

ASSOCIATION OF SOCIETIES FOR GROWING AUSTRALIAN PLANTS  
CALYTRIX STUDY GROUP NEWSLETTER 17-SEPTEMBER 2003

---

We have several new members and I wish to welcome to the Group.

Responses to the questionnaire in the last newsletter have been good and as a result I have been able to determine the direction most members of the group seem to wish to follow. We are particularly fortunate to have Lyndsay Craven as a member of our group, Lyn is the botanist who reviewed the Genus in 1987 and has identified 4 new species since then in 1990 and 1991, with another currently being reviewed.

Based on your responses and his suggestions it would seem that the first step we should take is to concentrate on a species that is reasonably well known and has been proven in cultivation, *Calytrix tetragona*. *Calytrix tetragona* is a variable species which can be found in all States. It also has the proven ability as being reliable on its own roots and has the potential to be a rootstock for other species of Caltrix.

I have attached below extracts from *Brunonia*, Volume 10, Number 1, 30 September 1987, in which Lyn Craven provides both a key for the Genus and also provides a full description of the species with locations. It is reproduced for study purposes only and we respect and acknowledge the copyright of the author and publication.

I believe that we should as an initial project identify locations of specimens of the species, compare them to the botanical description, noting differences particularly in size, shape and colour for horticultural potential. I will in the next newsletter have details on how to apply for permission to collect specimens and what to look for in collecting specimens for botanical identification. Should members have any difficulty in understanding botanical terms used for identification please let me know, I am working on the basis that you all know how to identify specimens botanically and can read a key. I have attached a copy from pages 5, 6 and 7 of *Brunonia* with leaf, bud and *cheiridion* descriptions

As a component of that first project members with specimens of the species from areas of known provenance could advise me and also propagate additional numbers, best by

cuttings of firm new growth. As a further project I believe we should be endeavouring to trial the different forms and variants of this species under different climatic conditions. We can determine which form or forms are the best horticulturally and which may be reliable rootstock for grafting.

I look forward to hearing from you, particularly over the next few months during the main flowering period of August to December. Please feel free to forward any pressed specimens to me.

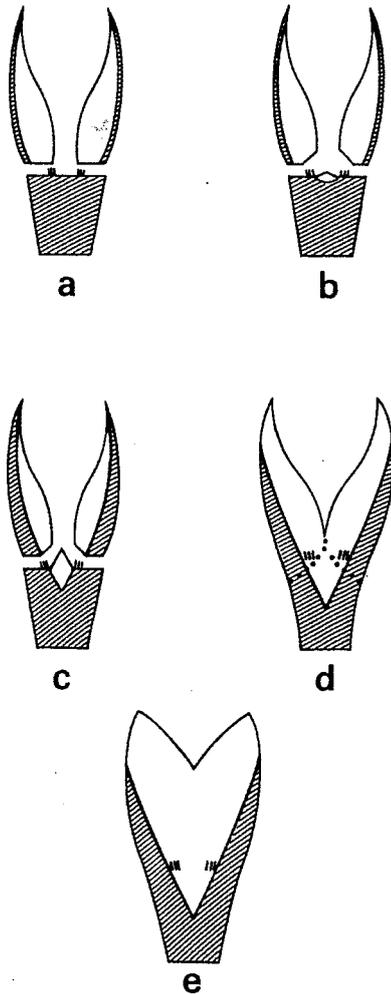
I will publish another newsletter just prior to Christmas with results to date and extracts from your letters, should not wish to be published, please advise me.

Here is the key to the Genus produced on pages 21 to 26 and a description of Caytrix tetragona produced on pages 29 to 33 in Brunonia.

Bud scales occur in several species of *Calytrix*. They are characteristic of one group of the genus, the *C. tetragona* group, but also occur in other species (see list on p. 19). In the *C. tetragona* group the bud scales are apparently derived from the leaf petiole but in *C. sapphirina* and *C. violacea* the scales are apparently laminar in origin.

### *Inflorescence*

The inflorescence in *Calytrix* is a 1-flowered unit (a monad), consisting of a peduncle with 2 free or connate, deciduous or persistent, bracteoles subtending the single flower. Pedicels, in the strict sense of the word, do not occur (nor are the flowers themselves stipitate). The monad is itself subtended by a leaf, here called a floral leaf.



**Figure 2.** Development of the cheiridium: *a*, peduncle with enations in the axils of free and deciduous bracteoles, e.g. *C. achaeta*; *b*, apex of peduncle slightly extended with the region between the bracteoles becoming prominent, e.g. *C. glaberrima*; *c*, apex of peduncle distinctly extended with the region between the bracteoles becoming even more prominent than in *b*, e.g. *C. fraseri*; *d*, bracteoles persistent and connate at the base (dotted line indicates zone of fusion), e.g. forms of *C. depressa*; *e*, bracteoles connate for much of their length, e.g. *C. glutinosa*.

The floral zone of a shoot may have from one to many flowers, with the flowers either dispersed along the stem, or closely clustered with the floral leaves often modified into bracts. Pseudanthia as described in the myrtaceous genera *Actinodium* Schauer and *Darwinia* Rudge by Briggs and Johnson (1979) do not occur. In some *Calytrix* species the flower cluster has a suppressive effect on the apical meristem which fails to continue growth after flowering, new growth arising from leaf axils below the floral zone. While this feature may be common in a particular species it is never sufficiently constant to be used diagnostically. Vigorous growth can apparently overcome the suppression factor

as shown by one collection of *C. tetragona* in which the flowers are mostly clustered, each flower subtended by bracts or modified leaves, while on some young vigorous growth the flowers are scattered and subtended by typical leaves [Orchard 1182 (AD, CANB)].

Useful characters occur in the morphology of the peduncle and bracteoles. Modifications in these organs have led to the development of a highly unusual structure. The peduncle may be unmodified, as in *Calytrix achaeta*, or more commonly it is extended at the apex in such a way that the perimeter surrounds the base of the hypanthium for a short distance, as in *C. fraseri*. In both of these species the bracteoles are free and deciduous but occasionally the bracteoles can be connate and deciduous, as in some collections of *C. sapphirina* (which also has apically extended peduncles). The most highly developed state occurs when the bracteoles are persistent on the extended peduncle and connate as well, thus forming a single structure, as in *C. glutinosa*. The bracteoles are never completely connate; the distal portions always remain free.

Although the connate and persistent condition of the bracteoles occurs in about 70% of the species of *Calytrix*, no morphological term has been applied to it, and it appears as if homologous structures have not previously been reported. 'Cheiridium' (from the Greek word *cheiridion*, meaning 'little sleeve') seems to be an appropriate term for this structure and is so used in this revision. It has not been used in the generic description because of its relatively limited relevance to the Myrtaceae as a whole, although it can be applied in other genera of Chamelaucieae, e.g. *Calythropsis* and *Wehlia*. The presumed development of the cheiridium is illustrated diagrammatically in Figure 2. In some species, especially *C. carinata*, *C. depressa* and *C. tetragona*, development of the cheiridium is not always complete, the bracteoles sometimes being deciduous. When deciduous the bracteoles are usually free although in *C. tetragona* they may also be connate. *Calytrix creswellii* differs from the other cheiridiate species in that the bracteoles are persistent but completely free. This presumably represents an intermediate stage in the development of the cheiridium.

At the apex of the peduncle, in the axils of the bracteoles, there may be a number of minute enations which are similar in texture to the enations occurring in the leaf axils. Enations may also be present in one or two discontinuous series on the inner surface of the cheiridium, where they demarcate the peduncular and bracteolar tissue. If the enations are absent the distinction between tissues can be difficult to make, although sometimes epidermal discontinuities can be a guide. Possibly these enations are the last traces of elements of an ancestral compound inflorescence or, more likely, they are homologous with the enations in the leaf axils and represent vestigial stipules.

### *Hypanthium*

In overall shape the hypanthium varies from being short and cup-shaped to long and more or less cylindrical. It is often produced considerably above the ovary and then forms a narrow tube around the style. This tube can be some appreciable distance from the style or may surround it tightly. In a number of species it is actually adnate to the style, either completely or incompletely. When adnate is used in the keys and species descriptions it means, unless stated otherwise, that the hypanthium is adnate to the style for the entire length of the hypanthium.

