat, glabrous or glabrescent, smooth and without a prominent midrib, glandular punctate, margin minutely crenulate, apex rounded, base broadly cuneate. Inflorescence a terminal cyme of 12–50 (or more) flowers, the branches minutely stellate-puberulous; flower-bracts narrowly ovate, 1–2 mm long, caducous, pedicels slender, 3–10 mm long, minutely bibracteolate; mature flower bud narrow-obovoid, ca. 4.5 mm long, apex obtuse. Calyx somewhat fleshy, minutely stellate-puberulous, lobes deltoid, ca. 0.5 mm long, ciliolate; petals oblong-elliptic, ca. 5 mm long, white, tip inflexed; antipetalous stamens equal to corolla, antisepalous to  $1\frac{1}{2}$  times as long; anthers suborbicular-cordate, ca. 0.7 mm long; gynophore shortly cylindrical, ca. 0.4 mm high; ovary subspherical, ca. 1 mm high, smooth, glabrous; carpels without an obvious sterile apex. Fruit and seed not seen.

**DISTRIBUTION:** New Zealand, north-west region of North Island (according to Allan, loc. cit., from lat. 35° to 37° 30', in forests, especially marginal).

**NEW ZEALAND, NORTH ISLAND:** Kiwiriki, T. Kirk 83 (AD); Little Barrier Island, Miss Shakespear (AD); Huia, Auckland, alt. 900 ft., K. Wood 28480 (NSW); Marakan Harbour, anon. (NSW).

*Phebalium nudum* is the only species of this genus found outside of Australia or Tasmania. Although it shows no strong affinity with any other *Phebalium* species it is a typical member of the sect. *Leionema*. This section is otherwise found in the extreme south-east Queensland, eastern New South Wales, Victoria, south-east South Australia, and Tasmania.

#### 41. *Phebalium carruthersii* (F. Muell.) Maiden et Betche

Maiden et Betche, Census N.S.Wales Pl. 116 (1916).

*Eriostemon carruthersii* F. Muell., Vict. Nat. 7:46 (1890) [named in honour of J. Carruthers, Minister of Public Instruction in New South Wales]; Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906).

Typification: "At Mornya, near the Clyde, on sandy coastland, W. Bauerlen." Lectotypus: MEL 4638 "Moruya, July 1887, William Bauerlen 564; iso.: MEL 4639; syntypes: MEL 4640 "Moruya, June 1890, William Bauerlen 6", K (photo seen).

Small shrub to 1 m high. Branchlets terete, pilose with simple hairs. Leaves divaricate; petiole erect, flattened, ca. 1 mm long; lamina coriaceous, narrowly to broadly triangular, 10 x 1.5–5 mm, entire, smooth, glandular, sparsely pilose, apex obtuse, base  $\pm$  truncate or slightly cordate, margin recurved to revolute. Inflorescence terminal, nutant, of 4–10 flowers in the axils of the terminal leaves or bracts; pedicel 2–5 mm long, sparsely pilose, with a pair of pilose, linear bracteoles, ca. 5 mm long, at the apex; mature flower bud ellipsoidal, obtuse, ca. 8 mm long. Calyx thin, obconical, ca. 5 mm long, sparsely pilose outside, upper two thirds divided into long, valvate, narrowly triangular lobes; petals narrowly oblong-elliptic, ca. 8.5 mm long, somewhat conduplicate, glandular, yellowish-green, sparsely pilose, apex slightly inflexed, midrib linear, prominent; stamens  $\pm$  twice as long as the petals; filaments filamentose, dark red, glabrous; anthers narrowly cordate-oblong, ca. 1.8 mm long; disc ca. 0.6 mm long,  $\pm$  equal in width to ovary, prominently furrowed between carpels; ovary short-cylindrical, ca. 1 mm high, glabrous, smooth, apex rounded, carpels with a small sterile, slightly retuse, apical portion; style shorter than stamens. Cocci erect, ca. 5.5 mm high, glandular verrucose, rounded at summit, shortly bicornute at outer angle, hirtellous. Seed thick to 4 mm long; raphe covered by a glossy, thinly crustaceous layer.

DISTRIBUTION: New South Wales, Clyde River district, apparently restricted to a small area near Moruya—Map 29.

*P. carruthersii* has a similar indumentum to *P. diosmeum* which it also resembles, except for the ovary, in its flower characters. The petals and stamens both in their colour and morphology resembles those of *P. viridiflorum*.

All material of this species I have seen was collected during the period 1887–1890, from the one locality.

#### 42. *Phebalium ralstonii* (F. Muell.) Benth.

Bentham, Fl. Austral. 1:339 (1863); Maiden et Betche, Census N.S.Wales Pl. 116 (1916).

*Eriostemon ralstonii* F. Muell., Fragm. 2:101. tab. 14 (1860) [named in honour of A. J. Ralston]; F. Muell., Nat. Pl. Vict. 1:74 (1874); F. Muell., Key Syst. Vict. Pl. 1:140 (1887); F. Muell., op. cit. 2: tab. 15 (1885); Moore et Betche, Handb. Fl. N.S.Wales 44 (1893); Dixon, Pl. N.S.Wales 49 (1906).

Typification: "In rupibus graniticis juxta flumen Yowaka River sinum Twofold Bay versus." Holotypus: MEL 4945; iso.: MEL 4946, K (photo seen).

Small shrub. Branchlets strongly angular, smooth, glabrous. Leaves sessile, chartaceous, narrowly obovate and gradually narrowed to base, 2.5–5 x 0.5–0.8 cm, entire except for slightly bilobed apex, recurved (or revolute) in the dried state, smooth, glabrous except for a few stellate hairs along midrib which is impressed above and prominent below. Inflorescence a compact

terminal cyme of 4–7 flowers on a recurved peduncle, glabrous or glabrescent; bracts caducous (not seen); pedicel fleshy, ca. 3 mm long, with two linear bracteoles ca. 1 mm long towards the base; mature flower bud cylindrical. Calyx hemispherical, fleshy, glabrous, lobes deltoid, ca. 1 mm long; petals oblong-elliptic ca. 8 mm long, pale green, tip slightly inflexed; stamens much exceeding petals to 16 mm long, filaments green, filamentose, glabrous, anthers elliptic-cordate ca. 2 mm long; gynophore short, ca. 0.3 mm high; ovary shortly cylindrical, slightly swollen at the base ca. 1.7 mm high, glabrous; carpels rounded at summit with a short sterile apex; style  $\pm$  equal to stamens. Cocci erect, 4–5 mm high, rounded at summit and apiculate at outer angle. Seed not seen.

DISTRIBUTION: New South Wales, Twofold Bay district—Map 34.

NEW SOUTH WALES: Wyndham, "Plants grow to about 2 ft. high, much branched and twiggy growths, growing on the sides of hills amidst large loose stones where a slight exudation", J. L. Boorman, Aug. 1915 (NSW, SYD); Pambula, "woody shrub 2–3 ft., dry stony place", J. L. Boorman, Aug. 1915 (NSW).

*Phebalium ralstonii* is known only from three collections which may have all come from the same locality, the last known collection of the species being in 1915. References by both Bentham and Mueller to a Leichhardt specimen, and by Maiden to a Forsyth one, apply to a distinct species, *P. viridiflorum*.

The related species, *P. viridiflorum* and *P. sympetalum*, may be distinguished from *P. ralstonii* by the stellate indumentum of the first and the united petals of the second. All three species are characterized by having a similar leaf-shape, while the yellow-green corolla and long stamens are also characters not found elsewhere in the genus. The three species are each confined to a small isolated geographical area and show no prominent morphological variation.

#### 43. *Phebalium sympetalum* P. G. Wilson, sp. nov.

[sympetalus = having united petals]

Ramuli angulares, glabrescentes. Folia chartacea, obcuneato-elliptica, 1.5–3.5 x 0.4–0.8 cm, glabra. Inflorescentia terminalis, saepe nutans, 1–3-flora. Calyx hemisphericus, lobis late deltoideis ca. 1 mm longis; corolla sympetalum, cylindrica, ad 15 mm longa, virido-flava, staminibus breviter exsertis.

Holotypus: AD 96434202, New South Wales, near Olinda, Rylstone District, 2,700 ft., sandstone ridge, 6–8 ft. high, flowers nodding, green, pedicels red, filaments green, anthers yellow, 2.ix.1951, L. A. S. Johnson. Isotypus: NSW 69695.

Shrub 2–3 m high. Branchlets angular, smooth, stellate-puberulous when young, soon becoming glabrous. Leaves shortly petiolate, chartaceous, obcuneate-elliptic, 1.5–3.5 x 0.4–0.8 cm, smooth, minutely puberulous along midrib otherwise glabrous, margin slightly recurved (when dry) and  $\pm$  serrulate towards the retuse apex, midrib impressed above, prominent below. Inflorescence a terminal cluster of 1–3 flowers, often nutant; peduncle and pedicel slender, sparsely stellate puberulous, red, peduncle ca. 4 mm long, pedicel ca. 7 mm long with two minute opposite bracteoles; mature flower bud obtusely cylindrical ca. 12 mm long. Calyx fleshy, hemispherical, glabrous, lobes broadly deltoid, ca. 1 mm long; corolla sympetalous, cylindrical, to 15 mm long, greenish-yellow, separating towards the apex into erect acute lobes, minutely glandular punctate; stamens shortly exceeding the corolla; filaments filamentose, glabrous, green; anther oblong-cordate, ca. 2 mm long, yellow; gynophore very short, ca. 0.2 mm high; ovary doleiform, ca. 2 mm high, irregularly corrugate; carpels rounded at summit, the upper third sterile; style glabrous,  $\pm$  equal to stamens. Cocci erect, ca. 4 mm high, rounded at summit and shortly rostrate on outer angle. Seed not seen.

Chromosome no.  $n = 16$ , from material collected at Rylstone, fide Smith-White (1954) as "*P. ralstonii* var."

DISTRIBUTION: New South Wales, near Rylstone—Map 34.

NEW SOUTH WALES: 3 mi E of Olinda, in gullies on steep sandstone ridge, shrub to 7 ft., H. S. McKee, 31.viii.1951 (BRI); Khyber Pass, ca. 15 mi east of Rylstone, ca. 3,000 ft., S. Smith-White and H. S. McKee, 5.vi.1950 (NSW).

This is the only species of *Phebalium* which has united petals; in this character it resembles the genus *Correa* and the species *Nematolepis phebaloides*. Probably, as in the genus *Correa* (Hartl 1957), this sympetalae is due to a secondary fusion, in which case there is little distinction from an apopetalous corolla with valvate petals.

*P. sympetalum* is closely related to *P. ralstonii* and *P. viridiflorum* as is evidenced by the well exert anthers, the corolla shape and colour, and the leaf form.

#### 44. *Phebalium viridiflorum* P. G. Wilson sp. nov.

[viridis = green, florus = flowered]

*P. ralstonii* [non (F. Muell.) Benth.] Benth., Fl. Austral. 1:339 (1863) p.pte., as to Leichhardt specimen cited; F. Muell., Fragm. 3:165 (1863); F. Muell., op. cit. 9:109 (1865) "varietate breviter stellari-pubescente detectus."; Maiden et Betche, Proc. Linn. Soc. N.S.Wales 27:27 (1902).

Ramuli teretes, stellato-tomentosi. Folia chartacea, oblongo-elliptica, 2-4 x 0.4-0.8 cm; pagina inferiore stellato-tomentosa. Inflorescentia terminalis, nutans. Calyx hemisphaericus, profunde lobatus, lobis acuto deltoideis, ca. 2 mm longis; petala flavido-viridia, anguste oblongo-lanceolata, ca. 10 mm longa, staminibus petalis duplo longioribus.

Holotypus: NSW 6277, New South Wales, Belougery Mountain, Warrumbungle Range, alt. 3,000 ft. trachyte formation, plant 1½-2 ft. high, bushy habit, 28.v.1948, E. F. Constable; iso.: MEL 4949.

Shrub 1(2) m high. Branchlets terete, stellate-tomentose. Leaves shortly petiolate, chartaceous, oblong elliptic, 2-4 x 0.4-0.8 cm, smooth, ± recurved or revolute (when dry), entire except for the shortly bilobed apex, base cuneate, upper surface sparsely stellate to glabrescent, lower surface ± stellate-tomentose, midrib impressed above, prominent below. Inflorescence terminal, nutant, cymose or sub-umbelliform, stellate-tomentose, 6-12-flowered; floral bracts linear, 2-3 mm long, caducous; pedicels 4-8 mm long with two small bracteoles near the middle; mature flower-bud narrow-ovoid, obtuse, ca. 9 mm long. Calyx hemispherical, fleshy, lobes acutely deltoid, ca. 2 mm long, stellate puberulous on both sides; petals narrowly oblong-lanceolate, ca. 10 mm long with a linear dorsal keel, glandular punctate, pale yellow-green, stellate-puberulous outside, tip prominently inflexed; stamens to twice as long as petals, filaments filamentose, glabrous; anthers oblong-cordate, ca. 2.5 mm long; gynophore ca. 0.5 mm high. Ovary short-cylindrical, ca. 2 mm high, glabrous; carpels with rounded apex, the terminal third sterile. Cocci erect, ca. 6 mm high, transversely corrugate, apex rounded and prominently rostrate on outer angle. Seed not seen.

DISTRIBUTION: New South Wales, Warrumbungle Range—Map 34.

NEW SOUTH WALES: Belougery Split Rock, Warrumbungle Range, alt. 1,800 ft. on trachyte, "rounded bushy shrub 130 cm high, flowers pale yellow-green", B. G. Briggs, 31.iii.1961 (NSW); Warrumbungle Ranges, W. Forsyth, Oct. 1901 (NSW, MEL); "At the foot of the Castle rocky mountains, trachytic", Leichhardt, 18.v.1843 (BRI, MEL, NSW); Castlereagh River, leg. Woolls (MEL).

This species appears to be restricted to the Warrumbungle Ranges. It was included by Bentham under *P. ralstonii* by the citation of the Leichhardt specimen from "Castle Rock Mountain" but not as to description. A specimen in herb. MEL collected by Leichhardt bears a field label which reads "At the foot of the Castle rocky mountains, Trachytic. 18 May 43". A

duplicate in herb. BRI has a field(?) label reading "Rocky creek at the foot of the castle." They correspond to collections from the Warrumbungle Ranges, but I can find no data to confirm that Leichhardt was there at the date cited. Several collections, including Leichhardt's, mention that the plant was growing on trachyte.

*P. viridiflorum* is closely related to both *P. ralstonii* and *P. sympetalum*, but may be distinguished by its stellate-tomentose indumentum and terete branchlets.

