

A Survey of Eucalyptus Species in Tasmania

By

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Plates XV-XVII

INTRODUCTION

The following notes, descriptions, and suggestions have been made in field, herbarium, and nursery work in connection with the Biological Survey of Tasmania in progress at the present time.

DIFFICULTIES OF EUCALYPT STUDY

The genus *Eucalyptus* has engaged the attention of some of the world's greatest botanical taxonomists during the past 150 years, and has been the subject of endless controversy. Some of the troubles have arisen from the following causes:—(1) The botanists who first collected in Australia and Tasmania, or who worked on existing collections, were not in possession of our modern knowledge of plant cytogenetics, and consequently could not make adequate allowance for the mutational and hybridization factors which are responsible for the high degree of species variability. Before a type description can be satisfactorily made, it is necessary to review material collected over a wide area to determine the limits of variation and the possible existence of interspecific hybridization. It may thus take several years' field and nursery experience of a group suspected to constitute a species before a safe type description can be made. Many of the early types were founded by European botanists on fragmentary and imperfect material sent from one tree only by Australian collectors. In other cases descriptions were made from trees under cultivation in Europe. This is very unsafe, as some species behave anomalously when under artificial cultivation. (2) Although during the past 30 years our field knowledge of the

genus has enormously increased, workers have continued to find species on the old lines, and we have witnessed the elevation of pure hybrid types to specific rank. It is during these years that the failure to study the effects of interspecific hybridization has prevented real progress, and the difficulties have almost increased rather than diminished. It is true that in this time many true species have been discovered and the range of others extended, e.g., the recognition of *E. rubida* in Tasmania by Maiden. Work of great importance has been done by Maiden and others in describing seedlings. The influence of this is to be seen in the 'Key to the Eucalypts', by Blakely (1934). (3) The synonymy has been complicated to an inordinate degree by the fact that many of the type specimens are in the great European herbaria and are not available to Australian workers. The existence of eucalypt collections in European centres has made the question of priority a very vexed one. As an example of this note the loss of the old established name *E. amygdalina* Labill., and the change to *E. salicifolia* (Sol.) Cav. The immense size and protean character of the genus make inherent difficulties of synonymy in addition to the aggravation referred to above. Workers in the field of Tasmanian eucalypts must bear these three points in mind.

SPECIES REVIEW

The Tasmanian species have been surveyed with two objectives in view: (1) an attempt to isolate biotypes, (2) the detection of interspecific hybridization and its effect upon variability. An endeavour has been made to isolate polymorphic hybrid swarms, and determine the effect of hybridization on the origin of new eucalypt species. The term hybrid is frequently used in what follows. It is to be understood strictly in the sense of interspecific (undefined)¹ hybrid. The task of attempting to isolate Mendelian and the many other hybrid types discussed by cytologists and cytogeneticists has not been undertaken. This is a rich field for future investigation. In the course of field work both in Tasmania and on the mainland of Australia phenomena have been noted which indicate the possible existence of Mendelian hybrids.

In 'A Key to the Eucalypts', Blakely gives 32 species for Tasmania. Of these it is claimed that *E. Haberlandiana* Naudin (see *E. criminalis* in check list) and *E. nitida* Hook., f., are not in Tasmania. With regard to *E. nitida*, readers are referred to the 'Critical Revision', Maiden, pt. 38, p. 235, where an incomplete description is given. Specimens collected by R. H. Cambage from near the summit of Mt. Roland are quoted in the range for Tasmania. By the kindness of Mr. W. F. Blakely I have been permitted to see one of these specimens, and have no hesitation in saying that it is *E. coccifera* var. *parviflora*. This variety is widely

¹ See Darlington, 1932.

distributed at alpine levels in the district of Mt. Roland. A fuller description is given in 'A Key to the Eucalypts', and Risdon is quoted as a district. I have not seen the specimens on which this statement is made, but suggest that they are hybrids of *E. Risdoni* with *E. viminalis*. The former species produces two very different hybrid swarms at Risdon, one with the *E. viminalis* and the other with *E. salicifolia*.

The second specimen collected by Gunn would match one of the many hybrid forms of *E. Risdoni*. In connection with this supposed species it should be noted that some of the hybrid forms of *E. Risdoni* show marked similarities to *E. coccifera* or its variety. Thirty-one species are discussed in the check-list, which includes an additional species, *E. divaricata* McAulay & Brett, sp. nov., and excludes *E. Huberiana* Naudin and *E. nitida* Hook., f.

It is suggested in this paper that the 31 species described below are composed of the following types: (1) simple or compound Linnaean species, (2) polymorphic species, (3) hybrids. The terms 'compound species' and 'polymorphic species' are used for convenience. The former is intended to describe groups which obviously contain two or more biotypes, e.g., *E. pauciflora* Sieb.; and which can be split into two or more species or varieties as the result of future investigation. The latter describes groups which are of obvious hybrid origin, including races in varying degrees of fixation. A detailed study of *E. Risdoni* and its many hybrid forms has been responsible for this suggestion (see note on *E. Risdoni* Hook., f.).

Group 1 (Simple or Compound Species)

- | | |
|---------------------------|---------------------------|
| 1. <i>E. ovata</i> | 13. <i>E. Perriniana</i> |
| 2. <i>E. aggregata</i> | 14. <i>E. obliqua</i> |
| 3. <i>E. globulus</i> | 15. <i>E. gigantea</i> |
| 4. <i>E. cordata</i> | 16. <i>E. regnans</i> |
| 5. <i>E. viminalis</i> | 17. <i>E. Sieberiana</i> |
| 6. <i>E. rubida</i> | 18. <i>E. salicifolia</i> |
| 7. <i>E. urnigera</i> | 19. <i>E. temirramis</i> |
| 8. <i>E. subcrenulata</i> | 20. <i>E. linearis</i> |
| 9. <i>E. vernicosa</i> | 21. <i>E. Risdoni</i> |
| 10. <i>E. Archeri</i> | 22. <i>E. pauciflora</i> |
| 11. <i>E. divaricata</i> | 23. <i>E. coccifera</i> |
| 12. <i>E. Gunnii</i> | |

Each description includes one or more biotypes. Seedlings exhibit what may be termed normal variability for a eucalypt species as opposed to hybrid segregation.

Group 2 (Polymorphic Species)

- | | |
|----------------------------|-------------------------|
| 24. <i>E. Dalrympleana</i> | 26. <i>E. Simmondsi</i> |
| 25. <i>E. Johnstoni</i> | 27. <i>E. Tasmanica</i> |

Each description includes a group of races which have probably arisen by hybridization, and are either fixed or are in process of becoming stabilized. Seedlings exhibit normal variation or varying degrees of hybrid segregation.

(Group 3 (Interspecific Hybrids))

- | | |
|---------------------------|------------------------|
| 28. <i>E. uialata</i> | 30. <i>E. Ichyi</i> |
| 29. <i>E. biangularis</i> | 31. <i>E. laeniola</i> |

The types represent an intermediate between two biotypes, and are probably in the F_1 generation. Seedlings exhibit a high degree of hybrid segregation (see Plate XV). The trees do not form pure stands exhibiting normal variability, but are isolated and difficult to locate, and are never found outside associations of the generating species. The elevation of these hybrids to specific rank makes key compilation unnecessarily difficult. The interesting *E. globulus* \times *acuta* described by Prof. A. L. McAulay in the same volume of these proceedings, Rodway's var. *Harrisoni* of *globulus* (*E. globulus* \times *cordata*), *E. Sieberiana* \times *obliqua*, and several other outstanding cases would equally justify specific rank.

NOTE ON *EUCALYPTUS RISDONI* HOOK., f.

(See also *E. Risdoni* Hook., f. in the Check-list)

No eucalypt species presents more difficulty than *E. Risdoni* Hook., f., and its var. *clata* Benth. (*E. Tasmanica* Blakely). To understand the problems associated with it the following points, summarizing its history and opinions held by different botanists with regard to it, should be noted:-

- (1) The type was described by Hooker (1847) on material from Risdon, and is beautifully figured in his 'Flora of Tasmania'. It is intended to cover the trees which maintain entirely opposite foliage.
- (2) Bentham, writing later on the same species, extended the description to include the trees which are practically entirely covered with opposite foliage but carry a few alternate leaves.
- (3) Mueller united *E. Risdoni* Hook., f., with *E. salicifolia* Cx. (*E. amygdalina* Labill.).
- (4) The type has a very limited distribution (see check-list).
- (5) The protean complex of forms which pass rapidly from the opposite to the alternate leaf stage, and often assume the dimensions of large trees, has a wide distribution.
- (6) This was identified by Hooker as *E. radiata* Sieb. He described and distributed five varieties of it.

- (7) Bentham described in the 'F. Aust.' the same complex as *E. Risdoni* Hook., f., var. *elata*. It went under this name until the species *E. Tasmanica* was founded by Blakely (1934).
- (8) Rodway supported the view that *E. Risdoni elata* is simply *E. Risdoni* Hook., f., in better soil conditions than obtain at Risdon.
- (9) On the basis of oil determinations Baker and Smith (1912) united *E. Risdoni* Hook., f., with its variety *elata* and the variety *hypericifolia* of *E. salicifolia* (*E. amygdalina*), at one time regarded by Rodway as *E. hypericifolia* R. Br.

It is suggested in this paper that Hooker's original type is the biotype, and not merely a tree prolonging the juvenile condition, and that departures from this type, slight or extensive, are due to hybridization.

The effect of soil conditions is still an open question, but in field observation I find little to support the view stated in (8). At Risdon there are trees of 20 feet or higher which have been protected from fire, and which retain the paired-leaf condition to the ultimate branchlets; they give every sign of flourishing just because they are in patches of better soil than exists in the average portion of the stand. The soil conditions on the upper side of the Huon-road stand of *E. Tasmanica*, as far as can be judged from the road-cutting, are little, if at all, better than those at Risdon. The trees at Risdon have been destroyed by fire at least once, as many of them grow mallee fashion from blackened root stocks. In the middle of this stand it could be said that umbels in the opposite leaf stage is the most characteristic condition. A similar stand of *E. Tasmanica* Blakely exists on mudstone near Cambridge, on the southern edge of the *E. Risdoni* distribution. There is the same destruction of the original stems as at Risdon, but very few umbels can be found in the opposite leaf stage. It is difficult to account for this on soil conditions alone. The tendency to flower in the opposite leaf stage has apparently vanished when we go as far south as the mudstone flats on the top of Tasman's Arch. It is significant that the districts south of Cambridge represent some of the oldest well-settled areas, and would probably contain an abundance of introduced insects that might aid hybridization.

The forms which connect the Risdon-Bellerive distribution with the comparatively stable types on Tasman's Peninsula show a much higher degree of polymorphism than those on the Huon-road. It must be recognised that if the lastmentioned and similar stands were created by hybridization, as is suggested below, this must have occurred long before the settlement of Tasmania. It is possible, then, that the high degree of polymorphism exhibited by the South-East Coast *E. Tasmanica* is due to secondary hybridization on what

were once stable races. To support this it should be noted that *E. Tasmanica* forms segregating hybrid swarms with *E. salicifolia* near such a long-settled district asROKEBY. The attempt to deal with such polymorphism is discussed fully below.

There is no question of challenging Mesner, Baker and Smith in their opinion with regard to the identities stated in (3). The conclusion is undoubtedly correct from the point of view of an oil classification. But it is very difficult to follow them in their statement that 'the Mt. Wellington trees differ in *saline* respects only, botanically or chemically, from the smaller trees or shrubs' (cf. Risdon).

It is very significant that the seedlings of the opposite-leaved *E. Risdoni* are much less viable than those of *E. Tasmanica*. As far as can be judged, the latter exhibit a remarkably increased viability, that might be due to what cytologists call 'hybrid vigour'.

With regard to the taxonomy of *E. Risdoni* Hook., f., and its supposed variety *clata*, it should be noted that Hooker's attempt to see five varieties of a different species from his own *E. Risdoni* is significant. Maiden has shown that four of these varieties are var. *clata* Benth.; the fifth he thought to be an example of what is now called *E. nitida*, Hook., f. (see above). The suggestion is made in this paper that all attempts to gather these forms under one or even several species will produce results that are most misleading. A study of Plate XVI must convince any but a most prejudiced observer that to classify all these forms as examples of a single species or variety is wrong. It is evident that the description *E. Tasmanica* Blakely does not cover the complete range. The difficulty of including all the forms under one species in a key is very great. The most satisfactory guide to further investigation is to class the whole complex of forms under what I have for convenience called a polymorphic species (Group 2 above).

