ISSN 0085-4417



NUYTSIA

Volume 4 Number 2
1983

WESTERN AUSTRALIAN HERBARIUM—DEPARTMENT OF AGRICULTURE

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DEPARTMENT OF AGRICULTURE,
SOUTH PERTH, WESTERN AUSTRALIA

22493—(1)

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A taxonomic revision of the tribe Chenopodieae (Chenopodiaceae) in Australia

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Abstract

Wilson, Paul G. A taxonomic revision of the tribe Chenopodieae (Chenopodiaceae) in Australia. Nuytsia 4(2): 135-262 (1983).

A taxonomic revision is presented for the tribe Chenopodieae (Chenopodiaceae) in Australia. Five genera and fifty two species are recognised viz.: *Chenopodium* (24 species), *Dysphania* (10 species), *Scleroblitum* (1 species), *Einadia* (6 species) and *Rhagodia* (11 species). One section, eight species, and seven subspecies are described as new; six new specific and eight new infraspecific combinations are made. A number of names are lectotypified, in some cases in a way different to that of earlier workers. The characters in the fruit that have traditionally been used for circumscribing the genera are shown to be unsatisfactory; this has led to the rearrangement of some species. The one species of *Rhagodia* described from outside the Australian and New Zealand region is considered to be a species of *Chenopodium*.

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Introduction

A historical survey of the treatment by different authors of the various genera now included in the tribe Chenopodieae is given by Scott (1978a and b). He recognised two subtribes, the Chenopodiinae and the Rhagodiinae, and distinguished them principally on the presence of a dry membranous pericarp in the former and a fleshy pericarp in the latter. With regard to the genera found in Australia, *Chenopodium, Dysphania*, and *Scleroblitum* (as *Chenopodium* sect. *Atriplicina*) were placed in the Chenopodiinae, while *Einadia* and *Rhagodia* were placed in the Rhagodiinae. I have not found the nature of the pericarp to be a character suitable for discriminating subtribes since, as detailed elsewhere, it can be succulent or dry in species which by other criteria appear to be closely related. For this reason no subtribes are recognised in this paper. Furthermore I have redefined the genera *Chenopodium* and *Einadia* so as to include under both some species in which fruits are characteristically dry and others in which they are succulent. Further notes on the history and circumscription of some of the supraspecific categories are given under the respective genera or sections.

The species circumscription adopted here is rather broad (by the standards of workers on the Chenopodiaceae in the European flora). Many taxonomic problems remain, the resolution of which would often require extensive field work or the use of experimental methods, neither of which are within the scope of the present study. The names applied to the non-endemic species have been taken from recent papers by workers in Europe, U.S.S.R., and North America and the relevant taxa are not here critically revised.

The synonymy provided for the species endemic to Australia is as complete as I have been able to ascertain. For other species the synonymy has been limited to names based on Australian collections or to names used in significant publications on Australian plants.

The author abbreviations used after botanical names follow those suggested in the Draft Index of Author Abbreviations compiled at The Herbarium, Royal Botanic Gardens, Kew (1980). The abbreviations for journal titles is generally in agreement with G. H. M. Lawrence *et al.*, Botanico-Periodicum-Huntianum (1968), while the abbreviations used for books have, where possible, followed the suggestions of F. A. Stafleu and R. S. Cowan, Taxonomic Literature, ed. 2 (1976-).

For each taxon usually two collections have been cited for each State in which it occurs. However, all specimens studied have been determined and all specimens bearing relatively precise geographical data have been mapped.

Morphology

Indumentum. A mealy indumentum is present to some extent in all species of *Einadia, Rhagodia,* and *Scleroblitum,* while it is also present in some species of *Chenopodium* subg. *Chenopodium.* The mealiness consists initially of one-celled spherical or irregularly shaped globules that may be white and dull, or glossy and transparent. The spherical or irregularly shaped cells are supported on slender stalk cells and both arise from the division of an epidermal cell (Esau 1977). Brian and Cattlin (1968) imply a non-cellular morphology to those spherical globules that constitute the mealy indumentum of *Chenopodium album* (and therefore, by inference, other mealy members of Chenopodiaceae). This appears to be incorrect since other workers (i.e. Wood 1923; Osmond *et al.* 1969, and Esau 1977) have described and illustrated the origin of the indumentum from epidermal cells, while in some species of *Chenopodium* a transitional series may be found ranging from the subsessile globule to a slender multicelled trichome. In those cases where the mealy indumentum is very dense the stalk cells are of different lengths so that the spherical cells are arranged in layers; this is the situation in *Chenopodium gaudichaudianum* and *Rhagodia spinescens.* The spherical cell usually collapses on drying as the organ on which it has arisen matures. If the cell wall is relatively firm the spherical cell then becomes saucer-shaped, as is common in many species of *Chenopodium, Einadia,* and *Rhagodia* (e.g. *C. desertorum, E. nutans* and *R. spinescens*). If, however, the cell wall is weak the cells may collapse to form a scurfy covering which is eventually shed as irregular shaped flakes, or they may fuse together to form a silvery sheen on the leaf or branch. The latter state is adopted in *Rhagodia candolleana* and *R. crassifolia,* a circumstance which serves to distinguish these two from all other species of the genus.

The mealy indumentum described above has been shown to have at least two functions, but not necessarily in the same species. Wood (1923) demonstrated that the collapsed cells in *Atriplex vesicaria* Benth. (which resemble those of *Rhagodia candolleana*) assist in the prevention of water loss by the plant, while Osmond *et al.* (1969) have shown that in some species of *Atriplex* the cells play an important part in excreting salt. These two activities are probably of only minor significance in those species of the Chenopodiaceae in which the mealy indumentum may be absent, or sparse and soon lost. For instance in *Rhagodia eremaea* the globular cells do not fuse together after collapsing but remain distinct as small scales which are shed as the leaf matures. In this species, therefore, the mealy indumentum would appear to have little influence on either the water or salt economies of the plants (see Hellmuth 1968, where referred to as *R. baccata*).

In *Dysphania* and in *Chenopodium* sect. *Orthosporum* are found both glandular and simple, septate-acuminate hairs, characters which support the suggestion of a close relationship between the two groups.

In *Chenopodium* sect. *Ambrina* both sessile glandular hairs and septate simple slender hairs are found on the branches and leaves, while distinctive geniculate hairs occur on the ovary.

In *Chenopodium* Sect. *Auricoma* vesicular mealy hairs are found, characteristic of those in section *Leprophyllum*. However, in addition, on the branches of the inflorescence occur contorted tubular, multi-cellular hairs that are evidently of a similar nature to the vesicular since they grade into them.

Sexuality. The species in the tribe Chenopodieae considered here range in their sexuality from dioecy through gynomonoecy to a monoclinous condition. In those taxa that are dioecious the terminal flower of a compound cyme tends towards the bisexual state; e.g. in a male plant of *Rhagodia* the terminal flower has a large pistillode, and in a female plant more prominent staminodes, than do the lateral flowers. In those taxa that are gynomonoecious the terminal flower of a cyme is bisexual while the lateral flowers are female; this is typically the situation in *Einadia*. In *Dysphania* the terminal flower is either bisexual or male (if the latter it possesses a prominent pistillode), while the lateral flowers are male.

Pericarp. The pericarp varies from being diaphanous (in *Dysphania*), membranous (in some species of *Chenopodium*), leathery (*Chenopodium* species), succulent (*Rhagodia* etc.), or crustaceous (*Scleroblitum*). In some species (e.g. *Chenopodium desertorum*) it can be either succulent or dry in the same subspecies, evidently dependent to some extent on the environmental conditions. The unusual nature of the crustaceous pericarp of *Scleroblitum* is described under that genus where it is noted that although in this character it is unique among the Chenopodiaceae of Australia, it is similar to *Monolepis*, a genus of small herbs found in Asia and America.

Key to genera

1. Plants shrubby, dioecious . . . . . 5. **Rhagodia**
   Plants herbaceous or weakly shrubby, monoecious or flowers polygamous. . . . 2

2. Herbs with basal rosette of leaves; tepals 4, cartilaginous in fruit 3. **Scleroblitum**
   Plants without a basal rosette 3

3. Plants glandular pubescent; tepals 1-4; stamens 1-2; embryo lateral or basal 2. **Dysphania**
   Plants glandular pubescent or mealy; tepals (3) 5; embryo variously positioned . 4

4. Tepals 5; stamens 1-3 in terminal bisexual flowers; seed horizontal; perennial herbs (or weak shrubs) with mealy indumentum . . . . . 4. **Einadia**
   Tepals (3-)5; stamens 1-5; seed horizontal or vertical; mostly annual herbs (rarely perennials or weak shrubs) with mealy or glandular indumentum or glabrous . . . . . 1. **Chenopodium**

1. CHENOPODIUM L.

Linnaeus, Sp.Pl. 218 (1753). *Lectotype: Chenopodium rubrum* L. (see Britton and Brown 1913).

Orthosporum (R. Br.) T. Nees, Gen. Fl. German. ad t. [58] (1835). *Chenopodium* sect. *Orthosporum* R. Br., Prod. 407 (1810). *Lectotype: Chenopodium carinatum* R.Br. (see Ulbrich 1934).

Annual (rarely perennial) *herbs*, occasionally weak *shrubs*, mealy with minute sessile vesicular hairs which may collapse to form a scaly indumentum, glandular or glabrous. *Leaves* alternate, petiolate, chartaceous or somewhat fleshy, entire or variously serrate or dissected. *Flowers* small, bisexual or female, usually clustered. *Perianth* 3 to 5 lobed, herbaceous or coriaceous, sometimes becoming cartilaginous in fruit. *Stamens* (1-)5, free or united at base into a saucer-shaped disc. *Style* usually very short; *stigma* 2 to 3(5). *Pericarp* membranous or rarely succulent. *Seed* lenticular to sub-globular, horizontal to vertical; *testa* crustaceous; *embryo* annular to hippocrepiform; *radicle* centrifugal or (in vertical seeds) inferior. *Seed* shed either attached to or free from perianth.

A cosmopolitan genus of over 70 species; 24 are recorded from Australia of which 14 are probably endemic.

Classification

The most recent outline of the infrageneric classification in *Chenopodium* is that provided by Scott (1978b). In that paper he surveys the historical aspects and provides a considerable synonymy.

I have differed from Scott on certain points, principally in the typification of some names and the circumscription or recognition of some sections. These matters are discussed under the relevant taxa. The *Chenopodium* species here recognised as being native or naturalized in Australia are classified as follows:

Chenopodium L.
- subgenus **Chenopodium**
  - sectio **Chenopodium,** species no. 1
  - **Degenia** Aellen, species no. 2
  - **Leprophyllum** Dumort., species nos. 3-9
  - **Desertorum** Paul G. Wilson, species nos. 10-12
  - **Auricoma** Aellen, species nos. 13-14
  - **Rhagodioides** Benth., species no. 15
- subgenus **Ambrosia** A. J. Scott
  - sectio **Ambrina** J. D. Hook., species nos. 16-17
  - **Orthosporum** R.Br., species nos. 18-24

Key to species

1. Plants somewhat mealy at least when young, not glandular 2
   Plants glandular pubescent, not mealy 18
2. Shrubs 3
   Herbs (sometimes perennial) 6
3. Fruit dry 4
   Fruit succulent 5
4. Spinescent shrub; leaves leathery, spathulate, to 3 cm long . 15. **C. nitrariaceum**
   Unarmed soft-wooded shrub; leaves chartaceous, oblong-elliptic to hastate, to 4 (6) cm long . . . . . 14. **C. auricomum**
5. Stigmas strongly penicillate . . . . . 12. **C. gaudichaudianum**
   Stigmas papillose . . . . . 11. **C. curvispicatum**
6. Tepals 5, eventually free, almost orbicular, very sparsely mealy, not shed with fruit; seed rounded on margin . . . . . 13. **C. auricomiforme**
   Tepals 3-5, if 5 then mealy and enclosing fruit when shed 7
7. Leaves variously toothed 8
   Leaves entire or lobed 13
8. Seed deeply muricate . . . . . 8. **C. erosum**
   Seed smooth or minutely pitted 9
9. Perianth glabrous; seed horizontal or erect; perianth 3-5 lobed 10
   Perianth mealy; seed horizontal; perianth 5-lobed 11
10. Perianth (at least of lateral flowers) shortly 3-lobed, urceolate 2. **C. macrospermum**
    Perianth segments free . . . . . 1. **C. glaucum**
11. Seed prominently keeled, finely pitted, dull; pericarp persistent . . 7. **C. murale**
    Seed bluntly keeled, smooth to striate or weakly furrowed, pericarp readily detached 12
12. Leaves considerably longer than broad, usually more than 3 cm long 3. **C. album**
    Leaves about as long as broad, usually less than 3 cm long . . . .4. **C. opulifolium**
13. Plant foetid (smelling of rotten fish) 14
    Plant not foetid 16
14. Tepals united to near apex; stamens 5 . . . . . 5. **C. vulvaria**
    Tepals free except near base 15
15. Stamens 1 or 2 . . . . . 6. **C. detestans**
    Stamens 5 . . . . . 10d. **C. desertorum** subsp. **virosum**
16. Inflorescence a very slender panicle; tepals becoming black and enclosing fruit; leaf lamina mostly c. 10 mm long; indumentum very thin . . . . . 9. **C. hubbardii**
    Inflorescence a narrow to broad panicle; tepals not black in fruit 17
17. Plant an erect annual; leaves mostly over 3 cm long with a very thin mealy indumentum; panicle large, sometimes 50 cm or more long . . . . . .3. **C. album**
    Plant prostrate to erect, usually a perennial; leaves always entire, usually less than 2 cm long; panicle up to 5 cm long . . . . . .10. **C. desertorum**
18. Stamens 1-2; seed lenticular, erect; leaves simple 19
    Stamens 5; seed horizontal to erect; leaves simple or pinnatisect 25
19. Tepals 4 20
    Tepals 5 21
20. Plant delicate, erect; flowers in open panicles (W.A.) . . . . . .24. **C. saxatile**
    Plant wiry, decumbent; flowers in dense axillary glomerules (New Zealand) 23. **C. pusillum**
21. Tepals strongly crested 22
    Tepals rounded to acute on back or keeled 23

22. Perianth rostrate at apex; tepals free . . . . . 21. **C. cristatum**
    Perianth truncate at apex; tepals united . . . . . 22. **C. truncatum**
23. Tepals keeled (at least towards apex) . . . . . 19. **C. carinatum**
    Tepals rounded on back 24
24. Tepals firmly united in lower half, completely covering fruit, usually black 20. **C. melanocarpum**
    Tepals free to near base, not completely covering fruit, white . . . .18. **C. pumilio**
25. Leaves serrate; seed horizontal to oblique . . . . . 16. **C. ambrosioides**
    Leaves pinnatisect; seed erect . . . . . 17. **C. multifidum**

Subgenus **Chenopodium**

Sectio **Chenopodium;** A. J. Scott, Bot. Jahrb. Syst. 100:215 (1978).

Chenopodium sect. *Pseudoblitum* J. D. Hook in Benth. et J. D. Hook., Gen. Pl. 3:52 (1880). *Type: C. rubrum* L.

Annual *herbs* more or less mealy. *Flowers* dimorphic in axillary and terminal panicles. *Perianth* 3-, 4-, or 5-merous; *tepals* free or united in lower half. *Stamens* 1-5. *Seeds* horizontal in terminal flowers, vertical in lateral flowers; *embryo* annular.

Cosmopolitan with four species of which one is found in Australia.

1. **Chenopodium glaucum** L., Sp. Pl. 1:220 (1753). Type: From Europe, n.v.

C. ambiguum R.Br., Prodr. 407 (1810).—*C. glaucum* var. *ambiguum* (R. Br.) J. D. Hook., Fl. Tasm. 1:313 (1857).—*C. glaucum* subsp. *ambiguum* (R.Br.) Murr et Thellung ex Thellung, Mem. Soc. Natl. Sci. Nat. et Math. Cherbourg 38:196 (1912); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3/2:612 (1960). *Type*: Tasmania, *R. Brown* (BM).

C. ambiguum var. *majus* Moq. in DC., Prodr. 13/2:67 (1849). No material cited.

C. ambiguum var. *minus* Moq. l.c—*C. glaucum* subsp. *ambiguum* f. *minus* (Moq.) Aellen, Verh. Nat. Gesell. Basel 41:102 (1931). *Type*: Western Australia, *Drummond* 225 (iso:MEL).

C. littorale Moq., Chenop. Monogr. Enum. 24 (1840) nom. illeg. non (L.) Thunb. (1815). *Type*: In nova Hollandia, *Caley* (holo:P).

C. glaucum var. *littorale* Rodway, Tasm. Fl. 155 (1903). *Type*: No specimens cited.

C. glaucum L. var. *paschale* Fuentes, Bol. Mus. Nac. Chile 5:2 (1931) n.v., fide Aellen, Feddes Repert. 26:47 (1929). *Type*: From Easter Island, n.v.

Annual *herb*, prostrate to decumbent or erect, to 0.5 m high, usually with several angular branches arising from base. *Leaves* somewhat fleshy; *lamina* elliptical to deltoid, 1-3 cm long, entire to sinuate dentate, often 3-lobed, obtuse, broadly cuneate at base and passing into a petiole about half length of lamina, upper surface glabrous, lower surface densely mealy. *Inflorescence* axillary and terminal of compact glomerules arranged in narrow paniculate cymes. *Flowers* glabrous, dimorphic; *terminal flowers* mostly hermaphrodite, tepals 3-4(5), free narrowly obovate, stamens 1-4(5), stigmas subsessile, very short and thick, seed horizontal; *lateral flowers* female or hermaphrodite, tepals 3(4), stamens 0-1, seed erect. *Pericarp* thin, free or loosely attached to seed, somewhat green. *Seed* discoid, orbicular to oval, with rounded margin, c. 1 mm diameter; *testa* finely reticulate, smooth or minutely pitted, reddish brown to black; *embryo* circular.

NEW SOUTH WALES: Lake George, Apr. 1898, *E. Betche* (NSW); Front Beach, *L. A. S. Johnson* 8248 (NSW).

VICTORIA: Thurla, *A. C. Beauglehole* 56212 (MEL); Wingan Inlet. *N. G. Walsh* 35 (MEL).

TASMANIA: Boomer, Mar. 1943, *W. M. Curtis* (HO); Stewarts Bay, *J. H. Hemsley* 6735 (HO).

SOUTH AUSTRALIA: Encounter Bay, 23 May 1933, *J. B. Cleland* (AD); 25 km S of Naracoorte, *D. Hunt* 677 (AD).

WESTERN AUSTRALIA: Fitzgerald R., *A. S. George* 11274 (PERTH); Herdsman Lake, *K. F. Kenneally* 1107 (PERTH).

Distribution. Southern temperate Australia. Cosmopolitan. Map 1.

Habitat. Usually in muddy eutrophic situations both inland and coastal.

Chenopodium glaucum is a polymorphic species in which numerous infraspecific taxa have been described. The 'Australian' plant is by some authors distinguished from the European as a distinct species (*C. ambiguum*) and by others as subspecies or variety of *C. glaucum*. Within Australia many variants are found, some of which may be of very recent introduction while others could be indigenous. The typical variant of *C. ambiguum* has deltoid 3-lobed leaves which are sinuate-dentate on the margin whereas in the typical variant of *C. glaucum* the leaves are narrow-ovate to narrow-elliptic with sinuate margins; Aellen (1960-1961) noted differences in the flower morphology but this varies considerably between populations which have similar leaf types. I consider it to be unprofitable to attempt to distinguish by name any of the numerous variants found in Australia since to do so would require a world-wide familiarity with the species and a knowledge of the application of the many infraspecific names. Some of the variants found in Australia correspond closely to those found in Europe so that subsp. *glaucum* also occurs in Australia if subsp. *ambiguum* should be recognised as distinct. Most Australian collections appear to be of a prostrate plant from boggy, often subsaline, situations; in Europe variants also occur which have an erect habit.

Aellen (1960-1961) recognised *C. glaucum* subsp. *ambiguum* as being a native to Australia, New Zealand, and Easter Island, and as a recent introduction to Switzerland. The plant from Easter Island was earlier named *C. glaucum* var. *paschale* by Fuentes.

Another member of section *Chenopodium* (and the type of the genus) is *C. rubrum* L. This species was recorded from Victoria by Ewart (1931), however, the specimens* on which this record was based are *C. glaucum*; this error was pointed out by Willis (1973).

*Railway Reserve, N.Melbourne, May 1910, *C. French* and *J. A. Tovey* (MEL); Coode Island, 23 March 1912, *J. R. Tovey* (MEL).

Sectio **Degenia** Aellen, Magyar Bot. Lapok 25:56 (1927) n.v.; A. J. Scott, Bot. Jahrb. Syst. 100:216 (1978b). *Lectotype: Chenopodium macrospermum* J. D. Hook. (Scott op. cit.).

Annual *herbs,* sparsely mealy. *Flowers* slightly dimorphic in cymose clusters paniculately arranged. *Lateral flowers* bisexual or female, perianth connate to near apex, very shortly 3-lobed; *stamens* 0-3; *stigmas* short and thick; *pericarp* membranous, free; *seed* usually vertical enclosed by sac-like perianth; *embryo* annular. *Terminal flowers* bisexual and either similar to lateral flowers or perianth divided to near base into 5 tepals; *stamens* 5; *seed* horizontal.

Three species in America and Europe. One species (*C. macrospermum*) introduced into Australia.

2. **Chenopodium macrospermum** J. D. Hook., Fl. Antarct. 341 (1846); Aellen, Feddes Repert. 26:42 (1929). *Type citation*: 'Falkland Islands; Berkely Sound and St. Salvador Bay, near the sea; *C. Darwin* Esq., J. D. H.' *Type*: n.v.

Erect *annual* to 1 m high branched from base. *Leaves* alternate, somewhat fleshy; *lamina* rhombic or deltoid, c. 5 cm long, sinuate dentate, upper surface glabrous, lower surface mealy when young, *petiole* slender ± equal to lamina. *Inflorescence* of axillary sessile spike-like clusters forming terminal panicles. *Flowers* slightly dimorphic. *Lateral flowers*: perianth very shortly 3-lobed, urceolate, closely enclosing fruit, c. 1.5 mm high, slightly succulent, glabrous, the lobes obscurely keeled; *stamen* solitary; *stigmas* 2 very short and subsessile; *pericarp* thin, readily detached; *seed* erect, flattened obovoid c. 1.5 mm long, reddish brown, glossy, testa faintly reticulate. *Terminal flowers* either similar to lateral flowers but with perianth shortly 3-4 lobed, or with perianth deeply 3-5 lobed and with 3-5 stamens.

WESTERN AUSTRALIA: Perry Lakes, 7.5 km west of Perth, *K. F. Kenneally* 7189 (PERTH); Lake Waneragup, 18 April 1978, *B. K. Masters* (PERTH).

Distribution. Western Australia, from Perth south to Bunbury. Probably a native of North and South America and an adventive in Europe (Aellen 1929, Standley 1931). Map 16.

Habitat. Peat on margin of slightly brackish lakes.

Chenopodium macrospermum is a very variable species. Aellen (1929) described several infraspecific taxa, of these, the plant introduced into Western Australia corresponds most closely to *C. macrospermum* subsp. *halophilum* (Phil.) Aellen f. *subviride* Aellen. For a comprehensive synonymy see Aellen and Just (1943). *Chenopodium macrospermum* subsp. *halophilum* was recorded for Australia by Probst (1949 p. 63) but without the citation of collections. The earliest record known to me is the one cited above dated 1978.

Aellen (1960-1961) described the terminal flowers of the clusters as being deeply 3-5 lobed, having 3-5 stamens and horizontal to vertical seeds. In Western Australia the terminal flowers are usually 3 lobed, rarely 4 lobed and only very occasionally deeply 5 lobed, while the stamens are usually solitary (rarely 3) and the seed consistently vertical.

I am grateful to Pertti Uotila (H) for providing the identification of a Western Australian collection of this species.

Sectio **Leprophyllum** Dumort., Fl. Belg. 21 (1827); A. J. Scott, Bot. Jahrb. Syst. 100:217 (1978). *Type: C. album* L.

Chenopodium sect. *Chenopodiastrum* Moq. in DC., Prod. 13/2: 61 (1849) nom. illeg. (superfluous name). *Type: C. album* L.

Chenopodium sect. *Euchenopodium* Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2, 16c:487 (1934) nom. illeg. *Type: C. album* L.

[*Chenopodium* sect. *Chenopodium* auct. pl. non sensu lectotypico.]

Annual *herbs* somewhat mealy. *Flowers* in cymose clusters spicate or paniculate. *Flowers* hermaphrodite (and female), 5-merous; *tepals* united in lower half; *stamens* 5; *stigmas* 2-3. *Pericarp* membranous. *Seed* horizontal; *embryo* annular.

Numerous species mostly extra-Australian in origin, many of which are now cosmopolitan weeds. Seven species are found in Australia.

3. **Chenopodium album** L., Sp. Pl. 1:219 (1753). *Type*: From Europe. *Lectotype:* LINN 313.8, photo seen (see Brenan 1954 p.6).

C. lanceolatum R. Br., Prod. 407 (1810) nom. illeg. non Muehlenb. ex Willd. (1809).— *C. browneanum* Roem. et Schult., Syst. Veg. 6:275 (1820). *Type:* Banks of Paterson's River, Oct. 1804, *R. Brown* (holo: BM).

C. probstii Aellen in Probst, Mitt. Naturf. Ges. Solothurn 20 (8):56 (1928); Aellen, Verh. Nat. Ges. Basel 41:83 (1931). *Type:* Australia, N. Adelaide; Switzerland, Derendingen in wool compost. See comments below. *Syntype:* Ward St., N. Adelaide, 16 May 1923, *J. M. Black* (AD 97810510).

Erect *annual* c. 1 cm high, usually much-branched, mealy white especially on flowers and undersurface of leaves. *Stem* round to angular with green stripes. *Leaves* thin, the lower petiolate, ovate rhombic, cuneate at base and variously dentate, the upper narrowly ovate to lanceolate entire, more or less sessile, the longer ones c. 4-6 cm long. *Inflorescence* largely leafless of sessile flowers in cymose glomerules aggregated in a large paniculate, spicate, or indeterminate arrangement. *Flowers* hermaphrodite; *tepals* 5, united in lower half, broadly ovate, obtuse, membranous on margin, weakly keeled (terminal flowers larger and more strongly keeled), green and somewhat mealy. *Stamens* 5, glabrous, disc absent. *Pericarp* membranous, glabrous, readily detached. *Seed* horizontal, lenticular, c. 1.2 mm diam., bluntly keeled; *testa* black, glossy, smooth, striate or weakly and irregularly furrowed (reticulate in var. *reticulatum). Seed* shed within the surrounding perianth.

QUEENSLAND: Tamborine Mt., Apr. 1947, *M. S. Clemens* (BRI); Charleville, *M. M. Biddulph* 195 (BRI).

NEW SOUTH WALES: Cooma, 15 Mar. 1955, *E. Gauba* (CBG); Canberra, *N. T. Burbidge* 7484 (CANB).

VICTORIA: SE of Wallacedale, *A. C. Beauglehole* 30512 (MEL); 3 mi [4.8 km] east of Tawonga, *R. V. Smith* 64/67 (MEL).

TASMANIA: Flinders Is., *J. Whinray* 23 (MEL); Macquarie Plains, Mar. 1861, *W. M. Curtis* (HO).

SOUTH AUSTRALIA: 5 km south of Blyth, *A. E. Orchard* 364 (AD); Adelaide, *B. Copley* 1310 (AD).

WESTERN AUSTRALIA: Albany, *G. Perry* 259 (PERTH); Manjimup, *R. D. Royce* 1463 (PERTH).

NORTHERN TERRITORY: Harper Springs, 26 Jan. 1949, *W. G. Steenson* (NT).

Distribution. All Australian states and territories but rare in the tropics. Cosmopolitan. Map 2.

Habitat. Widespread as a weed in agricultural areas.

The name *C. album* has here been used in a broad sense and may encompass several segregate species recognised by some European workers, including *C. suecicum* J. Murr, *C. berlandieri* Moq. and *C. giganteum* D. Don. No attempt is made here to distinguish the numerous infraspecific taxa which have been described, since such an undertaking would require the attention of a specialist who is familiar with the complex from different parts of the world. This is beyond the scope of this paper.

A plant which is readily recognisable in fruit is *Chenopodium album* var. *reticulatum* (Aellen) Uotila (1978 p. 31). This variety may be distinguished by the reticulate testa; it occurs sporadically with the other variants across Australia.

The application of the name *C. probstii* is in doubt. The plant was originally assumed by Aellen (1928 op. cit.) to have originated in South Australia and to have been introduced into Europe as a contaminant of wool. Jorgensen (1973 p. 314), while accepting it is a distinct species, throws doubt on its Australian origin and suggests it comes from North America. It has never been listed in an American flora and, if present in America, is presumably there included under *C. album*. In a study of *C. album* and *C. suecicum* in northern Europe Uotila (1978) discusses *C. probstii* and suggests that its taxonomy will only be understood after a thorough study has been made of the biology of the species in the *C. album* complex of both North and Central America. A lectotype should only be chosen after such a study is undertaken.

Aellen (1960-1961) and Beaugé (1974) suggest a possible synonyomy of *C. probstii* with *Chenopodium serotinum* L. (which itself is considered to be a synonym of *C. album* by Beaugé). Kjellmark (1934) determined the chromosome number as 2n=54, i.e. as a hexaploid; it therefore corresponds to that of *C. album* and *C. opulifolium*, q.v.

4. **Chenopodium opulifolium** Schrader ex Koch et Ziz, Cat. Pl. Palat. 6 (1814); DC., Fl. Francaise 6:372 (1815).—*C. album* subsp. *opulifolium* (Koch et Ziz) Maire, Fl. de l'Afrique du Nord 8:36 (1962). *Type*: From Palatinate (Pfalz), Germany, *Schrader* (S photo seen), see nomenclatural note below.

?C. triangulare Forsskal, Fl. Aegypt. Arab. 205 (1775). *Type*: From 'Taaes'. Yemen, n.v.

Very similar to (and sometimes considered conspecific with) *C. album*. It differs from the latter species in having long-petiolate 3-lobed rhomboid leaves 2-3 cm long and wide, strongly mealy below, and in having keeled strongly mealy tepals.

SOUTH AUSTRALIA: About Mortlock Experimental Station, Mintaro, 5 March 1969, *D. E. Symon* 6699 (ADW, CANB).

Distribution. Southern South Australia. Central and southern Europe, north Africa.

Habitat. A weed of agriculture.

This species is rather variable in morphology and difficult to distinguish from *C. album*, another highly complex taxon. The only unequivocal record is the Symon specimen cited above although other collections included by me under *C. album* may belong to *C. opulifolium*. It was first recorded in Australia by J. M. Black (1912) who cited a specimen from Henley Beach, South Australia but this was later seen by P. Aellen (1927 in litt.) who considered it to be better placed under *C. album*. An additional character useful for distinguishing the two species has been pointed out by Beaugé (1974 p. 305); he notes that in the seed of *C. album* the micropyle has the form of a dimple (a scar) while in *C. opulifolium* it resembles a knob (i.e. it is convex). I have been unable to confirm this observation in material of *C. opulifolium* available to me.

Work by Cole (1961, 1962) and Wilson (1980) has shown that both *C. album* and *C. opulifolium* are hexaploids (2n=54) unlike most other weedy species of the section which are either diploids (2n=18) or tetraploids (2n=36). Battandier (1888-1890 p. 753) states that one can find all intermediates between the two species. It would therefore be reasonable to accept a subspecies status for *C. opulifolium* as was done by Maire (1962 op. cit.).

Nomenclature. In the publication by Koch and Ziz (1814 op. cit.) the name '*Chenopodium opulifolium*. Schrad in. lit.' appears, without a description but with a reference to '*Ch. album* Borkh. in Rhein Mag.' i.e. to M. B. Borkhausen (ed.), Rheinisches Magazin zur Erweiterung der Naturkunde vol. 1:115 (1793). Here there is a description of the form of *Chenopodium album* found in the valley of the Rhine. I have not attempted to lectotypify this species nor to confirm that the plant described by Borkhausen is the same as that to which Schrader gave the name *C. opulifolium* (although the description agrees). The name *C. opulifolium* was also validly published by Decandolle (1815 op. cit.) with reference to the publication by Koch et Ziz (1814), to '*C. viride* Loiseleur' (1806) and to '*C. erosum* Bastarde' (1814). Beaugé (1974) cites as type a Schrader collection from 'Palatinate'.

The name *Chenopodium triangulare* Forsskal (1775) was given by Beaugé (1974) as a probable synonym of *C. opulifolium*; it is based on a plant from Yemen and has generally been placed in synonymy under *C. murale* L. (e.g. by Christensen 1922). Beaugé points out that the latter synonymy could not be correct and that the only species found in Yemen to which the description applies is *C. opulifolium*. If this is so then *C. triangulare* is the correct name for this species. The type was not seen by Christensen and is not present in Copenhagen (herb. C); I have not attempted to search elsewhere.

5. **Chenopodium vulvaria** L., Sp. Pl. 220 (1753).—*C. olidum* Curtis, Fl. Londinensis fasc. 5, t. 20 (c. 1785). *Type*: From Europe, n.v.

Spreading *annual* c. 20 cm high branching from base with a strong fish-like smell (of trimethylamine). *Branches* soft, mealy with thin-walled vesicular hairs. *Leaves* alternate; *lamina* ovate to broadly ovate or trullate, 1-2 cm long, entire, apex acute, base cuneate, upper surface subglabrous, lower surface mealy, petiole slender c. half length of lamina. *Inflorescence* of dense clusters of flowers forming short compact axillary and terminal thyrses 1-2 cm long. *Flowers* hermaphrodite (terminal) and fe-

male (lateral); perianth subglobular c. 1 mm diameter, shortly 5 lobed, enlarging with and enveloping the fruit, densely mealy outside. *Stamens* 5, glabrous, united at base into a cup-shaped disc, completely absent in female flowers. *Pericarp* membranous, papillose, somwhat adherent. *Seed* horizontal, lenticular with obvious keel, c. 1-2 mm diameter; *testa* radially lineate.

NEW SOUTH WALES: Binnalong, Jan. 1922, *J. J. Parry* (NSW); Berridale, Nov. 1914, *D. J. O'Rouke* (NSW).

VICTORIA: Warrnambool, *H. B. Williamson* 1348 (MEL); Omeo, *R. V. Smith* 64/29 (MEL).

SOUTH AUSTRALIA: Bool Lagoon, *D. Hunt* 1938 (AD).

Distribution. Eastern New South Wales, Victoria, south-eastern South Australia. North Temperate areas. Map 16.

Habitat. Principally a weed of horticulture.

Chenopodium vulvaria may be recognised by its fish-like odour and by its shortly lobed perianth which encloses the fruit. Features which distinguish it from *C. detestans* are discussed under the latter species.

Chenopodium vulvaria was first recorded in Australia by Ewart (1908) who stated that it was "introduced with impure agricultural seed, and now widely spread"; the earliest dated collection I have seen from Australia is the one cited above made by O'Rourke in 1914.

6. **Chenopodium detestans** Kirk, Trans. and Proc. N. Zeal. Inst. 9:550 (1877); Murr, Allg. Bot. Zeitschrift 16:57 (1910); Allan, Fl. N. Zeal. 1:228 (1961). *Type citation*: "Originally discovered by Mr J. D. Enys, who informs me that he has seen it in several localities in Canterbury". *Lectotype*: Trelissick Basin, Canterbury, New Zealand, 4 Feb. 1876, *T. Kirk* 827 (holo: WELT; iso: WELT), (see Allan 1961).

Prostrate to ascending annual *herb* with foetid odour, numerous wiry branches to 15 cm long arising from base. *Leaves* alternate; *lamina* thin, trullate, 5-10 cm long, entire or with a pair of lateral teeth, sparsely to moderately mealy with round vesicular hairs. *Inflorescence* of short dense axillary thyrses up to 5 mm long. *Flowers* mostly hermaphrodite; *perianth* erect in young flower, becoming incurved and obscuring fruit; *tepals* (4)5, thin, broadly ovate with short broad claw, cucullate and fleshy at apex, united towards base, mealy outside. *Stamens* 1 or rarely 2, completely absent in female flowers, divaricate at anthesis, ± equal to tepals; *filament* linear glabrous; *disc* absent. *Pericarp* membranous, prominently papillose, somewhat adherent. *Seed* discoid to lenticular with rounded margin, c. 1.2 mm diam.; *testa* punctate, black.

NEW SOUTH WALES: Nimitybelle near Cooma, Dec. 1896, *J. H. Maiden* (NSW 143153).

Distribution. Near Cooma, New South Wales, probably introduced; South Island, New Zealand.

Habitat. In New Zealand "lowland to montane open tussock-grassland and bare places" fide Allan (1961).

Chenopodium detestans resembles *C. vulvaria* in having the foetid odour of rotting fish caused by the chemical trimethylamine which is presumably located in the oil glands that are plentiful in the leaves and in the cortex of the stems. Apart from the different habit and larger leaves of *C. vulvaria*, it differs from *C. detestans* in having almost completely united tepals, usually 5 stamens united into a disc at base, and an obvious keel to the seed.

The orginal description of *C. detestans* and that provided by Allan (1961) stated that the flowers have four stamens (a most unusual number) whereas in material I have examined from New Zealand and Australia (including the lectotype) the number in the hermaphrodite flowers has been one or rarely two.

Chenopodium detestans is presumably endemic to New Zealand (the solitary record from Australia, cited above, is probably an introduction), however, there is also the possibility that it is an early introduction to New Zealand from South America since it behaves as a weed and is quite distinct from other Australian or New Zealand endemic species. The absence of recent Australian collections suggests that it is not common in that country, although in the field it could have been overlooked or confused with *C. vulvaria*.

Neither Kirk (1877 op. cit.) nor Allan (1961 op. cit.) suggested the probable affinities of *C. detestans* and this was not mentioned by Aellen (1960-1961) or Scott (1978b) in their conspectuses of the genus. Murr (1910) placed it in sect. *Chenopodiastrum* (= sect. *Leprophyllum*), in which decision he was followed by Maiden and Betche (1916). Cheeseman (1925) and Ulbrich (1934) suggested an affinity to *C. vulvaria*, probably being influenced by the odour the two species have in common; the latter author placed it with *C. vulvaria* in sect. *Euchenopodium* (= sect. *Leprophyllum*). My studies suggest that *Chenopodium detestans* is most closely related to *C. carnosulum* Moq. (1849) and *C. scabricaule* Speg. (1902) both of which are indigenous to South America (*C. carnosulum* is also recorded from Mexico and Texas). In the broad sense the three taxa could reasonably be treated as being conspecific for they are very similar in vegetative and floral characters. Aellen and Just (1943) placed *C. scabricaule* in synonymy under *C. carnosulum*, however, Giusti (1970) and Planchuelo (1975) considered them to be distinct being distinguished in part by the free pericarp of the former species and adherent pericarp of the latter. *Chenopodium detestans* has an adherent pericarp and thus in this character is more similar to *C. carnosulum*; it differs from both *C. carnosulum* and *C. scabricaule* in having a foetid smell, a character which is noticeably lacking (according to available descriptions) from the two American species.

7. **Chenopodium murale** L., Sp. Pl. 1:219 (1753). *Type:* From Europe, n.v. Figure 4B.

C. biforme Nees, Pl. Preiss. 1:636 (1845).—*C. murale* var *biforme* (Nees) Moq. in DC., Prodr. 13/2:69 (1849). *Type*: 'In arenosis prope Pointwater, Perth', *Preiss* 1256 (iso: MEL).

C. congestum J. D. Hook., London J. Bot. 6:280 (1847).—*Rhagodia congesta* (J. D. Hook.) Moq. in DC., Prodr. 13/2:51 (1849).—*R. baccata* var. *congesta* (J. D. Hook.) J. D. Hook., Fl. Tasmaniae 312 (1857); A. J. Scott, Feddes Repert. 89:7 (1978).—*R. billardieri* var. *congesta* (J. D. Hook.) Benth., Fl. Austral. 5:153 (1870). *Type:* 'Hobart Town,' Oct. 1840, *Gunn* 868 (holo: K).

Erect branched *annual* to 1 m high, sparsely mealy with thin walled vesicular hairs, sometimes foetid when crushed. *Stem* angular. Lower and middle *leaves* petiolate, lamina thin, broadly triangular to ovate, 2-8 cm long, mealy when young, acute, broadly cuneate at base, coarsely and irregularly dentate with slightly incurved teeth. *Inflorescence* of compact cymes in rather open panicles, axillary and terminal. *Flowers* hermaphrodite (or female); *perianth* sparsely mealy outside (becoming glabrous with age); *tepals* 5, c. 1.5 mm long, united in lower third, broadly ovate, obtuse, prominently keeled and slightly cucullate at apex, membranous and minutely ciliate on margin. *Pericarp* prominently papillose, often brownish, persistent. *Seed* horizontal, lenticular, 1-1.5 mm diam., prominently keeled; *testa* glossy, minutely pitted; *embryo* circular. *Seed* shed with surrounding perianth.

QUEENSLAND: Brisbane, *A. Dietrich* 2307 (NSW); Rockhampton, *P. O'Shanesy* 210 (MEL).

NEW SOUTH WALES: Pimpara Ck., *S. Jacobs* 1089 (NSW); Lord Howe Is., *A. Rodd* 1453 (NSW).

VICTORIA: Port Phillip, Apr. 1886, *C. Walter* (NSW); Port Fairy, 1894, *H. B. Williamson* (MEL).

TASMANIA: Stanley, Feb. 1948, *W. M. Curtis* (HO); Hobart, *L. Rodway* 9398 (HO).

SOUTH AUSTRALIA: Innes Nat. Park, *C. R. Alcock* 4821 (ADW); Mt Serle HS., *D. E. Symon* 4025 (ADW).

WESTERN AUSTRALIA: Millstream, *M. I. H. Brooker* 2103 (PERTH); Port Denison, *R. A. Saffrey* 1557 (PERTH).

NORTHERN TERRITORY: Alice Springs, 27 Jan. 1976, *A. Mitchell* (NT); Woodgreen HS, *D. J. Nelson* 2131 (NT).

Distribution. Principally extratropical Australia. Cosmopolitan. Probably indigenous to the Mediterranean area and to southern and south-western Asia (Engstrand and Gustafsson 1973). Map 5.

Habitat. A weed of agriculture and of disturbed areas, also coastal sands.

Numerous infraspecific taxa have been described from Europe but no attempt has been made in this paper to relate these names to the plants found in Australia.

The name *Chenopodium congestum* (1847) was based on a collection found on the south coast of Tasmania in which no fruits were observed by the author. Moquin (1840), although he saw only the type collection, described the young fruit as being slightly fleshy for which reason he transferred the species (but with reservations) to *Rhagodia*. Later, J. D. Hooker (1857 op.cit.) while accepting it as a member of this genus made it a variety of *R. baccata* in which decision he was followed by Bentham (1870). Neither Rodway (1903) nor Curtis (1967) mention the taxon. Scott (1978a) retained it as a variety of *R. baccata* although his description of the taxon applies to *R. candolleana* s. str. and two of the four collections he cites belong to that species; the other two I have not seen. It is curious that no mention was made by Scott of the dentate leaves of the type which very obviously distinguish it from any species of *Rhagodia,* while the nature of the pericarp and testa conclusively identify it as being

C. murale. The young fruit of *C. murale,* when dry, has a leathery pericarp and it is probably for this reason that Moquin considered it would be somewhat fleshy when mature.

Chenopodium murale was presumably an early introduction to Australia. It may be readily recognised by the usually glabrous leaves with prominent antrorse teeth and by the morphology of the seed.

8. **Chenopodium erosum** R. Br., Prodr. 407 (1810); Moq., Chen. Mon. Enum. 33 (1840); Moq. in DC., Prodr. 13/2:68 (1849); J.D. Hook., Fl. Tasm. 1:313 (1857). *Type*: In collibus arenos: Insularum Kents Group in fretu Bass, Dec. 1804, *R. Brown* (holo: BM; iso: BM). Figure 4A.

[*C. murale* auct. non L.: Benth., Fl. Austral. 5:160 (1870) p.p. as to the R. Brown specimen cited.]

"*C.* sp. aff. *suecicum* J. Murr", Willis, Handb. Pl. Vict. 2:86 (1973).

Erect slender or bushy *annual* to 1.5 m high. *Stems* ribbed, with red stripes, glabrescent. *Leaves* papery; *lamina* triangular to ovate 3-15 cm long, 1.5-10 cm wide, acuminate, base somewhat truncate, margin deeply incised, undersurface pubescent with thin-walled bladder-hairs when young, becoming glabrous; *petiole* 1/3 to 1/2 length of lamina. *Inflorescence* of compact terminal and axillary paniculate cymes, becoming open with age. *Flowers* hermaphrodite and female, sessile; *tepals* 5, shortly united at base, obovate, c. 1 mm long, with broad scarious margins and a fleshy mid-rib, pubescent with thin-walled bladder-hairs when young, becoming glabrous; *stamens* 5, glabrous, filaments linear, disc absent; *ovary* glabrous. *Pericarp* membranous, dull, adherent to seed. *Seed* horizontal, lenticular with rounded margins, c. 1.5 mm diam.; *testa* black, glossy deeply muricate with radial striations. *Seed* eventually falling free from perianth.

QUEENSLAND: Gayndah, 13 May 1917, *C. T. White* (BRI); Upper Logan, *Anon.* 284 (MEL).

NEW SOUTH WALES: Moona, Walcha, *A. R. Crawford* 464 (MEL); Coneac, *Johnson* et *Briggs* (NSW 142705); Tinderry South Peak, *J. H. Willis* (MEL 80686).

VICTORIA: Bonang—Gelantipy Rd., *A. C. Beauglehole* 37698 (NSW); Gippsland, *F. Mueller* (MEL 80689); 3 mi [4.8 km] NE of Suggan Buggan, *J. H. Willis* (MEL 20120).

TASMANIA: Kent Group, Bass Strait, Dec. 1804 *R. Brown* (BM).

SOUTH AUSTRALIA: South-west River, Kangaroo Is., *J. B. Cleland* (AD); Ardrossan, *J. G. O. Tepper* 915 (AD).

Distribution. South-west Queensland to Bass Strait, southern South Australia; New Zealand. Map 6.

Habitat. River banks, forest lands, often in disturbed areas.

This species is one of two in the sect. *Leprophyllum* apparently native to Australia. Other members of the section which have been described from Australia are now considered conspecific with European species and, therefore, probably represent

relatively recent introductions to that country. *Chenopodium erosum* itself has the aspect of an introduced Eurasian species, however, I have been unable to match it with any extra-Australian plant.

Although *C. erosum* is found over a wide area it has been collected only infrequently, Robert Brown's collection of 1804 being the solitary one for Tasmania. In New Zealand it is also widespread but rare; all collections in that country were made this century (W. R. Sykes, CHR, pers. comm.).

9. **Chenopodium hubbardii** Aellen, Candollea 8:19 (1940); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:616 (1960). *Lectotype*: Mungallala, Queensland, 31 Dec. 1930, *C. E. Hubbard* and *C. W. Winders* 6022 (holo: K n.v.; iso: BRI) *lecto. nov.*

Erect annual *herb* branching from base, c. 30 cm high. *Branches* slender, striate, sparsely mealy when young. *Leaves* alternate; *lamina* thin, ovate to hastate with rounded apex and lobes, c. 10(30) mm long, entire, upper surface sparsely mealy, lower surface mealy grey due to the opaque discrete vesicular hairs; *petiole* slender from half as long to as long as lamina. *Inflorescence* a terminal slender panicle c. 2 cm long (lengthening to 10 cm in fruit); flowers in compact glomerules (which become separated with age) subtended by filiform bracts, the branches terminated by a solitary bisexual flower (the others female). *Flowers* depressed globular c. 1 mm diam.; *tepals* orbicular, sessile (or in fruit shortly clawed), densely mealy outside with grey vesicular hairs. *Bisexual flower*: *stamens* 5, filaments linear broadened at base and united into a thick disc; *ovary* glabrous; *style* very short (c. 0.1 mm); *stigmas* 2, spreading, 0.3 mm long. *Female flower: stamens* and *disc* absent; *ovary* as in bisexual flower. *Fruiting perianth* eventually black, depressed globular, hard, closely enveloping fruit; *tepals* rounded on back, orbicular very shortly clawed. *Pericarp* brown to black, finely papillose, adherent to testa. *Seed* lenticular, 1.5 mm diam. with rounded margin; *testa* finely and irregularly pitted. *Seed* shed with enveloping perianth.

QUEENSLAND: 70 mi [112.6 km] S of Blackall, *W. J. Bissett* E 233 (BRI); Morven, *S. T. Blake* 10911 (BRI).

Distribution. South-central Queensland. A casual in Switzerland where introduced in wool. Map 7.

Habitat. Usually recorded from heavy soils which become seasonally waterlogged.

Chenopodium hubbardii was considered by Aellen (1940 op.cit.) to be closely related to *C. polygonoides* and he later (1960-1961) included it in *Chenopodium* sect. *Polygonoidea.* The two species are similar in appearance and both have persistent pericarps and pitted testas but, whereas *C. polygonoides* has only a single stamen, *C. hubbardii* has five. For this reason I am treating the latter as a member of section *Leprophyllum* while *C. polygonoides* I am transferring to the genus *Einadia.* This formal separation at the generic rank obscures the probable close relationship between the two species but the alternative, that of transferring all the species of *Einadia* to *Chenopodium,* would cause considerable systematic confusion.

Sectio **Desertorum** Paul G. Wilson, sect. nov.

Herbae perennes vel suffructices, farinosi. *Flores* monoici; *perianthium* farinosum, 5-lobum. *Stamina* 5, discus patelliformis, sparse puberulus. *Fructus* baccatus vel

siccus; *pericarpium* glabrum, membranaceum vel succulentum, mesocarpio aquoso. *Semen* horizontale, lenticulare vel depresso sphaericum; *embryo* annularis.

Typus: Chenopodium desertorum (J. Black) J. Black.

Perennial *herbs* or weak *subshrubs* largely covered with a mealy indumentum of discrete globular vesicular hairs. *Flowers* monoecious, those terminal to the inflorescence and its branches male, the others female. *Perianth* 5 lobed, mealy outside with vesicular hairs. *Stamens* 5, united at base into a sparsely puberulous disc. *Fruit* baccate or dry; *pericarp* glabrous, free from seed, membranous to succulent with a watery mesocarp. *Seed* horizontal, lenticular to depressed spherical; *embryo* annular.

Three species endemic to Australia.

The species in this section have, in floras and herbaria, frequently been confused with each other, for they are similar in indumentum, leaf-shape, and in flower and fruit morphology. In habit they are intermediate between herbs and shrubs being either herbaceous perennials or weak shrubs with straggly branches. The fruits when succulent have a watery interior and, on drying, leave either an inflated or a thin wrinkled pericarp which is often sticky but lacks the viscous character of the mesocarp in *Rhagodia*. Because of their often shrubby nature and their often succulent or semi-succulent fruit, these species have sometimes either been placed in *Rhagodia* or confused with one of its species. In that genus they are obviously misplaced; their semi-woody habit, their monoecious flowers, and their watery fruits (when baccate) clearly set them apart, while their habit and fruit also make them out of place in the genus *Chenopodium*. To segregate this group of species at the generic level is undesirable due to the similarity between some variants of *C. desertorum* and such northern-hemisphere species of *Chenopodium* as *C. vulvaria*. I have therefore included them in that genus, a course which is least disturbing of current taxonomic practice. Within *Chenopodium* the species of section *Desertorum* have most in common with those of subsection *Lejosperma* Aellen et Iljin of section *Chenopodium* (correctly of sect. *Leprophyllum*) in which are included the species *C. album, C. opulifolium*, and *C. vulvaria*.