The evolution of the different hypanthium types appears to be relatively straight forward and is shown in Figure 3. In general there is a positive correlation between the length of the calyx segments and the length of the hypanthium. As a rule the style is deciduous above the hypanthium apex only in fully adnate species although there are exceptions such as *C. violacea* and *C. acutifolia* in which the hypanthium is not elongated beyond the ovary but the style is deciduous. From a cup-shaped structure with unawned calyx segments (type a, e.g. *C. glaberrima*) the hypanthium has increased in length and the calyx segments are long acuminate (type b, e.g. *C. brownii*). From type b has developed a common condition in *Calytrix*: a long hypanthium with long-awned

*C. variabilis* alliance:

(Distinctive features are the usually well developed cheiridia and dichromatic, predominantly purple flowers)

62. *C. variabilis*  
63. *C. breviseta*

64. *C. pulchella*  
65. *C. tenuiramea*

Other alliances in the multiseriate groups exist in the form of species pairs, e.g. *C. angulata*-*C. divergens* and *C. amethystina*-*C. gracilis*, but once these are taken out the residue consists of species such as *C. decussata* and *C. fraseri* which do not appear to be particularly closely related to any of the others.

The *Calytrix violacea* group is not homogeneous and almost certainly will prove to be polyphyletic. In view of the presence of derived features such as the peduncle elongation and/or cheiridium development, the reduced number of hypanthium ribs in *C. acutifolia*, the tapered base of the hypanthium (although not sharply in *C. acutifolia*), and the number of series of stamens the lack of an extended hypanthium may represent a derived condition also. The relationships of *C. violacea*, *C. parvivalis* and *C. nematoclada* may well lie with *C. strigosa* and those of *C. merrelliana* with *C. sapphirina*. *C. acutifolia*, apart from the 3-seriate stamens and the lack of bud scales, has a number of features in common with some species of the *C. tetragona* group (scattered flowers, short hypanthium and white petals) and it may in fact prove to be better placed in that group.

## Taxonomic Treatment

## CALYTRIX

Labill., Nov. Holl. Pl. Spec. 2: 8, t. 146 (1806). — *Calycothrix* Meissner, Pl. Vasc. Gen. Pt. 1: 107, Pt. 2: 76 (1838), *nom. illeg.* — *Trichocalyx* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 238 (1841), *nom. rej.*, non Balf. f. (1884). — *Calycothrix* sect. *Macrochaetae* Niedenzu, in Engl. & Prantl, Nat. Pflanzenfam. III. 7: 100 (1893), *nom. illeg.* — *Calythrix* sect. *Eucalythrix* Kuntze, in T. Post & Kuntze, Lex. Gen. Phan. 94 (1903), *nom. illeg.* — *Calythrix* sect. *Macrochaetae* (Niedenzu) C. Gardner, Enum. Pl. Austral. Occ. 96 (1931), *nom. illeg.* — Typus: *Calytrix tetragona* Labill.

*Lhotskya* Schauer, Linnaea 10: 309 (1836). — *Calycothrix* sect. *Lhotskya* (Schauer) F. Muell., Trans. & Proc. Philos. Inst. Victoria 3: 43 (1859). — *Calythrix* sect. *Lhotskya* (Schauer) Kuntze, in T. Post & Kuntze, Lex. Gen. Phan. 94 (1903). — Typus: *Lhotskya ericoides* Schauer.

*Calycothrix* sect. *Brachychaetae* Niedenzu, in Engl. & Prantl, Nat. Pflanzenfam. III. 7: 100 (1893), *nom. inval.* — *Calythrix* sect. *Brachychaetae* (Niedenzu) C. Gardner, Enum. Pl. Austral. Occ. 95 (1931), *nom. inval.* — Typus: not designated.

*Calythrix* sect. *Coelotrachylae* J. Black, Trans. & Proc. Roy. Soc. South Australia 52: 226 (1928), *nom. inval.* — Typus: not designated.

*Calythrix* sect. *Stereotrachylae* J. Black, Trans. & Proc. Roy. Soc. South Australia 52: 226 (1928), *nom. inval.* — Typus: not designated.

[*Calycothrix* I. *Exstipulatae* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 240 (1841), *nom. nud.*]

[*Calycothrix* II. *Stipulatae* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 242 (1841), *nom. nud.*]

[*Calycothrix* II. *Stipulatae* A. *Octandra* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 242 (1841), *nom. nud.*]

[*Calycothrix* II. *Stipulatae* B. *Decandrae* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 243 (1841), *nom. nud.*]

[*Calycothrix* II. *Stipulatae* C. *Icosandrae* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 245 (1841), *nom. nud.*]

[*Calycothrix* sect. *Coilosiphon* F. Muell., Fragm. 10: 27 (1876), *nom. nud.*]

[*Calycothrix* sect. *Plerosiphon* F. Muell., Fragm. 10: 26, 27 (1876), *nom. nud.*]

Small to large shrubs, glabrous or with simple unicellular hairs, with or without bud scales. Leaves small, alternate, decussate or verticillate; stipules present or absent, mostly minute. Inflorescences 1-flowered, one to many per branchlet, in the axils of leaves or bracts, the flower pedunculate and subtended by a pair of persistent or deciduous, free or connate bracteoles. Flowers bisexual, perigynous or, when the hypanthium is adnate to the style, epigynous. Hypanthium short, or produced above the ovary into a long tube which is free from, or partly to completely adnate to, the style; rarely with the distal portion deciduous after anthesis. Calyx segments 5, imbricate, persistent (or lost with the distal part of the hypanthium), slightly connate at the base or free, the apex truncate (occasionally emarginate) to long attenuate or awned. Petals 5, imbricate, deciduous. Stamens usually indefinite in number (c. 6-150), 1-to several-seriate or arranged irregularly, the filament free, erect in bud or rarely a few in each bud inflexed, the anther dorsifixed, versatile or restricted by the connective, 2-celled, dehiscing by longitudinal slits. Ovary unilocular, the ovules 2 or rarely 3-4, anatropous, collateral on an axile-basal placenta; style slender, persistent or deciduous, the stigma minute, punctiform to subcapitate. Fruit dry, indehiscent (the hypanthium in fruit morphologically little changed from the hypanthium in flower). Seed 1, obovoid to narrowly obovoid, the testa membranous; embryo straight, obovoid to narrowly obovoid, with 2 short, plano-convex cotyledons at the apex of the thickened hypocotyl, endosperm absent. *Chromosome number*:  $x = 11$ ;  $2n = 22, 44$ .

As discussed above, there are no consistent differences by which *Lhotskya* can be separated from *Calytrix* and the two genera are here combined. The name *Trichocalyx* Schauer, listed as a *nomen rejiciendum* in the International Code of Botanical Nomenclature (Stafleu *et al.* 1978), apparently has never been used for *Calytrix*; Schauer merely suggested that it was a better derived word than *Calytrix* and he himself used Meissner's name, *Calycothrix*. The recognition of infrageneric taxa above the rank of species is not feasible as yet and for this reason no attempt has been made to lectotypify or otherwise validate any of the invalid sectional names proposed to date. This would be done more appropriately by an author wishing to use them in developing a formal infrageneric classification.

#### *Diagnostic Features of Limited Occurrence*

Some features are diagnostic only for a limited number of species. Their variation in the genus is discussed here because in the accounts of the species and subspecies they are described only for those taxa for which they are diagnostic.

1. Usually only a few secondary branchlets develop at the nodes of any one growth flush of a primary axis but in *C. achaeta* short secondary branchlets develop at nearly every node and persist for one to several seasons before senescing. A tendency to this type of branching pattern, although not as well developed as in *C. achaeta*, can also be observed in a few other species, e.g. *C. exstipulata* and *C. verticillata*.

2. Phyllotaxy is usually alternate but is verticillate in *C. verticillata* and decussate in *C. decussata*, *C. nematoclada*, *C. parvivalis* and *C. praecipua*. In *C. merrelliana* and *C. simplex* subsp. *suboppositifolia* the leaves are mostly alternate with some being opposite or subopposite.

3. Generally bud scales are absent but in certain species they occur on terminal buds (apparently they occur only at the apex of existing shoots, i.e. axillary buds do not possess them). The species which characteristically have bud scales are: *C. alpestris*, *C. erosipetala*, *C. glaberrima*, *C. gypsophila*, *C. involucrata*, *C. smeatoniana*, *C. tetragona*, *C. violacea* and *C. warburtonensis*. In *C. sapphirina* bud scales are rare, usually the buds being subtended by modified leaves that are morphologically rather similar to the floral leaves.

