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THE SPECIES OF *CRASSULA* L. IN AUSTRALIA

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Abstract

A taxonomic revision of the genus *Crassula* in Australia is presented together with a key to the 17 taxa recognized. *C. colorata* var. *tuberculata* Toelken and *C. sieberana* subsp. *tetramera* Toelken are described while the combination *C. colorata* var. *miriamiae* (Ostenf.) Toelken is made.

Introduction

The similarity of some of the Australian species of *Crassula* to the South African ones prompted the present research, which can be seen as a continuation of the earlier study on the South African species (Toelken, 1977). Similar problems such as the wide ecological and local variation as well as the difficulty of identifying herbarium material of some taxa are also encountered in Australia. As in the South African annual species, no putative hybrids were found here. However, the close resemblance of some of the Australian species to those of other continents compounds the problem of evaluating the variation within the geographical boundaries. Of the 11 taxa indigenous to Australia 5 also occur outside this area and, although the present study is almost entirely based on specimens from Australian herbaria, the limited number of specimens from outside were found adequate for decisions to be taken. Most of the work was done on herbarium specimens and only here and there were critical areas visited to investigate problems in situ. However, living or pickled material of all the species was investigated and its range of variation is included in the descriptions. In the case of *C. moschata* and *C. sarmentosa* too few Australian records were available so that the range of variation was extended to that found outside this continent.

History

Tillaea sieberana J.A. & J.H. Schultes (1827) was the first species in the Crassulaceae described from Australia, based on material collected by Sieber near Sydney. Hooker (1841) and Nees (1844-5) described another six species but Bentham (1862) recognized only four species in his 'Flora Australiensis'. Since then a few species have been added at intervals but no revision of the genus for the whole continent has been undertaken.

In all the early treatments the species were placed in the genus *Tillaea* partly because they often had 4-merous flowers (as opposed to 5-merous ones in *Crassula*) and partly because of their annual habit (*Crassula* spp. are predominantly perennials). Occasionally the genus *Bulliarda* was used for Australian species and the delimitation of each of the three genera was revised by each subsequent author. Schonland (1890) in his review of the whole family concluded that characters used were often not consistent and amalgamated genera such as *Bulliarda* and *Tillaea* with *Crassula* but upheld some of these as lower ranking taxa. He did not enumerate all species so that Ostenfeld (1918) was the first to place all the Australian species in the genus *Crassula* and most subsequent authors followed him.

The genus *Crassula* is represented by only a few species in Australia so that it is not unexpected that the subgeneric groupings were established in Southern Africa, which is the major centre of distribution of the genus. The species indigenous to Australia fit well into the two sections recognized in South Africa (Toelken, 1977). The species native in

Australia can be placed into two sections *Helophytum* and *Glomeratae* and the genus *Bulliarda* should be placed in the former section while *Tillaea* is placed into the latter. Both sections have an almost world-wide distribution and many other names have been proposed and the levels changed with every new treatment. The proposal for raising the status of *Helophytum* from sectional to subgeneric level by Friedrich (1979, p. 578) is not acceptable to the present author because it takes the one group out of context with others (for discussion see under *The Inflorescence*).

Five South African species and *C. alata*, from the eastern Mediterranean region, are definitely naturalized in Australia. The first record of these is of *C. natans* from near Perth in 1883 and now the species has spread through much of the wetter areas of the winter rainfall region of Australia. This species seems to be actively spreading from south-western Western Australia and southern South Australia where it is already well established. The first records from western Victoria have recently been collected. In contrast, *C. thunbergiana* was for the first time recorded also from near Perth in 1889, but has not spread beyond the south-western parts of Western Australia, where it is never common. The latest species found naturalized in some areas are *C. sarmentosa* and *C. tetragona*, both being widely cultivated as are many other South African species.

Taxonomic Characters

In small annuals such as the Australian species of *Crassula* all characters are so variable that few reliable taxonomic characters can be found. However, in spite of the extreme variation a high percentage of specimens can be identified by auxiliary characters when the main character cannot be used for one or other reason. A 'normal' range of, for instance, measurements of the leaves is, therefore, accentuated by placing extreme values in brackets. In the case of *C. moschata* and *C. sarmentosa* these extreme values were obtained from specimens collected outside Australia, because too few specimens were available to include what is considered a full range of variation.

C. helmsii and *C. natans* should both theoretically show two ranges of 'normal' measurements depending on whether the plants grow on marshy soil or are submerged. In practice this is quite unworkable as herbarium specimens rarely indicate whether the plants were only recently inundated or well established in standing water. Only one range of measurement is therefore provided in the description although in practice the majority of specimens will fit in either the upper or the lower part of the range. To counter this unusual phenomenon the full range of variation is discussed under each of the two species because they are at times not easy to distinguish.

The Inflorescence

In the revision of the South African species of the genus *Crassula* (Toelken, 1977) the inflorescences were partly interpreted in terms of Troll's concepts but used together with conventional terminology. The inflorescences of the predominantly annual species cannot be interpreted and compared with those of the perennials unless one accepts the interpretations of Troll (1964, 1969). As a change from conventional terminology was necessary, the clearly defined concepts of Briggs and Johnson (1979), which are based on Troll's work, are largely adopted here.

The complex thyrsoid is the fundamental inflorescence type in the Crassulaceae and all modifications can be derived from it. In the case of the annual species, for example *C. decumbens*, the inflorescence is usually a frondo-bracteose complex thyrsoid (fig. 1, A), but in 'shade' plants it will often be a frondose inflorescence which gives the whole plant an entirely different appearance. In some species the plasticity of the inflorescence is very great, and *C. decumbens* is one of them. Normally the complex thyrsoid consists of several dichasia at the apex and thyrsoids towards the base but under extreme conditions it can be reduced to a terminal dichasium, (fig. 1, B), a binodal botryoid, a triad or even only a single terminal flower. Within one population the whole range can be found as shown by the collections *Kraehenbuehl 676, 1468*. It was possible to confirm the observation by Wydler (1878, p. 351) who noted that *Bulliarda trichotoma* (synonym of *C. decumbens*) produces a terminal inflorescence after the third to fifth node. Troll (1969, p. 240) interpreted this juvenile stage (up to the third node) as a very much reduced vegetative growth and it becomes comparable with vegetative branches of species in the section *Petroqeton* where never more than four or five pairs are found, but in some cases it is reduced to a single pair.

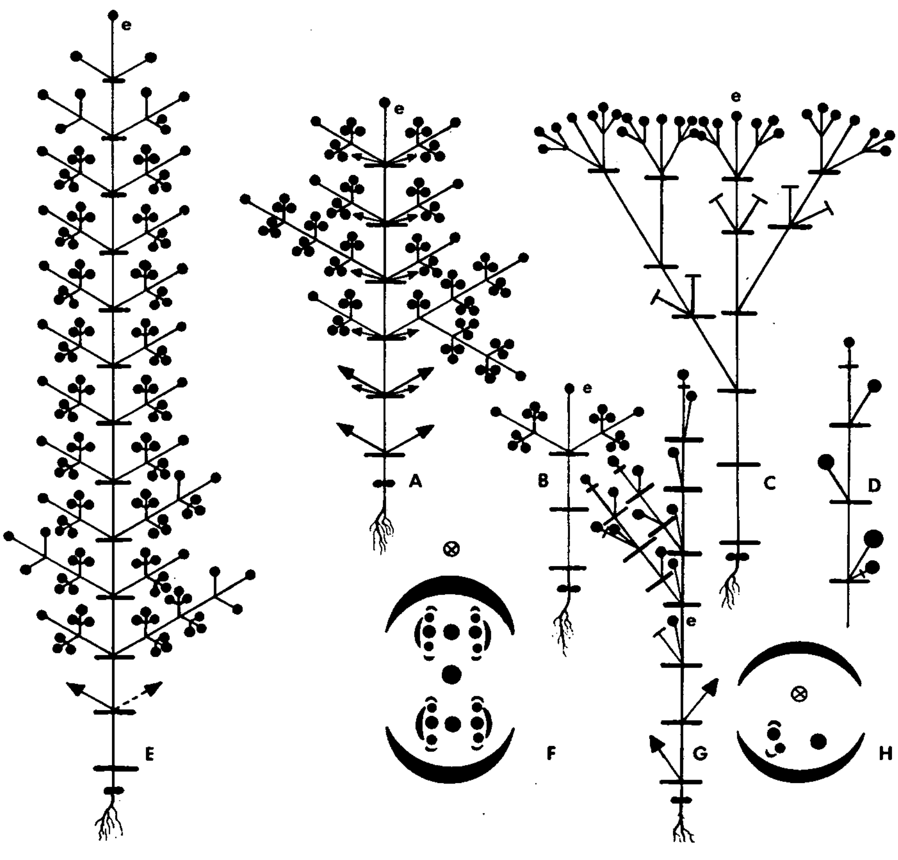


Fig. 1. Diagrams of types of inflorescences found in annual *Crassula* species. A, *C. decumbens*, well developed plant (*Toelken 6443*); B, *C. decumbens*, depauperate plant (*Kraehenbuehl 629*); C, *C. glomerata*, well developed plant (*Boorman* in NSW 143675); D, *C. natans*, flowering branch (*Toelken 6422*); E, *C. exserta*, well developed plant (*Toelken 6421*); F, *C. decumbens*, dichasium (*Toelken 6443*); G, *C. natans*, well developed plant (*Eichler 16414*); H, *C. natans*, sequence of development of flowers at one node (*Toelken 6422*); e, terminal flower; large arrow indicates potential position of additional inflorescences similar to the terminal one; small arrows indicate position of potential accessory inflorescences; T, part-inflorescences often suppressed at first but developing later.

Under favourable conditions even the lowest two nodes, and sometimes even the node which bore the cotyledons will develop axillary branches, which in turn may or may not bear flowers on its first node. Usually, however, each of these branches is a thyrsoid or complex thyrsoid with flowers even from the basal node in *C. decumbens*. The whole plant consists ultimately of a terminal and several lateral thyrsoids or complex thyrsoids and mature specimens may be interpreted as a complex thyrsoid because the developmental sequence can no longer be recognised.

Fig. 1: A, B, C, E show dichasia each with only seven flowers but often the numbers will increase depending on the species and on prolonged favourable conditions. The sequence in which the flowers mature on the inflorescence varies somewhat in different species but most of the time they develop according to the plan (fig. 1, F). Sometimes, however, some flowers may be suppressed and only develop later, if at all, so that the dichasia end in monochasia. A similar suppression of one of a pair of part inflorescences or whole lateral inflorescences at a node is occasionally found in some species but usually the branch develops later.

Accessory inflorescence branches (fig. 1, A) are quite common in well developed specimens of this species, but rare in others. Depending on conditions they usually consist of a thyrsoid with one to several pairs of dichasia or rarely are reduced to a binodal botryoid or a triad.

In spite of all this possible variation there are three main developments distinguishable among the species of *Crassula* in Australia.

1. A basitonic development of the inflorescence results in an elongation of the inflorescence as additional flowers are produced at nodes towards the base of the branch. In *C. exserta* (fig. 1, E), *C. colorata* and *C. sieberana* the effect is accentuated by the sessile lateral part-inflorescences which produce rarely more than one dichasium. In depauperate plants sometimes the upper two or more nodes of the terminal axis, and of the lower lateral axis, develop only monads so that the inflorescence is a panicle. This condition is, however, rare and in such cases there are usually other specimens in the same collection with a normal inflorescence.

Although the inflorescences in the Crassulaceae tend to be anthotelic they sometimes become auxotelic as in *C. sieberana* subsp. *sieberana*. Sometimes it is even possible to find anthotelic and blastotelic inflorescences at the apex of different branches of the same plant. It has, however, only been observed in perennial plants with a pronounced basitonic development of the inflorescence.

2. In an inflorescence with a pronounced acrotonic development the flowers are all aggregated at the apex into a corymb-like inflorescence as found in *C. glomerata* (fig. 1, C). Plants of this species are usually sparsely branched but many of the upper uniflorescences develop only later if favourable conditions prevail. It is typical of this species that often only one of the two axillary branches develops at a node, so that an apparently dichotomous branching can be observed. The single branches are arranged rather haphazardly around the main axis.

3. The flowers of the species of the section *Helophytum* seem to be axillary. However, the absence of a bud in the axil of the leaf (not appearing to subtend the flower) can be shown by severing the growing point as in all cases studied an axillary branch developed between the flower and its subtending leaf. The severed axis had, therefore, developed from the other axillary bud at that node. This 'classical' example of sympodial growth is often claimed to represent a radical difference from other growth patterns in *Crassula*, and it seems tempting to redefine either *Bulliarda* or *Helophytum* on this basis. However, as any cymose inflorescence is an example of sympodial growth, it is important to delimit the inflorescence as opposed to vegetative growth.

Troll (1969, p. 240-2) reviews the detailed studies by Caspary (1860) on *Bulliarda* (*Crassula*) *aquatica* which develops the first flower (i.e. the terminal flower) on the fourth node. Like *C. decumbens* (see earlier), first a short period of vegetative growth takes place which terminates in a monochasium or sometimes in a dichasium with monochasial branches, as is commonly found in other genera of the family, e.g. *Cotyledon* (Toelken, 1978, p. 378). However, in most species of the section *Helophytum* the monochasia are often branched by subsequent development of the second axillary bud of some nodes (fig. 1, G), and the temporary suppression of this second axillary branch at some nodes was already described in both *C. decumbens* and *C. glomerata*.

Troll's illustration of *Bulliarda vaillantii* (fig. 196, I) also shows that the three basal 'vegetative' nodes each produce an axillary branch terminating in a dichasium with monochasial branches. The whole plant of *C. natans* and *C. helmsii* is comparable with the morplology of *C. decumbens* except that the terminal and lateral branches of the inflorescences tend to be monochasia. The occasional dichasium, however, shows that a generic delimitation based on monochasial as opposed to dichasial development, as sometimes suggested, cannot be accepted especially as similar monochasial inflorescences are also found in *C. pellucida* subsp. *alsinoides* (Toelken 1977; p. 185) which is placed into an entirely different section.

In the case of *C. natans*, and particularly in plants of it which are growing in marshy conditions, sometimes up to three flowers are found on the one side of the node. Two of these flowers usually develop somewhat later (fig. 1, H) so that it may be concluded that they belong to a slightly displaced and very much reduced axillary or accessory monochasium. It seems, however, more likely to represent an axillary branch as accessory inflorescences have not been recorded for any species of the section *Helophytum*.

The Flowering Period

Ephemerals, such as most of the *Crassula* species indigenous to Australia, must be closely synchronized with their environment in order to survive. They often complete their life cycle in less than one month. Their seeds will usually only germinate after a good rain so as to ensure new seed production. Consequently in the southern parts of Australia the flowering period for most species is from August to November. The exceptions are *C. helmsii*, *C. natans* and *C. peduncularis* which will continue to flower as long as water is available, and flowering specimens for at least the first two species have been recorded in each month of the year.

Similarly, flowering specimens of both subspecies of *C. sieberana* have been recorded during summer from the summer rainfall areas of New South Wales and Queensland as well as during winter in the predominantly winter rainfall areas of Victoria and South Australia. The flowering period of *C. sieberana* subsp. *sieberana* tends to be slightly later than that of the subsp. *tetramera*, but under favourable conditions both subspecies will continue flowering for some time, so this characteristic cannot even be used in the field.

Distribution

The genus *Crassula* is mainly found in temperate regions of the world with the greatest number of species occurring in South Africa. Most of the perennial species are restricted to the African continent. The greatest number of annuals are also found in Africa but some have been described from many parts of the world excluding most areas with tropical climate.

Australia, together with New Zealand, is the area with the greatest number of species outside Africa, in spite of the few species indigenous to this area. These predominantly annual species show in Australia a similarity with the South African species in that the greatest number are found in the winter rainfall areas although they usually extend also into adjoining areas.

C. decumbens is the only species native to both South Africa and Australia. The apparent similarity between *C. thunbergiana* (South Africa) and *C. sieberana* subsp. *tetramera* (Australia) seems to be superficial. *C. decumbens* is widely distributed in Australia but does not occur in New Zealand. In contrast to this, *C. peduncularis* occurs from the southern parts of Australia to those of South America, while *C. moschata*, which has recently been recorded from Tasmania, has a southern circumpolar distribution. All this indicates the divergent elements found in Australia.

In Australia the genus is mainly restricted to the temperate region with only a few species extending their distribution into adjoining areas. *C. sieberana* subsp. *tetramera* and *C. colorata* var. *tuberculata* are also widespread in sheltered rock crevices of the central region with dry continental climate.

The gap in the distribution associated with the Nullarbor desert has been proven to be due to insufficient collecting at least in some species. Marsh plants will obviously not find suitable habitats in that area. It is, however, noteworthy that *C. helmsii* and *C. peduncularis* have only been recorded a few times west while *C. exserta* has been recorded much more frequently from the west than east of this gap.

CRASSULA L.

L., Sp. Pl. ed. 1:282 (1753); Gen. Pl. ed. 5:136 (1854); DC., Prodr. 3:383 (1828); Ostenfeld, Dansk. bot. Ark. 2,8:39 (1916); Berger, Pflanzenfam. ed. 2, 18a: 386 (1931); Toelken, Contr. Bolus Herb. 8:39 (1977).

Type: *C. perfoliata* L.

Tillaea L., Sp. Pl. ed. 1:128 (1723); Gen. Pl. ed. 5:62 (1754); Benth., Fl. Austr. 2:450 (1862); Benth. & Hook. f., Gen. Pl. 1:657 (1865).

Bulliarda DC., Bull. Sc. Soc. Philom. 3:1 (1801); Prodr. 3:382 (1828).

Annuals or perennials with prostrate, decumbent or erect habit, with carnose branches to 1 m long. *Leaves* opposite, sessile or rarely petiolate, usually entire, sheathing at the base, more or less succulent. *Inflorescence* a thyrsoid with one to many dichasia, rarely reduced to a solitary flower, often with bracts leaf-like. Flowers 3-5-merous. *Calyx* slightly fused at the base, with lobes often unequally long. *Corolla* shortly connate. *Stamens* in one whorl alternating with the petals, adnate to base of corolla. *Squamae* opposite carpels, dorsiventrally compressed. *Carpels* free or slightly sunk into the receptacle.

The genus is represented by only a few herbaceous, mainly annual, species in Australia while the greatest number (145 species) is found in South Africa. Many of the latter are grown in local gardens and some escapes have become naturalized, others have been accidentally introduced and are spreading as weeds.