Mueller's view that *E. Risdoni* and *E. salicifolia* are the same indicates the serious lack of field knowledge which hampered early workers. It was doubtless arrived at by the examination of intermediate hybrid forms which connect the two species, and may be the origin of Prof. Ewart's statement quoted below under *E. Risdoni* in the check-list.

The important question of terminology must be raised at this stage. Following Cockayne and Allen, whose valuable work on hybridization in the New Zealand Flora has been an important guide in preparing these notes, polymorphic swarms of hybrid origin are represented by the symbol \times preceding the generic name. The specific names are compounded of two or more words, and are intended to indicate the main generators of the swarm. Thus $\times E. Risdelata$ (formed by fusing the words *Risdoni* and *clata*) represents the whole complex at present imperfectly described by *E. Tasmanica* Blakely. When a particular specific influence can be

observed, the species name is fused with *Risdelata*. Thus the stand on the Huon-road referred to above is mainly $\times E.$ *Risdo-salicilata*. Other examples are to be noted on Plate XVI. When an unknown member of the section *macrantherae* is apparently present, as is strongly suggested by the seedlings from many trees near to and on Tasman's Peninsula, the swarm is described as $\times E.$ *Risdomacranthelata*. It should be noted that $\times E.$ *Risdelata* = *E.* *Risdoni* \times one or more species not known or stated.

At Risdon direct hybridization can be observed, as, for example, in the forms that have been classified as *E. tenuiramis* Miq. In this case the swarm would be defined as $\times E.$ *Risdosalicifolia* (the affix *elata* being dropped). A second swarm, $\times E.$ *Risdoviminalis*, can be observed in the same locality. Note the difference between $\times E.$ *Risdoviminalis* and $\times E.$ *Risdovimelata*.

These notes and terminology are given more with a view to show the lines on which investigation is proceeding, and are based upon field and nursery experience. No attempt is made here to do other than give examples and show the kind of swarm that can be isolated from the $\times E.$ *Risdelata* complex. Descriptions will be undertaken when seedlings at present under cultivation are at a more advanced stage.

Similar polymorphic swarms to that described above as $\times E.$ *Risdosalicifolia* exist in connection with the species of Group 3. Further investigation will be required before complete descriptions of the elements of these can be given (see Plate XV and *E. viminalis* in the check-list).

An extension of terminology is obvious. The swarm connecting *E. viminalis* and *E. globulus* can be described as $\times E.$ *vimiglobulus*. Thus *E. unialata* Baker and Smith is suggested as $\times E.$ *vimiglobulus* (name of author) *unialata* Baker and Smith. In these cases the second name indicates the F_1 generation, and not part of the segregating swarm. It is certain that no real progress will be possible until types such as those of Group 3 are recognised as of definite hybrid origin and future additions of the kind are rendered impossible.

SUMMARY OF SUGGESTIONS

1. *E. Risdoni* Hook., f., as originally described, is the biotype.
2. It constitutes a weak stock. Its adaptability to xerophytic conditions enables it to thrive on mudstone, where the more vigorous competing species are considerably checked.
3. Its viability has been strengthened by various stages of hybridization until in some cases stabilized races capable of producing tall, well-timbered trees have been evolved.
4. This view of the origin of *E. Risdoni* var. *elata* (*E. Tasmanica*) in the present state of experimental knowledge accounts

for the increased vigour as satisfactorily as the soil type theory, and better explains why *E. Tasmanica*, as well as *E. Risdoni*, is confined to mudstone formations. (One mudstone deposit cannot substantially differ from another in fertility.)

5. The hybridization may have occurred at different intervals of time. Stable races are probably of ancient origin. Such unstable polymorphism as exists on the South-East Coast may be due to secondary hybridization occurring since the settlement of Tasmania.

6. Departure from the connate juvenile leaf condition and the appearance of alternate leaves, however few, are the first indications of hybridization.

7. The multiplicity of forms thus produced cannot be satisfactorily described by Linnaean species or varieties of such species, but are best regarded as constituting a polymorphic complex, described above as a polymorphic species (Group 2).

8. A suitable terminology to describe such a polymorphic complex is suggested above.

KEY TO THE EUCALYPT SPECIES IN TASMANIA

In the present imperfect state of our knowledge it has not been possible to isolate sharply the biotypes, hence the key below allows the admission of hybrids close to the biotypes. The complex of forms described above as $\times E. Risdelata$ is included for the sake of convenience under the name *E. Tasmanica*. A study of the means adopted to do this should indicate that there is a marked departure here from the case of a clearly defined simple species like *E. rubida*.

Determination has been necessary in some cases by simple statistical estimates, hence it is important to realize that imperfect material is liable to give misleading results. Due allowance should be made for colour changes in a specimen when dried. Provided suitable material is examined, it is hoped that failure to get a result on this key with the aid of the check-list indicates (a) an introduced species, (b) a member of an F₁ generation not listed in Group 3, (c) one of the segregating hybrids in a polymorphic swarm, (d) a new species.

KEY TO SECTIONS

- A. Anthers oblong to obovate; gland large, occupying the upper part of the connective Section I. *Macrantherae*
 - B. Average number of flowers in umbel exceeding three Subsection I. *Terticorneae*
 - BB. Umbels one, two, or three flowered Subsection II. *Paradiel-antherae*
- AA. Anthers reniform; gland small and terminal Section II. *Renantherae*

KEY TO SPECIES

SECTION I.—MACRANTHERAE

Subsection 1.—Tereticornes.

- A. Leaves ovate to ovate-lanceolate, often strongly undulate; average maximum width exceeding 2.5 cm. *E. OVATA* (1)
- AA. Leaves lanceolate; average maximum width under 2.5 cm. *E. AGGREGATA* (2)

Subsection II.—Parallelantherae.

- A. Umbels predominantly one-flowered, occasionally two or three flowered.
- B. Leaves lanceolate to falcate-lanceolate, 10-30 x 2-9 cm., or larger, sub-vernicoe *E. GLOBULUS* (3)
- BB. Leaves ovate to oblong-lanceolate, 2-4 x 1.5-2 cm., vernicoe *E. VERNICOSA* (9)
- AA. Umbels predominantly three-flowered, occasionally two or one flowered.
- C. Umbels axillary in opposite leaves.
- D. Leaves glaucous.
- E. Leaves connate at base *E. PERRINIANA* (13)
- EE. Leaves cordate, sessile, average length less than 8 cm. *E. CORDATA* (4)
- EEE. Leaves oblong to oblong-lanceolate, sessile, average length exceeding 8 cm. *E. GLOBULUS* (3)
- DD. Leaves non-glaucous, vernicoe *E. VERNICOSA*
- CC. Umbels axillary in alternate leaves.
- F. Average length of peduncles equal to or exceeding 13 mm.; fruit urceolate.
- G. Average diameter of fruit equal to or less than 1 cm. *E. URNIGERA* (7)
- GG. Average diameter of fruit exceeding 1 cm. *E. BIANULARIS* (29)
- FF. Average length of peduncles less than 13 mm.
- H. Buds pedicellate, central pedicel, 1.5 mm. or longer, lateral pedicels rarely absent.
- J. Valves sunk in capsule, slightly exsert or not exsert.
- K. Tips of valves slightly to freely protruding. Always associated with *E. Dalrympleana* and *E. Gunnii* *E. IRBYI* (3)
- KK. Valves completely enclosed *E. GUNNII* (12)
- JJ. Valves not sunk in capsules.
- L. Buds, fruits, mature leaves or branchlets with traces of glaucousness;¹ juvenile leaves strongly glaucous, sessile, ovate to orbicular or cordate, 2-6 x 2.5-5 cm. *E. RUBIDA* (6)

¹ Examination for traces of glaucousness should not be made in artificial light.

- LL. Glauconess absent in adult stage.
 M. Average length of peduncles usually exceeding 5 mm.; juvenile leaves sub-glaucous to glaucous, sessile, oblong-ovate to ovate or cordate, 1.0 x 1.5 cm. or longer; sometimes stem-clasping. *E. PAULI-MILLERIANA* (23)
- MM. Average length of peduncles 7 mm. or less; juvenile leaves not glaucous in the type, sessile, oblong to oblong-lanceolate, 5-10 x 1.3 cm. *E. VITINATA* (6)
- UL. Buds sessile, or lateral buds sessile, with central pedicel equal to or less than 1.5 mm., or all buds with pedicels equal to or less than 1 mm.
- N. Maximum diameter less than the altitude of the fruit.
 O. Calyx tube obconical to sub-cylindrical, fruit sub-urceolate to urceolate, buds, fruits, and branchlets usually glaucous. *E. DIVARICATA* (11)
- OO. Calyx tube cylindrical or ovoid, fruit cuneimucronate to ovoid-truncate, glaucousness absent in the adult stage. *E. ARCHERII* (30)
- NN. Maximum diameter equal to or exceeding the altitude of the fruit.
 P. Mature leaves, buds, fruit, and branchlets usually strongly glaucous; juvenile leaves glaucous and perfoliate. *E. PERRINIANA* (18)
- PP. Glauconess absent in adult stage; juvenile leaves non-perfoliate, non-glaucous or glaucous.
 Q. Average ratio of length of mid-rib to maximum diameter of leaf less than 7.7; species confined to alpine or sub-alpine situations.
 R. Average length of mature leaf blade exceeding 4.5 cm.
 S. Average maximum diameter of mature fruit equal to or exceeding 9.5 mm. *E. JOHNSTONI* (25)
- SS. Average maximum diameter of mature fruit less than 9.5 mm. *E. SUBCRENULATA* (24)
- RR. Average length of mature leaf blade equal to or less than 4.5 cm. *E. TERNIGOSA* (9)
- QQ. Average ratio of mid-rib to maximum diameter of leaf equal to or exceeding 7.7; not found in alpine or sub-alpine situations, and always associated with *E. globulus* and *E. resinoides*. *E. UNILATA* (12)

SECTION II.—RENANTHERAE: Umbels, with the exception of the three-fruited *E. coccifera*, averaging more than three flowers.

- A. Midrib bisecting the greatest width of the leaf or nearly so.
- B. All or some leaves with semi-longitudinal venation.
- C. Peduncles strap-shaped.
- D. Average length of peduncles usually equal to or exceeding 12 mm., mature leaves vernicose; average maximum width of leaves usually equal to or exceeding 17 mm.; fruit pyriform to falcate-pyriform, pinnately veined leaves absent *E. SIEBERIANA* (17)
- DD. Average length of peduncles usually less than 12 mm., mature leaves sub-vernicose; average maximum width of leaves less than 17 mm.; fruit sub-pyriform to ovoid-truncate, pinnately veined leaves often present; always in association with *E. Sieberiana* and *E. salicifolia* *E. TAENIOLEA* (31)
- CC. Peduncles terete to angled.
- E. Average length of peduncles exceeding 8 mm., juvenile leaves opposite for three to five pairs, bark smooth to base *E. PAUCIFLORA* (22)
- EE. Average length of peduncles equal to or less than 8 mm., juvenile leaves opposite for a large number of pairs; bark rough on the stem, upper branches smooth *E. SIMMONDSI* (26)
- BB. Veins pinnate, a few at the base sometimes with a longitudinal tendency, or venation of mature leaves obscure.
- F. Buds and fruit non-glaucous or with minute traces of glaucousness.
- G. Average maximum width of the leaves less than 1.5 cm.
- H. Average maximum width of the leaves equal to or exceeding 0.5 cm.; bark rough, upper branches often smooth, with bark hanging in ribbons (seedlings raised from occasional smooth barks in this class appear to indicate hybridization) *E. SALICIFOLIA* (18)
- HH. Average maximum width of leaves less than 0.5 cm.; bark smooth to base *E. LINEARIS* (20)
- GG. Average maximum width of leaves exceeding 1.5 cm. *E. TENUIRAMIS* (19)
- FF. Buds or fruit, or both buds and fruit, sub-glaucous to strongly glaucous; buds smooth to costate or angled.
- J. Umbels axillary in opposite leaves.
- K. Alternate leaves absent from the tree; fruit pyriform-truncate; top of capsule sub-concave to concave *E. RISDONI* (21)
- KK. Majority of leaves on adult tree alternate; fruit turbinate to sub-globose, or sub-pyriform to pyriform truncate; top of capsule convex to flat, or sub-concave to concave *E. TASMANICA* (27)