## EXCLUDED NAMES

(= indicates a taxonomic synonym: ≡ indicates a nomenclatural synonym)

- Eriostemon argyreus* F. Muell. et Tate, Trans. Roy. Soc. S. Austral. 13:107 and 97 (1890) = *Pityrodia* sp. (? *P. lepidota* (F. Muell.) E. Pritz.). This species was described from a sterile branch thought to have been collected by Tietkens near Mount Sonder (the original label "Mt. Saunders") in Central Australia. The peltate scales on the stem and leaves are of the type found in the genus *Pityrodia* (Verbenaceae), not in the Rutaceae. However this genus has not been recorded by G. Chippendale as occurring in Central Australia; the locality record may therefore be incorrect.
- E. capense* Persoon, Syn. Pl. 1:465 (1805) nom. illeg., based on *Diosma uniflora* L. ≡ *Adenandra uniflora* (L.) Willd.
- E. capitatus* F. Muell., Fragm. 1:106 (1859) nom. illeg., based on *Asterolasia chorilaenoides* F. Muell. (1855) = *Microcybe pauciflora* Turcz.
- E. capitatus* var. *baccharoides* F. Muell., Fragm. 9:107 (1875) ≡ *Microcybe multiflorus* var. *baccharoides* (F. Muell.) Ewart.
- E. correifolius* (A. Jussieu) F. Muell., Fragm. 1:105 (1859) based on *Phebalium correaefolium* A. Juss. (1825) ≡ *Asterolasia correifolia* (Juss.) Benth. = *Urocarpus* sp.
- E. corymbosum* Labill., Sertum austro-caledonicum 59. t. 58 (1824-25) ≡ *Myrtopsis corymbosa* (Labill.) Guillaumin.
- E. cunninghamii* F. Muell., Fragm. 9:107 (1875) [non *E. buxifolius* Sm. (1809)] ≡ *Asterolasia buxifolia* Benth. (1863) = *Urocarpus* sp.
- E. dentatus* Colla, Hortus Ripulensis t. 30 (1824) absque descriptione, = *Elaeocarpus dentatus* (J. R. et G. Forster) Vahl, fide Cheeseman, Man. N.Zel. Fl. 85 (1906).
- E. drummondii* F. Muell., Fragm. 1:105 (1859) nom. illeg. ≡ *Urocarpus phebaloides* Drummm. ex Harv. (1855).
- E. fabianoides* Diels in Diels et Pritzell, Bot. Jahrb. 35:322. t.39K & L (1904) ≡ ***Boronia fabianoides*** (Diels) P. G. Wilson, comb. nov.
- E. geleznowii* F. Muell., Fragm. 1:107 (1859) [non *E. verrucosus* A. Rich. (1833)] ≡ *Geleznowia verrucosa* Turcz.
- E. gracile* R. Graham, Edinb. New Phil. Journ. 16:175 (1834) = *Philothea* sp. e descr.
- E. grandiflorus* (Hook.) F. Muell., Fragm. 1:105 (1859) based on *Phebalium grandiflorum* Hook. (1848) ≡ *Asterolasia grandiflora* (Hook.) Benth. (1863) = *Urocarpus* sp.
- E. hookeri* F. Muell., Fragm. 1:104 (1859) nom. illeg. based on *Phebalium squamuligerum* Hook. (1848) ≡ *Asterolasia squamuligera* (Hook.) Benth. (1863) = *Urocarpus* sp.
- E. kendack* Montrouzier, Mem. Acad. Sci. Lyon II. 10:191 (1860) ≡ *Halfordia kendack* (Montr.) Guillaumin (1911).
- E. leichhardtii* F. Muell., Fragm. 5:5 (Apr. 1865) ≡ *Halfordia drupifera* F. Muell., op. cit. 43 (Oct. 1865) nom. illeg. = *Halfordia kendack* (Montr.) Guillaumin, Not. Syst. Paris 2:98 (1911), fide Francis, Austral. Rain-Forest Trees ed. 2. 196 (1951) (see also Guillaumin, op. cit. 97).

- E. linearifolium* DC., Prod. 1:720 (1824) ≡ *Geijera parviflora* var. *crassifolia* Benth. (1863) ≡ *G. linearifolia* (DC.) Black (1924).
- E. marginata* (L.f.) J. E. Smith in Rees, Cyclop. 13: n.5 (1809), based on *Diosma marginata* L.f. (1781) ≡ *Adenandra marginata* (L.f.) Roem. et Schult. (1819).
- E. mollis* (Benth.) F. Muell., Syst. Census Austral. Pl. 11 (1882) nom. illeg. ≡ *Asterolasia mollis* Benth. (1863) nom. illeg. ≡ *A. correifolia* var. *mollis* Maiden et Betche (1902), based on *Phebalium hexapetalum* A. Juss. (1825) ≡ *A. hexapetala* (A. Juss.) Druce (1917) = *Urocarpus* sp.
- E. novae-caledoniae* Pancher et Sebert, Not. bois. Nouv. Caled. 271 (1874) non vidi, nomen nudum fide Guillaumin, Bull. Soc. Bot. France 67:64 (1920) pro syn. sub *Myrtopsis macrocarpa* Engl.
- E. oblongifolius* (Hook.) G. Don in Sweet, Hort. Brit. ed. 3. 129 (1839); *Jambolifera oblongifolia* (Hook.) Steud., op. cit. 796; based on *Cyminosma oblongifolia* Hook. (1834) = *Acronychia laevis* Forst. et f. (1776).
- E. pallidus* (Benth.) F. Muell., Fragm. 7:22 (1869) ≡ *Asterolasia pallida* Benth. (1863) = *Urocarpus* sp.
- E. pallidus* R. Schlechter, Bot. Jahrb. 39:142 (1906) nom. illeg. non F. Muell. (1869). Type from New Caledonia. Probably best placed in *Myrtopsis*, certainly not a species of *Eriostemon*.
- E. paradoxus* J. E. Smith in Rees, Cyclop. 13:n.6 (1809) ≡ *Boronia paradoxa* (Sm.) DC. (1824) = *Boronia* sp.
- E. pleurandroides* F. Muell., Fragm. 1:106 (1859) nom. illeg., based on *Asterolasia phebalioides* F. Muell. (1855) ≡ *A. pleurandroides* Benth. (1863) [non *A. phebalioides* (Harv.) Benth. (1863)] ≡ *Pleurandropsis phebalioides* (F. Muell.) Baillon (1872) = *Urocarpus* sp.
- E. salsolifolius* J. E. Smith in Rees, Cyclop. 13:n.3 (1809) ≡ *Philotheca australis* Rudge (1815) nom. illeg. (superfluous epithet) ≡ *P. salsolifolia* (Sm.) Druce (1917).
- E. sandfordii* F. Muell., Fragm. 1:107 (1859) [non *E. calycinus* Turcz. (1849)] based on *Sanfordia calycina* Drumm. ex Harv. (1855) ≡ *Geleznovia calycina* (Harv.) Benth. (1863).
- E. spathulifolius* Gandoger, Bull. Soc. Bot. France 60:458 (1913) "Hab.: Australia, Victoria ad Esmerald [sic] (MacLennan)." I have not been able to obtain a photograph of the type of this species; however the description agrees with a form of *Asterolasia* found at Emerald in the Dandenong Ranges of Victoria. This form was included under "*Asterolasia muelleri* Benth." by Ewart, Fl. Vict. 703 (1931) [≡ *A. asteriscophora* (F. Muell.) Druce], but it may deserve recognition as a distinct species under *Urocarpus*.
- E. trinerve* Hooker, J. Bot. Hooker 1:254 (1834) type from Tasmania, non *Leptospermum trinerve* DC. (1828), = *L. glaucescens* Schau. (1841), fide J. H. Willis, Muelleria 1/3:136 (1967).
- E. trymalioides* (F. Muell.) F. Muell., Fragm. 1:106 (1859), based on *Asterolasia trymalioides* F. Muell. (1855) ≡ *Pleurandropsis trymalioides* (F. Muell.) Ewart (1931) = *Urocarpus* sp.
- E. uniflora* (Linnaeus) Smith in Rees, Cyclop. 13:n.4 (1809) ≡ *Adenandra uniflora* (L.) Willd. (1809).



- Phebalium* sect. *Correoides* Endl., Gen. Pl. 1156 (1840) = *Urocarpus*.
- Phebalium asteriscophorum* F. Muell., Trans. Vict. Instit. 1:31 (1855) ≡ *Asterolasia muelleri* Benth. (1863) nom. illeg. (superfluous name) ≡ *A. asteriscophora* (F. Muell.) Druce (1917) = *Urocarpus* sp.
- P. baxteri* Bentham, Fl. Austral. 1:345 (30 May 1863) ≡ *Nematolepis baxteri* (Benth.) Engler (1896) "Paxteri" = *N. euphemiae* F. Muell., Fragm. 3:149 (Apr. 1863). This species is not congeneric with *N. phebaloides* Turcz. (the type species) and deserves recognition as a distinct genus.
- P. buckinghamii* Blakely, Austral. Nat. 10:246 (1940) ≡ *Asterolasia buckinghamii* (Blakely) Blakely (1941).
- P. capitatum* S. Moore, J. Linn. Soc. Bot. 45:165 (1920) = *Microcybe* sp.
- P. correifolium* A. Jussieu, Mem. Soc. Hist. Nat. Paris 2:130. t.10 (1825) "correaeifolium", see *Eriostemon correifolius* (Juss.) F. Muell. (1859).
- P. euphemiae* (F. Muell.) Gardner, Enum. Pl. Austral. Occ. 70 (1931) (with only an indirect indication of basionym) *M Nematolepis euphemiae* F. Muell. (1863). Apparently however a distinct genus, see note under *P. baxteri*.
- P. grandiflorum* Hooker, Ic. Pl. 8:t.724 (1848) see *Eriostemon grandiflorus* (Hook.) F. Muell. (1859).
- P. hexapetalum* A. Jussieu, Mem. Soc. Hist. Nat. Paris 2:131. t.11.f.1 (1825) see *Eriostemon mollis* (Benth.) F. Muell.
- P. squamuligerum* Hooker, Ic. Pl. 8: (1848) t. 727 ≡ *Eriostemon hookeri* F. Muell. (1849) nom. illeg. ≡ *Asterolasia squamuligera* (Hook.) Benth. (1863) = *Urocarpus* sp.

#### NOMINA NUDA

- Eriostemon densiflorus* Seghers, Revue de l'horticulture belge et étrangère. Bruxelles 20:97 (1894), nom. nud. (with details of culture only).
- E. ericaefolium* Mackay ex G. Don in Sweet, Hort. Brit. ed. 3: 129 (1839), nom. nud.
- E. glaucescens* Aiton ex G. Don in Sweet, Hort. Brit. ed. 3; 766 (1839) nom. nud.
- E. linifolium* Seghers, Rev. hort. belge Brux. 20:97 (1894) nom. nud. (with details of culture only).
- E. punctatus* Pancher ex Guillaumin, Ann. Mus. Col. Marseille Ser. 2.9:110 (1911) nom. nud.

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## EXPLANATION OF FIGURES

Fig. 1.—*Eriostemon deserti*: (1) L.S. of carpel showing placentation of ovules, (2) Attachment of ovules to placenta. *Crowea angustifolia* seed: (3) Side view, (4) Adaxial face, (5) L.S. through base. *E. australasius* seed: (6) L.S. showing embryo, (7) Adaxial face, (8) Adaxial face with attached placental endocarp.

(1-2 from Wilson 3514, the rest from cultivated material)

Fig. 2.—*E. myoporoides* seed: (1) Side view, (2) Adaxial face, (3) L.S. through base. *E. difformis* seed: (4) Adaxial face, (5) Side view, (6) L.S. *E. gardneri* seed: (7) Adaxial face, (8) L.S. *E. tomentellus* seed: (9) Adaxial face, (10) L.S.

(1-3 from R. Hill 990; 4-6 from cultivated materials; 7-8 from A. George s.n.; 9-10 A. George 4239)

Fig. 3.—*E. thryptomenoides* seed: (1) Adaxial face, (2) Side view. *E. pungens* seed: (3) Adaxial face, (4) Side view. *E. spicatus* seed: (5) Adaxial face, (6) Side view. *E. deserti* seed: (7) Adaxial face, (8) Side view. *P. brachyphyllum* seed: (9) Adaxial face, (10) Side view. *P. rude* seed: (11) Adaxial face, (12) Side view.

(1-2 from Blackall 3490; 3-4 from Sharrad 409; 5-6 from Gardner 2702; 7-8 from Veitch 4; 9-10 from D. Hunt 2222; 11-12 from A. George 7263)

Fig. 4.—*P. squameum* seed: (1) Adaxial face, (2) Side view. *P. bullatum* seed: (3) Adaxial face, (4) Side view. *P. brachyphyllum*: (5) Endocarp with seed enclosed, (6) Adaxial face with placental endocarp attached, (7) Elastic endocarp after dehiscence.

(1-2 from Macfarlane s.n.; 3-4 from Wilson 1002; 5-7 from D. Hunt 2222)

Abbreviations used in illustrations of seed—

c = chalaza, m = micropyle, h = hilum, r = raphe, hr = hard covering to raphe, tr = thin covering to raphe, s = sclerotesta.

Fig. 5.—Anthers (abaxial face except where indicated).

1, *Crowea angustifolia*—(a) Abaxial, (b) lateral (median) view. 2, *E. australasius*—(a) abaxial, (b) lateral, (c) abaxial. 3, *E. myoporoides*. 4, *E. angustifolius*. 5, *E. pungens*—(a) abaxial, (b) lateral showing apex of filament. 6, *E. deserti*. 7, *E. spicatus*. 8, *P. brachyphyllum*. 9, *P. squameum*. 10, *P. bullatum*—(a) adaxial, (b) lateral (median) view. 11, *P. anceps*. 12, *P. rude*.