Key to species and subspecific taxa

1. Flowers borne well above leaves (bracts, if present, scale-like); perennials 2

Flowers borne in axils of leaf-like bracts; annuals, or if perennials, leaves shorter than 12 mm 3

2. Leaves serrate, flat ..... (sect. *Anacampseroideae*) .... 13. *C. sarmentosa* var. *sarmentosa*

Leaves entire, terete or almost so ..... (sect. *Acutifolia*) .... 14. *C. tetragona* subsp. *robusta*

3. Calyx $^1/_2$-$^2/_3$ of the length of corolla; flowers 1 (-3) from '*axil*' of one leaf per node ..... (sect. *Helophytum*) 4

Calyx longer than or as long as corolla; flowers (1-) 3-18 in axils of both leaves at a node ..... (sect. *Glomeratae*) 7

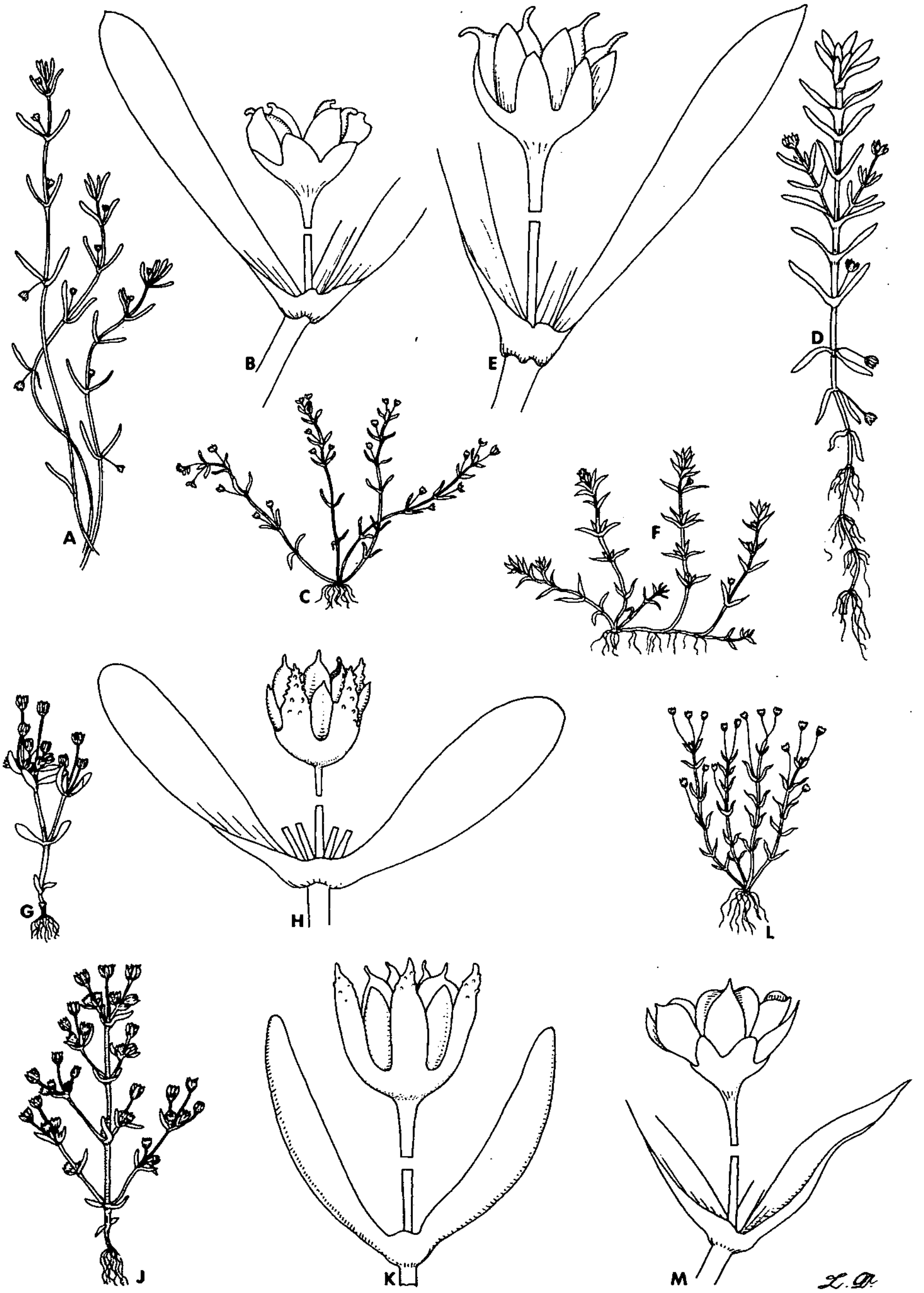


Fig. 2. A-C, *Crassula natans* var. *minus*: A, branch of plant growing in water, X 1; B, flower with fruit, X 10 (A & B, *Alcock 968*); C, plant growing on moist soil, X 1 (*Weber 1764*). D-F, *C. helmsii*: D, branch of plant growing in water, X 1; E, flower with fruit, X 10 (D & E, *Eichler 17731*); F, branch of plant growing on moist soil, X 1 (*Eichler 14879*). G, H, *C. pedicellosa* (*Chinnock 4104*): G, whole plant, X 1; H, flower with fruit, X 10. J, K, *C. decumbens* var. *decumbens* (*Chinnock 4103*): J, whole plant, X 1; K, flower with fruit, X 10. L, M, *C. peduncularis* (*Morrison*, 24.x.1891): L, whole plant, X 1; M, flower with empty pericarps, X 10.

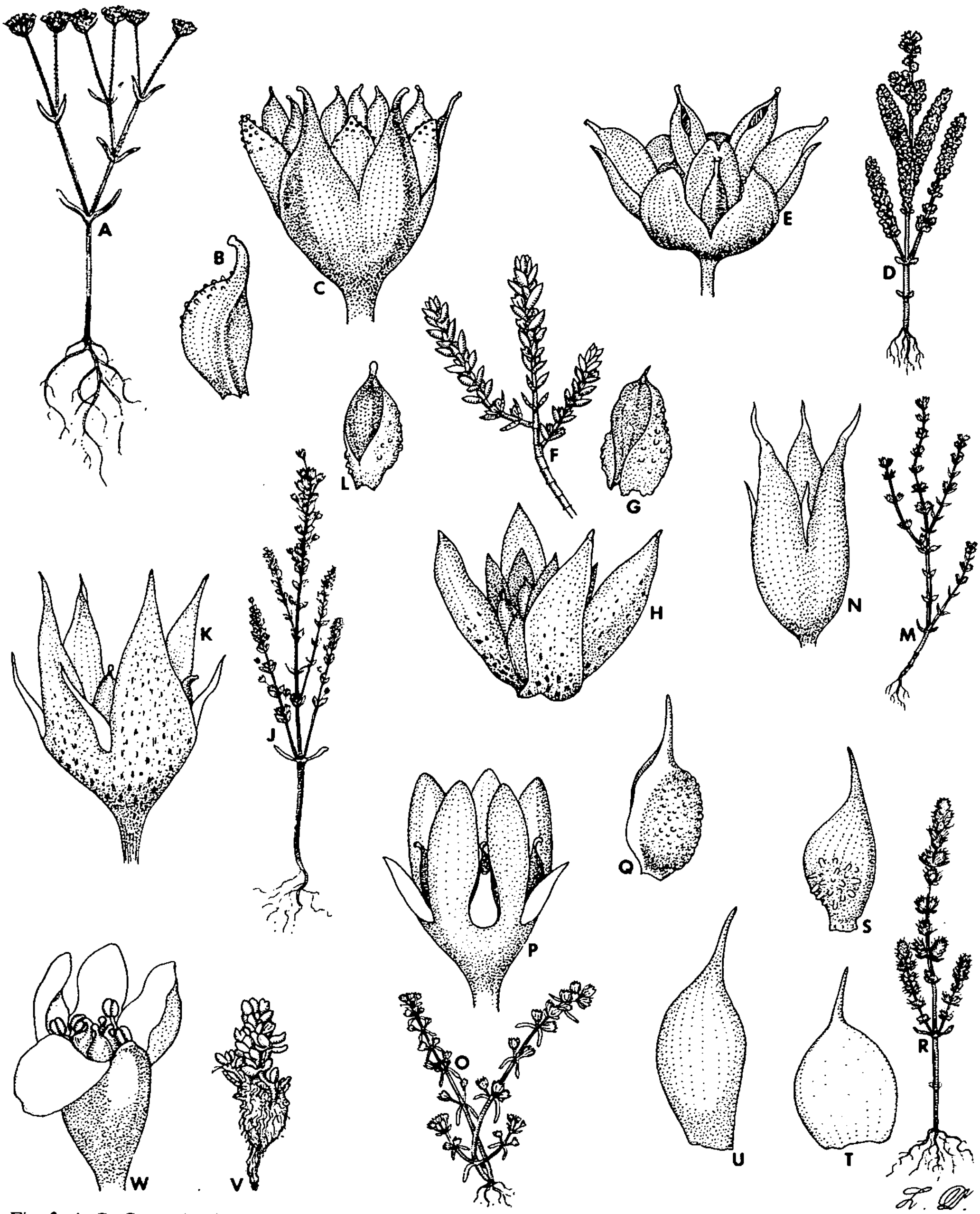


Fig. 3. A-C, *Crassula glomerata* (*Boorman* in NSW 143675); A, whole plant, X $^1/_2$; B, fruit, X 20; C, flower with fruit, X 10. D, E, *C. exserta* (*Toelken 6421*): D, whole plant, X $^1/_2$; E, flower with fruit, X 10. F-H, *C. sieberana* subsp. *sieberana* (*Toelken 6546*): F, branch with segmented base, X $^1/_2$; G, pericarp with seeds shed, X 20; H, flower, X 10. J-L, *C. sieberana* subsp. *tetramera* (*Toelken 6547*): J, whole plant, X $^1/_2$; K, flower, X 10; L, pericarp with seeds shed, X 20. M, N, *C. alata* (*Toelken 6548*): M, branch, X 1: N, flower, X 20. O-Q, *C. thunbergiana* subsp. *thunbergiana* (*Toelken 6439*): O, small plant, X $^1/_2$; P, flower with fruit, X 10; Q, fruiting carpel, X 20. R, S, *C. colorata* var. *tuberculata* (*Toelken 6424*): R, whole plant, X $^1/_2$; S, fruit, X 20. T, —var. *miriamiae*, fruit, X 20 (*Ostenfeld 1452*). U, —var. *colorata*, fruit, X 20 (*Toelken 6491*). V, W, *C. moschata* (*Allen* in HO 30959): V, small plant, X $^1/_2$; W, flower, X 10.

4. Carpels each with one ovule .... 4. *C. natans* var. *minus*
   Carpels each with (2-) 4-16 ovules 5
5. Leaves obovate to spathulate .... 1. *C. moschata*
   Leaves linear to oblong-elliptic 6
6. Style less than $^1/_4$ of the length of ovary and abruptly joining ovary; leaves rarely to 1 mm broad .... 2. *C. peduncularis*
   Style about half as long as and gradually tapering into ovary; leaves (1-) 1.5-2.5 (-3) mm broad .... 3. *C. helmsii*
7. Inflorescence a flat-topped terminal thyrsoid 8
   Inflorescence elongate, terminal or axillary 9
8. Fruiting pedicels absent (rarely to 4 mm on first flower of inflorescence) .... 5. *C. glomerata*
   Fruiting pedicels 4-15 mm long .... 6. *C. pedicellosa*
9. Flowers predominantly 3 or 4-merous 10
   Flowers predominantly 5-merous 12
10. Flowers 3-merous .... 12. *C. alata* var. *alata*
   Flowers 4-merous 11
11. Basal branches carnose, articulated with swollen nodes; follicles opening along the whole suture .... 9a. *C. sieberana* subsp. *sieberana*
   Basal branches wiry-woody, not articulated; follicles opening by apical pore .... 9b. *C. sieberana* subsp. *tetramera*
12. Flowers sessile or almost so 13
   Flowers with pedicels at least 1.5 mm long 16
13. Follicles dehiscing by apical pore and basal circumscissal split .... 10. *C. exserta*
   Follicles dehiscing only by basal circumscissal split 14
14. Follicles inflated, abruptly constricted into style .... 11b. *C. colorata* var. *miriamiae*
   Follicles laterally compressed, gradually tapering into style 15
15. Follicles almost elliptic in profile, smooth or rarely with bulging epidermis cells .... 11a. *C. colorata* var. *colorata*
   Follicles oblanceolate to almost spathulate in profile with clusters of tubercles below the middle .... 11c. *C. colorata* var. *tuberculata*
16. Carpels each with (1) 2 ovules 17
   Carpels each with 8-20 ovules 18
17. Calyx lobes sharply pointed .... 10. *C. exserta*
   Calyx lobes blunt .... 8. *C. thunbergiana* subsp. *thunbergiana*
18. Calyx lobes papillose; peduncles absent .... 6. *C. pedicellosa*
   Calyx lobes smooth or with few papillae towards the apex; peduncle 3-7 mm long .... 7. *C. decumbens* subsp. *decumbens*

A. sect. **Helophytum** (Eckl. & Zeyh.) Toelken, Contr. Bolus Herb. 8:84 (1977).

Type: *H. natans* (Thunb.) Eckl. & Zeyh.

Helophytum Eckl. & Zeyh., Enum. 288 (1836); Harv., Fl. Cap. 2:328 (1862).

Annual herbs usually. *Inflorescence* a terminal and often axillary thyrsoids with mainly monochasial branches; flowers 1 (3-) in the axil of one of the leaves at a node due to sympodial growth. *Calyx* to $^2/_3$ of the length of the corolla, with lobes usually obtuse. *Carpels* with obovoid ovaries abruptly constricted into short styles.

This section has an almost world-wide distribution but individual species usually do not cover a very wide area.

1. **C. moschata** Forst. f., Commentat. Soc. Regiae Sci. Gott. 9:26 (1787).

Type: South America, 'Statenland prope Terra de Fuego', *J.R. & G. Forster* (BM, 3 spec. AD, photo.!).

Bulliarda moschata (Forst. f.) Urv., Mem. Soc. Linn. Paris 4: 618 (1826).

Tillaea moschata (Forst. f.) DC., Prodr. 3:382 (1828); Hook., Ic. Pl. 6, pl. 535 (1843); Allan, Fl. N.Z. 1:197 (1961).

Annuals or perennials (?) with prostrate to decumbent axes 2-5 (-15) cm long, rarely branched. *Leaves* obovate, spathulate or rarely oblanceolate, 1.5-3 (-5) x 1.5-2.5 mm, obtuse, often subpetiolate, almost flat above and distinctly convex below, green. *Inflorescence* reduced to single terminal flower in axil of one of the leaves at a node; pedicels 1-2 mm long; flowers 4-merous. *Calyx*: lobes broadly triangular, 0.8-1 mm long, obtuse, glabrous, slightly fleshy, green. *Corolla* cup-shaped, white; lobes oblong-oblanceolate 1.3-1.5 (-2) mm long, obtuse, recurved. *Squamae* oblong-cuneate 0.3-0.5 x c. 0.2 mm, truncate, pale yellow. *Ovaries* obovoid, each abruptly constricted into short thin style arising from the inner margin, with 2-4 (-8) ovules. *Follicles* smooth, recurved, splitting along the whole suture; seeds smooth or almost so. (Fig. 3, V & W).

Growing on wet rocks near the coast; recorded only from Gull Reef near Port Davey (Tasmania).

The species is only known from a single recent record from Tasmania, although Hooker (1841) had expected it to be found there. This specimen, which was raised in cultivation, does not fit the description which Allan (1961) provides for *C. moschata* in New Zealand because it has neither 6-8 (-10) ovules per carpel nor leaves longer than 5 mm. However, the type specimens of *C. moschata* shows a wider range of variation in the length of the leaves and in the protologue the species is described to have 3 or 4 seeds per follicle.

The extreme measurements of some organs provided in brackets in the above descriptions were taken from specimens from outside Australia in order to facilitate a broader species concept in case more robust specimens are found. Much more material would be needed for a clear evaluation of the variation of the species and its local forms.

Specimens examined

TASMANIA: *M. Allan* in HO 30959, Gull Reef (HO).

2. **C. peduncularis** (Sm.) Meigen, Bot. Jb. 17:239 (1893); Laudon, Watsonia 5:61 (1961); Willis, Handb. Pl. Vict. 2:191 (1972); Curtis, Stud. Fl. Tasmania 1:184 (1975).

Type: Paraguay, Estancia de Jose Bermudes, near Monte Video, *Commerson* s.n. (LINN-SM, holo; BM; G, G-DC, microfiche!).

Tillaea peduncularis Sm. in Rees Cyclop. 35 (1817).

Crassula bonariensis Cambess., St. Hil. Flor. Brasil merid. 2 (39 Crassulaceae): 195 (1829); Webb in Fl. Europea 1: 351 (1964); Blackall, West. Austr. Wildflow. ed. Grieve 1: 178 (1954); Beard, Cat. West Austr. Pl. 36 (1965), nom. illeg.

Type: same as for *C. peduncularis.*

Tillaea purpurata Hook. f., Hooker's J. Bot. 6: 472 (1841); Fl. N. Zealand 2: 75 (1853); Fl. Tasm. 2: 145 (1860); Benth., Fl. Austr. 2: 451 (1864); Tate, Fl. S. Austr. 85 (1890); Bailey, Queensl. Pl. 169, fig. 142 (1913).

Crassula purpurata (Hook. f.) Domin, Bibl. Bot. 89: 704 (1925); Burbidge & Gray, Fl. A.C.T. 190 (1970); Beadle et al., Fl. Sydney Region 173 (1972).

Type: Tasmania, Formosa, *Gunn 1967* (K, holo.!).

Crassula pedicellosa sensu Beadle, Stud. Fl. NE NSW 2: 157, fig. 69C (1972), non (F. Muell.) Ostenf.

Annuals with short decumbent branches to 6 cm long and usually much branched. *Leaves* linear-lanceolate, (2-) 3-5 x 0.5-1 mm, cuspidate or acuminate, sometimes slightly constricted towards the base, dorsiventrally flattened and more or less convex on both surfaces, green to deep red. *Inflorescence* with single terminal flowers in the axil of the leaves due to sympodial growth, with pedicels 3-8 (-10) mm long when fruiting; flowers 4-merous. *Calyx*: lobes broadly triangular, 0.7-1 mm long, obtuse rarely acute, glabrous, slightly fleshy, green to red. *Corolla* cup-shaped, white more or less tinged red; lobes oblong-triangular, 1.3-1.5 mm, obtuse, spreading. *Squamae* narrowly oblong, 0.4-0.6 x c. 0.1 mm, rounded, usually constricted towards the base, yellow. *Ovaries* obovoid, each abruptly constricted into short thin styles arising from the inner margin, with 10-14 ovules. *Follicles* smooth, recurving at the apex, splitting along the whole suture and opening up so widely that they are easily confused with the slightly smaller petals; seeds with fine vertical ridges. (Fig. 2, L & M).

Growing in marshy areas which are rarely flooded; occurring mainly in south-eastern Australia from the Eyre Peninsula to north-eastern New South Wales and in Tasmania but also a few scattered records from southern Western Australia. (Map 1). The species occurs also in New Zealand and South America.

A species with remarkably little variation. Fruiting specimens are easily identified by the very large and spreading margins of the membranous pericarp which can only be distinguished from the smaller petals by its usually emarginate apex and style rudiment. Marsh plants of *C. helmsii* superficially resemble flowering plants of *C. peduncularis*, but are distinguished by their long styles which are about half as long as and taper gradually into the ovary. Also, seeds of the former are more or less smooth while those of *C. peduncularis* have vertical ridges covered with tubercles.

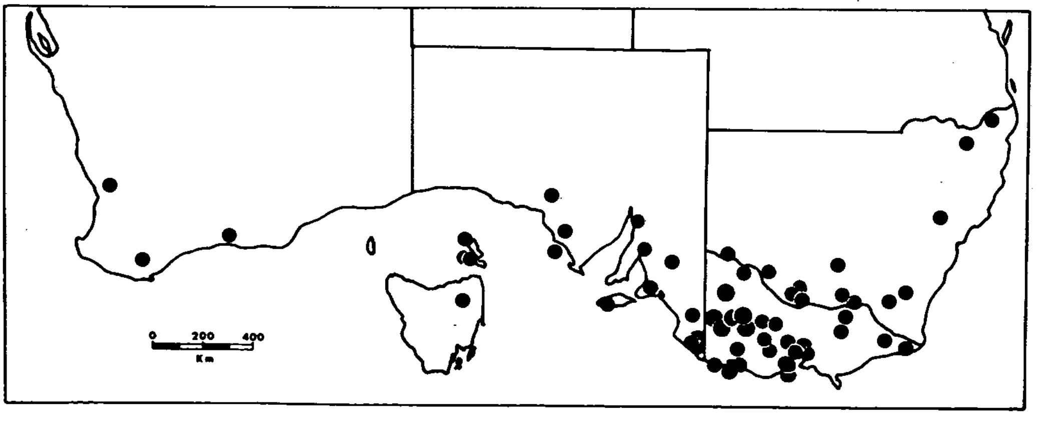
According to descriptions the calyx lobes of plants from South America are acute while they are usually obtuse in Australia except for occasional records from New South Wales. Hence Laudon's suggestion to place the Australian species, *C. purpurata*, into the synonymy of *C. peduncularis*, was adopted here.

Selection of Specimens examined (79 seen)

WESTERN AUSTRALIA: *Eichler 2007F*, 22 km N Stokes Inlet (AD); *Mueller* in MEL 90578, Stirling Ranges (MEL).

SOUTH AUSTRALIA: *Ising* in AD 97701103, Wudinna (AD); *Mueller* in MEL 90580, Mt Remarkable (MEL); *Weber 1893*, Big Heath National Park (AD); *Wilson 645*, Kelly Hill, Kangaroo Island (AD).

NEW SOUTH WALES (incl. A.C.T.): *Briggs 2179*, 5 km W Gungal (NSW); *Coveny 5147*, Tarloom Falls (NSW); *McBarron 3479*, Bulgandry Reserve (SYD).



Map 1. Distribution of *C. peduncularis*.

VICTORIA: *Beauglehole 6665*, Lady Julia Percy Island (MEL); *Beauglehole 28488*, Wyperfeld National Park (MEL); *Morrison s.n.*, Werribee, 24.x.1891 (AD, CANB, PERTH); *Wakefield 3451*, Cann River (MEL).

TASMANIA: *Mueller s.n.*, South Esk River (MEL, NSW); *Whinray 877*, Big Green Island (MEL); *Whinray 1251*, Mount Chappell Island (MEL).

3. **C. helmsii** (Kirk) Cockayne, Trans. N.Z. Inst. 39: 349 (1907); Burbidge & Gray, Fl. A.C.T. 190 (1970); Willis, Handb. Pl. Vict. 2: 191 (1972); Beadle, Stud. Fl. NE NSW 2: 157 (1972), pro parte excl. fig. 69B; Aston, Aquatic Pl. Aust. 67, fig. 24 (1973); Curtis, Stud. Fl. Tasm. 1: 185 (1975).