- JJ. Umbels axillary in alternate leaves.
 L. Buds sessile, tapering at the base in the larger fruited types to give effect of a peduncle; operculum flat or concave, without any well-defined point, or rarely sub-acute.
 M. Umbels 3-6 flowers *E. COCCIFERA* (25)
 MM. Some umbels with more than 6 flowers *E. TASMANICA* (27)
 LL. Buds pedicellate; umbels 6-25 flowered; operculum more or less convex, acute, or obtuse, smooth or warty *E. TASMANICA* (27)
 AA. Midrib not bisecting the greatest width of the leaf.
 N. Fruit pyriform; disc oblique; valves not protruding, more or less deeply enclosed by the disc; average diameter of mature fruit exceeding 7 mm.
 O. Glauousness to sub-glaucousness present on buds, fruits, and mature leaves or branchlets; old fruit and branchlets pruinose; juvenile leaves glaucous, oblong-ovate to oblique lanceolate *E. GIGANTEA* (15)
 OO. Glauousness absent in the adult and juvenile stages; branchlets not pruinose, old fruit green or brown *E. OBLIQUA* (14)
 NN. Fruit obconical to sub-pyriform; disc flat to sub-oblique, usually 1 mm or less in width; valves enclosed by the disc, and often slightly protruding; average maximum diameter of mature fruit 7 mm. or less *E. REGNANS* (16)

CHECK-LIST

The descriptions below are concerned not with the complete range of a species when that extends beyond the State, but only on the Tasmanian forms. The greatest assistance has been gained from 'A Key to the Eucalypts'. Eucalyptography owes a great debt to W. F. Blakely for this pioneer work. The form of the descriptions follows the excellent example set by Blakely; every measurement has been checked, and departures from the estimates and descriptions given in the above work have only been made when necessary. In some cases these are substantial, e.g., *E. rubida* is quoted as having sessile buds; Tasmanian forms are never sessile, whereas specimens of *E. rubida* collected by me in Victoria have umbels with completely sessile buds. Other important differences will be noted.

1. *E. ovata* Labill. (*E. acerula* Hook., f.). Labill., 1806—Nov. Holl. Pl. ii, 153. A medium to small tree, but sometimes up to 30 m. Bark usually rough at the base, but smooth deciduous on portion of trunk and upper limbs. White or brown in colour. Old isolated trees sometimes exhibit a black scaly bark persistent on whole of trunk. Juvenile leaves opposite for 4 or more pairs, ovate to orbicular, undulate, very shortly petiolate, 4-8 × 3-7 cms., glaucous

to green. Intermediate leaves alternate, ovate to ovate-lanceolate, with long petioles 11×5 cm. or larger. Mature leaves alternate-ovate to ovate-lanceolate, undulate, sometimes emarginate, subvernucose with long petioles, thinly to thickly coriaceous, venation clearly defined, $9-12 \times 1.3-5$ cm. Umbels axillary, 4-8 flowered. Peduncles terete to compressed, 5-12 mm. Buds pedicellate, elliptical with obconical calyx-tube, 8-9 mm. \times 5-7 mm. Operculum pointed, subrostrate, equal or slightly greater in altitude than the calyx-tube. Fruit obconical, 5.9×6.8 mm. Valves exsert.

Habitat: Common at sea-level, where it is found growing in sandy and poor soil. It also thrives in swampy ground at an elevation, and in some northern districts is called 'Swamp Gum'.

Distribution: Common at sea-level and up to 2000 feet. Also Victoria, New South Wales, and South Australia. Marked differences are observable between *E. ovata* in Victoria and Tasmania. The South Australian trees match those of the Tasmanian distribution very well.

Affinities: With *E. aggregata*.

Hybrids: Hybridizes freely with *E. viminalis* and probably *E. salicifolia*. One hybrid with *E. globulus* has been investigated (see note to Group 3). The forms with glaucous juvenile foliage occasionally found may be due to hybridization with *E. pauciflora*, with which this species is sometimes associated in Midland districts.

2. *E. aggregata* Deane and Maiden (*E. Rodwayi* Baker and Smith). Deane and Maiden, 1900—Proc. Linn. Soc. N.S.W., XXV, 104. A medium to tall tree, up to 45 m. Bark rough, dark, fibrous, persistent to the secondary branches, suggesting that of a black peppermint (*E. salicifolia*), with which this species is confused by uncritical observers. Juvenile leaves opposite for 4 to 5 pairs, ovate to oblong, with reduced petioles $4.6 \times 1.5-3.5$ cm. Intermediate leaves ovate to narrow-lanceolate. Mature leaves alternate, petiolate, narrow-lanceolate to narrow-falcate-lanceolate, venation obscure when fresh, dark-green and shining, $7-12 \times 1.5-2.3$ cm. Umbels 4-8 flowered. Peduncles slender, 4-6 mm. Buds elliptical, shortly pedicellate, 3.4×4.5 mm. Operculum conical, equal to or slightly exceeding the calyx-tube. Fruit hemispherical, shortly pedicellate, 4×5 mm. Valves exsert.

Habitat: Prefers marshy land at an elevation.

Distribution: Tasmania—Victoria Valley, Interlaken, Penstock Lagoon, Guildford Junction. Also New South Wales.

Affinities: With *E. ovata*.

Hybrids: The black fibrous bark of the tree is a constant character, and the infrequent smooth barks are found in a mixed stand of *E. pauciflora* and *E. aggregata*. Occasional seedlings of these trees have a tendency to glaucousness, suggesting hybridization with *E. pauciflora*.

3. *E. globulus* Labill. Labillardière, 1799. *Relation du Voyage Recherche Perouse*, 1. 152. A small to large tree, depending mainly on type of soil conditions, 6-15 m. Bark smooth, deciduous, sometimes rough and deeply furrowed on the whole or half the trunk, olive-green to reddish-brown. Juvenile leaves opposite for an indefinite number of pairs, sessile to amplexicaul, glaucous, oblong-ovate to oblong-lanceolate, 7-16 \times 4-9 cm. The non-glaucous juvenile leaves occasionally found on Mt. Wellington, and perhaps elsewhere, are probably due to hybridization with *E. viminalis* or even *E. ovata*. Intermediate leaves petiolate, alternate broad lanceolate to ovate-lanceolate and falcate-lanceolate. Mature leaves alternate, petiolate, dark-green, subverniceous to vernicose, lanceolate to falcate-lanceolate, 10-30 \times 3-4 cm. or larger. Umbels axillary, usually 1-flowered, sessile. Terminal umbels are occasionally 3-flowered, and rare trees have a majority of 3-flowered umbels. A polymorphic hybrid swarm connects *E. globulus* with *E. viminalis*, and it is possible that these 3-fruited forms are components. A specimen showing *E. globulus* budding in the opposite-leaved stage, collected by Mr. E. Cruickshank from the stump of a felled tree at Glenorchy, is preserved in the Rodway Herbarium. Peduncles much reduced, compressed, broad or triangular. Buds glaucous, turbinate, rugose, quadrangular, 20-30 \times 20 mm. Operculum calyptriform, umbonate, rugose, shorter than the calyx-tube. Fruit sessile, depressed globular to turbinate, rugose, quadricostate, 10-20 \times 15-30 mm. Disc large, convex, thick, smooth, sometimes covering valves which are slightly exsert.

Habitat: Prefers moist, well-drained, sandy soil in sheltered valleys, and in these conditions grows to a tall timber tree. When growing on dry mudstone hills it is reduced almost to shrub-like dimensions, and acquires a mallee habit. Will flourish in sandy soil at sea-level.

Distribution: Blakely (1934) does not give any mainland localities for *E. globulus*. I am informed by Mr. St. John, of the National Herbarium, Melbourne, that *E. globulus* with single fruits in the umbel grows in Victoria. I have not seen these trees in the field. Both from field observation and evidence from seed-raising I am fully convinced that *E. St. Johnii* R. T. Baker and *E. bicostata* Maiden Blakely and Simmonds, included as varieties of *E. globulus* in Flora of Victoria (Ewart, 1930), although allied to *E. globulus*, are specifically distinct from it.

Tasmania: Common on East and South-East Coast, Risdon, Mt. Wellington, Spring Hill.

Affinities: With *E. Johnstonii*.

Hybrids: With *E. viminalis*, *E. ovata*, *E. urnigera*.

4. *E. cordata* Labill. Labillardière, 1806. Nov. Holl., Pl. ii, 13. t. 152. A small shrub to tall tree, 1-2-60 m. In this connection the following quotation from the Crit. Rev. (Maiden), Pt. 51, Vol. VI. is important: 'Mr. L. Rodway, of Hobart, writes to me that at Cape Frederick Henry, Brown Mt., and Ridgeway it is a scrambling

to semi-erect shrub of about 4 or 5 feet. In the South-West Gully at Chimney Pot Hill, close to Ridgeway, it is a small tree up to, say, 20 feet in height. At Uxbridge he has seen trees of it approximately 100 feet, and Mr. Fenton, of that town, an experienced timber-cutter, brought him a specimen in typical foliage and flower from a tree that was 200 feet high, with a clean branchless bole for 100 feet, and with timber light yellow ochre in colour'. I have seen the Uxbridge specimens in the Rodway Herbarium, and they are without a doubt close to the type. Further observations and research are necessary with this species. Bark smooth, white, with green to purplish blotches. Juvenile leaves opposite for an indefinite number of pairs, cordate to cordate or even oblong-lanceolate, crenulate, sessile, amplexicaul, glaucous. Intermediate foliage similar to the juvenile. Mature leaves opposite, sessile to amplexicaul, cordate to ovate-lanceolate. Umbels axillary, 3-flowered. Peduncles 5-10 mm. Buds sessile, turbinate to depressed-urceolate. Operculum calyptriform, umbonate to subapiculate, shorter than the calyx-tube. Fruit sessile, glaucous, ovate-truncate to globular. Valves 3-4, deeply enclosed.

Habitat: More information is necessary (see note above on size of tree). I am not as yet able to say that the small scrambling shrubs at Brown Mt. will give seedlings that grow to tree dimensions under favourable conditions. A medium tree growing in a Hobart garden is said to be raised from seed collected at Chimney Pot Hill, Mt. Wellington.

Distribution: Confined to Tasmania. Mt. Wellington, Brown Mt., Port Arthur, Nelson's Tier, Recherche Bay.

Affinities: With *E. urnigera*.

Hybrids: With *E. globulus*.

5. *E. viminalis* Labill. Labillardière, 1806—Nov. Holl., Pl. ii, 12, t. 151. A small to medium tree, 6-15 m. Bark smooth, white, deciduous, or scaly rough at base, occasional trees with a more or less deeply furrowed bark to upper branches. Juvenile leaves opposite for an indefinite number of pairs, dark to light green, glossy in the comparatively pure types, sessile to amplexicaul, 5-10 × 1.3 cm. or larger. Intermediate leaves petiolate, alternate, broadly-lanceolate to falcate. Mature leaves alternate, lanceolate, lanceolate to falcate-lanceolate, 11-18 × 1.5-2 cm. Umbels axillary, 3-flowered. Peduncles terete, 3-6 mm. Buds with short to well-developed pedicels, ovoid to cylindroid, 5-7 × 4-5 mm. Operculum obtuse to acute, hemispherical to conical, as long as or shortly longer than the calyx-tube. Fruit pedicellate, spherical to turbinate, 5-6 × 7-8 mm. Disc prominent, subconvex to convex. Valves 3-4, strongly exsert.

Habitat: Will thrive in sandy or clay soils, but prefers well-drained moist conditions in sheltered valleys.

Distribution: Tasmania. Common except in south and west.

Affinities: With *E. rubida* and *E. Dalrympleana*.

Hybrids: With *E. rubida*, *E. ovata*, *E. globulus*, and *E. salicifolia*.

A polymorphic hybrid swarm connects *E. globulus* and *E. viminalis*. Some of these components with normal *viminalis* fruits produce juvenile foliage of normal dimensions, but strongly to faintly glaucous, others have sub-glaucous, broad ovate-lanceolate leaves (see Plate XV, fig. 3). Some of these which are comparatively common on Mt. Wellington have been confused with *E. Dalrympleana*. A specimen in the Rodway Herbarium from Mt. Nelson, labelled *E. Dalrympleana* by Maiden, matches the foliage shown in Plate XV, fig. 3. Such specimens as these probably explain the mention of Chimney Pot Hill by Blakely in 'Key to Eucalypts' as a locality for *E. Dalrympleana*.