Figure 1

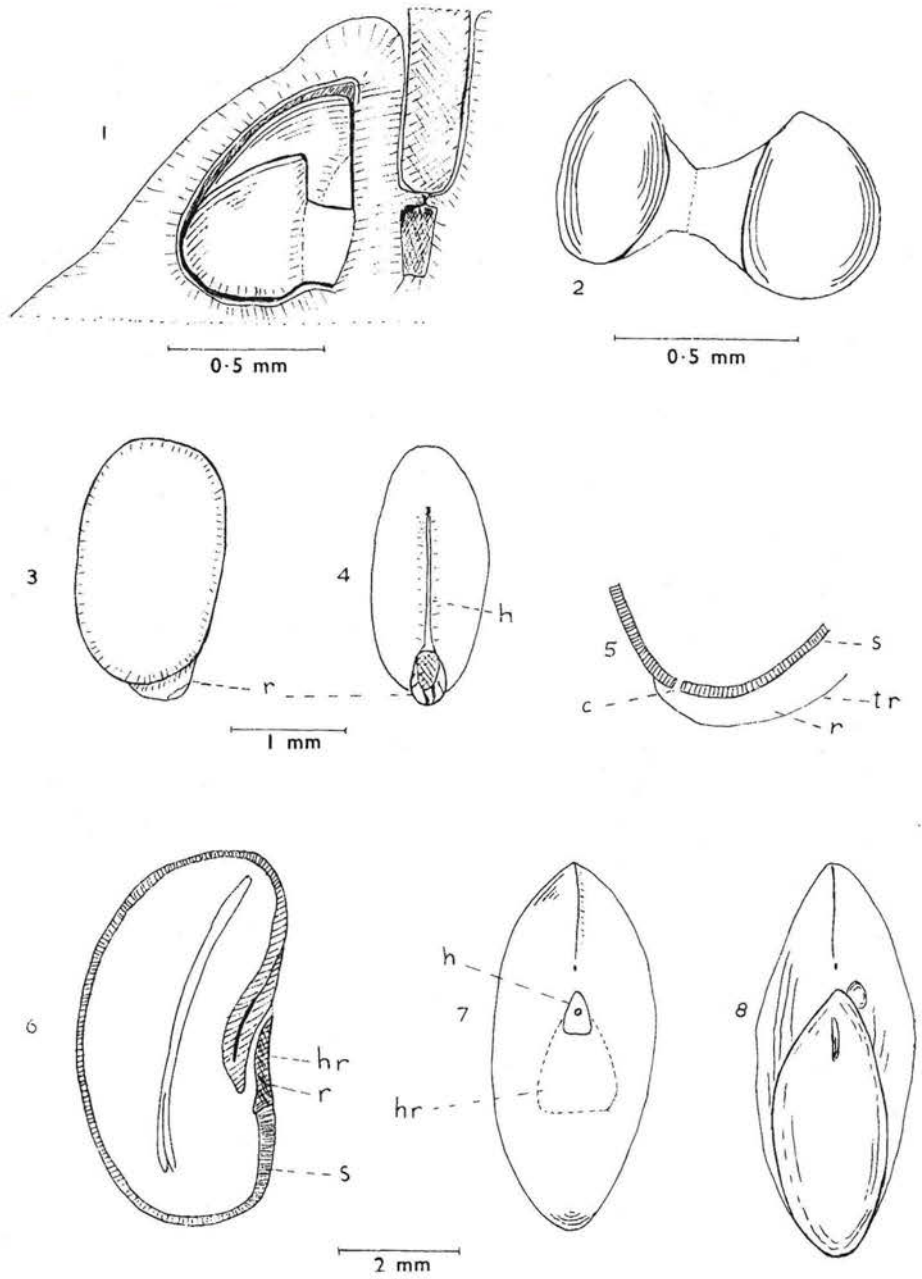


Figure 2

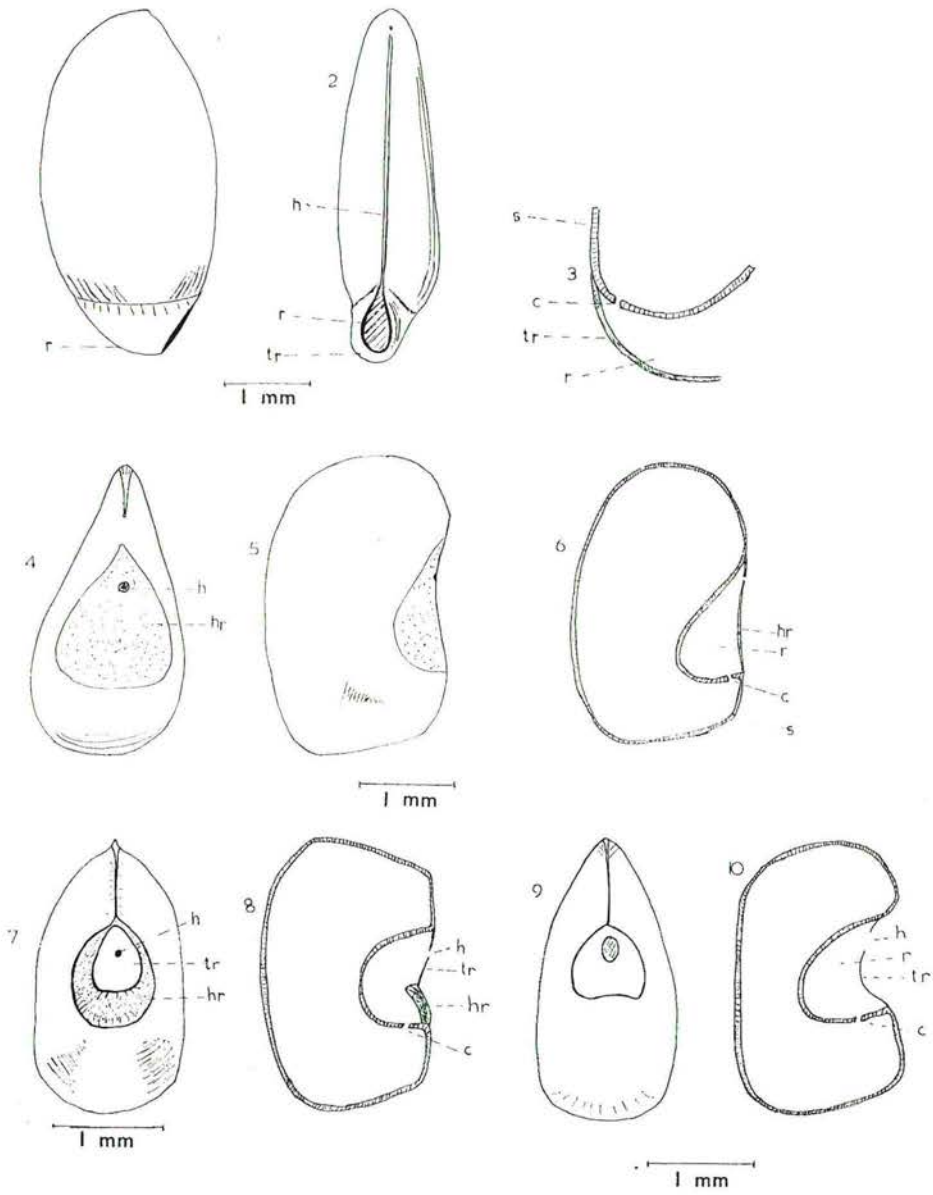


Figure 3

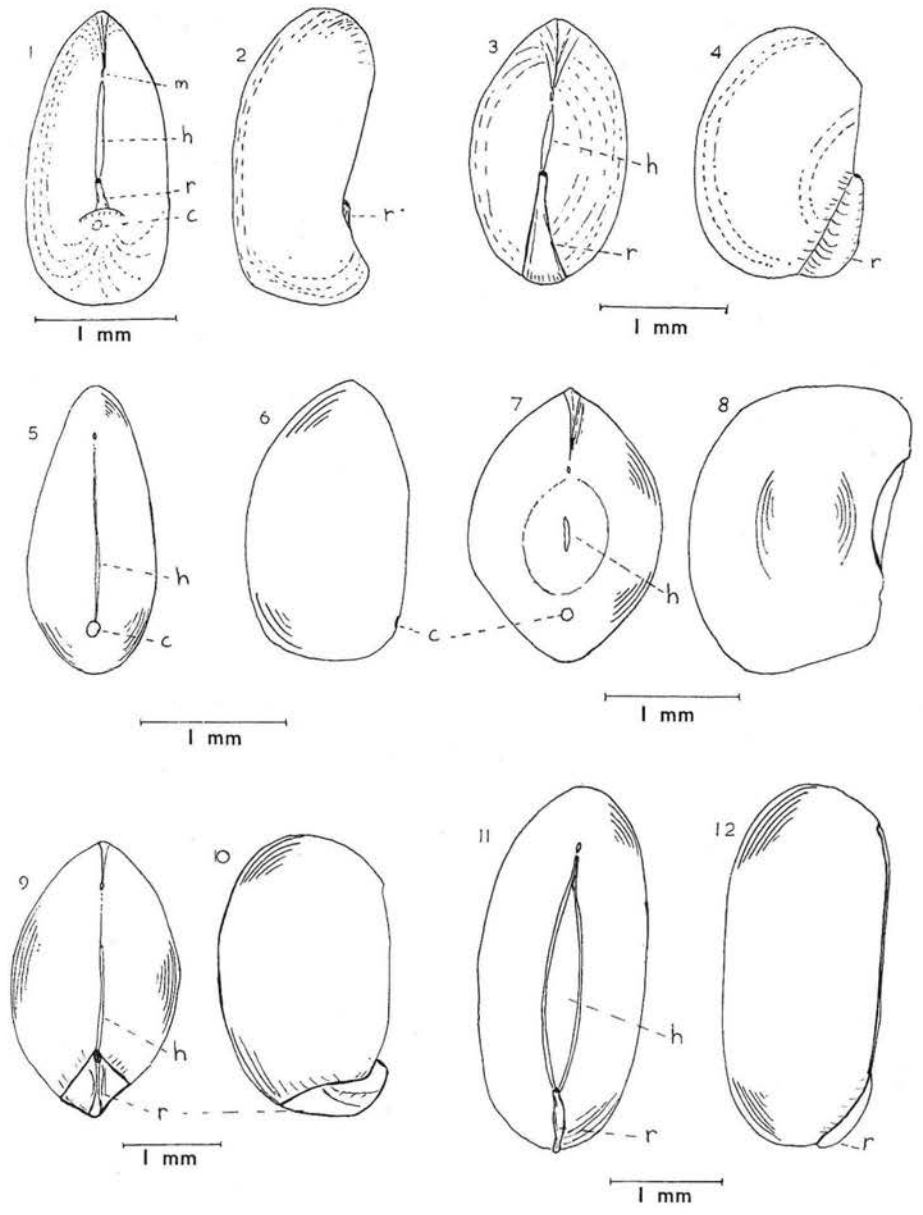


Figure 4

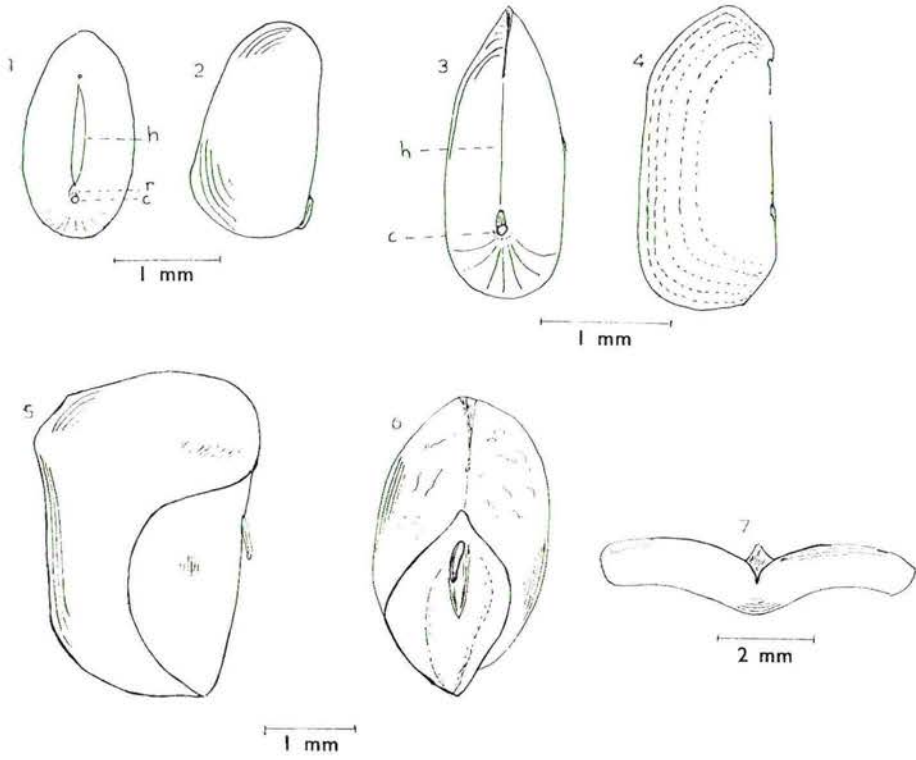
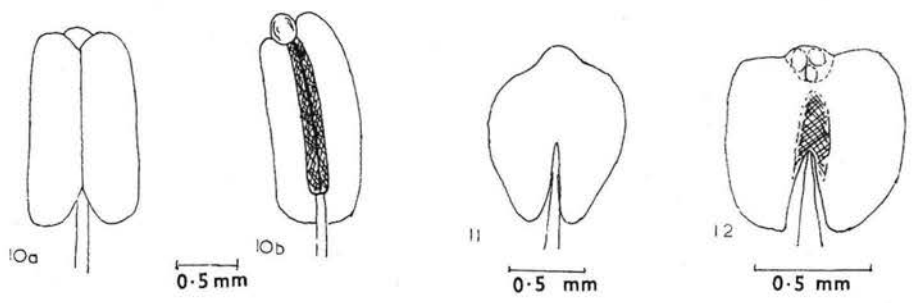
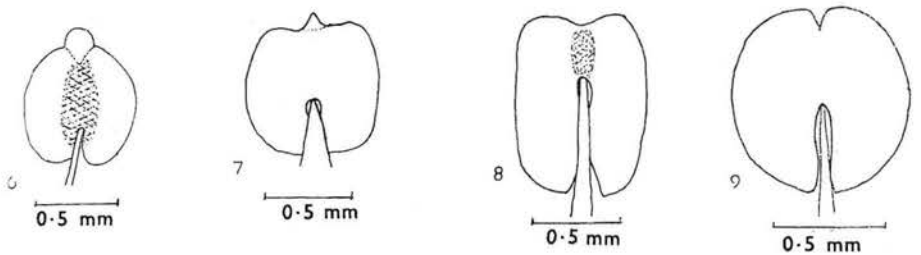
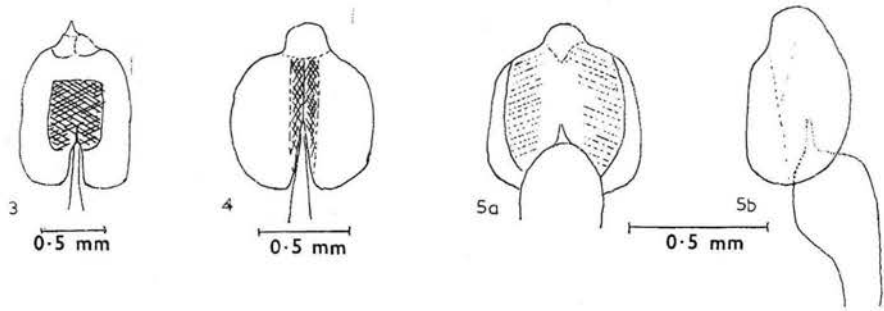
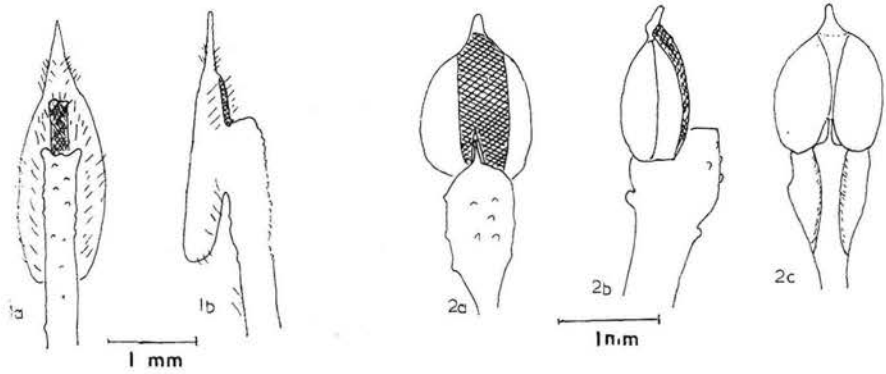
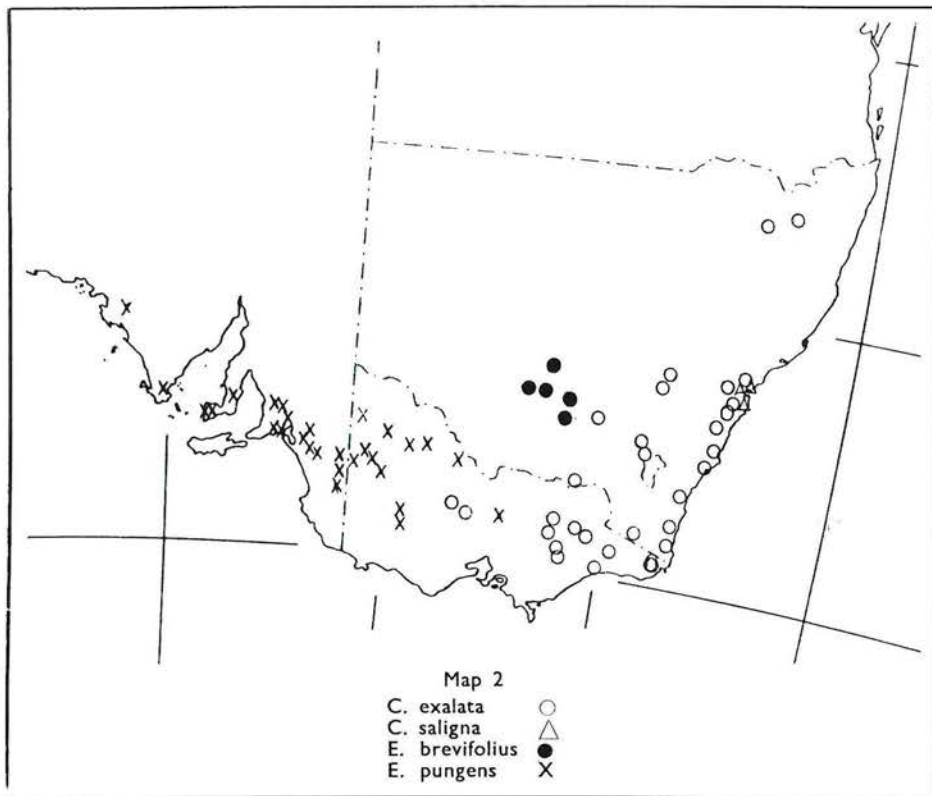
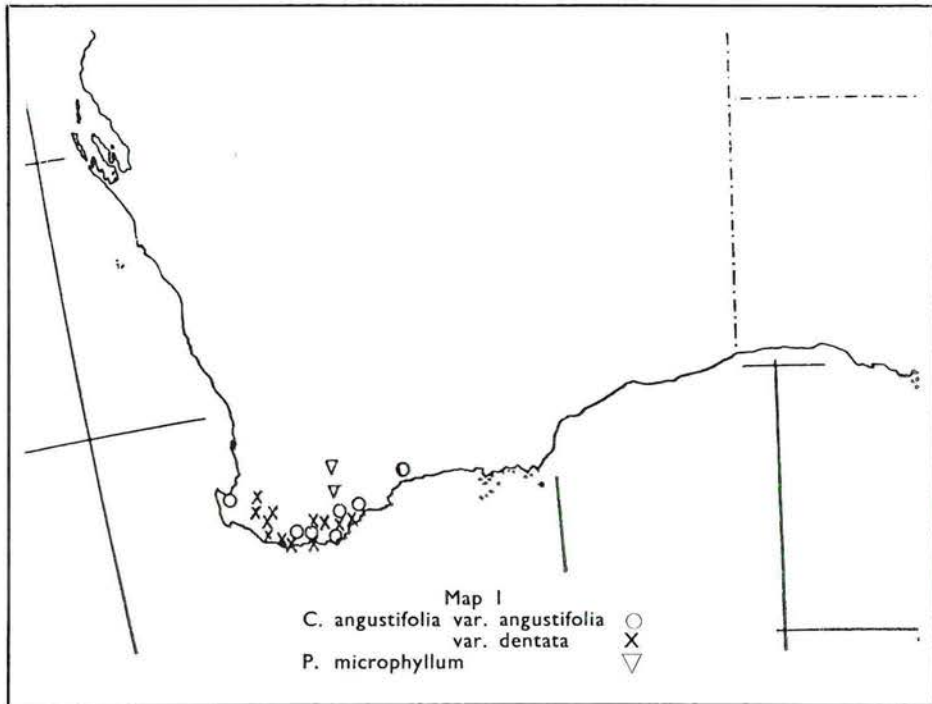
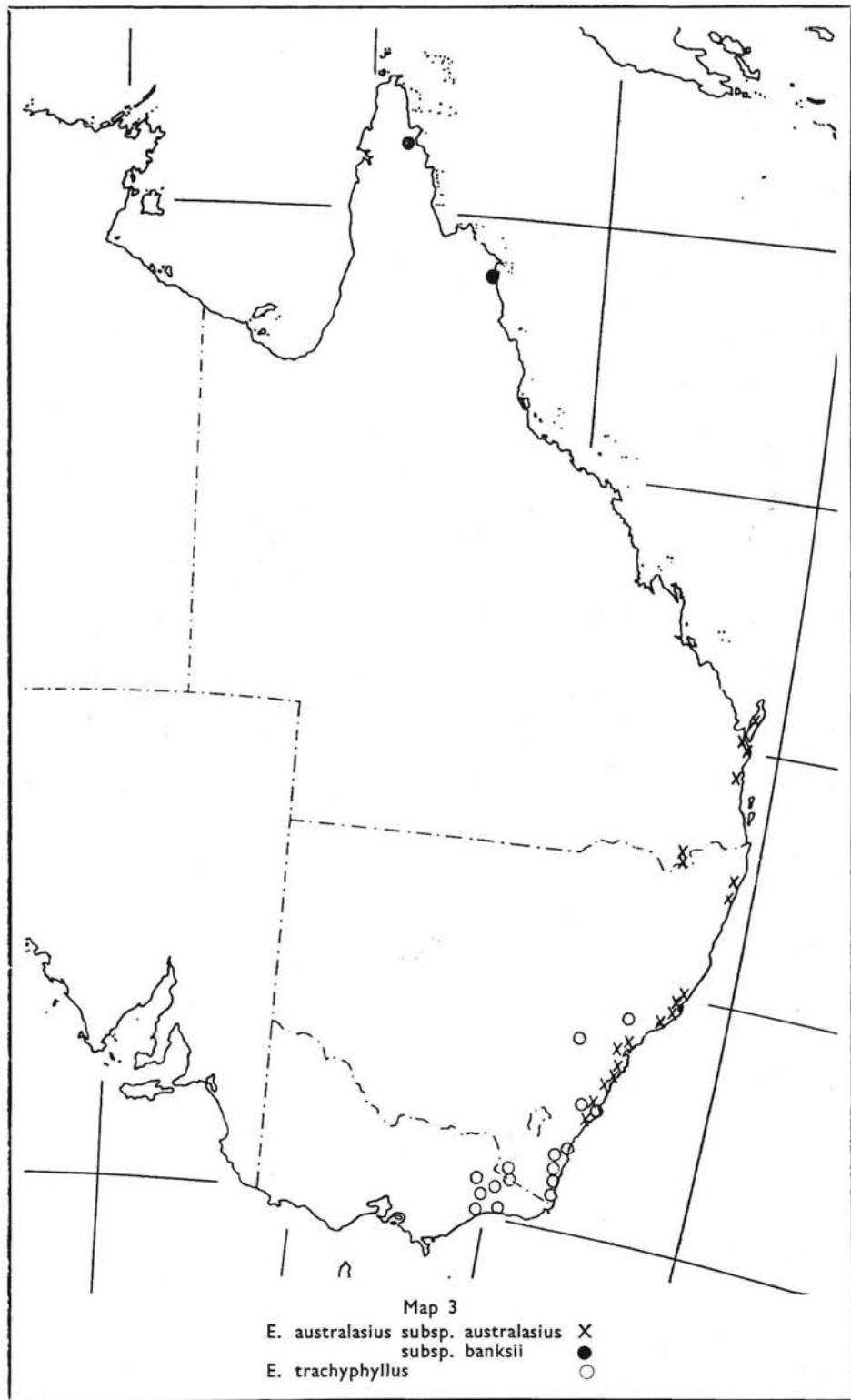