Types: New Zealand, near Greymouth, *Helms s.n.* (WELT!, lecto, designated here); Karamea, *Spencer 30* (WELT!).

Tillaea helmsii Kirk, Stud. Fl. N.Z. 142 (1899); Allan, Fl. N.Z. 1: 198 (1961).

Tillaea verticillaris sensu Hook. f., Hooker's Icon. Pl. 3, pl. 295 (1840), non L.

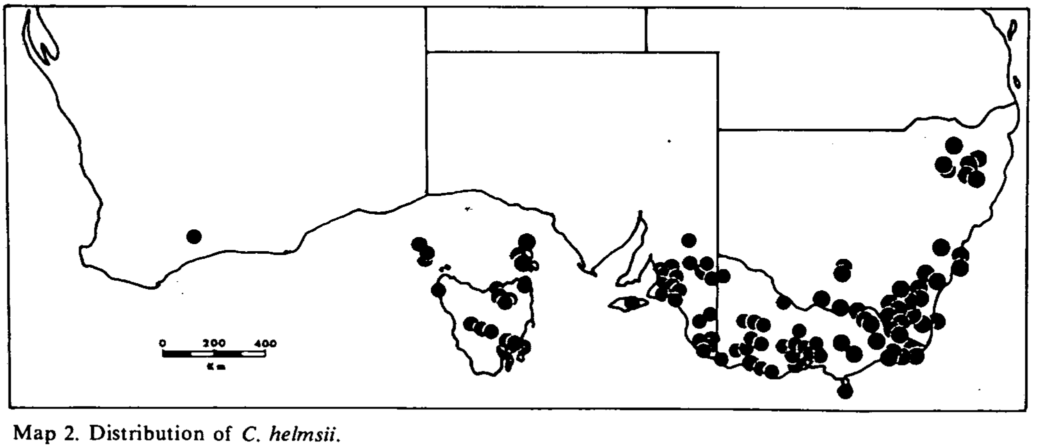
Bulliarda recurva Hook. f., Hooker's J. Bot. 6: 472 (1847).

Tillaea recurva (Hook. f.) Hook. f., Fl. Tasm. 1: 146 (1860); Benth., Fl. Austr. 2: 452 (1862); Tate, Fl. S. Austr. 85 (1890); Bailey, Queensl. Fl. 159, fig. 143 (1913); Maiden & Betche, Census NSW 86 (1916); Black, Trans. R. Soc. S. Austr. 40: 63 (1916); 42: 45 (1918).

Crassula recurva (Hook. f.) Ostenf., Dansk bot. Ark. 2, 8: 46 (1918); Black, Fl. S. Austr. ed. 2: 392 (1948); Blackall, West. Austr. Wildflow. ed. Grieve 1: 178 (1954); Beard, Cat. West Austr. Pl. 36 (1965), non N.E. Br. (1890).

Type: Tasmania (Van Diemen's Land), *Gunn 91* (K, holo!).

Annuals with decumbent branches to 12 cm long and often much branched in marsh plants, or floating branches to 25 cm long and occasionally branched. *Leaves* oblong-lanceolate to oblong-elliptic, 3-8(-12) x (0.8-) 1-2(-3) mm, acute to acuminate, rarely cuspidate, scarcely constricted towards the base, dorsiventrally flattened and slightly fleshy in marsh plants, green to brown. *Inflorescence* with one terminal flower in the axil of the upper leaves due to sympodial growth, with pedicels 4-7 mm long when fruiting; flowers 4-merous. *Calyx*: lobes triangular 0.6-0.8 (-1) mm long, bluntly acute to usually obtuse, glabrous, slightly fleshy, green. *Corolla* more or less cup-shaped, white; lobes lanceolate 1.6-2 mm, acute, spreading to somewhat recurved when flowering. *Squamae* oblong-cuneate 0.8-1 x 0.2-0.3 mm, truncate, gradually constricted towards the base, almost membranous, white. *Ovaries* obovoid to almost obconical but somewhat tapering into the styles, each with (2-)4-10 ovules. *Follicles* smooth, slightly recurved, splitting along the whole suture but opening mainly into an apical pore; seeds smooth or with fine often incomplete vertical ridges. (Fig. 2, D & F).



Map 2. Distribution of *C. helmsii*.

Growing in or around standing water; occurring mainly in south-eastern Australia from near Adelaide in South Australia, through Victoria to north-eastern New South Wales and Tasmania. (Map 2). It also occurs in New Zealand and there are two old records from Western Australia.

The broader and acute to acuminate leaves of *C. helmsii* distinguish floating branches from those of the more delicate *C. natans*, apart from the fact that the latter has carpels similar in shape to those of *C. peduncularis*. Flowers of the latter two species are distinguished from those of *C. helmsii* by the ovary which is abruptly constricted into the short style.

Like all the species of *Crassula* which are tolerant to being submerged at times, *C. helmsii* varies between two extreme growth forms according to the conditions under which it grows. Firstly, submerged plants produce long branches that float on the surface of the water, and it is this form which is most commonly collected. The internodes are usually longer than 10 mm and the leaves are 2-3 mm broad. Secondly, when plants grow on moist soil they form small cushions with leaves densely clustered, up to 6 mm long and about 1 mm broad.

An interesting local variant was recorded from the Grampians and in particular from Mt Arapiles (*Beauglehole* 29792) in which the leaf apices are cuspidate to acuminate and young flowers are almost sessile, but shape of the carpel and seeds leave no doubt that this form should be placed into *C. helmsii*. Similarly plants from Tasmania tend to have leaves which are about 3 mm broad and have a cuspidate to mucronate leaf apex.

Of the two syntypes of *C. helmsii* the Helms's collection is not only a more complete specimen but also contains a note which explains that Baron von Mueller considered it to be a new species, which in turn might have been the motivation for Kirk to describe it. It is for these reasons selected as lectotype.

Selection of Specimens examined (219 seen)

WESTERN AUSTRALIA: *Drummond* in MEL 90816, Western Australia (MEL); *Grove* in MEL 90608, near Lake King (MEL).

SOUTH AUSTRALIA: *Eichler 14896*, Purnong Landing (AD, MEL); *Hunt 1507*, Comaum (AD); *Symon 2061* (ADW, CANB); *Tate s.n.*, Kangaroo Island, 23.v.1880 (AD).

NEW SOUTH WALES (incl. A.C.T): *Burbidge & Gray 6219*, Fitz Hill (CANB, NSW); *Coveny 8797*, Mt Kaputar National Park (NSW); *McBarron 4420*, Mulwala (SYD); *Sainty* in NSW 143702, Hanwood (NSW).

VICTORIA: *Beauglehole 1606*, Mt Arapiles (MEL); *Beauglehole 21273*, Port Campbell National Park (MEL); *Morrison* in CANB 133636, Port Melbourne (CANB); *Wakefield 4269*, Coringle (MEL).

TASMANIA: *Hannaford* in NSW 143689, Tamar River (NSW); *Morris 7967*, Sea Elephant River, Kings Island (HO); *v. Mueller* in MEL 90504, banks of Loddon River (MEL); *Whinray 866*, Big Green Island (MEL).

*4. **C. natans** Thunb., Prodr. 54 (1794); Fl. Cap. ed. Schultes 282 (1823); DC., Prodr. 3: 389 (1828); Toelken, Contr. Bolus Herb. 8: 86 (1977), Blackall, West. Austr. Wildflow. ed. Grieve 1: 179 (1959).

Type: Cape, near Cape Town, *Thunberg* in Herb. Thunberg 7772 (UPS, holo.!; G!; S!).

Although the typical variety is more widespread in South Africa and is usually common it has not been introduced into Australia.

Var. **minus** (Eckl. & Zeyh.) Rowley, Cactus Succ. J. Gt Brit. 40: 53 (1978).

Type: Cape, Green Point, *Ecklon & Zeyher 1843b* (S!; SAM!).

Helophytum natans (Thunb.) Eckl. & Zeyh. var. *minus* Eckl. & Zeyh., Enum. 288 (1837).

Crassula natans Thunb. var. *filiformis* (Eckl. & Zeyh.) Toelken, Jl S.Afr. Bot. 41: 112 (1975).

Type: Cape, Platte Klip, *Ecklon & Zeyher 1850* (GRA!; K!; S!; SAM!).

Annuals with decumbent filiform branches to 10 cm long and often much branched when growing on marshy substrate, or slender floating branches to 25 cm long and rarely branched. *Leaves* linear, rarely linear-elliptic, 3-5 (-8) x 0.5-1 mm in marsh plants, or (5-) 6-12 (-14) x 1-1.5 (-2) mm in plants with floating branches obtuse to rarely acute when young, scarcely constricted towards the base, dorsiventrally flattened and slightly fleshy at least in marsh plants, green to pale reddish-brown. *Inflorescence* with one terminal flower (rarely two in marsh plants) in the axils of the leaves due to sympodial growth, with pedicels (2-) 3-5 mm long when fruiting; flowers 4-merous. *Calyx*: lobes broadly triangular 0.2-0.3 mm long, obtuse, glabrous, slightly fleshy, green to pale brown. *Corolla* more or less cup-shaped, white; lobes oblanceolate 0.6-0.8 mm long, acute to obtuse, spreading. *Squamae* oblong-cuneate 0.4-0.5 x 0.1-0.2 mm, truncate, first abruptly later gradually constricted towards the base, slightly fleshy, yellow or red. *Ovaries* obovoid to almost obconical, abruptly constricted into short styles, with one ovule. *Follicles* smooth, erect to slightly recurved, splitting and opening along the whole suture; seeds smooth and shiny or almost so. (Fig. 2, A-C).

Growing usually on marshy soil around standing water but occasionally plants are inundated; introduced from South Africa, where it is confined to the extreme SW Cape, to Perth and Adelaide but now recorded from many localities in southern Western Australia, and similarly now also from south-eastern South Australia and a few records from adjoining areas in Victoria and Tasmania. (Map 3).

The first specimen of the species was collected by *Sewell* (in MEL 90487) in 1883 from the vicinity of Perth. *Morrison* made several collections of the species from the same area between 1898 and 1902, but it is not known how quickly the species spread from there as no records exist until the late 1950's when the present distribution seems to have been attained.

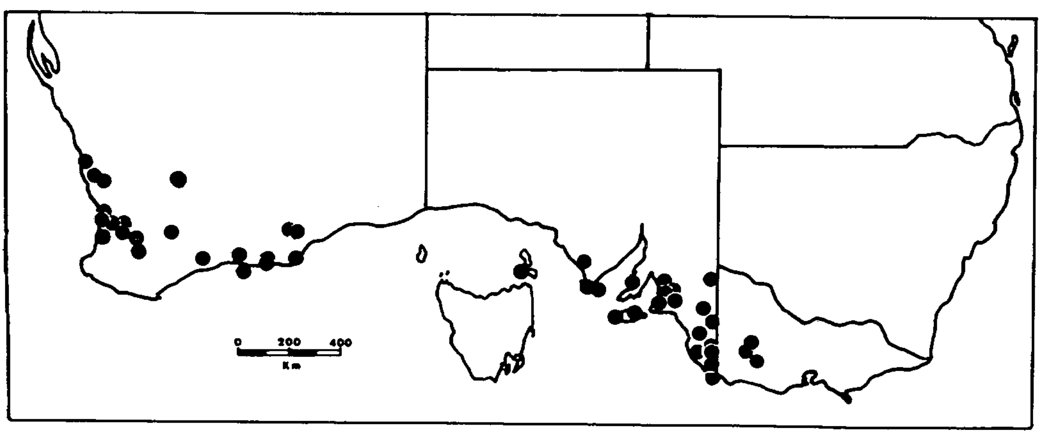
Selection of Specimens examined (72 seen)

WESTERN AUSTRALIA: *Eichler 19859*, 14 km SW Howick Hill (AD, CANB); *Morrison s.n.*, Cannington, 18.viii.1898 (BRI); *Toelken 6422*, Lake Logan (AD); *Willis s.n.*, Balladonia (AD).

SOUTH AUSTRALIA: *Alcock 2972*, Big Heath National Park (AD); *Eichler 19103*, Uley Station Road (AD); *Phillips 1055A*, 18 km W of Flinders Chase National Park (CBG); *Spooner 452*, Torrens Gorge (AD).

VICTORIA: *Beauglehole 6769*, between Burnt Creek & Zumsteins (MEL); *Beauglehole 21301* and *21547*, Port Campbell National Park (MEL).

TASMANIA: *Whinray 534*, Badger Island (AD).



Map 3. Distribution of *C. natans*

B. sect. **Glomeratae** Haw., Rev. Pl. Succ. 12 (1821); Toelken, Contr. Bolus Herb. 8: 99 (1977).

Type: *G. glomerata* Berg.

Annuals herbs, rarely perennials. *Inflorescence* terminal and/or axillary thyrsoids each with 1-many dichasia. *Calyx* longer or as long as corolla, acute or pointed. *Carpels* with elongate ovaries gradually tapering into slender styles.

As in sect. *Helophytum*, the species of sect. *Glomeratae* have a world-wide distribution but most species occur in Southern Africa.

*5. **C. glomerata** Berg., Descr. Pl. Cap. 85 (1767); L., Mantissa 60 (1967); Schonl., Trans. R. Soc. S. Afr. 17: 187 (1929); Toelken, Contr. Bolus Herb. 8: 115 (1977).

Type: Caput Bonae Spei, *Grubb s.n.* (STB, holo.!).

Annuals with stiffly erect branches to 15 cm high, more or less branched. *Leaves* oblong-lanceolate to oblong-elliptic 6-10(-1.5) x 1-2(-3) mm, subulate and often with a terminal seta, dorsiventrally compressed and slightly convex on both surfaces, green to brown. *Inflorescence* a terminal rounded or flat-topped thyrsoid often divided into several dense dichasia; pedicels usually absent, rarely to 4 mm long on the first flower of the inflorescence; flowers 5-merous. *Calyx*: lobes lanceolate 1-2.5 mm long, acute and each usually with a terminal point, glabrous, somewhat fleshy, green to brown. *Corolla* cup-shaped, white; lobes oblong-lanceolate, 1-1.6 mm long, obtuse or bluntly acute, recurved. *Squamae* oblong-cuneate, 0.4-0.5 x 0.2-0.3 mm, usually rounded, at first abruptly later gradually constricted downwards, almost membranous, pale yellow. *Ovaries* almost cylindrical and gradually constricted into distinct styles, with 2 ovules. *Follicles* tuberculate, erect, releasing lower seed by basal circumscissal split while upper one remains in hard pericarp; seed with faint or no vertical ridges. (Fig. 3, A-C).

Growing mainly in sandy soils in coastal areas; introduced from the coastal areas of the Cape Province, South Africa, to the vicinity of Perth but has now also been recorded from near Albany. Although it has been recorded from Sydney Botanic Gardens it does not seem to have become naturalized there.

Usually the flowers are sessile in dense dichasia but when plants grow in deep shade the inflorescence is loosely branched with the first flower often distinctly pedicellate. In such flowers the calyx usually elongates to twice the normal length. Also the size and in particular the width of the leaves varies greatly depending on the availability of moisture and shading.

Specimens examined

WESTERN AUSTRALIA: *Burbidge 8090*, Two People's Bay (CANB); *Cranfield s.n.*, Garden Island (PERTH); *Fitzgerald* in NSW 143676 & 7, Garden Island (NSW); *Lindgren s.n.*, Carnac Island (PERTH); *McArthur s.n.*, Garden Island (PERTH).

NEW SOUTH WALES: *Boorman* in NSW 143675, Sydney Botanic Gardens (NSW).

6. **C. pedicellosa** (F. Muell.) Ostenf., Dansk bot. Ark. 2, 8: 42 (1918); Black, Fl. S. Austr. ed. 2: 392, fig. 549B & D (1948); Beard, Cat. West Austr. Pl. 36 (1965); Willis, Handb. Pl. Vict. 2: 191 (1972).

Type: Western Australia, Sterling Mountains, *Mueller* in MEL 8845 (lecto.! selected here; MEL).

Tillaea macrantha Hook. f. var. *pedicellosa* F. Muell., Fragm. 11: 118 (1881); Black, Trans. R. Soc. S. Austr. 40: 63 (1916).

Tillaea pedicellosa (F. Muell.) F. Muell., Second Cens. 1: 84 (1889).

Annuals with erect branches to 10 cm long, usually little branched. *Leaves* oblanceolate to elliptic 4-10 (-12) x (2-) 3-4 mm, obtuse, rarely acute, flat or slightly convex above and usually somewhat convex below, green to deep red. *Inflorescence* a condensed thyrsoid, rarely several, usually with 2 or 3 dichasia sessile or almost so, pedicels to 30 mm long when fruiting; flowers 5-merous. *Calyx*: lobes lanceolate 1.5-2 mm long, acute and covered with blister-like papillae especially towards the apex, fleshy, green to red. *Corolla* cup-shaped, white to cream; lobes oblong-lanceolate, 1.8-2 mm long, acute, spreading. *Squamae* usually T-shaped, 0.3-0.4 x 0.6-0.7 mm, usually truncate to slightly rounded, abruptly constricted below the apex, somewhat fleshy towards the apex, pale yellow to white. *Ovaries* almost cylindrical and gradually constricted into distinct style, with 18-22 ovules. *Follicles* erect, smooth, releasing seeds through apical pores; seeds with faint vertical ridges. (Fig. 2, G & H).

Growing usually on sandy soils on lower slopes or on plains; occurring in the southern parts of Western Australia, southern South Australia and south-western Victoria, and also one record from Tasmania. (Map 4).

C. pedicellosa is very similar to *C. decumbens* but it is easily distinguished from the latter by its very short peduncles of the lateral branches of the dichasia so that the flowers appear to be arranged in an umbel. As the fruit matures the pedicels elongate very much more than in the latter species. The seeds of *C. pedicellosa* have vertical ridges while in *C. decumbens* these ridges are covered with tubercles.

Five sheets of what seems to be part of the type collection are found in von Mueller's herbarium, but only one of these bears the name '*Tillaea macrantha* var. *pedicellosa*' and this sheet No. 88451 is selected as a lectotype.

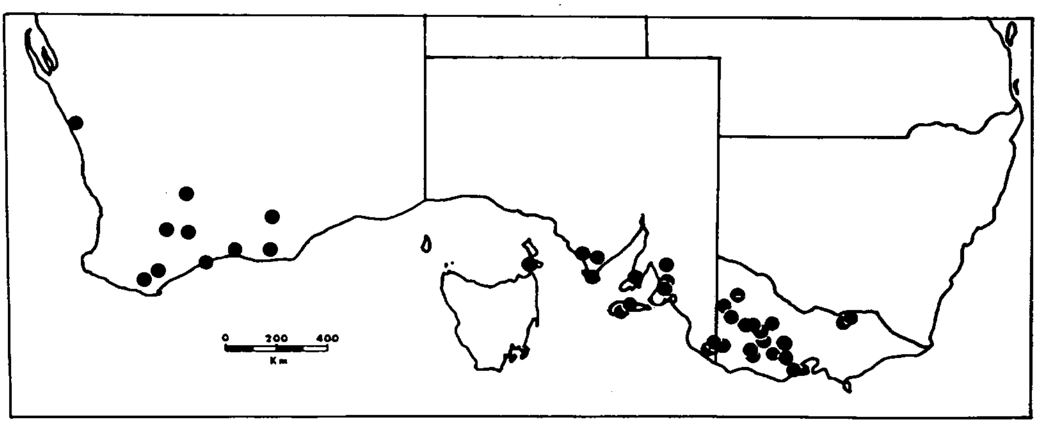
Selection of Specimens examined (75 seen)

WESTERN AUSTRALIA: *Chinnock 4104*, 30 km N Narembeen (AD); *Helms s.n.*, Frazer Range (AD, NSW); *Orchard 1216*, 13 km N Stokes Inlet (AD); *Trudgen 2209*, 13 km E Nanson (PERTH).

SOUTH AUSTRALIA: *Eichler 19290*, Bascombe Well (AD); *Kraehenbuehl 2285*, Tarnma (AD); *Spooner 226*, Torrens Gorge (AD); *Wilson 648*, Kelly Hill, Kangaroo Island (AD).

VICTORIA: *Aston 1069*, Mt Arapiles (MEL); *Beauglehole 49549*, 14 km NW Anglesea (MEL); *Williamson s.n.*, Geelong (BRI, MEL).

TASMANIA: *Whinray 184*, Cape Barren Island.



Map 4. Distribution of *C. pedicellosa*.

7. **C. decumbens** Thunb. var. **decumbens**

C. decumbens Thunb., Prodr. 54 (1794); Fl. Cap. ed. Schultes 280 (1923); Schonl., Trans. R. Soc. S. Afr. 17: 183 (1929); Toelken, Contr. Bolus Herb. 8: 122 (1977).