Also the existence of occasional rough barked trees of *E. viminalis*, to be seen at Lindisfarne and elsewhere, probably explains the reference to *E. Huberiana* Naudin for Tasmania in the same volume. I am well acquainted with *E. Huberiana* in South Australia and Victoria, and believe it to be similar to those species in Group 2, i.e., it consists of many hybrid races in various stages of stability. Seedlings raised from these different forms exhibit marked differences almost from the cotyledon stage. Examination of *E. viminalis* in the Loffy Range, South Australia, and in Victoria and Tasmania, suggests that the biotype is smooth-barked and 3-fruited. The many-fruited, smooth-barked forms do not produce more or less pure stands as do the rough-barked races at present called *E. Huberiana*. Occasional smooth-barked, many-fruited forms are found in Tasmania. The origin of these is most probably hybridization with *E. ovata*; the many-fruited character is not present in every umbel. A large proportion of the umbels carry the typical cruciform arrangement of three buds. Smooth-barked hybrids with *E. salicifolia* (quite distinct from *E. linearis* and the occasional deciduous or semideciduous forms found in a pure stand of *E. salicifolia*) are often present where these two species meet, as at Westerway.

6. *E. rubida* Deane and Maiden. Deane and Maiden, 1899—Frie, Linn. Soc. N.S.W., xxi, 156. A very glaucous small to tall tree, 9-30 m. Bark smooth, white, often blotched pink or red. Juvenile leaves opposite for an indefinite number of pairs, glaucous, sessile, cordate to orbicular or ovate, 2.0 \times 2.5-5 cm. Intermediate leaves petiolate, glaucous, ovate to ovate-lanceolate, short-lanceolate to falcate-lanceolate. Mature leaves alternate, petiolate, lanceolate or falcate-lanceolate subvernigose, 19-18 \times 2-3.5 cm. Branchlets bear a fine glaucous bloom. Umbels axillary, 3-flowered. Peduncles subnervete, 3-6 mm. Buds glaucous or subglaucous, ovoid, 6-7 \times 4-5

mm., shortly to distinctly pedicellate. Operculum conical to hemispherical, equal to calyx-tube. Fruit pedicellate, subglaucous to glaucous, 4-6 \times 4-8 mm., hemispherical to turbinate. Disc flat to domed. Valves exsert.

Habitat: Prefers open country at an altitude of 1000 to 2000 feet. Thrives on poor soils of mudstone varieties.

Distribution: Tasmania. Westerway, Ouse, Conara, St. Marys. Also South Australia, Victoria, New South Wales, Queensland.

Affinities: With *E. viminalis* and *E. Dalrympleana*.

Hybrids: With *E. Dalrympleana* where the two species meet. A wide variability in size of fruit can be seen from measurements above. Seedlings raised from a tree of the small-fruited type exhibit a wide range of variability in juvenile leaves, both in colour and shape. Some have practically normal shape, but are dark glossy green. It is not yet possible to say whether the small fruit is associated with the hybrid character.

An observer of *E. rubida* in South Australia, Victoria, and Tasmania might incline to the view that the most 'typical' *E. rubida* is in Tasmania. In the first mentioned State a high degree of hybridization has taken place. It is safe to assume that the multi-flowered *E. rubida* is of hybrid origin. I have in my possession seedlings from such a tree growing at Woodside, South Australia. Almost perfect segregation towards *E. camaldulensis* Dehn. (*E. rostrata* Schlecht) and *E. rubida* is shown.

7. *E. urnigera* Hook., f. Hooker, f., 1847—Lond. Journ. Bot., Part VI, 477. A small to medium tree, with drooping branches, 9-12 m. Bark smooth, deciduous, white, blotched green and red. Juvenile leaves opposite for an indefinite number of pairs, strongly glaucous in type, cordate, orbicular to elliptical or ovate, sessile to shortly petiolate, crenulate, 6 \times 7 cm. or larger. These leaves bear a striking resemblance to the mature leaves of *E. cordata*. Mature leaves alternate, petiolate, green, narrow to broad-lanceolate, 8-18 \times 1.7-2.5 cm. Umbels axillary, 3-flowered. Peduncles compressed to subterete, 13-20 mm. Buds urceolate, petiolate, glaucous, 12-14 \times 7 mm. Non-glaucous buds and fruit departing from these rough limits of measurement are most probably hybrids of *E. Johnstoni*, or represent a comparatively stabilized race with glossy, dark-green, juvenile foliage, probably derived by hybridization from *E. Johnstoni*, and confined to Mt. Wellington. (See note under *E. Johnstoni*.) Operculum umbonate or subapiculate, forming a cap to the calyx-tube, and much shorter than it. Fruit pedicellate, urceolate, 15-17 \times 7-10 mm. Valves deeply enclosed.

Habitat: Prefers well-drained situations at sub-alpine levels.

Distribution: Confined to Tasmania. Mt. Wellington and common on the Central Plateau.

Affinities: With *E. divaricata*.

Hybrids: With *E. Johnstonii*, also probably *E. Daintoniana*, and *E. subcrenulata*.

The following extract from the Crit. Rev. (Maiden) refers to the variety *E. elongata* of Rodway: 'A tall, spreading tree. Bark smooth, white. Leaves linear-lanceolate, 1-3 inches long. Peduncles not very long. Operculum conical umbonate, half as long as the capsule. Fruit pyriform-globose, slightly constricted, 1 inch long. Capsule much sunk. ("The Tas. Flora", p. 58.)

Mr. Rodway (in a letter to me) points out the close resemblance of the juvenile foliage of this form to that of *E. cinulalis*. He has suggested the possibility of this form being a hybrid between *E. acutigena* and *E. cinulalis*, and says that wherever he has seen the variety growing, he has always seen the two species associated'.

Insufficient note has been taken in the past of Rodway's field observations of this type. In my experience his opinions on natural hybrids of *Eucalyptus* have always been most reliable.

E. subcrenulata Maiden and Blakely. Maiden, 1929 -Crit. Rev., Part LXXI, 59. A small alpine tree to large timber tree, up to 50 m., with a smooth deciduous bark of brilliant orange when freshly exposed. Juvenile leaves opposite for an indefinite number of pairs, dark glossy green, sessile, orbicular to ovate, subcrenulate and undulate. Intermediate leaves alternate, petiolate, broadly ovate to oblong-lanceolate, subcrenulate, dark-green, vernicose, 5-10 × 3-5 cm. Mature leaves alternate, with long subterete petioles, oblong to oblong-lanceolate and narrow falcate-lanceolate, coriaceous, subcrenulate, 5-12 × 1.5-2.5 cm., dark-green and vernicose. All leaves change colour to light-green on drying. Umbels axillary, 3-flowered. Peduncles 2-4 mm. or longer. Buds sessile, ovoid to globular, compressed at the base, 6-8 × 5-6 mm., irregularly ribbed or faintly winged to smooth, pitted rugose; operculum conical, obtuse to subrostrate, usually shorter than the calyx-tube. Fruit hemispherical to shortly campanulate. Valves strongly exsert.

The type description as published by Blakely (1934) is misleading, as it was probably described on insufficient material. It is there regarded as a small alpine tree. This tree, which is very common on the Central Plateau, was previously thought to be *E. Johnstonii*. On a collecting trip to National Park, Prof. A. L. McAulay concluded that this form of *E. Johnstonii*, as then regarded, is identical with *E. subcrenulata*, and later, on Biological Survey work in the same district, considered that the reduced alpine forms are identical with the tall timber tree below Lake Ponton, also previously regarded as *E. Johnstonii*. In these opinions I concur, and have shown from a rough statistical examination that the group of forms under the name of *E. Johnstonii* at present confined to Mt. Wellington is distinct from *E. subcrenulata*. The reduced alpine forms of this species are undoubtedly the forms showing transit to *E. vernicosa* described by Rodway and others.

Habitat: Alpine and sub-alpine situations. In sheltered situations the tree thrives and grows to large dimensions.

Distribution: Confined to Tasmania. Common on the Central Plateau, extending north to Cradle Mt.

Affinities: With *E. vernicosa* and *E. Johnstoni*.

Hybrids: With *E. Gunnii*.

9. *E. vernicosa* Hook., f. Hooker, f., 1847—Lond. Journ. Bot., VI., 478. A shrub or small tree, often of twisted appearance, 1.2-3.6 m. Bark smooth, deciduous, brown-orange. Juvenile leaves dark-green, glossy, opposite for an indefinite number of pairs, sessile or shortly petiolate, elliptical to oblong or oblong-lanceolate, 1.5-2 × 1.2 cm. Intermediate leaves similar to juvenile, but with developed petioles. Mature leaves opposite or alternate, elliptical to lanceolate, petiolate, subcrenulate, dark-green, strongly vernicose and thick, 1.5-5 × 1.5-2 cm. Umbels axillary, 1-3 flowered. Peduncles thick, 1.5-5 mm. Buds sessile, elliptical, 7-8 × 5 mm. Operculum hemispherical, apiculate or sharply conical, equal to or shorter than the slightly ribbed calyx-tube. Fruit sessile, hemispherical to shortly campanulate or subcylindrical, 5-7 × 7-8 mm. Valves 3-5, enclosed.

Habitat: Alpine situations.

Distribution: Confined to Tasmania. Mt. Fatigue, Mt. La Perouse to Arrowsmith, West Coast, Mt. Sorell, Macquarie Harbour, Cradle Mt.

Affinities: With *E. subcrenulata* and *E. Johnstoni*.

Hybrids: Trees growing on the shores of Sutton's Tarn in the Cradle Mt. Reserve strongly suggest hybridization with *E. subcrenulata*. A study of material collected over a wide area appears to indicate two biotypes: a single-fruited form, common in the south-west, and a 3-fruited form. The Cradle Mt. trees are exclusively of the latter. It is tentatively suggested that this latter may have arisen from hybridization with *E. subcrenulata*. Further field and horticultural observation is necessary on this point.

10. *E. Archeri* Maiden and Blakely. Maiden, 1929—Crit. Rev., Part LXXI, 58. A small shrub or dwarf stunted to medium tree, 3-9 m. Bark smooth, deciduous, orange in colour, sometimes scaly at base. Juvenile leaves glaucous, opposite for an indefinite number of pairs, sessile to shortly petiolate, cordate to orbicular or elliptical. Intermediate leaves elliptical to oblong-lanceolate or spatulate. Mature leaves alternate, coriaceous, narrow-lanceolate to broad-lanceolate and falcate-lanceolate, 5-10 × 1.3 cm. Umbels axillary, 3-flowered. Peduncles compressed, 3-7 mm. Buds sessile or nearly so, oblong or cylindrical, 5 × 6 mm. Operculum hemispherical, obtuse, 2-3 times shorter than the calyx-tube. Fruit, sessile, ovoid-truncate to campanulate, 6-7 × 5-6 mm. Valves deeply sunk, with tips minutely emerging at times.

Habitat: An alpine to sub-alpine species.

Distribution: Confined to Tasmania. Western Tiers and Mt. Barrow. The type specimen which, through the kindness of Mr. Blakely, I have been able to see is given as from the Western Mts. Doubtless this means the Western Tiers. Material collected from this locality matches the type very well.

Affinities: With *E. Gunnii* and *E. divaricata*.

Hybrids: There is a specimen in the Rodway Herbarium, labelled *E. Gunnii*, from the Western Tiers. A pencil note of the collector calls attention to the strong resemblance of the buds to those of *E. viminalis*. These would certainly pass for buds of *E. viminalis*, if separated from the fruit. The pedicels are up to 2 mm. in length, while fruit and leaves are close to the type of *E. Archeri*. The specimen certainly suggests a hybrid of possibly *E. Dalrympleana*.

11. *E. divaricata* McAulay and Brett, sp. nov. (Plate XVII.) Arbor divaricata, alta 12-15 m.; cortice squameo; ramulis tenuis persistente, cinereo, v. nigro. Folia juvenilia bina opposita per multa paria, cordato-orbiculata v. elliptica, sessilia vel brevi-petiolata, 2.5 cm. longa, 2 cm. lata. Folia intermedia alterna, petiolata, elliptica v. oblongo-lanceolata. Folia matura glauca v. atroviridia, alterna, angusta v. lato-lanceolata, v. falcato-lanceolata, 4.8 cm. longa, 1.5-3 cm. lata. Umbellae axillares, 3-florae, pedunculis compressis v. sub-compressis, 5-10 mm. longis. Gemmae sessiles v. brevi-pedunculatae, glaucae, obovatae v. cylindriciformes, 6-8 cm. longa, 5 mm. lata. Operculum plano-hemisphaericum v. planum v. calyptriformem, subapiculatum, brevius quam calycis tube. Capsulae, glaucae, cylindriciformes v. suburceolatae, 7-9 mm. longae, 6 mm. latae. Valvae inclusae.