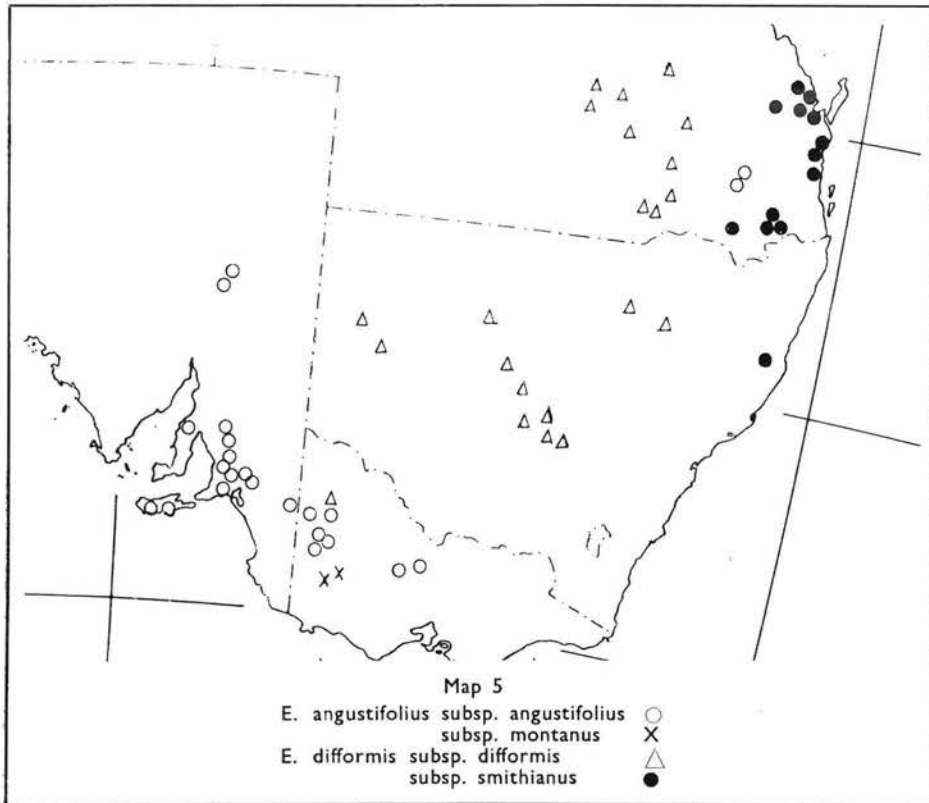
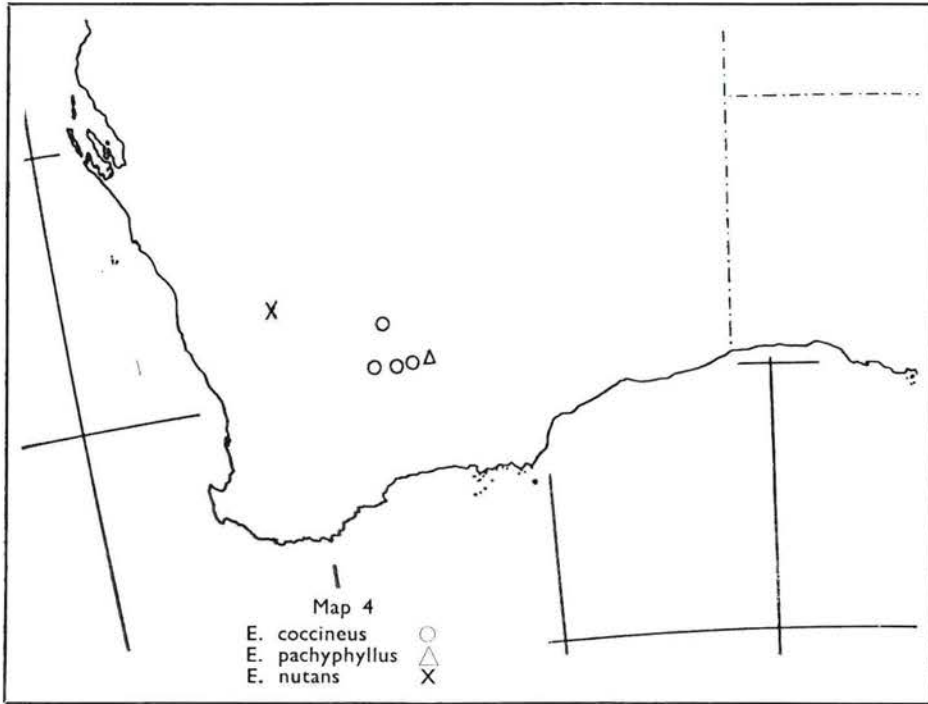


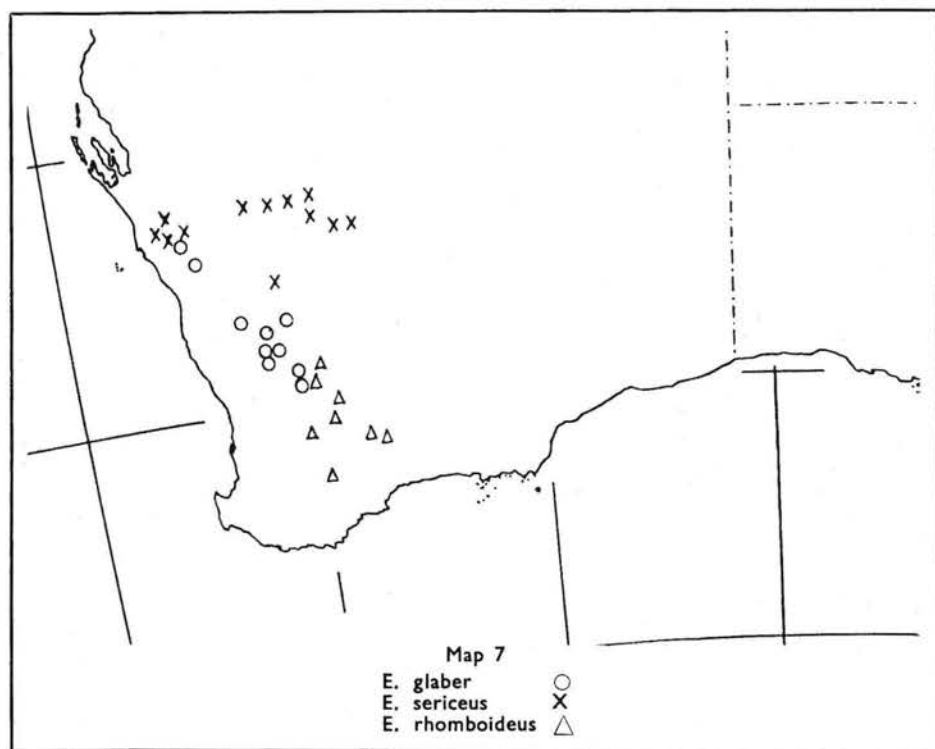
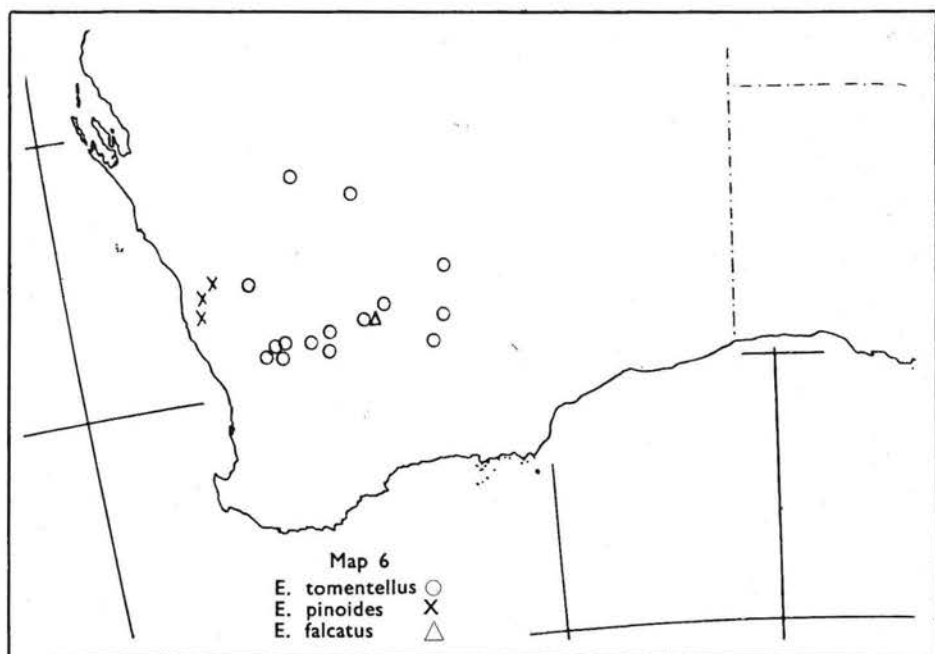
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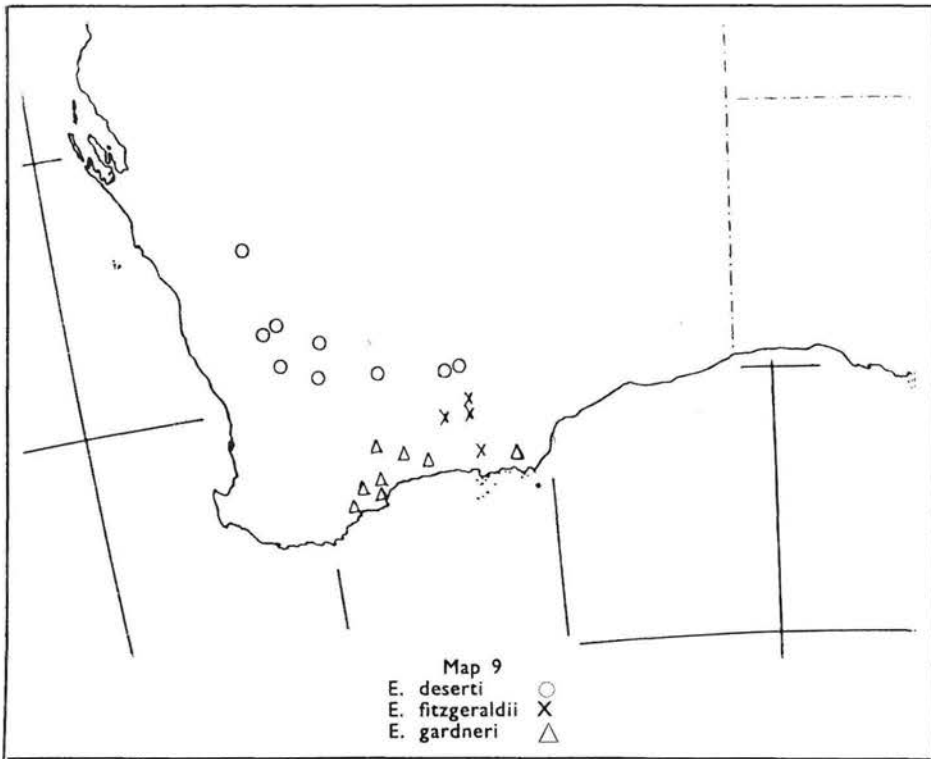
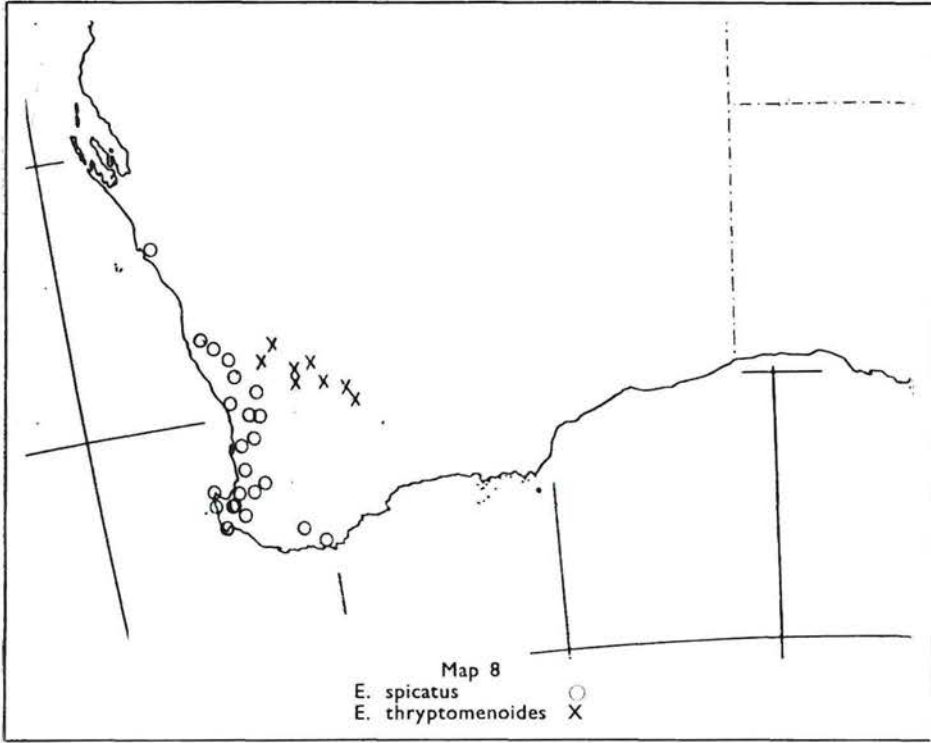


