A Taxonomic Revision of the genus Maireana (Chenopodiaceae)

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Abstract

A taxonomic revision is provided for the genus *Maireana* (Chenopodiaceae) which as circumscribed includes the Australian species previously placed in the genus *Kochia*. Nine species and one subspecies are described as new; 48 new combinations are made. The Australian genera within the subtribe Kochiinae are briefly described and their relationships discussed.

Introduction

The genus *Maireana*, as here delimited, encompasses those species of Australian Chenopodiaceae which have commonly been placed in the genus *Kochia*. There appear to the author to be strong reasons, based on morphological data, for considering the Australian species to be distinct from *Kochia* s.str. (a predominantly northern hemisphere genus) and the acceptance of this distinction appears on strictly taxonomic grounds to be necessary. The alternative, that of continuing to consider the Australian species as congeneric with the *Kochia* species of the northern hemisphere, raises problems of nomenclature with unsettling consequences. It has always been recognised that *Kochia* and *Bassia* (both in the strict sense) are very closely allied and were considered by most authors in the 19th century, and in several recent European floras, to be congeneric. This synonymy is taxonomically sound, and thus, if it is considered that the Australian taxa here referred to *Maireana* are in fact true species of *Kochia*, and the latter genus is considered by European botanists to be congeneric with *Bassia*, then it follows that the Australian taxa in turn will have to be transferred to the last genus, it being the earliest.

In addition to the complication outlined above it is here considered that the Australian species commonly placed in *Bassia* are in fact generically distinct and should, for the most part, be transferred to *Sclerolaena*. A situation could thus arise in which the Australian species of '*Kochia*' were placed in *Bassia* and most of the 80+ Australian species of '*Bassia*' were transferred to *Sclerolaena*. Although the author considers that the acceptance of the genus *Sclerolaena* is both necessary and inevitable, he does not consider it either taxonomically sound, or from the practical viewpoint, desirable, to transfer the Australian *Kochia* species to *Bassia*.

Historical Survey of the Use of the Names Kochia and Bassia

The genus *Bassia* was described by Allioni in 1766. It was based on the species later known as *Bassia muricata* (L.) Aschers., a plant in which short spines develop on the back of the perianth segments when in fruit.

The genus *Kochia* was described by Roth in 1801. It was based on the one species *K. arenaria* (Maerklin) Roth (= *K. laniflora* (Gmel.) Borbas). In this species the perianth segments give rise to short, horizontal, chartaceous, wing-like outgrowths. Later in 1801 (or 1802?) (and in the same volume of the same periodical) Maerklin described the genus *Willemetia;* he based it on two species, *W. arenaria* (Maerklin) Maerklin (= *K. laniflora* (Gmel.) Borbas) and *W. lanata* Maerklin which was based on "*Salsola laniflora* Linn." (= *K. laniflora*) but provided a description for the latter which correctly applies to *Bassia hyssopifolia* (Pall.) Volk.

Robert Brown (1810) discussed the taxonomy of the *Kochia* group and suggested (but did not adopt the suggestion) that it could be divided into two genera, the genus *Kochia* containing those species with spiny appendages

and the genus *Willemetia* containing those with membranous appendages. All the species he dealt with (which were members of the Australian flora) possessed membranous appendages. He did not recognise any spiny appendaged *Kochia* species as being present in Australia.

C. F. Ledebour (1829) followed Brown in using the name *Kochia* to cover the *Bassia-Kochia* group but divided it into two sections, the section *Kochiae* containing those species with scale-like appendages and the section *Willemetiae* those with spiny appendages. He thus reversed Brown's application of these names. This nomenclature was also followed by Bluff et al. (1836–38).

Moquin-Tandon (1834a) adopted Robert Brown's suggestion that these two groups of species should be placed in separate genera but again reversed Brown's application of the names to accord better with the intentions of their original authors (he spelt the second name as '*Villemetia*').

The name *Bassia* Allioni (1766) was not taken up by early or mid 19th century botanists because of the then current use of its homonym *Bassia* Koenig ex Linnaeus (1771), a genus in the Sapotaceae. For this reason Moquin (1834a) believed it necessary to adopt the later name *Willemetia*. However, shortly after the paper by Moquin it was pointed out by Soyer-Willemet (1834) that the name *Willemetia* Maerklin was a later homonym of that of Neeker (1790). Moquin (1834a) therefore, in a footnote to the article by Soyer-Willemet, published the name *Echinopsilon* as a nomen novum for Willemetia Maerklin. Neeker's name can be regarded as a unitary designation of a species and is therefore to be rejected from the point of view of priority (Intern. Code Bot. Nomenclature (1972) article 20), but there is also the name *Willemeta* Cothenius (1790), currently considered to be a synonym of *Koehrenteria* Laxman (1772). If *Willemetia* Maerkl. is regarded as a homonym of *Willemeta* Coth. the former would be illegitimate and the name *Echinopsilon* would then be a legitimate nom. nov.

The application of the name *Willemetia* Maerkl. depends on its lectotypification and on the interpretation of the International Code of Botanical Nomenclature. As noted above, two species were cited by Maerklin, both of which (as to the names used) are now considered to belong to the genus *Kochia*. The description given by Maerklin of the second species, '*W. lanata*', obviously applies to a species of *Bassia* All. and it was the species covered by this description (but which did not apply to the basic name cited) that was selected by Moquin (1834) as the lectotype of *Willemetia* (by excluding the other species). Article 10 of the I.C.B.N. states that "The type of a name of a genus . . . is a species". It is not clear whether it is intended that the type should be that species referred to by the name, or that intended by the description (when there is one). If the former, then the names *Willemetia* and *Echinopsilon* become congeneric with *Kochia;* if the latter, then by Moquin's lectotypification they become congeneric with *Bassia* All. (For a discussion on a similar nomenclatural question see Regnum Vegetabile 81 : 14–15, 98–100 (1972).)

When considered to be distinct genera the names *Echinopsilon* and *Kochia* were used by most 19th century botanists in the sense adopted by Moquin; possibly two of the last authors to do so were M.M. Il'in in Flora U.S.S.R. 6:124 (1936) and Abrams, Illust. Fl. Pacif. States 2:90 (1944). Bentham (1870 and 1880) preferred to consider *Echinopsilon* (and therefore also *Bassia* All.) as a section of *Chenolea* Thunb. (1781) but he retained the genus *Kochia* as distinct. However, most writers of European floras have not (until recently) accepted the suggestion that *Bassia* (or *Echinopsilon*) and *Kochia* are generically distinct and have usually used the name *Kochia* to include all the species in this complex. Examples are Boissier, Flora Orientalis (1879); Wagner, Illust. Deutsche Flora (1882); Post, Flora Syria, Palestine, and Sinai (1896); Bonnier, Flore Complete France, Suisse et Belgique (1927). The reason these

writers adopted the name *Kochia* was, as is pointed out above, the confusion as to the legitimacy of the earlier name *Bassia* All. It appears that F. Mueller (1882a and 1882b) was the first to recognise the priority of the latter name over *Bassia* Koenig. He was followed by Baillon (1887), O. Kuntze (1891), Volkens (1893), and by many later botanists, who have, however, circumscribed the genus in various ways. Hermann (1956), for instance, made *Kochia* a section of *Bassia* while Allen (1961) retained it as a separate genus.

The Australian species which are customarily referred to the genus *Kochia* have generally had an uneventful nomenclatural history. Robert Brown (1810) described the first two Australian species (*K. brevifolia* and *K. aphylla*), and suggested that they could belong to the genus *Willemetia.* These were transferred to *Salsola* by Sprengel (1825) (who did not recognise the genus *Kochia* as being distinct), but, except for one species in *Maireana*, they, and most of the other species which have been described later, have otherwise been accepted as belonging to the genus *Kochia* (apart from the re-arrangement of a few species with controversial affinities).

The genus *Maireana* Moquin (1840) was based on the species *M. tomentosa* Moq. The generic name was accepted by Mueller (1859) who established in it the section *Asterocarpus* with the one species *M. stelligera* F. Muell. This species was subsequently (1869) transferred by him to *Echinopsilon* while in the same paper he made *Maireana* a section of *Kochia* and included in it those species of the latter genus with a simple wing. Volkens (1893) made *Maireana* a section of *Bassia* and included in it *M. stelligera*, in which decision he was obviously following Mueller in his paper of 1859. Thus apart from the one species described by Mueller, which was based on a plant soon removed to another genus, the name *Maireana* has not been accepted at the generic level subsequent to the two publications by Moquin.