A small to medium umbrageous tree, with markedly divaricating branches, 12-15 m. Bark rough, scaly, grey to black, persistent on the trunk and branches; the branchlets covered with a light to heavy glaucous bloom. Juvenile leaves opposite for an indefinite number of pairs, glaucous, cordate orbicular to elliptical, sub-crenulate, sessile to shortly petiolate, 2.5 × 2 cm. In a general way the juvenile leaves of *E. Gunnii* are larger than those of *E. divaricata* and *E. Archeri*, whilst the glaucousness of the juvenile *E. divaricata* is more marked than that of either of the other two. Intermediate leaves alternate, petiolate, elliptical to oblong-lanceolate or lanceolate. Mature leaves green, alternate petiolate, narrow to broad-lanceolate or falcato-lanceolate, 4.8 × 1.5-3 cm. Umbels axillary, 3-flowered. Peduncles compressed to almost terete, 5-10 mm. Buds sessile to shortly pedicellate, glaucous, obovate to cylindroid, 6-8 × 5 mm. Operculum depressed, hemispherical or flat to cap-shaped, sub-apiculate, shorter than the calyx-tube. Fruit glaucous, cylindroid to sub-urceolate, often urceolate when immature, 7-9 × 6 mm. Disc small, slightly convex, valves deeply sunk.

Habitat: A sub-alpine species; prefers open flats at an altitude of about 3000 feet.

Distribution: Northern and eastern shores of the Great Lake. Miena, skirting St. Patrick's Plains, Arthur Lakes. Confined to Tasmania.

Affinities: With *E. Gunnii*, *E. Archeri*, and *E. urnigera*.

Hybrids: With *E. Dalrympleana*. There are many hybrids of these two species on Alma Tier. The trees resemble *E. Gunnii* in their smooth barks and pedicellate buds. The juvenile foliage of the seedlings is very distinct from that of juvenile *E. divaricata*. It is much larger and less glaucous.

12. *E. Gunnii* Hook., f. Hooker, J. D., 1844—Lond. Journ. Bot., iii, 499. A medium to tall tree, up to 30 m. Bark smooth, deciduous, scaly, persistent at base of old trees, orange to pinkish-white. Juvenile leaves opposite for an indefinite number of pairs, glaucous, cordate, orbicular to elliptical, sessile to shortly petiolate, 3.4×2.4 cm. or larger. Intermediate leaves alternate, elliptical to oblong-lanceolate, green to glaucous, crenulate. Mature leaves alternate, narrow to broad-lanceolate, $4.7 \times 1.5-3$ cm. Umbels axillary. 3-flowered. Peduncles compressed to terete, 3-8 mm. long. Buds sub-glaucous to non-glaucous, pedicellate, cylindroid, with an umbonate or mucronate operculum less than the calyx-tube. Fruit shortly pedicellate to nearly sessile, hemispherical or campanulate to ovoid-truncate, $7-10 \times 5-8$ mm. Valves sunk in capsule, not exsert.

Habitat: A sub-alpine tree, preferring marshy conditions.

Distribution: This tree has been reported both in Victoria and New South Wales. I have not seen the specimens from the summit of Mt. Baw Baw, Victoria, but have raised plants from seed labelled *E. Gunnii* collected in New South Wales. The seedlings bear no resemblance to those of *E. Gunnii*. I believe, with R. T. Baker (1912), that this species is confined to Tasmania.

Tasmania: The Middlesex Plain, Alma Tier, Mt. Arrowsmith.

Affinities: With *E. Archeri* and *E. divaricata*.

Hybrids: With *E. Dalrympleana* (Baker's Tier) and *E. subcrenulata* (Cradle Mt. Reserve).

The following two specimens in the Rodway Herbarium strongly suggest natural hybridization with *E. subcrenulata*. Both were collected on Mt. Field (whether East or West is not stated). In this area the two species form an association.

Specimen I, labelled *E. Gunnii* H. Mt. Field, 1902: The buds are large, and resemble those of *E. Gunnii*, but peduncles are long, equal to or exceeding 8 mm. The fruit is that of *E. subcrenulata*. The sucker foliage would match that of *E. urnigera*.

Specimen II, labelled *E. Gunnii*, cultivated in Hobart from seed collected on Mt. Field: Only buds appear, and all parts are more highly glaucous, but there are strong resemblances, particularly in long peduncles, to Specimen I.

13. *E. Perriniana* (F. v. M.) Rodway. Rodway, 1893—(Pap. Roy. Soc. Tas., 181. A small, shrub-like tree of mallee habit to medium tree, about 3-12 m. Bark smooth, deciduous, of glaucous appearance, with pruinose blotches, sometimes scaly at base. The mature tree presents a glaucous pruinose appearance. Juvenile leaves opposite for an indefinite number of pairs, glaucous, perfoliate, orbicular to elliptical-cordate, 5-6 \times 4-10 cm. Intermediate leaves glaucous, ovate, connate at base or opposite and sessile, or alternate, lanceolate or falcate-lanceolate, petiolate. Mature leaves glaucous, petiolate, alternate, lanceolate to falcate-lanceolate, up to 13 \times 1.2-5 cm. Old trees may exhibit all three types of foliage on the one secondary branch. Umbels axillary, 3-flowered. Peduncles 2-5 mm. Buds glaucous, sessile, with central pedicel sometimes developed, 6-9 \times 4-7 mm. Fruit glaucous, sessile, truncate-globose to subcylindrical, 5 \times 7-8 mm. Valves 4-5, completely enclosed or minutely exsert.

Habitat: Prefers poor soil of the mudstone variety at an elevation.

Distribution: Tasmania (Tunnack, Strickland); also Victoria and New South Wales.

Affinities: Possibly with *E. Gunnii*.

Hybrids: None observed.

14. *E. obliqua* L'Herit. L'Heritier, 1788—(Sert. Angl., p. 18, t. 20. A medium to tall tree, 15-60 m. Bark fibrous, deeply furrowed, and persistent to branchlets, occasionally smooth, deciduous on branches. Juvenile leaves opposite for 3-4 pairs, petiolate, lanceolate to elliptical-lanceolate, 6-8 \times 3-4 cm. Intermediate leaves alternate, obliquely ovate to lanceolate, bright green or yellowish-green and shining, up to 20 \times 14 cm. or larger. Mature leaves alternate, petiolate, oblique-lanceolate, 10-16 \times 2-3 cm., thick and shining. Umbels axillary, 7-16 flowered. Peduncles compressed to subterete, 8-13 mm. Buds clavate, pedicellate, 7 \times 3-5 mm. Operculum hemispherical, smooth or apiculate, shorter than the calyx-tube. Fruit pyriform, truncate, pedicellate, 8-12 \times 8-10. Disc oblique. Valves deeply enclosed.

Habitat: Grows from sea-level to a moderate altitude. Thrives best in well-drained sandstone soils in sheltered valleys.

Distribution: Common in Tasmania. Also South Australia, Victoria, and New South Wales.

Affinities: With *E. regnans* and *E. Sieberiana*.

Hybrids: With *E. regnans* on Mt. Wellington; \times *E. Risdelata* on Tasman's Peninsula; also possibly with \times *E. Radosolicilata* on Mt. Wellington, as smooth-barked types can be found with fruit-bearing, broad, flat discs, quite unlike the pyriform, obliquely rimmed fruit of *E. obliqua*.

15. *E. gigantea* Hook., f. Hooker, J. D., 1847—Lond. Journ. Bot., VI, 479; also 1860—Flora Tas., i, 136 (*partim*). A tall tree, 18-30 m. The smaller trees are possibly of hybrid origin. Bark rough, fibrous, deeply furrowed, persistent, grey in colour, extending for variable distances up the trunk; occasional trees bear strips of smooth bark to the base or are almost entirely smooth-barked (see note under hybrids). The smooth deciduous portions cream in colour, streaked with grey. The foliage tree presents a sub-glaucous appearance which is very characteristic. The sapling is markedly glaucous both on leaves and trunk. Occasional trees, as on Alma Tier, develop a marked weeping habit, with long pendulous branches of striking appearance. Juvenile leaves opposite for 3-4 pairs, petiolate, glaucous, lanceolate. Intermediate leaves alternate, oblong-elliptical to oblique-lanceolate, glaucous. Mature leaves alternate, petiolate, sub-glaucous, narrow-lanceolate to broadly oblique-lanceolate, 8-16 \times 2-5 cm.; the branchlets covered with fine to heavy glaucous foliage. Umbels axillary, 7-15 flowered. Peduncles flattened to terete, 10-20 mm. or even longer. Buds clavate, pedicellate, faintly glaucous, 7-8 \times 4-7 mm. Operculum hemispherical, obtuse or minutely umbonate, shorter than the calyx-tube. Fruit pedicellate, pyriform to globose-pyriform or falcate-pyriform, 10-14 \times 9-13 mm. Disc thin, oblique to suboblique; valves enclosed.

Habitat: Prefers an altitude of 2000-3000 feet.

Distribution: Common in Tasmania, forming forests at an altitude from 2000-3000 feet. Also Victoria and New South Wales.

Affinities: With *E. obliqua* and *E. Sieberiana*.

Hybrids: With *E. obliqua*. On Mt. Wellington, small to medium trees, with practically smooth bark, shining mature leaves, and smaller fruits than the forest tree, suggest hybridization with *E. regnans* at the levels where the two trees are closely associated. In districts where the species associates with *E. Dalrympleana*, trees bearing smooth bark almost to the base are frequently found. The rough portions of the bark are scaly rather than fibrous, and the timber, according to Mr. L. Connell, of 'Waldheim', Cradle Mt., is of very inferior quality to that of the typical gum-top stringy-bark. The fruit is globose to sub-pyriform, with a broad convex rim, reminiscent of *E. Dalrympleana*.

16. *E. regnans* F. v. M. F. von Mueller, 1870—Rept. Accl. Soc. Vict., 20. A medium to very tall tree, 12-90 m. or taller. Some very tall trees of this species beyond the above limits have been reported in Southern Tasmania, but in the absence of absolutely reliable estimates no measurements are quoted. Bark smooth, deciduous on trunk and limbs, often peeling in long ribbons, occasionally persistent. The colour when freshly exposed is bluish-grey, occasionally streaked with cream. Juvenile leaves opposite for 2-3 pairs, shortly petiolate, lanceolate. Intermediate leaves petiolate, broad-lanceolate

to oblique-lanceolate, alternate. Mature leaves subvernicate, alternate, petiolate, narrow to broad oblique-lanceolate, acuminate, 10-16 \times 2-5 cm. Venation with a semilongitudinal tendency. Umbels axillary, sometimes in pairs, 7-15 flowered. Peduncles terete, 8-15 mm. Buds clavate, pedicellate, 7-9 \times 5 mm. Operculum hemispherical to conoid, shorter than the calyx-tube. Fruit pedicellate, obconical to campanulate, 7-8 \times 5-6 mm. Disc flat to sub-oblique. Valves enclosed.

Habitat: Prefers moist, well-drained soil near running water. Forms stands at sea-level, but prefers rain forest conditions, and attains large dimensions in mountain gullies.

Distribution: Common up to an altitude of about 2000 feet. Also Victoria.

Affinities: With *E. obliqua*. Regarded by Mueller as having an affinity with *E. salicifolia*, but almost every character for comparison in Eucalypts separates the two trees.

Hybrids: With *E. obliqua*, and possibly *E. gigantea*.

17. *E. Sieberina* F. v. M. F. von Mueller, 1879—Eucalyptographia, Dec., ii. A medium to tall tree, 15-30 m. Bark rough, deeply furrowed, dark-grey, persistent on trunk; upper branches with smooth deciduous bark, cream in colour when freshly exposed. The branchlets and stem of saplings markedly glaucous. Juvenile leaves opposite for 4 to 5 pairs, sessile to shortly petiolate, elliptical to broadly lanceolate, glaucous, coriaceous, 8-12 \times 5-7 cm. Intermediate leaves alternate, petiolate, glaucous, broadly lanceolate to sub-oblique-falcate-lanceolate. Mature leaves alternate, petiolate, lanceolate to falcate-lanceolate, vernicose, with semilongitudinal venation, 9-18 \times 1.5-2 cm. Umbels axillary, 5-12 flowered. Peduncles strap-shaped, 7-14 mm. or longer. Buds clavate, pedicellate, 5-7 \times 3-5 mm. Operculum hemispherical, shorter than the calyx-tube. Fruit pedicellate, pyriform-truncate, 8-11 \times 7-8 mm.; disc small, flat or oblique; valves enclosed.