10. **Chenopodium desertorum** (J. Black) J. Black, Fl. S. Austral. 181 (1924) et in Trans. Roy. Soc. S. Austral 49:272 (1925).—*C. microphyllum* var. *desertorum* J. Black, Trans. Roy. Soc. S. Austral. 46:566 (1922). *Type citation*: 'Murray lands; Port Augusta westward to Ooldea'. *Lectotype*: Ooldea, Nov. 1921, *D. Bates* (holo: AD 97811131; iso: MEL 545186, NSW 143061) *lecto. nov.*

Rhagodia prostrata A. Cunn. ex Moq. in DC., Prod. 13/2:52 (1849) non *C. prostratum* (Pallas) Roemer et Schultes (1820). *Type citation*: 'In Nova-Hollandia (*Cunning.*!)'. *Lectotype*: N.E. from L.R. [i.e. Lachlan River], 5 Aug., *A. Cunningham* (K) *lecto. nov.*

C. microphyllum F. Muell., Trans. Phil. Inst. Vict. 2:74 (1858) nom. illeg. non Thunb. (1794).—*C. triandrum* var. *lanuginosum* F. E. Haviland, Proc. Linn. Soc. New South Wales 36:532 (1912) based on preceding.—*C. pseudomicrophyllum* Aellen, Candollea 8:8 (1939) based on *C. microphyllum* F. Muell. *Lectotype*: Bacchus Marsh, 1853, *F. Mueller* (lower left-hand specimen of MEL 80671) (MEL) *lecto. nov.*

C. anidiophyllum Aellen, Candollea 8:9 (1939). *Lectotype*: Dubbo, Feb. 1886, *E. Betche* (holo: G n.v.; iso: NSW 143105) *lecto. nov.*

C. cochlearifolium Aellen, Candollea 8:10 (1939). *Lectotype*: Lower Loddon R., Victoria, Nov. 1887, *C. Walter* (holo: G n.v.; iso: MEL 80675, NSW 142716) *lecto. nov.*

Annual or perennial *herbs* or *subshrubs*, prostrate to erect, branched from the base, covered at least when young with vesicular hairs or (inflorescence) with branched or simple tubular hairs. *Leaves* opposite or alternate, chartaceous to somewhat fleshy, subsessile or with slender petiole; *lamina* elliptic, deltate, hastate or orbicular, 5-20 mm long. *Inflorescence* a narrow to broad panicle, shorter than or much exceeding terminal leaves, flowers clustered in sessile (basically 3-flowered) cymes; terminal flower of inflorescence and of its principal branches male or bisexual, lateral flowers female. *Flowers* sessile, depressed-globular, 1-2 mm diameter; *tepals* 5, ovate, shortly united at base, thickened in centre, scarious along margins, densely vesicular hairy outside, spreading at anthesis. *Male flower:* stamens 5; filaments linear, united at base into a circular disc which is sparsely vesicular pubescent within; *pistillode* usually minute. *Female flower: staminodes* absent; *ovary* glabrous; *style* 0.2-0.5 mm long; *stigmas* slender. *Fruit* enveloped by perianth; *pericarp* membranous to slightly succulent and then separated from seed by a watery sap, sometimes sticky. *Seed* horizontal, lenticular with rounded margin, 1-1.5 mm diameter, *testa* almost smooth to slightly rugulose or striate, black.

Key to subspecies

1. Floral indumentum of glistening irregularly shaped vesicular hairs a. subsp. **desertorum**
   Floral indumentum of dull, grey to white vesicular hairs 2
2. Plant prostrate to decumbent; leaves small to 10 mm long; flowers small, c. 1 mm diameter in short inflorescences 3
   Plant erect; leaves 5-20 mm long, flowers 1-2 mm diameter; inflorescences usually exceeding terminal leaves 4
3. Leaves elliptic to orbicular, often glabrescent above; plant without a noticeable smell . . . . . b. subsp. **microphyllum**
   Leaves narrowly elliptic, mealy on both surfaces; plant with foetid odour d. subsp. **virosum**
4. Branches slender, straight and rigid; leaves small (to 10 mm long), orbicular to obovate, sparsely mealy; flowers small (c. 1 mm diam), sparsely to moderately covered with sessile vesicular hairs . . . . . e. subsp.**rectum**
   Branches straight or flexuose; leaves various, densely mealy (at least below); flowers with globular or branched often stipitate hairs . c. subsp. **anidiophyllum**

10a. subsp. **desertorum**

Erect, rounded, much-branched *herb* to 20 cm high. *Leaves* densely covered when young with colourless, glistening, transparent, branched vesicular hairs; *lamina* deltoid to orbicular, 3-8 mm long. *Inflorescence* congested or loose, narrowly pyramidal or slender, exceeding the terminal leaves and often up to 3 cm long. *Flowers* 1.5-2 mm diameter; *perianth* with a felty indumentum of glistening transparent irregularly shaped vesicular hairs. *Seed* c. 1.5 mm diameter.

NEW SOUTH WALES: 5 mi [8 km] W of Moulamein, *C. W. E. Moore* 3400 (CANB); 128 km E of Wilcannia, 14 May 1971, *G. J. White* (NSW).

VICTORIA: Annuello, *A. C. Beauglehole* 55816 (MEL); Wyperfeld Nat. Park, *A. C. Beauglehole* 29462 (MEL).

SOUTH AUSTRALIA: Tallaringa Well, *T. R. N. Lothian* 3836 (AD); 10 km W of Blanchetown, *D. J. E. Whibley* 3747 (AD).

WESTERN AUSTRALIA: Fitzgerald R. Nat. Park, *K. Newbey* 4142 (PERTH); Salmon Gums, *R. D. Royce* 3539 (PERTH).

NORTHERN TERRITORY: Ormiston Gorge area, *J. R. Maconochie* 2244 (CANB).

Distribution. Northern South Australia south-eastwards to central and western New South Wales and north-west Victoria; rare in southern Western Australia and the Northern Territory. Map 6.

Habitat. Recorded from deep sand but evidently also found in other well-drained soils.

The typical variant of this subspecies is a compact perennial with felty leaves and flowers. In western Victoria a variant is found with a looser habit and large leaves with a less dense indumentum; the hairs of this variant are of the same nature as those of the type.

10b. subsp. **microphyllum** Paul G. Wilson, nom. et stat. nov.—Basic name *C. microphyllum* F. Muell., Trans. Phil. Inst. Vict. 2:74 (1858) nom. illeg. non Thunb. (1794).—*C. triandrum* var. *lanuginosum* F. E. Haviland, Proc. Linn. Soc. New South Wales 36:532 (1912), based on preceding.—*C. pseudomicrophyllum* Aellen, Candollea 8:8 (1939), based on *C. microphyllum* F. Muell. *Lectotype*: Bacchus Marsh, 1853, *F. Mueller* (lower left-hand specimen of MEL 80671) (holo: MEL) *lecto. nov.*

Rhagodia prostrata A. Cunn. ex Moq., op. cit.

C. cochlearifolium Aellen, op.cit.

[*Rhagodia spinescens* auct. non. R. Br.: Benth., Fl. Austral. 5:155 (1870) p.p. as to A. Cunningham specimen cited.]

[*C. triandrum* auct. non. G. Forster: Murr, Allg. Bot. Zeitschr. 16:56 (1910); Maiden et Betche, Census N.S. Wales Pl. 66 (1916).]

Intricately branched prostrate to decumbent *perennial* with prominent taproot; not noticeably foetid. *Leaves* thin to slightly fleshy, elliptic to orbicular, shortly petiolate, 5-10 mm long, undersurface covered with small simple rounded white vesicular hairs, upper surface glabrescent. *Inflorescence* short, scarcely exceeding the terminal leaves. *Flowers* c. 1 mm diameter; *perianth* covered with small round white vesicular hairs. *Seed* c. 1 mm diameter.

NEW SOUTH WALES: 15 mi [24.1 km] W of Rankin Springs, *J. De Nardi* 945 (NSW); 12 mi [19.3 km] S of Mt. Hope, *C. W. E. Moore* 5945 (CANB).

VICTORIA: Nhill, *G. D'Alton* 26 (MEL); 15 mi [24.1 km] W of Shepparton, *T. B. Muir* 2547 (MEL).

SOUTH AUSTRALIA: 5 km W of Mannum, *D. G. Spooner* 2737 (AD); Hincks Nat. Park, *D. E. Symon* 6495 (ADW).

WESTERN AUSTRALIA: Lake Wagin, 1890, *M. Cronin* (MEL); 2 mi [3.2 km] NW of Ongerup, *K. Newbey* 3632 (PERTH).

Distribution. Principally in south-eastern Australia from Eyre Peninsula eastwards; also in south-west Western Australia. Map 8.

Habitat. Usually in heavy soil; often in woodland.

This subspecies is variable both in habit and leaf shape and I have been unable to clearly separate the variants of which it is composed. The white spherical vesicular hairs combined with the small relatively thin leaves and prostrate to decumbent habit distinguish subsp. *microphyllum* from the other subspecies.

Typification. The lectotype of *Rhagodia prostrata* is a specimen in herb. K bearing that name in Moquin's handwriting; a fragment in herb. P (mounted with the holotype specimen of *R. drummondii* Moq.) is presumably an isolectotype.

The name *R. prostrata* was included by Bentham (1870) and Scott (1978a) as a synonym of *R. spinescens* R. Br., an obvious misplacement since it is certainly a synonym of *C. microphyllum* F. Muell. Although the name *R. prostrata* Moq. (1849) is earlier than *C. desertorum* (J. Black) J. Black, it cannot be transferred at the rank of species to the genus *Chenopodium* since there exists the validly published name *C. prostratum* (Pall.) Roemer et Schultes (1820).

The varietal combination *Chenopodium triandrum* var. *lanuginosum* was evidently published inadvertently by F. E. Haviland in 1912 as a new name based on *C. microphyllum* F. Muell. It would appear that Haviland obtained the name from the herbarium of the Botanic Gardens, Sydney, which had received it from J. Murr as the manuscript name "forma *lanuginosa*" for a collection made by E. Betche in February 1886 in Dubbo (NSW 143105) and a collection from the Wimmera in Victoria (NSW 143082). The duplicates of these collections in herb. PAE (now in herb. G) were later cited by Aellen (1939) as syntypes of *C. anidiophyllum.* The name *C. triandrum* G. Forster was considered by Murr (1910) to be correct for the taxa here included under *C. desertorum*; however, the former species belongs to the genus *Einadia* although it bears strong superficial resemblances to members of the *C. desertorum* complex. Haviland (and others) applied the name *C. triandrum* var. *lanuginosum* to collections of *C. desertorum* subsp. *anidiophyllum.*

10c. subsp. **anidiophyllum** (Aellen) Paul G. Wilson, stat. nov.—*C. anidiophyllum* Aellen, Candollea 8:9 (1939). *Lectotype*: Coolabah, March 1907, *J. H. Maiden* (G ex herb. P. Aellen) *lecto. nov.*

[Rhagodia parabolica auct. non R.Br.: Benth., Fl. Austral. 5:153 (1870) p.p. as to *Dalton* specimen cited.]

Erect perennial herb or weak *subshrub* c. 20 cm high with slender branches. *Leaves* thin; *lamina* ovate to broadly elliptic, deltoid or subreniform, 10-20 mm long, mealy below with round vesicular hairs, glabrescent above (in typical variant); *petiole* slender, 5-20 mm long. *Inflorescence* more or less equal to terminal leaves (typical variant) to well exceeding them. *Perianth* c. 1.5 mm diameter covered with simple or branched white vesicular hairs. *Pericarp* thin and close fitting or loose and somewhat succulent when fresh (wrinkled and orange when dry). *Seed* c. 1.5 mm diameter.

QUEENSLAND: Tambo, *S. L. Everist* 1455 (BRI); Enniskillen, *C. T. White* 11674 (BRI).

NEW SOUTH WALES: Condobolin, *G. M. Cunningham* 255 (NSW); Dubbo, Feb. 1886, *E. Betche* (NSW 143105, syntype).

SOUTH AUSTRALIA: Tinga Tingana, Strezelecki Creek, *D. E. Symon* 5845 (ADW).

NORTHERN TERRITORY: 24 mi [38.6 km] S of Alice Springs, *D. J. Nelson* 666 (CANB).

Distribution. The typical variant is found in north-central New South Wales and south-central Queensland; the "central Australian" variant is found in western New South Wales, northern South Australia and the southern portion of the Northern Territory. Map 9.

Habitat. Varies according to variant involved.

In the eastern limit of its distribution (near Dubbo) this subspecies is a weak perennial with small ovate leaves (lamina to 10 mm long) and a thin close indumentum on the flowers; towards the west the leaves increase in size (lamina to 15 mm long) and become more orbicular, the plant is more erect, and the indumentum becomes denser and thicker. There appear to be a number of local variants within the general transitional cline and, in addition, plants may be found intermediate in character between subsp. *anidiophyllum*, subsp. *microphyllum*, and subsp. *desertorum*, particularly in the areas of overlap of these subspecies.

In southern Queensland subsp. *anidiophyllum* frequently has a strong smell of stale fish (as is also found in subsp. *virosum*) but this is not always the case as has been noted by collectors. Several collectors also note that the plants are very palatable to stock. The distribution map for subsp. *anidiophyllum* indicates a marked disjunction between the central Australian and the eastern populations which is not reflected in the morphology of the plants from the two areas; specimens collected from north-eastern South Australia and north-western New South Wales are virtually identical to those from the "Centre", that is, they have an erect habit with straight branches, and relatively large leaves and flowers, these have a thick vesicular indumentum. Further east the plants become more straggly with thinner and smaller leaves and flowers. The "central" Australian variant appears to be usually found on deep sand while the "eastern" variant is generally found on clays or loamy soils.

I have included under subspecies *anidiophyllum* the central Australian plant which has thicker and usually larger leaves than that found in central New South Wales from where the type comes. Also included is a variant found in the northern Flinders Range with rather thick reniform leaves. Although these and other regional variants have features which give them a distinctive appearance there is intergradation and there is considerable morphological variation. An additional reason for not splitting up this complex further is the difficulty of expressing the subtle differences in a manner which can be interpreted by others.

Some specimens have a habit and leaf shape intermediate between subsp. *anidiophyllum* and *Chenopodium curvispicatum*, they also have a faint reticulate ornamentation of the testa. It seems likely that these plants are the result of introgressive hybridization between the two taxa, particularly since they are found in areas where the putative parents also occur, that is in western New South Wales and in the Flinders Range.

Some of the specimens referred to subsp. *anidiophyllum* are possibly intermediates between the subspecies *desertorum* and *microphyllum* but this cannot be recognised easily without field experience.

Typification. Paul Aellen cited three syntypes with his description of *Chenopodium anidiophyllum,* these were as follows:

"Victoria: Wimmera; no date and collector; sent by F. v. Mueller as *C. microphyllum* F.v.M. (Herb. Murr). New South Wales: Dubbo, 1886, *E. Betche* (Herb. Murr); Coolabah, 1904, *J. H. Maiden* (Herb. Murr)." The specimens were in a collection of chenopods sent in about 1909 to Josef Murr in Feldkirch, Austria by J. H. Maiden, Director of the Royal Botanic Gardens, Sydney. They were identified by Murr as *Chenopodium triandrum* Forst. f. (see Murr 1910). I have selected as lectotype the Coolabah collection since it is the only syntype present in Paul Aellen's herbarium (now in herb. G). It is also an excellent representative of the plant generally referred in herbaria to *C. anidiophyllum.* The Dubbo syntype cited above belongs to this taxon but the syntype from Wimmera (NSW 143105) has greater affinity to subsp. *microphyllum.*

Bentham (1870) included collections of this subspecies in *Rhagodia parabolica* (which it somewhat resembles in leaf-shape) while Scott (1978a) cited collections of subsp. *anidiophyllum* under both *Rhagodia gaudichaudiana* (= *Chenopodium gaudichaudianum*) and *R. deltophylla* (= *R. spinescens*). While fragments of vegetative material of subsp. *anidiophyllum* and of the other species can be similar in appearance, the flowers are very distinct; when in fruit, the subspecies cannot be confused.

10d. subsp. **virosum** Paul G. Wilson, subsp. nov.

Herba perennis effusa foetida. *Lamina* folii ovata vel elliptica c. 10 mm longa, chartacea, acute vel obtusa, ad basim anguste cuneata. *Inflorescentia* anguste pyramidalis, congesta; *flores* depresso globosi c. 1.5 mm diam.

Typus: 15 mi [24.1 km] N of Deniliquin, New South Wales, Oct. 1965, *W. E. Mulham* S393a (holo: NSW).

Spreading prostrate to decumbent, perennial *herb* with numerous branches arising from stock, smelling strongly of rotten fish (trimethylamine) when crushed. *Root* a woody taproot. *Branches* slender closely mealy. *Leaves* opposite or alternate, closely covered with grey vesicular hairs; *lamina* (ovate to) narrow-elliptic, c. 10 mm long, chartaceous, apex acute to obtuse, base narrowly cuneate and passing into the short petiole. *Inflorescence* a dense narrowly pyramidal terminal panicle not exceeding leaves, composed of few-flowered clusters subtended by linear bracts c. 2 mm long. *Flowers* sessile, depressed, c. 1.5 mm diam.; *tepals* oblong, obtuse, incurved, rounded on back and cucullate at apex, densely vesicular pubescent outside, somewhat enlarged in fruit. *Terminal flower* of inflorescence and of lateral clusters male or bisexual; *filaments* glabrous passing at base into a thick circular disc sparsely vesicular pubescent or glabrous. *Lateral flowers* female; *staminodes* and *disc* absent. *Fruit* enveloped by the incurved tepals; *pericarp* membranous or slightly succulent, smooth, readily detached. *Seed* c. 1.5 mm diam., *testa* radially striate.

NEW SOUTH WALES: Morundah—Urana, *C. W. E. Moore* 1372 (CANB); 15 mi [24.1 km] N of Deniliquin, *W. E. Mulham* S 393 (NSW); Wunnamurra, June 1920, *J. Sloane* (NSW).

VICTORIA: Daylesford (?), 1878, *R. Wallace* 182 (MEL).

Distribution. South central New South Wales, possibly also in central Victoria. Map 9.

Habitat. Clay soil.

The arrangement and morphology of the flowers of subsp. *virosum* are the same as those found in the other subspecies of *C. desertorum* and it is with this species that the plant's affinities obviously lie. The subsp. *virosum* is rather similar to subsp. *microphyllum* in leaf shape although readily distinguished by its smell. This smell of trimethylamine is also present in *C. vulvaria* and *C. detestans*; subsp. *virosum* may be distinguished from *C. vulvaria* by the differently shaped leaves and perennial habit and from *C. detestans* by the flowers which in that species have only one or two stamens.

The single herbarium record of subsp. *virosum* from Victoria is accompanied by a label in which the locality 'Daylesford' has been queried; until further collections become available its occurrence in that State must remain in doubt.

The epithet '*virosum*' is taken from the latin word *virosus* meaning foetid.

10e. subsp. **rectum** Paul G. Wilson, subsp. nov.

Herba perennis erecta ad 40 cm alta cinereo-virida. *Rami* recti, divaricati, tenues. *Lamina* folii late elliptica ad late obovata vel orbicularis, 5-10 mm longa, ad apicem rotundata vel truncata. *Inflorescentia* tenuis; *flores* c. 1 mm diam.

Typus: Porcupine Hill, Musgrave Range, South Australia, 29 Oct. 1966, *J. Z. Weber* 180 (holo: AD; iso: PERTH).

Erect grey-green perennial *herb* or *subshrub* to 40 cm high. *Branches* straight, divaricate, slender, sparsely covered when young with small discrete rounded vesicular hairs. *Leaves* alternate; *lamina* broadly elliptic to broadly obovate or orbicular, 5-10 mm long, when dry often leathery and bordered in red, apex rounded to truncate, lower surface sparsely to moderately covered with small sessile vesicular hairs, glabrescent above; *petiole* slender, half length of lamina. *Inflorescence* slender, equal to terminal leaves; *perianth* c. 1 mm diameter, sparsely to moderately covered with small grey round vesicular hairs. *Fruit* with membranous to slightly succulent pericarp. *Seed* 1 mm diameter; *testa* smooth.

NEW SOUTH WALES: 13 mi [20.9 km] SE of Mt Hope, *C. R. Dunlop* 1538 (CBG); 45 mi [72.4 km] NW of Balranald, *W. E. Mulham* W372 (NSW).

VICTORIA: Hattah Lakes Nat. Park, 20 Feb. 1969, *G. Anderson* (MEL); Nandaly, *H. B. Watts* 376 (NSW).

SOUTH AUSTRALIA: 5 km S of Maralinga, *B. Copley* 2698 (AD); Hambidge Nat. Park, *T. R. N. Lothian* 4270 (AD).

WESTERN AUSTRALIA: 15 mi [24.1 km] E of Zanthus, *R. D. Royce* 5577 (PERTH).

NORTHERN TERRITORY: Petermann Reserve, *T. S. Henshall* 764 (NT); Finke River, *Schwartz* and *Schultz* 14 (MEL).

Distribution. Western New South Wales and north-western Victoria to Eyre Peninsula, the North West Plains of South Australia and the southern portion of Northern Territory; also recorded from Zanthus in Western Australia. Map 8.

Habitat. Deep sand.

The subspecies *rectum* is distinctive in its erect habit and slender straight branches. The leaves are usually more leathery when dry than in the other subspecies and are often bordered by a reddish tinge.

In spite of the wide and disjunct distribution of subsp. *rectum* the plant is rather uniform in habit and in flower size and morphology. At Maralinga in South Australia where it has been collected by T. R. N. Lothian (No. 4022, AD), a plant intermediate in indumentum between subsp. *rectum* and a *Rhagodia* species has also been found. This plant has a more shrubby habit than subsp. *rectum* and has sterile or partially sterile male flowers with a woolly disc; it appears likely that this plant (T.R.N. Lothian 4023, AD) is a hybrid between subsp. *rectum* and a species of *Rhagodia*. Also from Maralinga has been gathered a specimen (F. L. Hill 748, AD) which is intermediate in appearance between subsp. *rectum* and subsp. *desertorum* (a plant also found in this area). This 'intermediate' specimen is probably a hybrid between the two subspecies.

The infraspecific epithet is taken from the Latin word *rectus*, straight, referring to the straight spikes.

11. **Chenopodium curvispicatum** Paul G. Wilson, sp. nov. Figure 4D.

[*R. spinescens* R.Br. var. *deltophylla* F. Muell., Rep. Pl. Babbage's Exped. 19 (1859) p.p. not as to lectotype. (See note below).]

Suffrutex debilis, dense farinaceus. *Folia* plerumque opposita; *lamina* deltoidea vel hastata, obtusa, 1-1.5 cm longa et lata, dense farinacea. *Inflorescentia* paniculata, cernua, 2-5 cm longa. *Flores* globosi, extus dense farinacei, c. 2 mm diam.; *perianthium* 5-partitum in fructu divaricatum, 5 mm diam. *Flores* terminales masculini; *stamina* 5, glabra; discus patelliformis, sparse vesiculoso-pilosus; *pistillodium* minutum. *Flores* laterales feminei, staminodia et discus absens, ovarium glabrum. *Fructus* baccatus; *pericarpium* succulentum. *Semen* horizontale, lenticulare, margine rotundato; *testa* prominente reticulata, nigra.

Typus: South Australia, 3 km E of Sanderston; growing on red-brown calcareous loam; straggling subshrub c. 70 cm high; fruit red; 30 Mar. 1959, *R. Schodde* 1082 (holo: AD; iso: CANB, duplicates distributed to CAL, K).

Weak intricately branched spreading *shrub* c. 0.5-1 m high. *Branches* slender (the ends frequently nutant), densely mealy when young with vesicular hairs. *Leaves* opposite or sub-opposite; *lamina* deltoid to hastate with obtuse to rounded angles, 1-1.5 cm long and wide; densely covered with an indumentum of white rounded vesicular hairs; *petiole* slender, somewhat shorter than lamina. *Flowers* polygamo-monoecious, sessile or shortly pedicellate in drooping pyramidal panicles 2-5 cm long; *bracts* linear, caducous. *Male* (or *bisexual) flowers* terminal to inflorescence and to its branches; *perianth* 5-partite, globular, c. 2 mm diameter, densely covered outside with white stipitate vesicular hairs, glabrous within; *staminal filaments* linear-terete, united into a broad saucer-shaped disc which is sparsely vesicular hairy within; *pistillode* globular, usually minute but sometimes equal to a normal ovary and fertile,

with stigmas subulate, erect and usually minute. *Female flowers* found below male; *perianth* similar to that of male flower, enveloping fruit until fully mature when it hardens and opens out to 5 mm diameter, often becoming red above; *staminodes* absent; *ovary* globular, glabrous, style short with a pair of slender papillose stigmas. *Fruit* a berry; *pericarp* succulent, filled with sap within, red (orange on drying). *Seed* lenticular with rounded margin, c. 1.5 mm diameter; *testa* prominently reticulate with a honeycomb matrix, black.

NEW SOUTH WALES: Balranald, 7 July 1971, *G. M. Alchin* (NSW); 30 mi [48.3 km] W of Euston, *T. R. Whaite* 1838 (NSW).

VICTORIA: Hattah Lakes Nat. Park, 23 March 1969, *G. Anderson* (MEL); Raak Salt Plain, *A. C. Beauglehole* 16089 (MEL).

SOUTH AUSTRALIA: 38 km N of Morgan, *N. N. Donner* 311 (AD); 22 km SW of Renmark, *Hj. Eichler* 13742 (AD).

WESTERN AUSTRALIA: 20 km W of Naretha, *D. W. Goodall* 822 (PERTH); 8 mi [12.9 km] S of Norseman, *L. A. S. Johnson* W182 (NSW).

Distribution. Southern Australia from south western New South Wales and north western Victoria westwards to south eastern Western Australia. Map 10.

Habitat. Evidently in well-drained soils often associated with limestone.

This species has been confused in herbaria and literature with several other species, principally *Chenopodium gaudichaudianum, C. desertorum*, and *Rhagodia spinescens*. Mueller (1859) included specimens of *C. curvispicatum* (along with those of *R. spinescens*) when he described *R. spinescens* var. *deltophylla* (cf. collection "Desert of the Murray River", Feb. 1847, F. Mueller, MEL 87962, a syntype of that variety); Bentham (1870) cited the Mueller collection and at least three other specimens of *C. curvispicatum* under *R. spinescens*; J. M. Black (1948) included characters pertaining to *C. curvispicatum* under both *R. spinescens* var. *deltophylla* and *C. desertorum* (as is also evident from his herbarium); while Scott (1978a) cited collections here referred to *C. curvispicatum* under both *R. gaudichaudiana* and *R. deltophylla*.

Chenopodium desertorum may be readily distinguished from *C. curvispicatum* by its smooth seed; it is also a small plant whereas *C. curvispicatum* is a straggly shrub. *Rhagodia spinescens* is a dioecious shrub with stiff straight compact inflorescences, it has a small perianth which never encloses the fruit and the berry is viscous when dry. *Chenopodium gaudichaudianum,* while similar to *C. curvispicatum* in habit, has a broader more branched inflorescence; it differs most obviously in the stigma which is markedly penicillate.

The specific epithet *curvispicatum* refers to the drooping spike-like panicles which are typical of this species.

12. **Chenopodium gaudichaudianum** (Moq.) Paul G. Wilson, comb. nov.—*Rhagodia gaudichaudiana* Moq., Chenop. Enum. 11 (1840). *Type*: Baie des Chiens marins, *Gaudichaud* (holo: P n.v.; iso: BM). Figure 7F.

R. coralliocarpa S. Moore, J. Bot. 35:168 (1897). *Type*: Kilkenny Soak, June 1895, *S. Moore* (holo: BM).

Intricately branched scrambling *shrub* to 2 m high. Branchlets, leaves and inflorescence densely mealy with discrete cream-coloured vesicular hairs. *Leaves* alternate, chartaceous (when dry), deltoid to narrow hastate with slender petiole 3-5 mm long, in all 10-20 mm long. *Inflorescence* a pyramidal panicle 5-10 cm long with disjunct clusters of flowers, the main axis and branches flexuose. *Flowers* polygamo-monoecious, subsessile, those terminating the inflorescence or its branches male (with small pistillode) or bisexual, the others female. *Perianth* 5-partite, depressed globular c. 1.5 mm diam. at anthesis and 3.5 mm in fruit, eventually spreading and c. 7 mm diameter, persistent, densely covered outside with vesicular hairs. *Bisexual flowers*: *stamens* 5, filaments linear-terete, united into a broad saucer-shaped disc which is glabrous or vesicular puberulous; *ovary* depressed globular, style slender 0.5 mm long with a pair of delicate strongly penicillate stigmas c. 0.6 mm long. *Female flowers* without staminodes. *Fruit* a berry, at first enveloped by perianth but which eventually becomes spreading; *pericarp* pale and membranous or orange to red and succulent with sap filled interior (not viscous), eventually falling from perianth. *Seed* lenticular c. 1.4 mm diameter with rounded margin; *testa* deeply reticulate with a rough surface, dark reddish brown.

SOUTH AUSTRALIA: Yudnapinna HS., *N. N. Donner* 3205 (AD); Tarcoola, *E. H. Ising* 1408 (AD); Maralinga, 21 Sept. 1960, H. Turner (AD).

WESTERN AUSTRALIA: Roebourne, Aug. 1884, *F. S. Carey* (MEL); Narrine, Sept. 1903, *W. v. Fitzgerald* (NSW); 23 mi [37 km] S of Learmonth, *A. S. George* 1258 (PERTH); Miss Gibson Hill, SW of Warburton, *A. S. George* 4043 (PERTH).

Distribution. Karratha to Geraldton in Western Australia, south-east to the northern edge of the Nullarbor Plain, eastwards to northern Eyre Peninsula. Map 1.

Habitat. Sand, clay or loam, often in slightly saline situations.

This species was recorded by Bentham (1870) and by Maiden (1916) as occurring in New South Wales but the collections on which these records were based are of other species, principally *C. curvispicatum*. Scott (1978a) recorded it from central and eastern South Australia and from New South Wales, but the relevant collections are either *C. desertorum* or *C. curvispicatum*. The strongly penicillate stigmas of *C. gaudichaudianum* clearly distinguish it from all other species of *Chenopodium* and all species of *Rhagodia*, while its scrambling habit with flexuose branches make it readily recognisable in the field. It is uniform in habit and morphology throughout its range and does not appear to hybridize with other species.

The male flowers of *Chenopodium gaudichaudianum* have a widely spreading perianth at anthesis but this subsequently closes, while in female flowers the perianth remains closed during anthesis, with only the stigmas protruding, then opens widely under the mature fruit.

Sectio **Auricoma** Aellen, Feddes Repert. 69:69 (1964); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:577 (1960) nom. illeg. (without latin diagnosis). *Type: C auricomum* Lindl.

Herbs or soft-wooded *shrubs*, mealy with vesicular hairs and (at least in the inflorescence) villous with tubular hairs. *Leaves* chartaceous. *Flowers* in compact glomerules forming dense cylindrical spikes paniculately arranged, bisexual or female by abortion of stamens; *tepals* 5, united at first in lower half; *stamens* 5, fila-

ments linear, disc absent; *ovary* glabrous, styles very short, stigmas 2 and slender. *Pericarp* papery. *Seed* horizontal (rarely oblique or erect), lenticular; *embryo* annular.

Two species endemic to Australia.

This section is very similar to sect. *Leprophyllum* particularly with the addition to sect. *Auricoma* of *C. auricomiforme* which forms a connecting link between them, as has been noted by Murr et Thellung (1915). It differs from sect. *Leprophyllum* principally in the presence of tubular hairs in the inflorescence.

13. **Chenopodium auricomiforme** Murr et Thellung, Viertiljahrsschr. Naturf. Ges. Zurich 60:432 (1915); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:615 (1960). *Type*: 'Kammgarnfabrik Derendingen bei Solothurn, auf Kompost von australischer Schafvolde', 1915, *R. Probst* (holo: G). Figure 4c.

[*C. album* auct. non L.: Benth., Fl Austral. 5:160 (1870) p.p. as to Barton specimen cited.]

Erect annual *herb* to 1 m high. *Stem* and *branches* rather thick, striped green and yellow, sparsely mealy when young. *Leaves* chartaceous; *lamina* 3-nerved, narrowly ovate to ovate, rarely hastate (upper ones lanceolate), entire or sparsely and coarsely toothed, 2-10 cm long, weakly cuspidate, glabrescent above, mealy below when young. *Inflorescence* a terminal panicle with slender densely flowered branches made up of compact glomerules subtended by filiform bracts, axis villous with tubular hairs. *Flowers* bisexual (or female by abortion of stamens), sessile or subsessile, spherical, c. 1 mm diam.; *perianth* almost glabrous (a few vesicular and tubular hairs), (4)5-lobed to middle or lower (often initially syntepalous becoming choritepalous with age), lobes (or tepals) imbricate, broadly elliptic to almost circular, sometimes abruptly constricted at base into a short claw, yellow-green with fleshy keel and scarious margins, ciliate; *stamens* 5; filaments linear, glabrous; *disc* absent. *Ovary* glabrous; *style* very short; *stigmas* 2, slender. *Fruit* free from perianth; *pericarp* membranous, papillate, pale brown, adherent. *Seed* horizontal, lenticular, c. 1 mm diameter, rounded on margin; *testa* minutely puncticulate.

QUEENSLAND: Minerva, *S. T. Blake* 7927 (BRI); Pittsworth, *C. T. White* 6659 (BRI).

NEW SOUTH WALES: Bow via Merriwa, July 1923, *H. Sturt* (NSW); Premer, June 1912, *H. McMaster* (NSW).

SWITZERLAND: Derendingen, 12 Aug. 1927, *P. Aellen* (NSW).

Distribution. South-eastern Queensland and north-eastern New South Wales; a casual in Europe. Map 11.

Habitat. Black soil plains and heavy loams, often in low-lying situations.

This species was first recognised by Murr and Thellung who discovered it in Switzerland as an introduction with wool from Australia. Aellen (1960-1961) considered *C. auricomiforme* to be also a native of New Zealand but it is not recorded by Allan (1940 and 1961) as either native or introduced in that country nor is it present in the D.S.I.R. herbarium in Christchurch, N.Z. (CHR). Murr and Thellung (1915) considered it to be intermediate in morphology between *C. album* and *C. auricomum* and subsequently Murr (1926) suggested it might be a hybrid between these species.

Both species were confused with *C. auricomiforme* by previous authors for Bentham (1870) cited specimens under *C. album* and F. Mueller (1869 p. 11) under *C. auricomum.* The earliest record is a pre 1848 collection by L. Leichhardt from Liverpool Plains (MEL 88487). *Chenopodium auricomiforme* is clearly a distinct species and shows very little variability throughout its range.

Chenopodium auricomiforme was placed by Aellen (1960) in section *Polygonoidea* along with *C. trigonon, C. stellulatum, C. polygonoides,* and *C. hubbardii.* However, it differs greatly from the first three species both in habit and in number of stamens. It compares most closely to *C. auricomum*, particularly in hair and perianth characters, and I have therefore transferred it to sect. *Auricoma.*

14. **Chenopodium auricomum** Lindley in Mitchell, J. Exped. Int. Trop. Austral. 94 (1848); Moq. in DC., Prod. 13/2:460 (1849); Benth., Fl. Austral. 5:159 (1870); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:616 (1960). *Type*: Collected along the Narran R., 14 March 1846, *T. L. Mitchell* (holo: CGE n.v.; ?iso: MEL, NSW).

?C. auricomum f. *subglabrum* Aellen in Probst, Mitt. Naturf. Ges. Soloth. 20 (8):56 (1928); Aellen in Hegi, l.c. *Type:* Derendingen, Switzerland, n.v.

Soft-wooded bluish grey *shrub* to 2 m high. *Branches* slender, costate, thinly mealy. *Leaves* alternate, oblong-elliptic to hastate, 2-4(6) cm long including a slender petiole c. 1 cm, entire, chartaceous, apex and basal lobes rounded, upper surface glabrescent, lower surface with a thin mealy indumentum of grey or very pale yellow discrete globular vesicles. *Inflorescence* grey mealy to very pale yellow in a broad terminal panicle c. 10 cm long with ovoid to cylindrical branches composed of dense 3-5 flowered glomerules subtended by small spathulate bracts; *axis* pubescent with tubular hairs. *Flowers* bisexual, or female by abortion of stamens (sometimes with minute staminodes), sessile, depressed globular, c. 1 mm diam.; *perianth* united in lower 1/2 to 2/3, entirely pubescent outside (or only in distal half) with irregularly shaped short-tubular and bladder hairs, lobes imbricate, broadly obovate, membranous, ciliolate; stamens 5, filaments linear and neither thickened at base nor united into a disc; *ovary* globular, glabrous, style very short, stigmas slender. *Fruit* enveloped by perianth and deciduous with it; *pericarp* chartaceous, free, white and opaque. *Seed* horizontal (rarely oblique or erect), lenticular, c. 1.5 mm diam., margin rounded; *testa* minutely reticulate.

QUEENSLAND: Cunnamulla, *S. T. Blake* 10629 (BRI); Noondoo Stn., *S. L. Everist* 814 (BRI).

NEW SOUTH WALES: Depot Glen, *S. Jacobs* 3076 (NSW); Mt King Stn., *R. A. Perry* 5777 (NSW).

SOUTH AUSTRALIA: 48 km NE of Billa Kalina Stn., *M. Fagg* 379 (AD); Murnpeowie Stn., *D. E. Symon* 5653 (ADW).

WESTERN AUSTRALIA: DeGrey River district, *N. T. Burbidge* 1585 (PERTH): Mt Augustus Stn., 8 July 1970, *D. G. Wilcox* (PERTH).

NORTHERN TERRITORY: Supplejack Stn., *T. S. Henshall* 2306 (NT); Mt Andado Stn., *T. S. Henshall* 601 (NT).

Distribution. Western Queensland, central and western New South Wales, northern South Australia, northern Western Australia, Northern Territory. A casual in Europe. Map 11.

Habitat. Clay soil and heavy loam in depressions and areas of periodic flooding.

This species was placed by both Bentham (1870 l.c.) and Ulbrich (1934) in the same section as *C. album,* but Aellen (1960 l.c.) removed it to the monotypic section *Auricoma,* in which decision he was followed by Scott (1978b). The shrubby nature of *C. auricomum* as well as the presence of tubular hairs suggests that it should be considered sectionally distinct from the annual species related to *C. album.*

Bentham's (1870) suggestion that *C. auricomum* might be conspecific with *C. furfuraceum* Moq. (1840) and *C. acuminatum* Willd. (1799) is unacceptable since *Chenopodium furfuraceum* is a synonym of *Rhagodia candolleana* Moq. (1840) q.v., while *C. acuminatum* is an annual species with a sharply keeled margin to the seed, it is native to Asia and not found in Australia.

Owing to its palatability to stock this species has virtually disappeared from large areas of the pastoral country. It is also edible to humans and Max Koch (1895 in sched.) records it as being eaten by Aborigines in western New South Wales.

Sectio **Rhagodioides** Benth., Fl. Austral. 5:158 (1870); J. D. Hook. in Benth. et J. D. Hook., Gen. Pl. 3:52 (1880); Volkens in Engler et Prantl, Nat. Pflanzenfam. III. la:61 (1892); Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2, 16c:489 (1934); A. J. Scott, Bot. Jahrb. Syst. 100:214 (1978). *Type: C. nitrariaceum* (F. Muell.) Benth.

Spinescent *shrubs* with a thin mealy indumentum which eventually collapses and coalesces to form a scaly silvery sheen. *Flowers* sessile in a spinescent panicle, unisexual or bisexual; *tepals* 5 united towards base, enveloping mature fruit; *ovary* pubescent; *stamens* 5, glabrous; *disc* absent. *Pericarp* membranous, pubescent. *Seed* horizontal to vertical; *embryo* annular.

A monotypic section indigenous to Australia.

This section differs from sect. *Auricoma* principally in the spinescent habit, the weak mealy indumentum which becomes scaly with age, and the pubescent pericarp, characters which, individually, are indefinite in their application but which together demarcate *C. nitrariaceum* as a very distinct taxon.

Scott (1978b) included in this section *Rhagodia ulicina* (Gand.) Paul G. Wilson (as a species of *Chenopodium*), however, *R. ulicina* is a dioecious plant with a fleshy pericarp and was originally placed in the genus *Chenopodium* only through Gandoger's ignorance of its morphology.

15. **Chenopodium nitrariaceum** (F. Muell.) F. Muell. ex Benth., Fl. Austral. 5:158 (1870) 'nitrariacea'; F. Muell., Icon. Austral. Salsol. Pl. t. 28 (1890); S. J. Oostroom et T. J. Reichgelt, Gorteria 1:21 (1962).—*Rhagodia nitrariacea* F. Muell., Trans. Phil. Inst. Vict. 2:72 (1858); F. Muell. Sec. Gen. Rep. 14 (1854) nomen. *Lectotype*: Upper left-hand specimen on sheet bearing labels 1) 'Ad ripam fluvii Murray', Feb. 1847, and 2) 'Avoca', 2 Dec. 1852, both leg. *F. Mueller* (MEL 80673), see note below, *lecto. nov.*

C. lycioides Gand., Bull. Soc. Bot. France 66:224 (1919). *Type:* Warracknabeal, Victoria, 8 Oct. 1903, *F. M. Reader* (holo: LY).

Divaricately branched spinescent *shrub* c. 1 m high. *Branches* slender, covered with a grey metallic sheen due to fusion of collapsed vesicular hairs. *Leaves* alternate, frequently clustered at nodes; *lamina* coriaceous, spathulate with rounded apex passing at base into a short petiole, in all 10-30 mm long, sparsely mealy with minute branched collapsed vesicular hairs. *Inflorescence* a terminal panicle with spinescent branches to 15 cm long and wide or reduced to a single branchlet. *Flowers* subtended by small linear to ovate bracts, clustered in irregular glomerules, unisexual and dioecious or bisexual. *Perianth* depressed globular to broadly turbinate, 1.5-2 mm diameter; *tepals* 5, united in lower half, pubescent outside with small branched tubular hairs. *Male flowers; stamens* 5; *filaments* ligulate, glabrous; *disc* absent; *pistillode* c. 1 mm long, with minute erect stigmas. *Female flower: staminodes* minute c. 0.1 mm long or absent; *ovary* pubescent above with branched tubular hairs; *style* short or absent; *stigmas* 2, slender, to 1.5 mm long, pilosulose. *Fruit* enveloped by perianth, dry; *pericarp* membranous, white, pubescent above, free. *Seed* horizontal to vertical, depressed globular or concavo-convex, to sub-reniform, c. 1 mm diam.; *testa* punctate, reddish-brown to black, glossy; *embryo* hippocrepiform to annular.

QUEENSLAND: Noondoo Stn., *S. L. Everist* 831 (BRI).

NEW SOUTH WALES: Bourke, May 1918, *J. L. Boorman* (NSW); 8 mi [12.9 km] SW of Tulpa, *C. W. E. Moore* 5433 (CANB).

VICTORIA: Dimboola, 1947, *E. T. Muir* (MEL); Borung, 13 Nov. 1903, *F. M. Reader* (MEL).

SOUTH AUSTRALIA: 3 km W of Hawker, *B. Copley* 218 (AD); 48 km W of Tallaringa Well, *T. R. N. Lothian* 3847 (AD).

NORTHERN TERRITORY: 7 mi [11.3 km] E of Docker R. Settlement, *P. K. Latz* 968 (AD); 12 mi [19.3 km] SE of Tempe Downs HS., *N. M. Henry* 585 (NT).

Distribution. Central Australia south eastwards to north western Victoria, central and western New South Wales, south central Queensland. A casual in Switzerland, Germany, Holland and England. Map 15.

Habitat. Clay soil in seasonally waterlogged situations.

This species exhibits considerable variation in the shape of the flowers and in the nature of the stamens and ovary. In some plants the flowers are either all male (with a very small pistillode) or all female, in other plants the apparently male flowers have well-developed pistillodes which sometimes form seed (but the stigmas remain minute), while in yet others the flowers are bisexual. The orientation of the seed also varies. I have not been able to find characters by which the several variants that appear to be involved could be separated, partly because the herbarium material is usually imperfect.

Typification. Mueller (1858) did not cite specimens with his description of *Rhagodia nitrariacea* but he gave as its distribution 'Throughout the interior of Australia, from Arnhem's Land to Lake Torrens, the Murray River and its tributaries'. The only type material in herb. MEL is of four specimens mounted on one sheet (MEL 80673) on which are two labels indicating that the specimens were collected along the Avoca River on 2 December 1852 and along the Murray River in February 1847. I have chosen the upper left-hand specimen as the lectotype but there is no indication as to which label it relates. A syntype in herb. K was collected by Mueller along

Sturts Creek, Western Australia, presumably in 1856. This had been identified as *R. nitrariacea* by Mueller but was cited by Bentham (1870) under *R. crassifolia;* it is a specimen of *R. eremaea.*

Chenopodium nitrariaceum bears a superficial resemblance to *Rhagodia ulicina* but the two differ markedly in hair type and in flower and fruit characters.

Subgenus **Ambrosia** A. J. Scott, Bot. Jahrb. Syst. 100:211 (1978) *Type: C. ambrosioides* L.

Sectio **Ambrina** J. D. Hook. in Benth. et J. D. Hook., Gen. Pl. 3:51 (1880). *Type: C. multifidum* L.

Ambrina Spach, Hist. Nat. Veg. 5:295 (1836). nom. illeg. (includes type of *Roubieva). Type: C. multifidum* L.

Roubieva Moq., Ann. Sci. Nat. Bot. ser. 2,1:292 (1834).—*Chenopodium* sect. *Roubieva* (Moq.) Asch. et Graebner, Syn. Mitteleur. Fl. 5/1:21(1913). *Type: C. multifidum* L.

Annual or perennial *herbs* with yellow glandular hairs, aromatic. *Leaves* herbaceous, entire to pinnatifid. *Flowers* in dense axillary glomerules, bisexual and female. *Perianth* united in lower half; stamens 3-5; *stigmas* 2-5. *Pericarp* membranous, covered in part with geniculate glandular hairs. *Seeds* horizontal to vertical; *embryo* hippocrepiform to sub-annular.

About 8 species from South and Central America some of which are now cosmopolitan weeds. Two species are found in Australia.

The sect. *Ambrina* has been by some authors (e.g. Ascherson et Graebner 1913, Aellen 1960-1961, Scott 1978b) lectotypified on the species *C. ambrosioides.* However, Spach (1836 op. cit.) when describing the genus *Ambrina,* included in it both *C. multifidum* L. (as *A. pinnatisecta* Spach) and *C. ambrosioides* (among other species). Moquin (1840) while accepting the genus placed *C. ambrosioides* in *Ambrina* sect. *Adenois* (which he stated to be the typical section) and *C. multifidum* in the genus *Roubieva.* The latter name was based on *Roubieva* Moq. (1834) with the one species *R. multifida (Chenopodium multifidum* L.). The generic name *Ambrina* is therefore illegitimate being superfluous and is to be typified by the type of the name which should have been adopted, i.e. *C. multifidum.* J. D. Hooker (1880) clearly based the sectional name *Ambrina* on Spach's generic name and gave it the same broad circumscription. I consider that *C. ambrosioides* and *C. multifidum* belong to the same section so the effect of a lectotypification different to that of other recent authors (who have selected *C. ambrosioides)* is not significant.

I have accepted the name *Chenopodium* sect. *Ambrina* in the sense of J. D. Hooker (1880). It was first used by J. D. Hooker in Flora Novae-Zelandiae 213 (1853) without reference to an author or to a basionym. He included two species, *C. carinatum* R.Br. and *C. pumilio* R.Br., and gave as a description 'seed vertical'. The name if treated as new is illegitimate, being superfluous since it includes the lectotype of the section *Orthosporum* R.Br. (1810). Hooker probably intended it to be based on the genus *Ambrina* and was following Moquin (1840) who included both *C. carinatum*

and *C. pumilio* in *Ambrina* sect. *Adenois* (the typical section of that genus). It is debatable whether Hooker's two word description in his 1853 publication is acceptable as a diagnosis, particularly since his description for the unnamed group, which contained the rest of the species he placed in the genus, was 'seed horizontal, rarely (in *C. glaucum* sometimes) vertical.' This being the case, and in order to retain current nomenclature where possible, I am treating the 1853 publication of the name as being invalid. *Chenopodium* sect. *Ambrina* therefore dates from 1880 and is based on *Ambrina* Spach.

The species of section *Ambrina* are peculiar in having geniculate hairs on their ovaries. This character, along with their distinctive smell, clearly distinguish them from all other *Chenopodium* species found in Australia.

16. **Chenopodium ambrosioides** L., Sp. Pl. 219 (1753). *Type citation*: 'Habitat in Mexico, Lusitania'. Type: n.v.

Perennial *herb* c. 1 m high with ascending branches, strongly aromatic, glabrous or villous towards apex. *Leaves* herbaceous; lower ones elliptic to narrowly elliptic, coarsely serrate or incised, narrowed at base into a short petiole, in all c. 10 cm long; upper ones entire and smaller; under-surface prominently covered with sessile globular amber-coloured oil-filled hairs. *Flowers* sessile in small glomerules forming leafy or leafless panicles, sometimes spicate. *Terminal flower* of glomerule bisexual; *perianth* 5-lobed to near base, glabrous, lobes cucullate and enclosing flower; *stamens* 5, glabrous, filaments ligulate, anthers exserted; ovary pubescent in upper half with shortly stipitate geniculate glandular hairs, style short with 3-4 slender stigmas. *Lateral flowers* female; *perianth* depressed spherical shortly 5-toothed and enclosing flower. *Pericarp* membranous, free, glandular pubescent above *Seed* horizontal or oblique, obtusely lenticular, c. 1 mm diam., almost smooth, glossy; *embryo* hippocrepiform.

QUEENSLAND: Moreton Island, *L. Durrington* 1464 (BRI); Carnarvon Gorge, *T. J. McDonald* 215 (BRI).

NEW SOUTH WALES: Mt Harris Station, 1 May 1952, *E. F. Constable* (NSW); Scarborough Park, Koyarah, *E. F. Constable* 5940 (NSW).

VICTORIA: Recorded for eastern Victoria by Willis (1973), no specimens seen.

SOUTH AUSTRALIA: Paradise, Adelaide, *A. G. Spooner* 3973 (AD).

WESTERN AUSTRALIA: Fremantle, *P. G. Wilson* 8687 (PERTH).

Distribution. Widespread in mainland Australia. Cosmopolitan, native of tropical America. Map 10.

Habitat. Disturbed situations, often bordering streams or creeks.

I have not attempted to distinguish in this paper the various closely related species recognised by Aellen (1960), nor have I considered the infraspecific taxa enumerated by Aellen (1929) and by Aellen and Just (1943). Much of the Australian material agrees well with *C. anthelminticum* L. as delimited by Aellen (*C. ambrosioides* var. *anthelminticum* (L) A. Gray), and a few specimens from Rockhampton, Queensland, correspond to Aellen's description (1960-1961) of *C. spathulatum* Sieber (*C. ambrosioides* f. *spathulatum* (Sieber) Aellen 1929) which he records from Sydney.

The former species is distinguished by its slender spike-like inflorescence branches in which the bracts of the flower clusters are very small or absent, while the latter species is recognised by its spathulate bracts. Comments on this species complex by C. F. Reed in Flora of Texas (1969) and by J. A. Duke in Flora of Panama (1961) appear to be apposite to the situation in Australia; Duke remarks on *C. ambrosioides:* 'polymorphically perplexing, this species, or some of its subspecies, varieties or forms, is quite cosmopolitan', while Reed, after commenting on two varieties, states that: 'combinations of all characters vary to a degree that separating them is very difficult'.

Voroschilov (1942) and Aellen (1960-1961) recognised the following three taxa of the *C. ambrosioides* complex as being present in Australia:

C. integrifolium Vorosch., J. Bot. URSS 27:42 (1942) n.v.; Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed.2, 3:596 (1960).

C. spathulatum Sieber ex Moq. in DC., Prod. 13/2:73 (1849); Aellen in Hegi, loc. cit.

C. suffruticosum Willd. subsp. *remotum* Vorosch. op. cit. n.v.; Aellen in Hegi, op. cit. 595.

I have not attempted to discriminate any of the above taxa.

This species is cultivated in some countries for its oil which is considered to have anthelmintic properties while the leaves are used for making the drink known as Mexican tea. The variety *anthelminticum* is also cultivated and its oil, as the varietal epithet suggests, has a vermifugal effect, which is more pronounced than that of the typical variety. An account of the oil content of the plant found in Australia is given by Shapter (1941).

17. **Chenopodium multifidum** L., Sp. Pl. 220 (1753).—*Roubieva multifida* (L) Moq., Ann. Sci. Nat. Bot. ser. 2, 1:292 (1834).—*Ambrina pinnatisecta* Spach, Hist. Nat. Veg. 5:296 (1836). Type citation: 'Habitat in Bonaria' (Buenos Aires). Type: n.v.

C. multifidum f. *spathulatum* Aellen, Amer. Midl. Naturalist 30: 50 (1943). *Type* not cited.

Perennial *herb,* prostrate, decumbent or erect, to 1 m high, much branched from the base, aromatic. *Branches* sparsely to moderately covered with cottony hairs. *Leaves* pinnatisect, to 6 x 3 cm; segments linear with recurved margins, under surface densely covered with pale yellow glandular hairs and sparsely so with cottony hairs. *Flowers* predominantly female, sessile in few flowered glomerules forming spicate panicles. *Bisexual flower: perianth* hemispherical, shortly 5-lobed; *stamens* 5, filaments ligulate, glabrous; *ovary* narrowly turbinate, with shortly stipitate amber-coloured geniculate glandular hairs in upper half; *stigmas* 3-5, sessile, slender. *Female flower: perianth* obovoid (pouch-like), minutely lobed and enclosing pistil. *Fruiting perianth* c. 2.5 mm long, coriaceous and reticulate-veined. *Pericarp* membranous, free. *Seed* erect, lenticular with rounded margin; *testa* reddish brown, glossy, puncticulate; *embryo* hippocrepiform.

QUEENSLAND: Near Warwick, Nov. 1958, *Shirley* (BRI).

NEW SOUTH WALES: East Tamworth, *R. H. Goode* 226 (NSW); Hay, Feb. 1970. *B. M. Alchin* (NSW).

VICTORIA: Seymour, *R. V. Smith* 64/105 (MEL); Coode Is., 23 Mar. 1912, *J. R. Tovey* (MEL).

SOUTH AUSTRALIA: Pt. Adelaide, *D. E. Symon* 1233 (ADW); Semaphore, 19 June 1940, *C. G. Samuel* (ADW).