The Australian species which are currently referred by Australian authors to the genus *Bassia* have been placed in several different genera by different workers. Robert Brown (1810), who described the first Australian species, placed them in his new genera *Anisacantha* and *Sclerolaena*, and these were treated by botanists as being distinct until F. Mueller (1882) synonymized them both under *Bassia.* Volkens (1893) also took this position and under *Bassia* created the sect. *Anisacantha* in which he placed *Sclerolaena* in synonymy. Domin (1921) and Ulbrich (1934) retained the genus *Sclerolaena* and placed under it *Anisacantha.* Bentham (1870 and 1880), who recognised the genera *Anisacantha* and *Sclerolaena*, included under *Chenolea* four species which were later placed by Anderson (1923) and Ising (1964) in *Bassia.* Six other genera based on Australian types were also included by Ising in the genus *Bassia.* These genera are *Kentropsis* Moq. (1840), *Sclerochlamys* F. Muell. (1858), *Dissocarpus* F. Muell. (1858), *Coilocarpus* Domin (1921), *Austrobassia* Ulbrich (1934) and *Sclerobassia* Ulbrich (1934). None of those that were published before 1880 had been accepted by Bentham (who included *Sclerochlamys* under *Kochia*, and *Dissocarpus* and *Kentropsis* under *Sclerolaena*), or by Volkens (1893). All, except *Sclerochlamys*, were recognised as distinct genera by Ulbrich (1934). Australian botanists have without exception followed Mueller (1882a, b) and have synonymized the segregate genera (including those described since 1882) under *Bassia*, while Aellen (1961), a Swiss botanist who had a comprehensive knowledge of Eurasian Chenopodiaceae, kept up the genera *Sclerolaena* and *Austrobassia.*

The Eurasian-Australian Generic Disjunction

The genera of those members of the subtribe Kochiinae whose type species are from Australia are all endemic to that country. These taxa exhibit in their fruiting perianths a multiplicity of form which causes considerable difficulty in delimitation. The genera may, however, be segregated on the basis of several

characters from the "Eurasian" members of the subtribe (which also includes a few African and North American species), and in particular from the genera *Kochia* and *Bassia*.

In *Bassia* and *Kochia* the species are annual (with one exception) and have herbaceous stems. In *Maireana* and *Sclerolaena* the species are perennials, sometimes shrubby, and have woody stems.

In *Bassia* and *Kochia* the flowers are usually aggregated into condensed axillary cymes and may or may not be subtended by secondary bracts. In *Maireana* and *Sclerolaena* the flowers are axillary and solitary or paired.

In *Bassia* and *Kochia* the perianth remains chartaceous and weak, and is not modified opposite the radicle. The spines or wings when formed are on the back of the perianth lobes. The embryo is always horizontal and the radicle is variously positioned. In *Maireana* and *Sclerolaena* the fruiting perianth is variously enlarged and thickened and is modified (by a slit, rib, canal, tubercle or spines) opposite the radicle which is always in the same intertepaline position. This character I have referred to as the radicular anomaly. The spines in *Sclerolaena* are intertepaline in position while the embryo is erect to horizontal. (Figs. 1A-D, 2E)

The combinations of distinguishing characters listed above appear to be sufficient to consider the Australian species which have at various times been included in the genera *Bassia* (or *Echinopsilon*), *Kochia*, and *Chenolea*, to be generically distinct from these and to constitute, as does the "Eurasian" group, a complex of closely related taxa without sharp intergeneric delimitations.

Generic Delimitation within the Subtribe Kochiinae

The genera under discussion were placed by Bentham (1880) in the tribe Chenoleae and by Ulbrich (1934) in the tribe Camphorosmeae subtribe Kochiinae. Ulbrich included 15 genera within this subtribe of which two (*Londesia* and *Chenolea*) are not recognised by recent authors as being represented in Australia and need not be further discussed. Of the other 13, four have generally been considered as representing distinct genera. These are *Enchylaena*, *Threlkeldia*, *Didymanthus* and *Babbagia*, while the remaining 9, as regards recognition or delimitation, have been variously treated by different workers; these are *Bassia*, *Malacocera*, *Austrobassia*, *Sclerolaena*, *Dissocarpus*, *Kochia*, *Duriala*, *Coilocarpus*, and *Sclerobassia*. To this list should be added two genera which have been described since 1934; they are *Roycea* C. A. Gardn. (1948) and *Cyrilwhitea* Ising (1964).

The characters used by various authors for distinguishing the Australian genera have not been satisfactory, and in fact the multiplicity of form shown in the fruiting perianths of the Australian species usually included in the genera *Kochia* and *Bassia* has not made it possible to use key characters which provide a completely natural separation between these and the other genera within the subtribe. Furthermore, characters which appear not to be homologous have been used to classify as being congeneric, species with obviously different affinities.

To appreciate the position it is necessary to understand the basic morphology of the flower in the Australian representatives of these genera. The perianth is normally 5-merous (occasionally 3-4-merous) and consists of a saucer- to cup-shaped basal portion and a (3) 5-lobed upper portion. The perianth bears two series of veins, 5 tepaline and 5 intertepaline in position (opposite the radicle there may be a pair of inter-tepaline veins). As the fruit develops the basal portion of the perianth usually enlarges and becomes variously thickened; outgrowths often develop from one or other series of veins, or just below the lobes a wing-like structure may form which encircles the perianth. The embryo may be horizontal and almost circular (to horseshoe shaped), or the radicle may be erect, or the whole embryo slanting to erect.

Whatever form the embryo takes it is always positioned in such a manner that the radicle is opposite a particular point of the perianth; at this point the perianth normally develops a slit, bulge, ridge, canal, or one or a pair of tubercles or spines (the radicular anomaly). These various radicular modifications of the perianth are associated with the emergence of the radicle at germination; the greater the thickness of the perianth, the more definite the modification. In a few species where the radicle is erect and the perianth open at the summit, there is no prominent radicular modification since the radicle emerges through the open apex of the perianth.

It is evident that the characters used to delimit the genera which are here recognised do not always create a natural grouping of species. If an attempt were made to do this it would be found that several small 'genera of convenience' would be absorbed into others, with an appreciable loss of value to workers. The genus *Babbagia* (1858), for instance, is at present considered to contain four species which are obviously closely related and apparently linked by variants intermediate in form. The perianth structure and plant habit in these species is very similar to that found in *Threlkeldia salsuginosa*—the type of *Osteocarpum* (1858)—which lacks, however, the vertical perianth wings of the *Babbagia* species. *Threlkeldia salsuginosa* is itself very similar to *Bassia urceolata* (which has only small intertepaline tubercles) and to *B. aniscanthoides*—the type of *Coilocarpus* (1921). A study of herbarium material suggests that these species are either connected by a series of intermediate forms, or else that hybridization occurs between them in the field. In any case they are obviously closely related. In addition, through the two species of Bassia mentioned, the group shows strong connections to the monotypic genus *Cyrilwhitea* (1964).

Intergeneric relationships may also be recognised in the following groups, although hybridization does not necessarily occur between their members.

(1) Threlkeldia proceriflora—Bassia astrocarpa—Dissocarpus spp.

(2) Enchylaena tomentosa–Maireana georgei, and Enchylaena tomentosa–Maireana turbinata.

(3) Maireana amoena–M. luehmanii–Bassia symoniana–Kochia fimbriolata (Bassia longifolia W. V. Fitzg.).

(4) Maireana oppositifolia–Roycea spp.

The intergeneric relationship involved in the above cases are discussed more fully elsewhere in the text.

Where a species is obviously misplaced its transfer to another genus is warranted, but a mass rearrangement of species in an attempt to provide a more natural grouping of taxa appears at this stage to be unwise, especially as the characters then required to circumscribe the genera would be very difficult to delineate.

Key to Australian Genera of the subtribe Kochiinae

1. Fruiting perianth succulent.
   2. Fruiting perianth sub-globular with a marked vertical radicular slit .... **Enchylaena**
   2. Fruiting perianth without a vertical slit .... **Threlkeldia**
1. Fruiting perianth not succulent.
   3. Fruiting perianth with wing-like outgrowths, or surrounded by a single horizontal wing.
      4. Flowers in pairs and fused by their bases; embryo erect; perianth with 5 horizontal wings; leaves opposite .... **Didymanthus**
      4. Flowers solitary or if in pairs then not fused by their bases or without wing-like growths.
         5. Wings 1–5 intertepaline and vertical, situated on top of perianth .... **Babbagia**
         5. Wing (or wings) horizontal (or both horizontal and vertical) .... **Maireana**
   3. Fruiting perianth without wing-like outgrowths.
      6. Perianth urceolate, regularly, deeply lobed, not enclosing utricle and without any outgrowths .... **Roycea**

6. Perianth enlarging in fruit and enclosing utricle, usually bearing outgrowths.
7. Flowers in axillary clusters of 2–16 rigidly fused together in fruit .... **Dissocarpus**
7. Flowers solitary or if in pairs then not fused together in fruit.
8. Fruiting perianth without outgrowths—see *Threlkeldia* and *Maireana*.
8. Fruiting perianth with spines.
9. Fruiting perianth with spine-like outgrowths which alternate with perianth lobes (sometimes with additional accessory lobes) or with ca. 10 short radiating teeth .... **Sclerolaena**
9. Fruiting perianth with 3–5 outgrowths opposite the perianth lobes.
10. Embryo and outgrowths horizontal.
11. Outgrowths solid and hard ... . **Maireana**
11. Outgrowths cylindrical, soft .... **Malacocera**
10. Embryo vertical, spines erect or somewhat spreading at apex of cylindrical perianth .... *Threlkeldia proceriflora* and *Bassia astrocarpa*

Babbagia F. Muell. (1858).