4. The leaves of an individual specimen are usually fairly similar throughout the specimen but in the following species the leaves subtending the flowers often are morphologically different from the usual stem leaves: *C. alpestris*, *C. divergens*, *C.*

*glutinosa*, *C. involucrata*, *C. islensis*, *C. platycheiridia*, *C. sapphirina*, *C. smeatoniana*, *C. superba*, *C. tetragona* and *C. violacea*. In *C. variabilis* the leaves of flowering growth increments are usually all different from those of the vegetative growth increments.

5. Stipules are generally solitary on each side of the petiole base (i.e. 1-paired) in all species, although development of the flower can cause inner enations to become displaced making the stipules appear 2-paired. In *C. duplistipulata* and *C. similis*, however, the presence of 2-paired stipules, especially in leaves subtending flowers, seems to be more than an artefact for the pairs are well developed.

6. The enations occurring in the leaf axils are very distinctly turgid in *C. brevifolia* and *C. truncatifolia* whereas in all of the other species they are not turgid.

7. When enations occur on the inner surface of the cheiridium they are in one (often discontinuous) series around the inner surface in all species except *C. creswellii*, in which there are two such series.

8. The apex of the peduncle (including those instances in which the peduncle forms part of the cheiridium) is distinctly extended so as to surround the base of the hypanthium in all species except *C. achaeta*, *C. acutifolia*, *C. alpestris*, *C. brownii*, *C. glaberrima*, *C. platycheiridia*, *C. rupestris*, *C. smeatoniana*, *C. sylvana* and *C. verticillata*. In these species the peduncle apex is scarcely, or not, extended.

9. The bracteoles or cheiridium are, in most of the species, variously ornamented (e.g. keeled, ridged or grooved) or turgid but the following species lack any such ornamentation: *C. alpestris*, *C. amethystina*, *C. aurea*, *C. birdii*, *C. decandra*, *C. drummondii*, *C. duplistipulata*, *C. faucicola*, *C. flavescens*, *C. fraseri*, *C. glaberrima*, *C. habrantha*, *C. leptophylla*, *C. merrelliana*, *C. plumulosa*, *C. sapphirina*, *C. simplex*, *C. strigosa* and *C. superba*. In *C. glutinosa* the cheiridium is viscid, a feature which only occurs in that species.

10. There are several features of the hypanthium which are characteristic only for certain species. In *C. harvestiana* the hypanthium is articulated just below the calyx and the distal region is deciduous; none of the other species have an articulated hypanthium. (Although the distal region is deciduous in *C. truncatifolia* and some collections of *C. brevifolia* these two species lack any articulation.)

11. The hypanthium is more or less straight in all of the species except *C. paucicostata*, in which it is slightly curved towards the branchlet.

12. The hypanthium is produced above the ovary for at least 2 mm in all species except the following: *C. achaeta*, *C. arborescens*, *C. brownii*, *C. faucicola*, *C. glaberrima*, *C. harvestiana*, *C. paucicostata*, *C. platycheiridia*, *C. purpurea*, *C. rupestris*, *C. smeatoniana*, *C. sylvana* and some collections of *C. strigosa*, in which it is produced for less than 2 mm; and *C. acutifolia*, *C. merrelliana*, *C. nematoclada*, *C. parvivalis* and *C. violacea*, in which it is not produced above the ovary.

13. The hypanthium, in those species in which it is free from the style, usually is an appreciable distance from the style but in *C. birdii*, *C. brevifolia*, *C. divergens*, *C. eneabensis*, *C. harvestiana*, *C. oldfieldii*, *C. platycheiridia* and *C. similis* it tightly surrounds the style for the free portion.

14. The hypanthium apex in some species has minute, hair-like enations which do not appear to represent pubescence in the usual interpretation of the term. The species in which they are present (sometimes variably) are: *C. achaeta*, *C. arborescens*, *C. brownii*, *C. decandra*, *C. duplistipulata*, *C. glutinosa*, *C. microcoma*, *C. plumulosa*, *C. rupestris*, *C. strigosa* and *C. verticillata*. In the other species of the genus the hypanthium apex is smooth.

15. Petal margins are entire in all species except *C. arborescens*, *C. erosipetala* and *C. faucicola* in which they are erose, or subentire to erose.

16. The staminal filaments are erect in bud in all the species except *C. creswellii*, *C. gurulmundensis* and *C. islensis*, in which some filaments in each bud are inflexed. The filaments are acicular in all species except *C. superba*, in which they are swollen just above the middle. The filaments are glabrous in all species except *C. fraseri*, in which they are retrorsely papillate.

17. The anthers are fully versatile in all species except some of the *C. decandra* group, in which the connective is so strongly developed that anther movement is restricted and the anther in effect becomes introrse. These species are *C. decandra*, *C. duplistipulata* and *C. glutinosa*. In all species the thecae are oblong to suboblong (broadly suboblong in *C. drummondii* to broadly oblong in *C. leschenaultii*) except in *C. asperula*, *C. aurea*, *C. chrysantha*, *C. erosipetala* and *C. flavescens*, in which they are suborbicular.

18. The apex of the ovary is often conical in *C. arborescens* and always in *C. faucicola*; in all other species with an appreciable free zone around the base of the style the ovary apex is more or less flat.

19. The ovary is 2-ovulate in all species except *C. praecipua* which has a 3- to 4-ovulate ovary. The ovary in this species has a vestigial septum which also is a unique feature.

20. The stigma is punctiform in all species except *C. angulata*, *C. asperula*, *C. aurea*, *C. chrysantha*, *C. divergens*, *C. flavescens* and *C. platycheiridia* which usually have a subcapitate stigma.

### Keys to the Species and Subspecies of *Calytrix*

The keys presented here are largely artificial; a synopsis of the genus is given in the preceding section. The stipules are often minute and fragile and their presence or absence is more easily determined by examination of the younger leaves. Shapes of transverse sections of leaf blades are illustrated in Figure 1. The term cheiridium is explained on p. 7.

1. Hypanthium up to 6 mm long ..... Key 1
1. Hypanthium more than 6 mm long
  2. Hypanthium glabrous
    3. Hypanthium free, or partly free, from the style ..... Key 2
    3. Hypanthium completely adnate to the style ..... Key 3
  2. Hypanthium pubescent (sometimes only towards the base) ..... Key 4

#### Key 1

1. Hypanthium glabrous
  2. Leaf blade glabrous (sometimes puberulent in *C. arborescens* and *C. exstipulata*)
    3. Calyx segments up to 3 mm long
      4. Stipules present
        5. Terminal buds with bud scales
          6. Branchlets glabrous ..... 1. *C. glaberrima*
          6. Branchlets pubescent ..... 3. *C. alpestris*
        5. Terminal buds without bud scales
          7. Hypanthium 3- to 4-ribbed ..... 59. *C. paucicostata*
          7. Hypanthium 5- to 10-ribbed ..... 72. *C. acutifolia*
      4. Stipules absent
        8. Hypanthium articulated ..... 22. *C. harvestiana*
        8. Hypanthium not articulated
          9. Calyx segments shortly mucronate ..... 25. *C. platycheiridia*
          9. Calyx segments not mucronate
            10. Hypanthium subfusiform to subcylindrical, 2.5-3.5 mm long
              11. Branchlets glabrous, calyx segments 0.2-0.25 mm long ..... 67. *C. sylvana*
              11. Branchlets pubescent to puberulent, calyx segments 0.3-2 mm long ..... 72. *C. acutifolia*
            10. Hypanthium narrowly obconical, 5 mm long ..... 21. *C. purpurea*
    3. Calyx segments more than 3 mm long
      12. Terminal buds with bud scales
        13. Calyx segments usually awnless (rarely acuminate to awned and then to 4.5 mm long) ..... 3. *C. alpestris*
        13. Calyx segments awned, up to 19.5 mm long (rarely acuminate or apiculate and then c. 1-2.5 mm long) ..... 4. *C. tetragona*
      12. Terminal buds without bud scales