Type: Cape, near Cape Town, Thunberg in Herb. *Thunberg 7751* (UPS, lecto.! Toelken, 1977); BM! STB!).

Tillaea macrantha Hook. f., Hooker's Icon. Pl. pl. 310 (1841); Fl. Tasm. 1: 145 (1860); Benth., Fl. Austr. 2: 452 (1864); Tate, Fl. S. Austr. 85 (1890), as 'micrantha'; Black in Trans. R. Soc. S. Austr. 40: 63 (1916); Ostenf., Dansk. bot. Ark. 2, 8: 40 (1916); Maiden & Betche, Census NSW 86 (1916).

Crassula macrantha (Hook. f.) Diels & Pritzel, Bot. Jb. 35: 210 (1904); Ostenf., Dansk. bot. Ark. 2, 8: 40 (1916); Black, Fl. S. Austr. ed. 2: 392 (1948); Blackall, West. Austr. Wildflow. ed. Grieve 1: 178, fig. (1954); Beard, Cat. West Austr. Pl. 36 (1965); Burbidge & Gray, Fl. A.C.T. 191 (1970); Beadle et al., Fl. Sydney Region 173 (1972); Curtis, Stud. Fl. Tasm. 1: 185, fig. 45 (1975).

Type: Tasmania (Van Diemen's Land), *Gunn s.n.* (K, holo.!).

Tillaea macrantha Hook. f. var. *sepalosa* F. Muell., Fragm. 11: 117 (1881).

Type: S. Australia, between Venus and Streaky Bay, *H. Babbage s.n.* (MEL, holo.!).

Crassula macrantha (Hook. f.) Diels & Pritzel var. *nuda* Ostenf., Dansk. bot. Ark. 2, 8: 41 (1916).

Syntypes: Western Australia, near Perth, *Davis sub Ostenfeld 1349* (NSW!); Near Armadale, *Ostenfeld 358* (MEL!); *359* (NSW!; PERTH!); *362*; at Mundaring Weir, *Ostenfeld 363*.

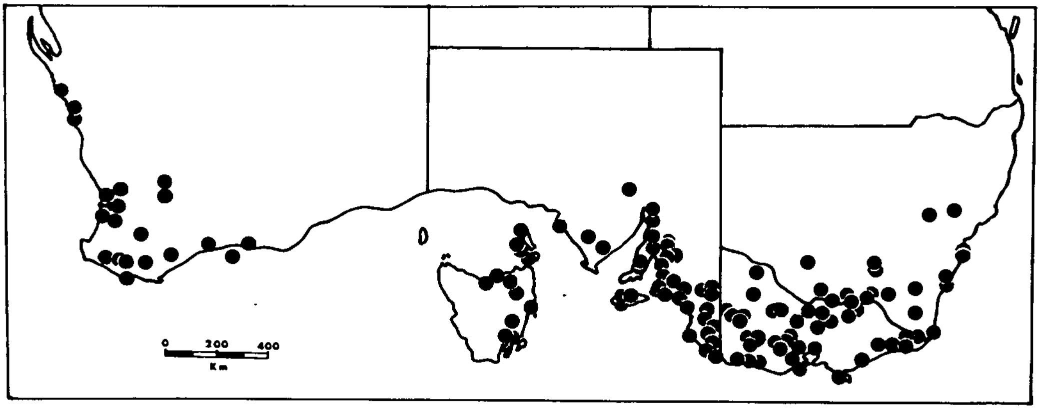
Annuals with erect or decumbent branches (0.5-) 3-9 (-12) cm long, rarely tufted, usually repeatedly branched. *Leaves* linear-lanceolate to linear-elliptic, 3-8 (-10) x (0.8-) 1-2 mm, usually acute, slightly constricted towards the base, dorsiventrally compressed and more or less convex on both surfaces, fleshy, green to reddish-brown. *Inflorescence* one to several elongate leafy thyrsoids often with several pairs of lateral dichasia, with pedicels to 8 mm long when fruiting; flowers 5-merous. *Calyx*: lobes lanceolate 1.5-2.5 (-3.5) mm long, acute, glabrous or rarely with a few terminal papillae, fleshy, green to pale brown. *Corolla* cup-shaped, white to cream; lobes lanceolate 1.5-2 mm long, acute, spreading. *Squamae* broadly wedge-shaped to T-shaped, 0.2-0.4 x 0.4-0.7 mm, usually truncate, first abruptly constricted later more gradually tapering towards the base, slightly thickened at the apex, pale yellow to white. *Ovaries* elongate-reniform in profile and gradually constricted into a thin style, with 4-12 ovules. *Follicles* smooth, slightly recurved, releasing seeds through broad apical pore; seeds with vertical ridges covered with tubercles. (Fig. 2, J & K).

Growing usually in moist places but often in different habitats varying from coastal dunes to mountain slopes; occurring in south-western Western Australia, southern South Australia, widespread in Victoria and south-eastern New South Wales also found in Tasmania as well as in the south-western Cape, South Africa. (Map 5). The var. *brachyphylla* is restricted to the coast of the south-western Cape Province.

The wide range of variation occasionally found in this species is particularly striking because most of the plants vary little as they tend to grow in similar positions. Occasionally plants grow in wet areas in deep shade and as expected all the organs are then enlarged including the bracts and pedicels so that the flowers appear to be axillary. Also unusual is the calyx which may be at least twice as long as the corolla.

On the other hand plants growing under unfavourable conditions may consist of a single branch about 10 mm long with one or two flowers, as plants start flowering from their third node above the cotyledons (see infloresences). A few papillae or teeth may at times be found along the margin of the sepals but cilia, as Hooker's original description of *C. macrantha* may suggest, have never been observed.

C. macrantha was included in the synonomy of *C. decumbens* despite the more pointed tubercles in typical material from South Africa. In Western Australia, however, the tubercles are much more like those in South Africa.



Map 5. Distribution of *C. decumbens* var. *decumbens*.

Selection of Specimens examined (332 seen)

WESTERN AUSTRALIA: *Moore s.n.*, Merredin (CANB): *Morrison* in BRI 156756, Hotham River, Marradong (BRI); *Toelken 6494*, Phillips River near Ravensthorpe (AD); *Willis* in MEL 90485, Boxer Island (MEL).

SOUTH AUSTRALIA: *Alcock 1636*, Lincoln National Park (AD); *Black s.n.*, Campbell's Creek, Melrose (AD); *Hunt 1100*, 10 km W Naracoorte (AD); *Jackson 145*, Reeve's Point, Kangaroo Island (AD).

NEW SOUTH WALES (incl. A.C.T.): *Bradley* in NSW 143790, S. Mosman (NSW); *McBarron 2110*, Albury (NSW); *McBarron 4966*, Coreen (SYD); *Rodway 2802*, Huskisson (NSW).

VICTORIA: *Aston* in MEL 90999, Mt Eccles (MEL); *Melville 864*, 2 km Kaniva (MEL); *Moore* in CANB 50494, Yarrawonga (CANB); *v. Mueller* in MEL 90764a, Campaspe River (MEL).

TASMANIA: *Gunn 1117*, George Town (NSW); *Hannaford 21*, Hobart (NSW); *Whinray 519*, Mt Chappell Island (AD); *Whinray 53*, Lady Barron, Flinders Island (MEL).

*8. C. **thunbergiana** J.A. Schultes subsp. **thunbergiana**

Crassula thunbergiana J.A. Schultes, Syst. Veg. 6: 733 (1820); Toelken, Contr. Bolus Herb. 8: 117 (1977).

Type: Cape, *Thunberg* in Herb. Thunberg 7750a (UPS, lecto.! (Toelken, 1977); G!).

Annuals with decumbent branches to 8 cm long and usually much branched. *Leaves* linear-lanceolate or linear-elliptic, 2-6 (-8) x 0.8-1.5 mm, with acute but usually blunt apices covered with blister-like papillae at least when young, flat on top and strongly convex below, fleshy, green to reddish-brown. *Inflorescences* one to several elongate leafy thyrsoids with sessile dichasia in the axils of the leaves, with pedicels (0-) 1-3 mm long; flowers 5-merous. *Calyx*: lobes lanceolate 1-2 (-3) mm long, bluntly acute and usually more or less covered with blister-like papillae, fleshy, green to brown. *Corolla* cup-shaped, cream, sometimes tinged red; lobes lanceolate c. 1 mm long, sharply acute and often folded lengthwise, spreading. *Squamae* T-shaped, 0.2-0.3 x 0.1-0.3 mm, truncate or slightly rounded, almost membranous, white to red. *Ovaries* elongate-reniform in profile, more or less abruptly constricted into thin style, with 2 ovules. *Follicles* erect, slightly papillose mainly towards the base, releasing upper seed through apical pore, while lower one remains enclosed in the pericarp which is shed by basal circumscissal split; seeds with vertical rows of tubercles. (Fig. 3, O-Q).

Usually growing in sandy soils in gardens or in disturbed areas; probably originally introduced to the vicinity of Perth from where the earliest records were made but now also from near Albany. It grows naturally on the western Cape coast in South Africa while the subsp. *minutiflora* occurs in the north-western arid areas of the Cape Province and south-western Namibia.

C. thunbergiana is very similar to some forms of *C. sieberana* subsp. *tetramera* and especially the fruits are almost indistinguishable. The latter species is, however, distinguished by its 4-merous flowers with acute calyx lobes often ending in a colourless awn. In both species the calyx lobes may be considerably elongated where plants grow in favourable or under shady conditions.

Specimens examined

WESTERN AUSTRALIA: *Eichler 16037*, Middleton Beach (AD); *Fitzgerald s.n.*, Cottesloe (NSW); *Royce 3927*, Hamelin Bay (PERTH); *Toelken 6439*, King's Park (AD); *Turvey* in NSW 143671, Melville (NSW).

9. **C. sieberana** (J.A. & J.H. Schultes) Druce, Rep. botl. Soc. Exch. Club Br. Isl. 1916: 704 (1917).

Type: Nova Hollandia, *Sieber 173* (M, holo.!; G-DC, microfiche!; K; MEL!).

Perennials or annuals with erect or decumbent branches to 20 cm long, more or less branched. *Leaves* linear-lanceolate (3-) 4-8 (-11) x 1-3 mm, acute to obtuse, usually flat above and more or less convex below, fleshy, green to greyish-brown rarely reddish-brown. *Inflorescence* one to several elongate thyrsoids, rarely panicles, usually with many pairs of dichasia sessile in the axils of the leaf-like bracts, with pedicels 1-10 mm long when fruiting; flowers 4-merous. *Calyx*: lobes lanceolate to linear-lanceolate 1.5-3 mm long, acute and usually with a colourless terminal point and sometimes with papillae, often very fleshy, green to pale brown. *Corolla* cup-shaped, pale yellow to red; lobes lanceolate 1-2 mm long, sharply acute and often folded lengthwise, erect to spreading. *Squamae* linear-cuneate to oblong-T-shaped, 0.4-0.6 x 0.1-0.2 mm, more or less truncate, slightly fleshy at the apex, white or pale yellow. *Ovaries* almost cylindrical to almost conical and gradually constricted into styles, with 2 ovules. *Follicles* often slightly papillose, splitting along the whole suture but usually opening into an apical pore and often also with basal circumscissal split; seeds almost smooth, with faint ridges or rarely with small tubercles.

The typical subspecies is restricted to the mountainous areas of eastern Australia while subsp. *tetramera* occurs widely in temperate and arid regions of Australia.

The type specimen (in M) is probably the holotype because it is from Schultes herbarium and shows the decumbent habit and adventitious roots mentioned in the original diagnosis. These characteristics are not visible in other specimens of the type collection investigated.

9a. subsp. **sieberana**

Tillaea sieberana J.A. & J.H. Schultes, Mant. 3: 345 (1827); Allan, Fl. N.Z. 1: 199 (1961).

Crassula sieberana (J.A. & J.H. Schultes) Druce, Rep. botl. Soc. Exch. Club Br. Isl. 1916: 704 (1917); Domin Bibl. Bot. 89: 704 (1925) pro parte, *C. adscendenti*, *C. colorata* excl.; Ising in Trans. R. Soc. S. Aust. 61: 222 (1937); Burbidge & Gray, Fl. A.C.T. 190 (1970); Beadle, Stud. Fl. NE N.S.W. 157 (1972); Beadle et al., Fl. Sydney Region 173 (1972); Curtis, Stud. Fl. Tasm. 1: 184 (1975).

Tillaea verticillaris DC., Prodr. 3: 382 (1828); Hook. f., Fl. Tasm. 1: 145 (1860); Benth., Fl. Austr. 2: 451 (1862); pro parte, *T. adscendenti* et *T. colorata* excl.; F. Muell., Sec. Cens. 1: 83 (1889), pro parte; Tate, Fl. S. Austr. 85, 229 (1890); pro parte; Bailey, Queensl. Fl. 169, fig. 141 (1913); Maiden & Betche, Census N.S.W. 86 (1916).

Type: same as for *T. sieberana*.

C. helmsii sensu Beadle, Stud. Fl. NE N.S.W. 2, fig. 69B (1972) pro parte, descr. excl.; non (Kirk) Cockayne.

Perennials, rarely annuals, with decumbent branches and usually with adventitious roots. *Branches* carnose, with swollen nodes at least where without leaves and with basal internodes (1-) 3-5 (-8) mm long. *Follicle* releasing seeds through apical or lateral slit or pore, rarely shedding dark brown pericarp by basal circumscissal split. (Fig. 3, F-H).

Growing in crevices on wet rocks in mountains usually with an average yearly rainfall exceeding 600 mm; occurring in mountains in eastern Australia with few records from South Australia but common in Victoria, eastern New South Wales and south-eastern Queensland as well as Tasmania, Lord Howe Island and New Zealand. (Map 6).

Plants of the two subspecies often grow close to one another but in the field they could always be identified as one or the other subspecies by their individual habitat. Also well preserved specimens present no difficulty but when one tries to identify fragments without basal parts of the plants it becomes difficult to distinguish between the subspecies. Shade forms of subsp. *sieberana* may also cause some problems as their internodes elongate excessively and the whole soft plant has the appearance of an annual. To add to the problems plants of subsp. *tetramera* under similar conditions will develop soft branches, the whole plant becoming decumbent and much branched so that these plants appear to be similar to shade plants of subsp. *sieberana*. For these reasons some specimens, particularly from Tasmania, cannot be identified with certainty.

Much more robust plants have been recorded from near Nerriga (*Pickard 3319*) but unless a wider range of material becomes available or the population can be investigated in the field one hesitates to describe a new taxon in a variable species like this. Even the seeds show considerable variation in the size and number of tubercles on the seed testa.

Selection of Specimens examined (240 seen)

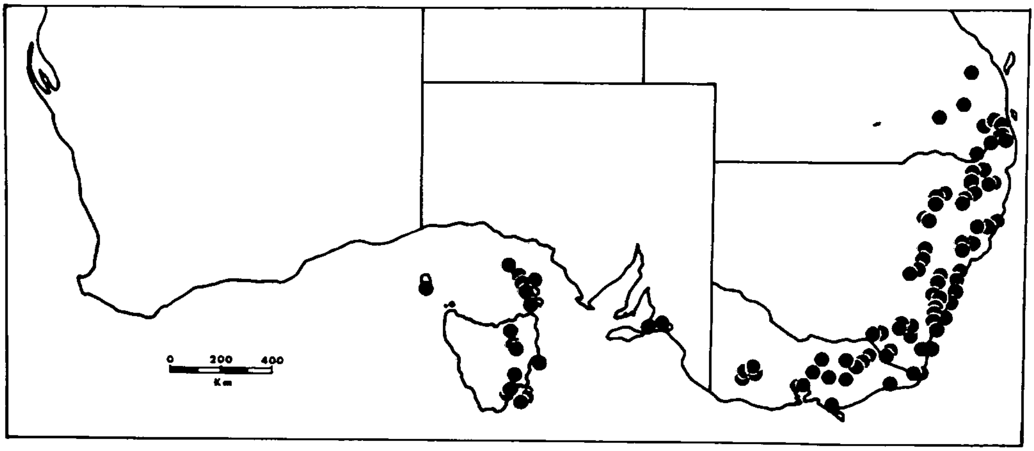
QUEENSLAND: *Keys* in BRI 244985, Mount Perry (BRI); *McDonald & Stanley* in BRI 225432, Lamington National Park (BRI); *White 8609*, Mt Ernest (BRI); *White* in BRI 244983 (BRI).

SOUTH AUSTRALIA: *Cleland* in AD 97209149, waterfall of Inman Valley (AD); *Cleland* in AD 97209158, Encounter Bay (AD); *Toelken 6546*, Hindmarsh waterfall (AD).

NEW SOUTH WALES (incl. A.C.T.): *Blake 2529*, Sydney (BRI); *Cambage* in BRI 245001, Torrington (BRI); *Constable* in NSW 30971, Narrabarka Creek (NSW); *Johnson 348/62*, Kowmung River (NSW); *Pickard 2746*, Lord Howe Island (NSW).

VICTORIA: *Beauglehole 22500*, Mt Fainter (MEL); *Briggs 2899*, McKenzie Falls (NSW); *Morton* in MEL 513258, Belgrave Height (MEL); *H.C.E. Stewart* in BRI 245019, Mt Buffalo (BRI).

TASMANIA: *Curtis* in HO 30032, near Kingston (HO); *Gordon* in HO 15321, near Neika (HO); *Whinray 786*, Craggy Island (MEL).



Map 6. Distribution of *C. sieberana* subsp. *sieberana*.

9b. subsp. **tetramera** Toelken subsp. nov.

Ab subsp. *sieberana* ramis erectis, non carnosis et habitu annuo differt; similis *C. thunbergianae* sed floribus tetrameris et calicis lobsi acutissmis differt.

Type: Northern Territory, Simpson's Gap National Park, *Latz* 4286 (AD, holo!, CANB!, NT!).

Annuals with erect rarely decumbent branches to 15 cm long, without adventitious roots; branches wiry-woody, not articulated and with basal internodes (4-) 8-12 (-20) mm long. *Follicles* releasing upper seed through apical pore while the lower seed is shed (still enclosed in the pale brown pericarp) by a basal circumscissal split. (Fig. 3, J-L).

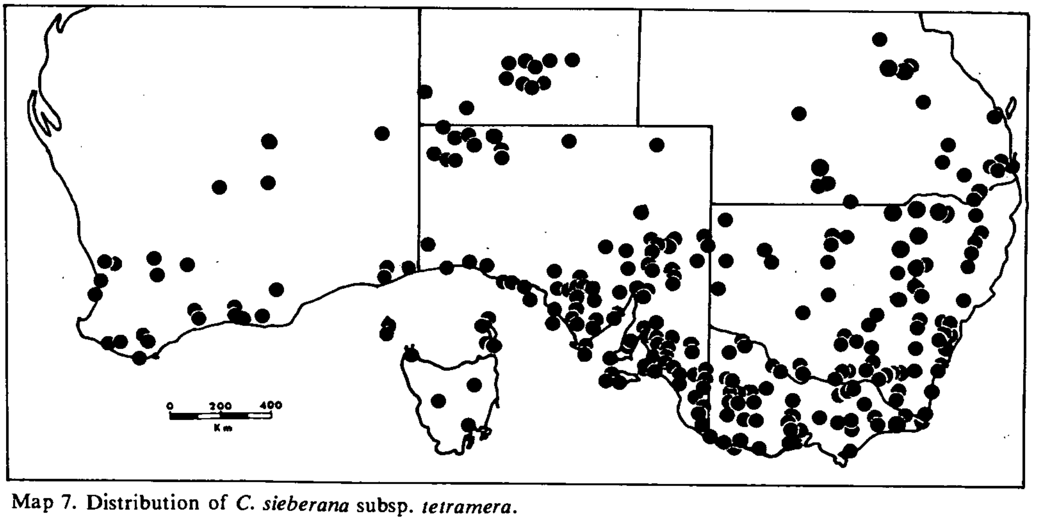
Growing in a wide range of habitats but usually somewhat sheltered either among rocks or in partial shade of trees or shrubs; widespread in temperate to subtropical areas of Australia including the eremaean region but with only a few records from central Western Australia south of the 26° latitude and more common in the coastal areas to the south and south-west; occasionally in rock outcrops or mountains in the Northern Territory south of the 23° latitude; a few scattered records throughout southern but mainly in south-eastern Queensland; more or less common throughout South Australia, Victoria and New South Wales except in the north-eastern coastal areas; few records throughout Tasmania. (Map 7).

Plants with a more decumbent habit are superficially similar to *C. thunbergiana* particularly when one considers the close resemblance of the fruits and the mode of seed dispersal. The flowers of subsp. *tetramera* are, however, 4-merous and have sharply acute calyx lobes which often end in a colourless point.