Type: *B. dipterocarpa* F. Muell.

Fruiting perianth subglobular, crustaceous or woody, 5-merous with 2–5 erect wings at apex which are intertepaline in position. Seed horizontal with an ascending radicle.

Four species are known in this genus.

Babbagia is closely related to *Sclerolaena* (from which it differs principally in the inter-tepaline processes being wing-like and not spiny) and to *Threlkeldia salsuginosa*, q.v.. Collections have been made of plants which are presumably hybrids between *Babbagia* sp. and *Threlkeldia salsuginosa*, and between *Babbagia* and *Sclerolaena* sp. (*Bassia urceolata* Ising).

Cyrilwhitea Ising (1964)

Type: *C. walkeri* (White) Ising

In this monotypic genus the fruiting perianth has five main spines which are erect and intertepaline in position with five much shorter spines between them. The tube has 5 narrow vertical wings (also inter-tepaline) with 5 prominent ribs between them. The lower half of the 'tube' consists of a 5-chambered base. The centrifugal radicle emerges through a canal in line with one of the main spines. The perianth structure is thus basically similar to that found in *Bassia brachyptera* and *B. microcarpa*, for the chambered hollow base is only a more prominent example of a character frequently found in Australian '*Bassia*' species (including *B. microcarpa*). There appears to be no good reason for segregating this species in a genus distinct from *Scleroleana*.

Didymanthus Endl. (1839)

Type: *D. roei* Endl.

Flowers in pairs. Fruiting perianths cylindrical, fused by their bases and strongly divaricate: apex of perianth with five horizontal chartaceous wings which are tepaline in position. Embryo erect.

This genus is represented by only one species. It differs from *Maireana* principally in the position of the embryo and the virtually actinomorphic fruiting perianth which lacks the radicular anomaly.

Dissocarpus F. Muell. (1858)

Type: *D. biflorus* F. Muell.

Flowers clustered in leaf axils and fused in condensed dichasia (ca. 2–7 in *D. biflorus* and 8–16 in *D. paradoxus*). Fruiting perianth hardened, 5-lobed; at the base of each lobe a spine or protuberance develops (not always present in *D. biflorus*). Seed horizontal; radicle ascending to erect.

Two species, each of which exhibits considerable variation.

This genus was distinguished by Mueller and recognised by Ulbrich (1934) on the basis of the flowers being united in clusters. The union of the flowers does not by itself warrant generic delimitation and for this reason both Anderson (1924) and Ising (1964) placed *Dissocarpus* in synonymy under *Bassia*. However, *Dissocarpus* differs markedly from other Australian '*Bassia*' species (i.e. from *Sclerolaena*) in having spines developing from the base of the perianth lobes (and not from between them) and in not having any radicular protuberance or slit. Anderson described spines as being occasionally present in *D. biflorus*, but the protuberances that he observed were the remains of sterile flowers forming part of the dichasia at the base of the fruiting perianth. These sterile structures range in size from minute excrescences to miniature but recognisable flowers, one or two of which may be present at the base of the same mature perianth. True spines (i.e. structures homologous to those found in *D. paradoxus*) are also found in *D. biflorus;* these arise at the base of the perianth lobes (which they resemble) and grow upwards to overtop and obscure them. A superficial examination may thus lead one to assume that the spines are the perianth lobes. (Fig. 2C–D).

Under *Bassia* sect. *Dissocarpus* a third species (*B. georgei* Ising) was included by E. H. Ising (1964). This species has fruits with irregularly lobed wings while the fruiting perianths themselves are united into clusters and appear to be sterile. It is not related to the other two members of the genus *Dissocarpus* and is quite possibly an intergeneric hybrid involving *Maireana* and *Sclerolaena*.

For a discussion on the nature of the axillary inflorescence in *Dissocarpus* see Bisalputra (1960).

The two species *Bassia astrocarpa* and *Threlkeldia proceriflora* have a similar perianth shape and spine arrangement to that found in *Dissocarpus*. This may be of phylogenetic significance.

Enchylaena R. Br. (1810)

Lectotype: *E. tomentosa* R. Br. (The only other species described by R. Brown was *E. paradoxa;* this, according to Bentham, is a monstrous state of *E. tomentosa*, and the name is therefore illegitimate.)

Perianth pentamerous, succulent in fruit with an inner cartilaginous layer, while towards the apex often a ring-like succulent outgrowth grows upwards and over the perianth lobes (corresponding to the wing of *Maireana*); opposite the radicle a vertical slit is present, the margins of which overlap. Embryo horizontal. (Fig. 1E–F).

This genus is represented by several species only one of which has been described. Other species which have been referred to the genus *Enchylaena* are either synonyms of *E. tomentosa* or correctly belong to other genera. Hybridisation between *E. tomentosa* and *Mairaena georgei* has been observed in the field at several localities.

Maireana Moq. (1840)

Type: *M. tomentosa* Moq.

Flowers 5-merous. Fruiting perianth patelliform to hemispherical with a ± horizontal wing-like outgrowth developing from beneath the perianth lobes or a separate process developing from beneath each lobe; opposite the radicle a slit, bulge or canal is present in the perianth tube. Seed ± horizontal; the radicle centrifugal or enclosed.

The genus consists of 58 species.

Malacocera Anders. (1926)

Type: *M. tricornis* (Benth.) Anders.

Fruiting perianth globose, 5-lobed, not hardened, with a prominent vertical slit opposite the radicle; from below the perianth lobes arise three soft cylindrical horizontal processes. Seed horizontal; radicle centrifugal.

The genus consists of two species.

Malacocera differs from *Sclerolaena* in having a horizontal embryo and in the tepaline position of the processes. From the genus *Bassia* s.str. it differs in having a prominent radicular slit in the perianth, and from *Maireana* in the shape and texture of the processes. In the reduced number of processes compared to the perianth lobes, and in the shape and texture of the perianth, it corresponds closely to some Eurasian species of *Bassia*, but no close relationship is suggested.

Roycea C. A. Gardn. (1948)

Lectotype: *R. pycnophylloides* C. A. Gardn.

Perianth deeply 5-lobed, without any radicular anomaly and scarcely enlarged in fruit. Utricle ovoid when ripe and considerably overtopping the perianth; pericarp crustaceous. Embryo vertical, circular. (Fig. 1G–H).

Three species (one undescribed).

The fruit of the two species when first described was unknown and the characters used by C. A. Gardner to distinguish the genus were not substantial since they could equally have applied to several species of *Maireana*. Fruiting material of all three species has recently been collected and it can be shown that the characters apparent therein clearly delimit *Roycea* from related genera. The two species originally described (*R. pycnophylloides* and *R. spinescens*) are predominantly dioecious, but a third species (undescribed) is hermaphrodite.

The leaves, indumentum, and flowers of the three species in this genus correspond closely to that found in *Maireana oppositifolia*. The fruiting perianth is, however, quite different.

Sclerolaena R. Br. (1810)

Lectotype: *S. uniflora* R. Br. (fide Ulbrich, 1934).

Fruiting perianth usually globular to urceolate, 3–4–5-merous, variously hardened, normally bearing 2–6 spines at apex of perianth-tube alternate to perianth lobes (when 4 to 6 spines then usually with a pair opposite the radicle). Seed ascending to erect.

80–90 species.

As delimited here the genus *Sclerolaena* includes the genera *Anisacantha*, *Coilocarpus*, *Austrobassia*, *Sclerochlamys*, *Sclerobassia Cyrilwhitea*, and *Kentropsis*. It differs from *Bassia* s.str. in usually having a woody fruiting perianth, in the seed position, in the spines being intertepaline in position, and in the radicular canal of the perianth. The plants are always woody perennials (annuals in *Bassia*).

The arrangement of the spines is fairly constant and is related to the position of the intertepaline veins of the perianth tube. Opposite the radicle the intertepaline rib consists of a contiguous pair, of which either or both members may give rise to a spine. Thus in species such as *B. eurotioides*, *B. parviflora*, and *B. microcarpa* (which have 5-merous flowers) there are six spines, two of which arise close together opposite the radicle. In *B. densiflora* (which has 4-merous flowers) there are 5 spines, two of which arise opposite the radicle. In many of the species of *Sclerolaena* one or more of the intertepaline veins does not develop into a spine, or one or both of the pair of radicular veins forms only a small tubercle. Thus in *B. eriacantha* there are

two spines of which one is next to the radicle and is associated with a tubercle which has developed from the other of the pair of veins. In *B. crenata* there are usually two tubercles opposite the radicle.

At the position of the pair of radicular spines or tubercles the division between the adjacent tepals develops more deeply than between the other tepals (or perianth lobes) and this division passes between the spines as a radicular slit, through which in many cases the radicle eventually emerges.

In *Bassia astrocarpa* the 5 spines are tepaline in position, and in flower structure and habit this species is very similar to *Threlkeldia proceriflora* q.v.

Threlkeldia R. Br. (1810)

Type species: *T. diffusa* R. Br.