14. Hypanthium free from the style
15. Leaves peltate ..... 27. *C. arborescens*
15. Leaves not peltate
16. Leaf blade 2-17 mm long, petals ovate to lanceolate ..... 18. *C. depressa*
16. Leaf blade 1-2(-4.5) mm long, petals narrowly elliptic to sublinear ..... 37. *C. exstipulata*
14. Hypanthium adnate to the style
17. Hypanthium 5- to 10-ribbed, leaf blade angular-obovate in transverse section ..... 47. *C. asperula*
17. Hypanthium 10-ribbed, leaf blade broadly obovate to suborbicular in transverse section ..... 52. *C. habrantha*
2. Leaf blade pubescent
18. Calyx segments awned (occasionally acuminate or mucronate)
19. Style inserted on the conical ovary apex ..... 28. *C. faucicola*
19. Style inserted in a cup or tube formed by the hypanthium, not inserted on the ovary apex ..... 4. *C. tetragona*
18. Calyx segments not awned (rarely acuminate or shortly awned)
20. Stamens 1-seriate
21. Calyx segments 0.2-0.3 mm long, the apex truncate to rounded; petals ovate to elliptic, 3.5-4 mm long ..... 2. *C. smeatoniana*
21. Calyx segments more than 0.5 mm long, the apex acute to rounded (rarely acuminate or shortly awned); petals elliptic, 4-5.75 mm long ..... 3. *C. alpestris*
20. Stamens 2- to several-seriate ..... 72. *C. acutifolia*
1. Hypanthium pubescent
22. Leaves decussate or verticillate
23. Leaves decussate
24. Stipules present, blade of calyx segments pubescent for at least  $\frac{1}{4}$  of its length ..... 70. *C. parvivallis*
24. Stipules absent, blade of calyx segments pubescent for c.  $\frac{1}{4}$  of its length ..... 71. *C. nematoclada*
23. Leaves verticillate ..... 9. *C. verticillata*
22. Leaves alternate (sometimes in part subopposite)
25. Calyx glabrous
26. Stamens 1-seriate
27. Calyx segments awned (occasionally acuminate or mucronate) ..... 4. *C. tetragona*
27. Calyx segments not awned
28. Calyx segments 0.2-0.3 mm long, the apex truncate to rounded; petals ovate to elliptic, 3.5-4 mm long ..... 2. *C. smeatoniana*
28. Calyx segments more than 0.5 mm long, the apex acute to rounded (rarely acuminate or shortly awned); petals elliptic, 4-5.75 mm long ..... 3. *C. alpestris*
26. Stamens 2- to several-seriate
29. Calyx segments awned or mucronate
30. Hypanthium narrowly obconical, calyx segments mucronate ..... 68. *C. merrelliana*
30. Hypanthium  $\pm$  cylindrical above the fusiform ovarian region, calyx segments awned
31. Flowers usually clustered, calyx awns distinctly curled and twisted in bud ..... 51. *C. sapphirina*
31. Flowers always scattered, calyx awns straight to sinuous in bud ..... 55A. *C. simplex* subsp. *suboppositifolia*
29. Calyx segments not awned or mucronate ..... 72. *C. acutifolia*
25. Calyx pubescent
32. Hypanthium hairs distinctly longer on the ovarian region than on the region above
33. Short secondary branchlets produced at nearly every node of the primary axes and persisting for one to several seasons (calyx lobes 1.5-3 mm long; petals 2-5 mm long, the apex obtuse; leaf blade 0.8-2.5 mm long) ..... 10. *C. achaeta*
33. Short secondary branchlets produced sparingly
34. Calyx lobes 2.5-5 mm long; petals 3-4.75 mm long, the apex acute to narrowly acute; leaf blade 2-11 mm long ..... 11. *C. brownii*
34. Calyx lobes 1.75-2.25 mm long; petals 1.8-2.5 mm long, the apex rounded to obtuse; leaf blade 2.5-3(-4.5) mm long ..... 12. *C. rupestris*
32. Hypanthium hairs not longer on the ovarian region than on the region above, or hypanthium with hairs on the ovarian region only

35. Calyx segments awned or at least acuminate  
 36. Hypanthium free from the style ..... 43. *C. strigosa*  
 36. Hypanthium adnate to the style  
 37. Leaf blade in transverse section orbicular to suborbicular ..... 54. *C. plumulosa*  
 37. Leaf blade in transverse section shallowly lunate .....  
 ..... 55B. *C. simplex* subsp. *suboppositifolia*  
 35. Calyx segments not awned or acuminate ..... 69. *C. violacea*

## Key 2

1. Stamens 1-seriate (in occasional flowers partly 2-seriate)
2. Terminal buds with bud scales (occasionally some buds naked)
  3. Leaf blade in transverse section broadly obtriangular to depressed angular-obovate, sometimes partly shallowly lunate
    4. Hypanthium usually constricted below the base of the style, the free region 0.5-4.5 mm long ..... 4. *C. tetragona*
    4. Hypanthium not constricted below the base of the style, the free region 4-7.5 mm long ...  
 ..... 5. *C. involucrata*
  3. Leaf blade in transverse section suborbicular, broadly to depressed obovate, elliptic or transversely elliptic
    5. Petals with an entire margin, thecae oblong to suboblong
      6. Hypanthium strongly constricted below the base of the style ..... 6. *C. warburtonensis*
      6. Hypanthium not constricted below the base of the style ..... 7. *C. gypsophila*
    5. Petals with an erose to suberose margin, thecae suborbicular ..... 8. *C. erosipetala*
2. Terminal buds without bud scales
  7. Hypanthium 5-ribbed ..... 17. *C. glutinosa*
  7. Hypanthium 10-ribbed
    8. Leaves decussate ..... 15. *C. praecipua*
    8. Leaves alternate
      9. Stipules prominent, up to 1 mm long, usually 2-paired in leaves subtending flowers .....  
 ..... 14. *C. duplistipulata*
      9. Stipules not prominent, less than 0.75 mm long, usually 1-paired (sometimes 2-paired in floral leaves)
        10. Apex of bracteole or cheiridium lobe acuminate to long acuminate
          11. Anther connective very prominent, hooded-conical, restricting anther movement; branchlets smooth ..... 13. *C. decandra*
          11. Anther connective prominent but apparently not restricting anther movement; branchlets minutely verrucose ..... 16. *C. verruculosa*
        10. Apex of bracteole obtuse to subtruncate, often apiculate ..... 26. *C. fraseri*
1. Stamens 2- to several-seriate (in occasional flowers partly 1-seriate)
  12. Leaves decussate ..... 40. *C. decussata*
  12. Leaves alternate
    13. Stipules present
      14. Enations in axils of floral leaves turgid
        15. Cheiridium lobes c.  $\frac{1}{3}$  the length of the cheiridium ..... 56. *C. brevifolia*
        15. Cheiridium lobes c.  $\frac{1}{2}$  the length of the cheiridium ..... 57. *C. truncatifolia*
      14. Enations in axils of floral leaves not turgid
        16. Hypanthium at the ovary trigonous to subtrigonous
          17. Bracteole apex obtuse to subtruncate, often apiculate ..... 26. *C. fraseri*
          17. Bracteole apex acuminate ..... 30. *C. mimiana*
        16. Hypanthium at the ovary  $\pm$  orbicular in transverse section (never trigonous)
          18. Leaf margin ciliate
            19. Hypanthium apex with minute hair-like enations adjacent to each petal .....  
 ..... 32. *C. microcoma*
            19. Hypanthium apex without enations
              20. Leaves subtending flowers with a wider scarious margin than foliage leaves ....  
 ..... 39. *C. islensis*
              20. Leaves subtending flowers similar to foliage leaves
                21. Leaf blade incurved to straight, the apex obtuse to acute, 1.5-4 mm long; bracteoles strongly keeled; petals pink to pinkish-purple for the greater part  
 ..... 33. *C. carinata*