WESTERN AUSTRALIA: Bunbury, Sept. 1942, *C. A. Gardner* (PERTH); Harvey, Dec. 1967, *K. S. Cole* (PERTH).

Distribution. Southern mainland Australia. Native of South America and now widely distributed. Map 12.

Habitat. Disturbed areas; often in coastal sand.

The branches of some specimens have the upper leaves entire and spathulate and it was evidently on this variant that the f. *spathulatum* Aellen (1943) is based.

As will be noted in the sectional synonymy this species is the type of the names *Chenopodium* sect. *Ambrina* and *Chenopodium* sect. *Roubieva*. These two sections have been considered distinct by some authors (e.g. Aellen 1960-1961, Scott 1978b) with *C. ambrosioides* (L.) Spach accepted as the type of sect. *Ambrina* and *C. multifidum* of sect. *Roubieva*. However, even if this typification is adopted, the two sections appear to be not deserving of separate status since sect. *Roubieva* is then only distinguished by its erect seeds and pouch-like perianth, characters which appear to be rather insignificant compared with those the two sections have in common, particularly the glandular leaves and the curious geniculate hairs on the ovary.

Sectio **Orthosporum** R.Br., Prod. 407 (1810); Benth., Fl. Austral. 5:162 (1870); J. D. Hook. in Benth. et J. D. Hook., Gen. Pl. 3:51 (1880) see note 1 below; Volkens in Engler et Prantl, Nat. Pflanzenfam. 3, la:61 (1892); Aellen, Verh. Naturf. Ges. Basel 44:308 (1933); Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed 2, 16c:494 (1934); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:576 (1960); Scott, Bot. Jahrb. Syst. 100:213 (1978). *Lectotype: Chenopodium carinatum* R.Br. (see Ulbrich 1934). See note 2 below.

Blitum sect. *Orthosporum* (R.Br.) C. Meyer in Ledeb., Fl. Alt. 11 (1829); Moq. in DC., Prod. 13/2:81 (1849). See note 3 below.

Orthosporum (R.Br.) C. Meyer ex T. F. L. Nees, Gen. Pl. Fl. German. ad t. [58] (1835). See note 4 below.

Orthospermum (R.Br.) Opiz, Seznam rostlin Kveteny Ceske 70 (1852). See note 5 below.

Chenopodium sect. *Ambrina* J. D. Hook., Fl. Nov.-Zel. 213 (1853) nom. invalid. non J. D. Hook. (1880). *Type: C. carinatum* R.Br.

Chenopodium sect. *Carinata* Standley, N. Amer. Fl. 21/1:11, 27 (1916) nom. illeg. (superfluous name). *Type: Chenopodium carinatum* R.Br.

Note 1: J. D. Hooker (1880) and Volkens (1892) included *Chenopodium tenue* Colla from Chile in the section *Orthosporum*. However, this species is conspecific with *C. multifidum* L., a member of section *Ambrina*.

Note 2: A. J. Scott (1978b) nominated *Chenopodium pumilio* R.Br. as the lectotype of section *Orthosporum* but since the choice of lectotype had already been made by Ulbrich (1934) this earlier selection stands.

Note 3: C. A. Meyer (1829 op.cit.) described *Blitum* sect. *Orthosporum* without reference to the name *Chenopodium* sect. *Orthosporum* R.Br. He did, however, include in his section the two species described by Brown under sect. *Orthosporum* and therefore it can be assumed that the names are nomenclatural synonyms. Moquin (1840) recognised Meyer's section but excluded both the species described by Brown; instead he placed them in *Ambrina* sect. *Adenois*. This error was corrected in a later publication (Moquin 1849).

Note 4: The generic name *Orthosporum* (R.Br.) C. Meyer ex T. Nees (1835 op.cit.) was based on *Blitum* sect. *Orthosporum* (R.Br.) C. Meyer (1829 op.cit.) but without any mention of Robert Brown or of the two species Brown had placed in *Chenopodium* sect. *Orthosporum*. A. J. Scott (1978b p. 209) considered the generic name *Orthosporum* to be illegitimate and gave as type *O. rubrum* (L.) T. Nees (= *Chenopodium rubrum* L.); this was one of the two species named and illustrated by Nees under *Orthosporum*, the other being *O. bonus-henricus* (L.) T. Nees (= *C. bonus-henricus* L.). However, since the generic name *Orthosporum* is indirectly based on *Chenopodium* sect. *Orthosporum* R. Br. it has the same type which is *C. carinatum* R.Br. The name *Orthosporum* is therefore legitimate and correct should the "*carinatum* group" be considered to warrant separate generic status.

Note 5: The generic name *Orthospermum* was attributed by Opiz (1852 l.c.) to Robert Brown and he gave as a synonym "*Orthosporum* C. A. Meyer". It would therefore appear that the first name is an orthographic variant of the second, and that it was based on Brown's sectional epithet either directly, or indirectly through Meyer's combination under *Blitum*, or through the generic name *Orthosporum* C. Meyer ex T. Nees.

Annual *herbs*, prostrate, ascending, or erect, pilose with segmented hairs and with sessile or stipitate gland-tipped hairs, strongly aromatic. *Flowers* ebracteate, small in dense axillary clusters (condensed thyrses) or paniculate (*C. saxatile*), bisexual and female. *Tepals* 4-5, erect, united towards base, variously thickened and enlarged in fruit; *stamens* 0-1(2) opposite anterior or (in 4-merous flowers) anterior-lateral sepal; *stigmas* 2, subsessile, slender. *Pericarp* membranous. *Seed* erect, lenticular; *funicle* very short; *embryo* hippocrepiform around apex of seed; *radicle* inferior. *Fruit* deciduous with perianth, an abcission zone forming at apex of pedicel.

Distribution. Australia and New Zealand; almost cosmopolitan through recent introduction. Seven species, six of which are endemic to Australia and one to New Zealand.

The habit, hair types, and inflorescence structure of the species in this section are similar to those found in *Dysphania* section *Tetrasepalae*; the principal differences between these sections of the two genera being found in the seeds. In *Dysphania* sect. *Tetrasepalae* the seed is globular or subglobular and the embryo either lateral or basal. In *Chenopodium* sect. *Orthosporum* the seed is lenticular and the embryo always hippocrepiform around its apex.

Hybridisation commonly occurs between the species of this section (apart from *C. pusillum* and *C. saxatile*) and several names have been given to the crosses or backcrosses; these are listed below with critical comments. Since the species themselves exhibit considerable variability the number of different variants is immense and it is pointless to attempt to name them. Where possible, herbarium specimens of apparent hybrid origin have been designated by a formula, but since parentage is often difficult to determine (unless a suite of specimens has been collected) often only the more obvious parent has been indicated.

In addition to the complexities noted above it is apparent that intergradation is present between at least some of the pairs of species, in particular, the following:

1. *C. pumilio—C. carinatum*
2. *C. carinatum—C. melanocarpum*
3. *C. cristatum—C. melanocarpum*

These are discussed below.

Names of hybrids—sect. Orthosporum

A. *Chenopodium* x*bontei* Aellen, Verh. Naturf. Ges. Basel 44:317 (1933).

Considered by Aellen to be a hybrid between *C. carinatum* and *C. cristatum* which, with the hybrid, were found at Derendingen in Switzerland. Aellen divided it into two varieties as follows:

nothovar. *cristatiforme* Aellen, op. cit. p. 318. *Lectotype*: Derendingen, Switzerland, 9 Sept. 1923, *R. Probst* (G) *lecto nov. Syntype*: Luterbach, Switzerland, 16 Aug. 1933, *R. Probst* (G).

Stated by Aellen to be a hybrid between *C. carinatum* var. *holopterum* (i.e. var. *carinatum*) and *C. cristatum*. The two specimens cited above appear to have been derived from *C. cristatum* and another species, possibly *C. carinatum*.

nothovar. *submelanocarpum* Aellen, op. cit. *Lectotype* Derendingen, Switzerland, 5 Sept. 1926, *R. Probst* (G) *lecto nov. Syntype*: Kettwig, Germany, 5 Oct. 1930, *L. Bonte* (G).

Stated by Aellen to be a hybrid between *C. carinatum* var. *melanocarpum* (= *C. melanocarpum*) and *C. cristatum*. The two specimens cited appear to have had such an origin.

B. *Chenopodium* x*christii* Aellen, op cit. p. 317.

Considered by Aellen to be a hybrid between *C. carinatum* var. *holopterum* (i.e. var. *carinatum*) and *C. pumilio*. Aellen divided it into two varieties as follows:

nothovar. *intermedium* Aellen, op. cit. 317. *Type*: "Western Australia: 120 km south of Perth, 1901, leg. *Cecil Andrews*, 1th collect. no. 697". (holo: K n.v.).

The description and illustration provided by Aellen suggest that this is a variant of *C. pumilio*.

nothovar. *semiconnatum* Aellen, op. cit. 317. *Type*: "In Nova Holandia ad portum Jackson, 1830, leg. *Gaudichaud*" (holo: G n.v.).

The Gaudichaud specimen is one of the two syntypes of *Ambrina carinata* var. *parvifolia* Moq. (1840). It is probably a variant of *C. pumilio*.

C. Chenopodium trigonocarpum Aellen, op. cit. 41:99 (1930). *Lectotype*: Derendingen, Switzerland, 31 July 1929, *R. Probst* (G) *lecto. nov.*

In addition to the lectotype, Aellen cited one other specimen from Derendingen (not seen) and stated that it was also known to him from New Zealand and Australia. In a later paper Aellen (1933) placed *C. trigonocarpum* in synonymy under *C. carinatum* var. *holopterum* (= var. *carinatum*). The lectotype appears to be a hybrid between *C. melanocarpum* and probably *C. cristatum* or between *C. melanocarpum* and another hybrid involving *C. cristatum*.

18. **Chenopodium pumilio** R.Br., Prod. 40 (1810); Benth., Fl. Austral. 5:163 (1870); Aellen, Verh. Naturf. Ges. Basel 44:314 (1933).—*Blitum pumilio* (R.Br.) C. A. Meyer ex Steudel, Nom. Bot. ed. 2, 1:210 (1840); Moq. in DC., Prod. 13/2:82 (1849).—*Ambrina pumilio* (R.Br.) Moq., Chenop. Monog. Enum. 42 (1840). *Type:* Kangaroo Island, *R. Brown* (holo: BM n.v.).

Blitum glandulosum Moq. in DC., Prod. 13/2:82 (1849) sensu lectotypica fide Aellen (1933).— *Chenopodium glandulosum* (Moq.) F. Muell., Fragm. 7:11 (1859).—*C. pumilio* f. *glandulosum* (Moq.) Aellen, Verh. Naturf. Ges. Basel 44:315 (1933); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2,3:598 (1960). *Type citation*: "In Nova-Hollandia" "(v.s. in h. Desf., Poir., DC. et Webb.)". Type: n.v.

Chenopodium carinatum f. *rubellum* Aellen, Feddes Repert. 24:345 (1928).— *C. pumilio* f. *rubellum* (Aellen) Aellen, Verh. Naturf. Ges. Basel 44:315 (1933). *Type citation*: "Johannisburg (advent. aus Austr.) 1922, leg. *C. E. Moss!* no 6702 (Herb. Pretoria)." Type: n.v.

Chenopodium x christii n-var. *intermedium* Aellen, Verh. Naturf. Ges. Basel 44:317 (1933). *Type*: 120 km S of Perth, Western Australia, *C. Andrews* 1st. Coll. no. 697 (holo: K n.v.).

Chenopodium x christii n-var. *semiconnatum* Aellen, Verh. Naturf. Ges. Basel 44:317 (1933). *Type citation*: "In Nova Hollandia ad portum Jackson, 1830, leg. *Gaudichaud*". Type: G-DC n.v.

Chenopodium pumilio var. *oblongifolium* J. Black, Fl. S. Austral. ed. 2, 289 (1948) nom. illeg., sine desc. latina.

[*Chenopodium carinatum* auct. non R.Br.: F. Muell., Icon. Austral. Sals. Pl. t. 32 (1890); Benth., Fl. Austral. 5: 162 (1870) p. p. majore; Beadle et al., Fl. Sydney Reg. 193, f. 29g (1972) p. p.]

[*Blitum carinatum* auct. non (R.Br.) Steudel: Reichenbach, Ic. Fl. Germ. 24: 118, t. 252 f. 8-10 (1909).]

Annual or short-lived perennial *herb* to 30 cm high and wide, usually with several stems arising from base, aromatic. *Stems* slender, simple or branched, sparsely to moderately pilose with both slender segmented and sessile to stipitate gland-tipped hairs. *Leaves* herbaceous; *lamina* narrow to broad elliptic to ovate, 10-20 mm long, obtuse, entire to sinuate or obtusely lobed, sparsely pilosulose with simple and gland-tipped hairs; *petiole* slender, c. half to equal length of lamina. *Flowers* in compact axillary glomerules, subsessile or on slender pedicels up to 2 mm long, ovoid, c. 0.5 mm high; *tepals* 5, erect, naviculiform, united towards base, herbaceous, thin, sparsely pilosulose at apex or along midrib. *Fruiting* perianth usually crustaceous and white, c. 1 mm high; *tepals* erect, narrowly naviculiform, rounded on back, contiguous at apex but often disjunct in middle to expose fruit. *Pericarp* diaphanous, dull grey or translucent, sparsely papillose. *Seed* lenticular 1 mm long, keeled or rounded on margin.

QUEENSLAND: Longreach, *S. T. Blake* 6615 (BRI); Bengalla, *L. Leichhardt* (MEL 20078).

NEW SOUTH WALES: 78 mi [125.5 km] W of Cobar, *J. C. De Nardi* 225 (NSW); Broken Hill, *P. L. Milthorpe* 176 (NSW).

VICTORIA: Kul Kyne Forest, *A. C. Beauglehole* 40651 (MEL); Creswick, *Whan* 196 (MEL).

TASMANIA: Buckland, 24 Apr. 1912, *R. A. Black* (HO); Cape Barren Is., *J. S. Whinray* 733 (AD).

SOUTH AUSTRALIA: Millswood, *D. N. Kraehenbuehl* 1878 (AD); Queenscliffe, Kangaroo Is., *J. G. O. Tepper* 1285 (MEL).

WESTERN AUSTRALIA: Wyola, *T. E. H. Aplin* 2203 (AD, PERTH); Pemberton, *M. Koch* 2558 (PERTH).

NORTHERN TERRITORY: Burt Plain, *G. Chippendale* (NT 8033).

Distribution. Principally southern Australia; as an introduced weed in many parts of the world and as an occasional weed in northern Australia. Map 13.

Habitat. Heavy loamy soils, sometimes slightly saline; frequently an agricultural weed.

The name *Chenopodium carinatum* was used by Bentham (1870) to include material correctly placed in *C. pumilio.* He was followed in this regard by Mueller (1889-1891), J. M. Black (1924) and Ewart (1931). It was not until 1933, when Aellen published a revision of the section *Orthosporum,* that the separate identity of both species became widely accepted, although some Floras continue to unite them.

Chenopodium carinatum and *C. pumilio* are evidently closely related. It would appear that in Australia with the widespread dissemination of *C. pumilio* since the coming of agriculture (in which industry it features as a prominent weed) it has spread into areas previously only occupied by *C. carinatum.* Integradation between the two is apparent from a study of herbarium material. The situation is complicated by the considerable variation, found between different populations of *C. pumilio,* in habit, leaf shape, and perianth structure. In spite of this variability I have not recognised any infraspecific taxa since the variants do not appear to occupy discrete areas and there appears to be a smooth gradation between them.

In *Chenopodium pumilio,* and possibly in other members of the section, the anterior tepal of hermaphrodite flowers subtends the solitary stamen and is initially larger than the others. At anthesis the swollen base of the staminal filament becomes turgid and causes the stamen and anterior tepal to spread widely. Later all tepals become equal in size and assume an erect posture. The perianth usually becomes cartilaginous and white in fruit but this change does not always occur and would appear to depend on the conditions under which the plant is growing.

19. **Chenopodium carinatum** R.Br., Prod. 407 (1810); Benth., Fl. Austral. 5:162 (1870) p. pte; Aellen, Verh. Naturf. Ges. Basel 44:312 (1933) exc. var. *melanocarpum.*—*Salsola carinata* (R.Br.) Sprengel, Syst. Veg. 1:923 (1825).—*Ambrina carinata* (R.Br.) Moq., Chenop. Enum. 41 (1840).—*Blitum carinatum* (R.Br.) C. A. Meyer ex Steudel, Nom. Bot. ed. 2, 1:210 (1840); Moq. in DC., Prod. 13/2:82 (1849). *Type*: Hawkesbury R., New South Wales, *R. Brown* (holo: BM).

C. cristatum var. *holopterum* Thellung, Vierteljahrsschr. Naturf. Ges. Zurich 64:724 (1919).—*C. holopterum* (Thellung) Thellung et Aellen in Probst, Mitt. Naturf. Ges. Soloth. 20(8):57 (1928).—*C. carinatum* var. *holopterum* (Thellung) Aellen, Verh. Naturf. Ges. Basel 44:312 (1933). *Type citation*: 'Mit dem Typus der Art und mit *Ch. carinatum*, 1917, *Probst.*' Type: n.v.

Ambrina carinata var. *parvifolia* Moq., Chen. Mon. Enum. 42 (1840) pro parte as to lectotype.—*Blitum glandulosum* var. *parvifolium* (Moq.) Moq. in DC., Prod. 13/2:82 (1849). *Lectotype*: D'Urville (P, n.v.) see Aellen (1933).

C. carinatum f. *foliosum* Domin, Biblio. Bot. 22:65 (1921). *Type*: Queensland, Brisbane River, *A. Dietrich* 968 (iso: NSW).

Annual *herb*, decumbent to erect, branching from the base, aromatic. *Stems* simple or branched, 30 cm long, pilosulose with both slender and sessile to stipitate gland-tipped hairs. *Leaves* herbaceous; *lamina* ovate to broadly ovate, 5-20 mm long, shortly lobed to coarsely serrate, glandular puberulous and pilosulose below on veins; *petiole* slender, rather shorter than lamina. *Flowers* subsessile, densely congested in fruit; *tepals* 5, erect, united towards base, narrow-oblong, naviculiform, hirtellous on keel. *Fruiting perianth* white, thickened and coriaceous; *tepals* prominently keeled especially towards apex, truncate or acute, sparsely hirtellous on keel. *Pericarp* diaphanous, smooth. *Seed* lenticular c. 0.5 mm long, keeled over radicle and channelled over cotyledons.

QUEENSLAND: Hughenden, *S. T. Blake* 6181 (BRI); Wandoon, *C. E. Hubbard* 5072 (BRI).

NEW SOUTH WALES: Kunghur, *E. F. Constable* 6578 (NSW); 1.5km N of Wollombi, *L. A. S. Johnson* and *B. G. Briggs* 3287 (NSW).

VICTORIA: Suggan Buggan, *A. C. Beauglehole* 36646 (MEL); Near Deddick, 21 Jan. 1948, *J. M. Bechervaise* (MEL)

Distribution. Eastern Queensland and New South Wales, far eastern Victoria. Map 4.

Habitat. Frequently an agricultural weed or an invader of disturbed soils.

There has been much confusion over the application of the name *Chenopodium carinatum*; this arose through Moquin (1840, 1849) not having seen the type of that species or of *C. pumilio* and therefore including material of the latter under the former name. This confusion was continued by Bentham (1870) who, while recognising both species placed most specimens of each under *C. carinatum* and included in it the plant later recognised as the species *C. melanocarpum*. The situation was clarified by Aellen (1933) who, unfortunately, had an individual approach to the international Code of Botanical Nomenclature and who, for his understanding of the species, relied to a large extent on plants arising in Europe from seed introduced there in wool.

While I recognise *C. carinatum* as a distinct species, hybrids with *C. pumilio, C. melanospermum,* and *C. cristatum* are common, probably largely through the movement of seed of these species due to agriculture and commerce; this is particularly apparent in Europe where numerous hybrids have been documented and in some cases named. The species exhibits considerable geographic variation in leaf and perianth form in particular in the tepals which range from being slightly to strongly

keeled. When strongly keeled the fruiting perianth has a form approaching that of *C. melanocarpum.* Specimens with a particularly prominently keeled and hardened perianth from central and South Australia and from north-western Western Australia have, in herbaria, sometimes been placed in *C. carinatum* and sometimes in *C. melanocarpum.* I have placed them with the latter taxon, as did Aellen who named this variant f. *leucocarpum,* although I recognise that the plants with this form of fruit have evolved in several independent lines: some have affinity to *C. carinatum,* some (a portion of the western element) probably to *C. melanocarpum,* while others which I have segregated under f. *leucocarpum* may represent a hybrid between *C. carinatum* and *C. melanocarpum.*

20. **Chenopodium melanocarpum** (J. Black) J. Black, Trans. Roy. Soc. S. Austral. 58:173 (1934).—*C. carinatum* var. *melanocarpum* J. Black, Trans. Roy. Soc. S. Austral 46:566 (1922); Aellen, Verh. Naturf. Ges. Basel 44:313 (1933); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:599 (1960). *Lectotype*: Broken Hill, New South Wales, Sept. 1918, per T. G. B. Osborn (AD 96732197) *lecto. nov.*

[*C. carinatum* auct. non R.Br.: Benth., Fl. Austral. 5:162 (1870) p.p. as to *Drummond* 165.]

[*C. holopterum* auct. non (Thell.) Thell. et Aellen: J. Black, Fl. S. Austral. 683 (1929) "*C. holocarpum* Thell. et Aellen". See note below.]

Annual *herb*, prostrate, with numerous stems arising from the base, aromatic. *Stems* simple, slender, to 30 cm long, pilosulose with both slender segmented and sessile to shortly stipitate gland-tipped hairs. *Leaves* slightly fleshy; *lamina* broadly elliptic c. 15 mm long, bluntly lobed to almost entire, glandular puberulous and pilosulose below along veins; *petiole* slender about half length of lamina. *Flowers* subsessile to shortly pedicellate (densely congested in fruit); *tepals* 5, erect, united in lower half, narrow-oblong, keeled, hirtellous; *stigmas* 2, subsessile, slender. *Fruiting* perianth bluntly stellate in cross-section, crustaceous, black (or pale fawn in f. *leucocarpum,* firmly united in lower half and completely covering fruit; *tepals* strongly and bluntly keeled, sparsely hirtellous on keel. *Seed* lenticular, 0.5 mm long, keeled on margin over radicle, channelled over cotyledons; *pericarp* diaphanous, dull, smooth or minutely puberulous towards apex, somewhat adherent to seed.

This species comprises two forms which may be distinguished by the colour of their fruiting perianths.

20a. forma **melanocarpum**

Fruiting perianth black.

QUEENSLAND: 35 mi [56.3 km] SW of Eulo, *M. law* 43 (BRI); Boatman Station, *S. L. Everist* 2792 (BRI).

NEW SOUTH WALES: Mt. Derriwong, *G. M. Cunningham* 774 (NSW); 12 mi [19.3 km] E of Turlee, *J. De Nardi* 340 (NSW).

SOUTH AUSTRALIA: Mann Range, 22 Aug. 1954, *J. B. Cleland* (AD); Amoorinyirra Hill, *D. J. E. Whibley* 1124 (AD).

WESTERN AUSTRALIA: 80 mi [128.7 km] E of Carnarvon, *C. A. Gardner* 6051 (PERTH); Mileura Stn., *P. G. Wilson* 8987 (PERTH).

NORTHERN TERRITORY: Palm Valley, *A. C. Beauglehole* 10403 (PERTH); 4 mi [6.4 km] N of Alice Springs, *R. Swinbourne* 563 (NT).

Distribution. Arid and semi-arid areas of Australia south of 22° latitude. Map 7.

Habitat. Well-drained situations either in sand or on sides of rocky hills.

The synonymy cited above is indicative of the difficulty experienced by different workers in fitting a nomenclatural framework onto a variable and freely interbreeding group. Bentham (1870 op.cit.) placed material of *C. melanocarpum* (and of *C. pumilio*) under *C. carinatum*, while Black (1922 op.cit.) still recognising it as part of that species, gave it varietal status, in which decision he was followed by Aellen (1933, 1960-1961). Later Black (1934 op.cit.) raised var. *melanocarpum* to the rank of species and in this he has been followed by workers in most Australian herbaria. The course adopted by Black is preferable since the typical form of *C. melanocarpum* differs appreciably in perianth and leaf shape from *C. carinatum*.

The spelling "*C. holocarpum*" was inadvertently used by J. M. Black (1924) instead of *C. holopterum*. This error was later noted by Black in Trans. Roy. Soc. S. Austral. 58:174 (1934) when he published the name *C. melanocarpum* as a new combination.

20b. forma **leucocarpum** (Aellen) Paul G. Wilson, comb. nov.—*C. carinatum* var. *melanocarpum* f. *leucocarpum* Allen, Verh. Naturf. Ges. Basel 44:313 (1933). *Neotype*, here chosen: Ashburton River, Minderoo, Oct. 1905, *A. Morrison* (holo: PERTH; iso: K).

Fruiting perianth pale fawn in colour.

Distribution. North western Western Australia (Port Hedland-Exmouth Gulf area), central and South Australia, eastern Queensland, New South Wales and Victoria. Map 4.

Habitat. As for the typical form.

No collections were cited by Aellen for this forma, however, a duplicate at herb K of the Morrison specimen which has been designated as a neotype has been determined by Aellen as f. *leucocarpum*.

21. **Chenopodium cristatum** (F. Muell.) F. Muell., Fragm. 7:11 (1864); Benth., Fl. Austral. 5:163 (1870); F. Muell., Icon. Austral. Salsol. Pl. 31 (1890); Aellen, Verh. Naturf. Ges. Basel 44:310 (1933).—*Blitum cristatum* F. Muell., Trans. Phil. Inst. Vict. 2:73 (1858). *Lectotype.* Raro in planitiis sterilioribus subsalsis prope montis Flindersianos, Oct. 1851, *F. Mueller* (holo: MEL 19998) iso: PERTH) *lecto. nov.*

Annual *herb*, prostrate to ascending with several stems arising from base, aromatic. *Stems* slender, mainly simple, pilosulose with both slender segmented and sessile to shortly stipitate gland-tipped hairs. *Leaves* slightly fleshy; *lamina* elliptic to broadly elliptic, entire to coarsely toothed, sparsely puberulous. *Flowers* subsessile; *tepals* 5, erect, acuminate, strongly keeled and hirsute, ciliate, united in lower half. *Fruiting perianth* spherical, c. 2 mm diameter, strongly 5-winged, white (rarely grey to black); *tepals* cartilaginous, strongly crested (vertically winged), semi-

orbicular, rostrate, completely enclosing the fruit. *Pericarp* diaphanous dull, papillate towards apex or all over. *Seed* lenticular, c. 0.5 mm long, the margin slightly keeled over radicle and grooved over cotyledons.

QUEENSLAND: Oakwood Stn., *L. S. Smith* and *S. L. Everist* 846 (BRI); Thargomindah, Apr. 1885, *Spencer* (MEL).

NEW SOUTH WALES: "Birdwood" NE of Pooncarie, *R. P. Green* 177 (NSW); W. of Stoney Crossing, *D. L. W. Henderson* 327 (NSW).

VICTORIA: 23 km NNW of Manangatang P.O., *A. C. Beauglehole* 55812 (MEL); nr. Lakes Ranfurly and Hawthorn, May 1937, *J. H. Willis* (MEL).

SOUTH AUSTRALIA: Koonamore, *Hj. Eichler* 12492 (AD); "Markaranka", Morgan, *D. E. Symon* 3557 (ADW).

WESTERN AUSTRALIA: Esperance, *R. A. Rose* 3005 (PERTH); W side Fraser Ra., *P. G. Wilson* 5898 (PERTH)

NORTHERN TERRITORY: Trephina Gorge, *B. G. Briggs* 1229 (NSW); 2 mi [3.2 km] S of Weepita Bore, *G. Chippendale* (NT 2499).

Distribution. Arid and semi-arid regions of Australia south of 20° latitude. Map 14.

Habitat. Frequently in red sandy loam, often long creek lines.

This species may be readily recognised when in fruit by the strongly crested rostrate tepals. It is most similar to *C. truncatum* which may be distinguished by the firmly united tepals and the absence of a rostrate apex to the perianth.

As is noted in the species description, the fruiting perianth while normally white is sometimes grey to black in colour. In some cases these melanized plants have obviously arisen through hybridisation with *C. melanocarpum* (i.e. when the grey fruited form has been collected with the two parents); in other cases the fruit shape is typical of *C. cristatum* while the colour is black and no plants of *C. melanocarpum* have been observed in the area.

22. **Chenopodium truncatum** Paul G. Wilson, sp. nov.

Herba prostrata vel adscendens cum pilis simplicibus et pilis glandulosis subsessilibus pilosula, caulis numerosis ex caudice exorientibus. *Folia* modice carnosa; *lamina* elliptica obtusa c. 10 mm longa, integra vel leviter undulata, glanduloso puberula. *Flores* in glomerulis axillaribus depositi; *tepala* 5 versus apicem connata, c. 0.5 mm longa; *stamina* 0-1, glabra. *Perianthium* fructiferum cartilagineum, late obtriangulare, c. 2 mm latum, apice applanato, marginis dentatis vel breviter laceratis, tepalis firme connatis. *Pericarpium* diaphanum, nitidum, glabrum. *Semen* erectum, lenticulare, c. 0.7 mm longum, margine rotundato.

Typus: 65 mi [104.6 km] W of Henbury HS on road to Kings Canyon, 10 Dec. 1968, *P. K. Latz* 255 (holo: AD; iso: CBG, NT).

Annual or (short-lived) perennial *herb*, prostrate or ascending, with numerous stems arising from rootstock, aromatic. *Stems* slender, pilosulose with both slender segmented and sessile to shortly stipitate gland-tipped hairs. *Leaves* slightly fleshy;

lamina elliptic c. 10 mm long, obtuse, entire or slightly undulate, glandular puberulous all over and pilosulose below along veins; *petiole* slender about half length of lamina. *Inflorescence* of discrete axillary glomerules. *Flowers* ebracteate, subsessile, bisexual and female (the terminal always bisexual), ovoid, c. 0.5 mm high; *tepals* 5, united to near apex, hirtellous on midrib; *stamen* 0-1, glabrous, anther shortly exserted. *Fruiting perianth* cartilaginous, broadly obtriangular in plain view, flat above (or the lobes slightly ascending), lateral margins toothed or shortly lacerate, shortly hirtellous, white or black, c. 2 mm wide, the tepals firmly united to apex. *Pericarp* diaphanous, glossy, glabrous. *Seed* erect, lenticular c. 0.7 mm high, margin rounded (neither grooved nor keeled).

QUEENSLAND: Thylungra, *S. L. Everist* 5717 (CANB); Oakham Stn., Windorah, 28 Aug. 1959, *R. S. Stranger* (BRI).

NEW SOUTH WALES: Near Mt Murchison, Jan. 1887, *R. H. Kennedy* (MEL); Calindry Stn., *J. H. Leigh* W183 (NSW).

SOUTH AUSTRALIA: NE corner of Lake Gairdner, *B. Lay* 341 (AD); 61 km E of Dalhousie Springs, *T. R. N. Lothian* 1917 (AD); 10 km W of Quinyambi HS, *D. J. E. Whibley* 3557 (AD).

NORTHERN TERRITORY: Old Andada Homestead, *A. C. Beauglehole* 27967 (NT); 5 mi [8 km] SE of Harper Springs Homestead, *G. Chippendale* (NT 6468).

Distribution. South-west Queensland, eastern New South Wales, northern and central South Australia, the southern half of the Northern Territory. Map 3.

Habitat. Usually associated with deep red sand.

Specimens of this species have, in Australian herbaria, generally been placed with *Chenopodium cristatum*, in some cases with the suggestion that they may be hybrids with *C. melanocarpum*. *Chenopodium truncatum* differs from *C. cristatum* most obviously in having a fruiting perianth which is truncate above (not with a rostrate apex), the tepals firmly united to apex (not free) and not so markedly crested; the pericarp is glabrous and glossy (not papillate and dull) and the lenticular seed has a rounded margin (not keeled or grooved). From *C. melanocarpum* it differs in having almost entire leaves (not strongly lobed) and in having crested tepals. Seven of the collections (representing about 15 per cent of the total) consisted of mixed material; in five *C. cristatum* was also present, in one *C. melanocarpum*, and in the other *C. pumilio*. This suggested that *C. truncatum* was of hybrid origin. However, most sheets of this species contained more than one specimen and in no case was there any evidence of introgression. In addition hybrids between *C. cristatum* and *C. melanocarpum* which I have observed on sheets of mixed material have a different appearance, being intermediate in morphology in both leaf and fruit characters.

The illustration provided by Aellen (1933) for the fruiting perianth of *C.* x*bontei* var. *submelanocarpum* resembles the fruiting perianth of *C. truncatum* (except for the union of the tepals in the latter). I have examined the two syntypes of var. *submelanocarpum* and find them to be intermediate between *C. melanocarpum* and *C. cristatum* as was stated by Aellen.

The specific epithet refers to the flat upper surface of the fruiting perianth.

23. **Chenopodium pusillum** J. D. Hook., Handb. N. Zeal. Fl. 231 (1864); Cheeseman, Man. N. Zeal. Fl. ed. 2, 407 (1925); Allan, Fl. N. Zeal. 1:228 (1961). *Type citation:* 'Sandy shores of Lake Taupo'. Type: *Colenso* (K, n.v.).

[*C. pumilio* auct. non R.Br.: J. D. Hook., Fl. Nov.-Zel. 1:214 (1853).]

Small decumbent *annual* with wiry stems radiating from base, c. 10 cm diam., pilose with simple segmented hairs and with sessile or subsessile gland-tipped hairs, aromatic. *Leaves* somewhat fleshy; *lamina* suborbicular to broadly ovate, obtuse, c. 5 mm long, entire or sparsely and bluntly dentate, sparsely puberulous above, glandular puberulous below; *petiole* c. half length of lamina. *Flowers* in compact axillary glomerules, shortly pedicellate; *tepals* 4, erect, c. 0.5 mm long, membranous apart from the narrowly oblong midrib, united in lower half, pilose, eventually enlarging to 1 mm long but not obscuring fruit. *Stamen* 1. *Pericarp* membranous, free from seed. *Seed* compressed obovoid to lenticular, 0.5-0.8 mm long; *testa* glossy, finely puncticulate, dark reddish brown.

NEW ZEALAND: Christchurch, gravel ballast, 23 Feb. 1949, *A. J. Healy* (CHR); Lake Lyndon, *T. Kirk* 1079 (CHR); Marlborough, on formed road, 23 Apr. 1952, *L. B. Moore* (CHR).

Distribution. New Zealand.

Habitat. 'In sandy and open places' (Allan 1961); frequently a coloniser of disturbed sites.

This species has been confused with *Chenopodium pumilio* which it resembles. The two may be distinguished by the much smaller and more orbicular leaves of *C. pusillum*, the 4-merous perianth, and by the membranous margin to its lobes which do not become hardened in fruit. *Chenopodium pumilio* is also found in New Zealand (presumably as an introduction). When growing in the same environment as *C. pusillum*, the two are very similar in habit and general appearance.

24. **Chenopodium saxatile** Paul G. Wilson, sp. nov.

Herba annua erecta subtilis aromatica ad 30 cm alta, pilis debilibus glanduliferis et pilis simplicibus rigidis modice pilosa. *Caulis* et rami tenues. *Folia* alterna; *lamina* chartacea, ovata vel elliptica 10-20 mm longa, integra, sinuata, vel obtuse lobata. *Inflorescentia* paniculata, ramis flexuosis; *flores* aggregati. *Tepala* 4, erecta, naviculiformia, breviter pilosa; *stamina* 0-2, filamento non pulvinato. *Pericarpium* diaphanum ad semen adherens, glabrum vel minute glandulosum. *Semen* erectum, lenticulare, c. 0.6 mm altum; *testa* minute puncticulatum; *embryo* hippocrepiformis ad apicem semine positus; *radicula* inferior.

Typus: 24 km E of Depot Springs HS., 28°54'S, 121° 20'E, Western Australia; base of breakaway; 27 Aug. 1970, *P. G. Wilson* 8909 (holo: PERTH; iso: K).

Delicate erect aromatic annual *herb* to 30 cm high, moderately pilose all over with weak gland-tipped and stiffer simple segmented hairs. *Stem* and branches slender. *Leaves* alternate; *lamina* thin ovate to elliptic, 10-20 mm long, entire, sinuate, or obtusely lobed; *petiole* slender c. half length of lamina. *Inflorescence* paniculate eventually occupying most of plant, composed of open dichasia with flexuose branches which become abbreviated towards apex of plant, the flowers sessile in small clusters. *Flowers* bisexual and female, c. 1 mm high (c. 1.5 mm in fruit); *tepals*

4, erect, naviculiform, shortly pilose, fleshy with membranous margins; *stamens* 0-2, slightly exceeding perianth, filament linear (not pulvinate at base), anther broadly cordate c. 0.25 mm long; *stigmas* 2 filamentous, united into a short style. *Utricle* enclosed in perianth which remains herbaceous in fruit; *pericarp* dull, diaphanous and adherent to seed, glabrous, or minutely glandular. *Seed* erect, lenticular, c. 0.6 mm high; *testa* minutely puncticulate; *embryo* hippocrepiform around apex of seed, radicle inferior. *Fruit* shed while enclosed in perianth.

Distribution. In the central portion of the Eremaean Botanical Province of Western Australia. Map 15.

Habitat. On rocky outcrops and at the base of breakaways.

WESTERN AUSTRALIA: Mt Magnet, Sept. 1903, *W. V. Fitzgerald* (NSW); Pass of the Abencerrages, Rawlinson Ra., *A. S. George* 12137 (PERTH); near Mt Squires, 27 Aug. 1891, *R. Helms* (AD).

Superficially this species would appear to be related to the 4-merous species in the genus *Dysphania* (e.g. *D. rhadinostachya*) but in seed character it is obviously different, being very similar to *Chenopodium pumilio* and its allies of the section *Orthosporum*. Yet even here its placement is uncertain since the other species of this section have flowers arranged in compact glomerules, have one stamen, and normally a 5-merous perianth. Aellen (1939 in sched.) was of the opinion that it was a member of the *Chenopodium botrys* complex, but those species (and others of the section *Botryoides*) differ in having 5-merous perianths and horizontal seeds. In 1956 Brenan described the sect. *Margaritaria* which contained the single species *Chenopodium congolanum* (Haum.) Brenan; this species is similar to *C. saxatile* except that it has whitish sub-globose hairs (as well as glandular) and only one stamen, in addition the terminal flower of each axillary cyme has a horizontal (not vertical) seed. Thus it appears that *C. saxatile* does not fit satisfactorily into any of the presently recognised sections. Rather than create a further section, which would be monotypic, I have expanded the circumscription of the section *Orthosporum* to include this species.

The axillary inflorescence (a dichasium) is similar in morphology to the compact glomerule typical of the sect. *Orthosporum*; its different appearance being due to the more open lateral branches which, towards the base of the plant, themselves branch and become flexuose.

The glandular hairs found in *C. saxatile* appear to be modifications of the normal multicellular trichome; the gland itself being very small and often scarcely observable. This situation is very different to that in the other species of the section where the glandular hairs consist of a large globular gland cell, either sessile or on a short stipe.

The specific epithet refers to rocky situations in which *Chenopodium saxatile* is found.

2. **DYSPHANIA** R. Br.

R.Br., Prod. 411 (1810); Moq. in DC., Prod. 13/2:86 (1849); Benth., Fl. Austral. 5:164 (1870); J. D. Hook in Bentham et J. D. Hook., Gen. Pl. 3:14 (1880) "Illecebraceae"; Pax in Engler et Prantl, Nat. Pflanzenf. 3, 1b:92 (1889) "Caryophyllaceae"; Pax et Hoffmann in Engler et Prantl, Nat. Pflanzenf. ed. 2, 16c:272 (1934)

"Dysphaniaceae"; Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3:748 (1961) "Dysphaniaceae"; Eckhardt in Melchior, A. Engler's Syllabus der Pflanzenf. ed. 12, 2:96 (1964) "Dysphaniaceae"; Airy Shaw in Willis, Dict. Fl. Pl. Ferns ed. 7.387 (1966) "Dysphaniaceae"; A. J. Scott Bot. Jahrb. Syst. 100:217 (1978).—*Chenopodium* sect. *Dysphania* (R.Br.) Aellen, Bot. Jahrb. Syst. 63:486 (1930); J. Black, Trans. Roy. Soc. S. Austral. 58:173 (1934).*Type: D. littoralis* R.Br.

Chenopodium sect. *Tetrasepala* Aellen, Bot. Jahrb. Syst. 63:490 (1930); J. Black, Trans. Roy. Soc. S. Austral. 58:172 (1934).—*Dysphania* sect. *Tetrasepalae* (Aellen) A. J. Scott, Bot. Jahrb. Syst. 100:218 (1978). *Lectotype: C. inflatum* Aellen (see A. J. Scott loc. cit.).

Dysphania sect. *Caudatae* A. J. Scott, Bot. Jahrb. Syst. 100:218 (1978).*Type: D. plantaginella* F. Muell.

Annual or short-lived aromatic perennial *herbs* with subsessile glands or simple and gland-tipped multicellular hairs, aromatic. *Leaves* alternate, simple, entire or variously dissected, fleshy or thin. *Inflorescence* of compact cymose glomerules of flowers (thyrses), these either axillary, spicoid or paniculate in arrangement. *Flowers* ebracteate, minute (0.5 mm long), bisexual and female; *bisexual flowers* (often functionally male) terminal to the glomerule or to each side of the glomerule; *female flowers* lateral. *Tepals* 1-4 (3 or 4 in terminal flowers of glomerule), free or united at base; limb cucullate and often inflated of spongy. *Stamens* 1-2, anterior-lateral in position, somewhat exceeding tepals at anthesis; *filament* slender thickened at base, disc absent. *Ovary* ellipsoid, erect; *stigmas* 1-2, linear, delicate. *Fruit* a nut; *pericarp* diaphanous, smooth to papillate. *Seed* erect, oblique, or horizontal, globular to ellipsoid or laterally compressed; *testa* crustaceous, smooth; *embryo* lateral or basal, situated beneath a groove ("embryo-groove"), radicle either inferior or superior.

Ten species all endemic to mainland Australia.

The taxonomic position of *Dysphania* has been a matter of doubt or disagreement amongst botanists since Brown (1810) first described the genus. Brown considered it to have affinity to the family Chenopodiaceae, in which he placed the genus but evidently with reservations. Moquin (1849) also included it in the Chenopodiaceae (as Salsolaceae) and suggested affinities with *Monolepis* and *Blitum*. Bentham (1870) suggested that it was closely related to the section *Orthosporum* of *Chenopodium* (a view with which I concur). J. D. Hooker (1880) included it in the Illecebraceae and Pax (1889), who was evidently influenced by J. D. Hooker, in the Caryophyllaceae. However, Pax (1927) and later Pax and Hoffmann (1934) placed it in its own family, the Dysphaniaceae, which they considered to be intermediate in morphology between Chenopodiaceae and Caryophyllaceae. This systematic arrangement was adopted by Aellen (1961), Eckhardt (1964 loc.cit.) and Airy Shaw (1966), who all recognised its affinity to the Chenopodiaceae. Aellen had earlier (1930) made *Dysphania* a section of *Chenopodium* as did Black (1934 l.c.).

The close relationship between *Chenopodium* and *Dysphania* appears to have always been recognised by workers in Australia who were familiar with some endemic species of the former genus that were very similar in habit and floral morphology to those of the latter. This relationship was not so evident to European systematists who would have compared species such as *Chenopodium album* with *Dysphania* and found them to be very different. The confusion created by the rather extreme positions taken by several workers was finally resolved by Eckardt (1967, 1968, 1969) and by Scott (1978b). Eckardt showed that the floral morphology of *Dysphania* corresponds to that of *Chenopodium* but is quite different to that found in the

Illecebraceae (or Caryophyllaceae). Even so the circumscription of *Dysphania* remained unsatisfactory for it included only species with three or fewer perianth segments. The addition to the genus by Scott (1978b) of the two species placed by Aellen (1930) in *Chenopodium* sect. *Tetrasepala* was a big improvement for it then became a discrete taxon clearly separable from *Chenopodium*. Scott recognised three sections in *Dysphania*; these were based on the number of perianth segments (1-2, 3, or 4) and the arrangement of the flower clusters (axillary or spicate). These sections appear to be natural ones (although the tepal numbers given by Scott are not always correct) but with so few species it appears to be unnecessary to provide an infrageneric classification.

The genus *Dysphania* is closely related to *Chenopodium* sect. *Orthosporum* (as was recognised by Bentham, 1870). This section has similar glandular hairs and glomerules of small flowers with 4-5 tepals and one stamen. The only characters which suggest that the two genera should be recognised as distinct are found in the seed. In *Dysphania* the seed (when erect) has either a basal or lateral embryo (or it is intermediate in position); when lateral the radicle is either inferior or superior. In *Chenopodium* sect. *Orthosporum* the erect, lenticular seed always has a hippocrepiform embryo curved around its apex. The position of the embryo in the *Dysphania* seed, is indicated by a corresponding depression in the testa; this I am referring to as the embryo-groove. The radicle is situated in a pouch formed by an invagination of the testa; this pouch is usually slightly protruding and, since at this point the testa is thicker, it also appears darker in colour. The orientation of the embry-groove and the position of the pouch are characters useful in recognising the different species.

Key to species

1. Tepals 1-3. 2
   Tepals 4. 10

2. Flowers in glomerules axillary to foliage leaves 3
   Flowers in spike-like inflorescences. 8

3. Tepals (of lateral flowers of glomerules) 1-2; seed erect, ellipsoid to obovoid or laterally flattened 4
   Tepals 3, seed napiform to subglobular . . . . . 5. **D. littoralis**

4. Tepals united at base and shed with the enclosed seed. 5
   Tepals free; seed and tepals shed separately. 6

5. Seed lenticular, embryo curved around its base . . . . . 3. **D. valida**
   Seed obvoid or ellipsoid, embryo lateral . . . . . 1. **D. glomulifera**

6. Seed strongly flattened (usually slightly twisted), obovate to deltoid; pericarp almost smooth. . . . . 4. **D. platycarpa**
   Seed ellipsoid, obovoid, or lenticular; pericarp smooth or glandular-papillate. . 7

7. Pericarp smooth, puncticulate, or minutely papillate; seed ellipsoid to obovoid or lenticular . . . . . 1. **D. glomulifera**
   Pericarp prominently papillate; seed asymmetrically narrow-obovoid (the embryo side flat). . . . . 2. **D. glandulosa**

8. Seed compressed globular, embryo oblique to erect. . . . . 7. **D. sphaerosperma**
   Seed ellipsoid, erect 9

9. Tepals free from each other, rounded or inconspicuously keeled on back . . . . . 6. **D. plantaginella**
Tepals united into a hard cup-shaped tube in lower half, prominently (and horizontally) keeled . . . . . 8. **D. simulans**

10. Plant prostrate or decumbent, many stems arising from base; seed (i.e. pericarp) glossy, compressed globular; inflorescence slender spicate . . . . . 10. **D. kalpari**
Plant erect with one main stem; seed dull (rarely glossy), almost globular; inflorescence paniculate . . . . . 9. **D. rhadinostachya**

1. **Dysphania glomulifera** (Nees) Paul G. Wilson, comb. nov.—*Atriplex glomulifera* Nees in Lehm., Pl. Preiss 1:634 (1844); Moquin in DC., Prod. 13/2:103 (1849); Benth., Fl. Austral. 5:177 (1870); Ulbrich in Engler et Prantl, Nat. Pflanzenf. ed. 2, 16c:515 (1934). *Type*: "In cultis ad caput fluvii Cygnorum, Januario a 1840". *Preiss* 1257 (holo: LD; iso:P).
D. myriocephala Benth., Fl. Austral. 5:165 (1870).—*C. myriocephalum* (Benth.) Aellen, Bot. Jahrb. Syst. 63:488 (1930). *Lectotype*: Western Australia, *J. Drummond* 206 (holo: K n.v.; iso: MEL, P) *lecto. nov.*

D. benthamiana Domin., Biblio. Bot. 89:103 (1925). *Type*: "Flooded ground south of Wills Creek, Howitts Expedition", *Dr Murray* (iso: MEL 19878).

Prostrate, decumbent, or erect annual or short-lived perennial *herb* c. 25 cm diam., to 15 cm high, numerous slender stems arising from base, sparsely covered with sessile or stipitate gland-tipped hairs. *Leaves* fleshy, crowded towards the apex; *lamina* narrow to broad elliptic, (1)5(10) mm long, passing into a slender petiole c. half its length. *Glomerules* of flowers dense, present in most leaf axils. *Terminal flower* (of glomerule) bisexual; *tepals* 3, obovate, cucullate, c. 0.7 mm long, green, fleshy except for scarious margin, glabrous or with a few marginal glandular hairs, shortly united at base or free; *stamens* 2 shortly exserted at anthesis; *style* solitary or paired. *Lateral flowers* (of glomerule) female; *tepals* 1 or 2 with a white bladdery strongly cucullate limb and a filamentous to linear claw; *stamens* absent; *ovary* ellipsoid, delicate; *styles* 1 or 2. *Fruiting perianth*: *tepals* 0.7-1 mm long; *limb* inflated and fungoid covering the fruit. *Pericarp* diaphanous dull, closely adhering to seed, puncticulate, papillate, or granulate. *Seed* erect, bluntly ellipsoid, compressed obovoid, or somewhat lenticular with rounded margins, c. 0.5 mm long; *testa* smooth reddish brown; *embryo* slightly curved extending along the dorsal lateral margin beneath the embryo-groove; *radicle* inferior with the radicular pouch forming a small dark protuberance at base of seed.

Typification. The type of *Dysphania glomulifera* (i.e. *Preiss* 1257) came from near Guildford (c. 15 km east of Perth) in cultivated ground near the Swan River ('in cultis ad caput fluvii Cygnorum'). It is a precise match with the lectotype of *D. myriocephala* (*Drummond* 206) which probably came from the same general area since it is only near here that the particular variant this collection represents has been found. Aellen (1938) recognised that the plant described by Nees (1844) as *Atriplex glomulifera* did not belong to that genus but since Aellen assumed the name to be a synonym of *D. littoralis* R.Br. (1810) he did not make a new combination under *Dysphania*. Very few replicates of *Preiss* no. 1257 appear to exist; neither Moquin (1849) nor Bentham (1870) saw this number (they relied on Nees' description when writing their own works) and both assumed the species to be correctly placed in *Atriplex* although a puzzling member. Moquin (1849) based his description of *D. littoralis* on *Drummond* 206, the lectotype of *D. myriocephala*; therefore his description applies to *D. glomulifera* rather than to the former species.

Key to subspecies

Seed compressed obovoid to bluntly lenticular; pericarp smooth (rarely papillate) . . . . . la. subsp. **glomulifera**

Seed ellipsoid; pericarp granulate lb. subsp. **eremaea**

la. subsp. **glomulifera** Figure 6A.

D. myriocephala Benth., op. cit.—*Chenopodium myriocephalum* (Benth.) Aellen, op. cit.

Lateral flowers of glomerules: *tepals* 1(2); *claws* filiform to linear, readily separating from pedicel (and from opposite member where present); *styles* (1)2. *Seed* broadly compressed obovoid to bluntly lenticular; *pericarp* smooth or minutely puncticulate (rarely papillate).

QUEENSLAND: Moonie Ponds, *S. L. Everist* 3718 (BRI); Cunnamulla, *P. Martensz* 62 (CANB).

NEW SOUTH WALES: Near Booligal, *E. M. Canning* 3859 (CBG); Coolabab, *W. E. Mulham* W857 (NSW).

VICTORIA: 15 mi [24.1 km] NE of Hattah, *A. C. Beauglehole* 40569 (PERTH); Lake Eildon, 14 May 1973, *J. H. Willis* (MEL).

SOUTH AUSTRALIA: Loxton, *Hj. Eichler* 12326 (AD); Lenswood, *A. G. Spooner* 5174 (AD).

WESTERN AUSTRALIA: Guildford, 12 Aug. 1901, *C. R. P. Andrews* (NSW); Leederville, Mar. 1967, *I. S. Hutchinson* (PERTH).

Distribution. Near Perth in Western Australia, south-eastern and north-eastern South Australia, Victoria, eastern New South Wales and Queensland. Map 17.

Habitat. Principally along banks of freshwater streams or rivers and in muddy areas. Some ecotypes in forest areas, rocky hillsides, or as weeds of cultivation.

lb. subsp. **eremaea** Paul G. Wilson, subsp. nov. Figure 6B.

D. benthamiana Domin., op. cit.

Flores laterales: *tepala* 2, limbis multo inflatis fructum obtegenti; *stylus* plerumque solitarius. *Semen* obtuse ellipsoideum; *pericarpium* granulatum.

Typus: Commonwealth Hill Stn. by windmill enclosure in Monsoon Paddock, 55 mi [88.5 km] W of Homestead, South Australia, 19 Feb. 1965, *D. E. Symon* 3380 (holo: ADW 29626; iso: CANB n.v., K n.v.).