Perianth subglobular to urceolate, 3 or 5-merous, fleshy in fruit with a hard inner layer which on drying may form several apical knobs. Embryo horizontal to erect with an ascending radicle.

Represented by 2–4 species depending on the circumscription of the genus.

T. diffusa has a 3-merous perianth and on drying the woody inner perianth develops inter-tepaline knobs (of which a contiguous pair are opposite the radicle). This condition is comparable to the situation found in the majority of *Sclerolaena* species.

In *T. inchoata* the flower is 5-merous and the fruiting perianth is raised opposite the radicle.

In *T. proceriflora* a shallow cup-shaped outgrowth forms at the apex of the perianth which gives rise to 5 teeth opposite the perianth lobes. The perianth appears to be dry (not succulent). This then is comparable to the situation in *Bassia astrocarpa*. It is obvious from general morphological characters that *T. proceriflora* and *B. astrocarpa* are closely related and possibly should both be segregated as a distinct genus.

T. salgusinosa is very similar in both vegetative and fruit characters to the species in the genus *Babbagia*. The fruiting perianth normally has a rounded protuberance at the position of the radicle and this protuberance is in some forms enlarged and slightly bifid while 4 small additional erect intersepaline processes may also develop. The perianth in this state is then little different from that in some species of *Sclerolaena* (e.g. *Bassia urceolata*), or that in *Babbagia scleroptera* in which the protuberances extend into erect wing-like structures.

Morphological Notes on Maireana

INFLORESCENCE

The flowers are normally solitary and axillary to a leaf. Sometimes they are clustered into terminal spikes and are then subtended by modified leaves or bracts. In a few species the flowers bear a pair of small bracteoles (e.g. in *M. diffusa*, *M. marginata*, *M. suaedifolia*, and *M. enchylaenoides*) but most are ebracteolate. A number of species have their flowers consistently in pairs, e.g. *M. amoena*, *M. luehmannii* and *M. scleroptera*, and in these the flowers of each pair are equal in size and normally both develop to the fruiting stage. In *M. planifolia* and *M. sedifolia* the flowers are also usually in pairs but normally only one of each pair matures. According to Bisalputra (1960) the solitary axillary flower in *Sclerolaena* represents a dichasium in which the lateral buds have been suppressed. If this is correct then the solitary flower of *Maireana* has probably a similar origin and it may be assumed that paired flowers represent a dichasium in which the terminal bud has been suppressed. (See also notes under Orientation of Flower and Fruit.)

In most species the flowers are basically hermaphrodite (although stamens may not always mature), but others are predominantly or strictly dioecious. The plants for example of *M. oppositifolia*, *M. atkinsiana*, and *M. sedifolia*

are normally strictly dioecious while *M. aphylla* and *M. prosthecochaeta* are polygamodioecious. It is interesting to note that the male flowers in those species which are strictly dioecious also possess a radicular slit to the perianth in the same position as it is found in the female flower.

PERIANTH

The perianth consists of a united portion (the tube) on which are borne 5 lobes, or the lobes may themselves be partially united above the apex of the tube proper: this united portion of the lobes is distinct both in texture and in indumentum from the tube. The portion of the perianth above the tube (and therefore above the wing in the fruiting perianth) is here referred to as the upper perianth: this corresponds to the 'limb' in *Sclerolaena*. In the position opposite the future radicle the lobes are usually distinct down to the tube, or this division between the two lobes (on either side of the future radicle) may continue for some distance into the tube. This division is here referred to as the radicular slit. The margins of the slit may overlap or may be raised or thickened.

THE WING

A horizontal wing develops as an outgrowth at the junction of the tube with the upper perianth, or when the perianth lobes are distinct down to the tube a separate wing may form opposite each lobe. In most cases the wing arises from below the level of the united perianth lobes and it is therefore single. Normally (as mentioned above) the radicular slit continues a short distance down the perianth tube and this causes the wing at that point to have a radial (radicular) slit. In a few species (e.g. *M. tomentosa* and *N. integra*) the radicular slit does not continue into the perianth tube and the wing in these cases is entire, while in a very few species (e.g. *M. atkinsiana*) the presence of the radial slit is variable in perianths on the same plant.

ACCESSORY LOBES OR WINGS

Some *Maireana* species bear, as well as the normal wing (or wings) between the tube and the upper perianth, additional structures which may be wing-like or spinose in appearance. Vertical wings are borne on the perianth tube in *M. crioclada*, *M. pentaptera*, and *M. triptera*, while in *M. polypterygia* an additional horizontal wing forms at the base of the tube. The vertical wings, whether on the tube or above the wing (as in *M. dichoptera*), are always alternate to the perianth lobes, and when opposite the radicle often arise as a contiguous pair (compare the contiguous pair of spines opposite the radicle in many species of *Sclerolaena*).

In a number of species accessory processes are present on the upper perianth (i.e. above the wing). These lobes are sometimes intertepaline in position (as in *M. lanosa*, *M. lobiflora*, and *M. prosthecochaeta*) and then presumably correspond to the spines found in *Sclerolaena;* or they may be tepaline in position (as in *M. sclerolaenoides*). In *M. glomerifolia* and *M. atkinsiana* there are five processes, a pair of which is present on each of two perianth lobes with a single process on a third lobe while the other two perianth lobes are without processes. In *M. melanocoma* numerous trichome-like processes form and these are not associated with the perianth venation. The nature of these trichomes is quite different from that of the processes otherwise found in this genus or in *Sclerolaena* and are probably in the nature of emergences.

RADICULAR CANAL

When the wall of the fruiting perianth tube is relatively thin, then at that position opposite the radicle it may be marked by a slit or weak point which readily breaks open. In those species where the wall is woody or otherwise indurated there is a 'tunnel' leading to the outside of the perianth. This

'tunnel' is here referred to as the radicular canal. It is not strictly a tunnel for, although enclosed, along its upper side runs the radicular slit of the upper perianth. The outer end of the radicular canal may be open, covered with indumentum, or closed over by a membrane.

STYLE

The style is normally a weak structure included within the perianth and divided into two or three stigmatic branches. In *M. platycarpa* it is very firm and prominently exserted, while in *M. georgei*, *M. turbinata* and *M. convexa* the style is broadly cone-shaped and forms a hard areolate cap to the utricle.

EMBRYO

The embryo is more or less circular with the radicle horizontal and either contained within the circle or slightly exserted (centrifugal). The cotyledons are normally incumbent and narrow but in those species with flattened fruits they are broad and twist to present their edges to the radicle (accumbent). Examples of the latter condition are found in the seeds of *M. platycarpa*, *M. glomerifolia* and *M. atkinsiana*.

Orientation of Flower and Fruit

As has been mentioned previously, the flowers and fruits of the majority of the species belonging to the Australian genera of the subtribe Kochiinae are asymmetrical. They are arranged on the branch in a regular manner according to the phyllotaxy of that branch. The asymmetry of the flower arises basically from the position of the embryo and the eventual emergence of the radicle. Attendant on this emergence is the radicular slit in the perianth tube and overlap of its margins; in addition there is associated the position of the spines (in *Sclerolaena*) or accessory processes (in several species of *Maireana*). When the phyllotaxy is an ascending clockwise spiral (here referred to as dextrorse) the radicular slit is on the right hand side (from the point of view of the observer), and when anticlockwise (sinistrorse) on the left-hand side. Normally at each successive branching the direction of phyllotaxy changes.

The radicle position is constant in relation to the subtending leaf or bract. Thus in a 4- or 5-merous flower the radicle emerges between the second and third perianth lobes away from the bract, either on the left or right-hand side depending on the phyllotaxy. The radicle lies on the abaxial (anterior) side of the fruit. In a dextrorse flower it is directed to the right and in a sinistrorse to the left.

In *Maireana* the subtending bract is excentric (placed to the left of the stem axis in a dextrorse phyllotaxy and to the right in a sinistrorse) which causes the radicular slit to occupy an apparent lower left or lower right-hand position. In *Sclerolaena* the bract is normally centrally placed and the radicular slit occupies an upper left or upper right-hand position.

It follows from the above that there are in each species of *Maireana*, *Sclerolaena*, and *Enchylaena*, etc., two flower and fruit forms, and that these forms are mirror images of each other. This is most obvious in those species with a markedly asymmetric fruiting perianth. (Figs. 1A–D.)

In the groups of species with consistently paired flowers (e.g. the *M. amoena* and *M. atkinsiana* groups) the flowers in each pair are identical, i.e. they are not mirror images of each other, and it depends on the phyllotaxy as to which of the two forms is present. This is also the case where, as in *M. planifolia*, either one or two flowers are formed in the axis of the bract, but when two, they are of different sizes and usually only one of them develops to the fruiting stage. The presence of only one type of flower at a node supports the suggestion made previously, that paired flowers represent a reduced dichas-

ium in which the terminal flower has failed to form, for if the two flowers consisted of one terminal and one lateral to a reduced raceme, then it could be expected that the one would be sinistrorse and the other dextrorse in morphology.