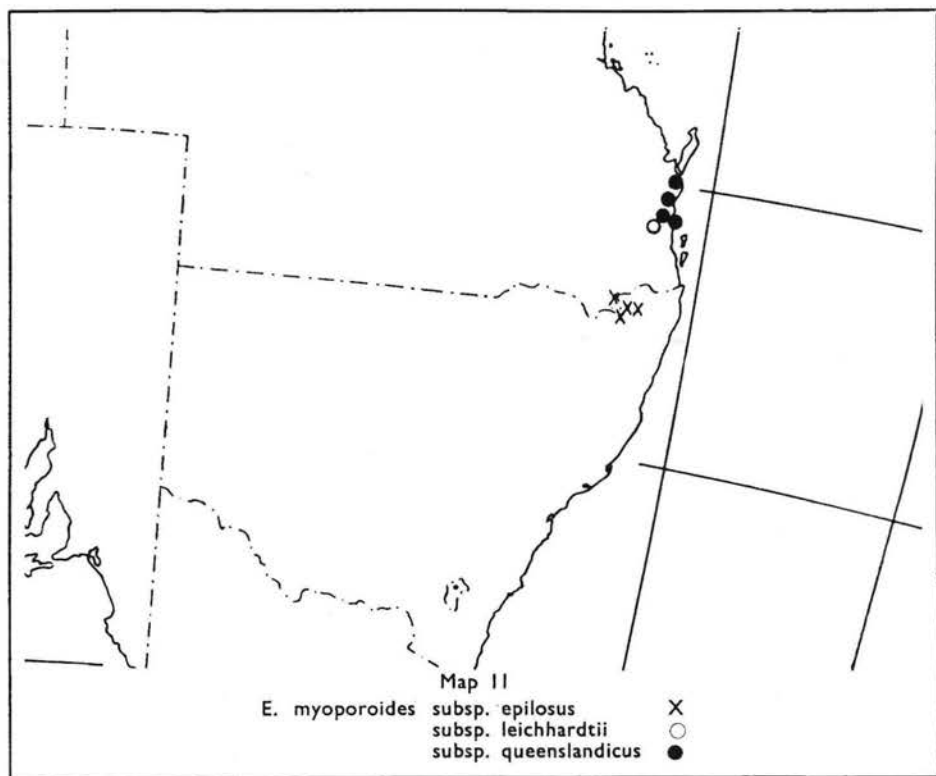
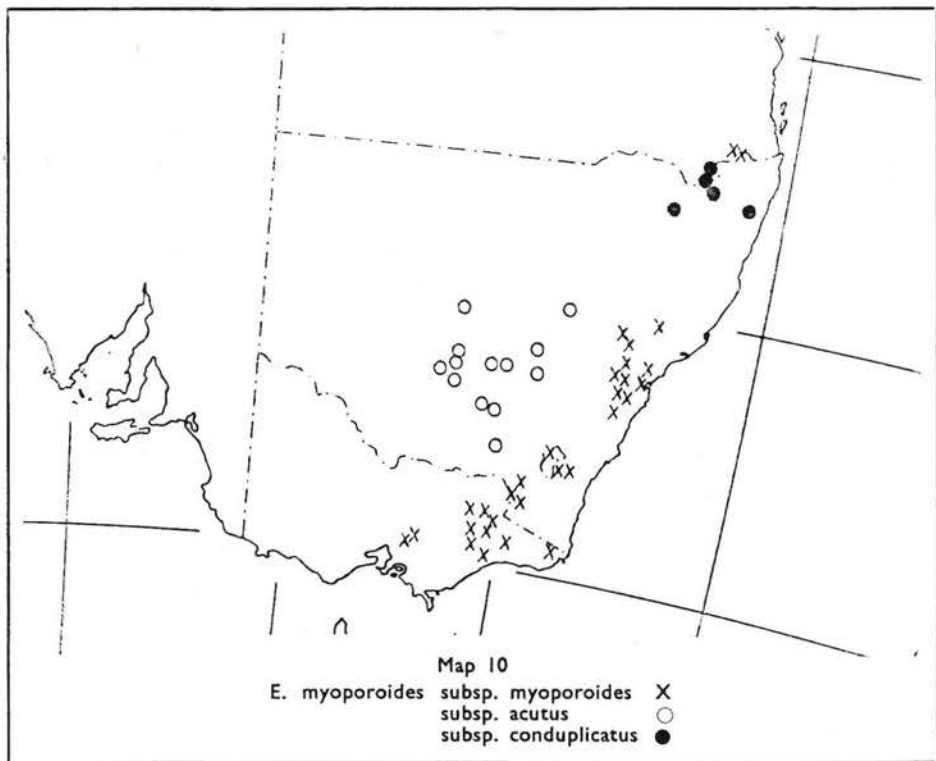


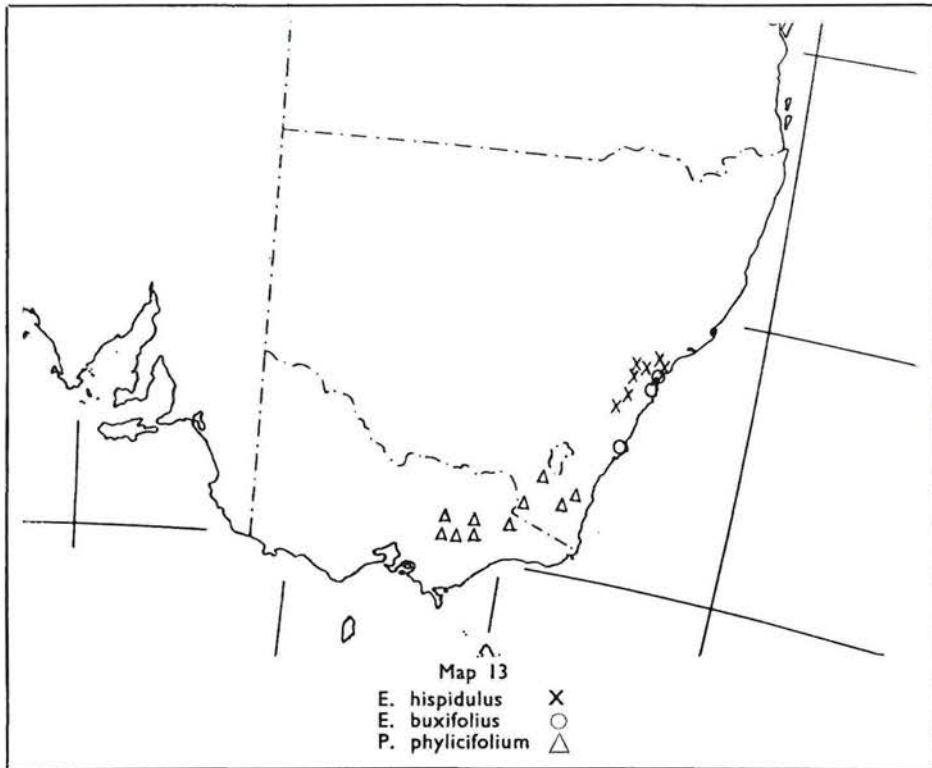
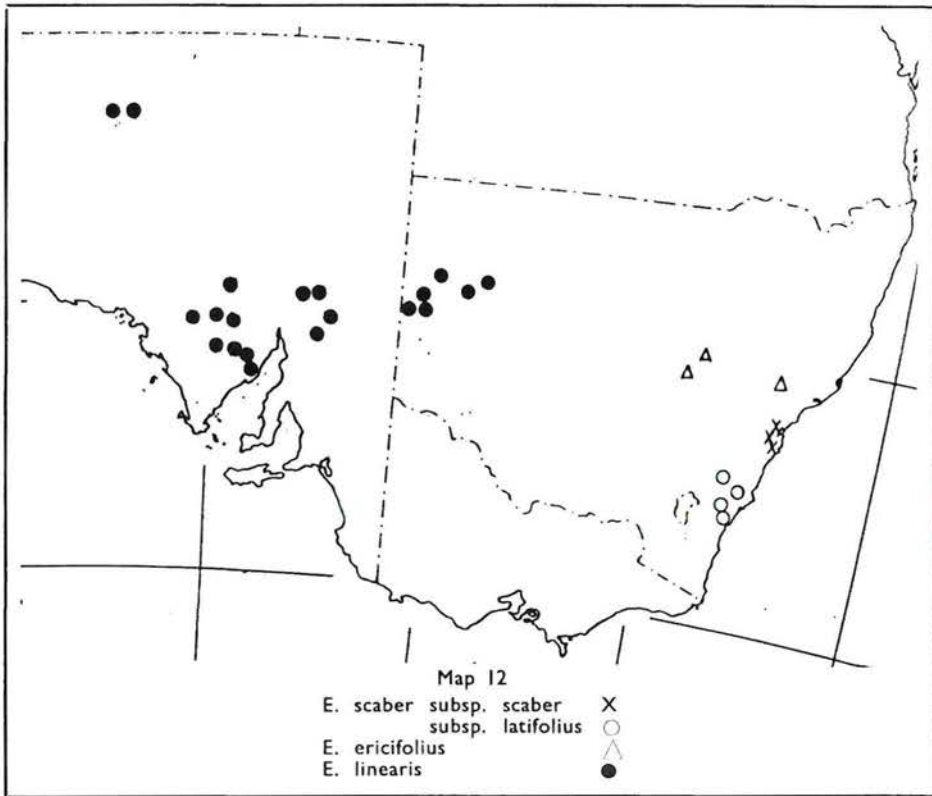