Lateral flowers of glomerules: *tepals* 2; *claws* narrow-oblong, sometimes shortly united at base with opposite member; *limbs* strongly inflated and completely covering fruit; *style* slender, solitary (rarely paired). *Seed* bluntly ellipsoid; *pericarp* granulate. *Fruit* usually shed while surrounded by the tepals which often remain attached to each other by their claws or by their apices.

QUEENSLAND: Birdsville, *S. T. Blake* 12224 (BRI); Boorara Stn., *R. C. Carolin* 4035 (SYD).

NEW SOUTH WALES: Wansaring, *L. A. S. Johnson* 547/125 (NSW); Wanheroo Hills, *P. G. Milthorpe* 1915 (NSW).

SOUTH AUSTRALIA: Coglin River, *Basendow* 7 (AD); Millars Ck. Stn., *R. J. Chinnock* 2573 (AD).

WESTERN AUSTRALIA: 22 mi [35.4 km] W of Browne Ra., *A. S. George* 5417 (PERTH); 18 mi [29 km] E of Meekatharra, *T. E. H. Aplin* 2460 (PERTH).

NORTHERN TERRITORY: Redbank Gorge, *G. Chippendale* (N T 4878); Mt Doreen Stn., *P. K. Latz* 2002 (NSW).

Distribution. South-West and central Queensland, north-west New South Wales, northern South Australia, central Western Australia, southern portion of the Northern Territory. Map 17.

Habitat. Damp sand near freshwater.

The typical variants of the two subspecies of *D. glomulifera* are quite distinct (at least as to microscopic characters) but there are numerous other variants which blur the separateness and provide additional characters that extend the morphological complexity. Since the distinguishing features are so small (and fragile) and appear to be subject to environmental modification, it appears unwise to treat the two taxa at the species level or to formally recognise further infraspecific groups.

Near the Murray River in Victoria are found two variants of subsp. *glomulifera*; in one the pericarp is smooth and in the other it is papillate. There do not appear to be other morphological characters which might support the recognition of these variants as distinct taxa. The variant with papillae on the pericarp may be readily distinguished from *D. glandulosa* by the shape of the seed.

The variant of subsp. *glomulifera* found in central and eastern New South Wales and in central and eastern Queensland, has a bluntly lenticular seed. This variant may be clearly separated from *D. valida* by its free (or almost free) tepals and by the embryo being lateral, not basal, in position.

The subspecies *eremaea* represents the plant referred by Aellen (1930) to *Chenopodium blackianum,* and by J. M. Black (1948) to its nomenclatural synonym *Dysphania littoralis.* Most Australian herbaria have followed Black in their misapplication of the latter name. Domin (1925) appears to have recognised the two taxa as distinct and described as a new species, *Dysphania benthamiana,* the plant here called subsp. *eremaea.* Unfortunately Domin incorrectly made *D. myriocephala* a synonym of *D. littoralis* (as *'D. litoralis'*) although he cited no material of that taxon; he also failed to recognise the critical characters which distinguished the species in this group. *Dysphania glomulifera* subsp. *eremaea* is, in fact, quite distinct from *D. littoralis* for in the latter species all flowers have three tepals firmly united at their base and deciduous together with the enclosed fruit, while the seed is sub-globular and the embryo horizontal.

The illustration of *'Dysphania litoralis'* provided by F. Mueller (1889-1891 t. 36), was evidently intended to portray the plant here referred to *D. glomulifera* subsp. *eremaea.* Unfortunately it would appear that the artist either exercised considerable licence or obtained material from several species and combined their different features in the one plant. In addition, the seed has been drawn incorrectly; the embryo

is indicated as being on the opposite side to that of the longitudinal groove (whereas it lies beneath it) and the radicular pouch is placed in an apical position (instead of basal) although the radicle itself is correctly illustrated as being inferior.

The infraspecific epithet is derived from the Greek word *eremia,* a desert, alluding to the typical habitat of this plant.

2. **Dysphania glandulosa** Paul G. Wilson, sp. nov. Figure 6C.

Herba prostrata; *caules* numerosi graciles ad basim exorientes. *Folia* parva, lamina anguste elliptica c. 3 mm longa. *Flores* in glomeratis axillaribus in fructu c. 1 mm diam. *Flos terminalis* hermaphroditus; *tepala* 3, libra; *stamina* 2; *styli* 2. *Flores laterales* feminei; *tepala* (1)2, libra, c. 0.5 mm longa, delicatissima, fructu imperfecte obtegentia. *Pericarpium* diaphanum, papillis prominentibus glanduliformibus ornato. *Semen* asymmetrice semi-obovoideum (latere embryonis plano), c. 0.3 mm longum, apice rotundato.

Typus: 28 km NE of Nambi Homestead which is 65 km NNE of Leonora (28°8'S, 121°43'E); prostrate in red loam; 29 Aug. 1968, *P. G. Wilson* 7503 (holo: PERTH).

Prostrate annual *herb* c. 20 cm diam., numerous slender stems arising from base and giving rise to many lateral branches, sparsely pilosulose all over (except inflorescence) with simple and glandular multicellular hairs. *Leaves* small, slightly fleshy; *lamina* narrow-elliptic, c. 3 mm long; *petiole* equal to lamina. *Inflorescence* of axillary glomerules as in *D. glomulifera;* glomerules (in fruit) c. 1 mm diam. *Terminal flower* of glomerule bisexual; *tepals* 3, free, the two anterior-lateral 0.4 mm long in fruit and larger than the posterior; *stamens* 2 opposite anterior-lateral tepals; *styles* 2, slender, c. 0.1 mm long. *Secondary terminal flowers* (when present) similar to terminal but with two tepals and one stamen. *Lateral flowers* female, tepals (1) 2, free, 0.5 mm long (in fruit), very delicate and incompletely covering fruit; *limb* strongly cucullate, slightly inflated, emarginate with a scarious margin; *claw* linear ±equal to limb. *Pericarp* diaphanous, covered with prominent gland-like papillae. *Seed* erect, asymmetrically semi-obovoid (the embryo-side flat), c. 0.3 mm long. apex rounded; *testa* smooth, reddish brown; *embryo-groove* longitudinal along flattened side of seed; *embryo* lateral, erect, radicle inferior. *Infructescence* disintegrating at maturity into separate tepals and fruits.

WESTERN AUSTRALIA: Glenorn Street, August 1938, *N. T. Burbidge* (PERTH); Belele Station, *D. W. Goodall* 3351 (PERTH).

Distribution. West-central area of Western Australia. Map 18.

Habitat. Loam; seasonally waterlogged areas.

Dysphania glandulosa may be distinguished from *D. glomulifera* (to which it appears to be most closely related) by its relatively small leaves, its small tepals (which do not completely cover the apex of the fruit), its strongly papillate pericarp, and by the shape of its seeds. One variant of *D. glomulifera* subsp. *glomulifera* also has papillae on the pericarp but in this plant the seed is broadly compressed-obovoid or lenticular whereas in D. glandulosa it is asymmetrically obovoid (flattened on the side bearing the embryo-groove).

The specific epithet alludes to the gland-like appearance of the papillae on the surface of the pericarp.

3. **Dysphania valida** Paul G. Wilson, sp. nov.

Herba perennis, prostrata, caulibus aliquot per radicem orientibus. *Folia* crassiuscula; *lamina* anguste oblonga vel anguste elliptica, integra, 10-15 mm longa. *Flores* in glomeratis axillaribus 3-5 mm diam. *Flos terminalis* masculinus; *tepala* 3 ad basim breviter connata; *stamina* 2; *pistillodium* minutum. *Flores laterales* feminei; *tepala* 2, in fructu c. 1.3 mm longa, ad basim breviter connata, limbo inflato obovoideo cucullato, unguide breviter oblongo; *styli* 2. *Pericarpium* diaphanum laeve. *Semen* erectum, lenticulare, c. 0.6 mm altum; *embryo* semicircularis basalis; *radicula* cotyledonesque erectae.

Typus: Warrego District, near Morven; hard red box-sandalwood country; common; 6 April 1941; *C. T. White* 11895 (holo: BRI 061936).

Short-lived herbaceous perennial, prostrate, to 60 cm diameter, almost glabrous to sparsely pilose with short, multicellular, simple or gland-tipped hairs. *Stems* several, slender, arising from rootstock. *Leaves* somewhat fleshy; *lamina* entire, narrow-oblong to narrow-elliptic, obtuse, 10-15 mm long; *petiole* slender c. half length of lamina. *Glomerules* of flowers dense, axillary, 3-5 mm diam. *Terminal flower* (of glomerule) functionally male; *tepals* 3 shortly united at base; *stamens* 2 opposite anterior-lateral tepals; *pistillode* minute, c. 0.2 mm high. *Lateral flowers* (of glomerule) female; *tepals* 2, at fruiting stage with an inflated obovoid cucullate limb scarious at the margin and a short broad claw united to opposite member at base, in all c. 1.3 mm long, glabrous or sparsely pilose with gland-tipped hairs; *styles* 2, short and delicate. *Pericarp* diaphanous, smooth, adherent to seed. *Seed* erect, lenticular, c. 0.6 mm long; *testa* smooth; *embryo* semicircular occupying lower 2/3 of seed; *radicle* and cotyledons erect; *raphe* extending from apex to base of seed. *Infructescence* breaking up at maturity to release fruit enclosed in the persistent tepals.

QUEENSLAND: Morven, *S. T. Blake* 10914 (BRI); Eulo, August 1967, *M. Law* (BRI).

Distribution. Southern Queensland (south of 26° latitude). Map 19.

Habitat. Collections have been noted as coming from "cultivation paddock in forest soil", hard red box-sandalwood country, and "timbered, rocky, sandy hilltop".

This species is similar to *D. littoralis* in its habit and in its firmly united tepals; it differs most obviously in the female flowers possessing only two tepals, in the lenticular seed and in the basal embryo. From *D. glomulifera* it differs in having larger tepals and again in its seed shape and embryo position.

The specific epithet *valida* is a Latin word meaning strong, and alludes to the firmly united tepals.

4. **Dysphania platycarpa** Paul G. Wilson, sp. nov. Figure 6D.

Herba prostrata sparse pilosulosa. *Folio* fere glabra; *lamina* elliptica 5-10 mm longa. *Flores* in glomeratis axillaribus in fructu c. 2-5 mm diam. *Flos terminalis* hermaphroditus; *tepala* 3, libra, c. 1 mm longa, prominente cucullata; *stamina* 2; styli 2, perbreves. *Flores laterales* feminei; *tepala* 1 vel 2, c. 0.7 mm longa. *Semen* erectum, applanatum, obovatum vel deltoideum, c. 0.4 mm longum, leviter tortum vel lateribus concavis; *embryo* lateralis, radicula inferiori. *Pericarpium* minute granulatum.

Typus: West of Western Australia—Northern Territory border at 23°10'S; edge of claypan, prostrate, 26 July 1967, *A. S. George* 8927 (holo: PERTH).

Prostrate annual *herb* to 20 cm diam., sparsely pilosulose with simple or glandular multicellular hairs, numerous slender mostly simple stems arising from base. *Leaves* slightly fleshy, almost glabrous; *lamina* elliptic, obtuse, 5-10 mm long; *petiole* slender, ± equal to lamina. *Glomerules* of flowers dense, axillary, c. 2.5 mm diam. in fruit. *Terminal flower* of glomerule bisexual; *tepals* 3, free, c. 1 mm long, prominently cucullate, claw filiform; *stamens* 2 opposite and ± equal to anterior-lateral tepals; *styles* 2, very short; *secondary terminal flower* similar to but slightly smaller than terminal with two tepals and one stamen. *Lateral flowers* female; *tepals* 1 or 2, strongly cucullate in fruit with delicate white inflated limb and a filamentous claw, in all c. 0.7 mm long. *Pericarp* diaphanous, minutely granulate, intimately adherent to seed. *Seed* erect, obovate to deltoid, flat, c. 0.4 mm long, slightly twisted or with faces sunken; *testa* dull reddish brown; *embryo* lateral, radicle inferior. *Infructescence* readily breaking up when mature into separate tepals and seeds.

QUEENSLAND: Birdsville, *S. T. Blake* 12224 (BRI); Currawilla, *S. L. Everist* 3977 (CANB).

NEW SOUTH WALES: Broken Hill district, *A. Morris* 890 (ADW, NSW); Sturt Nat. Park, *W. E. Mulham* W937 (NSW).

SOUTH AUSTRALIA: 13 km NW of Quinyambie H.S., *N. N. Donner* 3593 (AD); Abminga, *E. H. Ising* 2397 (AD).

WESTERN AUSTRALIA: W of W.A.—N.T. border at 23°10'S, *A. S. George* 8927 (PERTH).

NORTHERN TERRITORY: Mulga Park Stn., *T. S. Henshall* 134 (MEL); Andado Stn., *P K. Latz* 6826 (NT).

Distribution. Central Australia; South-west Queensland, extreme western New South Wales, central, northern and north-east South Australia, extreme west-central Western Australia, south eastern Northern Territory. Map 20.

Habitat. In clay or mud by fresh water.

Dysphania platycarpa may be readily distinguished from related species (i.e. *D. glomulifera, D. glandulosa*, and *D. littoralis*) by the slender claws to the tepals and by the peculiar fruit. This fruit, unlike that of all other *Dysphania* species, is flat but slightly twisted (or sunken on the broad faces), and the pericarp is minutely granulate.

The specific epithet is derived from two Greek words *platy*, broad, and *carpos*, fruit, with reference to the shape of the seed.

5. **Dysphania littoralis** R.Br., Prod. 412 (1810). —*Chenopodium blackianum* Aellen, Bot. Jahrb. Syst. 63:487 (1930) based on above, non *C. littorale* (L.) Thunb. (1815). *Type*: Port I [near Gladstone], Queensland, 6 August 1802, *R. Brown* (holo: BM; iso: K), see comment below. Figure 7B.

Prostrate annual (or perennial?) *herb* with fleshy taproot, c. 30 cm diam., sparsely pilosulose with simple or gland-tipped multicellular hairs, numerous slender, mostly simple, radiating stems arising from base. *Leaves* somewhat fleshy; *lamina* elliptic

obtuse, 5-10 cm long, petiole slender somewhat shorter than lamina. *Glomerules* of flowers axillary, dense, c. 2 mm diam. *Terminal flower* (of glomerule) male; *tepals* 3, one posterior and two anterior-lateral, shortly united at base, obovate, the limb inflated, in all c. 1.3 mm long; *stamens* 2 opposite the anterior-lateral tepals, anther c. 0.3 mm long; *pistillode* minute c. 0.2 mm high with a pair of short styles. *Secondary terminal flower* (when present) similar to the terminal but with only one stamen. *Lateral flowers* female; *tepals* 3 (4), at fruiting stage obovoid, very inflated (fungoid), without a scarious margin, white, claw narrow oblong somewhat shorter than the limb, in all c. 0.8 mm long; *style* 1 (rarely 2), slender. *Pericarp* diaphanous, smooth, glossy, closely adherent to the testa. *Seed* napiform to depressed globular, horizontal to oblique, 0.3-0.4 mm high, slightly furrowed over the horizontal embryo; *testa* smooth, reddish brown, raphe extending from radicle to base of seed. *Infructescence* breaking up when mature to release the seed enclosed in the three persistent tepals.

QUEENSLAND: Gladstone, *A. Dietrich* 2417 (MEL); Curtis Is., *S. T. Blake* 22525 (BRI).

NEW SOUTH WALES: Idalia, South Wanaaring, *P. L. Milthorpe* and *G. M. Cunningham* 4768 (NSW).

WESTERN AUSTRALIA: Upper Murchison, 1890, *I. Tyson* (MELU).

Distribution. Northern New South Wales; south eastern and east coastal Queensland; possibly the Murchison River district of Western Australia (see comment below). Map 18.

Habitat. The coastal variant in tidal mud flats; the inland variant in loam in open forest.

The name *Dysphania littoralis* has been used loosely to include *D. glomulifera* or, when the latter species has been recognised (usually as *D. myriocephala*), has been applied to the inland plant here referred to *D. glomulifera* subsp. *eremaea*. The two species are quite distinct: in *D. littoralis* the lateral flowers have three (rarely four) tepals which remain united at their base and the seed is turnip-shaped with a horizontal to oblique embryo; in *D. glomulifera* (and in the related species *D. glandulosa, D. platycarpa,* and *D. valida*) the lateral flowers have one or two tepals and the seed and embryo are erect.

The illustration under the name 'D. litoralis' provided by F. Mueller in his Icon. Austral. Salsol. Pl. tab. 36 (1890) was evidently derived from several collections, possibly none of which were of this species. For further discussion see under *D. glomulifera*..

The specimen collected by *Isaac Tyson* from the upper Murchison River is the only record of this species from Western Australia, while it has not been recorded from the Northern Territory, South Australia, or western Queensland.

The type of *Dysphania littoralis* was collected by *Robert Brown* on coastal mudflats in the tropics near Gladstone in Queensland. Material which matches the type comes from such habitats in Queensland along its east coast. A variant very similar to the type form has been collected at inland localities in southern Queensland and north-west New South Wales and here grows in quite different habitats such as 'mixed open forest, sandy soil' and 'hard red soil'. It is possible that the inland

ecotype should be recognised as a distinct taxon but, since I am unable to find clear morphological differences on which such a recognition could be based, I have included both variants under the same name.

Typification. George Bentham (1870) stated that Robert Brown had collected the type while running from some Aborigines, a comment that may relate to a note in Brown's unpublished diary in which he records an attack having taken place at Keppel Bay on 16 August 1802. However, in his manuscript Flora, Brown states that the collection was made at 'Port I' on 6 August 1802, which information is also given on the labels of the holotype and isotypes in the herbaria BM and K. Port I is near the present port of Gladstone and about 50 km SE of Keppel Bay.

6. **Dysphania plantaginella**, F. Muell., Fragm. 1:61 (1858).—*Chenopodium plantaginellum* (F. Muell.) Aellen, Bot. Jahrb. Syst. 63:487 (1930). *Lectotype:* Sturts Creek, Australia sub-centralis, March 1856, *F. Mueller* (MEL 19916) *lecto. nov.* Figure 7E.

Annual *herb* with several prostrate to ascending stems arising from base. *Stems* sparingly branched, pilose with multicellular hairs. *Leaves* sparsely pilose and with sessile glandular hairs; *lamina* elliptic to broadly elliptic, entire, obtuse, 1-2 cm long, base cuneate passing into a short petiole. *Inflorescence* of terminal, shortly pedunculate, very narrowly cylindrical usually erect spikes composed of continuous (or interrupted) globular dichasial cymes; *bracts* solitary beneath each globular cluster, with an inflated cucullate rostrate limb and a slender claw, in all c. 1 mm long. *Flowers* with a slender pedicel 0.3-0.5 mm long. *Terminal flower* (of dichasial cyme) bisexual; *tepals* 3, free but remaining attached to pedicel, erect, limb concave and strongly inflated with a rounded to spreading keel, ciliolate otherwise glabrous, closely enveloping seed; *stamen* solitary opposite an anterior-lateral tepal; *style* slender, solitary. *Lateral flowers* (of dichasial cyme) numerous, female, otherwise similar to terminal flower. *Pericarp* diaphanous, faintly areolate otherwise smooth. *Seed* ellipsoidal, erect, c. 0.5 mm high; embryo erect, lateral and basal beneath a longitudinal groove, the radicle inferior; *testa* smooth, reddish brown. *Infructescence* breaking up when mature at base of pedicels to release seed enclosed within the three tepals.

NEW SOUTH WALES: 23 km NNW of Conoble Rly Stn., *J. Pickard* 1943 (NSW).

SOUTH AUSTRALIA: Koonamore Stn., *Hj. Eichler* 17177B (AD); 2 mi [3.2 km] SE of Oodnadatta, *A. C. Beauglehole* 20839 (AD).

WESTERN AUSTRALIA: Nita Downs Stn., *R. A. Saffrey* 1680 (PERTH); 32 km W of Gascoyne Junction, *P. G. Wilson* 8424 (PERTH).

NORTHERN TERRITORY: 30 mi [48.3 km] N of Willowra HS, *G. Chippendale* (NT4739); 6 mi [9.7 km] S of Hermannsburg Mission, *P. K. Latz* 793 (AD).

Distribution. Central New South Wales north westwards through central and northern South Australia, the Northern Territory to northern and north western Western Australia. Map 18.

Habitat. Sand, either coastal or on the margin of waterholes and inland saltlakes.

Dysphania plantaginella is rather variable in its morphology, the dichasial cymes sometimes forming discrete globular clusters with rounded dorsal margins to the tepals, and sometimes forming an apparently continuous spike, with slightly spread-

ing keels to the tepals. In addition, whereas most collections appear to have erect spikes, in a few these are quite prostrate. These variants are not clearly defined so it seems unwise to establish infraspecific taxa to accommodate them. In view of the variety of habitats in which this species is found several ecotypes might be involved.

Dysphania plantaginella is evidently closely related to *D. sphaerosperma* but differs most obviously in seed shape and in the nature of the pericarp. In *D. plantaginella* the seed is ellipsoidal and the pericarp areolate (marked out in a fine reticulate pattern) whereas in *D. sphaerosperma* the seed is compressed-globular and the pericarp minutely granular-papillate.

7. **Dysphania sphaerosperma** Paul G. Wilson, sp. nov. Figure 6E-F.

Herba prostrata vel ascendens; *caules* numerosi ad basim exorientes. *Folia* pilosulosa; *lamina* elliptica obtusa integra vel undulata 0.5-1.5 cm longa. *Inflorescentia* spicata; *spicae* breviter pedunculata, anguste cylindraceae ad 15 cm longae, cymarum congestorum compositae. *Flores* fere sessiles vel pedicello crasso c. 0.1 mm longo instructi. *Flos terminalis* hermaphroditus (vel femineus); *tepala* 3, c. 1 mm longa, libra; *stamen* solitarium; *stylus* solitarius gracilis. *Pericarpium* diaphanum, minute granulatum. *Semen* compresse globulare c. 0.5 mm alte; *embryo* semicircularis obliques vel erectus, radicula inferiore. *Tepala fructum* cingentia persistentia.

Typus: Upper reaches of Turner River, Woodstock Stn., south of Port Hedland, Western Australia; travertine ridge near river, ascendent herb, 28 April 1958, *N. T. Burbidge* 5924 (holo: CANB 53651; iso: AD).

Annual *herb* with several prostrate to ascending stems arising from base. *Stems* sparingly branched, pilosulose with multicellular hairs; *lamina* elliptic, obtuse, entire or undulate 0.5-1.5 cm long, passing into a short petiole. *Inflorescence* of terminal, shortly pedunculate, narrowly cylindrical spikes to 15 cm long, composed of congested dichasial cymes of 3 to several flowers; *bracts* (beneath each cyme) with an inflated cucullate rostrate limb and a slender claw, in all c. 1 mm long. *Flowers* almost sessile or with a short thick pedicel c. 0.1 mm long. *Terminal flower* (of cyme) bisexual (or female); *tepals* 3, c. 1 mm high in fruit, free but remaining attached to pedicel, deeply cucullate and inflated with a rounded inflated limb and a short broad claw, glabrous except for a few sessile glands towards the margins; *stamen* solitary opposite an anterior-lateral tepal; *style* solitary, slender. *Lateral flowers* (of cyme) similar to terminal flower but female. *Pericarp* diaphanous, minutely granulate papillose. *Seed* compressed globular c. 0.5 mm high; *embryo* semicircular, oblique or erect, lying beneath a deep median groove, the radicle inferior; *testa* smooth, reddish brown. *Infructescence* breaking up when mature with flowers dehiscing at base of pedicels releasing the seeds enclosed in the three tepals.

WESTERN AUSTRALIA: Wolf Meteorite Crater, *A. C. Beauglehole* 47376 (PERTH); Dirk Hartog Is., *A. S. George* 11413 (PERTH).

NORTHERN TERRITORY: Curtin Springs Stn., *T. S. Henshall* 728 (NT); Lake Neale, *P. K. Latz* 2673 (NT).

Distribution. Shark Bay area on the west coast of Western Australia eastwards to the southern area of the Northern Territory. Map 21.

Habitat. Possibly always associated with gypseous or calcareous soil, frequently around salt lakes.

Dysphania sphaerosperma is similar in appearance to *D. plantaginella*; it differs in having rounded inflated tepals (not keeled), a very short thick pedicel, and subglobular seeds with a minutely granulate-papillose pericarp. Several herbarium collections consist of plants with only female flowers.

The specific epithet is derived from the Greek words *sphaera*, a sphere, and *sperma*, a seed, referring to the almost globular seeds.

8. **Dysphania simulans** F. Muell. et Tate ex Tate, Trans. Roy. Soc. S. Austral. 8:71 (1886).—*Chenopodium simulans* (Tate) F. Muell., Sec. Syst. Census 50 (1889); J. Black, Trans. Roy. Soc. S. Austral. 58:174 (1934). *Type*: Gypsum and salt flats in the spring country, Cootanoorina, *M. Murray* (holo: AD; iso: MEL, NSW, PERTH).

C. osbornianum Aellen, Bot. Jahrb. Syst. 63:488 (1930). *Type*: "Koonamore Head Station, 1914", *T. G. B. Osborn* (holo: G n.v.; iso: AD96630144).

Annual *herb* with several decumbent to ascending branches arising from its base and from below the inflorescences, 10-30 cm high, pubescent with simple multicellular hairs on branches, petioles, and inflorescence axes, and sessile glandular hairs on leaves and flowers. *Leaves* early deciduous; *lamina* chartaceous, elliptic, 1-2 cm long, with 2-4 pairs of prominent obtuse lobes, apex obtuse to acuminate, base cuneate and passing into a slender petiole somewhat shorter than lamina. *Inflorescence* an erect narrowly cylindrical spike 5-20(30) cm long, 4 mm diam., sessile at points of branching of stem, composed of densely arranged normally 7-flowered dichasial cymes; *bracts* (beneath each cyme) with an inflated strongly cucullate rostrate limb and a slender claw, in all c. 1 mm long. *Terminal flower* (of cyme) large and sessile, bisexual; *tepals* 3, cucullate, c. 1 mm long, united in lower half into an indurated strongly papillose cup-shaped tube; *stamen* solitary in axil of an anterior-lateral tepal; *styles* 2, slender. *Lateral flowers* (of cyme) female otherwise similar to, although smaller than, terminal flower. *Fruiting perianth* cartilaginous (especially at the cup-shaped base), at first firmly attached to axis; *tepal limbs* produced into spreading horizontal hyaline wings, in all 2 mm high and wide. *Seed* erect, broadly pear-shaped, c. 0.6 mm high; *embryo* vertical extending along one side and around base of seed; *Radicle* superior occupying the small dark-coloured terminal apiculum; *raphe* extending from apex to base. *Infructescence* tardily breaking up, the seed enclosed in the cartilaginous perianth which eventually splits into its separate components.

QUEENSLAND: Lake Crocker, 28 June 1939, *R. L. Crocker* (AD); Poeppel Corner, *D. E. Boyland* 237 (NSW).

NEW SOUTH WALES: 63 mi [101.4 km] SE of Wanaaring, *W. E. Mulham* W445 (NSW).

VICTORIA: 28.8 km W of Nowingi, 29 July 1979, *J. M. Browne* (MEL).

SOUTH AUSTRALIA: Koonamore Stn., *M.D. Crisp* 709 (AD); Oodnadatta, 8 Apr. 1950, *E. E. Lord* (MEL).

WESTERN AUSTRALIA: 37 km N of Agnew, *D. Symon* 9941 (ADW); 30 km NE of Nambi HS., *P. G. Wilson* 7499 (PERTH).

NORTHERN TERRITORY: 11 km SW of Erldunda Stn., *T. S. Henshall* 46 (NT); Mt Wedge Stn., *P. K. Latz* 2146 (AD).

Distribution. Central Australia; south-west Queensland, north-west New South Wales, north-east South Australia, east central Western Australia, southern portion of the Northern Territory. Map 21.

Habitat. Saline (halitic), gypseous, or calcareous soil, often on margin of salt lakes.

The densely arranged cymes form long terminal 'mouse-tail' inflorescences which, because of their erect and sessile habit, give the plant a candelabrum aspect. This, and the indurated cup-shaped base to the perianths, make *Dysphania simulans* a very distinctive species.

The illustration by Graff provided by Mueller in his Icon. Austral. Salsol. Pl. tab. 34 (1890) well portrays the species; however, it shows the embryo incorrectly with the cotyledons occupying the terminal apiculum whereas, in fact, this area is filled by the radicle. The orientation of the embryo is thus the reverse to that found in *D. plantaginella* (which has a similarly shaped seed); this is because the embryo differs in its position by 180° to that which it occupies in *D. plantaginella* causing the hilum to be moved near the apex of the seed and the raphe to elongate. The illustration (tab. 34) showing an incorrect orientation of the embryo appears to have been directed by Mueller from a specimen of A. Henry from Georgina River (MEL 19933) for there are some pencil sketches by Mueller in which he evidently instructed Graff on the fine detail of the fruit.

9. **Dysphania rhadinostachya** (F. Muell.) A. J. Scott, Bot. Jahrb. Syst. 100:218 (1978).—*Chenopodium rhadinostachyum* F. Muell., S. Sci. Rec. 2:98 (1882); F. Muell., Icon. Austral. Salsol. Pl. t. 33 (1890) p.p. *Type*: Finke River, 1881, *H. Kempe* 413 (holo: MEL 20098). Figure 7C-D.

Chenopodium rhadinostachyum var. *paniculatum* F. Muell. et Tate, Trans. Roy. Soc. S. Austral. 16:345 (1896) nomen.

Chenopodium inflatum Aellen, Bot. Jahrb. Syst. 63:490 (1930).— *D. inflata* (Aellen) A. J. Scott, Bot. Jahrb. Syst. 100:218 (1978). *Lectotype*: Bulloo Range, 29 August 1923, *MacGillivray* (holo: G n.v.; iso: ADW 17774, BRI 010647) *lecto. nov.*

Erect *herb* to 30 cm high with a single main stem, copiously branched above the base, moderately pilose all over with short glandular and longer segmented hairs, aromatic. *Leaves* thin; *lamina* elliptic, 10-20 mm long, undulate or with a few obtuse lobes, base cuneate and passing into a slender petiole. *Inflorescence* of axillary and terminal leafy or spike-like thyrses which occupy nearly the whole plant and are composed of compact dichasial cymes of 3-7 flowers subtended by a bract. *Bracts* of the inflorescence either foliaceous and shortly exceeding cymes or very reduced, narrowly ovate acuminate c. 2 mm long. *Pedicels* very short, turbinate, c. 0.2 mm long, all apparently arising from main axis. *Flowers* bisexual and female (the terminal flower of cyme always bisexual, the lateral sometimes so); *tepals* 4, erect, c. 1 mm long, incurved and cucullate, united in lower third, rounded or shortly and bluntly horizontally keeled on back, inflated in fruit, glabrous to hirsute, ciliate; *stamen* 0-1, about twice length of perianth; *styles* 2, slender, long exserted. *Pericarp* diaphanous, dull, sometimes slightly scurfy, somewhat loosely adherent to seed. *Seed* subglobular, horizontal to erect, c. 0.5 mm diam., slightly keeled and grooved over the semicircular embryo, radicle and cotyledons superior; *testa* reddish brown; *raphe* extending from apex to base of seed. *Infructescence* breaking up with flower dehiscing at apex of pedicel, the fruit loosely enclosed in perianth.

Key to subspecies

Tepals hirsute. . . . . 9a. subsp. **rhadinostachya**
Tepals glabrous or sparsely hirtellous, ciliate. . . . . 9b. subsp. **inflata**

9a. subsp. **rhadinostachya**

Tepals hirsute, rounded on back or slightly keeled. *Seed* oblique to erect; *pericarp* dull. *Inflorescence* much-branched with the bracts smaller than or exceeding the glomerules.

QUEENSLAND: Woodstock, *S. T. Blake* 6499 (BRI); Mt Isa, *R. L. Specht* and *R. W. Rogers* 30 (BRI).

SOUTH AUSTRALIA: Mt Ilbillee area, *A. C. Beauglehole* 25520 (AD); Mt Morris, *Hj. Eichler* 17333(AD).

WESTERN AUSTRALIA: Dampier, 30 March 1971, *H. Hukin* (PERTH); Rawlinson Range, *P. Wilson* 2378 (AD).

NORTHERN TERRITORY: Mt Olga, *G. Chippendale* (NT 4665); Mann Range, *D. J. Nelson* 362 (NT).

Distribution. Western Queensland, northern South Australia, north-west to east-central Western Australia, and southern half of the Northern Territory. Map 19.

Habitat. Typically a species of rocky slopes in skeletal soil.

9b. subsp. **inflata** (Aellen) Paul G. Wilson, stat. nov.—*Chenopodium inflatum* Aellen, Bot. Jahrb. Syst. 63:490 (1930). *Type*: loc. cit.

Tepals glabrous or sparsely hirtellous, ciliate, rounded on back. *Seed* horizontal or slightly oblique; *pericarp* dull (or rarely glossy). *Inflorescence* of long slender spikes often with slightly disjunct glomerules; *bracts* inconspicuous.

QUEENSLAND: Boulia, *S. T. Blake* 6475 (BRI); 51 mi [82.1 km] W of Yaraka, *L. Everist* 7368 (BRI).

NEW SOUTH WALES: Byrock, *E. McBarron* 14706 (NSW).

WESTERN AUSTRALIA: Mt Anderson Stn., *R. D. Royce* 6919 (PERTH); 74 km E of Carnarvon, *P. G. Wilson* 8393 (PERTH).

NORTHERN TERRITORY: Stirling Swamp, *T. S. Henshall* 510 (NT); 110 km N of Alice Springs. *J. Z. Weber* 995 (AD).

Distribution. Central Queensland, northern New South Wales, north-western Western Australia, and southern half of the Northern Territory. Map 20.

Habitat. Evidently usually in skeletal soil but also recorded from 'hard red mulga country' in Queensland.

Dysphania rhadinostachya has been confused with *D. kalpari* which may be distinguished by its decumbent habit and erect glossy seeds. The subspecies *inflata* varies considerably in habit; part of this variation is due to age and environmental conditions and part to the presence of several distinct forms which are not recognised nomenclaturally in this paper. In Western Australia is found a plant which is superficially similar to the lectotype of subsp. *inflata* (from Queensland) but in which the pericarp is almost glossy; to this variant belongs the lectoparatype of *Chenopodium inflatum* collected by *Morrison* at the Ashburton River (PERTH). This variant is further discussed under *D. kalpari.*

The characters which distinguished the two subspecies are far from constant and it is evident that these taxa grade into each other. For this reason I have not kept them as separate species as did both Aellen (1930) and Scott (1978b).

The plate in Mueller (1890 op. cit.) cited above under *Chenopodium rhadinostachyum* appears to contain illustrations of two species; the small habit drawing on the left-hand side is probably of *D. kalpari* while the drawing of the inflorescence is of *D. rhadinostachya.* The illustrations of the seed incorrectly display the position of the embryo and it is evident that both Mueller and Robert Graff, the artist, had difficulty in establishing the orientation of this minute organ.

The name *Chenopodium rhadinostachyum* var. *paniculatum* does not appear to have been validly published. It was applied by Tate to a collection made by R. Helms in 1891 on the Elder Exploring Expedition and, according to the text, was collected at camp 53. I have seen only one specimen with that name; the label accompanying it was written by Tate and the collection was made by Helms at camp 41. This specimen has a paniculate inflorescence typical of *D. rhadinostachya* but it is evident that Tate assumed it to represent a new variety because specimens collected at camp 53 were identified by him as being the typical form of *Chenopodium rhadinostachyum* whereas they are, in fact, the new species *D. kalpari.*

10. **Dysphania kalpari** Paul G. Wilson, sp. nov. Figure 7A.

Herba annua prostrata vel decumbens. *Folia* lamina profunde undulata, 1-5 cm longa. *Inflorescentia*: spicae breviter pedunculatae, erectae, graciles, ad 15 cm longae. *Flores* hermaphroditi et feminei; *tepala* 4, erecta obovata, c. 1 mm longa in base connata, breviter hirsuta; *stamen* 0-1; *styli* 2, graciles. *Semen* verticale compresse sphaericum, c. 0.5 mm diam.; *testa* laevis, nitida; *embryo* semi-circularis basalis, radicula cotyledonibusque superioribus.

Typus: West end of Hopkins Lake (south of Sir Frederick Range), Western Australia, ± 24°20′S, 128°40′E; 1 Aug. 1962; *D. E. Symon* 2354 (holo: PERTH; iso: AD, ADW).

Prostrate to decumbent annual *herb* with several stems arising from base, moderately pilose all over with sessile or shortly stipitate glandular hairs and longer segmented hairs, aromatic. *Leaves* thin, lamina elliptic, deeply undulate, 1-5 cm long; *petiole* slender, half to as long as lamina. *Inflorescence* of axillary and terminal, shortly pedunculate, erect, slender spikes to 15 cm long, made up of compact dichasial cymes of 5-7 flowers subtended by bract. *Bracts* stipitate, limb ovate, rostrate, in all c. 2 mm long, not exceeding cyme. *Flowers* bisexual and female (the terminal flower of cyme always bisexual); *pedicel* very short and thick, c. 0.2 mm long. *Tepals* 4, erect, obovate, c. 1 mm long, united in lower third, rounded on back,

shortly hirsute; *stamen* 0-1, shortly exceeding perianth; *styles* 2, slender. *Pericarp* diaphanous (so thin as to be not apparent). *Seed* vertical, compressed spherical with rounded margins (slightly keeled over embryo), c. 0.5 mm diam.; *testa* reddish brown smooth and glossy; *embryo* semi-circular, basal, radicle and cotyledons superior, raphe passing from upper margin to base. *Infructescence* breaking up when mature with flowers dehiscing at apex of pedicel, the seed loosely enclosed in perianth.

QUEENSLAND: Boatman Stn., S. L. Everist 2935 (BRI); 7.8 mi [12.6 km] N of Galway Downs, *G. Trapnell* E58 (BRI).

NEW SOUTH WALES: 70 km N of Bourke, *S Jacobs* 2061 (NSW); 8 mi [12.9 km] S of Barrier Hwy on Cobar-Ivanhoe road, *C. W. E. Moore* 6012 (CANB).

SOUTH AUSTRALIA: 48 km W of Tallaringa Well, *T. R. N. Lothian* 3847 (AD); 30 mi [48.3 km] W of Welbourne Hill Stn., *R. A. Perry* 5534 (AD, MEL, NSW, NT, PERTH).

WESTERN AUSTRALIA: Mundiwindi, *B. G. Briggs* 3601 (NSW); 44.5 mi [71.6 km] E of Carnegie Stn., *A. R. Fairall* 1999 (PERTH).

NORTHERN TERRITORY: 16 mi [25.7 km] NW of Hamilton Downs, *G. Chippendale* (NT 1779); 12 mi [19.3 km] W of Stuart Hwy on Yuendemu Rd, *J. R. Maconochie* 60 (NT).

Distribution. Widespread in the inland areas of Australia in all mainland States except Victoria. Map 22.

Habitat. Loam flats and red sand plains; often associated with mulga (*Acacia aneura*).

Dysphania kalpari has been confused with *D. rhadinostachya* from which it may be distinguished by its decumbent habit with several stems arising from the base, its erect glossy seeds, and its "rats-tail" spikes. The habitat preferences of the two species are quite different, those of *D. rhadinostachya* being skeletal soils often on rocky slopes while *D. kalpari* is found on mulga (*Acacia aneura*) flats or sand plains.

Intergradation with *Dysphania rhadinostachya* subsp. *inflata* appears to occur, at least with the variant of the latter found in the Pilbara region of Western Australia, and it is possible that the lectoparatype of *Chenopodium inflatum* from the Ashburton River area is a member of such an intergrade.

A note by F. T. Turvey with a collection made near Ernabella, South Australia, in 1968 (NSW 103747), states that "The natives gather the ripe seeds and make them into a meal, and at this time mix them in with the honey from honey-ants (also in season). This is relished as a food.". On a specimen from Warburton Mission (R. A. Gould, 3 April 1967, PERTH) it is recorded that the Aboriginal name is Kalpari and that it is an important seed-food plant of ngatatjara, pitjantjatjara and pintupi natives. A further specimen (W. H. Moyle, 1 July 1958, PERTH) has with it a note to say that it is called Kalpari and that it is sought after by Aborigines in the Walter James Range to make flour. The specific epithet is taken from the Aboriginal name for the plant in central Australia.

3. **SCLEROBLITUM** Ulbrich

Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2, 16c: 495 (1934); Aellen in Hegi, Ill. Fl. Mitt.-Eur. ed. 2, 3: 660 (1960). *Type: S. atriplicinum* (F. Muell.) Ulbrich.

Chenopodium sect. *Atriplicina* Aellen, Verh. Naturf. Ges. Basel 41:99 (1931); A. J. Scott, Bot. Jahrb. Syst. 100:211 (1978). *Type: C. atriplicinum* (F. Muell.) F. Muell. (=*S. atriplicinum*).

Somewhat succulent very sparsely mealy *herb. Stems* numerous arising from rootstock, unbranched. *Leaves* alternate simple, flat, the basal ones in a rosette. *Flowers* in compact glomerules axillary to basal and stem leaves. *Tepals* 4, free; *stamen* solitary in terminal flower, absent in others; *ovary* glabrous, stigmas 2, dorsiventral. *Pericarp* hard and thick. *Seed* erect, completely filling utricle; *embryo* inverted hippocrepiform (around apex of seed); *endosperm* sparse around embryo; *perisperm* copious, central.

One species, endemic to Australia.

This genus is not closely related to any other Australian genus but appears to have most in common with species of the genus *Monolepis* (northern hemisphere) and *Chenopodium* sect. *Thullingia* (South America).

1. **Scleroblitum atriplicinum** (F. Muell.) Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2, 16c:495 (1934); Aellen in Hegi, loc. cit.—*Blitum atriplicinum* F. Muell., Trans. et Proc. Vict. Inst. Advancem. Sci. for 1854-55: 133 (1855).—*Chenopodium atriplicinum* (F. Muell.) F. Muell., Fragm. 7:11 (1869); F. Muell. Icon. Aust. Salsol. Pl. t. 30 (1890). *Lectotype*: Cudnaka, Oct. 1850, *F. Mueller* (MEL) *lecto. nov.*

Euxolus enervis F. Muell., Fragm. 1:140 (1859). —*Amaranthus enervis* (F. Muell.) F. Muell. ex Benth., Fl. Austral. 5:216 (1870). *Type*: In planitiebus ad flumina Darling et Murray, *J. Dallachy* (holo: MEL).

Amaranthus tenuis Benth., Fl. Austral. 5:216 (1870). *Type citation:* 'Lower Darling River, Herb. *F. Mueller' (iso: MEL).*

Annual (or short-lived perennial?) somewhat succulent *herb. Taproot* prominent. *Stems* numerous slender, prostrate or ascending, arising from rootstock, normally unbranched. *Leaves* very sparsely mealy with thin-walled stipitate vesicular hairs, eventually glabrous. *Basal leaves* in a rosette, lamina thin, 3-nerved, hastate-acuminate c. 3 cm long with divaricate acuminate basal lobes; *Petiole* slender 3 to 8 cm long with a broad clasping base; *cauline leaves* alternate, well separated, the upper ones sub-sessile and narrowly elliptic. *Flowers* very shortly pedicellate; *tepals* 4, free, erect, imbricate, ovate, acute, c. 1.5 mm long, somewhat glumaceous, mealy in lower half with stipitate vesicular hairs; *dorsal sepal* larger than others and when mature several nerved. *Terminal flower* of glomerule bisexual; *stamen* solitary opposite dorsal sepal, filament slender, glabrous, not thickened at base; *anther* caudate, c. 0.7 mm long; *ovary* narrowly ellipsoidal, glabrous with a pair of opposite vascular traces which pass up into the dorsi-ventral long slender stigmas. *Ovule* completely filling ovary. *Lateral flowers* of glomerule female without staminodes. *Fruiting perianth* cartilaginous; *tepals* narrowly oblong acuminate, c. 2.5 mm long, thickened keeled and sigmoid at base. *Utricle* erect, lenticular; *pericarp hard and thick; epicarp* membranous; *mesocarp* white hard and rugose, endocarp dark reddish brown, crus-

taceous, rugose on the outside. *Seed erect*, completely filling utricle and fused to the endocarp; *testa* membranous, embryo inverted hippocrepiform (around apex of seed) radicle inferior; *perisperm* central, copious, vitreous. *Mature fruit* shed with surrounding perianth.

QUEENSLAND: Berbera, *C. T. White* 12231 (BRI); Clover Downs, *R. Roe* 3 (BRI).

NEW SOUTH WALES: Pinipara Ck., *S. Jacobs* 1003 (NSW); 3 mi [4.8 km] S of Nyngan, *G. M. Cunningham* 766 (NSW).

VICTORIA: Gunbower, Oct. 1914, *E. Curtis* (NSW); Lake Hindmarsh, Oct. 1899, *C. Walter* (NSW.)

SOUTH AUSTRALIA: Yourambulla Caves, *B. Copley* 2247 (AD); 31 mi [49.9 km] N of Overland Corner, *D. E. Symon* 3681 (ADW).

Distribution. Southern Queensland, central and southern New South Wales, north west Victoria and eastern South Australia. Map 3.

Habitat. Heavy soils usually clay, frequently in situations that are seasonally waterlogged.

Although this plant has been referred to by collectors as an annual it has a substantial taproot which may enable it to live through more than one season.

The genus *Scleroblitum* was originally separated from *Chenopodium* largely because of the cartilaginous fruiting perianth; this in itself does not appear to be generically significant (especially as hardening of the tepals does not always take place), however, the pericarp is very different from that in other Australian members of the family. This pericarp has previously been interpreted as the testa and its distinctive features overlooked: the developing seed fills the ovary at a very early stage causing the testa to be in intimate contact with the ovary wall; this then presents difficulties in distinguishing the two structures. The ovary wall is discernible, shortly after anthesis, as being composed of three layers; in the fruit these layers form very distinct structures of the pericarp, an outer membranous epicarp in which a pair of faint vascular strands pass up to the two style arms, a white crystalline mesocarp which becomes hard and rugose, and a dark reddish brown crustaceous endocarp. The endocarp is rugose on its outer surface (where in contact with the white mesocarp) and smooth on the inner surface where it fuses with the membranous testa. The whole structure is usually enclosed within the persistent cartilaginous perianth, however, in some cases (possibly due to continuing moist conditions) the tepals remain small and glumaceous.

Bentham (1870) described this species under three names, *Chenopodium atriplicinum, Amaranthus enervis* and *A. tenuis*. The last two names were based on material in which the fruiting perianth had not hardened. He also described the plant (*C. atriplicinum*) as being slightly glandular-pubescent, a description repeated by Black (1924, 1948) and by Scott (1978a). It was evidently for this reason that Scott placed *Chenopodium* sect. *Atriplicina* in subgenus *Ambrosia*, along with the glandular species of the genus, instead of in subgenus *Chenopodium*, in which are placed the species with a mealy indumentum. In the latter subgenus, the sect. *Atriplicina* comes closest to the sect. *Thullingia* in which the only species, *C. antarcticum* (J. D. Hook.) J. D. Hook. is very similar, it also being a prostrate sparsely mealy plant with a basal rosette of leaves, simple stems, glomerules of flowers with 2

to 4 tepals and solitary stamens, and erect seeds with a subannular embryo. The genus *Scleroblitum* is, in addition, very similar in fruit and seed morphology to the northern hemisphere genus *Monolepis* to which it is probably also closely related.

4. **EINADIA** Raf.

Rafinesque, Flora Telluriana 4:121 (1838); Dalla Torre et Harms, Gen. Siph. 145 (1900), pro syn. sub *Suaeda;* Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2, 16c: 555, 558 (1934) pro syn. sub *Suaeda* sect. *Schanginia*; A. J. Scott, Feddes Repert. 80:3 (1978). *Type: Einadia linifolia* (R.Br.) Raf.

Chenopodium sect. *Polygonoidea* Aellen, Feddes Repert. 69:69 (1964) et in Hegi, Ill. Fl. Mitt.-Eur. Ed. 2, 3/2:577(1960) sine desc. latina. *Type*: *Chenopodium polygonoides* (Murr) Aellen.

Herbaceous or weakly woody perennials, often prostrate or scandent, branching from the base. *Branches* slender, ridged, *Leaves* opposite or alternate, petiolate, linear to broadly hastate, c. 2-3 cm long, flat and slightly fleshy, ± covered when young (at least below) with spherical vesicular hairs. *Flowers* small, gynomonoecious in small cymose clusters forming racemose or open panicles, often congested; *pedicels* (when present) constricted at apex. *Terminal flower* of cluster bisexual; *lateral flowers* female without staminodes. *Tepals* (4) 5, herbaceous, sometimes succulent in fruit. *Stamens* 1-3, often spreading at anthesis with the subtending tepal, ± equal to tepals, glabrous; filament slightly pulvinoid at base; *disc* absent. *Ovary* glabrous; *style* absent or very short; *stigmas* 2, slender, papillose. *Fruit* a nut with thin dry pericarp or depressed globose (rarely ovoid) berry with inflated pericarp (succulent outside, water within), not enveloped by perianth. *Seed* horizontal, depressed globose to lenticular with rounded margin; *testa* crustaceous; *embryo* annular, radicle centrifugal; *perisperm* central and copious.

A genus of six species endemic to Australia and New Zealand.

Rafinesque (1838 op. cit.), in his original description, segregated the genus *Einadia* from *Rhagodia* on the basis of the presence of only one or two stamens instead of five. In this he was relying solely on Robert Brown's descriptions of the seven species of *Rhagodia* since he had seen no material. Brown (1810) only in *R. linifolia* referred to the stamen number (as being 1 or 2), evidently he assumed it to be 5 in the other species as indicated in his generic description. Rafinesque, therefore, only transferred this one species to *Einadia* and was unaware of its close relationship (and common stamen number) with *R. nutans* and *R. hastata* which had also been described by Brown. The generic name *Einadia* was subsequently ignored or misapplied until Scott (1978a) took it up. Although Scott recognised the marked difference between those species of *Rhagodia* with polygamous flowers and reduced stamen number (which he placed in *Einadia*) and those with dioecious flowers and five stamens (which he retained in *Rhagodia*), he did not comprehend the close relationship of the *Einadia* group with those Australian and New Zealand species of *Chenopodium* that have similar floral characters and similar habit but which lack a succulent pericarp. The similarity is such that with non-fruiting material it is often impossible to recognise to which genus it should be assigned. The difficulty is enhanced by the fact that the succulent pericarp does not always develop in the group of species with normally baccate fruits and, further, that hybridization appears to take place between related species placed in the different genera. I am therefore expanding the genus *Einadia* to include those Australian and New Zealand species of

Chenopodium and *Rhagodia* with a herbaceous perennial habit, small flat leaves with discrete vesicular indumentum and polygamous 5-merous flowers with reduced stamen number.

The distinction between *Einadia* and *Chenopodium* is not easy to define, partly because of the great variability found in the latter genus. *Einadia* comes closest to a group of species in *Chenopodium* sect. *Leprophyllum* (e.g. *C. hubbardii*) and another in sect. Desertorum (e.g. *C. desertorum).* From the former section the species of *Einadia* differ in being perennials (not annuals) and in having 1-3 (not 5) stamens, while from the latter section they differ in absence of disc (pubescent disc in sect. *Desertorum*) and again reduced stamen number.

The species of *Einadia* differ from those of *Rhagodia* sensu stricto in being herbaceous usually sprawling perennials with gynomonoecious flowers, a reduced stamen number and no disc. The fruit, if succulent, is "inflated", that is it has a fleshy outer and a watery inner layer; or drying it does not become viscous. The indumentum is of spherical hairs (which may collapse to become saucer—or shallowly cup-shaped) and not of irregularly shaped hairs, nor does it collapse to form a scaly sheen as it does in some *Rhagodia* species.

It is not clear why Dalla Torre et Harms (1900 op. cit.) made *Einadia* a synonym of *Suaeda*; possibly they assumed, as did Ulbrich (1934 op. cit.), that *Einadia linifolia* was a synonym of *Suaeda linifolia* Pallas, which is not the case; the two species are very distinct as are their respective genera.

Key to species

1. Fruit succulent 2
   Fruit dry 4
2. Leaves deltoid or broadly hastate with rounded apex, dark green . . 5. **E. hastata**
   Leaves linear to ovate, deltoid, narrowly hastate or sagittate, acute or obtuse, grey to green 3
3. Leaves ovate, obtuse, base usually sagittate (N.Z.) . . . . . 2. **E. triandra**
   Leaves linear to broadly triangular, base often hastate . . . . . 1. **E. nutans**
4. Tepals in fruit with a hard circular (often black) limb; leaves narrowly oblong-elliptic to narrowly hastate . . . . . 6. **E. polygonoides**
   Tepals in fruit oblong to obovate, herbaceous or indurated; leaves broadly ovate or elliptic to orbicular or deltoid 5
5. Leaves broadly elliptic to orbicular (N.Z.) . . . . . 4. **E. allanii**
   Leaves broadly ovate to deltoid, often hastate at base . . . . . 3. **E. trigonos**

1. **Einadia nutans** (R.Br.) A. J. Scott, Feddes Repert. 89:3 (1978).—*Rhagodia nutans* R.Br., Prod. 408 (1810). *Lectotype.* Ad rupes saxa in Oyster Cove in fluvio Derwent, Feb. 1804, *R. Brown* (holo: BM) *lecto. nov.* Figure 4E.