Infraspecific Variation and Hybridization

Most species of *Maireana*, even if widely distributed, are relatively constant in their morphology. In *M. georgei*, however, there is considerable regional variation both in fruit and foliage characters, while *M. oppositifolia* exhibits practically no variability in its fruit but a considerable amount in its habit and foliage, especially between the form found in inland Western Australia and that found along the south coast. When, as in the latter case, the variability is confined to the habit and foliage it is not possible without transplant experiments to distinguish between phenotypic and genotypic variation.

In *M. anioena* the range of variation both in leaf and fruit characters is very great and some forms come close to *M. scleroptera* with which it may once have had a clinal relationship. The two species are now separated geographically by a large area of the eremean desert in which neither plant has been collected.

Interspecific hybridization within the genus *Maireana* has not been confirmed in the field although it is probable that it does occur, for instance, between *M. villosa* and *M. planifolia*. These two species are sympatric over much of their range (although they differ in their ecological preferences), and frequently a plant intermediate in morphology between them is found. This intermediate form is also present in areas where *M. planifolia* has not been recorded (such as western New South Wales). More field work is required before any clear idea can be formed as to the actual situation involved.

Hybridization has been observed at several localities in Western Australia between *M. georgei* and *Enchylaena tomentosa*. The hybrid is intermediate between the parents both in leaf and fruit characters although the fruit falls readily even when immature. It is probable that hybridization also takes place between *M. turbinata* and *E. tomentosa* since plants intermediate in form between these species have been collected in South Australia and New South Wales in areas where both of the putative parent species are found. It may be noted that the fruiting perianth of *E. tomentosa* frequently develops an outgrowth corresponding to the wing of *M. georgei* but in the former species this 'wing' is succulent and is incurved over the perianth lobes.

Relationships with the genus Sclerolaena

The characters which distinguish *Maireana* from other genera are sometimes difficult to determine since species which exhibit intermediate characters do occur. Among the Australian species currently included within the genus *Bassia* there are two which have sometimes been placed in *Kochia*. These are *B. stelligera* (F. Muell.) F. Muell. and *B. brachyptera* (F. Muell.) Anders. They have a woody perianth with usually 5 or 10 short horizontal spines which may be united at their base into a short horizontal wing. The seed is horizontal and the embryo circular. Apart from the scarcely developed wing the fruiting perianths are very similar to those found in some species of *Maireana*. The closest affinity to these two species appears, however, to lie with some '*Bassia*' species, e.g. *B. microcarpa* Anders. and *B. costata* Anders. which are typical members of the genus *Sclerolaena*.

A further approach to *Maireana* is found in the species *B. symoniana* Ising. This species, with *B. luehmannii* F. Muell., was placed by Ising (1964) in his sect. *Spinosissimae*, a section characterised by having its flowers in pairs. In *B. luehmannii* the perianth is woody with 5 flattened horizontal spines opposite the perianth lobes. In *B. symoniana* the perianth is again woody but there are two series of appendages; in one series are five erect 'spines' which

arise opposite the perianth lobes, alternating with 4 + (2) horizontal 'spines' which are inter-tepaline in position, the odd pair being placed at the radicular slit. This arrangement of the inter-tepaline spines is identical to that found in most Australian '*Bassia*' species (*Sclerolaena*), while the erect spines presumably correspond to the horizontal spines found in *B. luehmannii* and to the wings found in some *Maireana* species. Almost identical in fruit morphology to *B. symoniana* is *Kochia fimbriolata* F. Muell. (in which the flowers are also in pairs). Closely related to *B. luehmannii* are *M. annoena* and *M. sclcroptera*, which in each case have paired flowers and distinct tepaline wings to the fruit. Although this group of 5 species has much in common it has been decided to place *K. fimbriolata* and *B. symoniana* in the genus *Sclerolaena* (in which genus there are some species with similar perianths) and the others in the genus *Maireana*.

The similarity (and apparent homology) between the spines found in *Sclerolaena* and the accessory lobes in *Maireana lanosa* and *M. lobiflora*, is discussed elsewhere.

Distribution

The genus *Maireana* is endemic to Australia (excluding Tasmania) where it is typical of the eremean areas, with a few species extending into the agricultural lands. In the latter case the plants are usually salt tolerant species and generally occur in coastal situations or inland in slightly saline soils. Several of the eremean species are also salt or gypsum tolerant and in fact are only found in association with inland 'salt' lakes. Other eremean species appear to be restricted to well-drained situations (e.g. *M. planifolia*, *M. melanocoma*, and *M. murrayana*) and a few appear to favour non-saline clay soils (e.g. *M. aphylla*).

A number of the species, particularly those that are succulent and almost glabrous, are heavily grazed by stock and for this reason are infrequent in agricultural or pastoral areas. The species *M. suaedifolia* and *M. thesioides*, for instance, are usually only found growing in the protection of a dense bush and their natural growth form has not been observed.

MAIREANA

Maireana Moquin-Tandon, Chenop. Enum. 95 (1840), et in Ann. Sci. Nat. Sér. 2. 15:97. t.13 (1841). Type: *M. tomentosa* Moq.

Kochia sect. *Maireana* (Moq.) F. Muell., Fragm. 7:12 (1869).

Bassia sect. *Maireana* (Moq.) Volkens in Engler et Prantl, Nat. Pflanzenfam. III. 1a: 70 (1893), not as to description.

Enchylaena sect. *Heterochlamys* F. Muell., Trans. Phil. Inst. Vict. 2:76 (1858). Type. *E. villosa* F. Muell.

Kochia sect. Duriala Anders., Proc. Linn. Soc. N.S. Wales 51:383 (1926) nom. illeg. (not validly published and a superfluous name). Type: *Enchylaena villosa* F. Muell.

Duriala Ulbrich in Engler et Prantl, Nat. Pflanzenfam. ed. 2. 16c:537 (1934), based on above.

Bassia sect. *Eriochiton* Anders., Proc. Linn. Soc. N.S. Wales 48:320 (1923) Type: *Echinopsilon sclerolaenoides* F. Muell.

Kochia sect. *Austrokochia* Ulbrich in Engler et Prantl, Nat. Pflanzenfam, ed. 2. 16c:535 (1934), without citation of type.

Bassia sect. *Spinosissimae* Ising, Trans. Roy. Soc. S. Austral. 88:75 (1964). Type: *B. luehmannii* F. Muell.

[*Kochia* auct. plur. non Roth : e.g. R.Br., Prod. 409 (1810); Bentham, Fl. Austral. 5:183 (1870); J. M. Black, Fl. S. Austral. ed. 2. 309 (1948); J. H. Willis, Handb. Pl. Victoria 2:102 (1972).]

Herbaceous to woody perennials or small shrubs, glabrous or with simple (often woolly) or branched hairs. Leaves alternate or opposite, globular to terete or narrowly-oblong, frequently fleshy or succulent. Flowers axillary, solitary or in pairs, sessile, rarely minutely bibracteolate, hermaphrodite, dioecious or polygamodioecious; perianth 5-lobed, with a flat to cup-shaped

tube, the lobes usually more deeply separated in the position opposite the future radicle; stamens 5, opposite the perianth lobes; ovary sub-globular, style short or long with 2–3 linear stigmas, ovule solitary. Fruiting perianth spongy, leathery, crustaceous or woody; tube patelliform to globular, sometimes with membranous extensions (accessory wings); wing arising at the base of perianth lobes, usually horizontal, simple and continuous (or with a radial slit opposite the radicle) or divided into 5 separate wings (rarely spines) each opposite a perianth lobe, chartaceous or rarely woody; perianth lobes usually horizontal and ± obscuring utricle, rarely erect, occasionally giving rise to erect appendages either tepaline or intertepaline in position, or to emergencies. Utricle discoid, turbinate or globular; pericarp membranous all over, or crustaceous above, or entirely crustaceous; style weak or firm, sometimes massive and hemispherical to cone-shaped; seed horizontal; endospermous; embryo circular or horse-shoe shaped, the radicle enclosed or centrifugal.

58 species endemic to mainland Australia.

Named after the French naturalist Maire.

Material has been studied from the major herbaria in Australia but for the sake of economy of time and of publication space only a small selection of this has been cited. The maps record the provenance of all specimens seen except where the localities could not be traced.

Key to Species

Note 1. This key is for specimens with fruit and, although several species are dioecious, it is not practicable to prepare a separate key to male plants, or to non-fruiting female or hermaphrodite plants.