The calyx is usually twice as long as the corolla in plants from the coastal areas and here the habit is usually also rigidly erect while plants from the more arid areas tend to start off with an erect habit but often become decumbent later, and the calyx tends to be rarely much longer than the corolla. Both these characters seem to be ecologically induced as some individuals as well as some collections show a range of intermediates, e.g. *Weber 3066*, *Cleland s.n.* (21.ix.1968).

Selection of Specimens examined (520 seen)

WESTERN AUSTRALIA: *Eaton* in MEL 90751, Swan River (MEL); *Keighery 1231*, Mt Hassell, Stirling Ranges (PERTH); *Toelken 6079*, 65 km NNW Leonora (AD); *Wilson 10044*, Condingup Hill, 65 km E Esperance (PERTH).



Map 7. Distribution of *C. sieberana* subsp. *tetramera*.

NORTHERN TERRITORY: *Henry 1012*, Mt Alooarjara (BRI, CANB, NT); *Latz 4190*, Dean Range (AD, CANB); *Perry 5481*, 56 km SW Alice Springs (CANB); *Schodde 394*, Ayers Rock (AD, CANB).

QUEENSLAND: *Blake 19077*, W. Millmerran (BRI); *Carolin 4028*, Boorara Station, N Hungerford (SYD); *Henderson et al. 839*, 32 km SE Blackwater (CANB, BRI, MEL); *Walker* in BRI 71668, Maryborough (BRI).

SOUTH AUSTRALIA: *Barker 2893*, Tjatamanuga rockhole (AD); *Beauglehole 19451*, 15 km W Penola (AD); *Lothian 4730*, Pedirka (AD); *Toelken 6001*, 2 km W Yatala Roadhouse (AD).

NEW SOUTH WALES (incl. A.C.T.): *Bailey* in NSW 143819a, Gilgandra (NSW); *Hoogland 10041* (CANB); between Nerriga & Nowra (CANB); *Hotchkiss 498*, Piangobla (SYD).

VICTORIA: *Beauglehole 21060*, Port Campbell National Park (MEL); *Muir 162*, Warby Ranges (MEL); *Wakefield 3450*, Mt Raymond (MEL); *Willis* in MEL 91052, Sturt Highway, 12 km E South Australian border (MEL).

TASMANIA: *Hannaford* in NSW 143653, Hobart Town (NSW); *Phillips* in CBG 030535, Ocean Beach, Shaban (CBG); *Whinray 54f*, Flinders Island (MEL); *Whinray 761*, Little Dog Island (MEL).

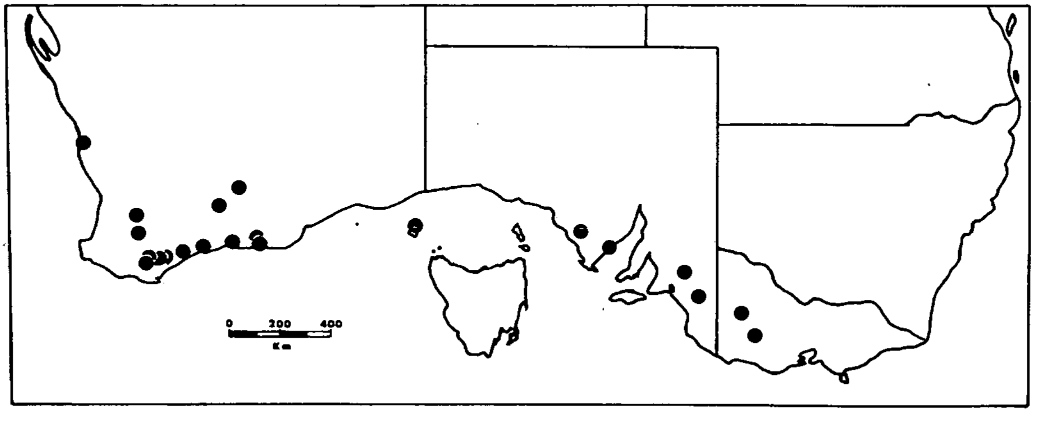
10. **C. exserta** (Reader) Ostenf. Dansk. bot. Ark. 2, 8: 48 (1918); Willis, Handb. Pl. Vict. 2: 192 (1972); Curtis, Stud. Fl. Tasm. 1: 184 (1975).

Type: Victoria, Dimboola shire, Lowan, *Reader* in MEL 90891 (MEL, holo.!).

Tillaea exserta Reader, Vict. Nat. 14: 83 (1897); Ewart et al, J. R. Soc. N.S.W. 42: 196, t.35 (1908).

C. sieberana J.A. & J.H. Schult. var. *exserta* (Reader) Domin, Bibl. Bot. 89: 704 (1925).

Annuals with erect stems to 15 cm long, little branched and mainly from the base. *Leaves* lanceolate 1.5-3 x 1-2 mm, obtuse, rarely acute, slightly constricted towards the base, flat or almost so above and strongly convex below, fleshy, glabrous to rugose, green to deep red. *Inflorescence* one, sometimes several thyrsoids, rarely panicles, with sessile dichasia in the axils of leaf-like bracts, with pedicels 0.5-2.5 (-5) mm long when fruiting; flowers 5-merous. *Calyx*: lobes lanceolate 1-1.3 mm long, pointed, fleshy, green to red but with colourless terminal point. *Corolla* cup-shaped, scarcely fused at the base, white to red; lobes linear-lanceolate, 0.8-1 mm long, sharply acute, spreading. *Squamae* linear, 0.4-0.5 x c. 0.1 mm, rounded to truncate, scarcely constricted towards the base, slightly fleshy, white. *Ovaries* almost cylindrical, abruptly constricted into short styles, with 2 ovules. *Follicles* erect, papillose to tuberculate, releasing seeds through large apical pore but lower seed usually retained as pericarp breaks off only after the calyx, which is clasping the follicles, has decayed; seeds smooth or almost so. (Fig. 3, D & E).



Map 8. Distribution of *C. exserta*.

Growing usually on sandy clay in low-lying areas often together with *C. colorata* and/or *C. sieberana* subsp. *tetramera*; few scattered records from southern Australia exist from south-western and southern Western Australia, from the Eyre Peninsula and southern Murraylands in South Australia and western Victoria, as well as one record from Flinders Island, Tasmania. (Map 8).

In the fruiting stage the ovaries seem to be much longer than the other floral parts but this is due to folding inwards of the calyx lobes so that they are situated between the carpels, a character which can also often be observed in *C. colorata*. Some specimens do not develop these characteristics and can only be distinguished from *C. thunbergiana* by the very pointed calyx lobes and from *C sieberana* by the 5-merous flowers of *C. exserta*.

From the time Reader collected the first specimen (6.xi.1892) to the final publication of the species, he continued to collect specimens of the species, corresponded with Mueller, and drew up and refined a description. However, it is not clear from the correspondence what material he used at which stage. Of the six sheets now in Melbourne Reader's first collection (MEL 90891) must be taken as a designated holotype similar to that of *C. acuminata* Reader. This unfortunate choice of a depauperate specimen must be adhered to becaue he did not cite another specimen in the protologue or even give an indication that plants were collected after 1892 as he did for *Prasophyllum fuscoviride* Reader, l.c. p. 163.

Selection of Specimens examined (30 seen)

WESTERN AUSTRALIA: *Jackson 1368*, 80 km WNW Esperance (AD, CANB, PERTH); *Oldfield* in MEL 90550, Tom River (MEL); *Orchard 1335*, Wittenoom Hills (AD, CANB); *Toelken 6421*, Lake Logan (AD).

SOUTH AUSTRALIA: *Blackburn* in ADW 10376, Tintinara (ADW); *Ising* in AD 966031032, Arno Bay, (AD); *Wheeler 775a*, Hincks National Park (AD).

VICTORIA: *Reader* in MEL 90891, near Dimboola (MEL); *Reader* in MEL 90492, Oakgrove, Little Desert (MEL); *Sullivan* in MEL 90902, plains near Mt William (MEL).

TASMANIA: *Sutton* in MEL 90493, Flinders Island (MEL).

11. **C. colorata** (Nees) Ostenf., Dansk bot. Ark. 2, 8: 46 (1918), Black, Fl. S. Austr. ed. 2, 391, fig. 549 A-C (1948); Blackall, West. Austr. Wildflow. ed. Grieve 1: 178, fig. (1954); Beard, Cat. West Austr. Pl. 36 (1965); Willis, Handb. Pl. Vict. 2: 192 (1972).

Type: Western Australia, near Perth, *Preiss 1932* (LD!; MEL!; S!).

Tillaea colorata Nees, in Lehm., Pl. Preiss. 1: 277 (1844-5).

Tillaea verticellaris sensu Benth., Fl. Austr. 2: 451 (1864), pro parte; sensu F. Muell., Second Cens. 1: 83 (1889), pro parte; Tate, Fl. S. Austr. 85, 229 (1890), pro parte quoad *T. colorata*.

Annual with usually erect stems to 15 cm long, little branched and mainly from the base. *Leaves* lanceolate 2-4(-6) x 1.5-3(-4) mm, obtuse or rarely acute, slightly but abruptly constricted towards the base, flat to slightly convex above, more or less convex below, green to reddish-brown. *Inflorescence* one, sometimes several thyrsoids, rarely panicles, with sessile dichasia in the axils of leaf-like bracts, with pedicels usually absent or rarely up to 1 mm long when fruiting, flowers 5-merous. *Calyx*: lobes triangular to lanceolate, 1-2.5 mm long, acuminate, fleshy, green to red. *Corolla* cup-shaped, pale yellow to red; lobes lanceolate, 1-2 mm long, acuminate to cuspidate, often slightly folded along the middle, spreading. *Squamae* linear, 0.5-0.7 x 0.1-0.2 mm, rounded, slightly constricted downwards, slightly fleshy, pale yellow. *Ovaries* pyriform to almost cylindrical and gradually constricted into slender styles, with 2 ovules. *Follicles* erect, smooth to tuberculate, releasing seeds when broken off by basal circumscissal split; seeds usually faintly ridged.

Although some variation is found in the follicles of the different varieties no intermediates between them have as yet been recorded. Several mixed collections of var.

colorata and var. *tuberculata* from various parts of their common distribution area exist and in all of these collections specimens of the latter are more numerous. It is not known whether the two varieties can be crossed. If so, it is not a simple dominant recessive relation as the percentage presence of var. *tuberculata* varies from 50-70%.

10a. var. **colorata**

Tillaea colorata Nees in Lehm., Pl. Preiss. 1: 277 (1844-5); Black, Trans. R. Soc. S. Aust. 42: 77 (1918).

Crassula colorata (Nees) Ostenf., Dansk. bot. Ark. 2, 8: 46 (1918).

Tillaea intricata Nees, in Lehm., Pl. Preiss. 1: 278 (1844-5).

Crassula intricata (Nees) Ostenf., Dansk. bot. Ark. 2, 8: 46 (1918).

Type: Western Australia, Rottnest Island, *Preiss 1929* (LD!; MEL!; S!).

Tillaea adscendens Nees in Lehm, Pl. Preiss. 1: 277 (1844-5).

Type: Western Australia, Fremantle, *Preiss 1931* (LD!; MEL!; S!).

Follicles laterally compressed, slightly constricted at the base, gradually constricted into slender styles, smooth, membranous, usually pale. (Fig. 3, U).

Restricted to the coastal areas where it occurs in a wide range of habitats; found commonly in southern Western Australia, sporadically in southern South Australia and few records in south-western Victoria. (Map 9).

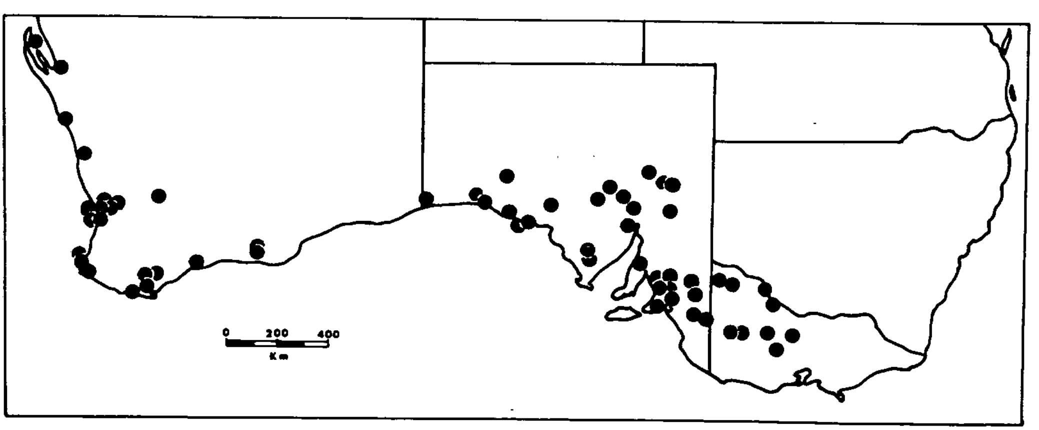
Sometimes the epidermal cells on the follicle are bulging and may be blister-like, but this cannot be confused with the tubercles on mature fruits of var. *tuberculata*, where they are usually restricted to one area. Usually the follicles remain attached to the plant for some time but occasionally, particularly in var. *colorata*, they are lost shortly after the plant matures, e.g. *F. Mueller* in MEL 90554.

Selection of Specimens examined (90 seen)

WESTERN AUSTRALIA: *Keighery 420*, 45 km E Lake King (PERTH); *Keighery 457*, Cape le Grand National Park, Hellfire Bay (PERTH); *Ostenfeld 360*, Yallingup Caves (MEL); *Mueller* in MEL 90554, Hamelin Pool, Shark Bay (MEL).

SOUTH AUSTRALIA: *Cleland* in AD 97209145, Kinchina (AD); *Eichler 12471*, Koonamore (AD); *Toelken 6000*, 2 km W Yalata Roadhouse (AD); *Wheeler 687*, Hincks National Park (AD).

VICTORIA: *Beauglehole 28554*, 7 km NW Dimboola (MEL); *Luehmann* in MEL 90852, Swan Hill (MEL); *Perry* in MEL 530698, Western Whipstick (MEL).



Map 9. Distribution of *C. colorata* var. *colorata*.

10b. var. **miriamiae** (Ostenf.) Toelken, stat. nov.

Crassula miriamiae Ostenf., Dansk bot. Ark. 2, 8: 43 (1918).

Type: Western Australia, near Perth, Davis sub *Ostenfeld 1452* (MEL1).

Follicles almost spherical, scarcely constricted towards the base and abruptly constricted into the short erect styles, smooth, membranous, pale. (Fig. 3, T).

Recorded from low-lying areas near Perth and the Stirling Ranges.

Ostenfeld compared this taxon with *C. sieberana* but it is much closer to and at times almost indistinguishable from var. *colorata* (cf. *Cronin* in MEL 90844). The smooth follicles of the latter are often also somewhat inflated but never abruptly constricted into a short style. Ostenfeld also stresses the relatively short follicles which are shorter than the sepals. They are also often shorter than the other varieties, but appear to be much longer than the calyx because the lobes curve inwards so that their length is deceptive (cf. *C. exserta*).

Specimens examined

WESTERN AUSTRALIA: *Mueller* in MEL 90636, Stirling Ranges (MEL).

11c. var. **tuberculata** Toelken, var. nov.

Ab var. *colorata* folliculis tuberculis differt.

Type: Western Australia, 65 km Leonora, *Toelken 6079* (AD, holo.).

Tillaea acuminata Reader, Vict. Nat. 15: 96 (1898); Black, Trans. R. Soc. S. Aust. 40: 63 (1916).

T. sieberana J.A. & J.H. Schultes var. *acuminata* (Reader) Ewart et al., J. Proc. R. Soc. N.S.W. 43: 196 (1908).

Crassula sieberana (J.A. & J.H. Schultes) Druce var. *acuminata* (Reader) Domin, Bibl. Bot. 89: 704 (1925).

Type: Victoria, Dimboola shire, Lowan, *Reader* in MEL 89418a (MEL, holo.!).

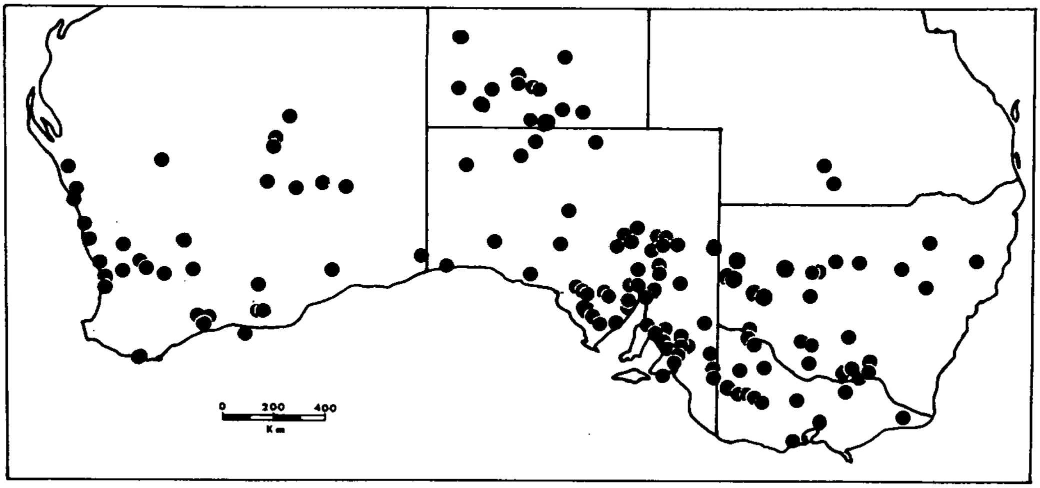
C. colorata sensu Burbidge & Gray, Fl. A.C.T. 190 (1970); sensu Beadle, Stud. Fl. NE N.S.W. 157 (1972), non (Nees) Ostenf.

Follicles almost cylindrical and slightly laterally compressed, abruptly constricted in the lower third and gradually constricted into a slender style, with a cluster of crustaceous brown tubercles in the lower third but otherwise membranous. (Fig. 3, R & S).

Growing in a wide range of habitats often together with *C. sieberana* subsp. *tetramera*; widespread but rarely collected in some areas of Australia including the southern temperate areas as well as much of the eremaean regions of Western Australia, south of the 22° latitude in Northern Territory, most parts of South Australia, with few records from south-central Queensland and mainly in areas west of dividing mountains of New South Wales and Victoria. (Map 10).

The calyx lobes are tightly clasping around the follicles, with the tubercles present just below them so that the follicles are retained in position often for several years. Even after heavy rains remains of old plants with many fruits still intact were found in some areas, e.g. *Toelken 6004*. Particularly in the south-western parts of Western Australia the styles plus the upper part of mature fruits are often strongly recurved, so that the plants look superficially similar to those of *C. exserta*. However, the distinctive profile of the individual follicles and specifically the tubercles on them leave no doubt that they must be identified as var. *tuberculata*.

Plants from eastern South Australia and north-western Victoria have mature follicles which are often rather broad and scarcely constricted towards the base. Mature fruits show the distinctive tubercles on the side of each follicle as for instance in *Beauglehole 30944*.



Map 10. Distribution of *C. colorata* var. *tuberculata*.

Selections of Specimens examined (206 seen)

WESTERN AUSTRALIA: *Chinnock 4102*, 30 km N Narembeen (AD); *Helms s.n.*, Mt Squires (MEL, NSW); *Toelken 6253*, 26 km ENE Carnegie HS (AD); *Willis* in MEL 90546, Boxer Island (MEL).

NORTHERN TERRITORY: *Beauglehole 20521*, Bagot Creek (NT); *Latz 4123*, Ayers Rock (AD); *Tate* in AD 97617608, Macdonnell Range (AD).

QUEENSLAND: *Carolin 4028a*, Boorara Station (SYD); *Everist 1635*, Cunnamulla (BRI).

SOUTH AUSTRALIA: *Cleland* in AD 97209148, Ooldea Soak (AD); *Ising 2307*, Kinchina (AD); *Lothian 810*, De Rose Hill Station (AD); *Weber 2204a*, 5 km W Brougham's Cottage (AD).

NEW SOUTH WALES: *McBarron 1214a*, Holbrook (SYD); *Crisp 4082*, Bundella Station (CBG); *Milthorpe & Cunningham 1343*, Fowler's Gap Station (NSW); *Officer* in NSW 143822, Zara, Wanganella (NSW).

VICTORIA: *Beauglehole 28260*, Wyperfeld National Park (MEL); *Beauglehole 38452*, Dimboola (MEL); *Pyre* in MEL 90880, Lower Goulburn River (MEL); *Robbins 42247*, Hepburn Hill (MEL).

*12. C. **alata** (Viv.) Berger var. **alata**

Crassula alata (Viv.) Berger, Pflanzenfam. ed. 2, 18a: 389 (1930); Wickens & Bywater, Kew Bull. 34: 633, 4 (1980).