R. linifolia R.Br., Prod. 408 (1810).—*E. linifolia* (R.Br.) Raf., Fl. Tellur. 4:121 (1838). *Lectotype:* Broad Sound, Sept. 1802, *R. Brown* (holo: BM; iso: K, NSW) *lecto. nov.*

R. chenopodioides Moq., Chenop. Monogr. Enum. 11 (1840). *Lectotype*: Port Jackson, 1830, *Gaudichaud* (holo: P) *lecto. nov.*

Chenopodium australasicum Moq., Chenop. Monogr. Enum. 20 (1840). *Type citation*: "Nova Hollandia, *Caley*". Type: P, n.v.

Scrambling perennial with woody base. *Branches* slender, ridged, sparsely covered when young with small discrete bladder hairs. *Leaves* opposite or alternate, lamina chartaceous to sub-coriaceous, linear to elliptic or narrowly to broadly triangular, entire 10-20(40) mm long, rounded to truncate or hastate at base, sparsely to moderately mealy when young, eventually glabrescent (at least above), abruptly petiolate. *Inflorescence* a narrow racemose panicle 2-4 cm long; *flowers* in glomerules, either compact or pedicellate, if terminal then bisexual, otherwise usually female. *Perianth* depressed globular, 0.7-1.5 mm diam., not enveloping the ovary, mealy with bladder hairs to glabrescent; *tepals* (4)5, oblong, somewhat enlarging and becoming red, fleshy and sometimes reflexed in fruit. *Bisexual flower: stamens* 1-2(3), spreading or erect at anthesis; *filament* ligulate, thickened at base, glabrous; *anthers* included, c. 0.3 mm long; *disc* absent; *ovary* ovoid, glabrous, stigma 2 sessile or subsessile, divaricate, terete, 0.1-0.2 mm long. *Female flower: staminodes* absent; *ovary* as in bisexual flower. *Fruit*: pericarp inflated succulent, orange or red, depressed (or narrowly ovoid), c. 4 mm diam., exceeding perianth, surface faintly colliculate; *seed* lenticular with rounded margin, 1-1.5 mm diam.; *testa* rugulose to areolate-reticulate, black.

Distribution. Central and eastern Australia including Tasmania.

This species exhibits considerable variation with several of the variants having broad regional distributions. In many cases these variants are partially sympatric although evidently ecologically separated. Transition between the variants is readily apparent from study of the herbarium material. Only four of the variants have been recognised in this paper leaving a large number of specimens which it is only possible to determine to the species level. To attempt a more complete taxonomic analysis would appear to be unwarranted due to the considerable plasticity of the plants, and their transition in the field from one variant to another. Vegetative or non-fruiting material is sometimes difficult to distinguish from *E. trigonos* subsp. *trigonos* and specimens of the two species were confused by Bentham (1867) and by later authors; it seems likely, from the observation of herbarium material, that the two hybridize but the study of field evidence is required to support this. Hybridization between *E. nutans* and *E. hastata* may also occur since several collections appear to be intermediate in morphology.

The name *Rhagodia nutans* was applied for some time to the New Zealand plant now known as *Einadia triandra* (e.g. by Cheeseman 1884 and 1914). The latter species is very similar to some variants of *E. nutans* and, if native to Australia, would probably be included with it under the earlier name *E. triandra*. One of the variants of *E. nutans* found in southern Australia is so similar to the New Zealand plant as to make identification somewhat dependent on locality data. *Einadia nutans* subsp. *nutans* is found in New Zealand as a recent introduction and is there very distinct in appearance and ecology from the native *E. triandra*. It forms dense hummocks or scrambles over hedgerows so as to kill the surrounded shrubs (A. J. Healy in sched. CHR 91541). The characters by which *E. nutans* may be distinguished from *E. trigonos* are discussed under the latter species.

The name *Rhagodia chenopodioides* Moq. was considered by Bentham (1870), who had not seen the type, to be possibly a synonym of *R. billardieri* (= *R. baccata*) and was included by Scott (1978a) under this latter name. The type is, however, a narrow-leaved varient of *Einadia nutans* subsp. *nutans*.

The terminal flower of a branch of the inflorescence is normally bisexual but may be functionally male through the weak production of stigmas. In most specimens studied this flower had normal stigmas and produced a seed.

Key to subspecies

1. Leaves linear to narrow oblong . . . . . 1c. subsp. **linifolia**
   Leaves either broader than above or hastate to sagittate at base 2
2. Leaves narrowly sagittate, sub-coriaceous; seed c. 1.5 mm diameter (central Australia) . . . . . 1d. subsp. **eremaea**
   Leaves narrowly to broadly hastate or deltoid, thin; seed c. 1 mm diameter . . . 3
3. Leaves narrowly hastate; berry ovoid . . . . . 1b. subsp. **oxycarpa**
   Leaves variable in shape; berry depressed globular (if ovoid then leaves deltoid-hastate) . . . . . 1a. subsp. **nutans**

1a. subsp. **nutans**

R. nutans var. *parvifolia* Moq. in DC., Prod. 13/2:54(1849). *Lectotype*: Ex herb. Fee (G-DC, photo seen) *lecto. nov.*

Chenopodium triangulare subsp. *convolvulinum* Murr, Allg. Bot. Z. Syst. 16:56 (1910).—*C. triangulare* var. *convolvulinum* (Murr) Maiden, Census N.S.W. Plants 66 (1916). *Syntypes:* Stonehenge, Dec. 1899, *J. H. Maiden* (NSW 33761); Jenolan Caves, Dec. 1899, *W. F. Blakely* (NSW 142922). *Lectotype:* Stonehenge, Dec. 1899, *J. H. Maiden* (NSW 33761) *Lecto. nov.*

? *R. nutans* var. *fallacina* Domin, Biblioth. Bot. 89: 616 (1921). *Type*: Cheltenham, Victoria, *Domin* IV. 1910, n.v.

R. chenopodioides Moq., op. cit. (1840).

Leaves chartaceous, hastate to deltoid and shortly lobed at base. *Inflorescence* slender or branched near base; *fruits* sessile or pedicellate. *Berry* depressed globular; *seed* variably reticulate, c. 1 mm diameter.

QUEENSLAND: Thallon, *R. Roe* 26 (CANB); 10 mi [16.1 km] N of Wondoan, *N. H. Speck* 1961 (NSW).

NEW SOUTH WALES: 5 mi [8 km] S of Cobar, *C. W. E. Moore* 4480 (CANB); Brush Island, 5 Sept. 1937, *F. A. Rodway* (NSW).

VICTORIA: 11.6 km from Dargo, *E. M. Canning* 3937 (CBG); Nandaly, *W. W. Watts* 465 (NSW).

TASMANIA: Lewisham, 3 Mar. 1952, *W. M. Curtis (HO); Carlton Bluff, 19 Feb. 1959, W. D. Jackson* (HO).

SOUTH AUSTRALIA: Wilpena Pound, *A. E. Orchard* 2594 (AD); Oraparinna Nat. Park, *J. Z. Weber* 2578 (AD).

NORTHERN TERRITORY: Mt Le Hunte, *P. K. Latz* 913 (NT); 30 km S of Alice Springs, *R. Pullen* 10556 (CANB).

Distribution. Central and south-eastern Australia including Tasmania. Map 23.

Habitat. Occupying a wide range of habitats but usually in loam or heavy soil.

This polymorphic subspecies comprises, apart from the type variant, those variants not included in the other three subspecies. In New South Wales it grades to the north into subsp. *linifolia* and to the north-west into subsp. *eremaea*. However, plants with the leaf shape of subsp. *nutans* are also found in northern New South

Wales and southern Queensland where plants intermediate between these and subsp. *linifolia* also occur. A variant of subspecies *nutans* very similar in appearance to the east coast plant also occurs in the southern portion of the Northern Territory and in adjacent regions of South Australia; it is here sympatric with subsp. *eremaea* although probably ecologically isolated being an inhabitant of the ranges rather than the sandplains. No putative hybrids between the two subspecies in this area have been seen.

A variant of *Einadia nutans* found in south-east Queensland appears to differ significantly from the other variants referred to subsp. *nutans.* It is a more delicate plant than typical subsp. *nutans* with very slender branches. The leaves are predominantly opposite, thin, with the lamina bluntly deltoid-hastate, and c. 10 mm long in the south-east becoming larger (c. 15 mm long) farther north. The inflorescence is slender with fruits on long slender pedicels c. 5 mm long. The tepals enlarge so as sometimes to almost cover the young fruit but eventually are reflexed. The berry in some specimens appears to be ovoid in shape as in subsp. *oxycarpa* but mature fruit is not usually present and no collector has commented on its appearance. The following specimens are examples of this 'delicate' variant in eastern Queensland: 2 mi [3.2 km] S of Inverai School, *R. W. Johnson* 432, 433 (BRI); Bybera, *C. T. White* 10387, 10405 (BRI); Mungallala, *C. E. Hubbard* 6025 (BRI); Hannaford, *L. Pedley* (BRI, CANB); Chinchilla, *A. Beasley* 34 (BRI); Woodlands, *T. J. McDonald* 196 (BRI); Coppersmith Rock, *G. Tandy* (BRI).

1b. subsp. **oxycarpa** (Gauba) Paul G. Wilson stat. et comb. nov.—*Rhagodia nutans* var. *oxycarpa* Gauba, Vict. Nat. 65:167 (1948). *Type*: Near Loveday, South Australia, 28 May 1943, *E. Gauba* (holo: MEL 80685).

Scrambling *sub-shrub* to 1 m high. *Leaves* somewhat leathery, narrowly hastate acute, c. 15 mm long, lateral lobes narrow, acute. *Inflorescence* branched; *flowers* and *fruits* sessile. *Fruiting perianth* fleshy and reflexed, red; *berry* ovoid, c. 4 mm long, pericarp colliculate; *seed* horizontal to erect c. 1 mm diameter, testa moderately reticulate.

NEW SOUTH WALES: 56 km N of Wentworth, 29 Aug. 1969, *A. Rodd* (NSW); 10 km ESE of Mungindi, *A. Rodd* 1070 (NSW).

SOUTH AUSTRALIA: 2 mi [3.2 km] NW of Lake Bonney, *B. Copley* 2577 (AD); Koonamore, *M. Crisp* 565 (AD).

Distribution. New South Wales and South Australia. Map 24.

Habitat. Often on sandhills but also recorded in other situations.

This subspecies cannot be readily distinguished when in flower from some variants of the polymorphic subspecies *nutans*; it usually has thicker and narrower leaves which have narrow divaricate basal lobes, however, since leaf characters are notoriously plastic in this genus it is really only by the ovoid fruit that subsp. *oxycarpa* may be positively identified.

According to M. D. Crisp (pers. comm.) subsp. *oxycarpa* is edaphically segregated from subsp. *nutans*, the former being found on the top of sand dunes and the latter on the flats. While this is evidently the case in some areas, over its total range subsp. *oxycarpa* occupies a variety of habitats.

The wide and scattered distribution of subsp. *oxycarpa* suggests that it may represent a fruit-form which appears sporadically in populations of subsp. *nutans*, but extensive field and experimental work is required to establish the biological situation.

1c. subsp. **linifolia** (R. Br.) Paul G. Wilson, Comb. et stat. nov.—*Rhagodia linifolia* R.Br., Prod. 408 (1810).—*Einadia linifolia* (R.Br.) Raf. 1.c. (1838); Ulbrich in Engler et Prantl. Nat. Pflanzenfam. ed. 2, 16c: 558 (1934) pro syn. sub *Suaeda linifolia* Pallas.—*E. nutans* var. *linifolia* (R.Br.) A. J. Scott, Feddes Repert. 89:4 (1978). *Lectotype:* see above.

Chenopodium australasicum Moq., op. cit. (1840), see note below.

Prostrate or scrambling perennial. *Leaves* thin, linear to narrow-oblong. *Inflorescence* slender; *fruits* frequently slender pedicellate. *Tepals* enlarged and spreading or reflexed in fruit; *berry* depressed globular; seed finely reticulate, 1 mm diameter.

QUEENSLAND: Noondoo Stn, *S. L. Everist* 829 (BRI); East of Condamine, *W. T. Jones* 3733 (CANB).

NEW SOUTH WALES: Warrah, Mar. 1920, *W. W. Froggatt* (BRI); 5 mi [8 km] from Aberdeen, *R. Story* 7092 (CANB).

VICTORIA: Echuca, *H. King* 4 (MEL).

Distribution. Eastern Queensland and New South Wales, northern Victoria. Map 24.

Habitat. Predominantly found on heavy soils.

The typical variant of this subspecies is found in north east Queensland and eastern New South Wales. In New South Wales it grades into subsp. *nutans* and to the west into subsp. *eremaea*. Some inland variants have rather thick leaves and compact inflorescences, possibly as a result of soil salinity, but this is not evident from the label data on the herbarium specimens.

I have not seen the type of *Chenopodium australasicum*, however, Moquin's description corresponds to that of subsp. *linifolia* and it was with this taxon that he later (1849) synonymized the name.

A variant of *Einadia nutans* with very narrow leaves is found in N.W. Victoria and south central New South Wales but the material I have seen is too incomplete to determine its precise affinities. I have included this variant within subsp. *linifolia* on the basis of its leaf shape.

The synonymizing of *E. linifolia* under *Suaeda linifolia* Pallas by Ulbrich (1934) was presumably made on the assumption that they were nomenclatural synonyms. This is not the case and I do not know why Ulbrich came to this conclusion.

1d. subsp. **eremaea** Paul G. Wilson, subsp. nov.

Herba perennis leviter scandens. *Rami* graciles sulcati. *Folia* opposita vel alterna, cinerea; *lamina* aliquantum coriacea, anguste triangularis ad basim sagittata, 15-40 mm longa. *Flores* fructusque sessiles. *Baccus* depresso globularis. *Semen* c. 1.5 mm diam.; *testa* valde alveolata.

Typus: Close to Ayers Rock, Northern Territory, sandy soil, 25 Aug. 1973, *A. A. Munir* 5132 (holo: AD 97342352; iso: DNA, NT).

Scrambling perennial *herb* to 1 m high with slender sulcate branches. *Leaves* opposite or alternate, grey; *lamina* somewhat coriaceous, narrowly triangular, sagittate at base, 15-40 mm long. *Inflorescence* paniculate, branched near base. *Flowers* and *fruit* sessile. *Berry* depressed globular; *seed* c. 1.5 mm diameter, testa strongly alveolate.

QUEENSLAND: Earlstoun Stn., *S. T. Blake* 5480 (BRI); Boorara, *W. J. Bisset* 253 (BRI).

NEW SOUTH WALES: Tundulya, *C. W. E. Moore* 4559 (CANB).

SOUTH AUSTRALIA: 35 km W of Mabel Creek, *T. R. N. Lothian* 2783 (AD); 48 km W of Todmorden Stn., *T. Reichstein* 24 (AD).

WESTERN AUSTRALIA: 8 km S of Giles, *R. H. Kuchel* 161 (AD); Giles Settlement, *R. Hill* 1369 (AD).

NORTHERN TERRITORY: Tanami Sanctuary, *T. S. Henshall* 1256 (NT); Petermann Creek, *N. M. Henry* 576 (NT).

Distribution. Central and Western Queensland, north western New South Wales, northern South Australia, east-central Western Australia, the Northern Territory. Map 25.

Habitat. Generally in sand.

This subspecies is sympatric with subspecies *nutans* in parts of the Northern Territory and in the Musgrave Ranges area of South Australia, where the two evidently occupy different ecological niches (subsp. *eremaea* in sand and subsp. *nutans* on hilly country) and I have seen no suggestion of intergradation between the two in that region. Subspecies *eremaea* is a more robust plant than any of the other subspecies and is bigger in all its parts; it grades to the east into subsp. *linifolia* and to the south and south-east into subsp. *nutans*.

2. **Einadia triandra** (G. Forster) A. J. Scott, Feddes Repert. 89:5 (1978).—*Chenopodium triandrum* G. Forster, Fl. Ins. Austr. 21 (1786); Moq., Chen. Mon. Enum. 25(1840) p. p.; J. D. Hook., Fl. Nov.-Zel. 1:212 (1857) p.p.; J. D. Hook., Handb. N. Zeal. Fl. 230 (1864) p.p.—*Rhagodia triandra* (G. Forster) Aellen, Candollea 8:5 (1939); Allan, Fl. N. Zeal. 1:231 (1961). *Type*: Queen Charlotte Sound, New Zealand, *J. R.* and *J. G. A. Forster* (holo: BM; iso: K n.v. fide Allan 1961). Figure 5B.

[*Rhagodia nutans* auct. non R.Br.: Cheeseman, Man. N. Zeal. Fl. ed. 2, 404 (1925)]

Spreading or scrambing perennial with woody (sometimes rhizomatous?) rootstock and numerous slender matted stems. *Branches* striate, mealy when young. *Leaves* opposite or alternate, mealy or glabrescent; *lamina* thin, ovate, 5-10 mm long, entire, apex obtuse and minutely apiculate, base truncate to shortly sagittate; *petiole* slender c. 4 mm long. *Inflorescence* of glomerules in terminal or axillary slender racemose panicles c. 5 cm long in fruit. *Flowers* globular 1-2 mm diam.; *tepals* ovate, flat or cucullate, enlarging and becoming fleshy in fruit, mealy outside; *stamens* 0-3, spreading

at anthesis; *filament* thickened at base; *stigmas* 2 sessile, slender c. 0.5 mm long. *Fruit* a berry; *pericarp* red, globular, succulent c. 4 mm diam. *Seed* depressed spheroid, c. 1.7 mm diam, *testa* prominently reticulate.

NEW ZEALAND: N of Kaikoura, *R. Melville* 5833 (CHR); Near Cape Campbell, *W. R. Sykes* 500/70 (CHR).

Distribution. New Zealand; 'from near north Cape to a little south of lat. 44°' fide Allan 1961.

Habitat. 'Rocky and gravelly coastal places' fide Allan 1961.

I have not seen the type of *Einadia triandra* but the description of the leaves given by J. G. Forster agrees with current concepts and with the plant described under the name *Rhagodia triandra* by Aellen (1939).

The transfer of *Chenopodium triandrum* to *Rhagodia* was intimated by F. Mueller in 1886 and 1887 when he wrote 'The *Chenopodium triandrum* of New Zealand is transferable to the genus *Rhagodia*', but I cannot find any publication in which he made the combination.

The name *Chenopodium triandrum* G. Forster was considered by Murr (1910) to include *C. microphyllum* F. Muell., and his synonymy was accepted by Maiden and Betche (1916). The two species are, in fact, quite distinct and differ, among other characters, in stamen number and fruit type, although it is probable that Murr had specimens of *C. allanii* (= *Einadia allanii*) in mind rather than *C. triandrum* when he suggested the synonymy.

Einadia triandra is very similar to some variants of *E. nutans* and if it were not for the fact that the one is endemic to New Zealand and the other to Australia a subspecific status for *E. nutans* would probably be more suitable. The leaves of *E. triandra* have consistently an ovate shape obtuse at apex and truncate at base usually with short downwardly directed lobes (sagittate) whereas in *E. nutans* the leaves tend to be triangular, acute at apex and hastate at base (i.e. with divaricate lobes). In *E. nutans* the seed is lenticular with rounded margin and the surface rugulose to deeply reticulate; in *E. triandra* the seed is depressed-spheroid (i.e. thicker than in *E. nutans*) and consistently deeply reticulate.

Prior to the paper by Aellen (1939) material of *Einadia triandra* had usually been referred to *Rhagodia nutans* and the name *Chenopodium triandrum* incorrectly applied to the species described by Aellen as *C. allanii.* The last species may be distinguished by its thin dry pericarp; it also differs from all related species found in New Zealand by its entire, elliptic to orbicular leaves.

The recording by Sykes (1977) of *E. triandra* (as *Rhagodia triandra*) in the Kermadec Islands was based on several collections some of which are of a variant of *E. trigonos*, q.v. while others are of an undescribed species.

3. **Einadia trigonos** (Roemer et Schultes) Paul G. Wilson, comb. nov.—*Chenopodium trigonon* Roemer et Schultes, Syst. Veg. 6:275 (1820) based on following.—*C. triangulare* R.Br., Prod. 407 (1810) nom. illeg. non Forsskal (1775). *Type:* Nepean and Hawkesbury Rivers, *R. Brown* (holo: BM).
C. stellulatum Aellen in Probst, Mitt. Naturf. Ges. Soloth. 8:57 (1928). *Type*: Wollkompost der Kammgarnfabrik Derendingen, 1916, *R. Probst,* n.v.

Weak prostrate to erect straggling perennial *herb* branching from the base. *Branches* slender, faintly striate, glabrous or sparsely mealy when young. *Leaves* alternate or subopposite, thin, lamina broadly ovate to deltoid (or hastate with short spreading lobes), 8-15 mm long, glabrescent above, sparsely to moderately mealy below with white spherical vesicles; *petiole* slender, short or equal in length to lamina. *Inflorescence* a congested to slender terminal and axillary panicle with numerous sessile flowers aggregated into glomerules. *Flowers*, if terminal to a partial cluster, bisexual; the others female. *Perianth* depressed globular 0.5-1 mm diam.; *tepals* broadly ovate to obovate, spathulate or linear, often cucullate, sparsely mealy or glabrous. *Bisexual flower: stamen* solitary, divaricate at anthesis, filament thickened (pulvinoid) at base; *ovary* depressed, papillose; *stigmas* slender, spreading, ± sessile. *Female flower: stamens* and *staminodes* absent, otherwise as in bisexual flower. *Fruit: tepals* narrow to broad oblong or obovate, herbaceous or indurated, smooth, if indurated then with a slender claw and cucullate limb enclosing and persisting around fruit; *pericarp* dry (?slightly succulent in subsp. *leiocarpa*), thin, often black and usually prominently papillose. *Seed* lenticular with rounded margin, c. 1 mm diam.; *testa* slightly granular (or striate in subsp. *leiocarpa*).

In habit and leaf shape *E. trigonos* is similar to some variants of *E. nutans* but in the latter species the leaves are usually more prominently hastate. The tepals of *E. trigonos* vary from being broad-oblong to linear. The variant with broad tepals (in *subsp. trigonos*) when in flower is difficult to distinguish from some variants of *E. nutans* and even fruiting material can be troublesome since, although the latter species usually has baccate fruit, the succulence does not always develop or is not apparent in dried material. A further distinction is found in the seed which in *E. trigonos* is granular and the pericarp smooth to strongly papillate (but see also subsp. *leiocarpa*); in *E. nutans* the seed is alveolate to rugulose and the pericarp smooth or colliculate (i.e. with low convex markings). It appears probable, on the basis of herbarium material, that the two species do hybridize.

To separate *Einadia trigonos* from *E. hastata* is also sometimes difficult in the absence of fruit, however, the leaves of *E. hastata* are usually darker green, thicker, and they are nearly always opposite, whereas in *E. trigonos* they are predominantly alternate.

Key to subspecies

1. Tepals spathulate to linear; pericarp strongly papillose, frequently black . . . . . 3b. subsp. **stellulata**
   Tepals ovate or elliptic to obovate; pericarp almost smooth 2
2. Leaves broadly hastate or deltoid with rounded apex . . . . . 3a. subsp. **trigonos**
   Leaves hastate to narrow hastate, acute . . . . . 3c. subsp. **leiocarpa**

3a. subsp. **trigonos**

Plant prostrate to decumbent. *Leaves* broadly hastate or deltoid with rounded apex. *Tepals* ovate to obovate, herbaceous in fruit. *Pericarp* almost smooth.

NEW SOUTH WALES: Moona Plains, Feb 1899, *S. R. Crawford* (NSW); Conjala, May 1899, *W. Heron* (NSW).

VICTORIA: Mt Tingaringy, *A. C. Beauglehole* 35726 (MEL); Melbourne, 1886, *J. Minchin* (MEL).

NEW ZEALAND: Coppermine Is., Mauraki Gulf, 25 Oct. 1968, *M. A.* and *I. M. Ritchie* (CHR); Little Sister Is., 25 Oct. 1973, *B. D. Bell* (CHR); Curtis Island, Kermadec Group, *W. R. Sykes* 923/K (CHR).

Distribution. Southern Victoria and extreme eastern New South Wales to just north of Walcha. New Zealand (an atypical variant). Map 26.

Habitat. Often near water but also in open country or forested areas.

The typical variant of this subspecies has thin, deltoid to broadly hastate leaves and broadly ovate tepals, it is found in the extreme south east of Victoria north to an area just north of Sydney. Farther north still the tepals become narrower and the plant grades into subsp. *stellulata* which has linear tepals.

The presence of *Einadia trigonos* subsp. *trigonos* in New Zealand is probably due to its relatively recent introduction. The earliest collection seen by me is dated 1926 although only the specimens in herb. CHR have been studied. In New Zealand it is variable in leaf form and whereas some of these variants are found in Australia others are distinct and approach in aspect, and in flowers and fruit, *E. allanii,* a species endemic to New Zealand, suggesting that hybridization may be taking place. Sykes (1977) recorded *Rhagodia triandra* from several islands in the Kermadec Is. group but the specimens I have seen from these islands which have been so annotated either belong to the New Zealand variant of *E. trigonos* subsp. *trigonos* or to an undescribed species. Sykes also recorded *Einadia allanii* (as *Chenopodium allanii*), based on the presence of its seed in the crop of a parakeet; since, however, the seed of *E. allanii* is virtually indistinguishable from that of *E. trigonos* it seems likely that they came from plants of the latter species which on some islands was recorded as abundant.

The New Zealand specimens of subsp. *trigonos* have flowers with broad tepals which enlarge with the fruit and almost envelop it at maturity; many also have purplish stems and leaf margins, characters not observed (or not noted) on Australian specimens.

3b. subsp. **stellulata** (Benth.) Paul G. Wilson, comb. et stat. nov.—*Chenopodium triangulare* var. *stellulatum* Benth., Fl. Austral. 5:161 (1870).—C. stellulatum (Benth.) Aellen, Verh. Naturf. Ges. Basel 41:93 (1931) nom. illeg. non Aellen (1928). *Type citation*: "New England, *C. Stuart.*" *Lectotype*: River Severn. *C. Stuart* 44 (MEL 80677) *lecto. nov.*

C. stellulatum Aellen in Probst, op. cit.

Prostrate to spreading *herb* with stout taproot. *Inflorescence* congested when in flower, elongating in fruit to a slender racemose panicle with disjunct glomerules of flowers. *Tepals* spathulate to linear, frequently indurated in fruit. *Pericarp* strongly papillose, frequently black.

QUEENSLAND: Waterford, *W. Jones* 3345 (CANB); Cooranga North, *C. T. White* 2492 (BRI).

NEW SOUTH WALES: Grafton, *H. Henholz* (NSW); Swan Bay, 8 June 1957, *L. A. S. Johnson* (NSW).

NEW ZEALAND: Tai Tapu, Canterbury, *A. J. Healy* 54/123 (CHR); Between Halswell and Tai Tapu, 24 Aug. 1949, *S. E. Archer* (CHR 68003).

Distribution. South-east Queensland and eastern New South Wales. A recent introduction in New Zealand. Map 27.

Habitat. In partial shade frequently in moist situations in heavy soil. A ready coloniser of disturbed situations.

The vernacular names of Tar vine and Fish weed applied to this plant are a reflection of the strong fish smell possessed by some variants; it has been reported to cause cows to produce tainted milk (C. T. White 1921 as *Chenopodium triangulare*).

As a recent introduction it is stated to be well established along a roadside near Halswell in the South Island of New Zealand (A. J. Healy 1954 in sched.)

3c. subsp. **leiocarpa** Paul G. Wilson, subsp. nov.

Herba perennis erecta, ad basim ramificans. *Folia* alterna; *lamina* hastata vel anguste hastata acuta, c. 15 mm longa. *Pericarpium* laeve, translucens (non denigratum). *Semen* c. 1.2 mm diam., testa striata.

Typus: Pilliga, New South Wales, Nov. 1932, *H. M. R. Rupp* 5 (holo: NSW 142708).

Erect perennial *herb* branching from base. *Leaves* alternate; *lamina* hastate to narrow hastate (upper ones narrow elliptic), c. 15 mm long, acute, noticeably mealy below; *petiole* slender, c. half length of lamina. *Tepals* broadly elliptic to obovate. *Pericarp* smooth, translucent (not blackened), evidently herbaceous when mature. *Seed* c. 1.2 mm diam.; *testa* glossy, radially striate.

NEW SOUTH WALES: Gurley, Nov. 1914, *E. Breakwell* (NSW); Boggabri, *R. H. Cambage* 3655 (NSW); 6.5 mi [10.5 km] W of Wee Waa, 19 Dec. 1966, *L. A. S. Johnson* (NSW); Moree, Feb. 1907, *J. T. Scott* (NSW).

Distribution. North-east New South Wales. Map 26.

Habitat. Only recorded with one collection as "Common on heavy grey alluvium under *Eucalyptus camaldulensis*".

This subspecies is distinctive in having small narrowly hastate leaves and in having a fruit with a smooth transluscent pericarp; the striate seed also clearly separates it from the other subspecies. The subspecies *leiocarpa* is possibly more closely related to *E. nutans*, with which the seed ornamentation and herbaceous pericarp would have more in common, but it seems preferable to restrict the latter species to those plants with a succulent fruit.

A collection from 16 mi [25.7 km] W of Garah (K. L. Solling 431, NSW) differs from typical subsp. *leiocarpa* in having a more triangular leaf, a thin pericarp and an almost smooth seed. From the same locality has been collected a plant with leaf shape typical of subsp. *leiocarpa* but with tepals in fruit somewhat succulent and a pericarp thin but succulent (K. L. Solling s.n. NSW 142982). It appears to be intermediate in morphology between *E. trigonos* subsp. *leiocarpa* and *E. nutans.*

The infraspecific epithet is derived from two Greek words, *leios*, smooth, and *carpos*, fruit, referring to the smooth pericarp.

4. **Einadia allanii** (Aellen) Paul G. Wilson, comb nov.—*Chenopodium allanii* Aellen, Candollea 8:7 (1939). *Lectotype*: Lammermoor Mts, New Zealand, Jan. 1929, *H. H. Allan* (CHR 1064) *lecto. nov.* Figure 5A.

[*Chenopodium triandrum* auct. non G. Forster: J. D. Hook., Fl. Nov.-Zel. 1:212 (1853) p.p.; J. D. Hook., Handb. N. Zeal. Fl. 230 (1864) p.p.; ? T. F. Cheeseman, Ill. N. Zeal. Fl. 2:t.164 (1914).]

Spreading perennial woody towards base. *Branches* weak, slender, glabrescent. *Leaves* alternate; *lamina* thin, broadly elliptic to orbicular, 5-15 mm long, entire, sparsely mealy to glabrous; *petiole* slender. *Inflorescence* of axillary and terminal slender or branched panicles (congested when young). *Flowers* c. 0.5 mm diameter; *tepals* (4)5, ovate, not cucullate, united towards base, moderately mealy outside, enlarging in fruit but not enclosing nut; *stamens* 0-3, slightly exceeding tepals; *filaments* thickened at base, glabrous, disc absent; *style* absent, stigmas papillose c. 0.5 mm long. *Fruit* depressed spheroid c. 1.5 mm diam.; *pericarp* thin, papillose, loosely adherent. *Seed* depressed spheroid c. 1.3 mm diam; *testa* faintly punctuate, black.

NEW ZEALAND: North Island:—Wellington, 19 Feb. 1950, *G. B. Cone* (CHR); Te Kaminara Bay, 21 Nov. 1947, *V. D. Zotov* (CHR). South Island:— Ben Lomond, 10 Dec. 1943, *A. J. Healy*(CHR).

Distribution. North and South Islands of New Zealand.

Habitat. 'Coastal, lowland and montane sandy and rocky places throughout, but rather local inland', fide Allan (1961).

Until Paul Aellen's paper in 1939 *Einadia allanii* had been confused with *E. triandra* (while plants of the latter were generally referred to *Rhagodia nutans*). The two species have superficial resemblances but they differ in leaf-shape and in fruit since the pericarp of *E. allanii* is thin and dry while that of *E. triandra* is succulent. *Einadia allanii* is evidently closely related to *E. trigonos* for they are similar in habit as well as in flower and fruit character. The two are separable on leaf-shape, that of *E. allanii* being broadly elliptic (with rounded apex) to orbicular while in *E. trigonos* it is bluntly hastate. The situation is complicated by the presence in New Zealand of the typical subspecies of *E. trigonos,* of its subspecies *stellulata* (both presumably introduced in the past 200 years), and of plants which are intermediate in character between the typical variants of *E. trigonos* and *E. allanii.* It seems likely that these 'intermediate' collections are of hybrid origin but this suggestion needs to be substantiated by field observations since *E. trigonos* is extremely variable in Australia, as regards leaf form. This makes its recognition (and of putative hybrids) in New Zealand uncertain.

Einadia allanii exhibits considerable variability in leaf shape and texture, and in inflorescence character. I have adopted a rather broad concept of the species since I am unable to find any clear characters by which the complex could be subdivided. One variant does stand out and would appear to warrant recognition as a distinct species, this is a plant found on Little Barrier Island that has an open paniculate inflorescence the branches of which are destitute of bracts. A plant very similar in form is also found on the Kermadec Islands. Until further work is done on possible relatives in other islands of the Pacific or in South America it would seem best not to describe it as a distinct taxon. The following specimens from New Zealand represent this variant.

LITTLE BARRIER IS.: *T. F. Cheeseman* (CHR 331646); *R. Melville* 6572 (CHR 140167).

KERMADEC ISLANDS: Curtis Is., *W. R. B. Oliver* (CHR 289968); Raoul Is., *W. R. Sykes* 1423/K (CHR 326878).

The variant found on Little Barrier Island probably represents the plant illustrated in Cheeseman, Illustrations of the New Zealand Flora vol. 2:t 164 (1914), under the name *Chenopodium triandrum*. The variation in morphology was commented on by Allan (1961 p. 228), however, it is not clear what taxa he had in mind since the names *Chenopodium allanii* and *Rhagodia triandra* have been applied rather imprecisely.

5. **Einada hastata** (R.Br.) A. J. Scott, Feddes Repert. 89:4 (1978).—*Rhagodia hastata* R.Br., Prod. 408(1810). *Type*: Port Jackson, near Duck River on the Parramatta Road, *R. Brown* (holo: BM;? iso: K, MEL, NSW). Figure 4F.

Spreading perennial *herb* (rarely erect to 1.5 m), branching at base. *Branches* quadrangular, when young, with vitreous tubular and vesicular hairs (sometimes pale yellow) soon glabrous. *Leaves* opposite or subopposite, somewhat coriaceous and resinous when dry, glabrous or sparsely pubescent with vitreous vesicular hairs when young; *lamina* deltoid to broadly hastate, entire, 10-25 mm long, rounded and often apiculate at apex, lateral lobes short and obtuse, base cuneate to obtuse; *petiole* slender, somewhat shorter than lamina. *Inflorescence* a condensed or slender racemose panicle with scattered glomerules. *Flowers* sessile or shortly pedicellate, depressed, 0.5-1 mm diam.; *tepals* oblong-obovate, somewhat fleshy, thickened and cucullate at apex, remaining incurved over developing fruit, glabrescent, red and somewhat succulent in fruit; *stamens* 1-2, glabrous, filaments thickened at base, spreading at anthesis; *ovary* depressed, glabrous, smooth; *stigmas* sessile, spreading c. 0.5 mm long. *Fruit* a berry, depressed, clasped by persistent red succulent tepals, c. 3 mm diam.; *pericarp* succulent red. *Seed* lenticular with rounded margin, 1.5 mm diam., radially rugulose.

QUEENSLAND: Russell Is., *C. T. White* 3405 (BRI); Harrisons Pocket, *S. T. Blake* 3203 (BRI).

NEW SOUTH WALES: Tallebung, *G. M. Cunningham* 645 (NSW); 8 km S of Inglewood, *L. A. S. Johnson* 7216 (NSW).

VICTORIA: Mt Wheeler, *A. E. Orchard* 2662 (AD); Bendigo, *A. C. Beauglehole* 42128 (MEL).

Distribution. Victoria, eastern Queensland and New South Wales. Map 25.

Habitat. Shady gullies in rainforest, rocky hill slopes, and open plains.

Einadia hastata may be recognised by its relatively thick, green, almost glabrous, broadly hastate leaves with rounded apex. The hairs on the young shoots have a vitreous appearance unlike the milky colour of those in *E. nutans* and *E. trigonos*. Maiden in Agric. Gaz. New South Wales 8:123-125 (1897) states that the crushed leaves have an odour of perfectly fresh fish. It varies considerably in habit and in leaf size and texture but less so in leaf shape and least of all in seed characters.

6. **Einadia polygonoides** (Murr) Paul G. Wilson, comb. nov.—*Chenopodium triangulare* R.Br. var *polygonoides* Murr, Bull. Herb. Boiss. 4:994 (1904).—*C. triangulare* subsp. *polygonoides* (Murr) Murr, Allg. Bot. Zeitschr. 16:56 (1910).—*C. polygonoides* (Murr) Aellen, Mitteil. Ges. Soloth. 8:213 (1928). *Type citation*: 'Port Jackson district NSW, leg. *Ernst Betke,* 2. 1898, comm. *Charles Walter* (v. in herb. Turic.).' Iso (?): Kogarah (Sydney), Feb. 1898, *J. H. Camfield* (NSW 143135, ? MEL 88743), see comment below.

C. triangulare R.Br. var. *angustifolium* Benth., Fl. Austral. 5:161 (1870). *Type citation*: 'To this belong the Queensland specimens [of *C. triangulare*] and some from New England.' *Lectotype*: Armadilla, *W. Barton* 140 (MEL 80674) *lecto. nov.*

Spreading weak grey-green herbaceous perennial with numerous stems arising from woody taproot. *Branches* slender, striate, very sparsely mealy when young with vesicular hairs. *Leaves* opposite or alternate; *lamina* chartaceous, narrowly oblong-elliptic to narrowly hastate, 0.5-1.5 cm long; *apex* acute; *base* obtuse to truncate; *upper surface* glabrous or glabrescent; *lower surface* mealy with white vesicular hairs when young; *petiole* slender c. one quarter length of lamina. *Inflorescence* a compact terminal racemose panicle of dense glomerules of flowers, elongating in fruit to 15 cm with disjunct glomerules; *axis* when young with short tubular and globular hairs and with small gland-tipped hairs. *Flowers* sessile, 0.5-1 mm diameter; *tepals* broadly obovate with rounded apex; *stamens* 1(2), glabrous, filament thickened at base and spreading at anthesis; *ovary* depressed, papillose; *style* c. 0.1 mm; *stigmas* slender, divaricate, c. 0.5 mm long. *Fruit: tepals* imbricate, closely enveloping nut, coriaceous, with circular limb and short narrow claw, glabrous somewhat resinous when fresh, eventually straw-coloured to black, midrib prominent, *pericarp* thin, dry, prominently papillose above. *Seed* lenticular with rounded margin, 1 mm diam.; *testa* finely radially rugulose.

QUEENSLAND: Kindon Station, *L. S. Smith* 514 (BRI); Chinchilla, *J. P. Ryan* (BRI).

NEW SOUTH WALES: Marayong, 3 July 1966, *R. Coveny* (NSW); Narellan, *E. McBarron* 13673 (NSW).

SOUTH AUSTRALIA: Arno Bay, Jan. 1920, *T. G. B. Osborn* (AD); Clapham, 2 Mar. 1962, *R. Pearce* (ADW).

Distribution. Central-east Queensland to central-east New South Wales; as an introduction, in Eyre Peninsula and Adelaide, South Australia. Map 28.

Habitat. Appears to favour heavy loamy soils.

Einadia polygonoides may be readily recognised by its narrow leaves, slender infructescence and free coriaceous tepals with circular limbs. The indumentum of this species is unusual for *Einadia* since some of the small multicellular hairs are terminated by a minute spherical cell which appears to be filled with resin.

The type of *Chenopodium triangulare* var. *polygonoides* was stated by Murr (1904 l.c.) to have been collected by 'Betke' (a misspelling of 'Betche'). However, a note on a probable isotype in herb. NSW states that the collector was J. H. Camfield. Murr (1910) cites the Camfield collection and states that Betche collected it at the same place and date. Whether there were one or two collections is not clear but it seems certain that they are of the same population. The type specimen probably represents a relatively recent introduction to the Port Jackson district.

5. **RHAGODIA** R.Br.

R.Br., Prod. 408 (1810); A. J. Scott, Feddes Repert. 89:5 (1978). *Lectotype: R. billardieri* R.Br. (= *R. baccata* (Labill.) Moq.), see Ulbrich (1934 p. 480).

Dioecious *shrubs,* ± mealy (at least when young) with minute globular or lobed vesicular hairs, these (in some species) collapsing and becoming scurfy, scaly, or fusing to form a continuous silvery sheen. *Leaves* opposite or alternate, simple, entire or bluntly lobed at base, 2-40 mm long. *Flowers* small, glomerulate, arranged in panicles or reduced to spike-like thyrses; *bracts* small and linear or absent; *perianth* ± globular c. 1.5 mm diameter, usually mealy outside and glabrous within; *tepals* 5, shortly united at base, often spreading and slightly enlarged in fruit, chartaceous or slightly fleshy. *Male flowers: stamens,* 5, filaments linear, usually united at base into a thickened saucer- or cup-shaped disc woolly or puberulous within (rarely glabrous), anthers exserted; pistillode minute, with or without a pair of minute erect stigmas. *Female flower* if terminal to glomerules or branches then with staminodes and a disc which is woolly within, if lateral then with small usually glabrous staminodes or these absent; *ovary* glabrous and globular; *stigmas* 2, sessile, divaricate, papillose. *Fruit* a berry, depressed globular, c. 3 mm diameter, yellow or red; *pericarp* fleshy usually with watery interior, viscous on drying. *Seed* horizontal, depressed globular or lenticular, 1-1.5 mm diameter; *testa* crustaceous, black, smooth to rugulose or reticulate; *embryo* annular; *perisperm* copious central.

Eleven species, all endemic to Australia (including Tasmania).

Key to species

1. Leaves small c. 3 mm long; intricately branched spinescent shrubs. 2
   Leaves more than 3 mm long or plant not spinescent. 3
2. Stamens woolly at base; seed radially verruculose (W.A.). . . . . 4. **R. acicularis**
   Stamens glabrous; seed smooth to minutely granular (N.S.W., S.A., W.A.) . . . . . 3. **R. ulicina**
3. Perianth glabrous or almost so. 4
   Perianth mealy or with minute vesicular hairs 5
4. Leaves linear to narrowly or broadly obovate somewhat mealy below . . . . . 5. **R. preissii**
   Leaves narrowly elliptic with minute spherical or saucer-shaped vesicular hairs (rarely glabrous) . . . . . 6. **R.baccata**
5. Leaves mealy when young, becoming scaly and covered with a silvery sheen; staminodes present in female flower 6
   Leaves mealy or of irregular to spherical vesicular hairs or glabrous (not becoming scaly or forming a sheen) 7
6. Leaves papery or slightly fleshy, flat. . . . . 1. **R. candolleana**
   Leaves fusiform or semiterete, fleshy. . . . . 2. **R. crassifolia**
7. Indumentum of spherical (or saucer-shaped) vesicular hairs. 8
   Indumentum of irregularly shaped vesicular hairs 10
8. Leaves oblong to narrowly elliptic, c. 30 mm long, glabrous above, sparsely vesicular pubescent below (coastal south-west Australia). . . . . 6. **R. baccata**
   Leaves elliptic to deltoid or circular (inland or eastern States) 9

9. Leaves narrow elliptic, lamina mostly 7-10 mm long; female flowers lacking both disc and staminodes; seed almost smooth (W.A.) . . . . . 8. **R. drummondii**
Leaf-shape varied, lamina (3) 5-20 mm long; lateral female flowers with disc and often staminodes; seed prominently reticulate (central and eastern Australia). 9. **R. spinescens**
10. Leaves broadly obovate to orbicular or bluntly hastate, flat; inflorescence pyramidal 11
Leaves linear to elliptic or oblong-elliptic 12
11. Leaves obovate to orbicular, often conduplicate; indumentum of closely packed glossy, irregularly shaped vesicular hairs (W.A., Shark Bay to Geraldton) . . . . . 7. **R. latifolia**
Leaves broadly ovate to bluntly hastate, flat; indumentum of very minute vesicular hairs, dull (S.A., N.T., eastern Australia) . . . . . 11. **R. parabolica**
12. Leaves semiterete, somewhat fleshy; panicle narrow, often racemose (W.A., Geraldton area) . . . . . 7. **R. latifolia** subsp. **recta**
Leaves elliptic to ovate (inland or coastal south-west) 13
13. Leaves ovate or ovate-oblong, c. 15 mm long, thinly covered below with minute mealy hairs; flowers in dense slender spikes, sometimes paniculately arranged; staminodes usually absent in female flower (S.A., W.A., N.T., inland species) 10. **R. eremaea**
Leaves elliptic, 10-20 mm long, densely covered below with minute vesicular hairs; flowers in dense panicles (W.A., coastal south-west). 6. **R. baccata** subsp. **dioica**

1. **Rhagodia candolleana** Moq., Chenop. Enum. 10 (1840).—*R. baccata* var. *candolleana* (Moq.) Moq. in DC., Prod. 13/2:50 (1849). *Lectotype*: Nouvelle hollande, *Labillardière* (holo: P) *lecto. nov.* (See discussion below.) Figures 1, 2.

Chenopodium furfuraceum Moq. in DC., Prod. 13/2:64 (1849). *Type*: Terre de Diemen—detroit d' Entrecasteaux, 1802, herb. Delessert (holo: P).

[*R. billardieri* auct. non R.Br.: Benth., Fl Austral. 5:152 (1870) p.p. excluding Western Australian specimens cited.]

[*R. baccata* auct. pl. non (Labill.) Moq.: e.g. J. Black, Fl. S. Austral. ed. 2, 287 (1948); Beadle et al., Fl. Sydney Reg. 192 (1972); J. H. Willis, Handb. Fl. Vict. 2:83 (1973).]

[*R. billardieri* var. *congesta* auct. non (J. D. Hook.) Benth.: Benth., Fl. Austral. 5:153 (1870).]

[*R. baccata* var. *congesta* auct. non (J. D. Hook.) A. J. Scott: A. J. Scott, Feddes Repert. 89:7 (1978).]

Weak spreading *shrub* or erect and up to 5 m high. *Branches* striate, mealy when young. *Leaves* opposite to alternate, shortly petiolate; *lamina* chartaceous to coriaceous or somewhat fleshy, narrow to broad elliptic to broad ovate or hastate, 10-25(40) mm long, acute to obtuse; *upper surface* sparsely mealy to glabrous; *lower surface* mealy developing a continuous grey to silvery sheen with age or glabrescent. *Inflorescence* a terminal pyramidal panicle to 15 cm long. *Flowers* predominantly dioecious; *perianth* fleshy, densely pubescent outside with weak irregularly shaped hairs, tepals ovate and united near base, midrib thickened. *Male flowers: stamens* 5, filaments linear-lanceolate, united at base into a thick saucer-shaped disc shortly puberulous within; *pistillode* from minute to normal size with small erect stigmas. *Female flower: staminodes* with ovate membranous filaments 1/4 to 1/2 length of

tepals, sometimes terminating in minute antherodes, united at base into a thickened disc woolly within; *ovary* glabrous, style arms spreading, c. 0.5 mm long. *Berry* clasped at base by the fleshy red perianth. *Seed* depressed globose, 1.5-2.5 mm diam., testa almost smooth to faintly reticulate or rugulose.

Key to subspecies

Leaves elliptic to broadly ovate or hastate, lower surface grey or glabrescent
1a. subsp. **candolleana**
Leaves hastate, acute, lower surface with a silvery sheen . . . . . 1b. subsp. **argentea**

1a. subsp. **candolleana**

R. baccata var. *parvifolia* Moq. in DC., Prod. 13/2:50 (1849). *Type*: Port Jackson, *Durville* (holo: P).

Chenopodium furfuraceum Moq. op. cit.

Leaves narrow to broad elliptic, broad ovate, or hastate, obtuse; *lower surface* covered with a grey sheen or glabrescent.

NEW SOUTH WALES: 2 mi [3.2 km] N of Bermagui, *H. Salasoo* 5107 (NSW); Kogarah, Nov. 1899, *J. H. Camfield* (NSW).

VICTORIA: Lady Julia Percy Is., *A. C. Beauglehole* 49662 (MEL); Coringle, *N. W. Wakefield* 4274 (MEL).

TASMANIA: Sulphur Creek, Jan. 1954, *W. M. Curtis* (HO); Coles Bay, 20 Apr. 1930, *L. Rodway* (HO).

SOUTH AUSTRALIA: Henley Beach, 26 Mar. 1921, *E. H. Ising* (AD); Port Noarlunga, *L. D. Williams* 5134 (AD).

WESTERN AUSTRALIA: Middle Is., Recherche Archipelago, *A. S. Weston* 8856 (PERTH); Observatory Is., *A. S. Weston* 9386 (PERTH).

Distribution. Tasmania, southern New South Wales, Victoria, South Australia, Recherche Archipelago in Western Australia. Map 29.

Habitat. Coastal situations.

lb. subsp. **argentea** Paul G. Wilson, subsp. nov.

Frutex omnis argenteo-squamosus. *Folia* aliquantum hastata 10-25 mm longa, acuta.

Typus: South Australia; Maralinga Village, 15 July 1972, *T. R. N. Lothian* 5547 (holo: AD; iso: NCU n.v.).

Shrub closely covered all over with a silvery scaly indumentum. *Leaves* somewhat hastate, 10-25 mm long, acute.

SOUTH AUSTRALIA: Ifould Lake, *T. R. N. Lothian* 5429 (AD); Maralinga, 7 Feb. 1960, *H. Turner* (AD).

Distribution. South Australia, North-West Plains.

The subspecies *argentea* has a distinctive leaf shape and a thick silvery sheen. It is clearly distinct in its distribution from the typical subspecies and could be separated (on morphological characters) at the species rank.

Near Maralinga and at Ifould Lake subsp. *argentea* has an acutely hastate leaf; at Ooldea has been collected a plant (Spooner 2185, AD) which is similar but has an elliptic leaf; also at Ooldea has been collected a plant (J. B. Cleland, 17 Aug. 1939, AD) with leaves similar to the Spooner specimen but with flowers and indumentum more like those of *Chenopodium desertorum.* Until extensive field investigations take place no satisfactory interpretation of this data is possible.

On the Nullarbor Plain 12 km NW of Cocklebiddy *Rhagodia crassifolia* may be found growing with a plant intermediate in morphology between that species and *R. candolleana* subsp. *argentea.* This putative hybrid (P. G. Wilson, 11829, PERTH) suggests that *R. candolleana* subsp. *argentea* is also found in that district.