2. The term 'fruit' as used in the key refers to the fruiting perianth.

3. The wing (or wings) of the fruiting perianth may sometimes fail to develop. This apterous condition is particularly common in *M. microphylla;* it is also found in *M. brevifolia.*

1. Fruit with 5 ± horizontal wings surrounding the upper perianth.
 2. Fruit with erect processes arising from upper perianth.
  3. Wings flat, ± truncate or rounded at apex .... **11. M. lobiflora**
  3. Wings spine-like (fruit woolly) .... **1. M. sclerolaenoides**
 2. Fruit without erect processes.
  4. Leaves slender, glabrous, spurred at base; wings pubescent with curled hairs **3. M. cheelii**
  4. Leaves various; wings hairy or glabrous.
   5. Leaves sericeous; fruit densely silky lanate, ca. 10 mm diameter **2. M. eriantha**
   5. Leaves and flowers not as above.
    6. Flowers in pairs (tube of fruit ± flat or very shallow).
     7. Wings ± glabrous.
      8. Wings each deeply divided, pungent, woody .... **4. M. luehmannii**
      8. Wings neither deeply divided nor pungent .... **5. M. amoena**
     7. Wings densely woolly .... **6. M. scleroptera**
    6. Flowers solitary (wings glabrous).
     9. Wings thin, obovate, to fan-shaped.
      10. Wings equal and horizontal; leaves alternate; flowers hermaphrodite.
       11. Leaves slender 2–4 (10) mm long, not attenuate at base, often hairy (wing simple if present) .... **47. M. microphylla**
       11. Leaves attenuate at base, glabrous.
        12. Leaves obovoid (to terete), 1–5 long; flowers without bracteoles **7. M. brevifolia**
        12. Leaves on older branches slender-fusiform, to 15 mm long; flowers minutely bracteolate .... **8. M. diffusa**
      10. Two of the five wings smaller and sub-erect; leaves often opposite; plants usually dioecious .... **9. M. oppositifolia**
     9. Wings small, imbricate, lunate, incurved or inflated on margins; slender perennial to 0·3 m high .... **10. M. enchylaenoides**
1. Fruit with a single wing surrounding the upper perianth (accessory wings on tube or upper perianth may also be present).

13. Fruit small (under 5 mm diam.), ± densely silky pilose; tube almost flat and continuous with narrow wing (small perennials).
14. Upper surface of fruit with an erect cup-shaped outgrowth .... **15. M. coronata**
14. Fruit without such an outgrowth.
15. Fruit 2·5–4 mm diam., upper surface with a pentagonal shaped ridge **14. M. pentagona**
15. Fruit ca. 4 mm diam., upper surface with 5 narrow radial ridges extending from near the centre to the edge of the wing .... **13. M. ciliata**
13. Fruit (including wing) mostly over 5 mm diam. or if smaller not silky pilose.
16. Fruit enveloped in long dense wool.
17. Fruit shortly pedicellate, tube turbinate; flowers in vertical rows in dense spike **17. M. eriosphaera**
17. Fruit sessile, tube broadly hemispherical; flowers spirally arranged in dense spike **18. M. carnosa**
16. Fruit not enveloped in long wool.
18. Fruit glabrous with large rounded soft spongy tube; upper perianth ± flat.
19. Branches with a pale fawn indumentum of dendritic hairs; leaves very slender glaucous; horizontal wing not decurrent on tube .... **30. M. campanulata**
19. Branches with a white woolly indumentum of simple hairs; leaves fleshy, narrowly terete or fusiform; horizontal wing attached by a short decurrent wing to tube **29. M. spongiocarpa**
18. Fruit not with above characters combined.
20. Tube of fruit with an expanded fleshy base; wing a narrow rim **19. M. marginata**
20. Tube not expanded at base or the wing obvious.
21. (1) 3–5 vertical wings on tube or above horizontal wing.
22. Fruit small, thin walled, with 5 vertical radial wings above horizontal wing **16. M. dichoptera**
22. Fruit thick walled, the vertical wing or wings on tube.
23. Plant glabrous (or almost so) .... **32. M. triptera**
23. Plant hairy, at least on branches.
24. Fruit with a basal horizontal wing (in addition to normal wing); leaves pubescent .... **31. M. polypterygia**
24. Fruit without a basal wing; leaves glabrous or pubescent.
25. Leaves villous; perianth lobes erect and longer than tube **35. M. schistocarpa**
25. Leaves glabrous; perianth lobes not erect.
26. Vertical wings running length of tube and united at apex with horizontal wing; perianth lobes prominently woolly ciliate .... **33. M. erioclada**
26. Vertical wings often present only towards base of tube; perianth lobes arched and prominently tomentose .... **34. M. pentatropis**
21. No vertical wings on tube.
27. Horizontal wing present at base of tube similar in size and additional to normal wing .... **31. M. polypterygia**
27. No horizontal wing at base of tube (which may however be expanded and hollow).
28. Vertical processes present on upper perianth.
29. Processes of numerous fine needle-like emergences .... **37. M. melanocoma**
29. Processes 4–6. thick or subulate.
30. Leaves very small and condensed into glomerules along branches **40. M. glomerifolia**
30. Leaves well developed.
31. Fruit woolly all over; leaves acute, silky .... **12. M. lanosa**
31. Fruit glabrous or almost so; leaves not silky.
32. Leaves sparsely pubescent, succulent, usually rounded at apex (divaricately branched sub-shrub) .... **41. M. atkinsiana**
32. Leaves glabrous, narrow, acute; branches erect **43. M. prosthecochaeta**
28. No vertical processes above wing.
33. Plant glabrous (apart from axillary tufts of wool); slender lax plants.
34. Upper perianth convex; wing of mature fruit 8–15 mm diam.
35. Leaves narrowly fusiform, basally attached; fruit to 15 mm diam., dark coloured when dry .... **43. M. thesioides**
35. Leaves semi-terete, shortly spurred at base; fruit ca. 8 mm diam., straw-coloured when dry .... **57. M. aphylla**
34. Upper perianth ± flat; wing 10 mm or less in diameter.

36. Leaves slender-fusiform on flowering branches; flowers minutely bracteolate .... **44. M. suaedifolia**

36. Leaves terete; flowers ebracteolate.

37. Leaves not fleshy; stem sparsely hairy with short straight appressed hairs **47. M. microphylla**

37. Leaves fleshy; stem sparsely hairy with short woolly hairs **45. M. dcealvans**

33. Plant variously hairy.

38. Leaves opposite; tube patelliform or flat.

39. Leaves narrowed at base; wing (10) 15–23 mm diam. **39. M. platyearpa**

39. Leaves sessile by a broad base, apex recurved; wing ca. 6 mm diam. **38. M. eannonii**

38. Leaves all or mostly scattered.

40. Style hard and prominently protruding in fruit; tube patelliform or flat **39. M. platycarpa**

40. Not as above (usually only stigma arms exerted).

41. Wing of fruit glabrous.

42. Upper perianth flat or slightly concave or convex.

43. Tube of fruit abruptly narrowed at base into a prominent terete stipe (1) 2–3 mm long.

44. Upper perianth convex, open in centre to expose utricle **57. M. aphylla**

44. Upper perianth flat or slightly sunken, completely covering utricle.

45. Hairs on leaves dendritic (i.e. with short lateral branches); stipe of fruit papillose, solid ... . **58. M. stipitata**

45. Hairs on leaves simple; stipe smooth, hollow .... **56. M. appressa**

43. Tube not as above.

46. Tube expanded into a hollow spongy base (perennial herb) **20. M. exeavata**

46. Tube not (or scarcely) expanded at base.

47. Wing of fruit with a radial (radicular) slit.

48. Leaves, branches, and flowers closely tomentose with branched (dendritic) hairs; leaves obovoid; tube and convex upper perianth of fruit pubescent ... . **27. M. astrotricha**

48. Leaves and branches with ± simple hairs or glabrous.

49. Fruit large (wing ca. 15 mm diam. or more); tube thick walled, turbinate.

50. Upper perianth flat, glabrous except for woolly margin to lobe. **23. M. georgei**

50. Upper perianth convex, pubescent.

51. Wing to 15 mm diam., leaves linear to narrow-terete, acute, 10–20 mm long .... **24. M. convexa**

51. Wing to 25 mm diam.; leaves oblong-obcuneate, very thick, ca. 20 mm long .... **26. M. murrayana**

49. Fruit with wing 5–14 mm diam.; tube not thick walled.

52. Tube of fruit pubescent; upper perianth ± flat; leaves obovoid, fleshy ... ... **28. M. sedifolia**

52. Tube of fruit glabrous; leaves various.

53. Leaves flattened, linear to obovate.

54. Leaves linear, appressed villous; upper perianth glabrous; wing with radial anastomosing veins when dry .... **52. M. villosa**

54. Leaves narrowly to broadly obovate, pubescent with curled hairs; upper perianth pubescent; wing without obvious nevation **53. M. planifolia**

53. Leaves terete, semiterete, or obovoid.

55. Fruit produced into a short terete hollow stipe at base, straw-coloured when dry.

56. Open divaricately branched shrub; branches striate and often spinescent; upper perianth convex and open in centre **57. M. aphylla**

56. Branches ± ascending, neither spinescent nor striate; upper perianth flat or sunken and completely covering utricle **56. M. appressa**