Habitat: Prefers coastal belts of sandy soil or valleys at a moderate altitude.

Distribution: Tasmania—Occupies a coast belt on the North-East Coast, Falmouth, George's Bay, St. Mary's Pass, &c. Also Victoria and New South Wales.

Affinities: With *E. gigantea* and to some extent *E. obliqua*.

Hybrids: With *E. salicifolia*. A polymorphic hybrid swarm connects *E. salicifolia* and *E. Sieberiana* where the two species are mixed. Also with *E. obliqua*. The *obliqua* hybrids have markedly oblique-lanceolate leaves.

18. *E. salicifolia* (Sol.) Cav. (*E. amygdalina* Labill.) Cav., 1797—*l.c.*, iv, 24. A shrub to medium tree, depending on soil conditions and situation, 3-15 m. Bark fibrous, grey, persistent on the trunk

and branches. Often deciduous on the branches, and an occasional tree in a stand will present smooth bark to the butt. (Such a tree is quite distinct from *E. linearis*.) Juvenile leaves opposite for an indefinite number of pairs, linear to narrow-lanceolate, pale-green or glaucous, 0.7-1.5 cm. Intermediate leaves alternate, petiolate, lanceolate to falcate-lanceolate. Mature leaves petiolate, alternate, narrow-lanceolate to linear-lanceolate and linear-falcate, 4-10 \times 0.7-1 cm. Umbels axillary, 5-12 flowered. Peduncles terete, 5-10 mm. Buds clavate, pedicellate, 4 \times 3 mm. Operculum hemispherical, obtuse, shorter than the calyx-tube. Fruits pedicellate, hemispherical to sub-globose, 5 \times 7 mm. Disc flat or sub-convex. Valves enclosed or slightly exsert.

Habitat: Prefers open country and sandstone soils. Extends from sea-level to an altitude of 3000 feet or even higher.

Distribution: Widely distributed throughout Tasmania, and is confined to the State.

Hybrids: *E. salicifolia*, particularly at sea-level, is a very distinct biotype, and forms pure stands, often of considerable extent. Many hybrid races of varying degrees of fixation make this species at times somewhat bewildering. The principal hybridization has probably occurred with *E. viminialis* (see note on hybrids of *E. viminialis*), *E. ovata* and \times *E. Risdelata*. It is possible to note the influence of the last mentioned in the sucker foliage that follows destruction of a small stand by fire. Numerous instances of this occur in Southern Tasmania, e.g., about one mile from Huonville on the Hobart side. Tall, smooth-barked trees can be found with broad leaves where this species associates with *E. viminialis* and *E. ovata*. A notable example of this occurs on Tunnel Hill, Cambridge.

Affinities: With *E. linearis*.

19. *E. tenuiramis* Miq. Miquel, 1856—Ned. Kruidk. Arch., iv, 128. An imperfectly investigated species for Tasmanian distribution. Isolated trees at Risdon in *E. Risdoni*; *E. salicifolia* associations possess characters intermediate between the two species. Specimens of these were collected by Prof. A. L. McAulay, who showed that they matched the description in 'Key to the Eucalypts' (Blakely), p. 414. It was thought that they might be hybrids of the above-mentioned species. This suggestion has been justified, since seedlings show perfect segregation, and approach very closely to both the supposed parents. The specimens noted from Recherche Bay and Grass Tree Hill (*loc. cit.*) are probably of the same character. Material collected recently near Moina, from a group of trees with what appeared to be normal variation, matches very well material sent from Flinders Island. The venation, width of leaves, and other characters suggest *E. tenuiramis*, but until seedlings are raised it is not possible to label this material with any certainty.

The position appears to be roughly as follows:

- (1) There are trees on Flinders Island, and possibly other Straits Islands, which may justify separation from *E. salicifolia* as a species *E. tenaxramis*.
- (2) Most of, if not all, the material collected on the mainland of Tasmania, and labelled *E. tenaxramis*, is of hybrid origin, probably from *E. Risdoni*.

It remains, then, to investigate more fully the Straits Islands peppermint, and determine whether it forms any pure stands on the mainland of Tasmania.

The following description is quoted from 'Key to the Eucalypts'.

'A small to fairly tall tree, with a little rough persistent bark on the branches. Mature leaves alternate, petiolate, oblong-lanceolate to falcate-lanceolate, shortly apiculate or acuminate, thinly coriaceous and somewhat glossy on both sides, 5-11 \times 1-2.5 cm., the venation sub-obscure, the lateral veins irregular, and sometimes one or two near the base semilongitudinal, thin, diverging at an angle of 10-25 deg. to the somewhat prominent midrib; intra-marginal vein remote from the thin margin. Umbels axillary, 5-20 flowered; peduncles almost terete, 5-8 mm. long. Buds pedicellate, clavate, shining, sub-angular at the base, 5 \times 4 mm. Operculum patelliform, thick, shorter than the calyx-tube. Filaments all fertile; anthers reniform, very small. Fruit sub-pyriform to ovoid-truncate, somewhat thin, 3-4 celled, 8 \times 5 mm., the disc oblique or flat and scarcely exceeding the calycine ring; valves enclosed.'

Affinities: With *E. salicifolia* and *E. radiata* Sieber. The larger and different shaped fruits of the *E. tenaxramis* undoubtedly are those of the *E. Risdoni* hybrids above mentioned.

20. *E. linearis* Dehn. Dehnhardt, 1832--Cat. plant. horti. Camald., Ed. ii, 20. A small to medium tree, 6-15 m. Bark smooth, white, sometimes with bluish streaks. The narrow leaves give the tree a characteristic appearance. Juvenile leaves opposite for 5-6 pairs, minutely petiolate, linear to linear-lanceolate, 4-6 \times 0.2-0.3 cm. Mature leaves alternate, petiolate, linear to linear-lanceolate or linear-falcate, 5-12 \times 0.3-0.5 cm. Umbels axillary, 5-12 flowered. Peduncles terete to somewhat compressed, 7-10 mm. Buds clavate, shortly pedicellate, 4.5 \times 2-4 mm. Operculum hemispherical, minutely apiculate, shorter than the calyx-tube. Fruit petiolate, broadly globose to sub-pyriform, 4-6 \times 3-8 mm.; disc flat or oblique; valves enclosed.

Habitat: Shows adaptability to a variety of soils, but probably does best in those of a porous, light nature. Grows from sea-level to a moderate elevation, and thrives best in open country.

Distribution: Common in the South and East, and is closely associated with *E. viminalis* and often *E. globulus*. Some localities are: Hobart, Mt. Wellington, Kingston, Black Charlie's Opening (East Coast Road), Bagdad, Bruny Island.

Affinities: With *E. salicifolia*.

Hybrids: None observed. It is possible that the tree has had a hybrid origin from *E. salicifolia* and one of the Macrantherae, perhaps *E. viminalis*, since *E. linearis* is invariably associated with this species (see note on hybrids of *E. salicifolia*).

21. *E. Risdoni* Hook., f. Hooker, J. D., 1847—Lond. Journ. Bot., vi, 477. A very glaucous tree, 3-7.5 m. Bark smooth, deciduous, often retaining circular leaf scars until the first bark is completely shed. The bark of the adult tree is ashy-grey, streaked with cream. Juvenile leaves opposite for an indefinite number of pairs, connate, cordate-lanceolate, apiculate, glaucous, 4×2 cm. or larger. The connate character of the juvenile leaves is important. (Seedlings departing from this, and matching those in a hybrid swarm from a recognisable hybrid, sometimes occur in batches, raised from what is apparently a pure type.) It is suggested in this paper that the connate leaves are a constant character of the biotype, and the many departures noted in the various sessile or amplexicaul forms are due to hybridization. It is difficult to determine an intermediate leaf stage. Mature leaves opposite, connate, similar in shape to the juvenile, but becoming more lanceolate and sub-acuminate, strongly glaucous to dark glossy-green. The occasional alternate leaves observed ('Key to Eucalypts', Blakely, p. 214), it is suggested, are due to hybrid influence. Umbels axillary, 3-9 flowered. Peduncles terete to somewhat compressed, 7-10 mm. Buds clavate, strongly glaucous, pedicellate, $5-6 \times 4-5$ mm. Operculum hemispherical, obtuse, or apiculate, shorter than the calyx-tube. Fruit pedicellate, pyriform-truncate to nearly hemispherical, $6 \times 8-10$ mm. Disc moderately wide to thin and shrunken, flat to sub-oblique. Valves deeply to slightly enclosed.

Habitat: Prefers mudstone hills. The stock is non-viable and differs markedly in this respect from the forms classed under *E. Tasmanica* Blakely or the polymorphic group $\times E. Risdelata$.

Distribution: Extends from Risdon, following permo-carb. formations, to Cambridge. Muddy Plains and the valley of the South Esk are quoted by Blakely as localities, but I have not seen specimens from these districts. Confined to Tasmania.

The following quotation from Ewart, in 'Flora of Victoria', under *E. Australiana*—'In one form, sometimes known as *E. Risdoni*, the juvenile foliage is bluish-grey, with broad bases united across the stem'—must astonish any one who knows both species in the field or herbarium.

Affinities: With the polymorphic *E. Risdelata*, which covers a great range of forms, as can be seen in Plate XVI.

Hybrids: See note on *Eucalyptus Risdoni* Hook., f.

22. *E. pauciflora* Sieb. Sieber, 1827—Spreng. Syst., ov., Cur. Post., 195. The following description is somewhat unwieldy, and probably covers two, if not three, biotypes. Further investigation is necessary with this species. A small to medium tree, 6-15 m. Bark smooth to base, white or ash-grey, streaked with white. A sub-alpine type, is quite fastigate in character, and maintains this constantly; another form, often called Cabbage or Weeping gum, has remarkable pendulous branches, at times hanging in the fashion of a liana for 15 to 20 feet. Juvenile leaves opposite for 3-5 pairs, shortly petiolate, narrow to broad-lanceolate. Intermediate leaves alternate, petiolate, coriaceous, dark glossy-green to green, sub-glaucous to glaucous, up to $10-19 \times 10-14$ cm. or even larger. Mature leaves alternate, petiolate, with semilongitudinal venation, thick coriaceous, dark-green to green, shining, $8-14 \times 1.5-4$ cm. or larger. Umbels axillary, 5-15 flowered. Peduncles thick, terete, 7-25 mm. Buds clavate, pedicellate, $5-7 \times 4-5$ mm., angular or ribbed, glaucous or non-glaucous. Operculum hemispherical to sub-conical, acute, much shorter than the calyx-tube. Fruit pedicellate to shortly pedicellate, pyriform to pyriform-truncate or globose, glaucous or non-glaucous, $7-10 \times 8-12$ mm.; disc flat, broad to medium. Valves enclosed.

Habitat: Shows marked xerophytic characters at sea-level, where the tree flourishes in very dry conditions. The high-altitude forms often prefer moist, but not marshy, conditions.

Distribution: Common from sea-level to sub-alpine situations, and forms a very characteristic feature of eucalypt vegetation in the Midlands of Tasmania. The question of mainland distribution is an open one.

Affinities: Probably with *E. Simmondsi*. The following suggestions are made after an extensive field experience of the so-called *E. pauciflora* Sieb. in Tasmania. Three biotypes are tentatively suggested:—(1) The Weeping or Cabbage gum, so well-known in the Midlands of Tasmania. This was referred by Messrs. Baker and Smith, in 'Research on the Eucalypts of Tasmania', to *E. phlebophylla* F. v. M. There seems little doubt that this tree, although related to it, is specifically distinct from *E. pauciflora* Sieb. as described by Black in 'Flora of South Australia', Ewart in 'Flora of Victoria', and Blakely in 'Key to Eucalypts'. Mr. St. John, of the National Herbarium, Melbourne, a well-known authority on eucalypts, is of the opinion that the Tasmanian Cabbage gum is distinct from *E. pauciflora* Sieb. in Victoria. Fruit, buds, and branchlets often exhibit glaucousness. (2) A non-glaucous type, common in South-Eastern Tasmania and also at Sheffield. The sucker foliage

often reaches very large dimensions; the weeping character of the branches is not as marked as in the Cabbage gum. (3) A sub-alpine type, with leaves much narrower than in (1) or (2). The tree is of fastigate appearance, which it retains after maximum development. Forests of this type are to be observed at Interlaken and the Great Lake.