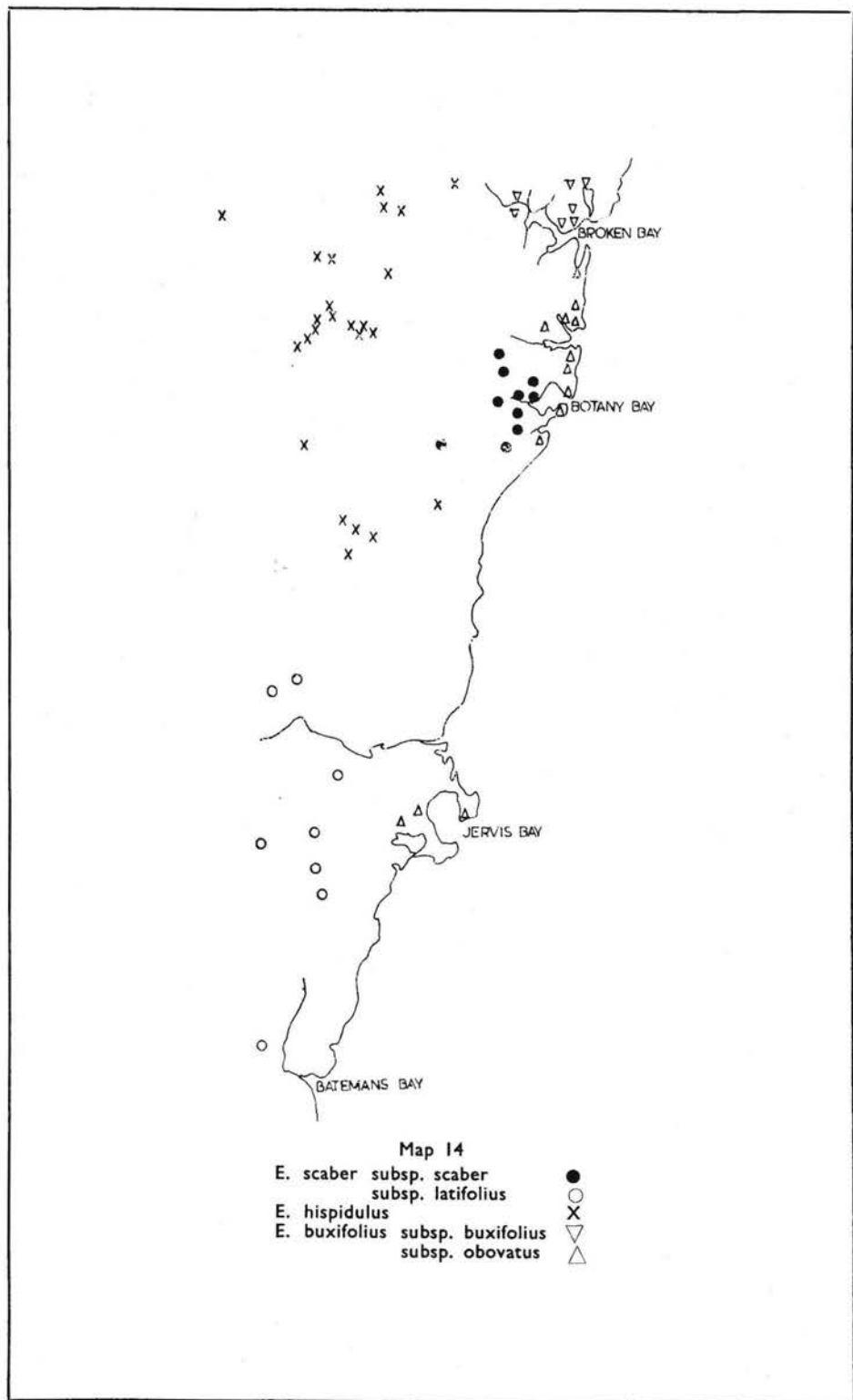


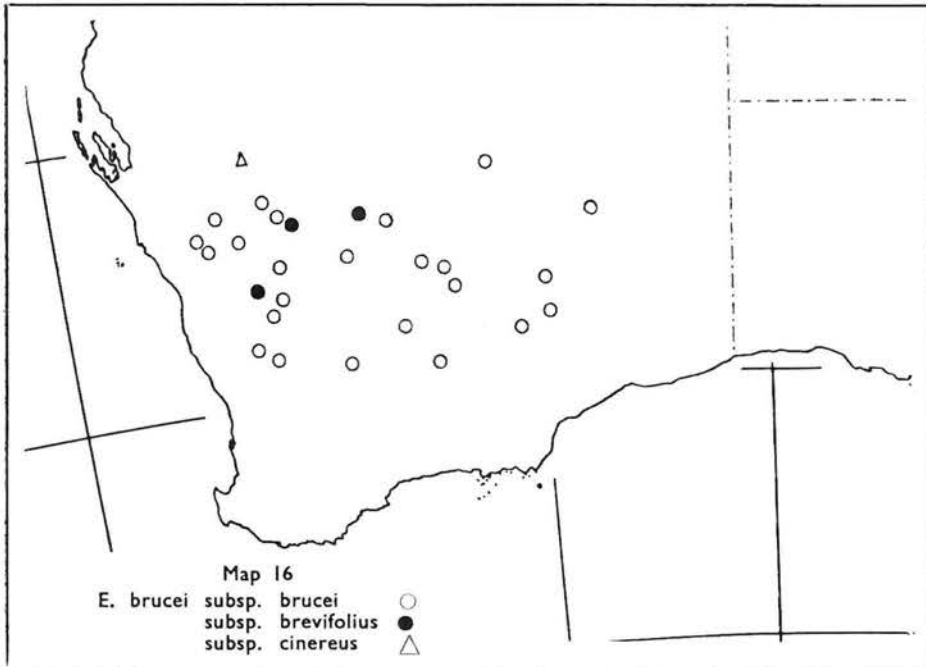
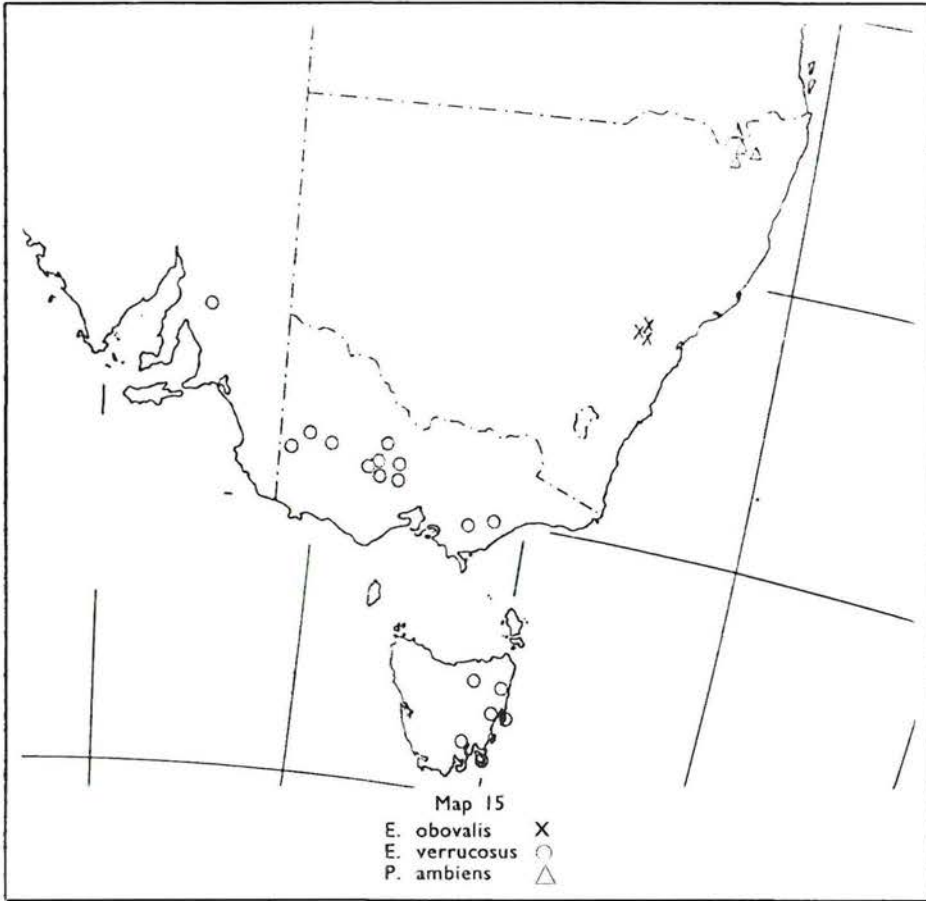


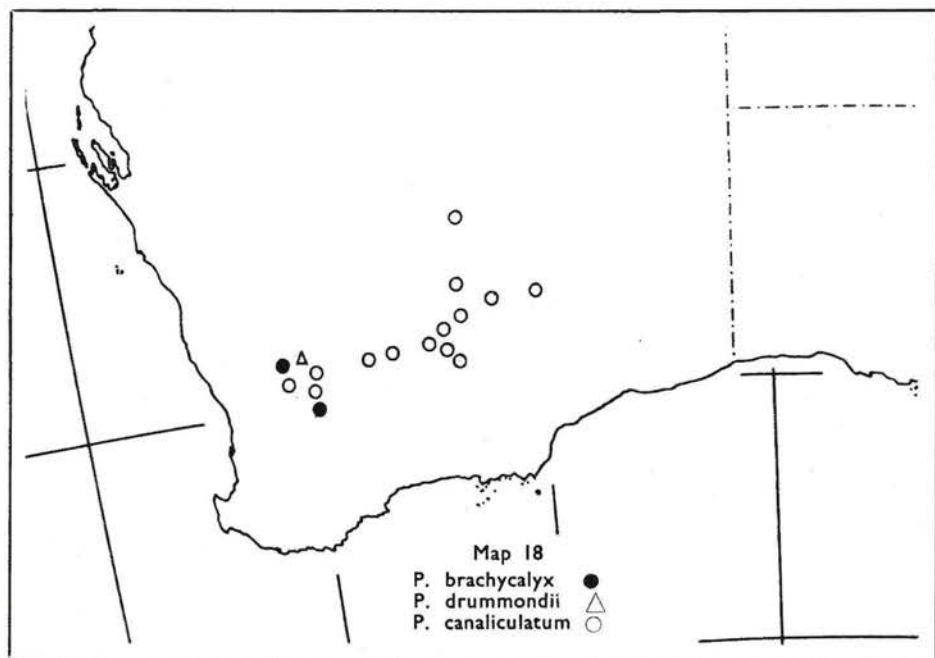
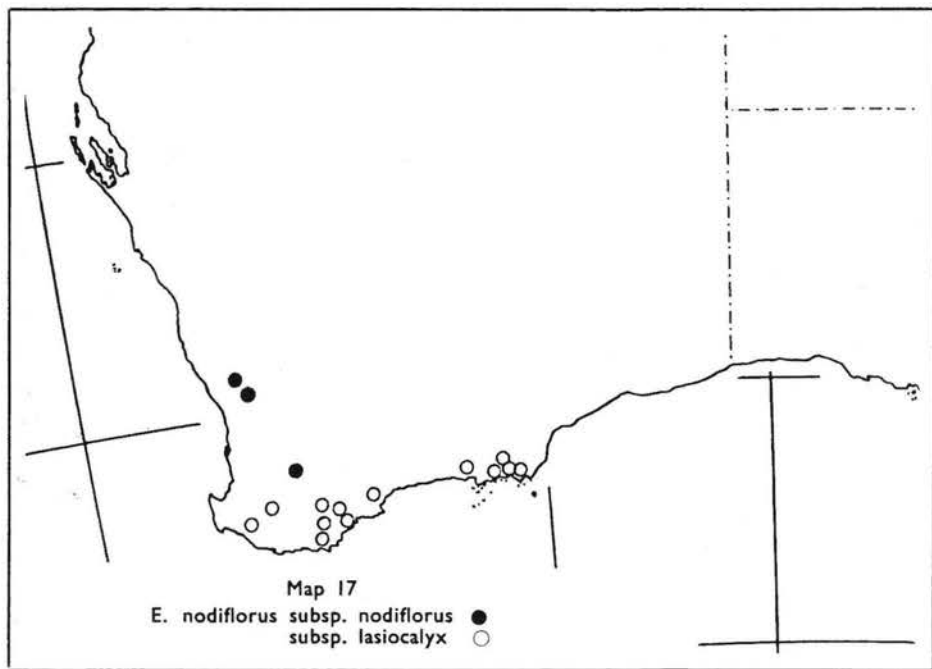


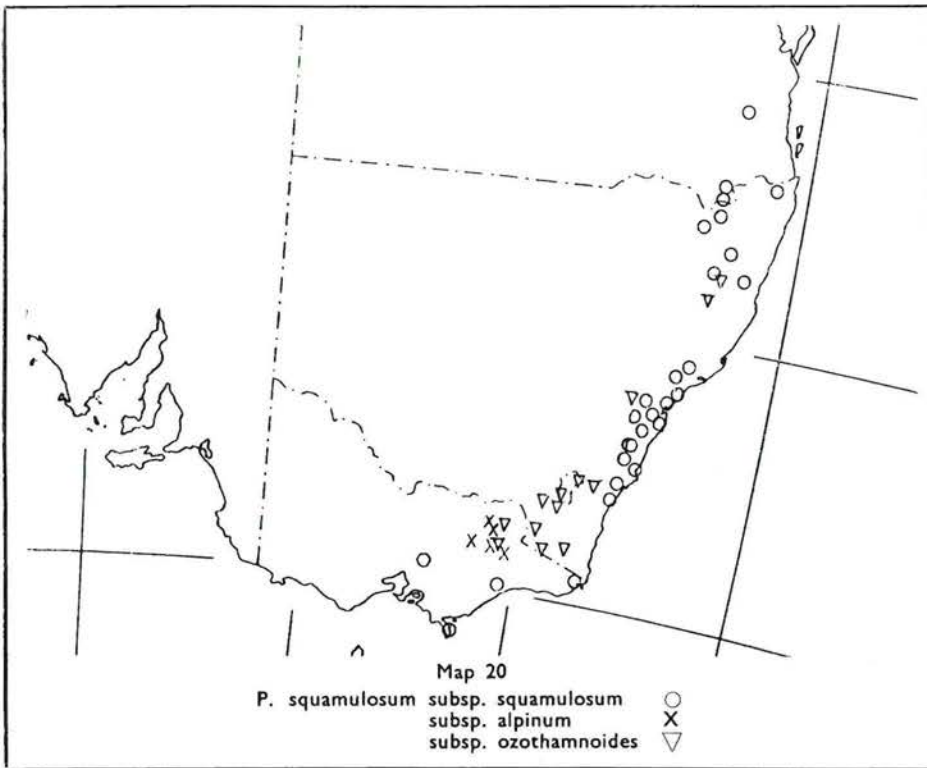
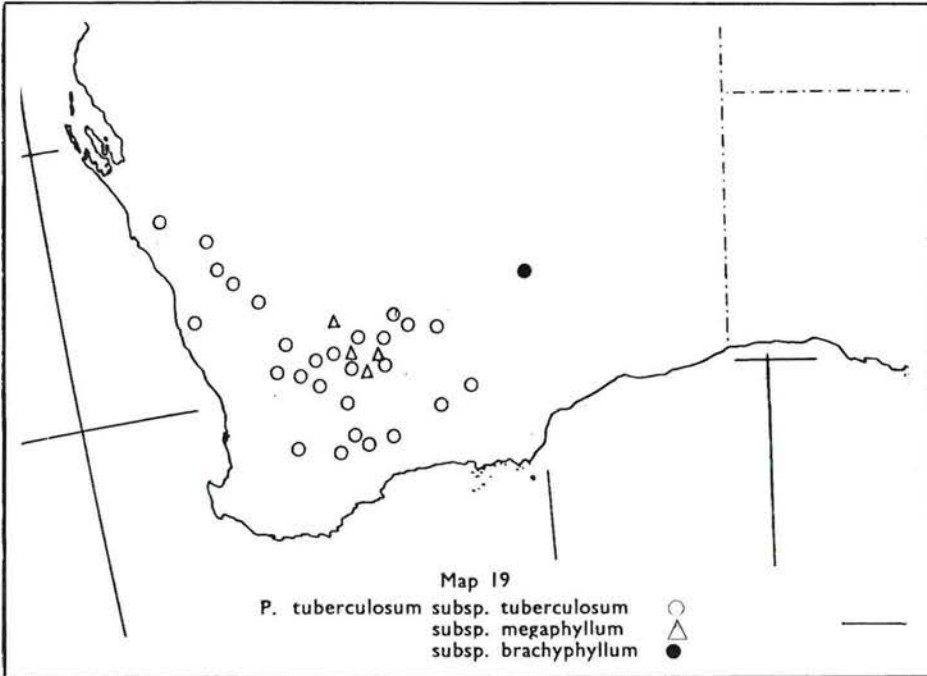