55. Fruit without a stipe-like base.

57. Upper perianth with a convex disc, open in centre; wing not prominently crenulate.

58. Stem striate; leaves sessile, woolly to glabrescent **57 M. aphylla**

58. Stem not obviously striate, leaves narrowed at base, glabrous **46. M. rohrlachii**

57. Upper perianth ± flat, concave, or if convex then closed in in centre.

59. Upper perianth tomentose; wing with fine but obvious radiating nerves .... **55. M. radiata**

59. Fruit glabrous or sparsely villous.

60. Branches ± tomentose at least on young parts (rarely glabrous); flowers not in dense spikes.

61. Leaves tomentose.

62. Fruit straw-coloured when dry and with a short hollow stipe .... **56. M. appressa**

62. Fruit almost black when dry, no stipe present **54. M. melanocarpa**

61. Leaves glabrous or sparsely villous; fruit brown when dry.

63. Upper perianth closed in centre; tube firm **48. M. microcarpa**

63. Upper perianth open in centre (exposing utricle); tube weak.

64. Wing 11–16 mm diam., often undulate **46. M. rohrlachii**

64. Wing ca. 8 mm diam., flat .... **45. M. decalvans**

60. Branches sparsely strigose or sparsely villous (or somewhat woolly when very young); leaves slender 2–4 mm long; wing of fruit crenulate, flowers in dense spikes **47. M. microphylla**

47. Wing of fruit continuous (i.e. without a radial slit); leaves semiterete.

65. Fruit large, wing ca. 15 mm diam.; tube turbinate, smooth **25. M. turbinata**

65. Fruit small, wing 11 mm or less in diameter; tube hemispherical to cupular.

66. Leaves 2–5 mm long, appressed on younger branches; wing 4–6 mm diam. .... **49. M. ovata**

66. Leaves over 5 mm long, spreading; wing usually 8–10 mm diam.

67. Upper perianth pubescent .... **51. M. integra**

67. Upper perianth glabrous (or almost so) apart from ciliate lobes **50. M. tomentose**

42. Upper perianth columnar in form with large erect lobes.

68. Leaves 2–6 mm long, shortly pubescent; no vertical wings on tube **36. M. pyramidata**

68. Leaves 5–12 mm long, appressed villous; tube with a narrow vertical wing .... **35. M. schistocarpa**

41. Wing of fruit pubescent above.

69. Upper perianth erect and columnar .... **35. M. schistocarpa**

69. Upper perianth not erect.

70. Wing up to 10 mm diam.

71. Perianth tube thin walled, base expanded into a hollow stipe; leaves semi-terete, ca. 10 mm long .... **21. M. trichoptera**

71. Perianth tube with a hard boss-like base; leaves elliptical to narrowly obovate, mostly 7–12 mm long .... **22. M. humillima**

70. Wing 15–25 mm diam., tube turbinate, base not expanded; leaves very thick and fleshy ca. 20 mm long .... **26. M. murrayana**

1. Maireana sclerolaenoides (F. Muell.) P. G. Wilson, comb. nov.

Echinopsilon sclerolaenoides F. Muell., Trans. Phil. Soc. Inst. Vict. 2:75 (1858).—*Eriochiton sclerolaenoides* F. Muell., Second Gen. Rep. 15 (1854), nomen.—*Chenolea sclerolaenoides* (F. Muell.) F. Muell. ex Benth., Fl. Austral. 5:192 (1870).—*Bassia sclerolaenoides* (F. Muell.) F. Muell., Census 1:30 (1882).—*Bassia eriochiton* Tate, Handb. Fl. Extratrop. S. Austral. 51 and 218 (1890).—*Austrobassia sclerolaenoides* (F. Muell.) Ulbrich, Nat. Pflanzenf. ed. 2. 16c:532 (1934). Type: "Desert of Lake Torrens, of the Murray and Darling." (Lecto: Cudnaka, F. Mueller, MEL, n.v., fide E. H. Ising, Trans. Roy. Soc. S. Austral. 88:72 (1964)).

Chenolea dallachyana Benth., l.c. 191. –*Bassia dallachyana* (Benth.) F. Muell., Census 1:30 (1882). Type: Murray river, *Dallachy* (MEL, fide Ising l.c., n.v.).

Ascending to erect perennial to 30 cm high. *Branches* slender, lanate. *Leaves* alternate, narrow-oblong to semi-terete, 5–10 mm long, acute, appressed villous (to sericeous). *Flowers* solitary, hermaphrodite, densely silky lanate,

usually congested towards the apex of the branches to form dense leafy spikes. *Fruiting perianth* cartilaginous to bony, obscured by the dense silky lanate indumentum; attachment small; tube hemispherical, 1 mm high and 2 mm wide at apex, ± 5-ribbed with the rib opposite the radiele deeply grooved; wings 5, opposite the perianth lobes, linear-acuminate (spine-like) eventually spreading, ca. 3 mm long; appendages within wing 5, erect, opposite the perianth lobes, oblong, ca. 3 mm long, each shortly to deeply divided into two acuminate lobes; upper perianth convex, hard, 5-lobed. *Utricle* thick; pericarp membranous, villous; style slender, exserted, villous. (Fig. 4E–F, Map 14.)

Distribution: Western New South Wales, South Australia, Western Australia south of the latitude of Carnarvon, southern portion of the Northern Territory.

New South Wales: Broken Hill, *A. Morris* 284 (ADW).

South Australia: Near Port Pirie, *M. Koch* 213 (PERTH).

Western Australia: 11 mi W of Yalgoo, *A. S. George* 7960 (PERTH); Leonora, *W. E. Blackall* 363 (PERTH); 3 mi S of Reid, 1 Sept. 1962, *T. E. H. Aplin* (PERTH).

Maireana sclerolaenoides does not easily fit into any of the described genera. The wings are spiny (whereas in most species of *Maireana* they are flat) and the erect appendages are strictly opposite the perianth lobes, unlike other species which possess similar appendages. Both Anderson (1923) and Ising (1964) placed *M. sclerolaenoides* in *Bassia* sect. *Eriochiton* as the only species.

2. Maireana eriantha (F. Muell.) P. G. Wilson, comb. nov.

Kochia eriantha F. Muell., Rep. Babbage's Exped. 20 (1859).— *K. villosa* var. *eriantha* (F. Muell.) Moore et Betche, Handb. Fl. N.S. Wales 110 (1893). Lectotype: Elizabeth Creek, Babbage's Expedition (MEL).

? *K. concava* Ising, Trans. Roy. Soc. S. Austral. 78:112 (1955). Type: Evelyn Downs, *E. H. Ising* 3561 (holo AD, iso NSW).

Subshrub to 50 cm high. *Branchlets* closely pubescent bearing persistent leaf bases. *Leaves* alternate, fleshy, linear, obtusely trigonous in cross section, 10–30 mm long, 1·5–3 mm wide, acute, densely sericeous. *Flowers* predominantly dioecious, solitary or in pairs, arranged in leafy spikes towards the branch apices; perianth cupular, 5-lobed, densely villous outside and within at base; ovary ovoid, sparsely villous, style of two filiform stigmas to 6 mm long; male flowers with prominently exserted stamens, anthers 1·5 mm long. *Fruiting perianth* densely long silky lanate all over; attachment small; tube obconical to cupular, ca. 3 mm high, chartaceous, 5 ± 1 ribbed (an intermediate rib opposite the radiele) or occasionally 10 ribbed; wing coriaceous, horizontal, ± deeply and irregularly divided into 5 lobes which are opposite the perianth lobes, ca. 2·5 mm wide and 10 mm diam.; upper perianth lobed to tube, completely covering ovary; lobes thick and coriaceous in lower two-thirds, chartaceous near apex. *Utricle* ± globose; pericarp crustaceous, sparsely woolly; seed oblique, embryo hippocrepiform. (Fig. 4G–H, Map 24.)

Distribution: South western Queensland, north western New South Wales, eastern South Australia north of Pt. Augusta, southern portion of the Northern Territory.

Queensland: S end of Bygrave Ra., 5 mi E of Warri Gate, 6 June 1955, *L. A. S. Johnson*

New South Wales: Fowlers Gap, Aug. 1955, *N. Allison* (AD); 13 km S of Warri Gate,

South Australia: 43 mi ESE of Lake Hart, *A. C. Beauglehole* 20012 (AD); Coober Pedy, 5 July 1960, *J. B. Cleland* (AD); Balta Baltana Ck, 28 Sept. 1953, *L. S. Francis* (AD); Arkaringa Ck., 16 May 1891, *R. Helms* (MEL, NSW); Uro Bluff, Yudnapinna, 13 July 1954, *F. M. Hilton* (ADW); Evelyn Downs, *E. H. Ising* 3560 (NSW); Mt. Lyndhurst, Oct. 1895, *M. Koch* 155 (MEL); De Rose Hill Stn., *T. R. N. Lothian* 853 (AD); 5 mi N of Dulf Ck., *T. R. N. Lothian* 1358 (AD); 40 km NW of Leigh Creek, *T. R. N. Lothian* 3534 (AD); Foothills of Emery Rd., *T. R. N. Lothian* 4795 (AD); 22 km E of Pedirka, *T. R. N. Lothian* 4819 (AD); Lords Gorge, *A. Morris* 1457 (ADW, NSW); 20 mi N of Red Lake, Stuarts Creek Stn., 2 Dec. 1960, *D. Symon* (ADW); Andamooka, *J. Z. Weber* 1447 (AD); Stokes Rd. to Cooper Ck, *Wheeler* (MEL 42101); Woomera, *L. D. Williams* 441 (AD).

Found principally on stony plains or on rocky hills.