Type: Egypt, near Kahirum, *Viviani s.n.* (GE?, holo.).

Tillaea alata Viv., Pl. Aegypt. Dec. 4: 16 (1830).

Crassula tripartita N.A. Wakefield, Vict. Nat. 73: 186 (1957); Willis, Handb. Pl. Vict. 2: 192 (1972).

Type: Victoria, Rutherglen, G.A. *Morrow s.n.* (MEL, holo.).

Annuals with erect stems to 5 cm long, little branched. *Leaves* linear-lanceolate to linear, 1.5-2.5 (-3) x 0.5-0.8 mm, acute and often with a colourless point, flat or almost so above, but usually strongly convex below, green to reddish-brown. *Inflorescence* one, rarely a few, thyrsoids with sessile dichasia in the axils of leaf-like bracts, with pedicels absent or almost so; flowers 3-merous. *Calyx*: lobes oblong-lanceolate 1.5-2 mm long, acuminate to cuspidate with colourless point; fleshy, green to red. *Corolla* cup-shaped, off-white often tinged red; lobes triangular, 0.7-1 mm long, usually cuspidate, erect. *Squamae* oblong-cuneate to almost square, 0.2-0.5 x c. 0.2 mm, rounded, slightly broadened at the apex, membranous, pale yellow. *Ovaries* almost conical, at first gradually later abruptly constricted into short styles, with 2 ovules. *Follicles* erect, smooth, splitting along the whole suture but opening only in the upper half and breaking off at the base by a circumscissal split; seeds with faint vertical ridges.

Growing in shallow soil on surface rocks or in crevices in masonry; introduced from the eastern Mediterranean area to suburbs of Perth and Adelaide, but also recorded from near Hamilton (Victoria) and Walbundrie (New South Wales).

C. alata is often included in the synonomy of *C. tillaea* Lester Garl. but recent workers have tended to keep the two taxa separate (Wickens & Baywater, 1980).

Specimens examined

WESTERN AUSTRALIA: *Keighery 1175*, Kings Park (PERTH); *Wheatley s.n.*, Harvey Bowling Club, (PERTH); *Wilson 9982*, Wooroloo (AD).

SOUTH AUSTRALIA: *Kraehenbuehl 362a*, Viaduct Creek, Tonsley Park (AD); *T.J. Smith 1967a*, Hazelwood Park Reserve (AD); *Spooner 455*, Torrens Gorge (AD).

NEW SOUTH WALES: *McBarron 3882*, Walbundrie (SYD).

VICTORIA: *Beauglehole 55347*, 19 km SSW Hamilton (MEL).

C. sect. **Anacampseroideae** Haw., Ref. Pl. Succ. 9 (1921); Toelken, Contrib. Bolus Herb. 8: 181 (1977).

Type species: *C. telephioides* Haw.

Perennial scramblers or shrubs usually with dorsiventrally flattened leaves. *Inflorescence* a terminal thyrsoid with scale-like bracts and star-shaped flowers. *Calyx* shorter than corolla. *Carpels* with elongate ovaries gradually tapering into slender styles.

Species of this section are found naturally only in Africa and the Malgasy Republic most species occur in the Eastern Cape Province of South Africa.

*13. **C. sarmentosa** Harv. var. **sarmentosa**

Crassula sarmentosa Harv., Fl. Cap. 2: 348 (1862); Schonl., Trans. R. Soc. S. Afr. 17:199 (1929); Toelken, Contr. Bolus Herb. 8: 199 (1977).

Type: Natal, near Omblas, *Drege s.n.* (S, lecto.! (Toelken, 1977)).

Perennials with irregularly shaped tubers from which a number of procumbent stems up to 80 cm long are produced, little or rarely branched. *Leaves* sometimes with a petiole up to 3 mm long; lamina ovate to elliptic, 2-3.5 (-6) x 1.5-2 (-3.5) cm, acute or acuminate, rarely cuspidate, abruptly constricted towards the base, serrate, flat and little fleshy, green to yellowish-green often tinged red towards the margin. *Inflorescence* a terminal rounded or flat-topped thyrsoid borne above the leaves and with stalks of part-inflorescences as well as of individual flowers spreading at almost right angle to axis from which they develop; pedicels 1-3 mm long and not elongating when flowering; flowers 5-merous. *Calyx*: lobes linear-triangular, 1-3 mm long, sharply acute, fleshy, green. *Corolla* star-shaped, white often tinged red; lobes lanceolate, 4-8 mm long, acute to acuminate, spreading at about right angles to the axis. *Squamae* transversely oblong, 0.2-0.3 x 0.6-0.8 mm, truncate or scarcely emarginate, somewhat constricted towards the base, fleshy, pale yellow to white. *Ovaries* oblong-reniform in profile, gradually constricted into slender styles, with 12-16 ovules. *Follicles* slightly recurved, smooth, dehiscing by apical pore; seeds with rows of aculeate tubercles.

Naturalized on sandy soil in sclerophyll forest of *Eucalyptus maculata*, *E. paniculata* and *E. longifolia* near Nowra, New South Wales.

Known only from one vegetative specimen so that the additional information was tentatively supplied from natural populations in South Africa. There are only three species of *Crassula* which have a serrate to crenate leaf margin, and of those *C. crenata* and *C. sarmentosa* produce procumbent branches. The former is distinguished from the latter by a petiole on all leaves which have usually got a crenate margin.

Specimen examined

NEW SOUTH WALES: *Briggs 3074*, 1.5 km S Nowra (NSW).

D. sect. **Acutifolia** (Schonl.) Toelken, Contr. Bolus Herb. 8: 242 (1977).

Type species: *C. acutifolia* Lam.

Crassula (sect. *Campanulatae* Schonl., Trans. R. Soc. S. Afr. 17: 167 [1929]) group *Acutifolia* Schonl., Trans. R. Soc. S. Afr. 17: 167 (1929).

Perennial shrublets to shrubs with leaves often terete or almost so. *Inflorescence* a terminal thyrsoid with scale-like bracts and campanulate flowers. *Calyx* shorter than corolla. *Carpels* with elongate ovaries gradually tapering into short styles.

All species except *Crassula sarcocaulis* are restricted to Southern Africa and most species occur in the Cape Province.

*14. **C. tetragona** L., Sp. Pl. ed. 1, 283 (1753); Toelken, Contr. Bolus Herb. 8: 259 (1977).

Type: Caput Bonae Spei, sine leg. in LINN 400.6 (holo.!).

Subsp. **robusta** (Toelken) Toelken in Jl S. Afr. Bot. 41: 122 (1975).

Type: Cape, Pluto's Vale near Grahamstown, *Toelken 4281* (BOL, holo.!).

C. robusta Toelken, Jl S. Afr. Bot. 38: 79 (1972).

C. tetragona sensu Thunb., Fl. Cap. ed. Schultes 283 (1823); sensu DC., Pl. Hist. Succ. 1, t. 19 (1799); Prodr. 3: 384 (1828); sensu Haw., Syn. Pl. Succ. 51 (1812); sensu Schonl., Trans. R. Soc. S. Afr. 17: 209 (1929), non L.

Perennial shrubs 30-50(-100) cm high, usually moderately branched. *Leaves* linear-triangular, (1.5-) 2-3 (-4) x 0.3-0.5 (0.6) cm, usually acute, not or scarcely constricted towards the base, curved upwards, slightly dorsiventrally constricted at the base but terete or almost so towards the apex, green to bluish-green. *Inflorescence* a terminal rounded or flat-topped thyrsoid borne above the leaves; flowers 5-merous. *Calyx*: lobes triangular, c. 1 mm long, acute, fleshy, green. *Corolla* campanulate, white or cream; lobes lanceolate 1.5-2.5 mm long, acute, with dorsal ridge and recurved at the apex. *Squamae* transversely oblong, 0.2-0.4 x 0.5-0.6 mm, often slightly emarginate, scarcely constricted towards the base, slightly fleshy, yellow. *Ovaries* ovoid-conical, gradually constricted into short styles, with (8-) 10 ovules. *Follicles* erect, smooth, dehiscing by apical pore; seeds with ridges with aculeate tubercles.

Naturalized in disturbed areas near habitations or on dry slopes in the Mt Lofty Range.

At present the species is mainly known from a few localities where it has established itself in somewhat disturbed areas.

Specimens examined

SOUTH AUSTRALIA: *Ellis 71*, Happy Valley, Mt Lofty Range (AD).

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Index to Collections

Collectors' names are arranged alphabetically and followed by their numbers in numerical order, but when the collector did not use numbers they are according to dates. The herbarium numbers usually refer to individual sheets which are already provided with determinations so that their usefulness in the identification of specimens not seen by the author, is limited. Each collection is followed by an abbreviation of the taxa as follows:

Crassula moschata	MOS	*C. sieberana* ssp. *sieberana*	SIEB
C. peduncularis	PEDU	ssp. *tetramera*	TET
C. helmsii	HEL	*C. exserta*	EXS
C. natans	NAT	*C. colorata* var. *colorata*	COL
C. glomerata	GLO	var. *miriamiae*	MIR
C. pedicellosa	PED	var. *tuberculata*	TUB
C. decumbens	DEC	*C. alata*	ALA
C. thunbergiana	THU	*C. sarmentosa*	SAR
		C. tetragona ssp. *robusta*	ROB

Abraham s.n., ix.1910/TET; viii.1911/TET. *Adams 1684*/HEL; *2573*/HEL; *s.n.*, 1889/TET. *H.W. Alcock s.n.*, viii.1896/COL. *Alcock 8*/COL; *26*/TET; *180*/DEC; *199*/NAT; *239*/PEDU; *260*/NAT; *968*/NAT; *1070*/COL; *1115*/TET; *1545B*/COL; *1545A*/TET; *1546*/TET; *1646*/DEC; *1664*/TET; *2123*/TET; *2309*/TET; *2309a*/TUB; *2334*/DEC; *2391*/TET; *2483*/COL; *2438a*/TET; *2876a*/TET; *2971*/DEC; *2972*/NAT; *3711*/TUB; *4131*/TUB; *4655*/TET; *4754*/NAT; *5726*/DEC; *5835*/NAT; *5839*/TET; *5851*/DEC; *5856*/TET; *5887*/TET; *5889*/DEC; *5902*/TET. *Allan* in HO 30959, 14.viii.1979/MOS. *Allen 294*/TET. *Amtsberg s.n.*, 21.x.1966/DEC. *Anderson 312*/TET; *s.n.*, xi.1969/TET; *s.n.*, xi.1969/TUB. *Andrews s.n.*, 14.vii.1901/NAT; *s.n.*, ix.1901/DEC; *s.n.*, vi.1902/DEC; *s.n.*, vii.1902/NAT; *s.n.*, viii-ix.1902/DEC; *s.n.*, x.1903/TUB; *s.n.*, x.1907/TUB. *Aplin 827*/COL; *2518*/TUB; *6439*/COL; *6442*/DEC; *6493*/COL; *s.n.*, 19.x.1962/EXS. *Archer* in NSW 143651/SIEB; in NSW 143681/HEL. *Ashby 306*/DEC; *306a*/TET. *Aston 643*/DEC; *1019*/PED; *1069*/PED; *1076*/DEC; *s.n.*, 21.x.1960/DEC; in MEL 91027, 21.x.1960/SIEB. *Babbage* in MEL 90519/DEC. *Bacchus* in MEL 90936/DEC. *Bailey* in NSW 143819, 3.x.1963/TUB. *Bailey* in NSW 143819a, 3.x.1963/TET; in BRI 244994, x.1901/TET. *Barber s.n.*, iii.1953/HEL. *Barker 1349*/NAT; *2267*/NAT; *2465*/NAT; *2843*/TET; *2893*/TET; *2893a*/TUB; *2967*/TET; *3481*/TET. *Barnard* in MEL 90736, 1882/TET. *Barnsley et al. 87*/COL. *Bate* in MEL 90703, 1881/SIEB. *Batt* in MEL 90752, 1889/TUB. *Betche* in MEL 90716/SIEB; *s.n.*, 30.xi.1881/HEL; *s.n.*, i.1888/HEL; *s.n.*, ii.1893/HEL; *s.n.* ii.1897/HEL; *s.n.*, xii.1898/HEL. *D. Black s.n.*, 8.x.1972/SIEB. *J.M. Black s.n.*, 24.ix.1904/DEC; *s.n.* 8.x.1904/DEC; *s.n.*, xii.1908/DEC; *s.n.*, 2.x.1909/DEC; *s.n.*, 9.x.1909/DEC; *s.n.*, i.1912/HEL; *s.n.*, 20.x.1913/DEC; *s.n.*, 17.ix.1915/DEC; *s.n.*, 17.x.1915/DEC; *s.n.* 11.ix.1916/DEC; *s.n.*, 2.x.1916/DEC; *s.n.*, 8.x.1916/DEC; *s.n.*, 25.ix.1917/DEC; *s.n.*, 29.xi.1917/DEC; *s.n.*, 10.x.1919/DEC; *s.n.*, 9.xi.1920/DEC; *s.n.*, 1.xi.1925/DEC. *R.A. Black s.n.*, 11.xi.1940/HEL. *Blackburn s.n.*, xi.1953/EXS. *Blake 2018*/TET; *2529*/SIEB; *19077*/TET. *Blakely s.n.*, x.1899/SIEB. *Blakely & Shiress s.n.*, vii.1922/SIEB. *Blaylock 230*/TET; *251*/COL; *658*/DEC; *659*/TET; *663*/TET; *671*/TET; *674*/TET; *677*/DEC; *684*/TET; *715*/TET; *760*/TUB; *967*/COL; *1014*/DEC; *1019*/PED; *1020*/TET; *1344*/TUB; *1571*/TET; *1751*/PED; *1980*/PEDU; *2011*/TET; *2022*/TET; *2029*/TUB. *Boehm* in MEL 90704/HEL. *Bonney* in MEL 90807/TUB. *Bonton* in MEL 90581, 1890/HEL; in MEL 90872, 1890/TET. *Boorman s.n.*, iii.1917/TET; *s.n.*, x.1901/GLO; *s.n.*, x.1903/TET; *s.n.*, iii.1906/HEL.

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Constable & E.F. Constable s.n.*, 9.viii.1950/SIEB. *Copley 450*/TET: *607*/COL; *607a*/TET; *742*/TET; *2070*/TET; *2785*/DEC; *3052*/DEC; *3062*/DEC; *3215*/DEC; *3216*/NAT; *3468*/DEC; *3699*/TET; *4284*/DEC; *4284a*/COL; *4986*/NAT. *Cotter s.n.*, 1886/TET. *Coveny 1268*/TET; *5147*/PEDU; *5719*/TET; *5774*/ SIEB; *8684*/SIEB; *8797*/HEL; *s.n.*, 18.vi.1966/TET. *Coveny et al. 7522*/SIEB. *Coveny & Armstrong 5773*/DEC. *Cranfield 123*/NAT; *s.n.*, 20.x.1977/COL; *s.n.*, 7.x.1978/TUB; *s.n.*, 20.x.1978/GLO; *s.n.*, 20.x.1978/COL. *Craven 676*/TET; *1617*/SIEB; *2004*/TET; *2158*/SIEB. *Crawford s.n.*, x.1884/SIEB; *s.n.*, iv.1903/TET; *s.n.*, ii.1915/HEL. *Cross s.n.*, 17.ix.1938/TET. *Crisp 534*/TET; *535*/TET; *1414*/TET; *1414a*/TUB; *1700*/TUB; *1997*/SIEB; *3901*/SIEB; *4082*/TUB; *4103*/TET: *4291*/TET; *4512a*/SIEB. *Cronin s.n.*, 1889/COL. *Cullinmore 66*/DEC. *Cunningham 768*/TET. *Cunningham & Milthorpe 1808*/HEL: *3308*/HEL. *Curdie* in MEL 90753/DEC; in MEL 90876/TET. *Curtis s.n.*, 23.xii.1944/HEL. *s.n.*, 3.iii.1952/HEL. *Czornij 175*/TUB; *175a*/TET; *341*/TUB; *341a*/TET; *733*/TET; *768*/TET. *D'Alton* in MEL 90701/TET; in MEL 90781/DEC; in MEL 90838/PEDU; in NSW 143694/HEL. *Darbyshire 1236*/TET; *D'Arnay 575*/SIEB. *D'Arnay & Gray 4577*/SIEB. *Davis* in MEL 90881, 1889/DEC; in MEL 90845, 1890/DEC; in MEL 90886, 1890/PED. *M. Davis sub Ostenfeld 1349*/DEC; *Davis sub Ostenfeld 1350*/TUB; *Davis sub Ostenfeld 1350a*/COL; *Davis sub Ostenfeld 1452*/MIR. *Deane s.n.*, ix.1887/DEC; *s.n.*, viii.1887/DEC. *Dehardi 621C*/TUB. *Dempster s.n.*, 1870/TET. *Dietrich 2782*/DEC; *Dietrich* in BRI 244981/SIEB. *Dixon sub Tate s.n.*, x.1883/PED. *Dodson s.n.*, 24.ii.1973/HEL. *Donner 957*/SIEB; *2982*/EXS; *3192*/TET; *3253*/TET; *3337*/TET; *3372*/TUB; *3372a*/TET; *3505*/TET; *3738*/TET; *4159*/HEL; *4999*/TET. *Drummond 114*/TET; *Drummond* in MEL 90555/TUB; *Drummond* in MEL 90556/TUB; *Drummond* in MEL 90557/TUB; *Drummond* in MEL 90558/TUB; *Drummond* in MEL 90816/HEL. *Dumbleton s.n.*, 9.vii.1969/TUB. *Dunlop 277*/TET; *648*/SIEB; *822*/TET. *Durrington & Levine 1175*/TET. *Dwyer 691*/TET; *s.n.*, x.1915/DEC. *Eardley s.n.*, viii.1951/NAT; *Eaton* in MEL 90751, 1889/TET; in MEL 90860, 1889/TET. *Eckert* in MEL 52894, 1890/PEDU; in MEL 90858, 1890/TET; in MEL 90790, 1890/DEC; *s.n.*, 1891/HEL; *s.n.*, 1892/DEC: *s.n.*, 1892/TUB; *s.n.*, 1897/TET; *s.n.*, x.1906/PED. *Eichler 12243*/HEL; *12347*HEL; *12471*/COL; *12472*/COL; *12484*/TET; *12495*/TET; *12814*/TUB; *12814a*/TET; *13840B*/NAT; *14006*/TET; *14200*/COL; *14201*/DEC; *14258*/DEC; *14879*/HEL; *14896*/HEL; *14949*/TET; *14949a*/COL; *15013*/DEC; *15063*/PED; *15068*/DEC; *15078*/DEC; *15100*/PED; *15237*/PED; *15322*/TET; *15645*/HEL; *15752*/NAT; *15851*/NAT; *15932*/DEC; *16036*/DEC; *16037*/THU; *16646*/HEL; *17041*/TET: *17043*/DEC; *17066*/NAT; *17130*/HEL; *17186*/HEL; *17547*/TET; *17731*/HEL; *18330*/