21. Leaf blade recurved to straight, the apex sub-truncate to rounded, 1.25-5.5 mm long; bracteoles subkeeled; petals pink to mauve for the greater part ..... 34. *C. longiflora*
21. Leaf blade straight (sometimes slightly incurved or recurved), the apex acute, 4-11 mm long; bracteoles keeled to subkeeled; petals yellowish-cream ..... 38. *C. gurulumundensis*
18. Leaf margin entire (i.e. not ciliate)
22. Stipules prominent, up to 1.25 mm long, 2-paired in leaves subtending flowers ..... 42. *C. similis*
22. Stipules not prominent, less than 0.5 mm long, usually 1-paired (sometimes 2-paired in floral leaves)
23. Leaf blade suborbicular in transverse section (rarely partly angular)
24. Hypanthium 13-17 mm long, the free region 7-8 mm long ..... 45. *C. cresswellii*
24. Hypanthium 8-12 mm long, the free region up to 5 mm long
25. Petals ovate; free region of the hypanthium up to 2.5 mm long, tightly surrounding the style ..... 41. *C. birdii*
25. Petals lanceolate to elliptic; free region of the hypanthium 3.5-5 mm long, not tightly surrounding the style ..... 44. *C. desolata*
23. Leaf blade angular in transverse section
26. Leaves peltate ..... 27. *C. arborescens*
26. Leaves not peltate
27. Leaf blade lunate to broadly obtriangular in transverse section 31. *C. megaphylla*
27. Leaf blade angular-obovate to depressed angular-obovate in transverse section
28. Hypanthium usually 5- but occasionally to 10-ribbed; bracteoles not keeled .... 35. *C. leptophylla*
28. Hypanthium 10-ribbed; bracteoles keeled to subkeeled . 38. *C. gurulumundensis*
13. Stipules absent
29. Free region of the hypanthium tightly surrounding the style
30. Leaf blade broadly obtriangular to angular-obovate in transverse section
31. Hypanthium 10-ribbed ..... 20. *C. oldfieldii*
31. Hypanthium 5-ribbed ..... 24. *C. divergens*
30. Leaf blade shallowly lunate to lunate in transverse section ..... 19. *C. eneabbensis*
29. Free region of the hypanthium not tightly surrounding the style
32. Hypanthium 5- to 9-ribbed
33. Petals lanceolate to elliptic, 3.75-5.5 wide; cheiridium 9-17 mm long .. 17. *C. glutinosa*
33. Petals narrowly elliptic to sublinear, 1.75-2.5 mm wide; cheiridium 4-9.5 mm long ..... 37. *C. exstipulata*
32. Hypanthium 10-ribbed
34. Free region of the hypanthium up to 6 mm long
35. Leaf blade 0.5-2 mm long; petals narrowly elliptic to sublinear, 1.75-2.5 mm wide .... 37. *C. exstipulata*
35. Leaf blade 2-17 mm long; petals ovate, lanceolate or narrowly elliptic, 2-4.25 mm wide
36. Cheiridium compressed, the lobes c.  $\frac{1}{2}$ - $\frac{3}{4}$  of its length ..... 18. *C. depressa*
36. Cheiridium not compressed, the lobes c.  $\frac{1}{3}$  of its length ..... 23. *C. angulata*
34. Free region of the hypanthium more than 6 mm long
37. Leaf blade 4-7 mm long ..... 36. *C. micrairoides*
37. Leaf blade 0.5-2 mm long ..... 37. *C. exstipulata*

### Key 3

1. Stipules absent
2. Hypanthium 5-ribbed ..... 24. *C. divergens*
2. Hypanthium 8- to 10-ribbed
3. Hypanthium trigonous ..... 50. *C. drummondii*
3. Hypanthium orbicular in transverse section
4. Cheiridium laterally shallowly grooved ..... 65. *C. tenuiramea*
4. Cheiridium laterally at least rounded, often ridged to subkeeled
5. Cheiridium usually compressed; petals elliptic to ovate, 7.5-9 mm long; some anthers sterile ..... 20. *C. oldfieldii*
5. Cheiridium not compressed; petals lanceolate to elliptic, 4.5-7.5 mm long; all anthers fertile ..... 66. *C. leschenaultii*

1. Stipules present
6. Enations in axils of floral leaves turgid
7. Cheiridium lobes c.  $\frac{1}{3}$  the length of the cheiridium ..... 56. *C. brevifolia*
7. Cheiridium lobes c.  $\frac{1}{2}$  the length of the cheiridium ..... 57. *C. truncatifolia*
6. Enations in axils of floral leaves not turgid
8. Hypanthium trigonous, at least in the ovarian region
9. Leaf blade angular-obovate to broadly angular-obovate in transverse section, rarely partly shallowly lunate; bracteoles 2-9 mm long
10. Bracteoles turgid towards the apex, the apex obtuse, apiculate or acuminate, incurved to slightly recurved
11. Hypanthium 5- to 10-ribbed, anther connective not prominent ..... 47. *C. asperula*
11. Hypanthium 10- to 12-ribbed, anther connective prominent (often globular with a patelliform apex) ..... 48. *C. chrysantha*
10. Bracteoles rarely slightly turgid, the apex with a long flexuous acumen 46. *C. flavescens*
9. Leaf blade lunate to broadly lunate in transverse section; bracteoles 9-11 mm long ..... 49. *C. aurea*
8. Hypanthium not trigonous ( $\pm$  orbicular in transverse section)
12. Branchlets pubescent, hypanthium 3- or 4-ribbed ..... 57. *C. paucicostata*
12. Branchlets glabrous, hypanthium 10-ribbed
13. Filaments turgid just above the middle, petals 16-19 mm long ..... 53. *C. superba*
13. Filaments acicular, petals less than 15 mm long
14. Leaf blade broadly obovate to suborbicular in transverse section
15. Anthers all fertile
16. Petals broadly elliptic, 6-7.5 mm long, 4-4.5 mm wide; cheiridium 6.5-9.5 mm long ..... 61. *C. gracilis*
16. Petals lanceolate to elliptic, 5-6 mm long, 2-3.25 mm wide; peduncle and bracteoles together less than 4 mm long ..... 52. *C. habrantha*
15. Anthers sterile, or much reduced, in inner stamens
17. Petals 4.5-7 mm long, the apex obtuse; cheiridium with one lobe often shorter than the other ..... 63B. *C. breviseta* subsp. *stipulosa*
17. Petals 7-9.5 mm long, the apex acute to acuminate; cheiridium lobes  $\pm$  equal in length ..... 60. *C. amethystina*
14. Leaf blade  $\pm$  angular in transverse section
18. Hypanthium subobovoid in the ovarian region (leaf blades usually less than 2 mm long) ..... 58. *C. formosa*
18. Hypanthium fusiform to subfusiform in the ovarian region (leaf blades mostly more than 2 mm long)
19. Leaves of flowering growth increments dissimilar to those of vegetative increments (blade often ovate and/or shorter) ..... 62. *C. variabilis*
19. Leaves of flowering growth increments similar to those of vegetative increments
20. Apex of cheiridium lobes rounded and mucronate, or acuminate, or truncate and apiculate; cheiridium with or without a slight ridge laterally, not grooved
21. Leaf blade linear, linear-lanceolate, or narrowly elliptic, 2-9 mm long; petals 7.25-10 mm long ..... 63A. *C. breviseta* subsp. *breviseta*
21. Leaf blade ovate, elliptic, or sometimes oblong to linear, 1.5-5.5 mm long; petals 4.5-7 mm long ..... 63B. *C. breviseta* subsp. *stipulosa*
20. Apex of cheiridium lobes acuminate to long acuminate; cheiridium shallowly grooved laterally
22. Leaves closely spaced; cheiridium lobes 4-7 mm long; petals 2.8-4 mm wide, the apex acute ..... 64. *C. pulchella*
22. Leaves widely spaced; cheiridium lobes 2-4 mm long; petals 2-2.5 mm wide, the apex obtuse to acute ..... 65. *C. tenuiramea*

#### Key 4

1. Hypanthium free, or partly free, from the style
2. Calyx glabrous
3. Stipules in foliage leaves prominent, to 3 mm long; flowers scattered (stamens usually 2-seriate) ..... 29. *C. surdiviperana*
3. Stipules in foliage leaves not prominent, to 1.5 mm long, or stipules absent; flowers usually clustered

- 4. Stamens 1-seriate ..... 4. *C. tetragona*
- 4. Stamens usually 3-seriate ..... 51. *C. sapphirina*
- 2. Calyx pubescent ..... 43. *C. strigosa*
- 1. Hypanthium completely adnate to the style
  - 5. Calyx glabrous
    - 6. Flowers usually clustered; unexpanded flowering shoots usually subtended by modified leaves, rarely by scale-like bracts ..... 51. *C. sapphirina*
    - 6. Flowers scattered; unexpanded flowering shoots subtended by normal foliage leaves
      - 7. Leaf blade 4–10 mm long, petals broadly lanceolate ..... 55A. *C. simplex* subsp. *simplex*
      - 7. Leaf blade 1.5–6 mm long, petals elliptic ..... 55B. *C. simplex* subsp. *suboppositifolia*
  - 5. Calyx pubescent
    - 8. Leaf blade  $\pm$  orbicular in transverse section ..... 54. *C. plumulosa*
    - 8. Leaf blade shallowly lunate in transverse section ..... 55B. *C. simplex* subsp. *suboppositifolia*

1. *Calytrix glaberrima* (F. Muell.) Craven, comb. nov. — *Lhotzkya glaberrima* F. Muell., *Fragm.* 1: 13 (1858), *basionym.* — Typus: South Australia. Kangaroo Island, *Bannier s.n.* (MEL, holo.; K, iso.).
- Lhotzkya glaberrima* var. *magnisepala* J. Black, *Fl. South Australia* 426 (1926). — Syntypi: South Australia. Kangaroo Island, between Kingscote and Vivonne Bay, 16 Nov. 1924, *Cleland s.n.* (AD); Kangaroo Island, Flinders Chase and towards Cape du Couedic, ironstone tableland, Nov. 1924, *Osborn s.n.* (AD).