Hybrids: With $\times E. Risdelata$ and *E. salicifolia*. For other important notes on hybrids see *E. Dalrympleana* and *E. aggregata*.

23. *E. coccifera* Hook., f. Hooker, J. D., 1847—Lond. Journ. Bot., vi, 477. A small to medium tree, about 1-12 m. Bark smooth, deciduous to butt, slate-grey in colour. Juvenile leaves opposite for an indefinite number of pairs, sessile, elliptical or cordate-orbicular, glaucous. Intermediate leaves alternate, petiolate, oblong-lanceolate, apiculate or sub-acuminate. Sub-glaucous. Mature leaves sub-glaucous to glaucous, alternate, petiolate, uncinat, 5-6 \times 1.5-2 cm. Umbels axillary, 3-6 flowered. The 3-flowered type is characteristic of the Mt. Wellington range, and apparently does not extend north of this. Peduncles compressed and often somewhat triangular in shape, or sub-terete, 5-10 mm. Buds glaucous or sub-glaucous, clavate, angular or markedly costate, 8-10 \times 5-6 mm. Operculum flat or concave, much shorter than the calyx-tube. Fruit sessile, or shortly petiolate, globose to hemispherical or broadly turbinate, shining or glaucous, smooth or somewhat furrowed or bicostate, 7-9 \times 10-12 mm. Disc flat or convex, 3-4 mm. broad. Valves enclosed.

Var. parviflora Benth. Benth, 1866—Flora Aust., iii, 204. Similar to type, but floral parts and leaves much smaller. A taller tree, up to 18 m. or taller, with much less glaucousness when growing in sheltered valleys, the mature leaves sometimes with slight sheen. Buds sometimes with a calyptra.

Habitat: An alpine species, preferring an altitude of 3000-4000 feet. The type flourishes in exposed situations, while the var. *parviflora* is found in sheltered valleys, where it attains the height of a medium tree.

Distribution: Common at alpine levels throughout the Island. The 3-fruited form, as far as can be judged, is confined to the South.

Affinities: In some of its characters it presents remarkable resemblances to some of the forms of $\times E. Risdelata$.

Hybrids: None observed.

24. *E. Dalrympleana* Maiden. Maiden, 1920—Forest Flora of N.S.W., Vol. VII, Pt. IV, 137. A medium to tall tree, 12-30 m. Bark smooth, deciduous, white or pinkish, with bluish streaks and blotches. Juvenile leaves opposite for an indefinite number of pairs, sessile, varying greatly in shape, size, and degree of glaucousness, cordate to orbicular, ovate-lanceolate to oblong-lanceolate, 4-6 \times 4-5 cm., and frequently much larger. Intermediate leaves opposite, petiolate, ovate to elliptical or ovate-lanceolate, varying in size

and degree of glaucousness. Mature leaves alternate, broad-lanceolate to narrow-lanceolate and lanceolate, with very long petioles, dark-green, glossy, and very coarsely veined, $10-22 \times 1.5-2.5$ cm., and sometimes much larger. Umbels axillary, 3-flowered. Peduncles compressed to subterete, 4-7 mm. Buds strongly pedicellate (the description 'sessile' in 'Key to Eucalypts' supports my belief that *E. Dalrympleana* is a polymorphic species belonging to Group (2), narrow to broadly ovoid, $7-8 \times 3-5$ mm. Operculum acutely to bluntly conical, as long as the calyx-tube. Fruit pedicellate, variable in shape and size, turbinate to globose, $7-10 \times 8-9$ mm. Disc domed to flat. Valves strongly exsert.

Habitat: Prefers sub-alpine situations in river valleys or alluvial flats.

Distribution: Common at altitudes between 2000 and 3000 feet. Tasmania: Waddamana, Lake St. Clair, Middlesex Plains, &c. Also New South Wales and Victoria.

Affinities: With *E. rubida* and *E. viminalis*.

Hybrids: With *E. rubida* where the two meet. From impressions in the field, and a study of seedlings, there is a possibility that the species had its origin in *E. rubida* and one or more others, including *E. pauciflora*. The evidence is not strong enough yet to advance this as any more than an opinion.

25. *E. Johnstoni* Maiden (*E. Muelleri* T. B. Moore). Maiden, 1922—Crit. Rev., Pt. LVI, 280. Moore, T. B., 1886—Proc. Roy. Soc. Tas., 267. A small to medium tree, 9-12 m. Bark smooth, deciduous, blotched, and with a prevailing tone of olive-green. Juvenile leaves opposite for an indefinite number of pairs, sessile to shortly petiolate, crenulate and undulate, dark-green and glossy. Intermediate leaves alternate, petiolate, oblong-ovate to lanceolate, coriaceous and vernicose, subcrenulate, $3-6 \times 2.5-6$ cm. Mature leaves dark-green, vernicose, alternate, petiolate, lanceolate to narrow-falcate-lanceolate $5-10 \times 1.5-3$ cm. Umbels axillary, 3-flowered. Peduncles compressed to strap-shaped or triangular, broad to narrow, 4-7 mm. Buds sessile, broadly turbinate to subelliptical, angular, 3 or 4 ribbed, $8-14 \times 6-10$ mm. Operculum flat, markedly umbonate or ridged across the top, shorter than the calyx-tube. Fruit hemispherical to broadly turbinate, 2-3 ribbed or narrowly winged, $7-10 \times 10-14$ mm. Disc domed, prominent. Valves large and exsert.

There is little doubt that the descriptions of this species have been based on the Mt. Wellington forms, but T. B. Moore included the very similar *E. subcrenulata* in the distribution. A study of a large quantity of material selected for as wide a range in size or fruit as possible reveals the existence of two forms: one, a large fruited type, tends in leaves and shape of buds towards *E. globulus*; the other shows transit to *E. subcrenulata*. The above measurements in the description indicate a very wide spread in the characters

chosen. It is here suggested that *E. Johnstoni* has arisen from *E. globulus* and *E. subcrenulata*, and is in process of becoming stabilized. A possible future course might be to establish two biotypes, or by a process of future intraspecific hybridization evolve a single biotype intermediate between the abovementioned forms. In support of this suggestion, which is based upon a close comparison between reproductive parts of *E. subcrenulata* and *E. Johnstoni*, it may be mentioned that, as far as can be ascertained, *E. Johnstoni* is confined to Mt. Wellington, and *E. subcrenulata* does not associate with *E. globulus*, which grows on the lower slopes of Mt. Wellington. There is apparently no *E. subcrenulata* on Mt. Wellington. In further support of the possibility, it may be added that Prof. A. L. McAulay and myself have independently concluded, on field and horticultural evidence, that the non-glaucous *E. urnigera*, confined to the south-east and south face of Mt. Wellington, has probably arisen from *E. Johnstoni* and *E. urnigera*, which latter is a markedly glaucous species on the eastern face of Mt. Wellington and in its wide distribution beyond this. The probability of an *E. globulus* component is increased by the extreme difficulty of separating some forms of *E. unialata*, an established hybrid of *E. globulus*, from the coarser fruited form of *E. Johnstoni*.

Habitat: Sub-alpine to alpine.

Distribution: As far as known at present, confined to Mt. Wellington.

Affinities: With *E. globulus*, *E. subcrenulata*, and *E. vernicosa*.

Hybrids: With *E. urnigera*.

26. *E. Simmondsi* Maiden. Maiden, 1922—Crit. Rev., Pt. LVII, 344. The following description is quoted from 'Key to Eucalypts' (Blakely): 'A tree 40-60 feet high (about 12-20 m.). Bark rough, fibrous, persistent on stem, branches smooth or ribbony. Timber pale, reputed durable. Juvenile leaves opposite for a large number of pairs, glaucous, ovate to broadly lanceolate, sessile to shortly petiolate, 5-10 × 3-5 cm. Mature leaves alternate, petiolate, coriaceous, lanceolate, 10-15 × 1-2 cm. Venation more or less longitudinal. Umbels axillary, 5-15 flowered. Peduncles terete or nearly so, 5-7 mm. long. Buds clavate, shortly pedicellate, 6-7 × 5-6 mm. Operculum hemispherical, less than half as long as the calyx-tube, obtuse or slightly umbonate. Fruits conoid to turbinate, 9-10 mm.; disc well defined, convexed, almost enclosing the short valves.'

'An imperfectly known species from Smithton, Tasmania. Flowers about December'.

Distribution: The type specimen is given as collected at Smithton. I am not familiar with the trees in the field. As far as yet known, confined to Tasmania.

Affinities: From the robustness and length of the pedicels, and the nature of the venation and the juvenile foliage, the suggestion

is that its origin is *E. pauciflora* and one of the macrantherae, possibly *E. viminalis*. I have collected material similar to this in the Cradle Mt. area, and make the very tentative suggestion that *E. Simmondsi* is polymorphic and belongs to Group 11.

27. *E. Tasmanica* Blakely. (*E. Risdoni* Hook. f., var. *E. elata* Benth., in part.) Blakely, 1934—'Key to Eucalypts', p. 211. The type description is quoted below: 'Arbor insigniter glauca, 10-70 pedes alta (circa 9-21 m.) cortice levi, deciduo. Folia juvenilia opposita, sessilia, cordato-lanceolata, connata, 3-6 cm. longa, 2.5-5 cm. lata. Folia matura alterna, petiolata, angusto-lanceolata, acuminata, 5-16 cm. longa, 1-3.5 cm. lata. Inflorescentia in umbellis axillaribus, 6-25 floris. Gemmae clavatae, glaucae, 5-6 mm. longae, 5 mm. latae, in crassos pedicellos angustatae. Operculum patelliforme, claycis tubo brevius. Antherae reniformes. Capsulae turbinatae vel subpyriformes, truncatae, pedicellatae, 9-13 mm. longae, 7-11 mm. latae.'

A study of Plate XVI will show that this description only covers part of the polymorphic \times *E. Risdelata*. The operculum in fig. 3 is not patelliform. From a study of the type description I suggest that *E. Tasmanica* Blakely is \times *E. Risdomacranthelata* in part.

Distribution: Very widely distributed throughout Tasmania, and is confined to the State.

Affinities: With *E. Risdoni*.

28. *E. unistata* Baker and Smith. (*E. viminalis*, var. *macrocarpa* Rodway.) Baker and Smith, 1912—*Proc. Roy. Soc. Tas.*, 106. A small to medium tree, 6-12 m. Bark smooth, deciduous, white in colour, or rough lightly furrowed with kino exudations, ribbony on branches. Juvenile leaves opposite for an indefinite number of pairs, glaucous, ovate to ovate-cordate to oblong-lanceolate, 5-7 \times 1.5-3 cm. or larger. Intermediate foliage petiolate, short-lanceolate to falcate-lanceolate. Mature leaves petiolate, with resemblance to those of *E. globulus* and *E. viminalis*, acuminate, dark-green, subverniceous, up to 10 \times 1.5-2 cm. Umbels axillary, 3-flowered. Peduncles broad, compression, 3-5 mm. Buds elliptical, sessile, or subsessile, green or subglaucous, 10-15 \times 7-10 mm. Operculum obtusely conical to substrate, as long as the calyx-tube. Fruit sessile, broadly obconical, turbinate or hemispherical. Disc flat or convex, valves slightly to strongly exsert.

Habitat: Only occurs as isolated trees in associations of *E. globulus* and *E. viminalis*.

Distribution: Tasmania—Eaglehawk Neck, Grass Tree Hill, Lindisfarne, Belliver, Mt. Nelson. Also on Port Phillip Island.

Affinities: With *E. globulus*, *E. viminalis*, and *E. Johnstonii*.