NAT; *19103*/NAT; *19290*/PED; 19353/TET; *19362*/DEC; *19717*/HEL; *19746*/HEL; *19859*/NAT; *20007F*/PEDU; *20091*/PED; *20307*/EXS; *20707*/TET; *s.n.*, 2.iv.1956/HEL. *Ellis 71*/ROB. *Evans 1560*/SIEB. *M. Evans 2615*/SIEB. *O.D. Evans s.n.*, 24.viii.1926/SIEB; *s.n.*, ix.1949/HEL. *Eveleigh 14*, ix.1971/TUB. *Everist 1635*/TUB; *1636*/TET; *7269*/SIEB. *Ewers s.n.*, 21.x.1956/TET. *Fagg 587*/SIEB; *865*/HEL; *s.n.*, 17.ix.1966/PED. *Fatchen et al. s.n.*, 1.x.1976/TET; *s.n.*, 1.x.1976/DEC. *Filan s.n.*, 13.vii.1959/TET. *Findlay s.n.*, 1883/SIEB. *Fitzgerald 25*/DEC; *s.n.*, viii.1900/THU; in NSW 143676, x.1900/GLO; in NSW 143680, x.1900/NAT; in NSW 143677, x.1901/GLO; in NSW 143671/TUB. *Fletcher s.n.*, ix.1887/TET; *s.n.*, x.1889/TET; *s.n.*, x.1890/TET; *s.n.*, 20.viii.1892/DEC; *s.n.*, 22.ix.1929/TUB; in NSW 143745/SIEB. *Flynn s.n.*, i.1959/HEL. *Ford s.n.*, 28.ix.1950/SIEB. *Forrest* in BRI 244998/SIEB. *Forsyth s.n.*, x.1901/TET. *Franklin s.n.*, 2.viii.1969/TET. *Fraser & Vickery s.n.*, xii.1933/SIEB. *French s.n.*, 1886/DEC; *s.n.*, 1890/PED. *Fullager* in MEL 90808/TET. *Galbraith s.n.*, 20.ix.1978/SIEB. *Garden* in NSW 143758, 9.x.1949/TET; in NSW 143823, 9.x.1949/TUB; *s.n.*, 28.viii.1950/SIEB; *s.n.*, 12.i.1956/HEL. *Gardner 7680*/NAT; *9374*/TUB; *s.n.*, vii.1942/DEC. *Gates s.n.*, 1891/SIEB. *Gauba s.n.*, 10.xii.1953/HEL; *s.n.*, 7.x.1952/TET; *s.n.*, 6.xi.1945/DEC; *s.n.*, 23.i.1945/HEL. *George 4593*/TUB; *9515*/NAT; *11352*/COL. *Gill s.n.*, x.1888/TET. *Gray 3879*/HEL; *4139*/DEC; *5110*/SIEB. *C. Green* in MEL 90743/TET. *Green 622*/DEC. *Gregory s.n.*, ix.1964/DEC. *Groener* in MEL 90529/DEC. *Grove* in MEL 90608/HEL. *Gunn 91*/TET; *91a*/SIEB; *91*, 12.i.1838/TET; *91a*, 12.i.1838/SIEB; *91*, 5.xi.1842/SIEB; *393*/HEL; *1117*/DEC; *1967*/PEDU; *s.n.*, 2.xii.1848/DEC. *Haegi 853*/TET; *853a*/TUB; *1172*/EXS. *Hain 62*/SIEB. *Haly* in MEL 90671/TET. *Hamilton s.n.*, vii.1899/TET; *s.n.*, 1902/TUB; *s.n.*, x.1909/SIEB. *Hammond s.n.*, 1885/TET. *Hannaford s.n.*, ii.1864/HEL; *s.n.*, v.1871/TET; in NSW 143685/HEL; in NSW 143689/HEL; in NSW 143798/DEC; in NSW 143799/DEC; in MEL 90597/HEL. *Hawke s.n.*, 4.xi.1882/DEC. *Heal s.n.*, 1889/COL; *s.n.*, 1889/DEC; *s.n.*, 1895/TET. *Heddle 53*/COL; *SCCP54*/PED; *MB85*/PED. *Helms s.n.*, 4.vi.1891/TET; *s.n.*, viii.1891/TUB; *s.n.*, viii.1891/TET; *s.n.*, 12.x.1891/PED; in MEL 90567, xi.1891/PED; in NSW 143833, xi.1891/TUB; *s.n.*, 23.ix.1897/DEC; *s.n.*, 30.ix.1899/COL. *Hemsley 6212*/DEC; *6250*/DEC. *Henderson et al. 839*/TET. *Henry 1012*/TET. *Hentish s.n.*, 1895/DEC. *Hester s.n.*, 1875/TET. *Hickey s.n.*, xi.1884/SIEB; *s.n.*, iii.1885/SIEB. *Hicks s.n.*, 22.ix.1960/TET. *Hilton 574*/COL; *s.n.*, 21.viii.1955/TET. *Hirth s.n.*, 24.xii.1977/HEL. *Hnatuik 770964*/TUB; *771221*/EXS. *Holding s.n.*, 1887/TUB; in MEL 90717, 1889/TET; in MEL 90717a, 1889/TUB. *Holtham s.n.*, xii.1914/TET; in MEL 90617/SIEB. *Holtze s.n.*, 1891/TET. *Hoogland 3050*/SIEB; *10041*/TET. *Hope 21551*/HEL. *Hotchkiss 498*/TET. *Howe* in MEL 90652/SIEB. *Howitt s.n.*, 1882/SIEB. *Hubbard 4243*/SIEB. *Hunt 546*/HEL: *1054*/TET; *1100*/DEC; *1374*/NAT: *1507*/HEL; *1525*/HEL; *1632*/NAT; *1640*/PED; *1867*/HEL; *2093*/NAT; *2256*/NAT; *2329*/NAT; *3207*/DEC. *Hussey 53*/TET; *s.n.*, 1893/DEC; *s.n.*, 1894/TET; *s.n.*, 1894/DEC; *s.n.*, 1895/TET; in MEL 532736, 1895/PED. *Ising 377*/DEC; *1776a*/TUB; *1545*/COL; *1545a*/TET; *2307*/TUB; *2307a*/TET; *s.n.*, 30.viii.1918/DEC; in AD 966030835, 8.ix.1920/COL; in AD 966030835a, 9.ix.1920/TET; *s.n.*, 14.x.1921/TET: in AD 966030724, 3.x.1922/DEC; in AD 966030849, 3.x.1922/TET; in AD 966031030, 4.x.1922/TET; *s.n.*, 6.x.1922/TUB; *s.n.*, 19.x.1924/DEC; *s.n.*, x.1925/TUB; *s.n.*, 13.viii.1925/TUB; *s.n.*, 14.x.1925/DEC; *s.n.*, 31.i.1926/HEL; *s.n.*, 28.viii.1926/DEC; *s.n.*, 1.ix.1926/TUB; *s.n.*, 17.ix.1926/COL; *s.n.*, 8.x.1927/TUB; *s.n.*, 8.ix.1928/DEC; *s.n.*, 8.ix.1928/TUB; in AD 966030932, 10.x.1928/TET; in AD 966031095, 21.x.1928/TET; in AD 966030942, 9.x.1929/TET; *s.n.*, 8.xi.1929/TET; *s.n.*, 14.x.1930/DEC; *s.n.*, 10.iii.1934/HEL; in AD 97648585, 19.x.1934/TET; in AD 97648586, 19.x.1934/DEC; *s.n.*, 23.x.1934/TET; *s.n.*, 10.iii.1935/HEL; *s.n.*, 25.viii.1935/TET; *s.n.*, 29.viii.1935/EXS; *s.n.*, 31.viii.1935/EXS; 31.viii.1935/PEDU; in AD 966030837, 1.ix.1935/PEDU; *s.n.*, 2.ii.1938/HEL; *s.n.*, 8.ix.1938/TUB: *s.n.*, 12.x.1938/COL; *s.n.*, 13.ix.1939/TET; *s.n.*, 28.ix.1939/TET; *s.n.*, 22.x.1939/DEC; *s.n.*, 30.ii.1957/HEL; *s.n.*, 20.ix.1962/DEC; *s.n.*, 20.ix.1962/TUB; *s.n.*, 20.ix.1962/TET; *s.n.*, 21.ix.1968/DEC; *s.n.*, 11.ix.1970/DEC; *s.n.*, 25.viii.1970/TET; *s.n.*, 27.viii.1970/DEC. *Irvine s.n.*, viii.1889/TUB. *Jackson 110*/TET; *145*/DEC; *284*/HEL; *483*/HEL; *590*/NAT; *704*/HEL; *1077*/TET; *1196*/NAT; *1368*/EXS; *1768*/TUB; *2366*/TET; *2366a*/TUB; *2587*/TET; *2390*/TET; *3152*/TUB; *3421*/TUB; *3421a*/TET; *3483*/TUB. *Jacobs 604*/TET; *1026*/TUB; *2218*/TET; *2895*/TET. *Jaegermann 440*/TET. *Jephcott* in MEL 90727, 1883/DEC; in MEL 90749, 1883/TET; *s.n.*, 1886/SIEB. *Jessup & Gray*/SIEB; *3492*/TET; *3493*/PEDU. *Johnson 438*/SIEB; *s.n.*, 22.xi.1950/SIEB; *s.n.*, 19.v.1951/SIEB; *s.n.*, 13.vi.1965/SIEB. *Johnson & Constable s.n.*, 17.viii.1950/SIEB; *s.n.*, 26.i.1951/HEL. *L. & T. Johnson 348/62*/SIEB. *Johnstone s.n.*, 1884/TET; in MEL 90832/DEC. *James s.n.*, 1882/SIEB. *Jones* in MEL 90799/SIEB. *Kate s.n.*, 1881/HEL. *Keighery 420*/COL; *421*/PED; *457*/COL; *462*/EXS; *470*/COL; *471*/DEC; *472*/TUB; *1016*/DEC; *1175*/ALA; *1231*/TET; *1825*/DEC. *Kempen* in AD 97744326, 7.x.1977/DEC; in AD 97744327, 7.x.1977/TET. *Kennedy s.n.*, 1886/TET. *Kenny s.n.*, 1911/SIEB; *s.n.*, ix.1921/SIEB. *Keys* in BRI 244985/SIEB. *Kirkpatrick s.n.*, xii.1970/SIEB. *Kirkpatrick et al. s.n.*, 8-15.ii.1971/SIEB. *Kleinschmidt s.n.*,13.ix.1954/TET. *Knoetzsch s.n.*, x.1884/SIEB. *Koch 327*/TUB; *863*/DEC; *1935*/DEC; *s.n.*, ix.1902/TET; *s.n.*, xii.1906/COL; in AD 97617601, viii.1898/COL; in AD 97617601a, viii.1898/TET. *Kraehenbuehl 261*/HEL; *352*/TET; *362*/ALA; *362a*/DEC; *615*/TET; *629*/DEC; *637*/TET; *660*/TUB; *676*/DEC; *1086*/DEC; *1101*/NAT; *1464*/TET; *1464a*/TUB; *1468*/DEC; *1468a*/TET; *1649*/DEC; *1661*/TET; *1680*/PED; *1700*/TET; *1700a*/TUB; *1730*/DEC; *1737*/DEC; *1738*/TET; *1756*/PED; *1771*/TET; *1771a*/TUB; *1896*/DEC; *1908*/TET; *1939*/PED; *2180*/DEC; *2269*/TET; *2270*/DEC; *2285*/PED; *3051*/DEC; *3360*/TET; *3512*/TET; *3516*/DEC; *3571*/TET. *Kuchel 325*/TUB; *785*/TUB; *1186*/DEC; *2487*/TUB. *Latz 4101*/TUB; *4101a*/TET; *4123*/TUB; *4145*/TUB; *4190*/TET; *4286*/TET; *4310*/TET; *4320*/TET; *4365*/TUB; *4497*/TUB. *Lauterer s.n.*, 1885/SIEB. *Lawson s.n.*, 1887/TET. *Leichardt* in NSW 143718/HEL. *Leigh S565*/PEDU; *S579*/TET; *s.n.*, 3.xii.1964/PEDU. *Limson* in BRI 244996/SIEB. *Lindgren s.n.*, 5.x.1966/GLO. *Littling* in MEL 90761/SIEB. *Lothian 730*/TET; *732*/DEC; *810*/TUB; *810a*/TET; *1531*/TUB; *2113*/TET; *2270*/TUB; *2313*/COL; *2483*/

TET; *2543*/TET; *2941*/DEC; *2942*/TET; *3132*/TET; *4730*/TET; *5051*/TET. *Lothian & Francis 390*/TET. *Lucas s.n.*, 1878/PEDU; *s.n.*, iii.1924/TET. *Luchmann* in MEL 90852, 1890/TET; in MEL 90852a, 1890/COL. *McArthur s.n.*, ix.1978/GLO. *McBarron 227*/TET; *1214*/TET; *1214a*/TUB; *1297*/SIEB; *1668*/HEL; *1843*/TET; *1977*/TUB; *2002*/DEC; *2110*/DEC; *2127*/DEC; *2876*/HEL; *3464*/TUB; *3464a*/TET; *3479*/PEDU; *3613*/DEC; *3692*/TUB; *3729*/PEDU; *3882*/ALA; *4420*/HEL; *4966*/DEC; *4968*/TUB; *4968a*/TET; *6213*/HEL; *7897*/HEL; *s.n.*, 26.xii.1947/TET; *s.n.*, 16.x.1965/TET; *s.n.*, 19.ix.1968/TET. *McCann s.n.*, 1881/SIEB. *McDonald & Stanley s.n.*, 14.iv.1977/SIEB. *McDonnell 193*/SIEB. *MacFarlane 651*/TET; *652*/COL. *McFarlane 1189*/DEC. *McIwer* in MEL 90800/SIEB. *Mackay s.n.*, 1890/TET. *McKee 7025*/HEL; *7575*/DEC; *7605*/PEDU; *11707*/PEDU; *11710*/DEC; *s.n.*, v.1928/SIEB. *McKinnon* in MEL 90668/SIEB. *McLean* in MEL 536024/HEL. *Macpherson s.n.*, 1898/TET. *Maiden s.n.*, xii.1896/HEL; *s.n.*, viii.1898/SIEB; *s.n.*, x.1898/SIEB; *s.n.*, xii.1899/SIEB; *s.n.*, x.1909/COL; *s.n.*, xi.1909/COL; in NSW 143669, xi.1909/COL; in NSW 143669a, xi.1909/TET. *Maiden & Forsyth s.n.*, i.1899/SIEB. *Mair s.n.*, 17.x.1951/DEC. *Martensz 4038*/SIEB. *Martin s.n.*, 1887/DEC. *Martinsen 69*/TET. *Mathews* in MEL 90795, 1889/TUB; in MEL 90795a, 1889/TET; *s.n.*, 1893/DEC. *Mattingley s.n.*, 28.xi.1937/SIEB. *Meebold 2303*/SIEB. *10199*/NAT; *10868*/NAT; *21698*/DEC; *21699*/TET. *Melville 864*/DEC; *1346*/DEC; *1519*/TET; *3145*/HEL; *s.n.*, 30.viii.1952/SIEB. *Melville & Bond 352*/TUB; *352a*/COL. *Melville et al. 1017*/TET. *Melville et al. 1519*/TET. *Melville et al. 1110*/TUB. *Melville & Mair 722*/SIEB. *Merrall s.n.*, 1888/COL; in MEL 90791, 1890/TUB; in MEL 90791a, 1890/TET; in MEL 90861, 1890/COL; in MEL 90730/TUB. *Milthorpe & Cunningham 1343*/TUB; *2655*/TUB. *Minchin* in MEL 90511, 1887/TET; in MEL 90734, 1887/TET; in MEL 90735, 1887/TUB; in MEL 90770, 1887/TUB; in MEL 90796, x.1887/TET; in MEL 90827, 1887/TET; in MEL 90865, 1887/DEC; in MEL 90865, 1887/DEC. *Moker s.n.*, x.1923/TET. *Moore 4025B*/TET; *4527A*/TET; *s.n.*, 15.ix.1945/DEC; *s.n.*, 18.ix.1945/DEC; *s.n.*, 20.viii.1963/DEC. *Morris* in NSW 143776, 2.ix.1920/TET; *s.n.*, in NSW 143816, 2.ix.1920/TUB; *s.n.*, in NSW 143771, 14.viii.1921/TET; *s.n.*, in NSW 143667, 14.viii.1921/TUB. *D.I. Morris 7967*, 9.i.1979/HEL. *Morrison s.n.*, xii.1871/HEL; *s.n.*, 23.xi.1889/SIEB; *s.n.*, 19.ix.1890/DEC; *s.n.*, 28.ii.1891/HEL; *s.n.*, 24.x.1891/PEDU; *s.n.*, 7.xii.1892/HEL; *s.n.*, 11.xi.1893/PEDU; *s.n.*, 9.xii.1893/HEL; *s.n.*, 28.ix.1885/TET; *s.n.*, 18.viii.1898/NAT; *s.n.*, 15.ix.1899/COL; *s.n.*, 3.vii.1900/NAT; *s.n.*, 31.viii.1900/NAT; *s.n.*, 23.ix.1900/COL; *s.n.*, 10.x.1900/COL; *s.n.*, 26.vii.1902/NAT; *s.n.*, 15.xi.1904/DEC. *A. Morton s.n.*, 26.iv.1979/SIEB. *L. Morton s.n.*, 1887/TET. *Mueller s.n.*, iii.1847/HEL; *s.n.*, 28.iv.1848/HEL; *s.n.*, viii.1848/DEC; *s.n.*, 14.ix.1848/DEC; *s.n.*, 23.ix.1848/TET; *s.n.*, xii.1848/TET; *s.n.*, ix.1851/HEL; *s.n.*, x.1851/PEDU; *s.n.*, xi.1851/PEDU; *s.n.*, xii.1851/TET; *s.n.*, ix.1852/DEC; *s.n.*, x.1852/SIEB; in MEL 90515, xi.1852/DEC; in MEL 90581, xi.1852/PEDU; *s.n.*, i.1853/HEL; *s.n.*, iii.1854/HEL; *s.n.*, i.1955/HEL; *s.n.*, vii.1855/SIEB; *s.n.*, xii.1856/TET; *s.n.*, xii.1862/SIEB; *s.n.*, ix.1867/PEDU; in MEL 90516, x.1867/PED; in MEL 90553, x.1867/EXS; in MEL 90578, x.1867/PEDU; in MEL 90900, 1867/PEDU; *s.n.*, 7.ii.1869/HEL; *s.n.*, in MEL 90508, x.1875/PEDU; in MEL 90539, x.1875/DEC; in MEL 90764, 1875/SIEB; in MEL 90764, 1875/DEC; *s.n.*, in MEL 90764a 1875/SIEB; *s.n.*, x.1877/COL; *s.n.*, x.1887/TET; *s.n.*, xi.1887/TET; *s.n.*, xi.1892/NAT; in MEL 90495/PEDU; in MEL 90504/HEL; in MEL 90527/DEC; in MEL 90534/DEC; in MEL 90534a/TET; in MEL 90536/DEC; in MEL 90549/TET; in MEL 90574/PEDU; in MEL 90594/DEC; in MEL 90595/HEL; in MEL 90598/HEL; in MEL 90633/HEL; in MEL 90634/HEL; in MEL 90637/COL; in MEL 90662/SIEB; in MEL 90672/TET; in MEL 90681/SIEB; in MEL 90694/TET; in MEL 90698/SIEB; in MEL 90599/HEL; 90938/SIEB; in MEL 90939/SIEB; in MEL 90941/HEL; in MEL 90942/EXS; in MEL 90943/TET; in NSW 143698/HEL: in NSW 143763/PEDU. *M. Mueller 1272*/HEL. *Muir 154*/TUB; *162*/TET; *1464*/PED; *1547*/DEC; *2972*/SIEB; *3496*/TET; *4536*/TET; *4537*/SIEB; *5462*/TET; *5463*/DEC; *5852*/PED; in MEL 90837/TET. *Mullett s.n.*, xii.1966/SIEB. *Murray 165*/COL; *165a*/TUB. *Murray-Smith s.n.*, 17.ix.1970/SIEB. *Musson s.n.*, 1891/TET. *Neate s.n.*, in MEL 90699/TET. *Nelson 503*/TUB; *504*/TET; *s.n.*, 24.x.1972/COL. *Oakden s.n.*, xii.1886/SIEB. *Officer s.n.*, xi.1903/TET; in NSW 143767, xii.1913/TET; in NSW 143820, xii.1913/TUB; *s.n.*, in NSW 143821, xii.1913/TUB; in NSW 143822, xii.1913/TUB; in NSW 143784, x.1917/DEC; in NSW 143771, x.1917/TET. *Oldfield* in MEL 90550/EXS; in MEL 90552/EXS. *Oliver s.n.*, 1881/TET. *Olsen 1989*/SIEB. *Orchard 1166*/NAT; *1215*/COL; *1216*/PED; *1335*/EXS; *4821*/HEL. *O'Reilly s.n.*, vii.1906/TET. *Osborn s.n.*, 8.i.1924/TET. *O'Shannesy 68*/SIEB; *3001*/TET; in MEL 90892/SIEB. *Ostenfeld 358*/DEC; *359*/DEC; *360*/COL; *361*/NAT; *1104*/PED; *1350*/TUB. *Oxenford s.n.*, 18.viii.1940/SIEB. *Paltridge 16*/TET; *s.n.*, 7.ix.1930/COL; *s.n.*, 26.viii.1931/TET. *Patton s.n.*, 18.i.1921/HEL; *s.n.*, 20.i.1936/SIEB. *Pedley & Johnson 59*/TET. *Perry 559*/COL; *716*/DEC; in MEL 530698, 25.ix.1960/COL; in MEL 530699, 25.ix.1960/DEC; *s.n.*, 10.x.1962/TET. *Phillips 221*/TET; *1055A*/NAT; *1149*/TET; *s.n.*, 24.xi.1961/SIEB; in CBG 039836, 18.ix.1965/TUB; in CBG 039836a, 18.ix.1965/TET; *s.n.*, 22.xi.1965/TET; *s.n.*, 19.ix.1966/SIEB; *s.n.*, 22.vi.1967/SIEB; *s.n.*, 24.ix.1968/TUB. *Pickard 197*/TET; *1887*/SIEB; *2653*/SIEB; *2746*/SIEB; *2783*/SIEB; *3133*/TET; *3319*/SIEB; *s.n.*, 11.ix.1970/SIEB. *Pickard & Blaxell 273*/SIEB. *Porter s.n.*, vi.1885/SIEB. *Preiss 1929*/COL; *1931*/COL; *1932*/COL; *241*/DEC. *Pullen 1909*/TET; *4283*/TET. *Purdie 125*/DEC; *559D*/TET. *Pyre s.n.*, 1889/TUB. *Raynor s.n.*, 20.iv.1870/HEL. *Reader s.n.*, xii.1879/TET; *s.n.*, 1880/SIEB; *s.n.*, 23.v.1883/TET; *s.n.*, 1888/HEL; *s.n.*, 6.ii.1892/EXS; *s.n.*, 25.ix.1892/TET; *s.n.*, 2.x.1892/PEDU; *s.n.*, 1892/HEL; in MEL 90566, 5.xi.1893/PED; in MEL 90890, 5.xi.1893/EXS; *s.n.*, 29.x.1893/DEC; *s.n.*, 1893/DEC; *s.n.*, 14.x.1894/PEDU; *s.n.*, 16.x.1895/PED; *s.n.*, 21.x.1894/EXS; *s.n.*, 13.xi.1897/EXS; *s.n.*, 28.xi.1897/HEL; *s.n.*, 12.xii.1897/HEL; *s.n.*, 9.x.1898/TET; *s.n.*, 14.x.1898/EXS; *s.n.*, 16.x.1898/TET; *s.n.*, 16.x.1898/SIEB; *s.n.*, 20.xi.1898/DEC; *s.n.*, 21.x.1900/PEDU; *s.n.*, 31.x.1903/DEC; in MEL 88454/EXS; *s.n.*, in MEL 90585/HEL; *s.n.*, in MEL 536020/PEDU. *Richards s.n.*, 1877/TET; *s.n.*, 1885/COL. *Richley 1431A*/TET; *F8*/TUB. *Robbins sub Beauglehole 7293*/HEL; *7294*/