Shrub to 1.3 m tall; glabrous; terminal buds with bud scales; apices of flowering stems continuing growth. Leaves closely to widely spaced, spreading-ascending to reflexed; stipules to 0.2 mm long; petiole 0.2–0.5 mm long; blade elliptic, linear or ovate, 1–4 mm long, 0.5–1 mm wide, straight to recurved, in transverse section broadly obtriangular (often with the surfaces slightly convex, sometimes either the adaxial surface or the abaxial surfaces slightly concave), the margin entire, the base abruptly tapering to the petiole, the apex rounded to acute, not apiculate. Inflorescences one to many, scattered. Peduncle 0.5–0.75 mm long, the apex only very slightly extended (not surrounding the hypanthium base), enations absent. Bracteoles free, deciduous, ovate to narrowly ovate, 1.5–2.75 mm long, the margin erose, the apex acute, straight to slightly recurved. Hypanthium 10-ribbed, free from the style, 1.5–2.5 mm long, cup- to funnel-shaped, 0.5–0.8 mm wide, the free region c. 0.25 mm long, the staminal disc unmodified. Calyx segments free or connate at the base (up to 0.1 mm), the blade ovate to suborbicular, 0.6–2 mm long, 0.6–1.3 mm wide, the margin erose, the apex emarginate to obtuse, or retuse with a short mucro in the sinus. Petals white to pink; elliptic, narrowly elliptic, or lanceolate, 3.5–6.5 mm long, 1.5–2 mm wide, the apex rounded to obtuse. Stamens c. 20–30, 1-seriate, the filaments (?white) 1.5–5.5 mm long, the anthers all fertile, the connective not prominent. Style deciduous, 2.75–5.5 mm long. Seed not known.

#### *Selected Illustration*

Black, J. M., *Fl. South Australia* edn 2. 637, f. 862 (1952), as '*Lhotzkya glaberrima*'.

#### *Distribution and Ecology*

South Australia: southern Mt Lofty Range and Kangaroo Island. See Map 1. Recorded as occurring in heathy scrub on white sand and a lateritic sand ridge, and on a limestone ridge. Flowering period: October to April.

#### *Other Specimens Examined* (selection only, c. 70 collections seen)

SOUTH AUSTRALIA: Cox's Scrub Conservation Park, *Spooner 4415* (AD); Black Swamp, near Tookyerta Creek, c. 25 km NNE. of Victor Harbor on railway, *Kraehenbuehl 1053* (AD, MEL); Finnis River, c. 55 km SSE. of Adelaide, Dec. 1943, *herb. Black s.n.* (AD); lane between Currency Creek and Black Swamp, *Hunt 2738* (AD); Santa Cruz Scrub, Waitpinga, *Hunt 3066* (AD, SYD); Cape Borda,

watermill, c. 10 km W. of Scorpion Spring, *Carrick 3398* (AD, SYD). VICTORIA: Wyperfeld National Park, c. 1.5 km S. of Moorong Rise, *Beaglehole & Finch 29529* (MEL); Little Desert, c. 5 km W. of Kaniva-Edenhope road along Elliott's track, *Corrick 6340* (CANB); c. 32 km S. of Nhill and 3 km W. of the Nhill-Gymbowen road, c. 5-8 km NNW. of Nurcoun, *Aston 982* (MEL); c. 40 km ESE. of Kaniva, top of sandstone ridge by the Crater in Spinifex Parish, *Melville, Morris & Hicks 974* (MEL); Grampians, 3 km NE. of Silverband Falls on Silverband Road, *Melville, Morris & Warry 1794* (MEL); Grampians, summit of Mt William, *Muir 4786* (MEL).

#### Notes

This species is closely related to the previous taxon, *C. smeatoniana*. One of the forms of *C. tetragona*, Form D, also is rather similar to *C. alpestris* but whether this is an indication of actual relationship or is the result of local hybridization is not known. The occasional occurrence of short awns in *C. alpestris* requires investigation to determine if they are the result of chance hybridization with *C. tetragona* or an independent development.

When describing *Genetyllis alpestris*, Lindley did not cite any specimens. The specimen chosen here as lectotype is in Lindley's herbarium at CGE and apparently is the specimen upon which his description of the species was based.

4. *Calythrix tetragona* Labill., Nov. Holl. Pl. Spec. 2: 8, t. 146 (1806). — *Calythrix tetraptera* DC., Prodr. 3: 208 (1828), *nom. illeg.* — *Calycothrix billardieri* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 245 (1841), *nom. illeg.* — *Calycothrix tetragona* (Labill.) F. Muell., Fragm. 4: 36 (1863). — *Calythrix billardieri* Benth., Fl. Austral. 3: 51 (1867), *nom. illeg.* — *Typus*: Western Australia. *Labillardière s.n.* (FL, holo.; W, iso.).
- Calythrix glabra* R.Br., Edwards's Bot. Reg. 5: t. 409 (1819). — *Calycothrix glabra* (R. Br.) Hook. f., Fl. Tasman. 1: 127 (1856). — *Syntypi*: Tasmania. King Island, Apr. 1802, *Brown s.n.* (BM); Georgetown, rocky banks of South Esk, Jan. 1804, *Brown s.n.* (BM).
- Calythrix ericoides* Cunn., in Field, Geogr. Mem. New South Wales 350 (1825). — *Calythrix virgata* Cunn., Bot. Mag. 61: t.3323 (1834), *nom. illeg.* — *Calycothrix virgata* Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 247 (1841), *nom. illeg.* — *Calycothrix glabra* var. *virgata* Hook. f., Fl. Tasman. 1: 127 (1856). — *Typus*: New South Wales. Pine hills near Bathurst, *Cunningham 111/1822* (K, holo.; MEL, iso.).
- Calythrix scabra* DC., Prodr. 3: 208 (1828). — *Calycothrix scabra* (DC.) Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 248 (1841). — *Typus*: New South Wales, *Sieber Fl. Novae Holl. 285* (MEL, W, iso.).
- Calythrix brunioides* Cunn., Bot. Mag. 61: sub t. 3323 (1834). — *Calycothrix brunioides* (Cunn.) Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 249 (1841). — *Typus*: New South Wales. In barren rocky country between Wellington and Croker's Range, *Cunningham 48/1825* (K, holo.; CGE, MEL, W, iso.).
- Calythrix curtophylla* Cunn., Bot. Mag. 61: sub t. 3323 (1834). — *Calycothrix curtophylla* (Cunn.) Schauer, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19 Suppl. 2: 242 (1841). — *Calythrix flavescens* var. *curtophylla* (Cunn.) Benth., Fl. Austral. 3: 42 (1867). — *Typus*: Western Australia. King George's Sound, 1827, *Fraser s.n.* (K, holo.; CGE, iso.).
- Calycothrix behriana* Schldl., Linnaea 20: 650 (1847). — *Calythrix behriana* (Schldl.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro. syn.]. — *Typus*: South Australia. Sandplain near Bethany, Nov., *Behr s.n.* (HAL, holo.; MEL, iso.).
- Calycothrix scabra* var. *minor* Schldl., Linnaea 20: 650 (1847). — *Typus*: South Australia. Pine scrub between Gawler and Light River, *Behr. s.n.* (HAL, holo.).