29. *E. biangularis* Simmonds. Maiden, 1927. *Conn. Rev.*, PL. LXVIII, 382. The following note by Simmonds appears on the label of the type specimen: 'Tree in grounds of W. D. Hunt, Invercargill, New

Zealand. In general aspect and bark, similar to *E. urnigera*. Jan. 14, 1918'. There is no record of a tree similar to this growing naturally in Tasmania. In the absence of any field notes the following description is quoted from 'Key to Eucalypts' (Blakely): 'A tree 40-100 feet high (about 12-24 m.), with a smooth deciduous bark. Timber not seen. Juvenile leaves opposite for an indefinite number of pairs, glaucous or pale-green, sessile cordate. Mature leaves alternate, petiolate, narrow to broad-lanceolate, 14-17 \times 1.3-3.5 cm. Umbels axillary, 3-flowered. Peduncles strap-shaped, 10-17 mm. long. Buds turbinate, glaucous or brownish, sessile or nearly so, biangular, very warty, 20 \times 13 mm. Operculum broadly conical or cap-like, warty, shorter than the calyx-tube. Anthers versatile, oblong, opening in parallel slits, gland ovate, moderately large. Fruit urceolate to campanulate, biangular, with very short compressed pedicels, 27 \times 20 mm. Disc thin, somewhat doubled, the inner portion broad and convex; valves deeply enclosed (Teddington, Botanic Gardens, Christchurch, New Zealand); grown from seed imported from Tasmania'.

Affinities: The suggestion of *E. globulus* \times *E. urnigera* is very strong. *E. globulus* produces an occasional hybrid with the allied *E. cordata* (see *E. globulus*, var. *Harrisoni*, in the Rodway Herbarium).

30. *E. Irbyi* Baker and Smith. Baker and Smith, 1920—Research on the Eucalypts, 2nd edition, 242. A small tree, up to 12 m., with a smooth bark, pale or ashy coloured. Juvenile leaves opposite for an indefinite number of pairs, sessile to shortly petiolate, glaucous, ovate to cordate. I have not yet been able to verify the statement 'juvenile leaves opposite for several pairs' ('A Key to Eucalypts', Blakely). Intermediate leaves alternate, petiolate, broadly lanceolate. Mature leaves alternate, petiolate, narrow-lanceolate to ovate-lanceolate, 10-20 \times 1.5-2.5 cm. Umbels axillary, 3-flowered. Peduncles terete, 4-7 mm. long. Buds distinctly pedicellate to shortly pedicellate, with turbinate calyx-tube, 5-6 \times 4-5 mm. Operculum shorter than calyx-tube, blunt to apiculate or subrostrate. Fruit hemispherical to sub-cylindrical, glaucous to non-glaucous, pedicellate, 7 \times 7-9 mm. in diameter. Valves slightly exsert.

Habitat: Trees are isolated, and do not form pure stands, and are found only in association with *E. Gunnii* and *E. Dalrympleana*.

Distribution: Not reported outside Tasmania. Alma Tier. Similar forms can be found in the *E. Gunnii* and *E. Dalrympleana* association at Daisy Dell, in the Cradle Mt. area.

Affinities: With *E. Gunnii* and *E. Dalrympleana*. This tree, which combines the characters of both species, is of direct hybrid origin, and its hybrid character is observable even in the cotyledon stage.

31. *E. taeniola* Baker and Smith. Baker and Smith, 1912--Proc. Roy. Soc. Tas., 198. A medium tree, 12-15 m. Bark fibrous and persistent on trunk, dark-grey, furrowed, and resembling that of *E. Sieberiana*, upper branches smooth. Juvenile leaves opposite for 4-5 pairs, petiolate, narrow-lanceolate, pale-green, 10-15 \times 1-5 cm. Intermediate leaves petiolate, narrow-lanceolate to falcate-lanceolate, mainly with semilongitudinal venation, a few pinnately veined. Mature leaves alternate, narrow to broad-lanceolate and subfalcate, 8-20 \times 1-2.5 cm., venation semilongitudinal. Umbels axillary, 3-7 flowered. Peduncles strap-shaped, 5-12 mm. Buds clavate, pedicellate, 5-7 \times 3-4 mm. Operculum hemispherical, apiculate, shorter than the calyx-tube. Fruit pedicellate, pyriform-truncate to pyriform-globose, subfalcate, 7-9 \times 5-9 mm. Disc flat to oblique. Valves deeply enclosed.

Habitat: Found as isolated trees only in mixed stands of *E. salicifolia* and *E. Sieberiana*.

Distribution: Not reported outside Tasmania. St. Mary's Pass, St. Helens.

Affinities: With *E. Sieberiana* and *E. salicifolia*. There is every indication that the tree is *E. Sieberiana* \times *E. salicifolia*. The hybrid character is evident at the cotyledon stage.

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PLATE XV

Figs. 1-5 represent seedlings from *E. unialata*, components of $\times E. \text{viminalis} \times E. \text{viminalis}$.

Fig. 1.—Seedling indistinguishable from *E. globulus*.

Fig. 2.—Leaves glaucous but narrower than those in *Fig. 1*.

Fig. 3.—Seedling showing leaves similar to those on specimens from Mt. Nelson labelled *E. Dalrympleana* by Maiden.

Fig. 4.—Juvenile leaves; would match those on many trees that are at present classed as *E. viminalis*.

Fig. 5.—Seedling indistinguishable from *E. viminalis*.

Fig. 6.—Specimens of *E. unialata*, showing capsules from which seedlings in *figs. 1-5* were obtained.

Fig. 7.—*E. globulus* with the majority of the umbels 5-fruited. Probably a component of $\times E. \text{viminalis} \times E. \text{viminalis}$.

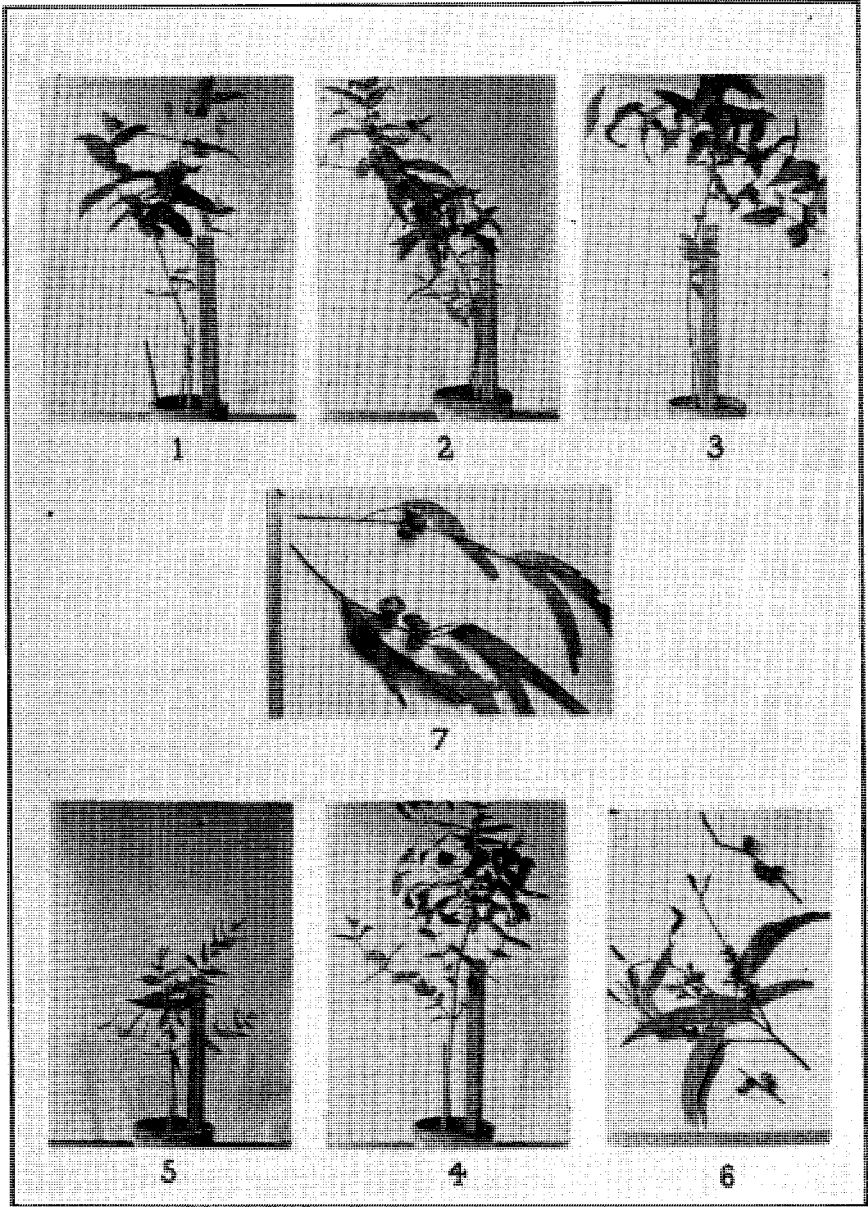


PLATE XVI

Fig. 1.—Probably *E. Risdocordata*, obtained from an association of *E. Risdelata* and *E. cordata*.

Fig. 2.—*E. Risdomacranthelata*.

Fig. 3.—*E. Risdopaucdata*. The figure does not indicate the semi-longitudinal venation shown in the leaves. Fruit and leaves are similar to hybrids of *E. pauciflora* and *E. salicifolia*.

Fig. 4.—A good example of *E. Risobliquata*.

Fig. 5.—Typical *E. Risosacilata*.

Fig. 6.—*E. Risdomacranthesalicata*. Gives a swarm segregating towards *E. Risdomacranthelata* and *E. salicifolia*.

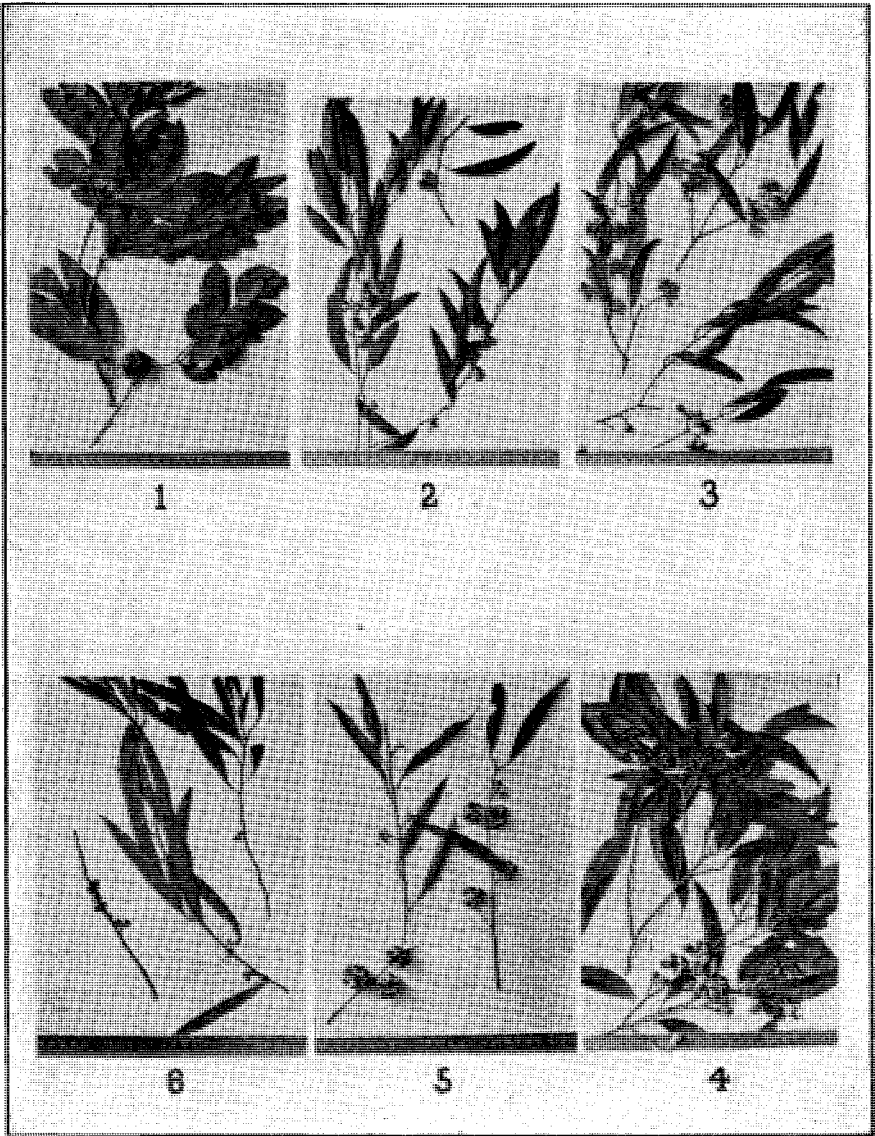


PLATE XVII

Eucalyptus nitens

A. Immature fruit. B. Mature fruit.