COL; *7296*/TET; *7297*/TUB; *7298*/DEC; *17076*/HEL; *17755*/DEC; *17756*/TET; *18364*/DEC; *19593*/TET; *42244*/DEC; *42246*/TET; *42247*/TUB. *Rodd 830*/HEL: *889*/TET; *1392*/SIEB; *s.n.*, 21.vi.1970/SIEB. *Rodd & Coveny 951*/PEDU. *Rodway 2800*/DEC; *2801*/DEC; *2802*/DEC; *2807*/SIEB; *2813*/SIEB; *2814*/SIEB; *2815*/SIEB; *2816*/SIEB; *11152*/DEC; *13746*/SIEB; *13999*/SIEB; *14542*/DEC; *15628*/DEC; *s.n.*, xii.1891/HEL; *s.n.*, i.1896/HEL; *s.n.*, ii.1898/DEC; *s.n.*, i.x.1929/TET; *s.n.*, x.1929/SIEB; *s.n.*, 13.iv.1931/SIEB; *s.n.*, 20.i.1933/DEC; *s.n.*, 10.x.1933/DEC; *s.n.*, 28.viii.1938/SIEB; *s.n.*, viii.1938/SIEB. *Rogers s.n.*, ix.1907/TET; *s.n.*, ix.1908/DEC. *Rohrlach 600*/TET. *Royce 1248*/TUB; *1251*/DEC; *1272*/EXS; *2115*/TUB; *2227*/COL; *2228*/DEC; *2283*/PED; *2851*/GLO; *3177*/GLO; *3927*/THU; *4510*/PED; *4554*/COL; *4641*/COL; *4658*/THU; *4666*/GLO; *4904*/GLO; *5156*/COL; *5195*/COL; *5457*/NAT; *7900*/DEC; *7904*/EXS; *7915*/COL; *8175*/COL; *8176*/DEC; *8200*/EXS; *8233*/NAT; *9671*/TUB; *s.n.*, 24.x.1944/THU; *s.n.*, ix.1945/TUB; *s.n.*, 24.ix.1946/DEC. *Rupp s.n.*, iv.1914/HEL. *St. John s.n.*, 29.xi.1901/HEL; *s.n.*, in MEL 90610, 12.xi.1908/HEL. *Sainty s.n.*, i.1967/HEL; *s.n.*, i.1965/HEL. *Salasoo 42*/COL; *42a*/TET; *99*/DEC; *274*/DEC; *408*/TUB; *433*/NAT; *2456*/SIEB; *s.n.*, 9.i.1967/SIEB. *Sammy 70*/COL. *Savell s.n.*, 1884/TUB. *Schodde 394*/TET; *857*/TET; *888*/DEC; *890*/COL; *926*/DEC; *3161*/SIEB; *5160*/SIEB. *Scrymgeour 60*/COL. *Seabrook 602*/NAT. *Sewell s.n.*, 1883/NAT; *s.n.*, xii.1884/DEC. *Sharpe 341*/SIEB; *2406*/SIEB. *Sharpe & Hockings 653*/TET. *Sharpe & Soul 1214*/SIEB. *Sharrad 310*/TET; *735*/DEC; *736*/TET; *736a*/TUB; *842a*/TET. *Shaw 348*/TET. *Shillabeer s.n.*, 31.ix.1960/TET. *Sieber 173*/SIEB. *Sikkes 61*/TET; *634*/TET; *1103*/TET. *Simmonds* in BRI 111618/SIEB. *Sims sub Cleland s.n.*, 17.viii.1968/NAT. *Slade 1899*/TET. *Slater s.n.*, 1870/TET. *Smith s.n.*, 3.i.1953/PEDU. *T.J. Smith 194*/TET; *217*/TUB; *224*/TET; *225*/DEC; *241*/DEC; *246*/DEC; *248*/TET; *249*/DEC; *334*/DEC; *544*/TET; *546*/DEC; *585*/TET; *620*/TET; *658*/TET; *1226*/DEC; *1405*/DEC; *1406*/TET; *1418*/TET; *1466*/TET; *1498*/NAT; *1530*/TET; *1531*/DEC; *1737*/COL; *1959*/NAT; *1962*/NAT; *1817*/TET; *1889*/TUB; *1970*/DEC; *1983*/COL; *1988*/TUB; *2039*/PED; *2054*/TUB; *2273*/TUB; *s.n.*, 31.viii.1970/COL; *s.n.*, 31.viii.1970/DEC; *s.n.*, 25.ix.1970/ALA. *Specht 2117*/SIEB; *2269*/COL; *2338*/TUB; *2518*/COL; *2622*/COL; *s.n.*, ix.1952/DEC; *s.n.*, x.1952/TET. *Solling 555*/TET. *Spang s.n.*, 1882/TET. *Speme s.n.*, 1889/DEC. *Spicer* in MEL 90531/DEC. *Spooner 266*/PED; *300*/DEC; *452*/NAT; *453*/DEC; *454*/TET; *455*/ALA; *559*/TET; *1401*/NAT; *1167*/PED; *1168*/PED; *1234*/COL; *1754*/HEL; *2339*/TET; *2530*/DEC; *2531*/NAT; *2541a*/TET; *2542*/DEC; *2543*/PED; *3063*/COL; *3501*/NAT; *3572*/PED; *3851*/HEL; *4124*/NAT; *4237*/TET; *4917*/DEC; *5301*/DEC. *Stamard s.n.*, ix.1916/TUB. *Stanley & Reynolds 7849*/TET. *Stewart s.n.*, 13.i.1951/SIEB. *Storr s.n.*, ix.1959/COL; *s.n.*, 6.ix.1969/COL. *Story* in MEL 90673/TET; in MEL 90686/SIEB; in MEL 90688/TET. *Stove 221*/TUB; *221a*/TET; *293*/TET; *293a*/TUB; *336*/TET; *337*/TUB; *339*/TET; *439*/TUB; *439a*/TET; *464*/TET; *620*/TET; *646*/TUB; *657*/TET; *657a*/TUB. *Stoward s.n.*, x.1912/COL. *Strahams s.n.*, 9.x.1910/TUB. *Streiman 2843*/SIEB; *2876*/SIEB; *3255*/SIEB; *3320*/SIEB. *Stuart* in MEL 90683/SIEB; in MEL 90934/PEDU. *Stuwe 517*/TET. *Sullivan 32*/DEC; *s.n.*, x.1872/TET; *s.n.*, 10.xi.1873/EXS; *s.n.*, ix.1879/DEC; in MEL 90507, xi.1883/HEL; in MEL 90895, xi.1883/HEL; *s.n.*, 1893/HEL; *s.n.*, in MEL 90644/TET; *s.n.*, in MEL 90644a/TUB. *Suvell s.n.*, 1889/TET. *Swinbourne 33*/COL; *165*/COL. *Swindley s.n.*, 1.xii.1959/HEL; *s.n.*, 9.xii.1959/HEL. *Symon 90*/DEC; *217*/TET; *544*/TUB; *597*/TET; *718*/DEC; *719*/TET; *720*/ALA; *1346*/TET; *1492*/TET; *2061*/HEL; *2555*/TET; *2863*/DEC; *2866*/TET; *4097*/COL; *6168 B*/COL; *6169*/EXS; *6303*/TET; *6481*/TET; *6481a*/TUB; *6482*/EXS; *7254*/TUB; *7254 A*/TET; *7318*/TET; *7551*/COL; *7555*/TET; *8089*/TUB; *8089 E*/TET; *8097*/DEC; *8648*/TET; *8972 B*/TET: *8976 A*/DEC; *9560 C*/TET; *9555 B*/TET; *10766*/TUB; *10860*/DEC; *s.n.*, in ADW 21090, 27.ix.1959/TET; *s.n.*, in ADW 21090a, 27.ix.1959/COL. *Tadgell s.n.*, ix.1921/SIEB; *s.n.*, x.1917/SIEB. *Tate s.n.*, 23.v.1880/HEL; *s.n.*, 27.x.1881/DEC; *s.n.*, 28.x.1882/DEC; *s.n.*, xi.1882/PEDU; *s.n.*, 4.xi.1882/PEDU; *s.n.*, 21.xi.1882/HEL; *s.n.*, i.1882/HEL; *s.n.*, 16.xi.1883/HEL; *s.n.*, xi.1883/PED; *s.n.*, 1883/HEL; *s.n.*, 30.ix.1887/DEC; *s.n.*, 1894/TUB; *s.n.*, ix.1896/TET; *s.n.*, xii.1896/HEL; *s.n.*, ix.1897/DEC. *Taylor s.n.*, 4.i.1965/NAT. *Telfer 71*/TET. *Telford 1531*/SIEB; *1603*/SIEB; *3095*/SIEB; *4193*/SIEB. *Tenison-Woods* in MEL 90793/SIEB; in BRI 244997/SIEB. *Tepper 169*/PED; *191*/COL; *192*/TET; *999*/DEC; *1055*/DEC; *1082*/DEC; *1093*/PED; *1395*/HEL; in MEL 90728, 1879/COL; in MEL 90729, 1879/TET; in MEL 90859, 1879/TET; in MEL 907220, i.1880/TUB; in MEL 90759, i.1880/TUB; *s.n.*, 1880/DEC; *s.n.*, 1881/DEC: *s.n.*, 12.xi.1886/TET; in MEL 90579/PEDU; in MEL 90805/TET; in MEL 90814/TET; in MEL 90878/TET. *Thom s.n.*, 1891/SIEB. *Thompson 255*/SIEB; *824*/HEL; *2035*/TET; *2856*/HEL; *s.n.*, 20.iii.1962/HEL; *s.n.*, 24.i.1968/HEL; in NSW 87106, 2.ix.1968/TUB; in NSW 81107, 2.ix.1968/TET. *Thornton s.n.*, 1889/TUB. *Tietkens s.n.*, 1874/PEDU. *Tildem 601*/SIEB. *Toelken 6000*/COL; *6001*/TET; *6004*/TUB; *6037*/TUB; *6048*/TUB; *6050*/TUB; *6059*/TUB; *6059A*/TET; *6079*/TET; *6158*/TUB; *6163*/TET; *6178*/TUB; *6235*/TUB; *6421*/EXS; *6424*/TUB; *6439*/THU; *6443*/DEC; *6445*/DEC; *6454*/COL; *6454A*/TUB; *6463*/COL; *6464*/EXS; *6472*/DEC; *6479*/EXS; *6494*/DEC; *6489*/EXS; *6491*/*COL*; *6491A*/TUB; *6492*/EXS; *6493*/TET; *6495*/NAT; *6497*/PED; *6516*/EXS; *6531*/TET; *6532*/COL; *6532A*/TUB; *6543*/COL; *6543A*/TUB; *6546*/SIEB. *Trudgen 2209*/PED; *2210*/TUB; *2211*/DEC. *Turner s.n.*, 29.ix.1960/TUB; *s.n.*, in MEL 90970/TUB. *Turvey s.n.*, 6.ix.1965/THU; *s.n.*, 21.vii.1968/TUB; *s.n.*, 14.viii.1968/TET. *Urquhart s.n.*, 1889/TET. *Vasek s.n.*, 20.ix.1968/TET. *Vickery s.n.*, 14.x.1949/HEL. *Wace 21*/COL; *22*/TET; *s.n.*, 7.xi.1970/DEC. *Wakefield 3450*/TET: *3451*/PEDU; *3452*/DEC; *4269*/HEL; *4668*/DEC. *Walker s.n.*, i.1962/HEL; *s.n.*, 20.vii.1967/TET. *Walter s.n.*, x.1887/TET; *s.n.*, x.1892/HEL; *s.n.*, x.1899/TET; *s.n.*, x.1899/TET; in MEL 90771/PED; in MEL 90773/DEC; in MEL 90774/TET; in MEL 90775/TET; in MEL 90804/DEC. *Watts 1170*/DEC; *1170a*/TET. *Weber 51*/TUB; *1108*/TET; *1140*/TET; *1310*/TET; *1310a*/TUB; *1331*/TUB; *1331a*/TET; *1419*/TUB; *1517*/TET; *1517a*/TUB; *1641*/DEC; *1714*/TET; *1764*/NAT; *1893*/PEDU; *2204*/TET; *2204a*/TUB; *2323C*/TUB; *2465*/TET; *2466*/TUB; *2540*/COL; *2540a*/TUB; *2697C*TUB; *3066*/TET; *3249A*/COL; *3249B*/TET; *3254B*/PEDU; *3474*/PEDU; *3562*/TET; *3562a*/COL; *3792*/TET; *3793*/DEC; *4201*/TET;

4270/TET; *5313*/TET; *5327*/TET; *5327a*/TUB; *5620*/TET. *Wehl s.n.*, 1874/DEC; in MEL 90748, 1882/TET; in MEL 90875, 1882/TET; *s.n.*, 1889/TUB. *Went 35*/COL. *Weston 10475*/COL; *10532*/COL; *10546*/COL; *10547*/COL; *10576*/COL. *Whaite s.n.*, 30.x.1953/SIEB. *Whan* in MEL 90648/TET; in NSW 143801/DEC; in NSW 143802/DEC. *Wheatley s.n.*/ALA. *Wheeler 37*/DEC; *119*/DEC; *164*/TET; *195*/SIEB; *221*/DEC; *658a*/TET; *687*/COL; *697*/COL; *775a*/EXS; *775b*/COL; *775c*/TET; *1017*/PED; *1058a*/TET; *1058B*/COL; *1146*/TET; *1206*/DEC; *1207*/TET; *1425*/TET. *Whibley 229*/TET; *229a*/TUB; *422*/NAT; *606*/COL: *606a*/TET: *861*/DEC; *997*/TET; *1105*/TET; *1105a*/TUB; *1307*/PED; *1319*/DEC; *1470*/DEC; *1594*/TET; *2300*/COL; *2300a*/TUB; *2581*/TET; *2888*/TET; *2894*/DEC; *2933*/DEC; *2938*/TET; *3567*/TET; *4055*/COL; *4056*/TET; *4154*/DEC; *4372*/TET; *4385*/TET; *6322*/TET; *6400*/TET; *6410*/TET; *6451*/TUB; *6451a*/TET; *6544*/TET; *6602*/TUB; *6603*/TET; *6674*/TET; *6783*/TET. *Whinray 22*/HEL; *53*/DEC; *54*/DEC; *54b*/TET; *54c*/TET; *54f*/TET; *55a*/DEC; *55b*/DEC; *184*/PED; *278*/TET; *285*/HEL; *290*/TET; *291*/SIEB; *313*/TET; *341*/TET; *346*/DEC; *371*/TET; *478*/TET; *509*/PEDU; *513*/TET; *519*/DEC; *554*/DEC; *559*/TET; *659*/TET; *582*/PEDU; *665*/DEC; *761*/TET; *786*/SIEB; *810*/DEC; *866*/HEL; *877*/PEDU; *888*/DEC; *926*/DEC; *1078*/DEC; *1100*/TET: *1111*/PED; *1140*/TET; *1151*/TET; *1251*/PEDU; *1278*/HEL; *1337*/TET; *1349*/TET; *1356*/DEC; *1490*/DEC; *1509*/TET; *1653*/SIEB; *1759*/SIEB; *s.n.*, iv.1966/SIEB; *s.n.*, 26.xi.1966/HEL; *s.n.*, 1966/SIEB. *White 6082*/SIEB; *8609*/SIEB; *9350*/TET; *s.n.*, vi.1913/SIEB; *s.n.*, vii.1916/SIEB; *s.n.*, viii.1916/TET; *s.n.*, iv.1918/SIEB; *s.n.*, vii.1919/TET; in BRI 244983, x.1919/SIEB; in AD 966040502, x.1919/SIEB; *s.n.*, x.1921/SIEB. *Whittaker & Niering s.n.*, 15.xii.1975/TET. *Wilhelmi* in MEL 90600/HEL; in MEL 90811/TET. *Willcocks 4*/TUB. *Williamson 482*/DEC; in MEL 90512, 1893/PED; in MEL 90572, 1893/PED; in MEL 90586, 1893/HEL; in MEL 90657, 1893/TET; in MEL 90786, 1893/DEC; in NSW 143832, x.1900/DEC; in NSW 143662, x.1900/TET; *s.n.*, ix.1901/PEDU; *s.n.*, x.1901/PEDU; *s.n.*, xii.1901/HEL; *s.n.*, xi.1902/TET; *s.n.*, xi.1903/HEL; *s.n.*, x.1905/PED; *s.n.*, xi.1905/PED; *s.n.*, ii.1908/PEDU; *s.n.*, ix.1910/PED; *s.n.*, x.1911/DEC. *Williams 119*/TET; *4121*/TET; *5608*/TET; *5609*/DEC; *5731*/DEC; *5732*/TET; *5736*/DEC; *s.n.*, v.1916/SIEB; in NSW 143737/SIEB. *Willis s.n.*, 16.xi.1929/HEL; *s.n.*, 30.i.1938/SIEB; in MEL 90967, 2.ix.1948/COL; in MEL 91052, 2.ix.1948/TET; in MEL 90546, 8.ii.1950/TUB; in MEL 90485, 8.ii.1950/DEC; *s.n.*, 8.xi.1950/NAT: *s.n.*, 18.xi.1950/TET; *s.n.*, 6.ix.1963/NAT; *s.n.*, 17.xi.1963/PEDU; *s.n.*, 11.ix.1965/TET; *s.n.*, 8.x.1976/DEC. *Wilson 505*/DEC; *579*/DEC; *s.n.*, 1880/TET; *s.n.*, 1881/DEC; in MEL 90763, 1884/HEL; in MEL 90780, 1884/PEDU; in MEL 532284, 1884/PED; in MEL 90708, 1890/DEC; in MEL 528993, 1890/PEDU. *P.G. Wilson 33*/COL; *120*/TUB; *120a*/TET; *645*/PEDU; *648*/PED: *1090*/HEL; *1268*/TET; *1347*/SIEB; *1959*/PEDU; *2020*/TET; *2038*/TET; *2120*/DEC; *2145*/DEC; *2874*/NAT; *3958*/DEC; *4248*/DEC; *5439*/NAT; *6201*/DEC; *6202*/NAT; *6204*/NAT; *6250*/GLO; *6302*/TET; *6765*/NAT: *6771*/TUB; *8136*/TET; *8178m*/DEC; *8178i*/EXS; *8749*/TUB: *8156*/NAT; *9982*/ALA; *9998a*/PED; *10044*/TET: *11637*/EXS; *11660*/NAT; *11682*/DEC; *11683*/ALA; *11684*/NAT; *11685*/DEC; *11686*/THU; *11688*/DEC; *11687*/ALA; *s.n.*, 6.x.1970/EXS. *Worsley s.n.*, 1889/TET. *Woolls s.n.*, 1875/HEL; in MEL 90532/DEC; in MEL 90670/SIEB; *s.n.*, in MEL 90690/SIEB. *Wooster s.n.*, 1882/DEC. *Wrighley 73*/*148*/TET; *s.n.*, 7.iii.1968/SIEB.