- Calycotrix diversifolia* Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 10: 328 (1852). — *Calythrix diversifolia* (Turcz.) B. D. Jackson, Index Kew. 1: 398 (1895). — Typus: Western Australia. *Drummond 5th coll. 116 p.p.* (KW, holo.; CGE, iso.).
- Calycotrix glabra* var. *ciliata* Hook. f., Fl. Tasman. 1: 127 (1856). — Typus: Tasmania. Sisters and Rocky Cape, *Gunn 806* (K, holo.).
- Calycotrix glabra* var. *glaberrima* Hook. f., Fl. Tasman. 1: 127 (1856). — Syntypi: Tasmania. *Gunn 13* (K); Georgetown and Rocky Cape, *Gunn 489* (K); Woolnorth, *Gunn 490* (K).
- Calycotrix leucantha* Miq., Ned. Kruidk. Arch. 4: 117 (1856). — *Calythrix leucantha* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: South Australia. On scrub-hills near Gawler, *Behr. s.n.* (MEL, ?holo.).
- Calycotrix monticola* Miq., Ned. Kruidk. Arch. 4: 118 (1856). — *Calythrix monticola* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: South Australia. In rocky hills towards Lake Torrens, Nov. 1851, *Mueller s.n.* (MEL, ?holo.).
- Calycotrix muelleri* Miq., Ned. Kruidk. Arch. 4: 119 (1856). — *Calythrix muelleri* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: South Australia. Port Lincoln, 1851, *Wilhelmi s.n.* (MEL, ?holo.).
- Calycotrix rosea* Miq., Ned. Kruidk. Arch. 4: 117 (1856). — *Calythrix rosea* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: South Australia. In sand-scrub between Gawler and Bethany, 23 Nov. 1848, *Osswald s.n.* (MEL, ?holo.).
- Calycotrix schlechtendalii* Miq., Ned. Kruidk. Arch. 4: 116 (1856). — *Calythrix schlechtendalii* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: South Australia. Mt Lofty Range, *Mueller s.n.* (MEL, ?holo.).
- Calycotrix squarrosa* Miq., Ned. Kruidk. Arch. 4: 118 (1856). — *Calythrix squarrosa* (Miq.) Benth., Fl. Austral. 3: 51 (1867), *nom. inval.* [pro syn.]. — Typus: Tasmania. *Hb. Mueller s.n.* (MEL, ?holo.).
- Calycotrix sullivanii* F. Muell., Fragm. 9: 1 (1875). — *Calythrix sullivanii* (F. Muell.) B. D. Jackson, Index Kew. 1: 399 (1895). — Typus: Victoria. Grampians, *Sullivan s.n.* (MEL, holo.).
- Calycotrix mitchellii* S. Moore, J. Linn. Soc., Bot. 45: 199 (1920). — Typus: Queensland. Near Mt Faraday, *Mitchell 394* (BM, holo.).

Shrub to 3 m tall; branchlets pubescent to glabrous; terminal buds with bud scales; apices of flowering stems continuing growth or suppressed. Leaves closely to widely spaced, appressed to spreading, sometimes slightly reflexed; stipules to 1 mm long, apparently sometimes absent; petiole pubescent to glabrous, 0.2–1.5 mm long; blade pubescent to glabrous (when glabrous the margin may be entire, scabrid or erose), linear, oblong, ovate, lanceolate, to narrowly elliptic, 0.75–14 mm long, 0.4–1.5 mm wide, straight (sometimes slightly incurved at the apex) to recurved, in transverse section depressed angular-obovate, to broadly or very broadly obtriangular (with the surfaces often convex), the base abruptly to gradually tapering to the petiole, the apex obtuse to acute, apiculate or not. Inflorescences one to many, tightly clustered or occasionally scattered, in the axils of leaves or bracts, the bracts ovate to obovate with the margin ciliate. Flowers pedunculate with deciduous bracteoles (free or connate), or cheiridiate. Peduncle pubescent to glabrous, 1–1.5 mm long, the apex extended and without enations. Bracteoles pubescent to glabrous, free or connate, deciduous, elliptic, ovate, or suborbicular, (when connate ellipsoid to funnel-shaped, compressed), 2.5–4.75 mm long, abaxially often ridged, the margin entire to strongly ciliate at the apex, the apex truncate to obtuse, shortly mucronate or not, mucro sometimes subdorsal due to the margin extending around the adaxial side of the apex, straight to recurved. Cheiridium pubescent to glabrous, funnel-shaped to narrowly funnel-shaped, sometimes compressed, 2.75–8 mm long, laterally often ridged; lobes elliptic, obovate, ovate, or

suborbicular, 1.75–5.5 mm long, the margin entire to erose, often ciliate at the apex, the apex shortly acuminate, to emarginate, mucronate or not, the mucro sometimes dorsal due to the margin extending around the adaxial side of the apex, straight or recurved; enations absent on the inner surface. Hypanthium glabrous or occasionally pubescent, 10-ribbed, partly free from the style, (5-)7–15 mm long, fusiform in the ovarian region, strongly constricted below the base of the style, cup-shaped, funnel-shaped, or cylindrical in the free region (rarely the hypanthium is either  $\pm$  cylindrical above the ovarian region and then without an obvious constriction, or short and  $\pm$  fusiform), the ovarian region 0.5–0.75 mm wide, the free region 0.5–4.5 mm long, 0.5–1.25 mm wide, the staminal disc unmodified. Calyx segments glabrous, connate at the base (up to 0.4 mm), the blade ovate, elliptic, depressed obovate, or suborbicular, 0.75–2.5 mm long, 1–2.75 mm wide, the margin entire to erose, the apex truncate to acute, produced into an awn to 17 mm long, or occasionally apiculate to acuminate, rarely retuse with a short mucro in the sinus, the awn scabrid to smooth, distinctly curled and twisted in bud. Petals glabrous; white to pink (flowers once recorded as yellow); elliptic to lanceolate, 3.5–7.5 mm long, 1.25–3 mm wide, the apex obtuse to acute. Stamens c. 23–45, 1-seriate, the filaments white (to ?pink), 1–6.5 mm long; the anthers all fertile, the connective not prominent. Style persistent, 3.5–11 mm long. Seed narrowly obovoid, 2.75–3 mm long, 0.5–0.6 mm wide.

#### Selected Illustrations

Labillardière, J.J.H. de, *loc. cit.* — Brown, R., *loc. cit.*, as *Calythrix glabra*. — Cunningham, A., *loc. cit.*, as '*Calythrix virgata*'. — Niedenzu, F.J., in Engler, A., & Prantl, K., Nat. Pflanzenfam. III. 7: 101, f. 46 (1893), as *Calycothrix tetragona*. — Black, J.M., Fl. South Australia edn 2. 636, f. 860 (1952), as '*Calythrix tetragona*'. — Burbidge, N.T., & Gray M., Fl. Australian Capital Territory 263, f. 262 (1970).

#### Distribution and Ecology

Western Australia, South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania: southern Western Australia and from the southern and south-eastern region of South Australia east- and north-eastwards to the Springsure district in Queensland; also in Tasmania and the Bass Strait islands. See Map 4.

Recorded as occurring in a wide range of habitats including ironbark woodland on yellow stony earth, rocky river banks, low open forest on ridge covered with pebbles of quartzitic conglomerate, heathy woodland on sandstone, eucalypt woodland on red earth over limestone, open granite slopes, heathy mallee country, dry sandy wallum, in heath on white and grey sands, and in damp heath. Flowering period: January to December, usually August to October.

#### Other Specimens Examined (selection only, c. 1200 collections seen)

WESTERN AUSTRALIA: 3 km W. of Collie, *Fairall 775* (PERTH); 0.5 km S. of the Cranbrook-Kojonup road junction with the Albany Highway, *Craven 7399* (CANB); opposite Stirling Range Caravan Park, *Woodburn 16* (CANB); Dulyalbin Rock, *Smith 3* (CANB); 18 km SSW. of Cocklebiddy, *Parsons 143* (AD). SOUTH AUSTRALIA: c. 43 km S. of Streaky Bay, *Donner 2487* (AD); c. 3 km NW. of Kyancutta on the Wudinna road, *Wilson 451* (AD); near foot of Dick's Nob, c. 6 km S. of Chalet, Wilpena Pound, *Muir 5320* (MEL); c. 1 km N. of Tanunda, *Kraehenbuehl 1584* (AD); c. 18 km NE. of Keith on Emu Flat Road, near Wirrega Road junction, *Berg 523A* (CANB). QUEENSLAND: 15 km W. of Gurulmundi on the Woleebee road, *Williams 77164* (BRI); Mt Beerwah, Glasshouse Mtns., 22 Sep. 1968, *Willis s.n.* (MEL); 96 km NW. of Cunnamulla, *Burrows 10* (BRI); Wyberba, Bald Rock Creek, 9 km S. of Stanthorpe, *Pedley 1562* (BRI). NEW SOUTH WALES: Green Gully, Glen Davis, c. 40 km N. of Lithgow, *Constable 7198* (NSW); Mt Canobolas, SW. of Orange, 15 Aug. 1953, *Johnson s.n.* (NSW); Waterfall, 29 Sept. 1933, *Rodway s.n.* (NSW); Ravine, Kosciusko National Park, *Craven 5416* (CANB). AUSTRALIAN CAPITAL TERRITORY: Pine Island, *Hoogland 8424* (CANB, MEL, PERTH); Gibraltar Creek area, *Schodde 3153* (AD, CANB, MEL). VICTORIA: The Rapids, W. side

of Wingan River, Wingan Inlet National Park, *Beaglehole 31673* (MEL); c. 6 km SW. of Inglewood, *Muir 1373* (AD, MEL); 10 km from Dunolly on the Dunolly-Tarnagulla road, *Muir 4916* (MEL); Whipstick Scrub, Bendigo, *Muir 4880* (CANB); c. 27 km from Whitfield on the Mansfield-Whitfield road, *Craven 1704* (CANB). TASMANIA: Rocky Cape, *Hemsley 6161* (HO); The Fisheries, near Coles Bay, *Buchanan 145* (HO); N. end of Cooks Beach, Freycinet Peninsula, *Buchanan 144* (HO); Cambridge, *Rodway 102* (CANB, HO).