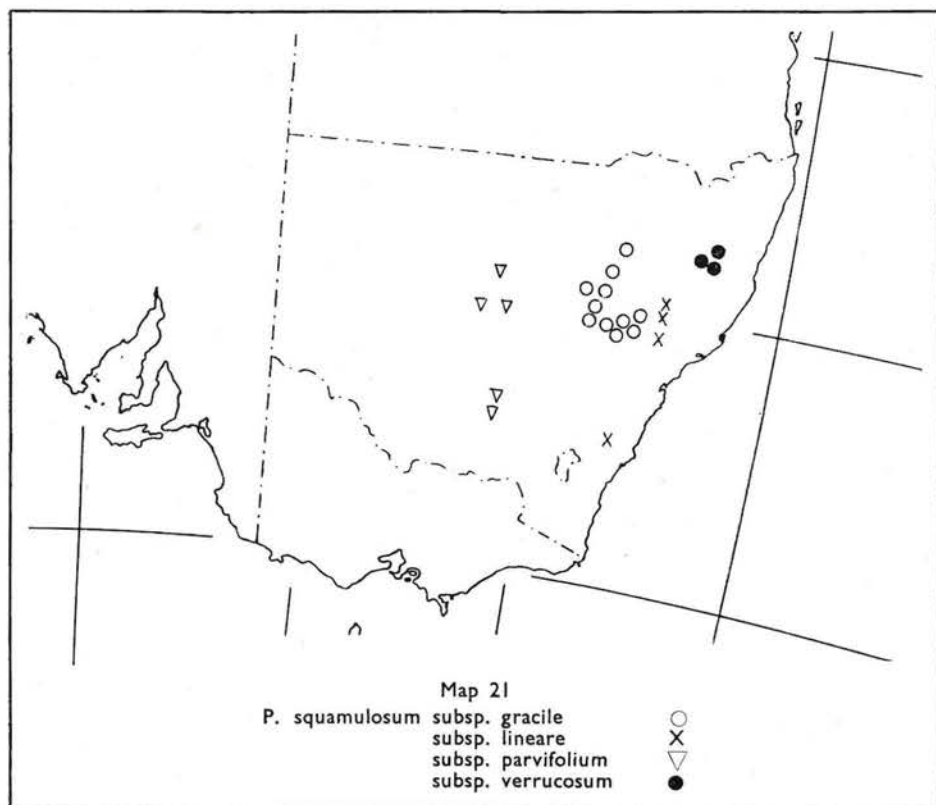


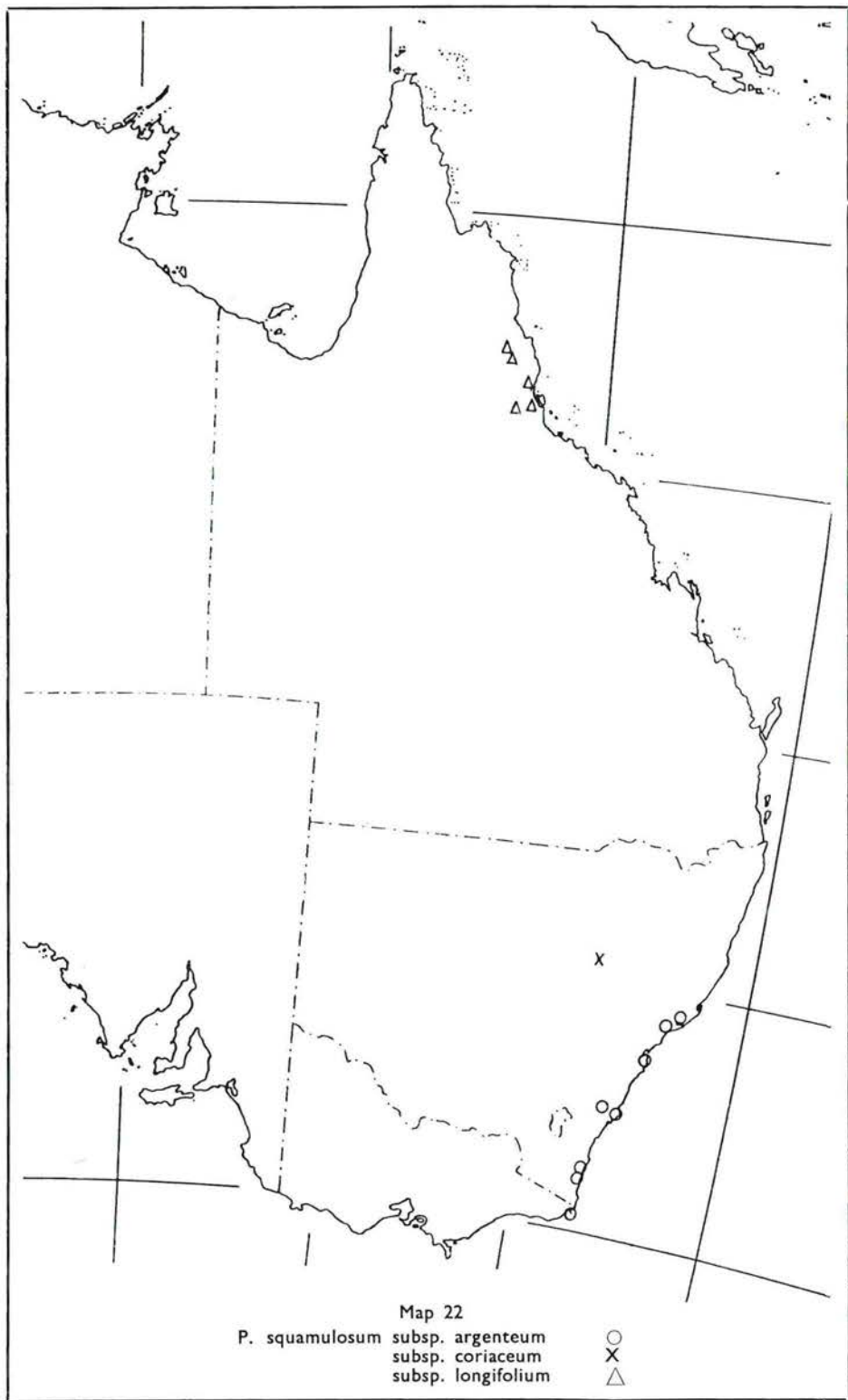


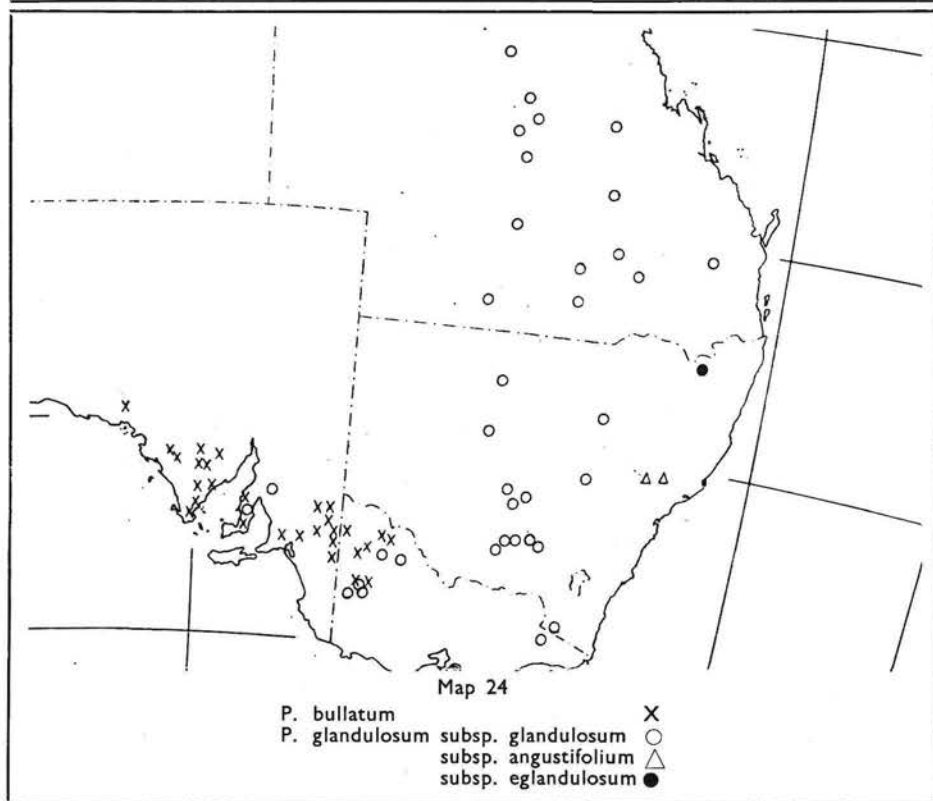
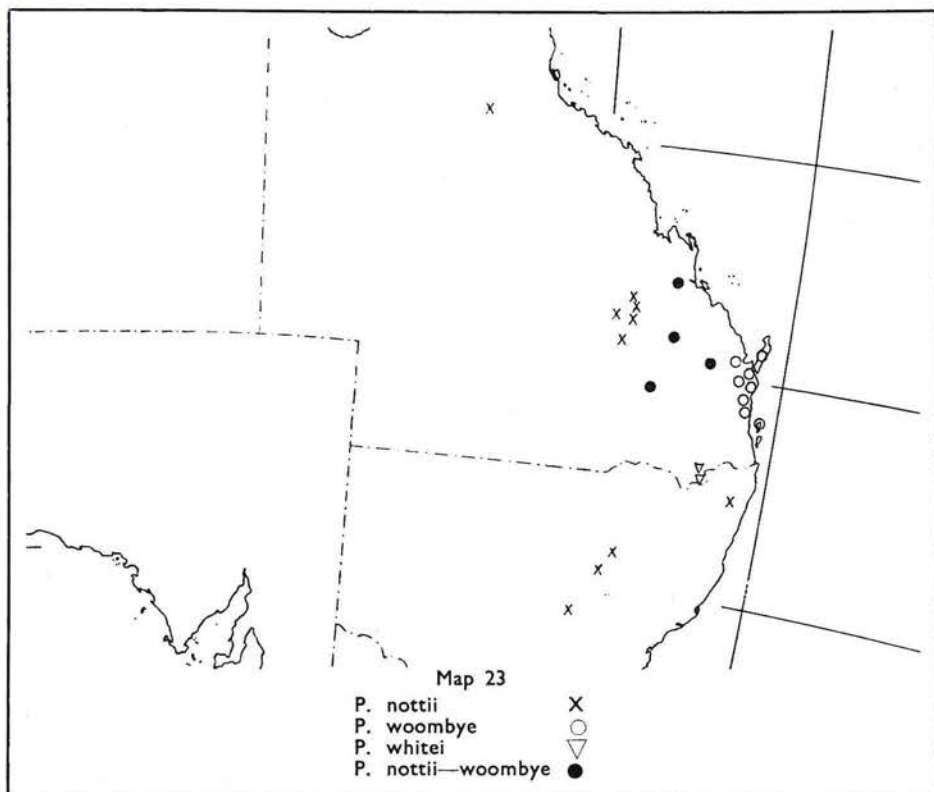


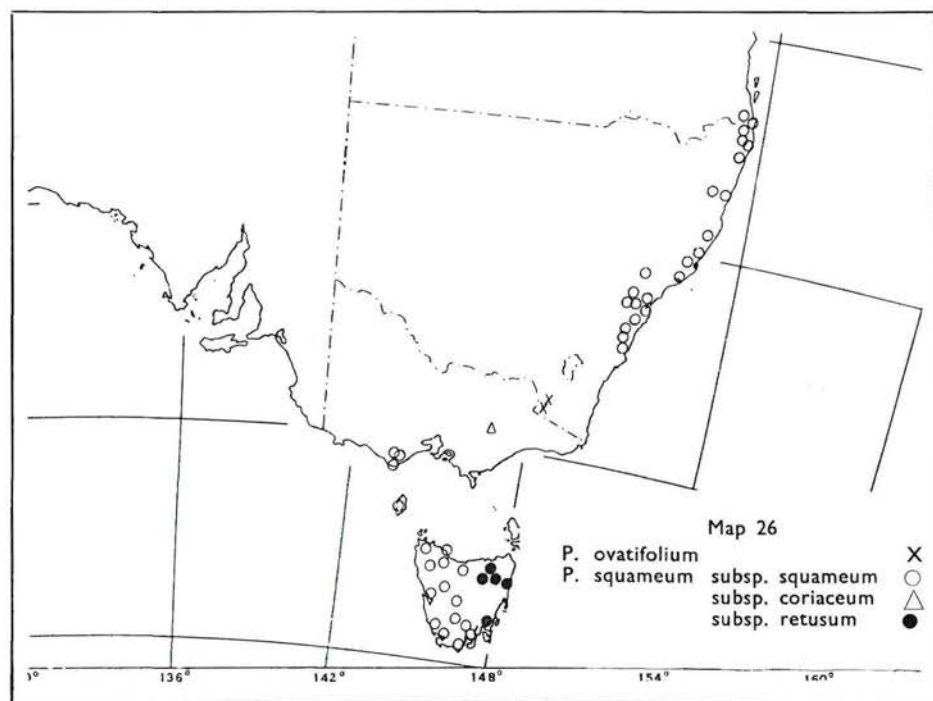
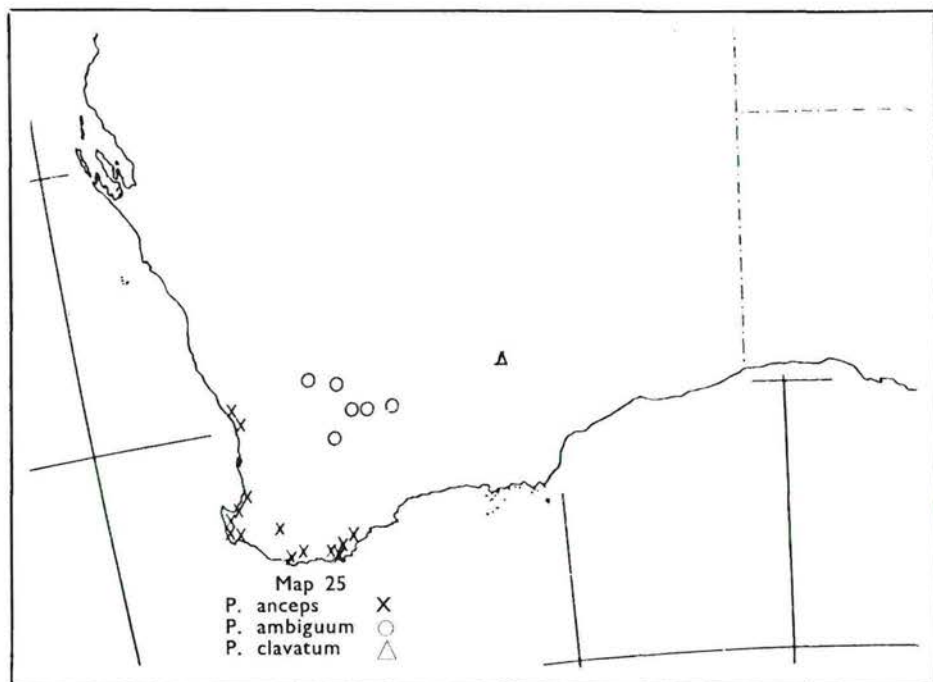




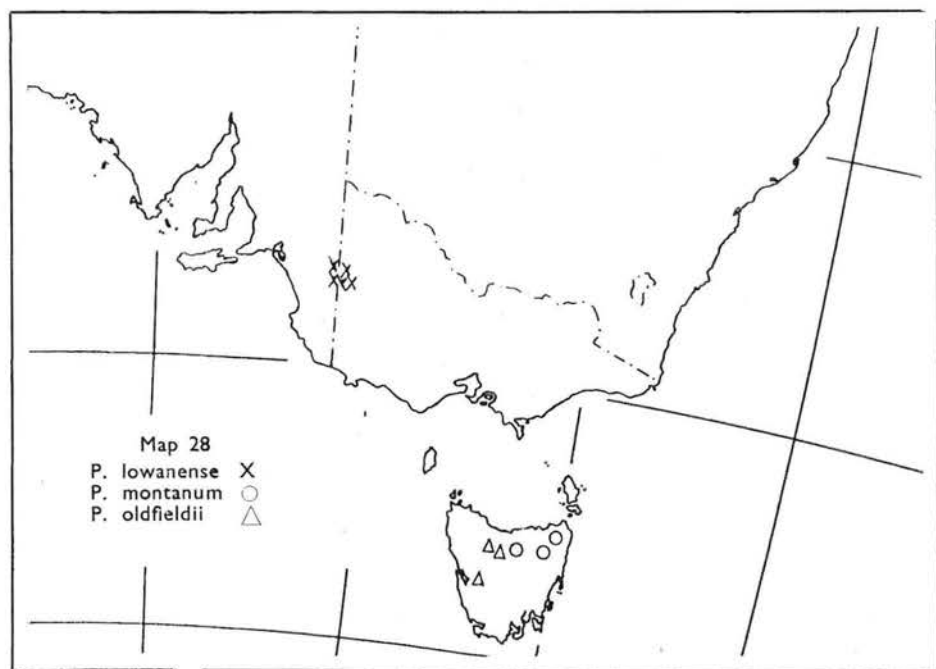
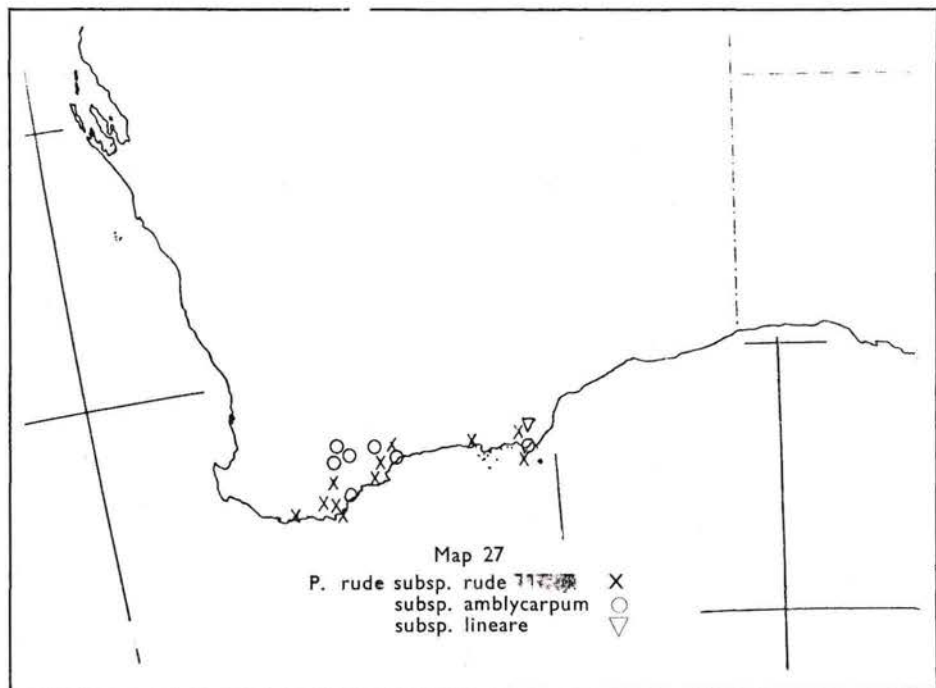