Lectotypification of the name Rhagodia candolleana. The correct application of the name *Rhagodia baccata,* and the reasons for rejecting it for the species occurring in eastern Australia, are discussed under that name. The lectotypification of the alternative name, *R. candolleana,* also requires an explanation since it was based on mixed material. Moquin (1840) cited the type of *R. candolleana* as "In nova Hollandia (v.s. in herb. Mus. Paris. DC., et Vindob.)". In 1849, under *R. baccata* var. *candolleana* (Moq.) Moq., he wrote "v.s. in h. Labil. et Mus. Paris." I have seen four sheets which appear to be syntypes of this species, their labels are as follows:

A. Herb. P

Label (1) *Rhagodia candolleana* Moq./Nouvelle hollande/*Labillardière*/Herb. Poiret.
(2) *Rhagodia Candolleana* Moq./Nova hollandia/herb. Vindob.
(3) Herb. Mus. Paris/Herbier Moquin-Tandon/(Monographies du Prodrome)

B. Herb. P

Label (1) *Rhagodia*/Nova Holland/*Drummond* No. 209.
(2) *Rhagodia hastata* R.Br./(non)/Nova hollandia/herb. Vindob.
(3) Herbarium Moquinianum/*Rhagodia baccata* Moq./var. *Candolleana*/ (*R. candolleana* Moq.) /nova Holland. (*La Bill*).
(4) Herb. Mus. Paris/Herbier Moquin-Tandon/(Monographies du Prodrome)

C. Herb. FI

Rhagodia Candolleana Moq. [In Moquin's handwriting]

D. Herb. G-DC

Label (1) Nouv Hollande côte d'orientale/Museum de Paris 1821
(2) *baccata/Rhagodia Billardieri* R.Br./var.*Candolleana*/Moq.
(3) Rhagodia/Nouv Hollande côte Merid./Mus de Paris 1821

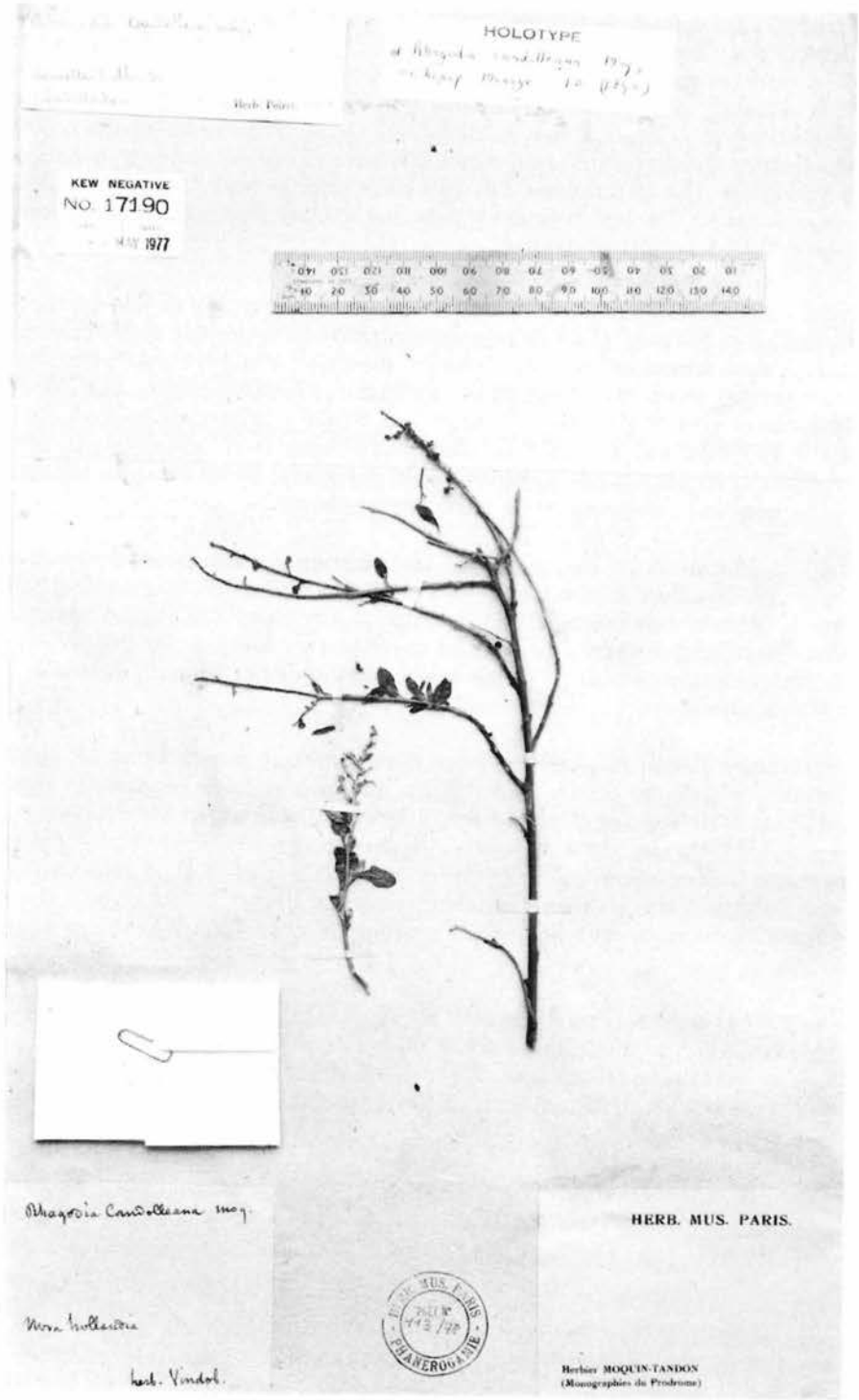


Figure 1. Lectotype of *Rhagodia candolleana* Moq. in herb. P.

Sheets A and D contain only specimens of the eastern Australian plant here referred to *Rhagodia candolleana*. Sheets B and C each contain a small vegetative specimen of *R. candolleana* and a larger specimen of *Tetragonia implexicoma* (Miq.) J. D. Hook. (Aizoaceae). I have selected sheet A in herb. P. (Figure 1) as the lectotype since it bears Moquin's handwritten determination and is of unmixed material. It is certainly one of the specimens studied by Moquin when describing the species. The sheet B in herb. P has, as noted above, a Drummond label no. 209. This is misplaced since James Drummond could not have collected either of the two specimens on the sheet; the Drummond no. 209 collection in herb. MEL is of *Rhagodia baccata* sensu stricto (i.e. the Western Australian plant) from which the Drummond label in herb. P had evidently strayed.

Rhagodia candolleana subsp. *candolleana* varies considerably in leaf form, texture and sculpturing of the seed (faintly rugose in Tasmania to faintly reticulate in South Australia); it also varies in stature, being a shrub to 5 m high in Tasmania while rarely exceeding 1 m on the Australian mainland. However, there are insufficient supporting characters with which to establish further infraspecific taxa. In South Australia it is often not possible to clearly distinguish *R. candolleana* from the coastal variant of *R. crassifolia,* however, since elsewhere these two species appear to be clearly separable I have continued to recognise them.

Although predominantly coastal in its distribution subsp. *candolleana* has been collected at Mt Gambier in South Australia. J. M. Black (1948) recorded it inland along the R. Murray but the relevant specimens are all of the inland variant of *R. crassifolia.* Black also recorded *Rhagodia baccata* var. *linearis* for South Australia, however, material so determined in his herbarium is either *Suaeda australis* (R.Br.) Moq. or *R. crassifolia.*

Rhagodia candolleana is nearly always dioecious but populations of apparently hermaphrodite plants do occur. Male plants sometimes have prominent pistillodes and these frequently enlarge to form berry-like structures which are probably galls.

The peculiar indumentum of *Rhagodia candolleana* (and of *R. crassifolia*) is made up of extremely thin-walled mealy hairs of irregular shape. These soon collapse and fuse together to form a metallic sheen similar to that found in some species of *Atriplex.*

The name *Chenopodium congestum* J. D. Hook. is based on a specimen of *C. murale* L., q.v. However, as a variety of *Rhagodia billardieri* or of *R. baccata* it has been misapplied by Bentham (1870) and Scott (1978a) to variants of *R. candolleana* in which the leaves tend to be rhombic or hastate and the inflorescence somewhat congested.

The type of *Chenopodium furfuraceum* is a male specimen of *Rhagodia candolleana.* It was not seen by Bentham (1870) who thought it might be conspecific with *C. auricomum.*

2. **R. crassifolia** R.Br., Prod. 408 (1810). *Lectotype*: Goose Island Bay, larger Island, 15-16 Jan. 1802 *R Brown*, dist. no. 3038 (holo: BM) *lecto. nov.*

R.parvifolia Moq. in DC., Prod. 13/2:52 (1849). *Type*: Ad Cygnorum fluvium, 1843, *J. Drummond* 715 (holo: P).

Shrub to 1.5 m high, divaricately branched. *Leaves* mostly alternate, fleshy, linear to narrow-elliptic in outline, fusiform or semiterete, often conduplicate or channelled above, falcate when thick, 1-2(4) cm long, mealy when young, becoming glabrescent above, hairs collapsing and fusing to form a metallic sheen. *Inflorescence* pyramidal to 5 cm long or reduced to a short spike. *Flowers* and *fruit* similar to that in *R. candolleana*. *Seed* depressed globose, 1.5 mm diam., very faintly reticulate or rugulose.

VICTORIA: 16 mi [25.7 km] NNW of Underbool, *A. C. Beauglehole* 40470 (MEL); 5 mi [8 km] E of Murrayville, 29 Aug. 1955, *J. H. Willis* (MEL).

SOUTH AUSTRALIA: Nundroo, *A. G. Spooner* 2194 (AD); Port Lincoln, 17 Dec. 1941, *J. B. Cleland* (AD).

WESTERN AUSTRALIA: Corbett Is., Recherche Archipelago, *R. D. Royce 6189* (PERTH); 12 km E. of Mundrabilla, *P. G. Wilson* 11832 (PERTH).

Distribution. North western Victoria westwards to near Albany on the south coast of Western Australia. Map 30.

Habitat. Principally a coastal species but also inland where usually on calcareous soil; often in a mallee community.

Rhagodia crassifolia intergrades with *R. candolleana in coastal regions of South* Australia and many collections cannot be confidently placed in either species. Near Cocklebiddy in the southern Nullarbor Plain of Western Australia *R. crassifolia* has been found growing with an apparent hybrid (P. G. Wilson 11834, PERTH) between that species and *R. candolleana* subsp. *argentea.*

The coastal variant of *R. crassifolia* differs somewhat from that found in the Murray-Mallee region of South Australia and adjacent areas of Victoria; this inland variant has a strongly divaricate habit and longer more slender leaves. It was principally this variant that J. M. Black (1948) incorrectly referred to under the name *R. baccata* var. *linearis.*

Moquin (1849 loc. cit.) based his concept of *R. crassifolia* largely on a specimen collected by Alan Cunningham on Dirk Hartog Island. This collection is, in fact, of a distinct species, *R. latifolia* (Benth.) Paul G. Wilson. The specimen of *R. crassifolia* collected by James Drummond in Western Australia, being considered by Moquin to be specifically distinct from that of Cunningham, was described as a separate species, *R. parvifolia.* Although Moquin cited its locality as 'Ad Cygnorum fluvium', i.e. from Swan River Western Australia, the specimen was probably collected near the Fitzgerald River mouth since it closely matches other specimens from that area while the species is not found on the west coast of Western Australia.

Bentham (1870) and Ewart and Davies (1917) recorded *R. crassifolia* from Northern Australia, in both cases citing a specimen from Sturt Creek collected by F. Mueller. This specimen is probably a syntype of *Chenopodium nitrariaceum* (F. Muell.) Benth. but is not conspecific with the lectotype of that species; it belongs in fact to *R. eremaea.*

3. **Rhagodia ulicina** (Gand.) Paul G. Wilson, Nuytsia 4:53 (1982.)—*Chenopodium ulicinum* Gand., Bull. Soc. Bot. France 66:224(1919). *Type:* Mt Lyndhurst, April 1900, *M. Koch* 366 (holo: LY; iso : PERTH). Figure 5F.

Dense intricately branched *shrub* 0.5-1 m high, dioecious. *Branches* divaricate, spinescent, mealy when young with close dense covering of small branched vesicular hairs. *Leaves* alternate, often clustered, fleshy, elliptic, 2-5 mm long, closely vesicular mealy, narrowed at base into an indefinite petiole. *Inflorescence* a few-flowered narrow condensed cyme (sometimes spinescent) with 1-4 lateral and a large terminal flower, or reduced to a single flower. *Perianth* depressed globose 1.5 mm diam., mealy outside with small branched vesicular hairs; *tepals* broadly ovate, united at base, eventually spreading beneath fruit. *Male flower: stamens* 5, filaments slender, glabrous, disc inconspicuous, anthers shortly exserted c. 0.5 mm long; *pistillode* minute. *Female flower: staminodes* represented by 5 scarcely observable antherodes c. 0.5 mm long; ovary glabrous; *style* absent to short and c. 0.5 mm long, glabrous or sparsely hirtellous; *stigmas* spreading, slender subulate, pilosulose. *Fruit* baccate, at first enveloped by perianth; *pericarp* succulent, appearing inflated on drying, free from seed. *Seed* lenticular with rounded margin, c. 1.5 mm diam., testa smooth to minutely granular, black.

NEW SOUTH WALES: Fowlers Gap, *S. Jacobs* 2268 (NSW); 20 mi [32.2 km] N of Balranald, *W. E. Mulham* W518 (NSW).

VICTORIA: Yatpool area, *J. H. Browne* 117 (PERTH).

SOUTH AUSTRALIA: Mt Grainger, *R. J. Chinnock* 1479 (AD); Wilkawillina Gorge, *T. R. N. Lothian* 5126 (AD).

WESTERN AUSTRALIA: 19 km NNW of Mt Glass, *K. Newbey* 5609 (PERTH); 12 km NW of Cocklebiddy, *P. G. Wilson* 11827 (PERTH).

Distribution. Eastern New South Wales and north-eastern Victoria to Northern Eyre Peninsula in South Australia westwards to the south-east of Western Australia around the Bremer Range. Map 31.

Habitat. Generally rocky situations often over limestone, but has been recorded from clay flats.

This species has been confused in herbaria with both *R. spinescens* and *Chenopodium nitrariaceum*. It was included by Bentham (1870) under the former name (i.e. the specimens cited as 'Murray river, F. Mueller', 'Gawler Ranges, Sullivan', and 'Barrier Range, Victorian Expedition'), however, his description of *R. spinescens* was based not only on that species and *R. ulicina* but also on *Chenopodium desertorum*. Gandoger (1919 loc. cit.) recognised *R. ulicina* as being a distinct species but his description was very brief and suggested that he was unaware that the plant was dioecious, shrubby, and had baccate fruits, for these characters establish the species as a member of the genus *Rhagodia* and not *Chenopodium*. Scott (1978b) included *R. ulicina* (as *Chenopodium*) with *C. nitrariaceum* under *Chenopodium* sect. *Rhagodioides* Benth.; however, Scott's sectional description is inapplicable to *R. ulicina* and the two species are not closely related.

Rhagodia ulicina may be distinguished from *R. spinescens* and *C. nitrariaceum* by its intricately branched habit and usually by its small fleshy leaves. Some specimens of *C. nitrariaceum* resemble *R. ulicina* in leaf shape but differ in indumentum: that of *C. nitrariaceum* is scurfy and forms a silvery sheen with age, while the vesicular hairs of *R. ulicina* are irregularly lobed and remain distinct.

Rhagodia ulicina is most similar to *R. acicularis* (an endemic of the Wongan Hills, Western Australia); the differences between them are give under the latter species.

4. **Rhagodia acicularis** Paul G. Wilson, Nuytsia 4:51 (1982). *Type*: Monk's Well Gully, Wongan Hills, 15 Feb. 1980, *P. G. Wilson* 11713 (holo: PERTH; iso: CANB). Figure 5E.

Compact intricately branched rounded *shrub* c. 0.5 m high, closely covered with minute vesicular hairs which retain their shape with age, dioecious. *Branchlets* spinescent. *Leaves* alternate, small, somewhat fleshy, narrowly elliptic, 2-5 mm long, glabrescent above, closely vesicular puberulous below. *Inflorescence* spicate (or shortly paniculate) with a spinescent axis c. 10 mm long; *flowers* few, sessile, subtended by a minute bract. *Male flowers* broadly turbinate, c. 1 mm long; tepals 5, divided to base, narrowly obovate, incurved, closely vesicular hairy outside, glabrous within; *stamens* 5; *filaments* slender-terete, lanate towards base, united into a thick cup-shaped disc; *anthers* shortly exserted, c. 0.5 mm long; *pistillode* minute. *Female flowers* spheroidal, c. 1.2 mm diam.; *tepals* narrowly obovate not enlarging in fruit; *staminodes* absent; *ovary* glabrous; *style* absent; *stigmas* slender, papillose, c. 0.3 mm long. *Terminal flower* on female inflorescence sterile, densely filled with woolly hairs arising from staminodes; *pistillode* minute with 2-3 erect glabrous stigmas. *Fruit* baccate, depressed spherical, clasped around margin by tepals but exposed at apex and towards base in inter-tepalar spaces; *pericarp* succulent, adherent to seed. *Seed* lenticular with rounded margin, 1.5 mm diam., radially verruculose.

WESTERN AUSTRALIA: Wongan Hills, *K. F. Kenneally* 2384 and 6448 (PERTH); ibid., *P. G. Wilson* 11712 (PERTH).

Distribution. Wongan Hills, south-western Western Australia.

Habitat. Red soil on gravelly lateritic slope in eucalypt woodland.

Rhagodia acicularis closely resembles *R. ulicina* but differs in the following characters: 1) Terminal flower of female inflorescence sterile (not large and fertile), 2) Seed radially verruculose (not smooth or minutely granular), 3) Male flower with woolly stamens united into a cup-shaped disc (not glabrous and with an inconspicuous disc). It is a typical member of the genus and evidently closely related to *R. spinescens* R. Br. and *R. drummondii* Moq.

5. **Rhagodia preissii** Moq. in DC., Prod. 13/2:49 (1849).—*Chenopodium preissii* (Moq.) Diels, Bot. Jahrb. 35:181(1904). *Type:* Near York, Western Australia, Preiss 1252 (iso: K, MEL).

R. obovata Moq., Chen. Mon. Enum. 10(1840). *Type:* Nouv. Holland. côte meridionale, 1821 (holo: P).

[R. *linifolia* auct. non R.Br.: Nees in Lehm., Pl. Preiss. 1:633(1845).]

Shrub to 2 m high. *Branches* slender, when young costate and sparsely mealy. *Leaves* chartaceous (slightly fleshy when fresh), to coriaceous (subsp. *obovata*), linear to broadly obovate or spathulate, 3-4 cm long, gradually tapering at the base into a slender petiole, apex rounded to acute, lower surface sparsely and minutely mealy when young. *Inflorescence* a pyramidal panicle c. 5 cm long, branches slender, flowers in disjunct glomerules. *Flowers* spherical, c. 1 mm diam; *tepals* almost orbicular, glabrous and eciliate (or sparsely mealy in subsp. *obovata*) enlarging slightly in fruit. *Male flowers: filaments* united into a saucer-shaped disc, somewhat pilose at base; *pistillode* minute (c. 0.5 mm high) with a pair of short erect subulate stigmas. *Female flowers: terminal flowers* usually sterile with prominent linear staminodes

densely pilose at base; *pistillode* ovoid, 0.3-1 mm high: *non-terminal flowers* fertile; *staminodes* absent; *ovary* with a pair of subulate stigmas. *Berry* depressed spherical, c. 3 mm diam. *Seed* c. 1.5 diam.; *testa* glossy with faint radial ribbing.

Key to subspecies

Leaves linear to narrow obovate, usually chartaceous . . . . . 5a. subsp. **preissii**
Leaves broadly obovate, coriaceous . . . . . 5b. subsp. **obovata**

5a. subsp.**preissii**

Leaves linear to narrow obovate or spathulate chartaceous (to coriaceous), flat or cymbiform. *Perianth* glabrous.

SOUTH AUSTRALIA: Barton, *N.T. Burbidge* 1866 (CANB); Dublin, *J. C. Noble* 84 (AD).

WESTERN AUSTRALIA: Merredin, *M. Koch* 2882 (NSW); 32 km NNE of Stokes Inlet, *A. E. Orchard* 1645 (CANB).

Distribution. West coastal and south-west Western Australia, southern South Australia. Map 32.

Habitat. Often in deep sand.

5b. subsp. **obovata** (Moq.) Paul G. Wilson, comb. et stat. nov.—*R. obovata* Moq., Chen. Mon. Enum. 10 (1840). *Type*: Nouv. holland. côte méridionale, 1821 (holo: P).

Leaves broadly obovate, gradually to abruptly narrowed at base into a slender petiole c. 1/3 length of leaf, in all 1.5-3 cm long, coriaceous, glabrescent to thinly mealy, apex rounded to truncate, apiculate. *Perianth* glabrous to sparsely mealy.

WESTERN AUSTRALIA: Dorre Is., *A.S. Weston* 10496 (PERTH); Kalbarri to Red Bluff, *R.J. Hnatiuk* 760494 (PERTH).

Distribution. Shark Bay-Geraldton region of Western Australia. Map 32.

Habitat. Frequently growing over limestone.

The application of the names *Rhagodia dioica* and *R. obovata* is difficult to determine due to intergradation of the typical variants of these species with *R. baccata* and *R. preissii*. The type of *R. obovata* comes from Dirk Hartog Island where the plant has leathery, broadly obovate leaves and glabrous flowers. On the mainland around Shark Bay the leaves are somewhat narrower and the flowers slightly mealy, while further south the mealiness increases and the leaf shape varies from obovate (near Geraldton) to elliptic (near Perth). Near Perth the flowers and leaves are densely mealy, and here the plant intergrades with *R. baccata*; this variant of intermediate aspect has been described as the species *R. dioica*. In addition to this apparent intergradation, *R. obovata* also passes, to the north and east of Shark Bay, into typical *R. preissii* with thin narrow leaves and glabrous flowers. I have, in this paper, recognised *R. baccata* as a distinct species because of its normally clearly distinguishable morphological characters while *R. obovata* I am including as a

subspecies of *R. preissii* whose typical subspecies is also clear cut in its characters. Since the syntypes of *R. dioica* come near to the typical variant of *R. baccata* I am treating them as conspecific.

6. **Rhagodia baccata** (Labill.) Moq. in DC., Prod. 13/2:50 (1849).—*Chenopodium baccatum* Labill., Nov. Holl. Pl. Sp. 1: 71, t. 96 (1805).—*R. billardieri* R. Br., Prod. 408 (1810), nom. illeg. *Type* "Habitat in capite Van-Diemen." *Lectotype*: FI (see notes below) *lecto. nov.* Figures 2, 3.

Rhagodia dioica Nees in Lehm., Pl. Preiss. 1:636 (1845). *Lectotype*: Fremantle, *Preiss* 1253 (holo: K; iso: MEL) *lecto. nov.*

Rhagodia radiata Nees in Lehm., Pl. Preiss. 1:637 (1845).—*R. billardieri* var. *linearis* Benth., Fl. Austral. 1:153 (1870).—*R. baccata* var. *linearis* (Benth.) J. Black, Fl. S. Austral. 683 (1929); Ewart, Fl. Vict. 449 (1931). *Type citation*: 'In elevatis arenosis juxta urbiculam Freemantle, Decembri a 1838. Herb. *Preiss.* No. 1250'. *Isotype:* MEL 80680, 80681, 80682.

Rhagodia cygnorum Gandoger, Bull. Soc. Bot. France 66:224 (1919). *Type:* Fremantle, 15 March 1899, *A. Morrison* (holo: LY).

Spreading *shrub* to 2 m high. *Branches* slender, costate, mealy when young. *Leaves* opposite or alternate shortly petiolate; *lamina* chartaceous (somewhat fleshy in subsp. *dioica*), narrowly oblong-elliptic to elliptic, 1-4 cm long, 3-8 mm wide, apex rounded to obtuse and minutely apiculate, margin often recurved, upper surface smooth and glabrous or sparsely mealy, lower surface with prominent midvein, sparsely to densely mealy with saucer-shaped collapsed vesicular hairs, rarely glabrous (minutely mealy in subsp. *dioica*). *Inflorescence* an open terminal panicle; *flowers* clustered in sessile lateral dichasial glomerules. *Flowers* predominantly dioecious, globular, 1.5 mm diam.; *perianth* densely covered with irregularly shaped vesicular hairs (rarely glabrous); *lobes* broadly ovate to orbicular, fleshy in centre. *Female plant: terminal flower* of main and lateral branches of panicle with 5 membranous lanceolate staminodes 1 mm long united into a fleshy saucer-shaped disc densely lanate within, pistil (or pistillode) glabrous with a pair of short erect styles; *lateral flowers* (which predominate) glabrous within, lacking staminodes and disc, ovary globular, glabrous with a pair of short spreading subulate styles. *Male plant:* staminal *filaments* narrowly lanceolate to linear, glabrous; *disc* saucer-shaped, fleshy; *pistillode* ellipsoidal, minute (c. 0.5 mm high) with a pair of short stylar processes. *Fruiting perianth* spreading to reflexed with somewhat hardened midrib, pale fawn in colour, persistent; *berry* depressed globular, red, pericarp fleshy. *Seed* lenticular, c. 1.8 mm diam.; *testa* glossy, minutely and irregularly tuberculate.

Key to subspecies

Leaves chartaceous with recurved margin (on drying), mealy beneath with discrete saucer-shaped hairs . . . . . 6a. subsp. **baccata**

Leaves fleshy, margin not recurved, mealy beneath with very small hairs
6b. subsp. **dioica**

6a. subsp. **baccata**

Rhagodia radiata Nees in Lehm., op. cit. (1845).

Rhagodia baccata var. *angustifolia* Moq. in DC., Prod. 13/2:50 (1849). *Type citation:* 'v.s. in h. Poir. Mus. Vindob. et DC., comm. a cl. Labill. Cunningh. et F. Bauer.' *Lectotype:* Nova Hollandia. Ex herb. Labill. (P; iso: FI) *lecto. nov.* (see notes below).

R. cygnorum Gandoger, op. cit. (1919).

Leaves narrowly oblong-elliptic to oblong-elliptic, 2-4 cm long, 4-8 mm wide, chartaceous, margin recurved, lower surface sparsely to densely mealy with saucer-shaped collapsed vesicular hairs, rarely glabrous.

WESTERN AUSTRALIA: Nornalup Inlet, 15 Jan. 1947, *M. B. Johnson* (PERTH); Recherche Archipelago, *R. D. Royce* 6280 (PERTH); 31 mi [49.9 km] S of Perth, *R. A. Saffrey* 877 (PERTH).

Distribution. Western Australia from Guilderton (80 km N of Perth) south and eastwards around the coast to Cape Arid. Map 31.

Habitat. Coastal or near coastal situations.

This subspecies (under various names) has frequently been considered to be conspecific with *Rhagodia candolleana*. It may be readily distinguished by its thin, narrow leaves with recurved margins and by the absence of staminodes in the female flowers (when lateral in position). A further distinction lies in the indumentum of the leaves which consists of collapsed vesicular hairs circular in outline. In *R. candolleana* the hairs are irregular in shape, very thin walled, and when collapsed fuse to form a silvery sheen. The species are both found in the Recherche Archipelago where they retain their distinctive characters; their distribution is otherwise quite distinct.

Almost glabrous plants of *R. baccata* subsp. *baccata* are found at some localities but this variant grades into the typical one with a mealy indumentum and there is no reason to segregate it as a distinct taxon.

Lectotypification of Chenopodium baccatum. Labillardière (1805 loc. cit.) gave as the provenance of *Chenopodium baccatum* 'Habitat in capite Van-Diemen', i.e. from the south coast of Tasmania. Material collected by Labillardière in herb. FI, and so determined by him, is mounted on four sheets; these contain some specimens which correspond to the Tasmanian plant and others which could only have been collected on the south-west coast of Western Australia. The plants from the two areas I consider to be specifically distinct (they have been generally considered by earlier workers to be distinct at either the level of species or variety); therefore it is important that *C. baccatum* be lectotypified.

Three of the four sheets mentioned above were re-identified by Moquin, presumably prior to 1849 when he cited the specimens in his treatment of the Chenopodiaceae in De Candolle's Prodromus vol. 13/2. The sheet containing the largest number of specimens was determined by Moquin as *R. baccata*, a second sheet as *R. baccata* var. *candolleana*, and a third as *R. baccata* var. *angustifolia*. Moquin had therefore selected one of the four sheets as being representative of the typical variety.

Labillardière refers to the leaves as being 'lanceolatis' and the inflorescence as 'racemis compositis'; the fruit was also described. The specimens which match the Western Australian species have narrowly elliptic leaves and bear large inflorescences; they correspond well with Labillardière's description and are a good match

with his illustration (tab. 96). The specimens which match the Tasmanian species have short elliptic to obovate leaves and are either vegetative or bear short racemes of young flowers; they do not agree with either Labillardière's illustration or description.

The lectotype of *Chenopodium baccatum* is, therefore, to be chosen from among those specimens collected by Labillardière in Western Australia and preferably from those selected by Moquin as being typical of the species. The sheet determined as *Rhagodia baccata* by Moquin contains Labillardière's manuscript description, four pieces of the Tasmanian plant, none of which corresponds to the illustration, and two pieces of the Western Australian, one of which is in flower and the other in fruit (Figure 2). As this fruiting specimen is an excellent match with tab. 96 (it was probably the one illustrated) and with the description, I am selecting it as the lectotype of *Chenopodium baccatum*. The Tasmanian material I am referring to *Rhagodia candolleana* Moq. (q.v.) a species which also requires lectotypification. I have seen a photograph of a specimen collected by Labillardière in herb. PH named by him *Chenopodium baccatum*. This is of the Western Australian plant and therefore of *Rhagodia baccata* sensu lectotypica.

Lectotypification of Rhagodia baccata var. angustifolia. In the Decandolle Herbarium at Geneva (G—DC) there are two specimens which appear to be syntypes of this variety. They are as follows:

(1) Lewis-Land, *Ferd. Bauer*
(2) King George Sound, *A. Cunningham*

In the Paris Herbarium (P) there is one specimen 'Ex herb. Labill.' which came from Moquin's herbarium and which was seen by him during the writing of the Chenopodiaceae for Decandolle's Prodromus vol. 13/2.

In the Florence Herbarium (FI) there is a specimen collected by Labillardière which has been determined by Moquin as *Rhagodia baccata* var. *angustifolia.*

Each of the four collections cited above is of the variant of *R. baccata* found on the south coast of Western Australia between the Recherche Archipelago and Albany. As lectotype of var. *angustifolia* I have selected the Labillardière specimen in herb. P, (Figure 3) of which the specimen in herb FI is probably a duplicate.

6b. subsp. **dioica** (Nees) Paul G. Wilson, comb. et stat. nov.—*R. dioica* Nees in Lehm., Pl. Preiss. 1:636 (1845). *Lectotype*: see above.

Leaves elliptic, 10 x 3 – 20 x 7 mm, obtuse, fleshy, coriaceous on drying, upper surface glabrescent, lower surface densely white mealy with very small hairs.

WESTERN AUSTRALIA: Garden Island, May 1946, *G. R. Meadly* (PERTH); Fremantle, *P. G. Wilson* 8693 (PERTH).

Distribution. Western Australia, Geographe Bay northwards to Fremantle. Map 30.

Habitat. Coastal.

This subspecies is sympatric over part of its range with the typical subspecies and plants intermediate in form between the two taxa may be found. It has thicker leaves

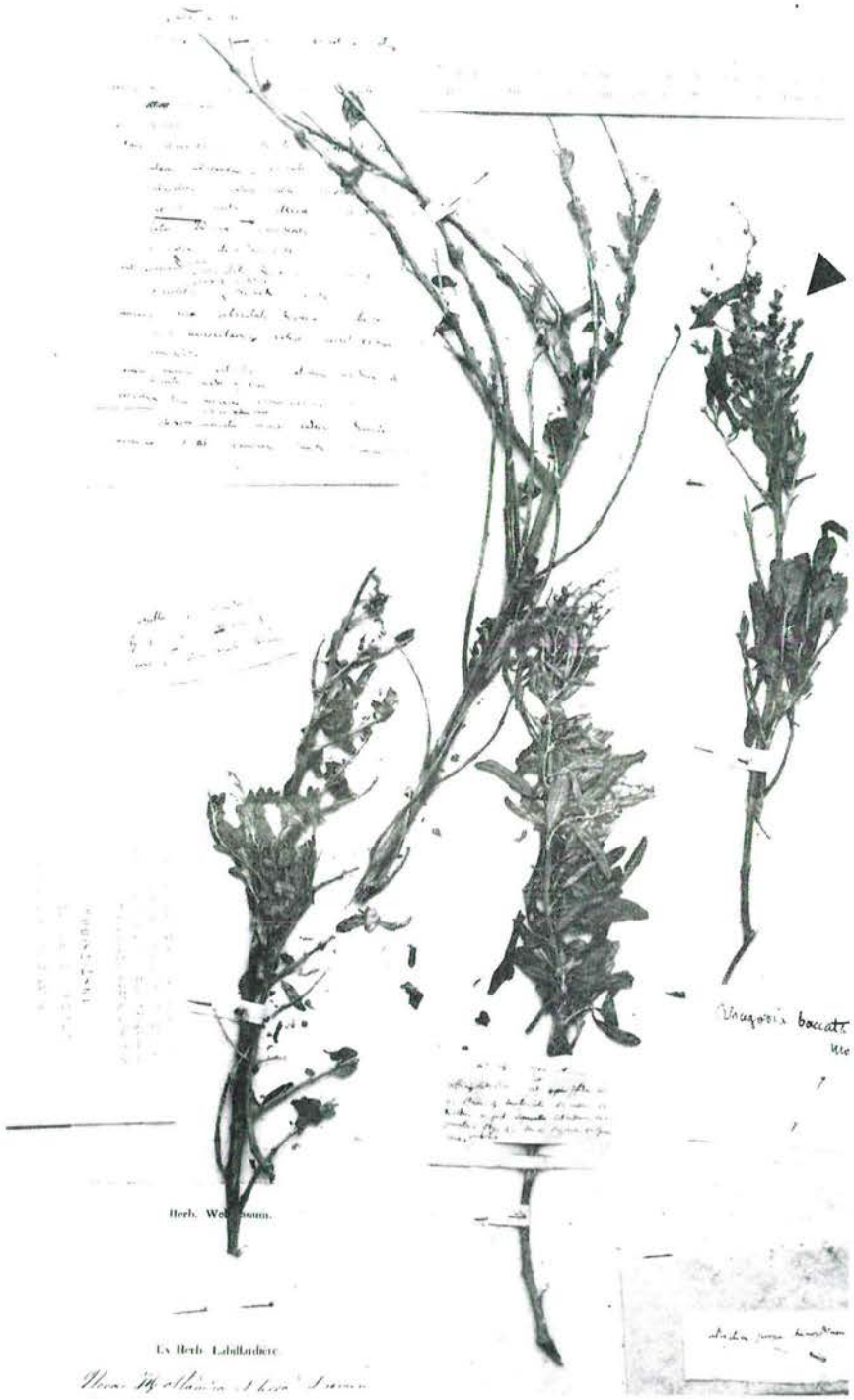


Figure 2. Lectotype of *Rhagodia baccata* (Labill.) Moq. Mixed collection made by Labillardière of *R. baccata* and *R. candolleana*. The left-hand, the upper central, and the lower specimen in the right-hand cluster are of *R. candolleana*. The lower central specimen and the upper specimen of the right-hand cluster are of *R. baccata*. The lectotype of *R. baccata* is indicated by an arrow. Photo of sheet in herb. FI.



Figure 3. Lectotype of *Rhagodia baccata* var. *angustifolia* Moq. in herb. P.

than subsp. *baccata* and a more dense indumentum which is made up of smaller and less well-defined bladder hairs. The type is of a variant of subsp. *dioica* rather close morphologically to the typical subspecies; that is the leaves are thinner and less furfuraceous. At the other extreme are found plants with very fleshy leaves similar in shape and size to those found in *R. crassifolia.*

7. **Rhagodia latifolia** (Benth.) Paul G. Wilson, comb. et stat. nov.—*R. crassifolia* var. *latifolia* Benth., Fl. Austral. 5:155 (1870). *Type*: Dirk Hartog Is., Jan 1822, *A. Cunningham* 321 (holo: K; iso: MEL).

Shrub to 1.5 m high, dioecious. *Branches* firm, densely covered when young with compact spherical or irregularly shaped vesicular hairs. *Leaves* opposite or alternate, densely covered all over with compact vesicular hairs; *lamina* coriaceous to fleshy, linear to broad elliptic or orbicular, c. 1 cm long; *petiole* slender c. 5 mm long. *Inflorescence* terminal, pyramidal or slender, glomerules scattered along its branches. *Flowers* depressed globular c. 1.5 mm diam; *tepals* obovate, cucullate, densely vesicular outside, not enlarging in fruit. *Male flower: filaments* united into a cup-shaped disc woolly within; *pistillode* minute c. 0.2 mm long without stigmas. *Female flower* when terminal in position with short membranous staminodes and densely woolly disc, when lateral in position without staminodes and glabrous within; *stigmas* divaricate. *Berry* depressed globular c. 3.5 mm diam., exceeding the spreading perianth which is pale red within. *Seed* lenticular, 1.3 mm diam., with faint radial rugulosity.

Key to subspecies

Leaves elliptic to orbicular; inflorescence pyramidal . . . . . 7a. subsp. **latifolia**
Leaves semiterete; inflorescence slender . . . . . 7b. subsp.**recta**

7a. subsp. **latifolia**

Divaricately branched *shrub. Leaves* coriaceous, elliptic to orbicular, often conduplicate and then lunate to semicircular, densely covered all over with compact spherical vesicular hairs. *Inflorescence* pyramidal.

WESTERN AUSTRALIA: Dirk Hartog Is., *A. S. George* 11580 (PERTH); Dorre Is., *A. S. Weston* 10482 (PERTH).

Distribution. Shark Bay south to Murchison River. Map 29.

Habitat. Sand dunes, frequently associated with limestone.

7b. subsp. **recta** Paul G. Wilson, subsp. nov.

Rami ascendentes, graciles. *Folia* crassiuscula, semiteretia, c. 10 mm longa, 1 mm lata, supra plana glabra, infra dense farinosa cum pilis minutis vesicularibus, irregulariter formatis. *Inflorescentia* in paniculam gracilem spiciformen disposita.

Typus: Victoria District, Geraldton, Jan 1901, *Diels* et *Pritzel* 212 (holo: PERTH).

Branches ascending, slender. *Leaves* fleshy, semiterete, c. 10 mm long, 1 mm wide, ± flat and glabrous above, densely mealy below with very small irregularly shaped vesicular hairs. *Inflorescence* a slender, spike-like panicle.

WESTERN AUSTRALIA: Mt Hill, *Oldfield* (MEL 87904); Geraldton, *C. H. Ostenfeld* 343 (PERTH).

Distribution. Western Australia; near Geraldton north to Murchison River. Map 29.

Habitat. Sand dunes.

The typical variant of *Rhagodia latifolia* is very distinct in appearance since the orbicular leaves become conduplicate (at least on drying) and are then lunate in shape. It evidently grades to the south into subsp. *recta* (in which the leaves are semiterete), since plants intermediate in form have been collected.

Rhagodia latifolia is quite distinct from *R. crassifolia,* under which name it was placed by Bentham (1870), for in the latter species the hairs of the leaves soon collapse and coalesce to form a silvery sheen while the female flowers possess prominent staminodes. Material of subsp. *recta* was considered by Bentham to represent typical *R. crassifolia,* a view evidently based solely on the leaf shape.

The infraspecific epithet is taken from the Latin word *rectus,* straight, referring to the straight branches of this plant.

8. **Rhagodia drummondii** Moq. in DC., Prod. 13/2:52 (1849). *Type: Drummond* 133 (P).

Intricately branched, loose, dioecious *shrub* up to 1.5 m high. *Leaves* opposite or alternate, somewhat coriaceous (slightly fleshy when fresh), narrowly elliptic to elliptic, shortly petiolate, 7-10(15) mm long, 2-3(4) mm wide, apex acute, base cuneate, upper surface glabrescent, lower surface densely covered with pale grey silvery spherical to saucer-shaped vesicular hairs. *Influorescence* a short terminal panicle to 2.5 cm long, frequently reduced to a short spike-like thyrse. *Flowers* sessile, depressed globular to broadly turbinate, solitary or in small glomerulate dischasia; *tepals* broadly ovate, shortly united at base, bluntly keeled towards apex, densely covered with vesicular hairs. *Male flowers:* staminal *filaments* united into a fleshy disc which is woolly within, pistillode minute without trace of stigmas. *Female flowers: terminal flowers* with minute staminodes and disc, slightly woolly within; *lateral flowers* glabrous within and without staminodes or disc, stigmas slender. *Fruiting perianth* at first clasping fruit but eventually spreading, c. 4 mm diameter, pale fawn or pale red within; *berry* depressed globular; *seed* lenticular, c. 1.8 mm diam., faintly radially rugulose, glossy.

SOUTH AUSTRALIA: 12 km E of the Serpentine Lakes, 28°30′S, 129°04′E, *D. E. Symon* 12540 (ADW); 9 km N of Connie Sue Crossing on S.A.-W.A. border, 28°25′S, 129°00′E, *D. E. Symon* 12621 (ADW).

WESTERN AUSTRALIA: Dowerin, *A. M. Ashby* 2849 (AD); 14.7 mi [23.7 km] N. of Winchester, *M. D. Tindale* 1289 (NSW).

Distribution. Inland southern Western Australia eastwards to the extreme west of South Australia. Map 33.

Habitat. Somewhat saline inland areas, also in *Eucalyptus salmonophloia* (Salmon Gum) Woodland.

Rhagodia drummondii is similar to *R. spinescens* but differs most obviously in the leaf shape (always elliptic) and in the absence of staminodes in the lateral female flowers. It was considered by Bentham (1870) and by Scott (1978b) to be a form of *R. crassifolia*, however, the two are not closely related; they differ very greatly in indumentum (the hairs of *R. crassifolia* collapsing to form a continuous metallic sheen) and in flower morphology, particularly in the presence of prominent staminodes in the female flowers of *R. crassifolia.*

9. **Rhagodia spinescens** R.Br., Prod. 408 (1810). *Type*: Inlet XIV [St. Vincent Gulf], *R. Brown* (holo: BM; iso: K). Figure 5D.

R. spinescens var. *deltophylla* F. Muell., Rep. Pl. Babbage's Exped. 19 (1859).—*R. deltophylla* (F. Muell.) A. J. Scott, Feddes Repert. 89:10 (1978). *Type citation:* Lake Campbell. *Lectotype:* N.E. of Lake Gairdner, *Hersch* [*Herschel*] *Babbage.*' (MEL 87960) *lecto. nov.* (see note below).

Intricately branched *shrub* to 1-5 m high. *Branches* divaricate, frequently spinescent, densely mealy when young. *Leaves* opposite or subopposite, chartaceous to coriaceous, mealy all over with discrete spherical or saucer-shaped hairs, lamina ovate to deltoid or hastiform 0.5-2 cm long, apex obtuse to rounded, petiole slender half length of lamina. *Inflorescence* a rigid, straight, terminal panicle sometimes reduced to a single axis. *Flowers* sessile, densely mealy outside, perianth 5-partite. *Male flowers: perianth* globular, 0.5-1 mm high, filaments united at base into a thick broad saucer-shaped disc, glabrous; *pistillode* hemispherical to obturbinate c. 0.5 cm high with a pair of minute erect subulate stigmas (rarely the pistillode is fertile). *Female flowers: perianth* at first soft and globular to broadly turbinate c. 1 mm high, eventually spreading under the fruit (never enveloping it) and 2.5-3 mm diameter, becoming thick and hard and often pale red; *staminodes* lanceolate, c. 0.3 mm long, with minute antherodes, united at base into a broad glabrous or sparsely hairy disc; *ovary* with a pair of spreading stigmas. *Berry* depressed globular, pericarp fleshy, pink or red. *Seed* lenticular c. 1 mm diameter; *testa* black, prominently reticulate with a radially elongated matrix.

QUEENSLAND: Noondoo, *S. T. Blake* 10543 (BRI); 20 mi [32.2 km] W of Tara, *T. J. McDonald* 71 (BRI).

NEW SOUTH WALES: Woorandara Stn., *E. M. Canning* 3808 (CBG); 16 mi [25.7 km] W of Garah, *K. L. Solling* 332 (NSW).

VICTORIA: 5 mi [8 km] NNW of Kerang, *H. J. Aston* 559 (MEL); 10 mi [16.1 km] W of Cohuna, *J. Vickery* 2021 (NSW).

SOUTH AUSTRALIA: 6 km W of Hawker, *B. Copley* 215 (AD): Tallaringa Well, *T. R. N. Lothian* 2689 (AD).

WESTERN AUSTRALIA: 3 mi [4.8 km] S of Reid, *T. E. H. Aplin* 1677 (PERTH); Nurina, *A. W. H.* No. E 17 (PERTH).

NORTHERN TERRITORY: Mt Brassey, *A. C. Beauglehole* 44701 (NT); Hale River Plot, *T. S. Henshall* 930 (NT).

Distribution. Central and eastern Australia. Map 34.

Habitat. Extremely variable due to the numerous ecotypes involved.

Lectotypification of the name Rhagodia spinescens var. deltophylla. This name has been applied in herbaria by F. Mueller and by later botanists to broad leaved variants of several species, principally *R. spinescens, Chenopodium desertorum and C. curvispicatum.* When searching for a suitable lectotype a number of specimens were found in herbaria K and MEL which had been collected prior to the publication of *R. spinescens* var. *deltophylla* and which Mueller had so annotated (or as *R. deltophylla*), and had evidently referred to when drawing up the protologue; however, none were labelled as having been collected at Lake Campbell, the principal locality mentioned therein. I have therefore selected as lectotype a specimen (MEL 87960) which agrees with the original description and which is the only collection I could find of this taxon that was gathered on the expedition by Babbage to the "North-western interior of South Australia" in 1858. The specimen is labelled "Scrub N. E. of Lake Gairdner"; since Lake Campbell is about 65 km NE of Lake Gairdner it is possible that this specimen is the one referred to by Mueller when he cited that locality. The name *"Rhagodia deltophylla"* was used by Mueller in his Second General Report (1854) but without a description. A specimen of *R. spinescens* which bears the name *R. deltophylla* was collected by him along the River Murray in January 1854 (herb. K); it presumably represents the plant referred to in the 1854 Report and is also evidently a syntype of *R. spinescens* var. *deltophylla.* Scott (1978a) gave the type citation of that variety as "South Australia, Lake Campbell; F. Mueller; Jan 1854"; he evidently had in mind the locality cited by Mueller for the specimen collected on the Babbage Expedition in 1858 and confused it with the data on the Mueller collection from the Murray River. Those specimens cited by Scott under *R. deltophylla,* that I have been able to check, are of *R. spinescens, Chenopodium desertorum* and *C. curvispicatum.* A similar mixture of species was included by J. M Black in his private herbarium under *R. spinescens* var. *deltophylla.*

Rhagodia spinescens, as delimited in this paper, exhibits considerable variability, more, in fact, than has been accepted for any other species of *Rhagodia.* The leaves vary in shape from narrow elliptic c. 5 mm long to deltoid and 20 mm long, and in texture from papery to fleshy.

I have not been able to discriminate clearly distinct infraspecific taxa since the different variants appear to grade into each other and the leaves vary in shape and texture on the same plant. Some variants are rather distinctive; these appear to be very limited in their distribution and since they also exhibit variability it is not clear as to whether they should be treated separately. The more easily recognisable of these variants are as follows:

(1) *Glossy variant. Leaves* narrow elliptic to deltate, 4-20 mm long, thin or fleshy; *indumentum* thin below of irregularly shaped glossy thin-walled bladder hairs, almost glabrous above. *Staminodes* glabrous, disc almost absent. North west Victoria.

Representative collections. VICTORIA: Hattah Lakes N.P., 13 Mar 1969, *G. Anderson* (MEL 88273); 10 mi [16.1 km] NNW of Underbool, *A. C. Beauglehole* 40379 (MEL); Wyperfeld N.P., *A. C. Beauglehole* 29535 (MEL).

This variant appears to grade into the local small-leaved variant of typical *R. spinescens* which is found in north western Victoria and neighbouring areas of South Australia and New South Wales.

(2) *Bisexual variant. Leaves* ovate, small, c. 5 mm long. *Flowers* bisexual, disc puberulous. *Testa* faintly rugose. *Indumentum* more finely furfuraceous than in typical variant. Northern South Australia.

Representative collections. SOUTH AUSTRALIA: 36 km W of Abminga siding, *Lazarides* 8276 (AD); Lindsay Ck., *B. Major* 65 (AD).

(3) *Central Australian foetid variant. Leaves* deltate to hastiform c. 10 mm long, closely furfuraceous with very small round bladder hairs. *Flowers* sessile or pedicellate. *Testa* almost smooth. Simpson Desert.
Representative collections. NORTHERN TERRITORY: Umbeara Stn., *T. S. Henshall* 1545 (NT); Beddome Range, *T. S. Henshall* 1519, 1533 (AD).
Rather variable and possibly intergrading with the typical variant which is found in the same area. The foetid plant appears to occur on rocky hillsides whereas the typical variant is found (in this area) in sand.

(4) *Thin leaved variant. Leaves* broadly elliptic, thin, c. 10 mm long, finely furfuraceous with very small irregular bladder hairs. Queensland and Northern Territory.
Representative collections. QUEENSLAND: Laglan Stn., *L. S. Smith* 10315 (BRI); Taroom, *R. W. Johnson* 696 (BRI); 10 mi [16.1 km] N of Wandoon, *Speck* 1959 (CANB). NORTHERN TERRITORY: 28.7 mi [46.2 km] SW of Ooratippra H.S., *G. C. Chippendale* (NT 3528).
Recorded as having a nauseous, fishy odour attractive to flies. Speck states that the creeping stems root at frequent intervals.

The intergradation between the variants listed and those more typical of *R. spinescens* is such as to make any formal classification difficult to apply.

Although *Rhagodia spinescens* as I delineate it is a very variable species, it is not so variable as has been considered by some authors. A. J. Scott (1978a), for instance, perceived it more broadly, including under this name specimens which I recognise as *R. drummondii* (Wilson 6088b), *R. ulicina* (Symon 4659), *R. eremaea* (Latz 114), and *Chenopodium desertorum* (Cunningham 384). The name *R. prostrata* Moq. was also cited by him as a synonym of *R. spinescens* whereas it is a synonym of *C. desertorum.*

Rhagodia spinescens is evidently most closely related to *R. drummondii* and *R. eremaea.* Apart from differences in leaf shape the latter two species may be distinguished by the absence of disc or staminodes in the female flowers, the inflorescence shape and, in *R. eremaea,* by the minute irregularly shaped vesicular hairs.

10. **Rhagodia eremaea** Paul G. Wilson, sp. nov. Figure 5C.

Rhagodia sp. B, Paul G. Wilson in Jessop, Fl. Central Australia 53 (1981).

Frutex dioecius ad 2 m altus. *Folia* alterna ovata vel elliptica 0.5-2 cm longa (petiolo 0.3-1 cm longo incluso) furfuracea cum pilis minutis vesicularibus irregulariter formatis ornatis vel glabrescentia. *Flores* congesti in paniculam terminalem pyramidalem vel paniculam gracilem spiciformen continuam dispositi. *Flos masculus* disco patelliformis intra pubescenti. *Flos femineus* staminodiis plerumque absentibus.

Typus: Rudall River, 22°33'S, 122°11'E; In rocky loam by creek-line. Much-branched shrub to 1 m, fruit deep red-pink, 19 May 1971, *A. S. George* 10676 (holo: PERTH; iso: CANB, K, MEL, NSW).

Rounded dioecious *shrub* to 2 m high becoming a scrambler in shade. *Branches* slender, closely grey-mealy when young with short branched vesicular hairs. *Leaves* alternate, ovate to elliptic, 0.5-2 cm long including petiole c. 1/2 length of lamina,

grey mealy with minute irregularly shaped hairs, glabrescent above. *Inflorescence* a terminal pyramidal to slender spicoid panicle, flowers congested so as to appear continuous along slender branches of panicle or (in northern Australia) in slender spicoid inflorescences with disjunct glomerules. *Perianth* 5-partite, densely mealy with short branched vesicular hairs. *Male flower* caducous; *perianth* globular, c. 1.5 mm diam.; *filaments* united into a thick saucer-shaped disc pubescent within; *pistillode* minute (c. 0.2 mm high). *Female flower: perianth* at first soft and globular c. 1 mm high, eventually hard and spreading beneath fruit becoming red within; *staminodes* usually absent (present in terminal flowers); *ovary* glabrous with a pair of slender stigmas. *Berry* depressed globular, c. 3 mm diameter; *pericarp*fleshy, red. *Seed* depressed globular, c. 1.3 mm diam.; *testa* black with reticulate ornamentation.

SOUTH AUSTRALIA: Ernabella, 9 Aug. 1933, *J. B. Cleland* (AD); 96 km W of Mabel Creek H.S. *T. R. N. Lothian* 3778 (AD).

WESTERN AUSTRALIA: Finucane Is., 5 Feb. 1981, *G. Craig* (PERTH); Lorna Glen Stn., *S. Hill* 25 (PERTH).

NORTHERN TERRITORY: Ayers Rock, *G. Chippendale* (NT 663); 20 mi [32.2 km] NW of Alice Spr., *D. J. Nelson* 1703 (NT).

Distribution. Central Australia westwards. Map 31.

Habitat. Recorded in clay-loam and on rocky hillsides with *Acacia kempeana*, also on sand with spinifex.

The flowers are arranged in glomerules each of which is subtended by a caducous linear bract. These glomerules may consist of a single terminal flower or this flower may be surrounded by others which may or may not be bracteate. The terminal flower of a glomerule in a female plant has staminodes while in the lateral flowers these are usually absent.

This species exhibits the following geographic variation. In central Australia the leaf is oblong-elliptic with rounded apex and somewhat leathery when dry. In the north-west of Western Australia (Hamersley Range area) the leaf is narrow-elliptic with acute apex and is thinner in texture. The plant from the north-west and from the far north of both Western Australia and the Northern Territory usually has a very slender, spicate type of inflorescence with discontinuous glomerules of flowers, unlike the continuous, dense spikes of the central Australian plant. Another variant found in Western Australia between Geraldton and Wittenoom has thin, broadly elliptic to obovate leaves with rounded apices; the leaves of those specimens growing in shade are thinner and broader than those in the open.

In herbaria female plants of *R. eremaea* have generally been identified as *R. spinescens* (or, more rarely, as *R. crassifolia)* and male plants as *Chenopodium nitrariaceum*. From both *R. spinescens* and *R. crassifolia* this species may be distinguished by the very small irregularly shaped vesicular hairs of the leaf indumentum, the slender, compact inflorescence, and by the lack of staminodes in the female flowers. Male plants may be distinguished from *C. nitrariaceum* by the indumentum, the scattered leaf arrangement, and the absence of spinescent branchlets.

A specimen of *R. eremaea* collected by F. Mueller in 1856 along Sturt Creek (north-east Western Australia) is evidently one of several syntypes of *Chenopodium nitrariaceum* (F. Muell.) Benth. This specimen was later re-identified by Bentham (1870) as *R. crassifolia* which name was also applied by Ewart and Davies (1917).

The specific epithet is taken from the Greek word *eremia*, a desert, alluding to the typical habitat of this plant.

11. **Rhagodia parabolica** R. Br., Prod. 408 (1810). *Type*: Inlet XII [Spencers Gulf], March 1802, *R. Brown* (holo: BM).