### Notes

This species is the most widespread of the genus. Throughout much of its range it is rather variable but, on present knowledge, it is advisable to treat the species as comprising only a single taxon. Character states which at first seem as if they could be used to distinguish regional entities can occur sporadically almost throughout the range of the species. More research, including extensive field work, needs to be undertaken before a satisfactory account could be given of *C. tetragona*.

If floral features alone are utilized, four major morphological entities may be recognized.

Form A. *Free part of the hypanthium more or less as long as broad; bracteoles connate and persistent.* This form occurs practically throughout the range of the species. Except for the names mentioned under the following forms the type specimens of all names referable to *C. tetragona* belong here.

Form B. *Free part of the hypanthium longer than broad; bracteoles connate and persistent.* This form occurs fairly commonly in the south-east of South Australia but occurs also in Victoria (16 km S of Robinvale, 14 Nov. 1959, *Rowlands s.n.* (MEL); c. 11 km N of Halls Gap, 9 Nov. 1963, *Willis s.n.* (MEL)), in New South Wales (Dubbo area, e.g. *Briggs 3066* (NSW); Dumaresq River, Oct. 1911, *Midson s.n.* (NSW); Warialda, Oct. 1906, *Rupp s.n.* (NSW)) and in Queensland (Rolleston-Comet road, *Story & Yapp 231* (CANB); Mt Playfair, *McLaughlin s.n.* (BRI); Inglewood, *Hockings 6* (BRI); Tweed River, Sept. 1916, *Longman s.n.* (K)). The type specimen of *Calythrix mitchellii* S. Moore is of this form.

Form C. *Free part of the hypanthium more or less as long as broad; bracteoles free or connate, deciduous.* This form occurs commonly in the south-east of South Australia but also occurs in Victoria (near Stawell, e.g. *Melville et al. 1753* (MEL); near Bendigo, e.g. *Aston 430* (MEL)) and in New South Wales (George's River, e.g. 6 Nov. 1948, *Johnson s.n.* (NSW); Cookamidgera, near Parkes, 22 Sept. 1947, *Constable s.n.* (NSW)). The type specimens of *Calycothrix scabra* var. *minor* Schldl. and *Calycothrix schlechtendalii* Miq. belong to this form.

Form D. *Hypanthium short; bracteoles connate and persistent.* This form occurs principally in the Grampians of western Victoria although there are occasional collections from elsewhere (e.g. in south-east South Australia near McLaren Flat, *Bell 138* (AD), and in Tasmania, Standup Point, Tasman Peninsula, 14 Sept. 1980, *Jackson & Boyer s.n.* (HO)). There is a possibility that the collections from the Grampians may represent the results of hybridization between *C. tetragona* and *C. alpestris* as a number of these specimens possess features approaching those of *C. alpestris* (such as the short, unstricted, pubescent hypanthium). The type specimen of *Calycothrix sullivanii* F. Muell. belongs here.

*Calytrix tetragona*, in eastern and south-eastern Australia, occupies such a large number of habitats and has such a wide distribution that in comparison its present distribution in Western Australia seems rather restricted. It may be that *C. tetragona* has only relatively recently migrated to Western Australia following a route south of the Nullarbor Plain which was suggested by Parsons (1969) as a likely means of circumventing this barrier. During glacial periods suitable habitat for mallee-heath floras apparently existed continuously from western to eastern Australia south of the Plain.

The typification of the *Calycothrix* species described by Miquel (1856), *C. leucantha*, *C. monticola*, *C. muelleri*, *C. rosea*, *C. schlechtendalii* and *C. squarrosa*, has not been straightforward. Types of his names have not been located at either U or L, in both of

which herbaria Miquel had worked. According to Stafleu and Cowan (1981), Miquel 'described many new taxa on the basis of material obtained on loan'. There are specimens in MEL, originating from the Sonder herbarium, of each of the species concerned. These specimens have been annotated by Miquel and may well be the holotypes of Miquel's species, here tentatively cited as such. However a thorough search needs to be undertaken of other herbaria that are likely to contain material studied by Miquel before my conclusions as to the type status of the MEL material can be confirmed.

5. *Calythrix involucrata* J. Black, Trans. & Proc. Roy. Soc. South Australia 52: 225 (1928) ('*Calythrix*'). — Lectotypus (here chosen): South Australia. Eyre Peninsula, Cummins, 30 Aug. 1928, *Stopp s.n.* (AD, lecto.; BRI, MEL, isolecto.).

Shrub to 1 m tall; glabrous; terminal buds with bud scales; apices of flowering stems continuing growth or suppressed. Leaves closely to widely spaced, spreading-ascending to reflexed; stipules to 0.3 mm long; petiole 0.4–1 mm long; blade linear, linear-lanceolate, to elliptic, 1.75–7.5 mm long, 0.7–1.25 mm wide, straight (sometimes slightly incurved towards the apex) to recurved, in transverse section broadly obtriangular to depressed angular-obovate, the margin entire to scabrid, the base abruptly to gradually tapering to the petiole, the apex obtuse to acute, apiculate or not. Inflorescence one to many, tightly clustered, the subtending leaves modified into bracts, the bracts usually obovate, up to 10 mm long, 5.5 mm wide, scarious, the margin ciliate, the apex acuminate or emarginate to truncate and stoutly mucronate. Cheiridium narrowly ellipsoid to narrowly funnel-shaped, 5.5–8 mm long, laterally ridged or subkeeled; lobes elliptic, narrowly elliptic, or obovate, 3–6 mm long, the margin entire to lacinate, the apex acuminate, or rounded and mucronate, recurved; enations absent on the inner surface. Hypanthium 10-ribbed, free from the style, 8–12 mm long, fusiform in the ovarian region and cylindrical above, or  $\pm$  cylindrical and tapering towards the base, the ovarian region 0.75–1 mm wide, the free region 4–7.5 mm long, 0.5–0.75 mm wide, the staminal disc scarcely produced inwards, with the inner edge sometimes turning upwards forming a slight collar. Calyx segments connate at the base (up to 0.3 mm), the blade broadly obovate to depressed obovate, 1–1.75 mm long, 1.75–2.5 mm wide, the margin erose, the apex emarginate to rounded, produced into an awn to 12 mm long, the awn scabrid, distinctly curled and twisted in bud. Petals white, sometimes tinged pink; ovate to elliptic, 4.5–7 mm long, 2–3.5 mm wide, the apex obtuse to acute. Stamens c. 17–25, 1-seriate, the filaments white, 1.25–5.5 mm long, the anthers all fertile, the connective usually not prominent. Style persistent, 9–13 mm long. Seed narrowly obovoid, 2.8 mm long, 0.7 mm wide.

*Selected Illustration*

Black, J.M., Fl. South Australia edn 2. 636, f. 861 (1952), as '*Calythrix involucrata*'.

*Distribution and Ecology*

South Australia: from Eyre Peninsula eastwards to the northern Mt Lofty Range district. See Map 5.

Recorded as occurring in mallee scrub on sandhills and limestone, on yellow sand, on sand abutting granite, and on a granite inselberg. Flowering period: August to October.

*Other Specimens Examined* (selection only, c. 105 collections seen)

SOUTH AUSTRALIA: S. face of Mt. Yardea, Gawler Ranges, *Haegi 830* (AD); Waulkinna Hill, Gawler Ranges, *Eichler 19570* (AD, CANB); c. 40 km W. of Kimba on the Eyre Highway, *Rosier 61* (AD); Kyancutta, *Caulfield 231* (AD); Boston Point, c. 15 km NE. of Port Lincoln, *Whibley 336* (AD);