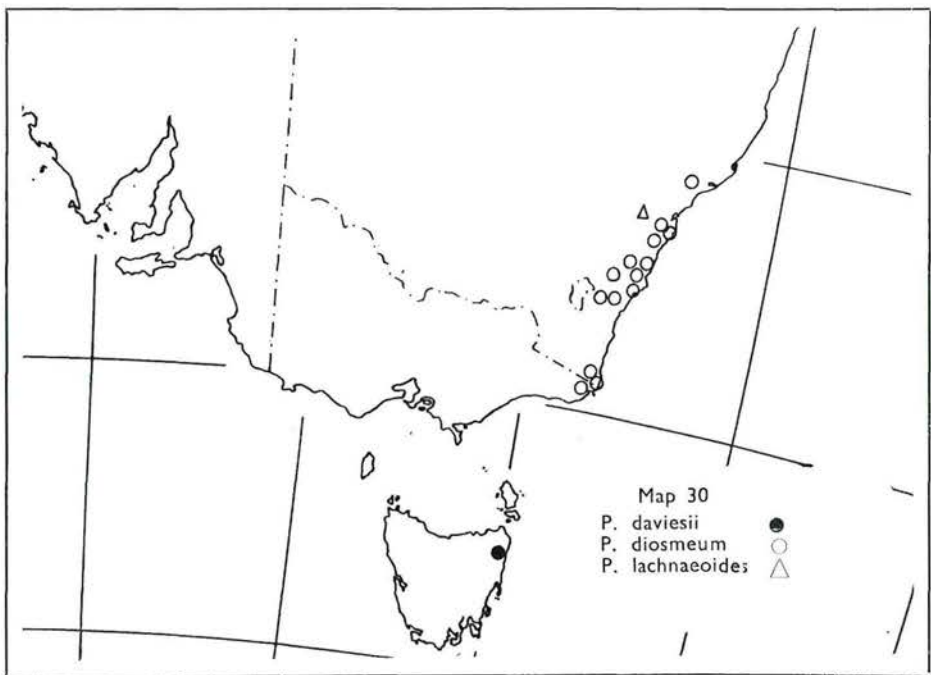
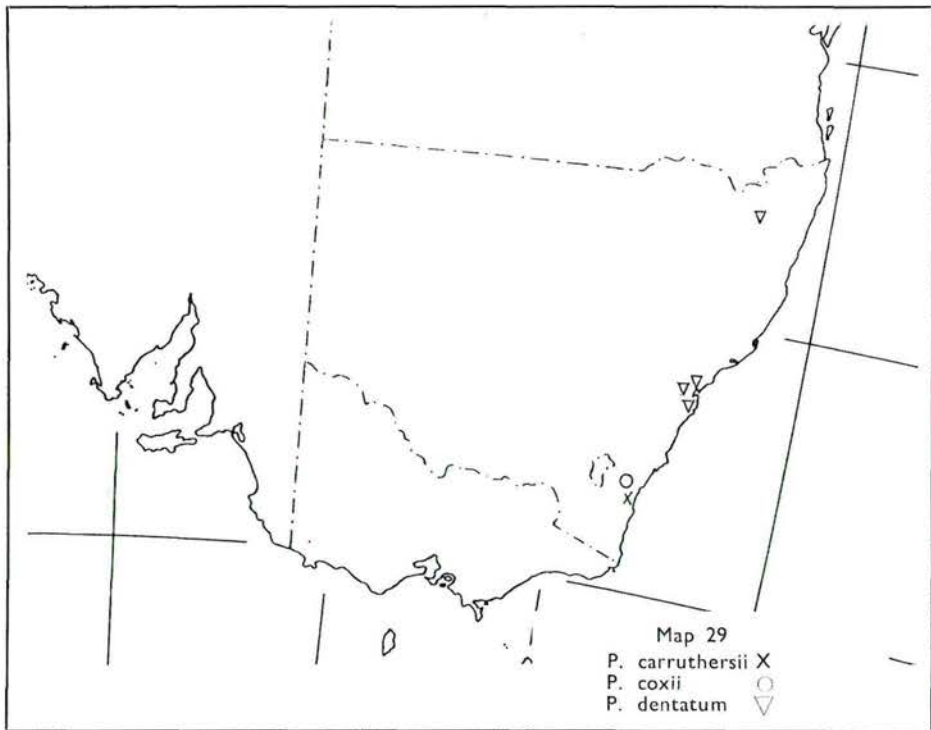


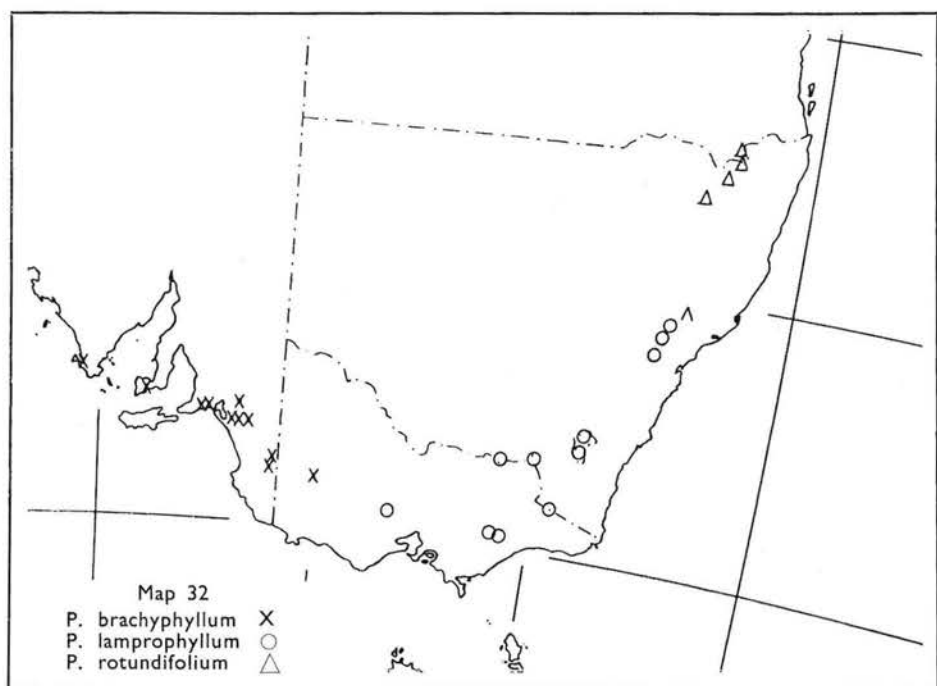
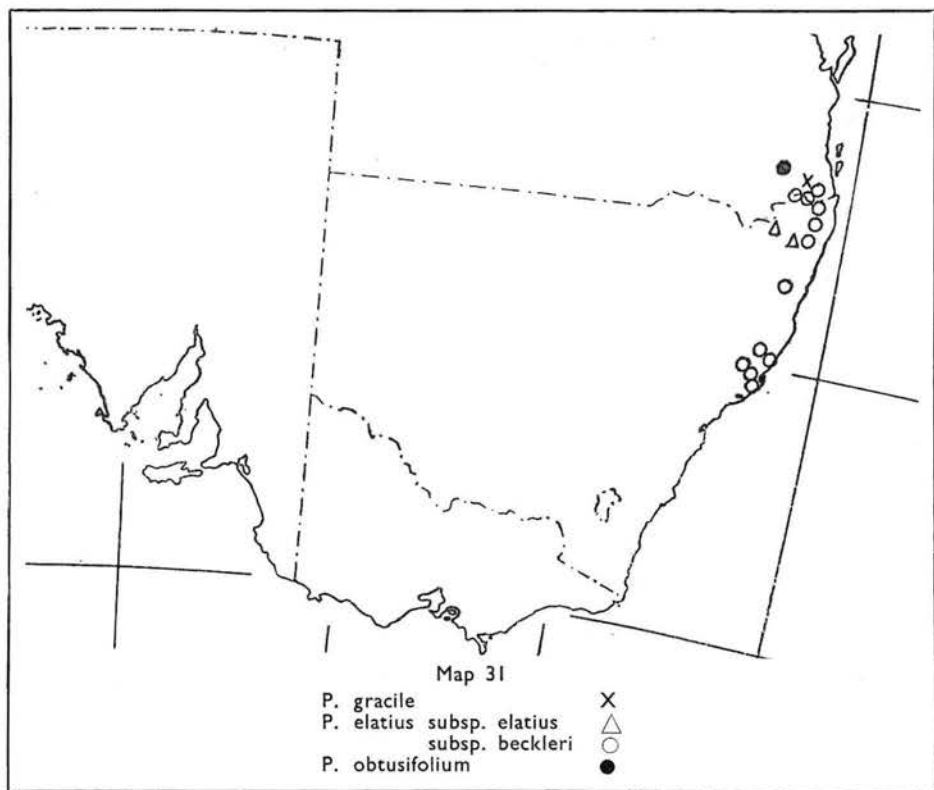


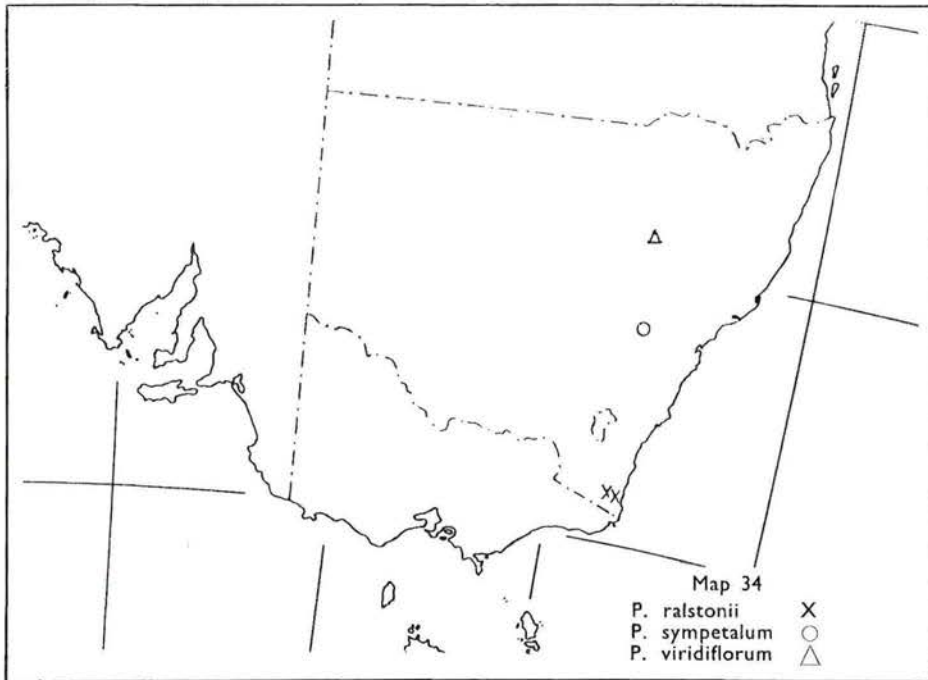
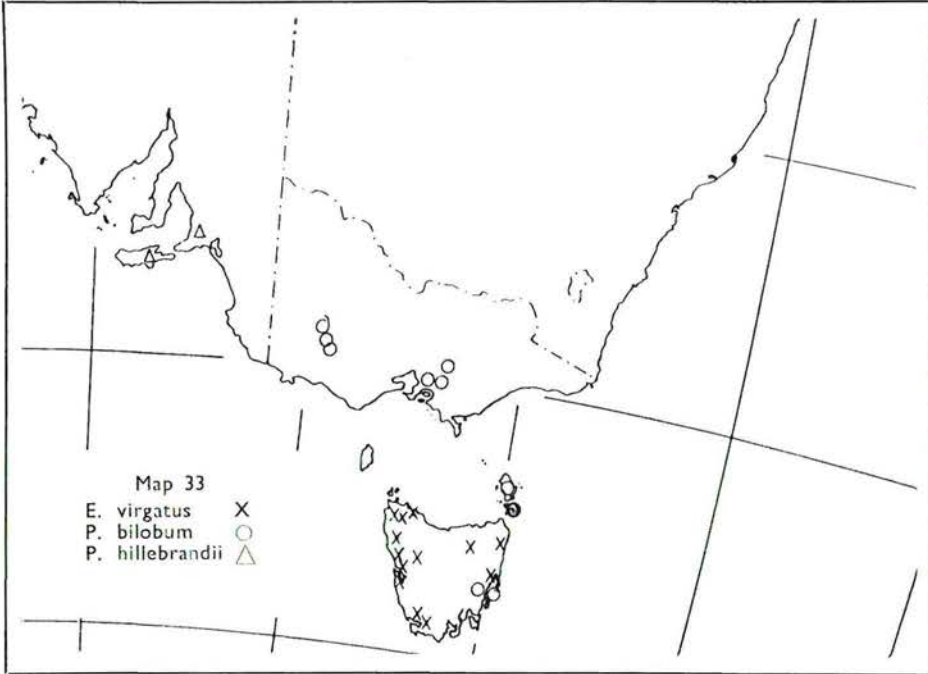


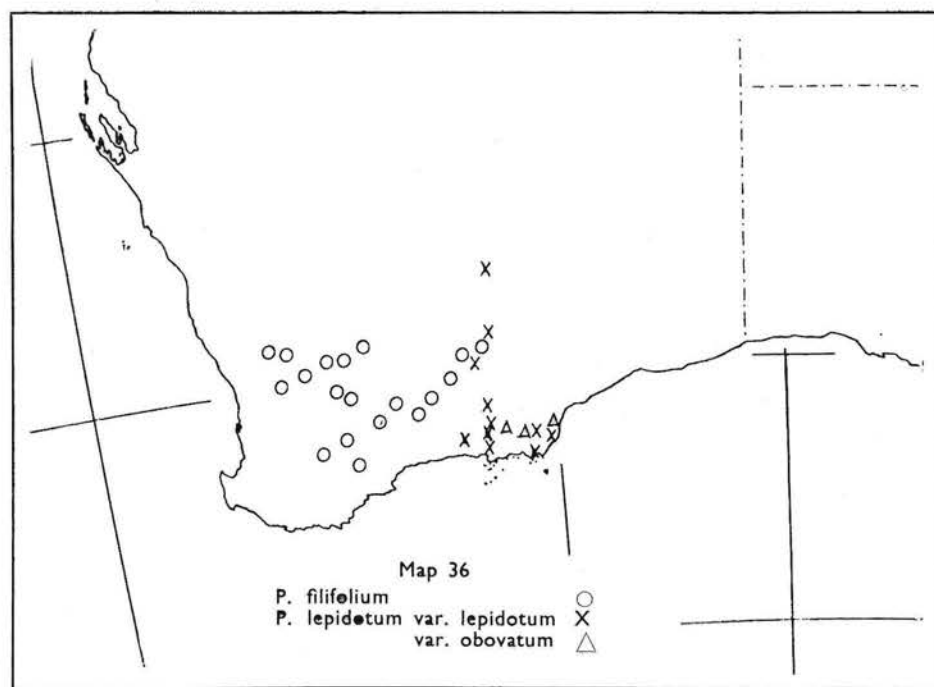
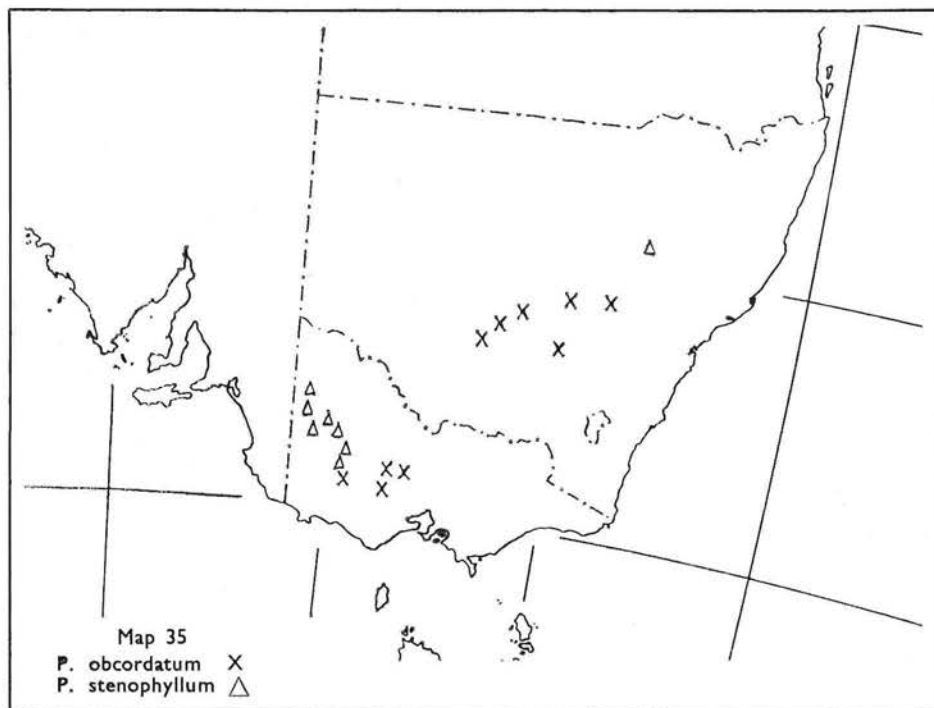












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