R. parabolica var. *typica* Domin, Bibl. Bot. 89:62 (1921) nom. illeg.

R. reclinata A. Cunn. ex Moq. in DC., Prod 13/2:51 (1849).—*R. parabolica* var. *reclinata* (Moq.) Domin, Bibl. Bot. 89:62 (1921). *Type*: Liverpool Plains, May 1825, *A. Cunningham* 7 (holo: K).

Rounded dense dioecious *shrub* 1-2 m high. *Branches* striate, somewhat flattened when young, mealy grey with minute irregularly shaped vesicular hairs. *Leaves* predominantly opposite or subopposite, chartaceous, broadly or very broadly elliptic to broadly or very broadly ovate (rarely bluntly hastate) 1.5-4 cm long, apex acute to rounded, apiculate, base truncate to cuneate passing into the slender petiole half the length of or equal in length to lamina, minutely mealy becoming reddish brown with age. *Inflorescence* a broad pyramidal terminal panicle 5-8 cm long, the flowers in discrete glomerules along its branches. *Flowers* spherical c. 1 mm diameter; *perianth* 5-partite, closely mealy, eventually spreading in the female flower to 2.5 mm diam. but scarcely indurated. *Male flowers*: staminal *filaments* united at base into a thick cupular disc which is densely wooly at junction with filaments; *pistillode* minute. *Female flowers: staminodes* in terminal flower of glomerule prominent, linear with minute antherodes and united into a deep cupular disc densely wooly within, in lateral flowers reduced or absent; *stigmas* subulate and spreading. *Berry* depressed globular c. 2.5 mm diameter. *Seed* depressed globular to lenticular, c. 1.8 mm diam., testa glossy with faint radial ribbing.

QUEENSLAND: Ooline, *S. T. Blake* 10930 (BRI); Isle Gorge, *P. Sharpe* 00646 (BRI).

NEW SOUTH WALES: Mt Hope, *G. M. Cunningham* and *P. Milthorpe* 2511 (NSW); 6 mi [9.7 km] W by S of Jerrys Plains, *R. Story* 7131 (CANB).

VICTORIA: Werribee Gorge, *A. C. Beauglehole* 39927 (MEL); Head of Coimadai Creek, 7 May 1944, *J. H. Willis* (MEL).

SOUTH AUSTRALIA: Mt Mary, *E. H. Ising* 1912 (AD); Koondoolka, *J. Z. Weber* 3053 (AD).

NORTHERN TERRITORY: Ilpapa Swamp, *T. S. Henshall* 1196 (NT); 0.5 mi [0.8 km] W of Ooraminna Rockhole, *D. J. Nelson* 1964 (MEL).

Distribution. South-east Queensland and north east New South Wales, southern Victoria, southern South Australia and Central Australia. Map 33.

Habitat. Recorded from rocky hillsides with skeletal soil, along creek banks and on sand banks.

This species appears to occupy four disjunct areas in Australia but the plants from each area are sufficiently alike not to warrant infraspecific recognition.

In the Northern Territory occasional plants are hermaphrodite and some have vertical (not horizontal) seeds, but it is not possible to establish from herbarium material how common these variants are.

In Yorke and Eyre Peninsulas and north of Adelaide, plants are found with elliptic leaves and a hair type intermediate between those found in typical *R. parabolica* (with small discrete vesicular hairs) and that found in *R. candolleana* (in which the hairs collapse to form a scurfy or silvery sheen). The typical, broad-leaved *R. parabolica* has been collected in the same areas so that it is possible that the narrow-leaved plant has arisen through hybridization with another species such as *R. preissii* or *R. candolleana.*

Doubtful or incorrect records

Blitum virgatum L. (= *Chenopodium foliosum* (Moench) Asch.) Recorded by J. D. Hooker, Fl. Tasman. XCVI (1959) as being found in Australia. I have seen no specimens which support this record.

Chenopodium bonus-henricus L. In the Victorian Naturalist 22:79 (1905) it is recorded that H. B. Williamson exhibited a specimen of this species collected from 'Hopkins mouth', Victoria. This record is referred to by Ewart and Tovey (1909) and by Ewart (1931) who state that it was naturalized in south-west Victoria in 1905. I have been unable to locate the Hopkins mouth collection but a specimen collected by Williamson nearby at Hawksdale in 1900 (MEL 88604 and 88605), and identified by Ewart as *C. bonus-henricus,* is of a species of *Atriplex.*

Chenopodium ficifolium Smith. Recorded as a weed in Brisbane by F. M. Bailey, Queensland Agric. J. 31: 321 (1913). I have seen no specimens to validate this record.

Chenopodium rubrum L. Recorded by Audas and Morris (1925) as widely spread in Victoria and by Ewart (1931) as naturalized at North Melbourne in 1910 and widely spread in Victoria. I have seen no Australian collection of this species. The following two specimens in herb. MEL which had been determined as *C. rubrum* are, in fact, both *Chenopodium glaucum:* Railway Reserve, N. Melbourne, May 1910, *C. French* and *R. J. Tovey* (MEL 88793); Coode Island, 23 March 1912, *R. J. Tovey* (MEL 88794).

Chenopodium viride L. Recorded by J. D. Hooker, Fl. Tasman. CIX (1859) as being found in Australia. I have seen no specimen to support this record.

Excluded names

Chenopodium insulare J. Black, Trans. Roy. Soc. S. Austral. 69: 309 (1945) = *Suaeda australis* (R. Br.) Moq. See Hj. Eichler, Supplement to J. M. Black's Flora of South Australia (1965).

Chenopodium australe R. Br., Prod. 407 (1810) = *Suaeda australis* (R. Br.) Moq.

Rhagodia eschscholtziana Fenzl, Denkschr. Akad, Wien (Math.-Nat.) 1: 257 (1850). Described from Oahu in the Hawaiian Islands; the description agrees with that for *Chenopodium oahuense* (Meyen) Aellen (*Atriplex oahuensis* Meyen 1835).

Acknowledgements

I am grateful to the Directors of the State, Commonwealth, and University herbaria in Australia and to the herbarium of the DSIR in Christchurch, for the loan of material. I am also grateful to the Directors of the herbaria in Paris (P), Florence (FI), Lund (LD), London (BM), and Kew (K) for the loan of type specimens. The National Herbarium of New South Wales (NSW) kindly sent manuscript herbarium notes on many of the species treated in this paper. Mr W. R. Sykes (CHR) sent comments on several of the species found in New Zealand.

The present study was commenced in 1978 while a guest of the Division of Plant Industry, CSIRO, Canberra. I am grateful to its Chief, Dr W. J. Peacock, for extending an invitation and to Dr Hj. Eichler, then Curator of the Herbarium Australiense, for making space and facilities available and for his personal support. The SEM photographs, figures 4 and 5, were prepared by Mr Stuart Craig of the Division of Plant Industry, Canberra and figures 6 and 7 by Mr Terry Robertson of the Queen Elizabeth II Medical Centre, Perth, to both of whom I wish to express my appreciation for their careful work.

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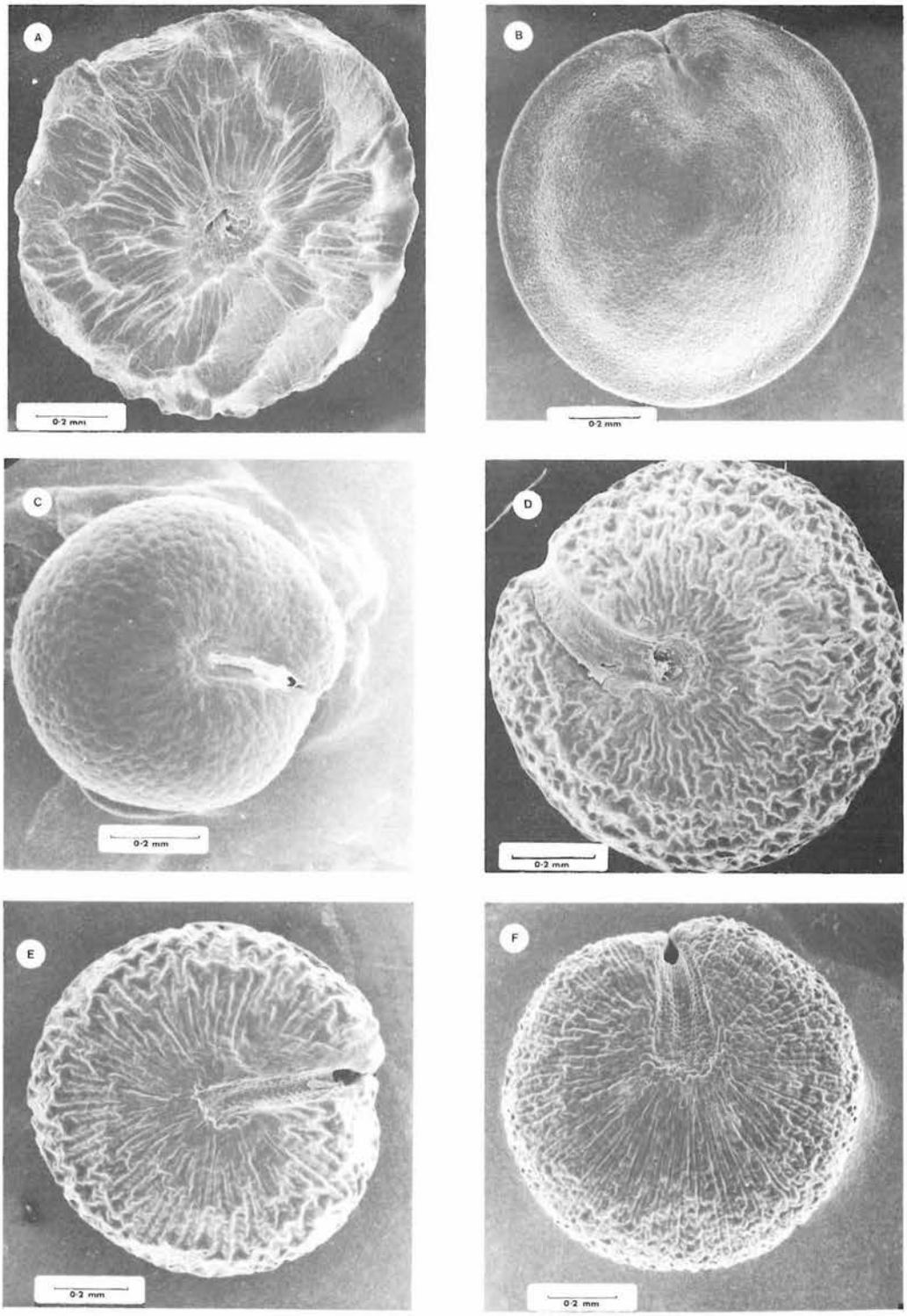


Figure 4. SEM photos of seeds: A—*Chenopodium erosum* (upper surface with pericarp attached), from *A. C. Beauglehole* 37201 (PERTH); B—*Chenopodium murale* (lower surface), from CANB 31776; C—*Chenopodium auricomiforme* (lower surface), from CANB 36430; D—*Chenopodium curvispicatum* (lower surface), from *R. Schodde* 1082 (CANB); E—*Einadia nutans* subsp. *nutans* (lower surface), from AD95826008; F—*Einadia hastata* (lower surface), from CBG046601.

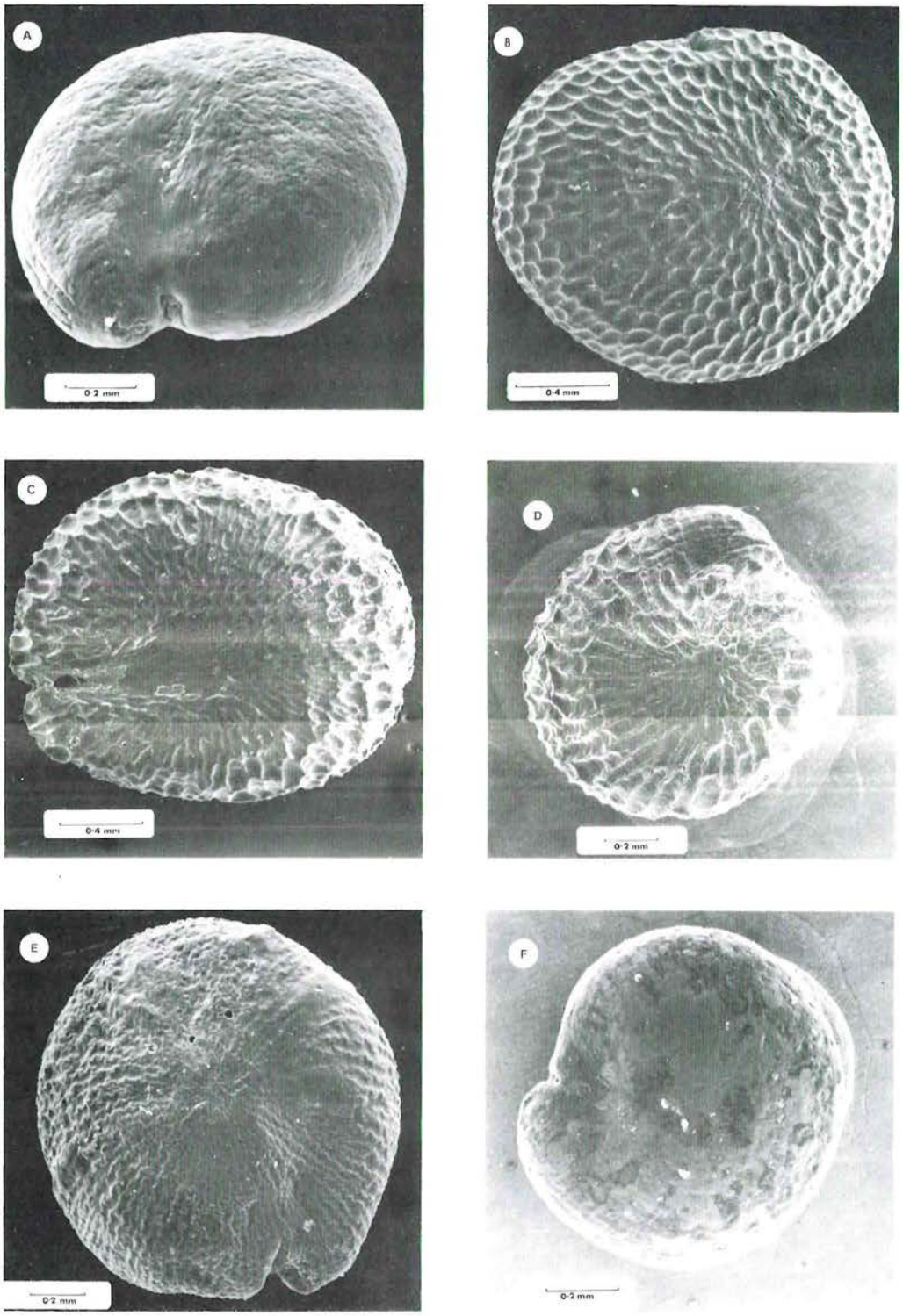


Figure 5. SEM photos of seeds: A—*Einadia allanii* (upper surface), from *P. Wardle* (CHR125728); B—*Einadia triandra* (upper surface), from *N. J. A. Simpson* 7160 (CHR); C—*Rhagodia eremaea* (lower surface), from *P. K. Latz* 139 (PERTH); D—*Rhagodia spinescens* (upper surface), from ADW34053; E—*Rhagodia acicularis* (upper surface), from *P. G. Wilson* 11713 (PERTH); F—*Rhagodia ulicina* (upper surface), from AD96503078.

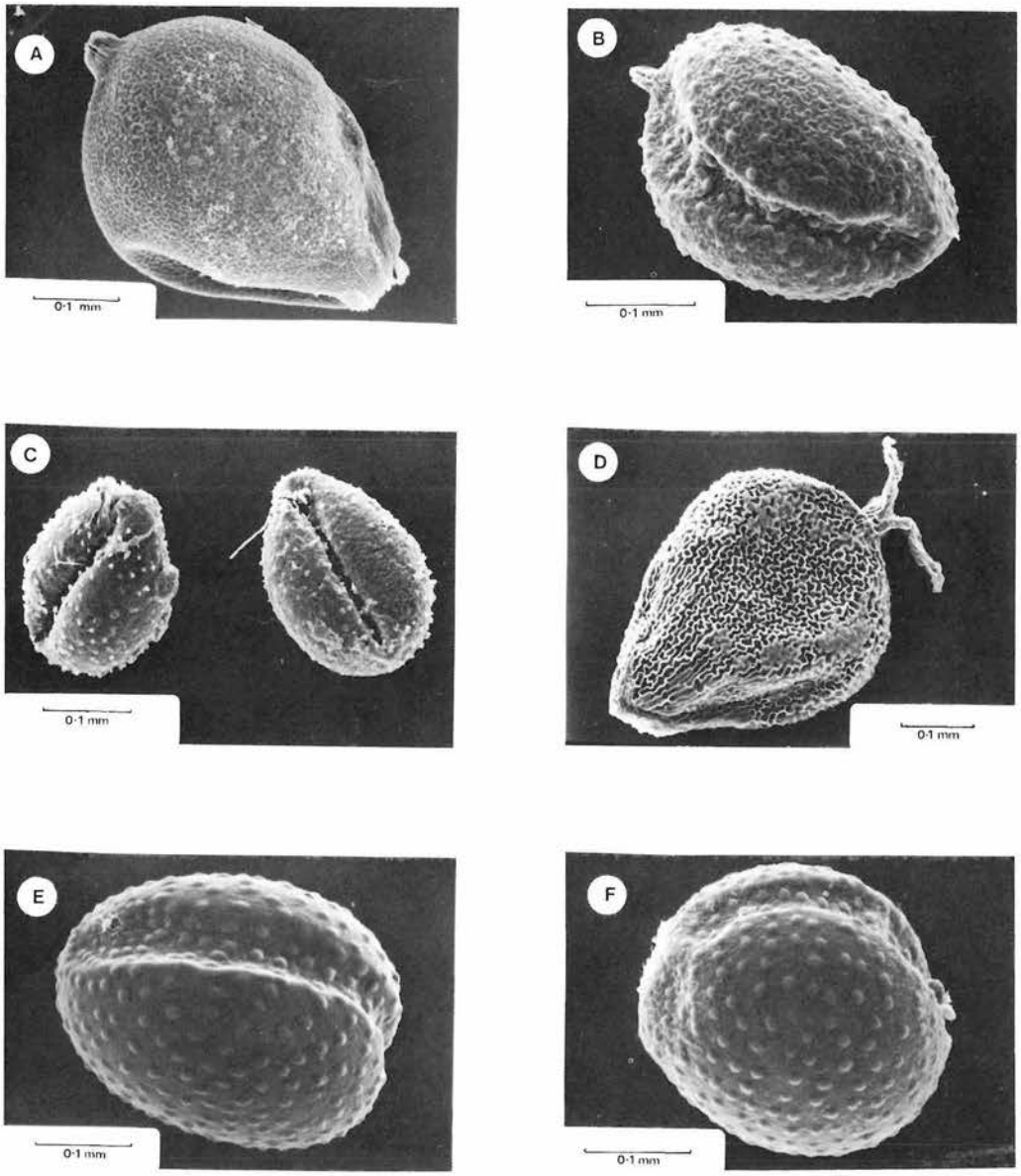


Figure 6. SEM photos of seeds: A—*Dysphania glomulifera* subsp. *glomulifera* (side view), from *C. Andrews,* April 1902 (PERTH); B—*Dysphania glomulifera* subsp. *eremaea* (side view showing embryo-groove), from *R. D. Royce* 1493 (PERTH); C—*Dysphania glandulosa* (side view showing embryo-groove), from *A. S. George* 717 (PERTH); D—*Dysphania platycarpa* (side view), from *A. S. George* 8927 (PERTH); E-F—*Dysphania sphaerosperma* (side view showing vertical embryo-groove).

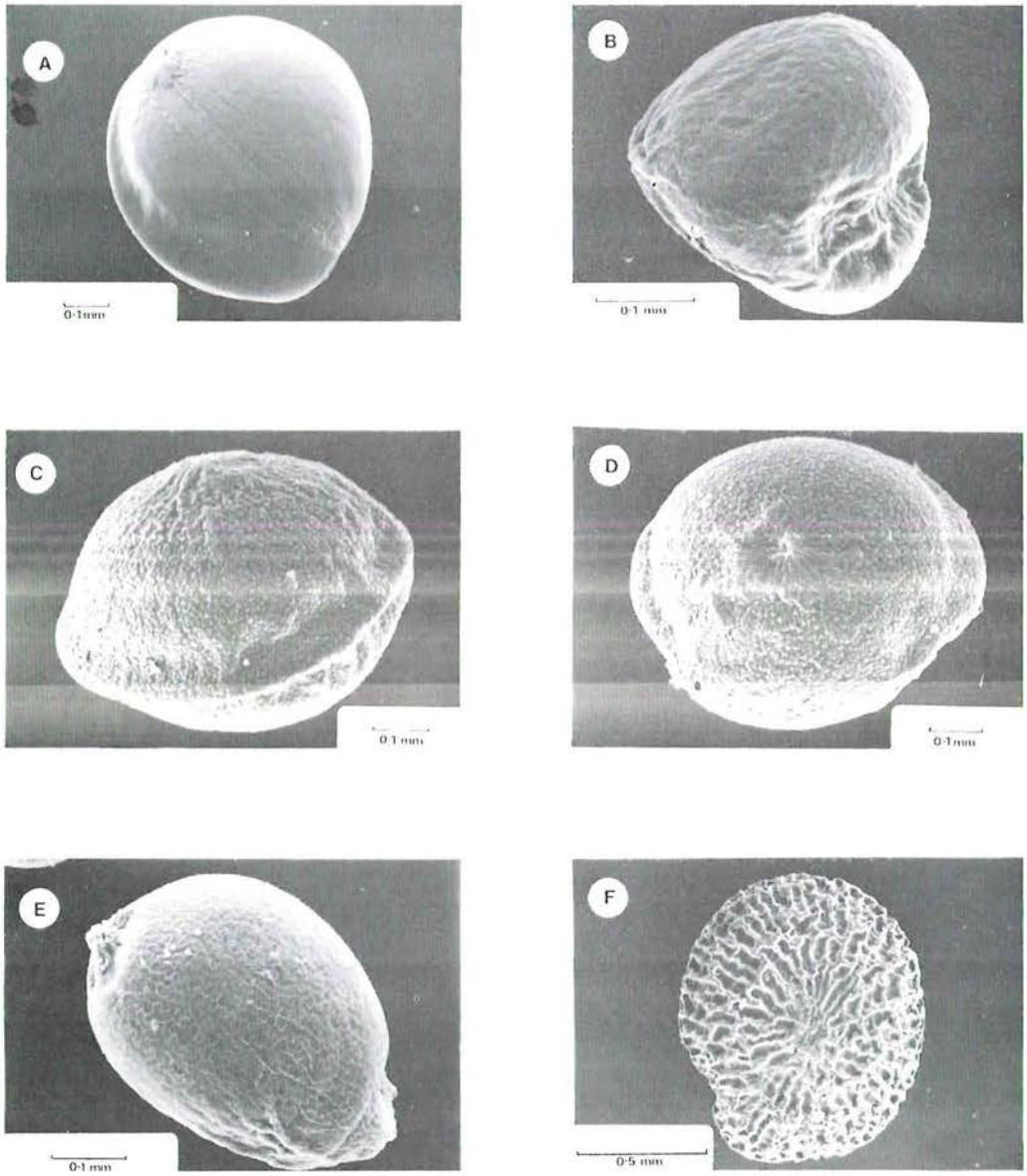
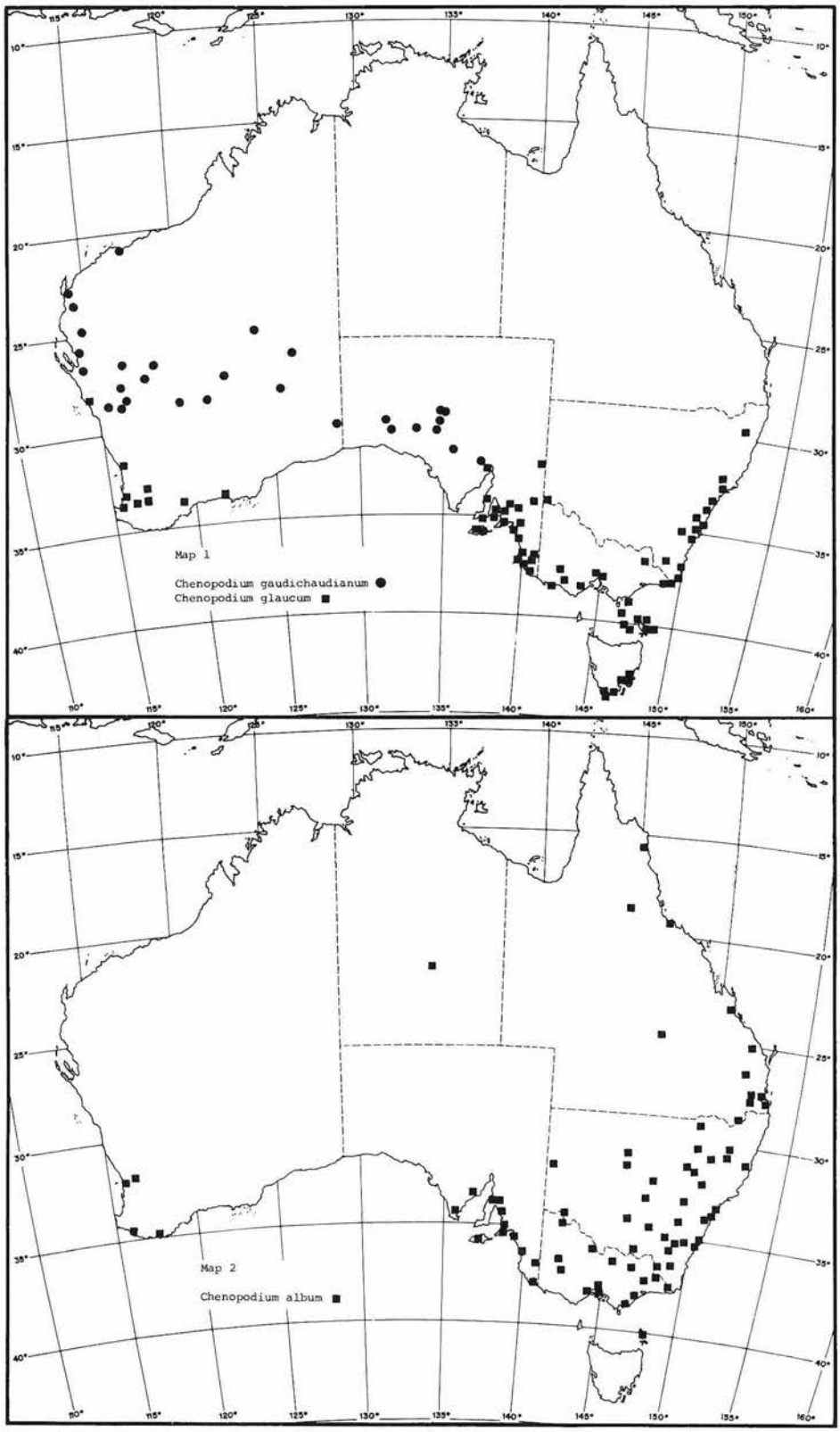
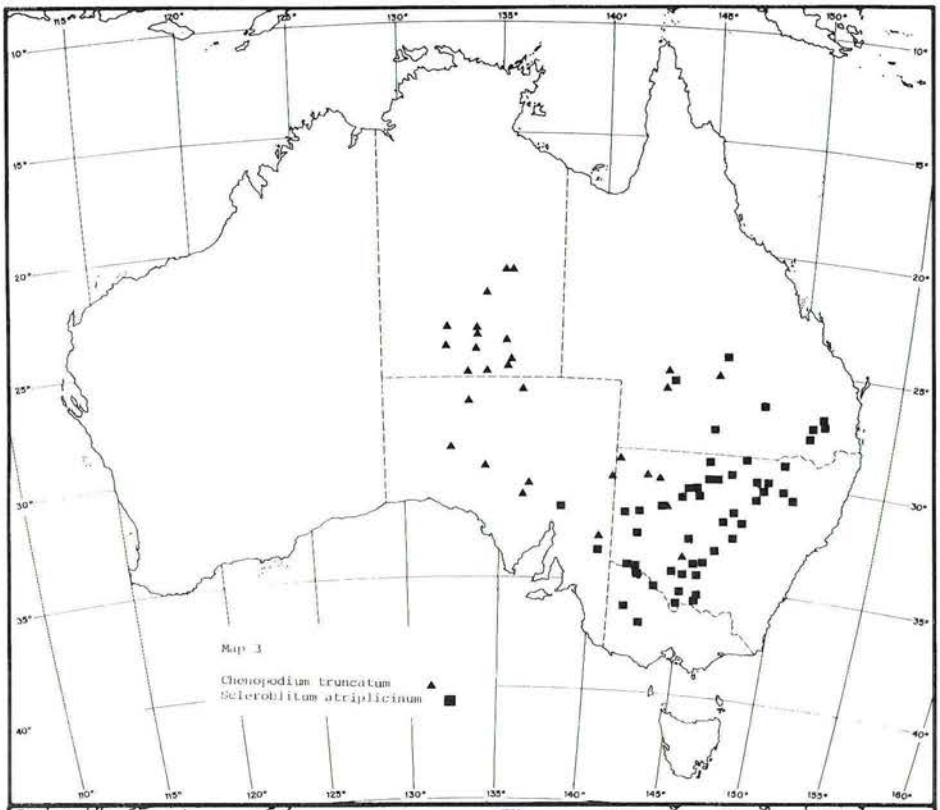
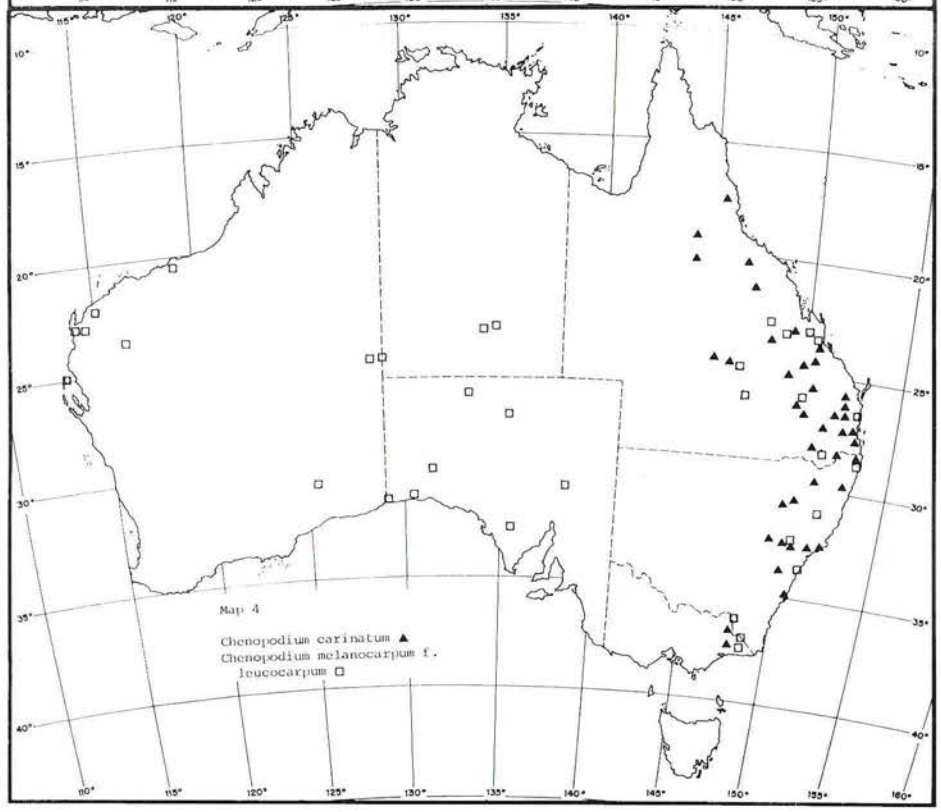
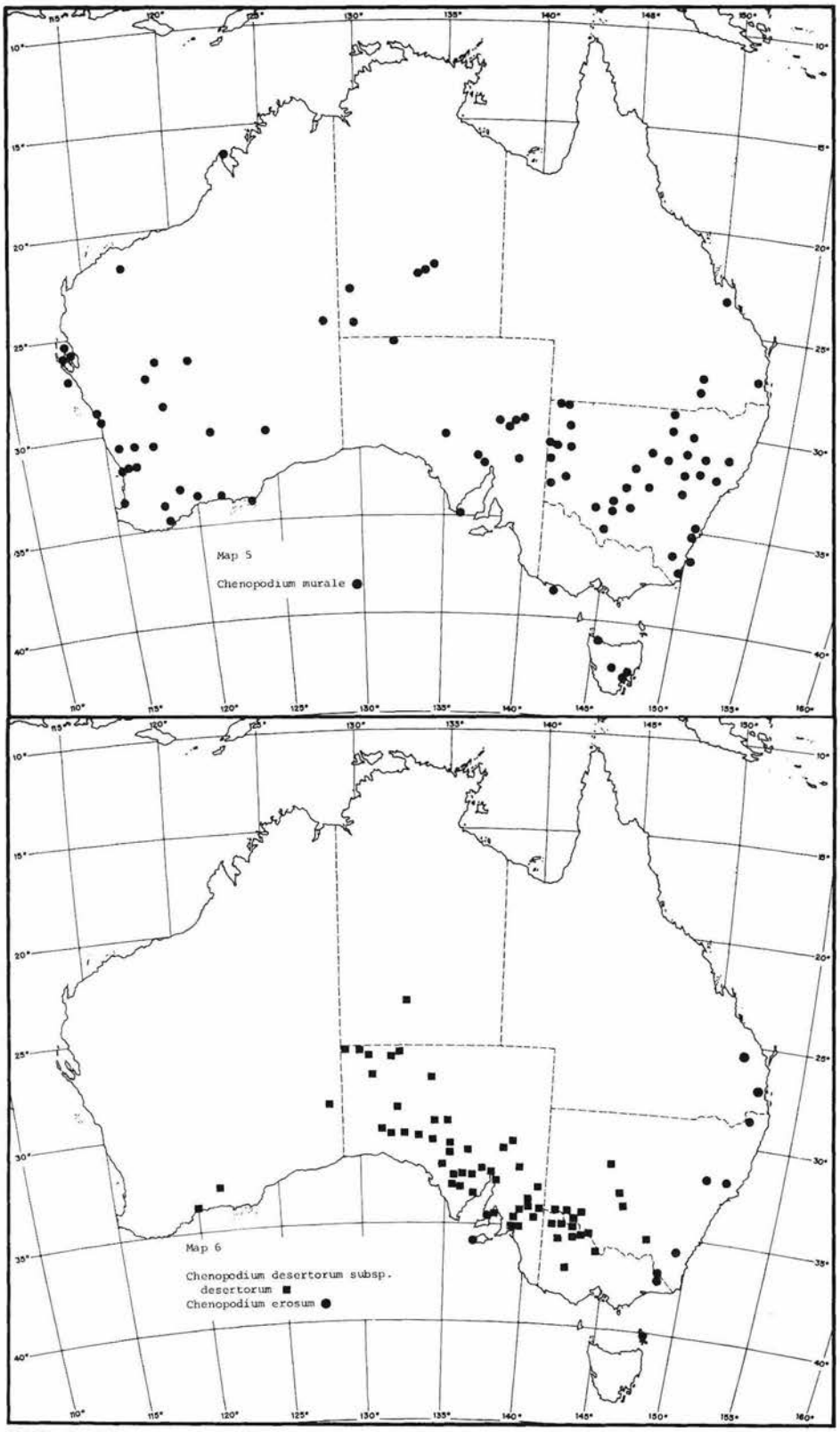


Figure 7. SEM photos of seeds: A—*Dysphania kalpari* (side view showing raphe), from *D. J. Nelson* 830 (NT); B—*Dysphania littoralis* (obliquely lateral view), from *P. G. Wilson,* 24 Feb. 1977 (PERTH); C-D—*Dysphania rhadinostachya (C—obliquely lateral view and D—upper surface, showing horizontal embryo-ridge), from R. J. Chinnock* 3855 (PERTH); E—*Dysphania plantaginella* (side view), from *A. C. Beauglehole* 48362 (PERTH); F—*Chenopodium gaudichaudianum* (upper surface), from *P. G. Wilson* 9911 (PERTH).

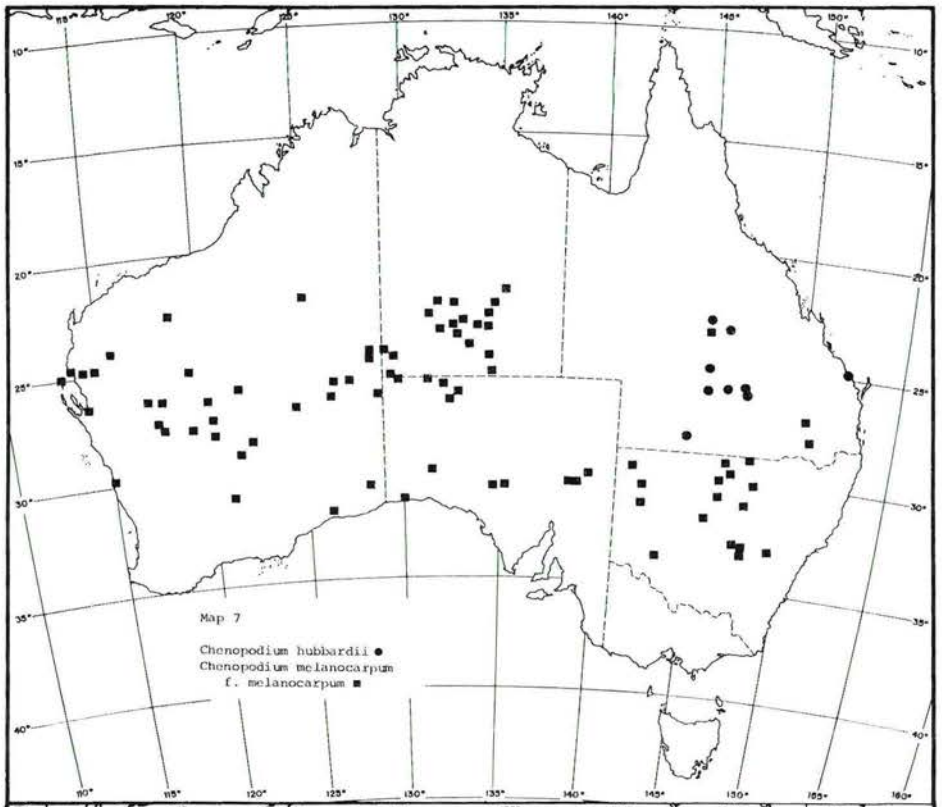

Map 1
Chenopodium gaudichaudianum
Chenopodium glaucum
Map 2
Chenopodium album

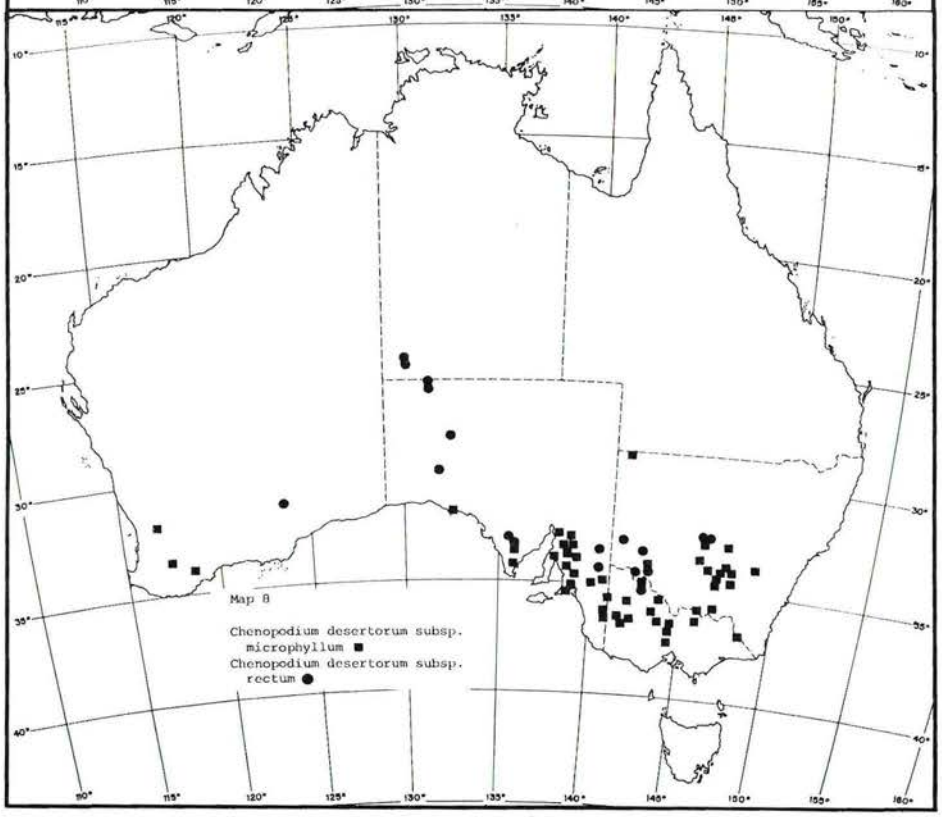

Map 3
Chenopodium truncatum
Sclerolitum atriplicinum

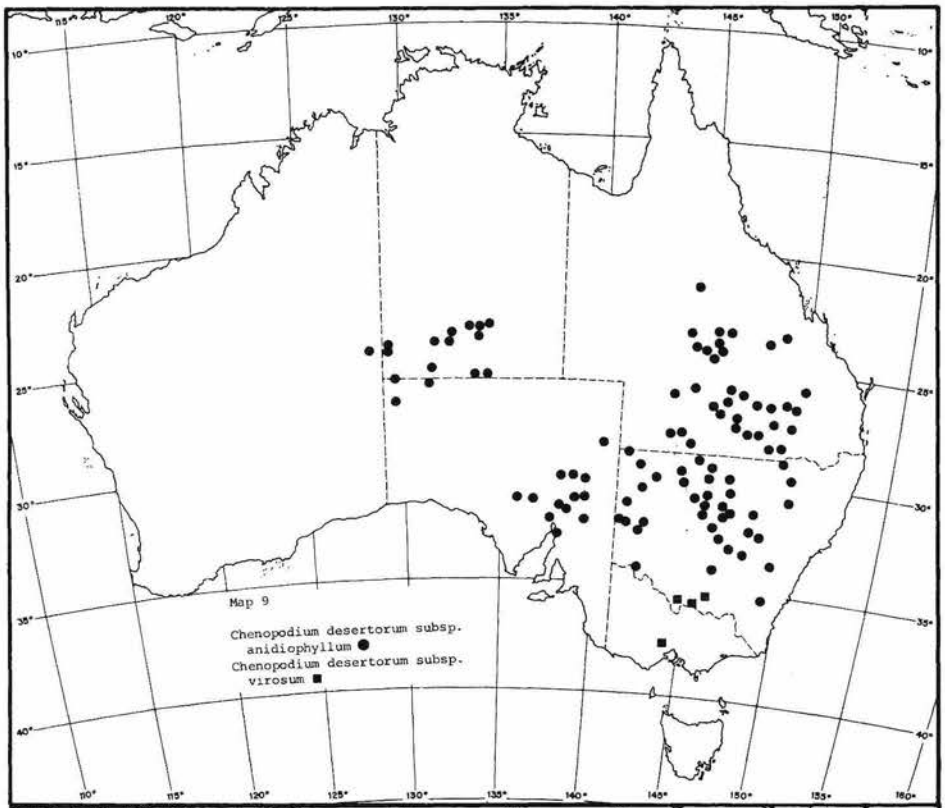

Map 4
Chenopodium carinatum
Chenopodium melanocarpum f. leucocarpum

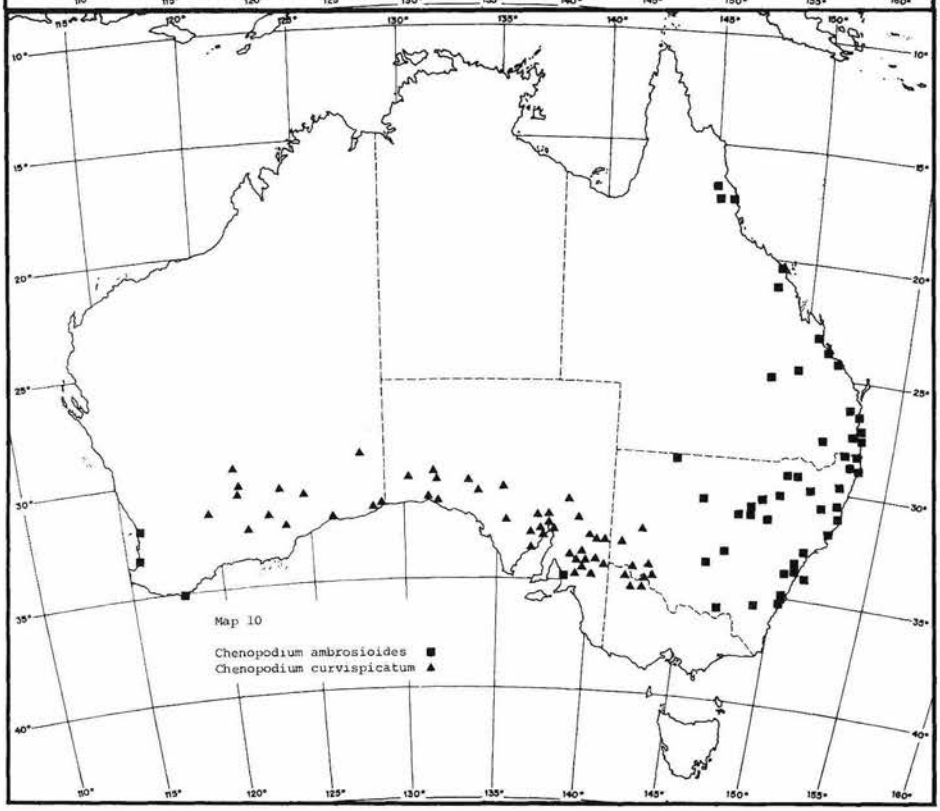

Map 5
Chenopodium murale
Map 6
Chenopodium desertorum subsp. desertorum
Chenopodium erosum

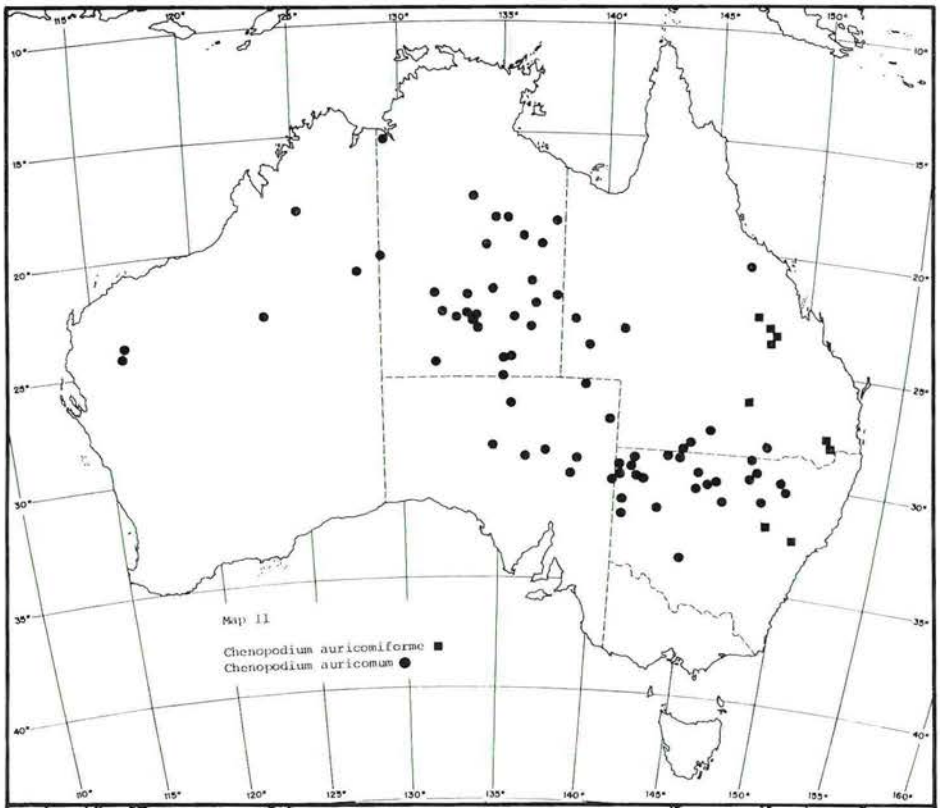
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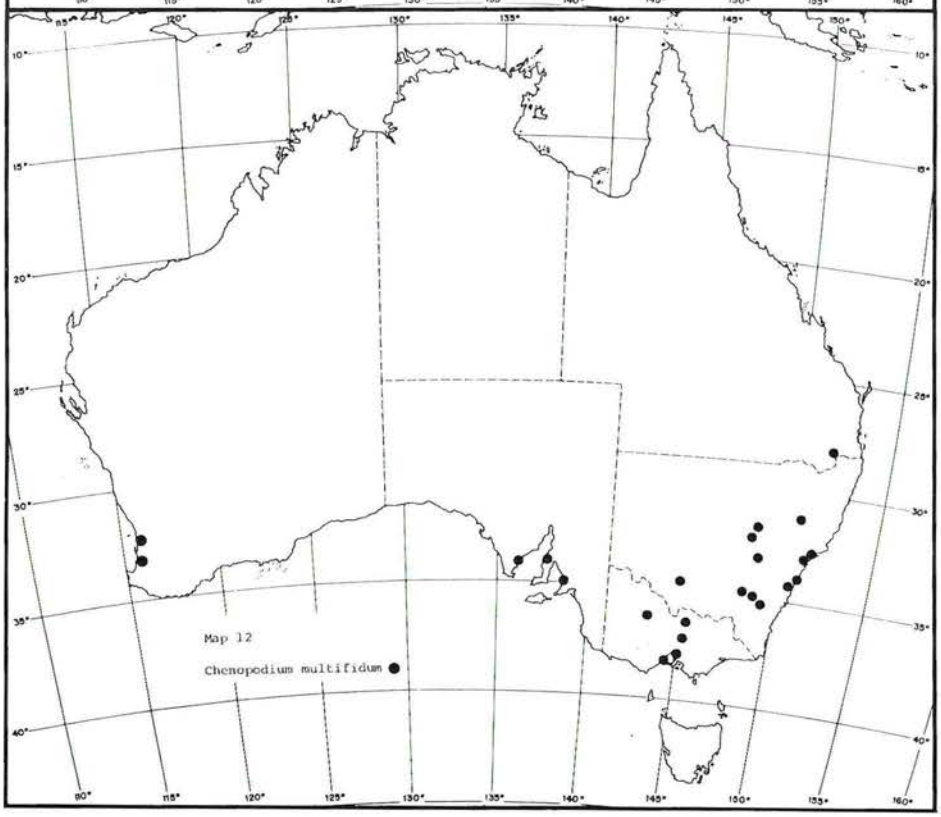

Map 7
Chenopodium hubbardii ●
Chenopodium melanocarpum
f. melanocarpum ■

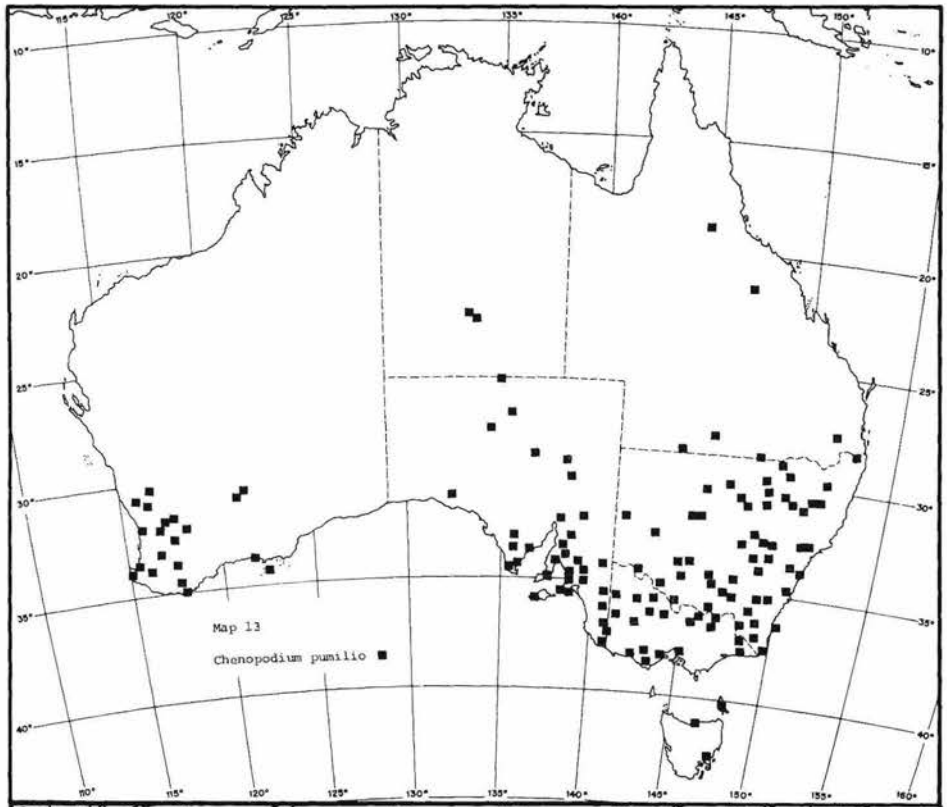

Map 8
Chenopodium desertorum subsp.
microphyllum ■
Chenopodium desertorum subsp.
rectum ●

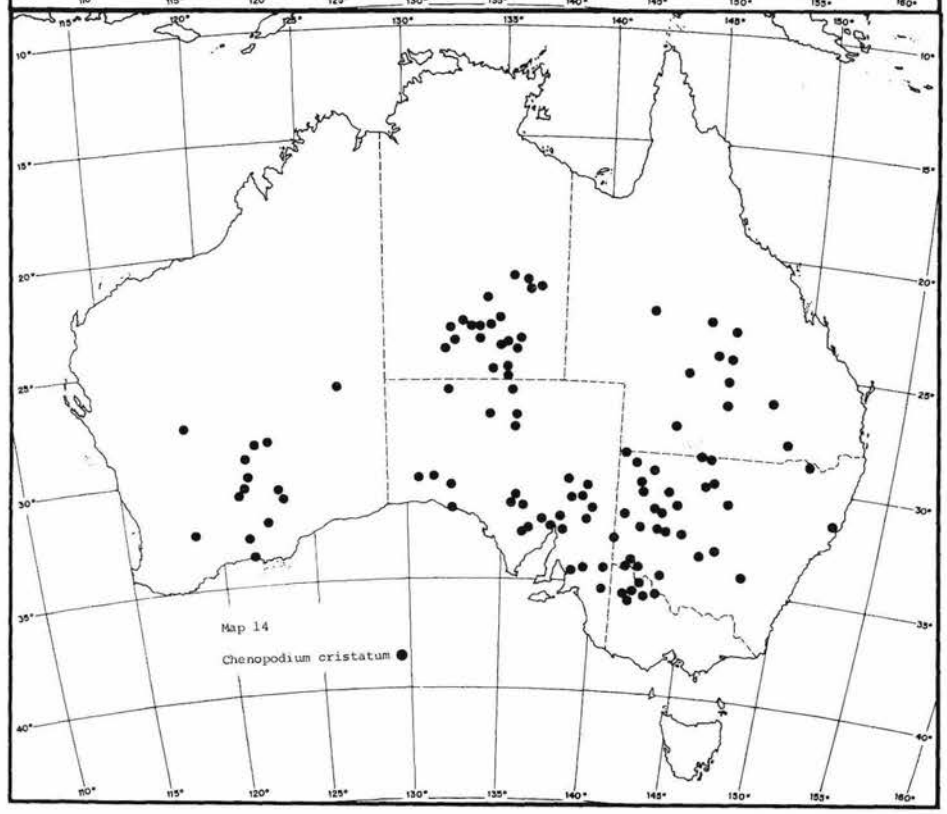

Map 9
Chenopodium desertorum subsp. anidiophyllum
Chenopodium desertorum subsp. virosum

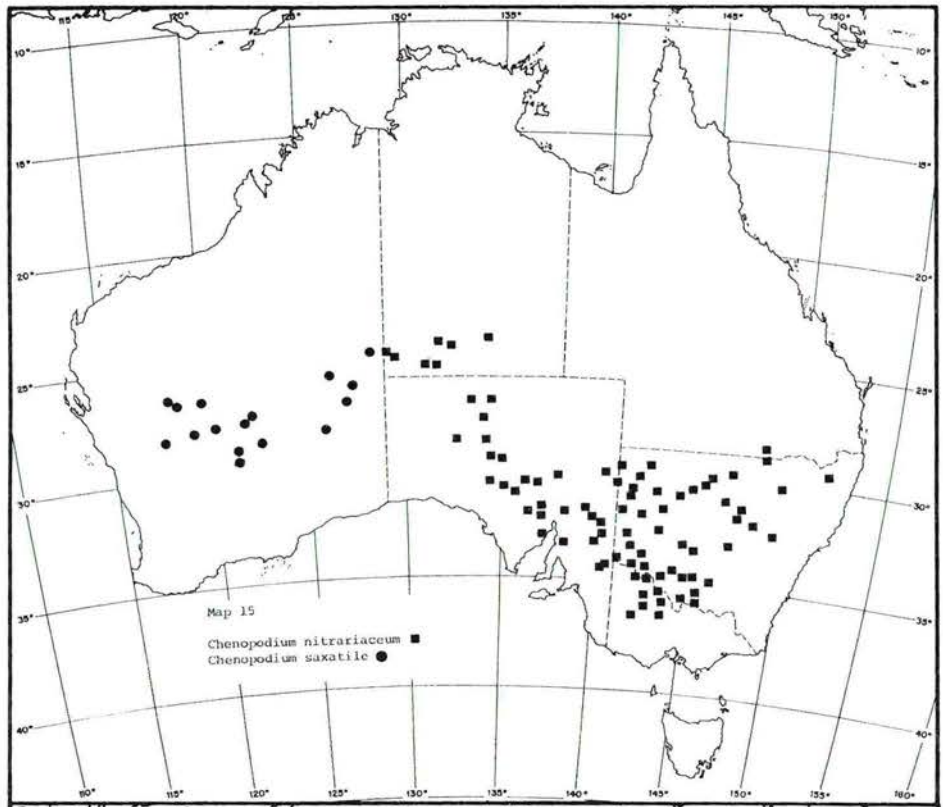

Map 10
Chenopodium ambrosioides
Chenopodium curvispicatum

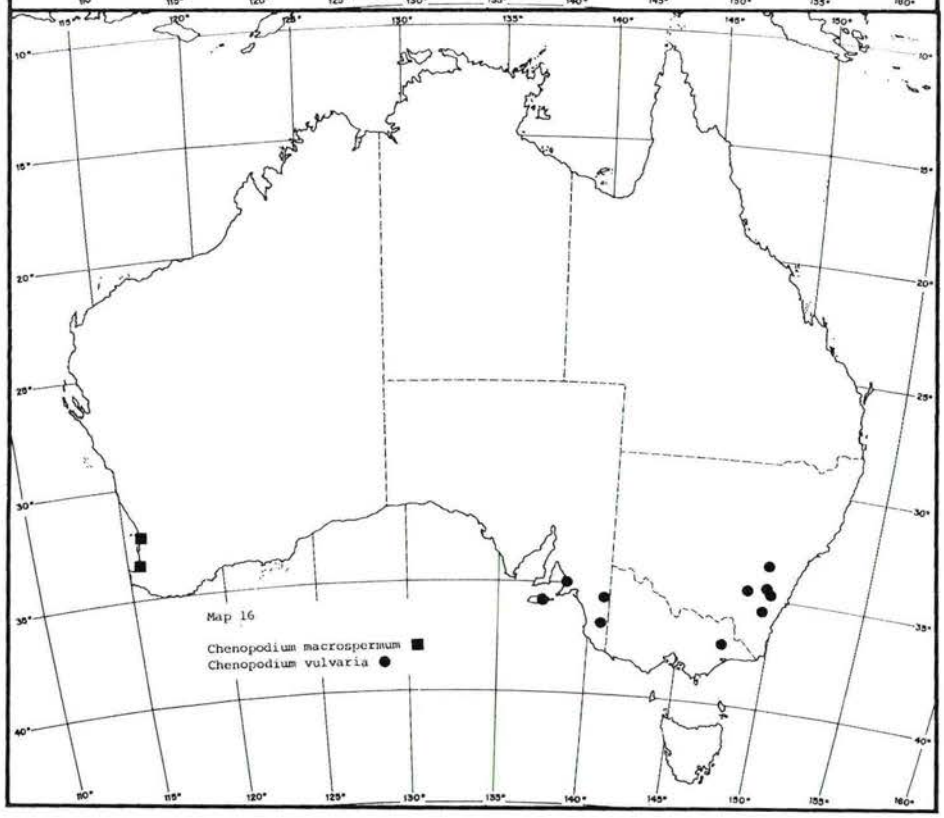

Map 11
Chenopodium auricomiforme
Chenopodium auricomum

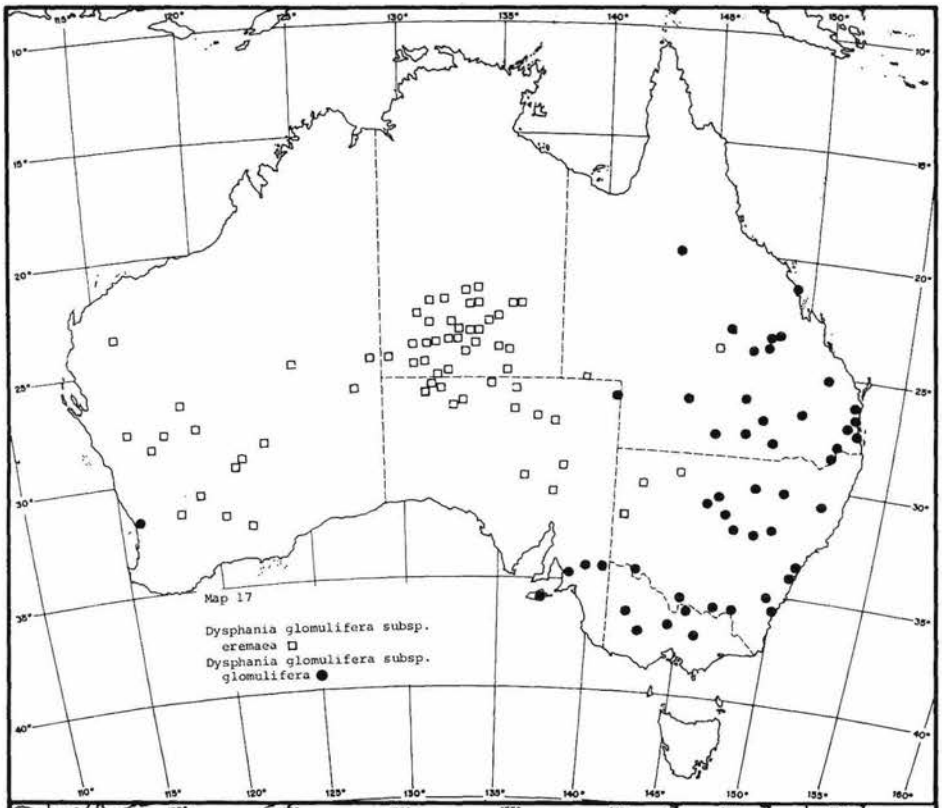

Map 12
Chenopodium multifidum

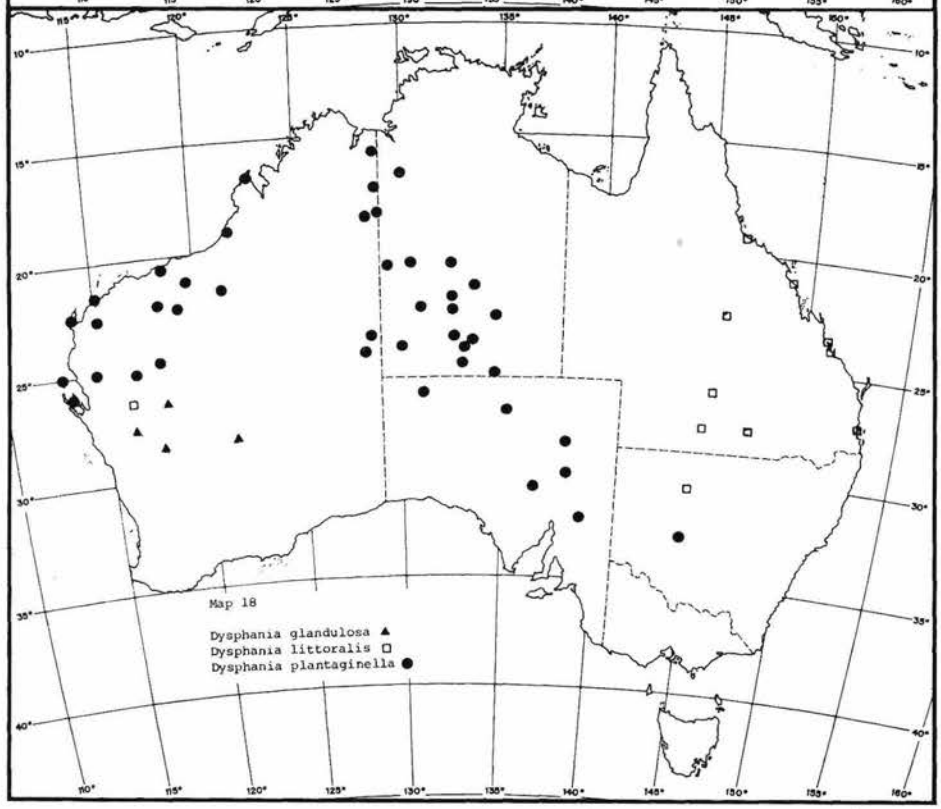

Map 13
Chenopodium pumilio

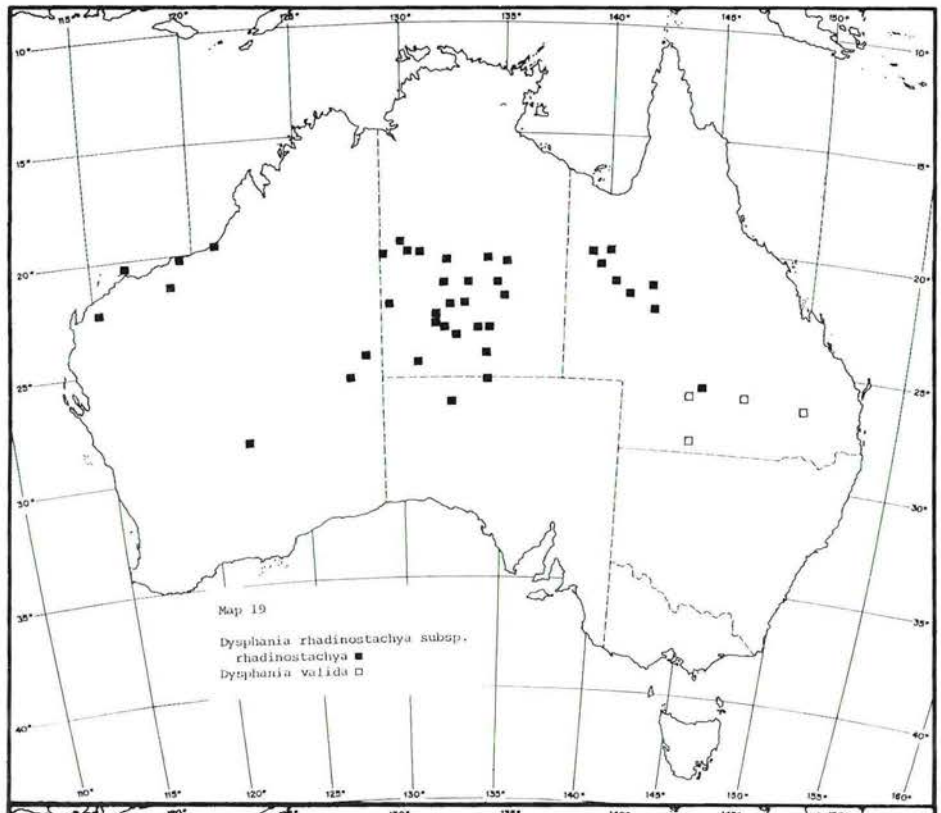

Map 14
Chenopodium cristatum

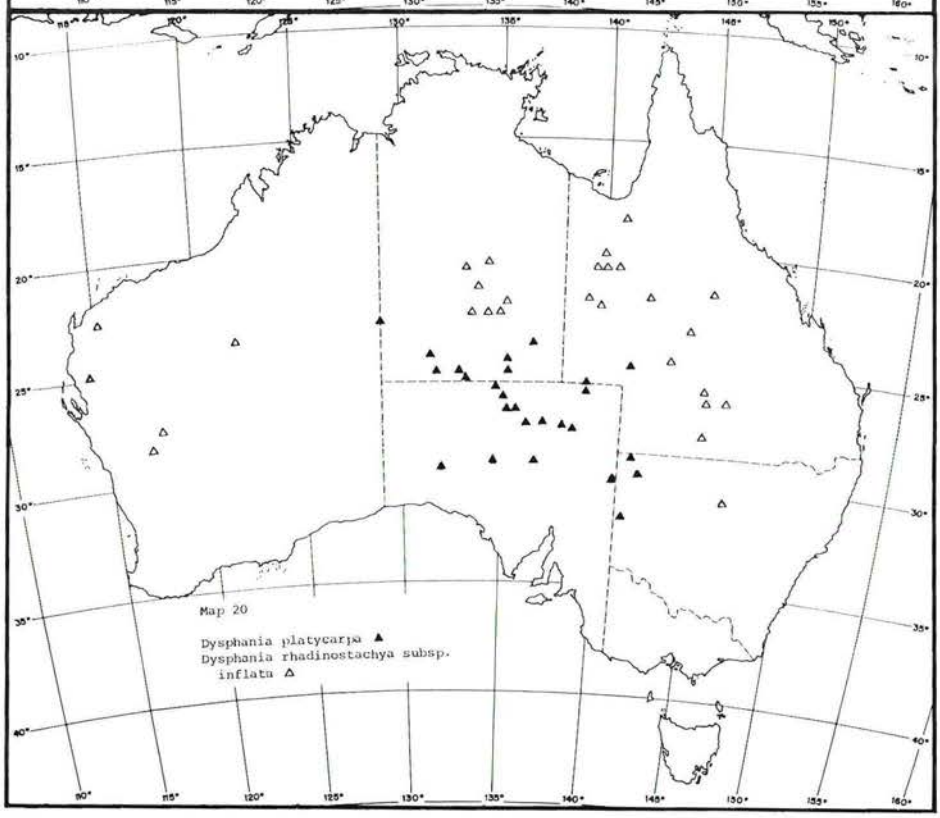

Map 15
Chenopodium nitrariaceum
Chenopodium saxatile

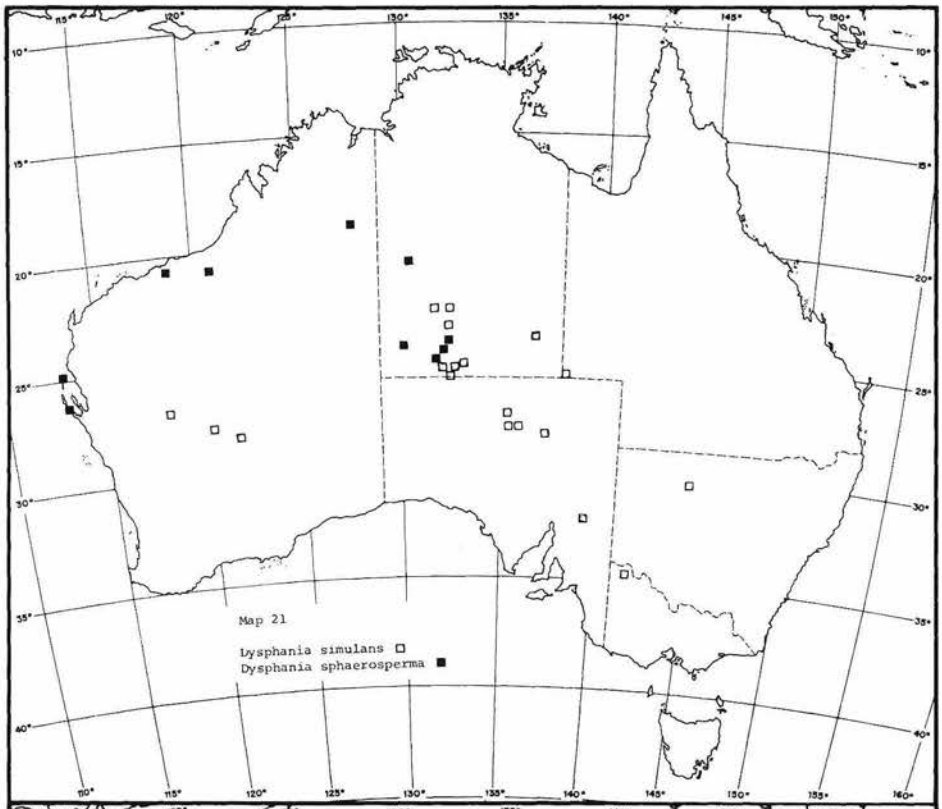

Map 16
Chenopodium macrospermum
Chenopodium vulvaria

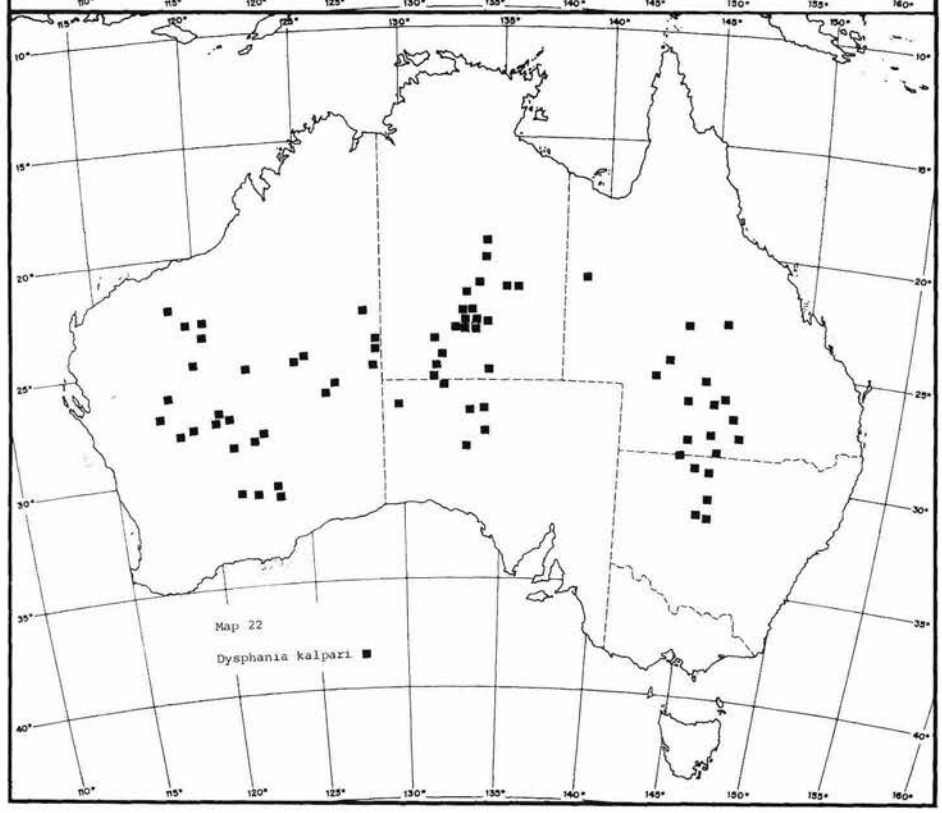

Map 17
Dysphania glomulifera subsp. eremaea
Dysphania glomulifera subsp. glomulifera

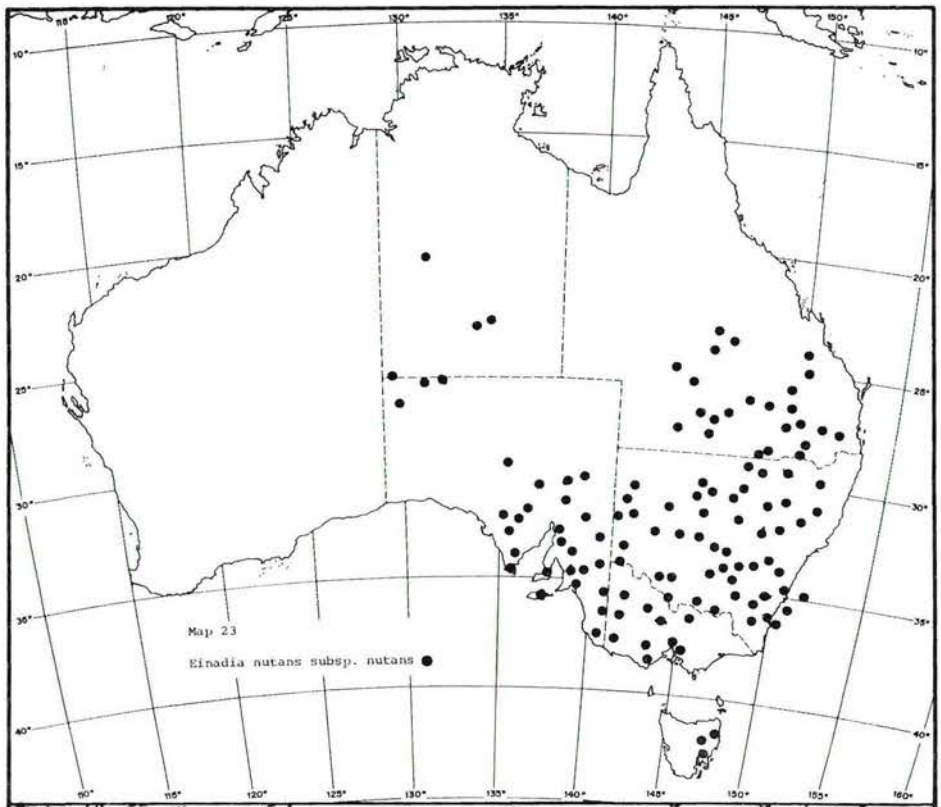

Map 18
Dysphania glandulosa
Dysphania littoralis
Dysphania plantaginella

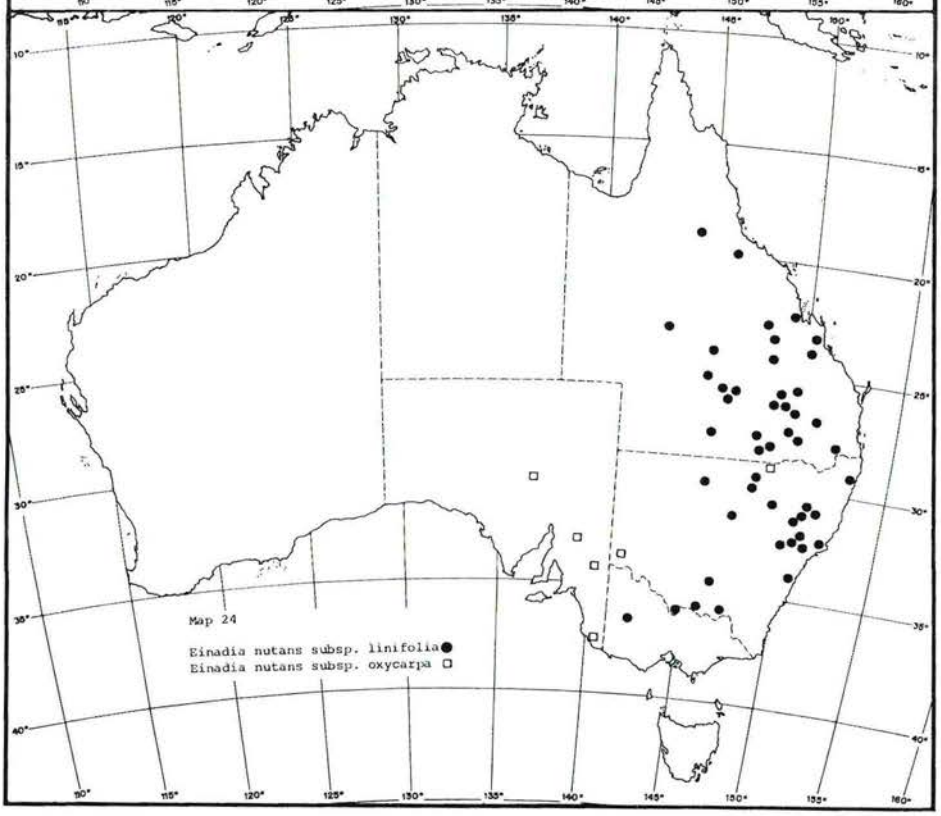

Map 19
Dysphania rhadinostachya subsp. rhadinostachya ■
Dysphania valida □

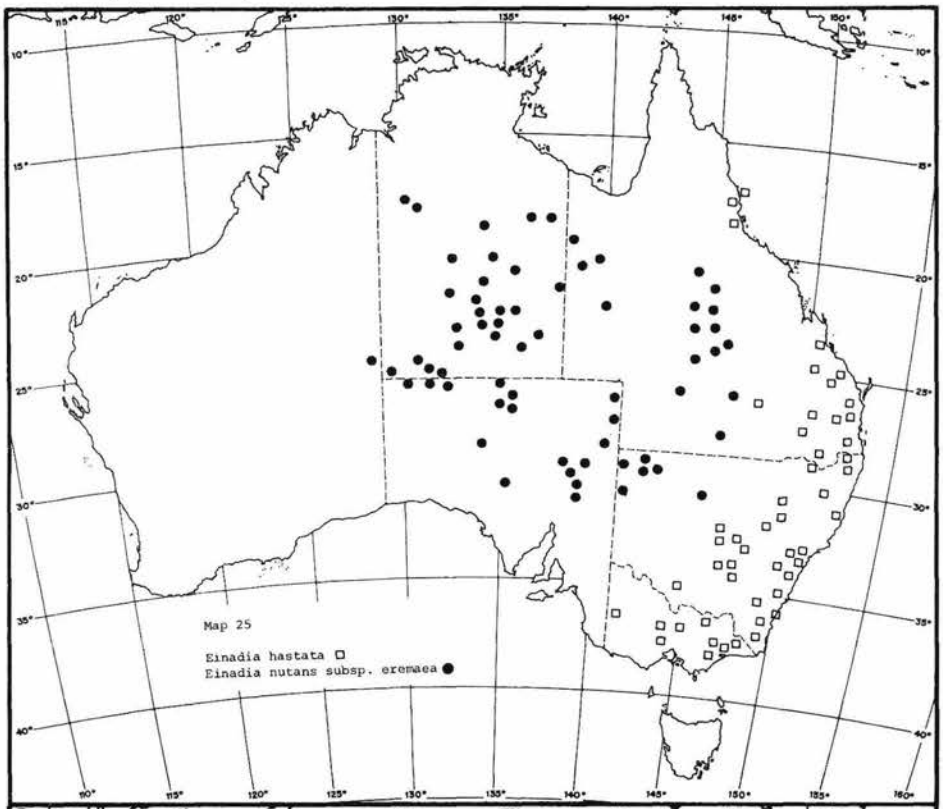

Map 20
Dysphania platycarya ▲
Dysphania rhadinostachya subsp. inflata △

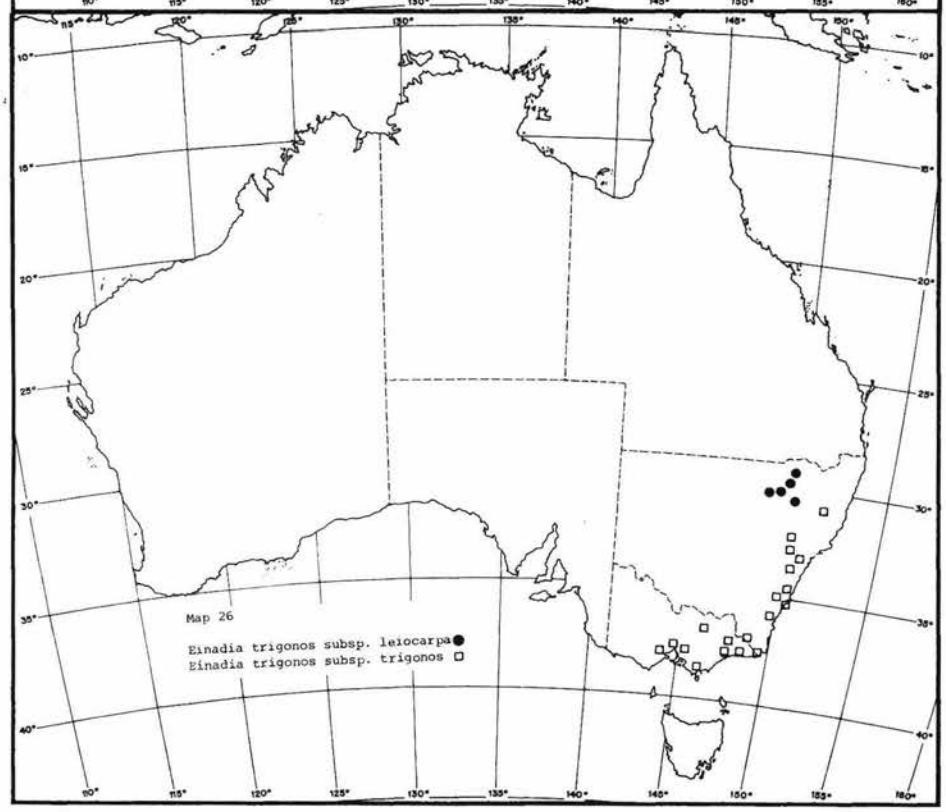

Map 21
Lysphania simulans
Dysphania sphaerosperma

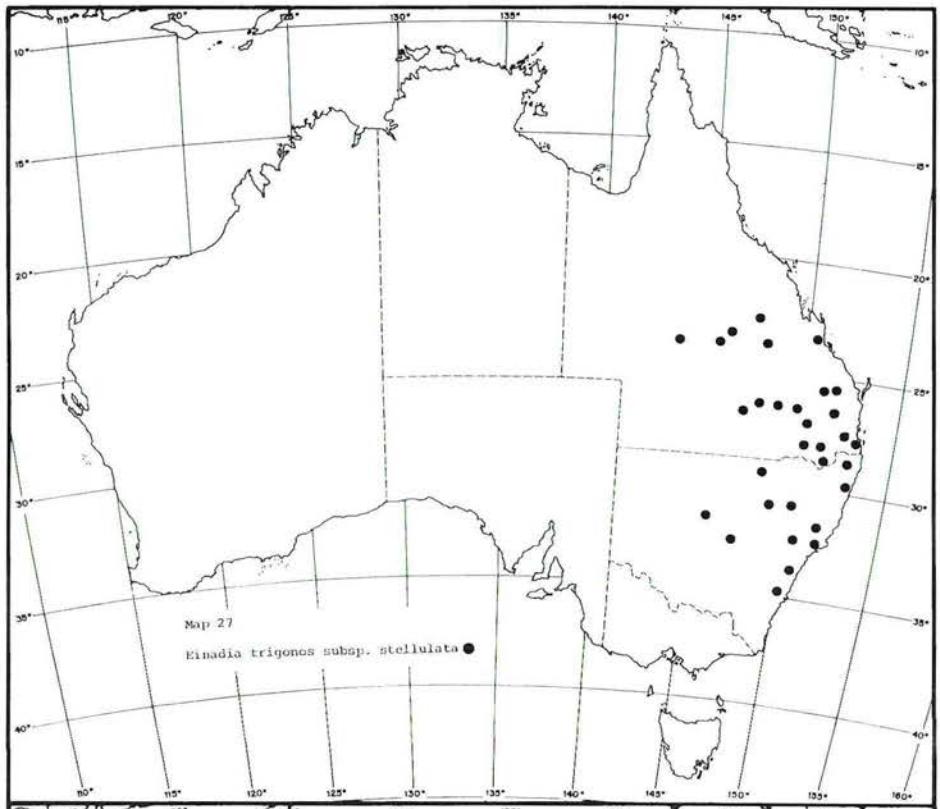

Map 22
Dysphania kalpari

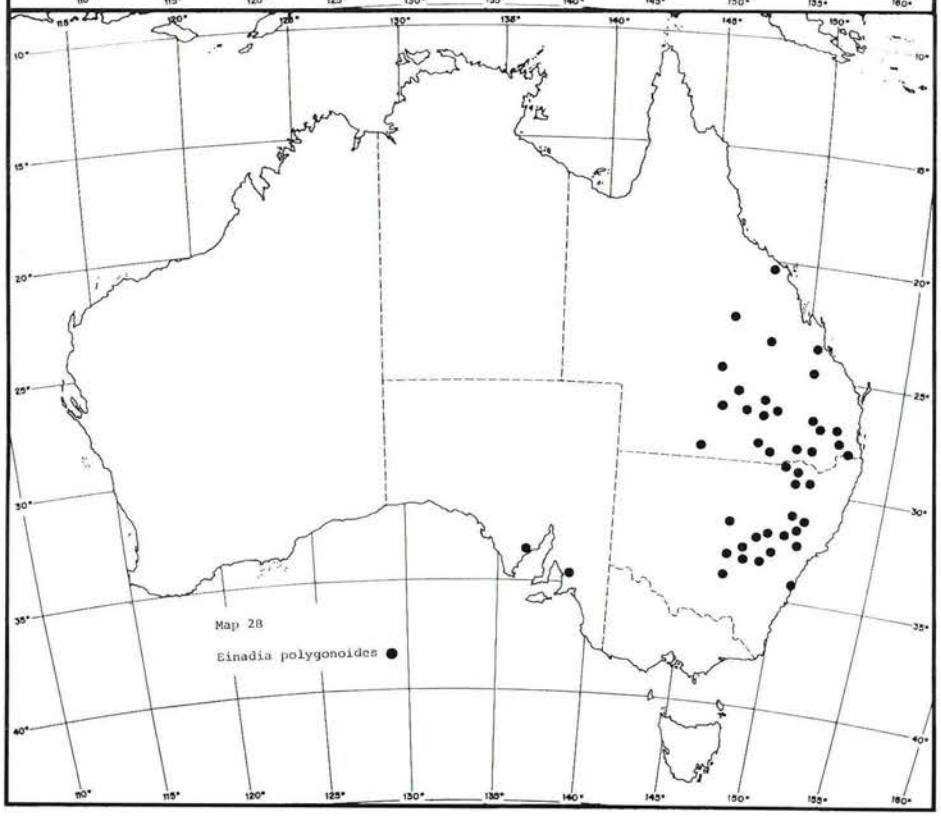

Map 23
Einadia nutans subsp. nutans

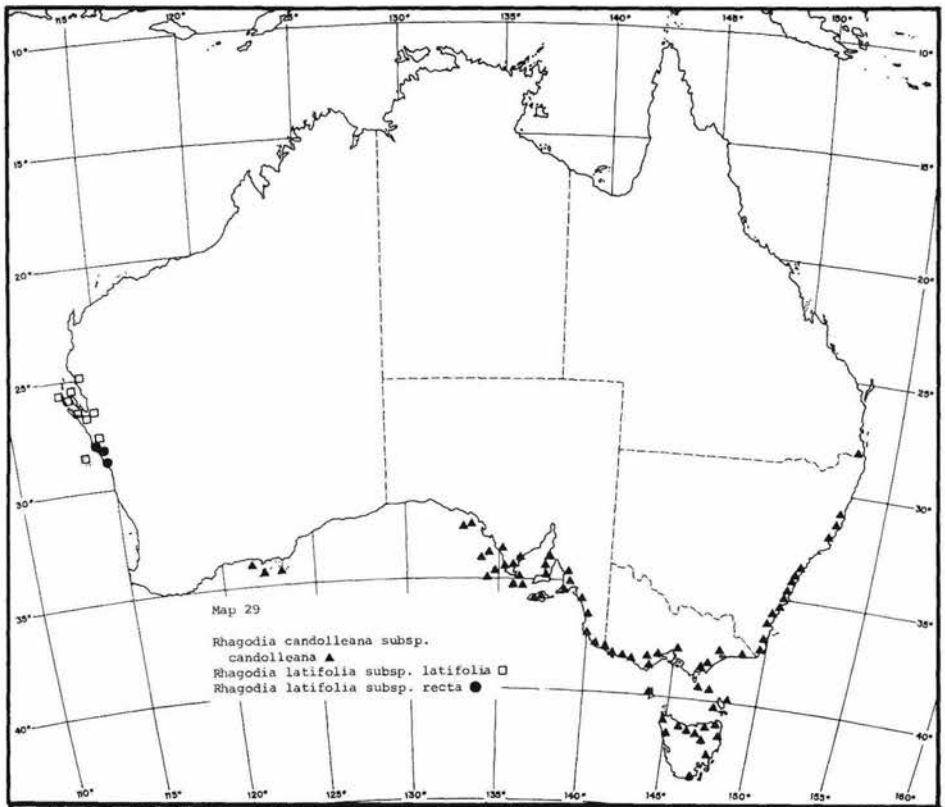

Map 24
Einadia nutans subsp. linifolia
Einadia nutans subsp. oxycarpa

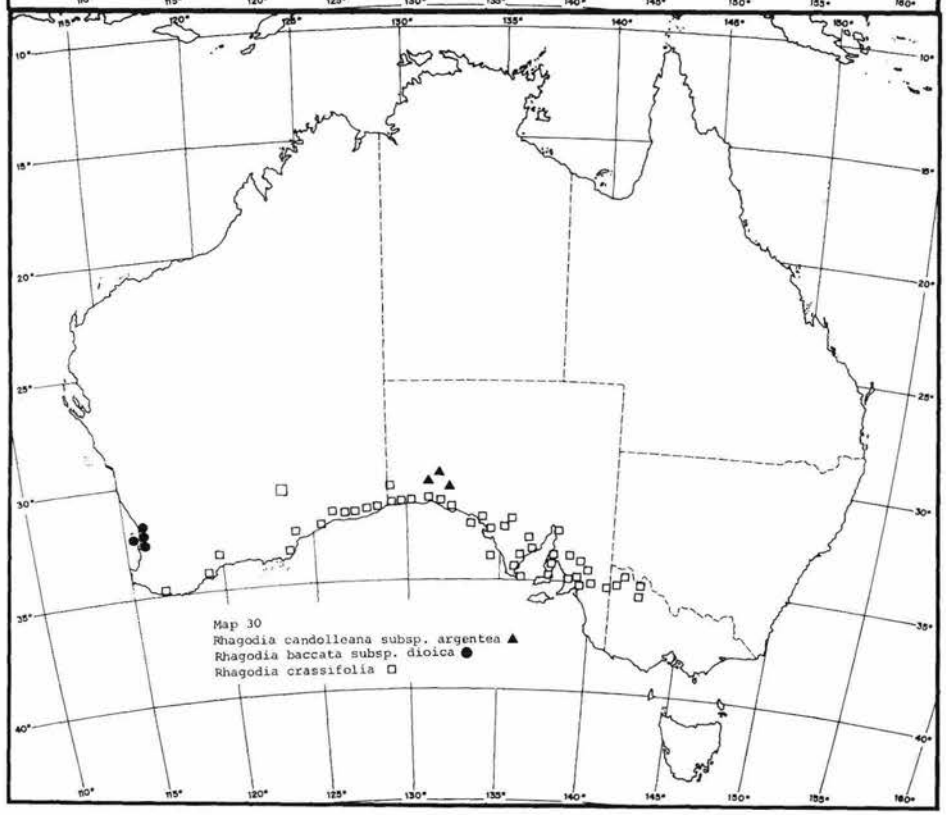

Map 25
Einadia hastata
Einadia nutans subsp. eremaea

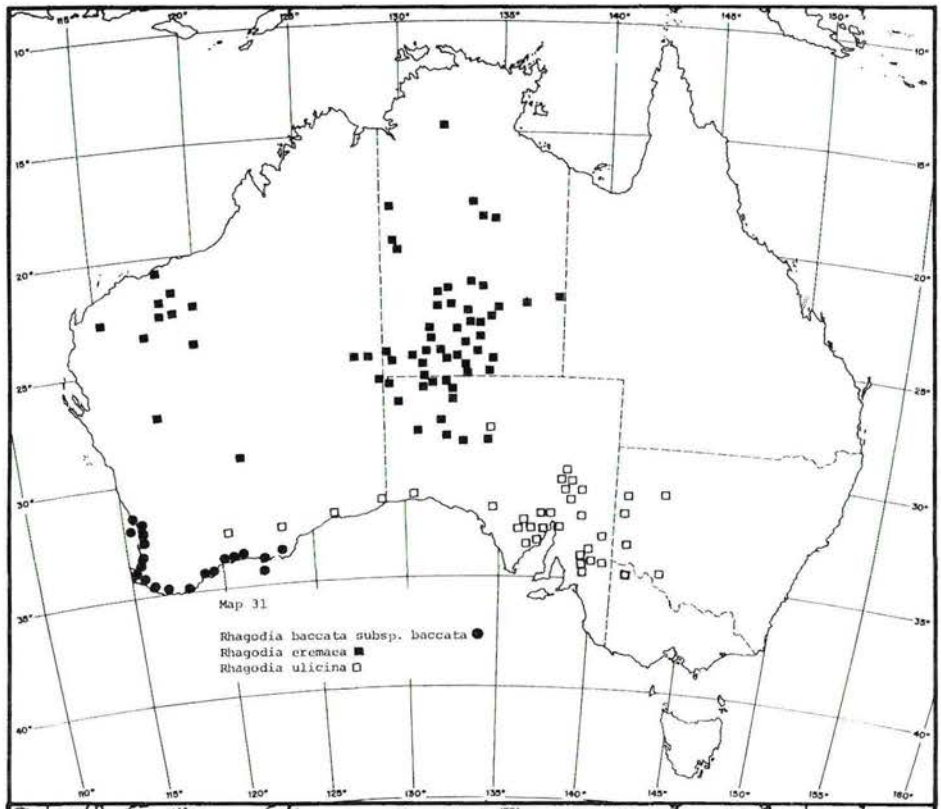

Map 26
Einadia trigonos subsp. leiocarpa
Einadia trigonos subsp. trigonos

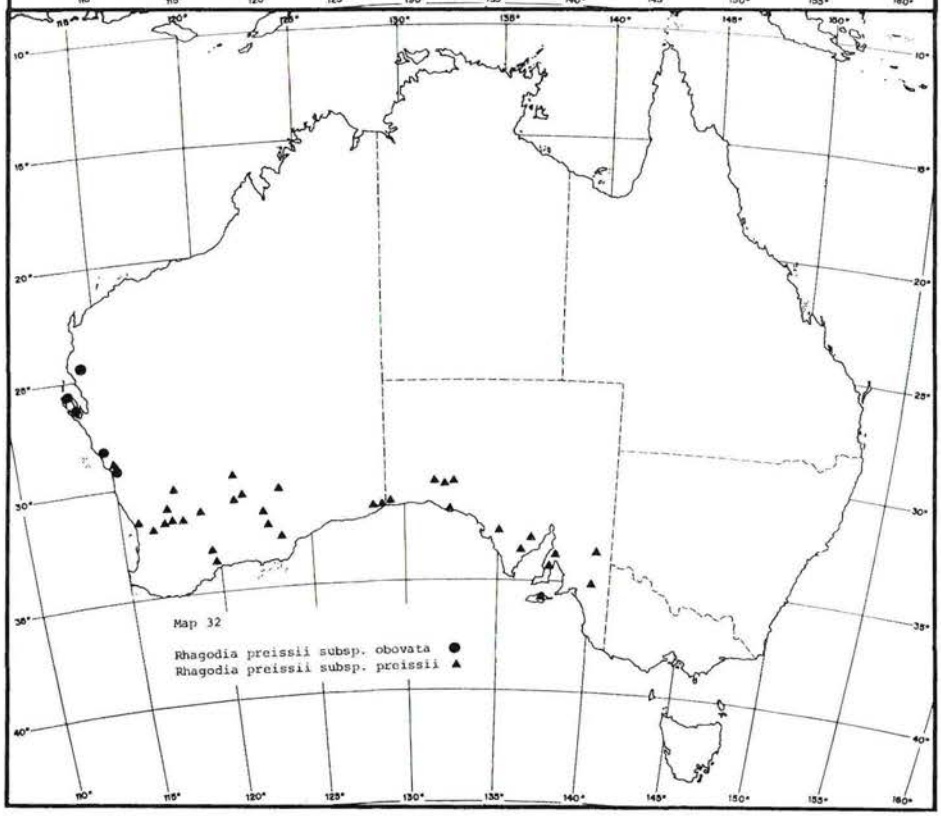

Map 27
Einadia trigonos subsp. stellulata

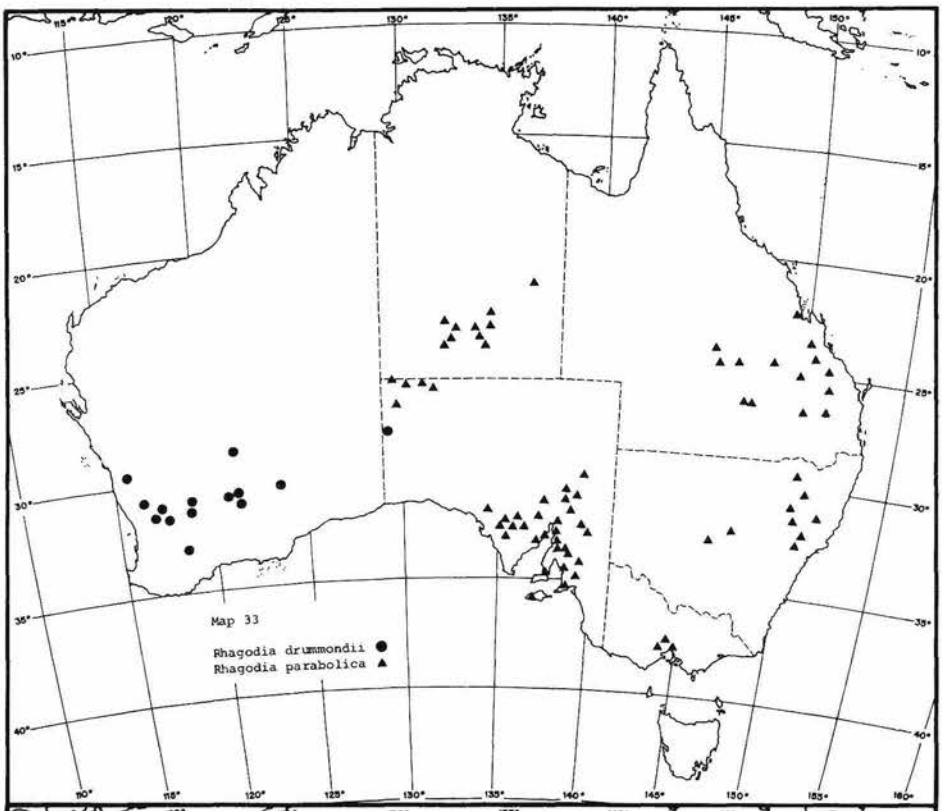

Map 28
Einadia polygonoides

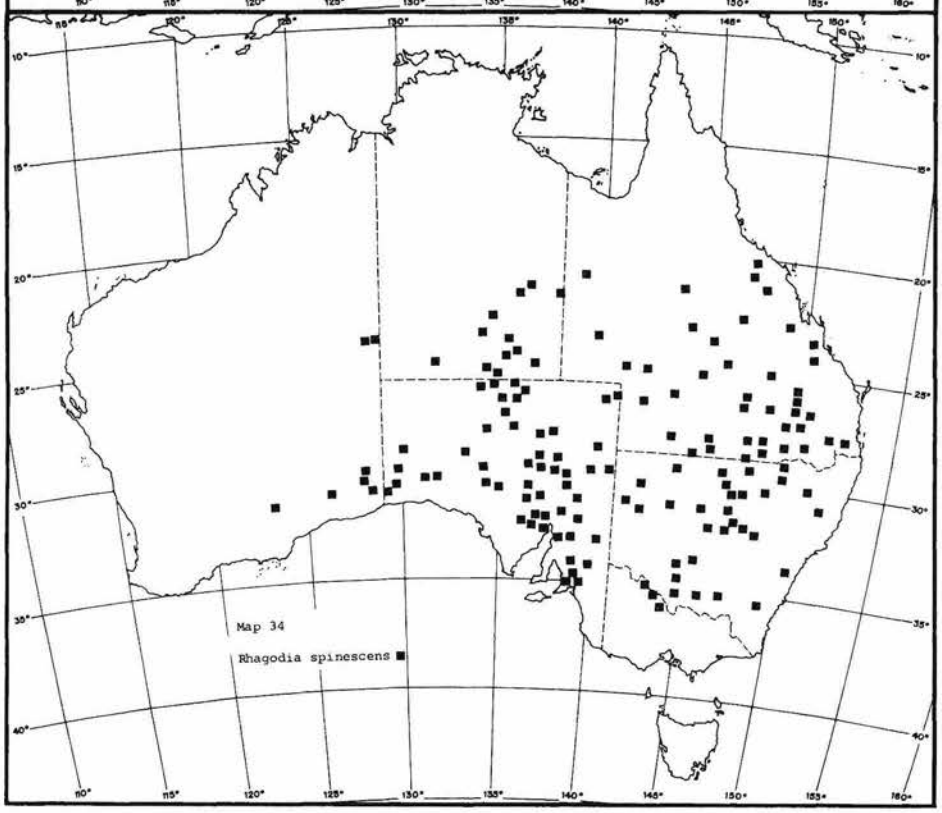

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Publication date of Nuytsia Volume 4 Number 1: 14 Oct. 1982.

22493/11/82—1M—L/3286 WILLIAM C BROWN, Government Printer, Western Australia