Maireana eriantha has a fairly uniform appearance but exhibits considerable variation in fruit characters. The tube varies from turbinate to hemispherical and the wing from being shallowly to deeply lobed. The form which was described by E. H. Ising as a new species '*Kochia concava*' is only known from the type collection and this consists of only three short pieces. It differs from *M. eriantha* in the fruit shape and in having a short sericcous indumentum on the branchlets. The fruits of *K. concava* are in pairs and are firmly fixed to the stem, only to be removed with difficulty; the tube is obconical and shorter than in M. eriantha; the wing varies from slightly to deeply lobed and from ± horizontal to erect; it is thick and hard at its base; the upper perianth is convex. From the little material available it is not possible to say whether *K. concava* is a good species, a hybrid involving *M. eriantha*, or a deformed state of the latter species. Typical *M. eriantha* has been found at the type locality of the former species.

3. Maireana cheelii (Anders.) P. G. Wilson, comb. nov.

Kochia cheelii Anders., Proc. Linn. Soc. N.S. Wales 59:270 fig. 3–4 (1934). Type: Zara, Dec. 1913, *E. Officer* (NSW).

Small erect caespitose perennial with a woody stock and swollen tap-root. *Branches* slender, striate, closely woolly when young. *Leaves* alternate, fleshy, slender, semiterete, ca. 6 mm long, glabrous, concave above, very shortly spurred at base. *Flowers* solitary or in pairs, hermaphrodite; perianth deeply lobed, shortly woolly. *Fruiting perianth* wheel-shaped, cartilaginous to woody, somewhat woolly above, in all 5–6 mm diam.; tube shortly convex (depressed in centre), ca. 2 mm diam., strongly 10–ribbed, with a solid boss-like base; wings 5, distinct, fan-shaped, cartilaginous, horizontally radiating, each up to 2·5 mm long; upper perianth flat, obscuring ovary, shortly lobed, the radicular slit extending to tube where it continues as a more prominent rib. *Utricle* discoid; pericarp thin, glabrous; style very short. (Fig. 5G–H, Map 26.)

Distribution: Near the New South Wales-Victoria border between Bendigo and Hay.

New South Wales: 1 mi N of Murray R. due south of Moulamein, 7 Nov. 1947, *D. L. W. Henderson* (NSW); Deniliquin, Sept. 1935, *J. C. McCaw* (ADW); Tchelery Stn., 9 Dec. 1957, *W. A. Mairhead* (NSW); 24 mi S of Hay, *J. C. DeNardi* 358 (NSW).
Victoria: 20 mi N of Bendigo, 29 Mar. 1947, *D. Henderson* (NSW).

Maireana cheelii is a very distinct member of the genus and shows no close affinity with any other species.

J. H. Willis in "A Handbook to Plants in Victoria" 2:103 (1972) records that the tap-root tastes of coconut when fresh. He suggests the vernacular name 'Chariot Wheels', alluding to the wheel-like appearance of the fruiting perianths.

4. Maireana luehmannii (F. Muell.) P. G. Wilson, comb. nov.

Bassia luehmannii F. Muell., Vict. Nat. 7:47 (1890).—*Austrobassia luehmannii* (F. Muell.) Ulbrich, Nat. Pflanzenf. ed. 2. 16c:532 (1934). Type: Finke River, *W. F. Schwarz* (MEL, fide E. H. Ising, l.c., n.v.).

Woody divaricately branched perennial to 40 cm high. *Branchlets* woolly when young. *Leaves* alternate, succulent, obovoid, ca. 5 mm long, shortly sericcous, narrowed into a petiole-like base. *Flowers* hermaphrodite, in axillary pairs, pubescent. *Fruit* woody, somewhat flattened and appressed to stem; attachment broad and flat; tube short, convex, ca. 10-ribbed; wings 5, woody, 2–3 mm long, spreading and often irregularly curved, each ± divided into two (or more) spiny lobes; upper perianth flat, divided to base into 5 imbricate lobes; radicular canal prominent. *Utricle* glabrous; style short, pilose; seed thick and discoidal, endosperm prominent. (Map 11.)

Distribution:* Northern South Australia, northern eremean Western Australia, Northern Territory.

*Partly after E. H. Ising (1964).

South Australia: Dalhousie Springs, *S. A. White* (AD, n.v.).
Western Australia: Lake Auld, *A. S. George* 9142 (PERTH).
Northern Territory: 20 mi SSW of Mongrel Downs, *P. K. Latz* 746 (PERTH).

E. H. Ising (1964) placed this species in the monotypic section *Bassia* sect. *Spinosissimae*. Its affinities are, however, obviously with *M. amoena* which it resembles closely both in vegetative and floral morphology.

5. Maireana amoena (Diels) P. G. Wilson, comb. nov.

Kochia amoena Diels, Bot. Jahrb. 35:183 (1904). Type: Near Bullabulling, *Diels* 5200 (B, now destroyed).

Brittle undershrub to 40 cm high. *Branchlets* woolly when young. *Leaves* succulent, globular to ovoid or terete, 5–15 mm long, glabrous to sericeous. *Flowers* hermaphrodite, in pairs, covered with a short dense indumentum. *Fruit* pilose, woolly, or glabrescent; base angular, truncate; tube short ± hemispherical, woody (rarely firm and spongy); wings 5, horizontal, oblong to flabelliform, (0·5) 1·5–3 mm long, chartaceous to coriaceous or spongy (rarely almost absent); upper perianth lobed to base, coriaceous (to spongy), completely covering ovary, lobes exduplicate valvate, so as to form 5 radial ridges, or imbricate; radicular canal prominent; utricle hemispherical (flat above); pericarp cartilaginous above, otherwise membranous; seed thick, endosperm prominent. (Fig. 5C–D, Map 12.)

Distribution: Western Australia, from the latitude of Carnarvon south to Norseman.

Usually found in the sandy rises around gypseous or salt lakes.

Western Australia: 250 mile peg on Great Eastern Highway, *K. M. Allen* 722 (PERTH); Dundas Rocks, *A. C. Beauglehole* 13210 (CANB, NSW, PERTH); White Well, Glenorn Stn, 15 Aug. 1938, *N. T. Burbidge* (PERTH); 75 mi E of Wiluna, *A. R. Fairall* 1896 (PERTH); 11 mi E of Carnegie HS, *A. S. George* 5521 (PERTH); Nannine, Sept. 1903, *W. V. Fitzgerald* (NSW); S of Wiluna, *C. A. Gardner* 2400 (PERTH); Lake Wooleen, 23 Sept. 1950, *A. W. Humphries* (PERTH); Carnarvon, *J. N. Hutchinson* 2 (PERTH); Cowcowing, Sept. 1904, *M. Koch* 1166 (NSW, PERTH); 15 mi SW of Nannine, *N. H. Speck* 739 (PERTH); Yarra Yarra Lakes near Three Springs, *R. A. Saffrey* 631 (PERTH); 5 km W of Pindar, *P. G. Wilson* 9958 (PERTH).

This species exhibits great variability but it does not seem practicable to delineate infraspecific taxa. The type form, which is by far the most common, is found from Cowcowing east to Zanthus and north to Nannine and Laverton. In this form the leaves are globular to obovoid and glabrous (except when young). The fruit has five fan shaped wings which are ± in contact, and a short broad tube. The perianth lobes are exduplicate valvate so as to form 5 short radial ridges in the centre of the fruit.

Near Lake Wooleen (leg. A. W. Humphries) is found a form with subterete and acute leaves which are sericeous (at least when young). The fruit has a very short tube and a broad flat base; the wings are coriaceous, irregular, oblong to obovate and shortly fimbriate, and the radial ridges on the upper surface of the fruit are very prominent.

Towards the west coast of Western Australia near Three Springs (R. A. Saffrey 631) is found a form with a spongy perianth and very short 'wings' (which are practically absent). Plants intermediate in character between those found at Three Springs and the type form of *K. amoena* have been collected at Pindar (Wilson 9958) and at Carnarvon (J. N. Hutchinson 2).

6. Maireana scleroptera (J. M. Black) P. G. Wilson, comb. nov.

Kochia scleroptera J. M. Black, Trans. Roy. Soc. S. Austral. 46:568 (1922). Lectotype: R. Alberga, June 1913, *Miss Staer* (AD).

Prostrate to erect perennial up to 30 cm high with a woody perennial base. *Branches* slender, striate, woolly. *Leaves* scattered, narrow-oblong to narrow-obovate, 5–10 (20) mm long, sericeous to glabrescent. *Flowers* hermaphrodite, arranged in pairs in the leaf axils; perianth depressed globose, densely woolly.

Fruiting perianth cartilaginous to woody, moderately to densely woolly all over; attachment small; tube convex, 10-ribbed, ca. 2 mm diam.; wings 5, horizontal, cartilaginous, broadly oblong, flat, crenulate on margin, 1–2 mm long; upper perianth lobed to tube, open in centre, thick and hard forming a disc-like ring around the membranous horizontal tips. *Utricle* discoid, pericarp coriaceous above otherwise membranous, glabrous; style short, sparsely villous. (Map 15.)

Distribution: Found in the central eremean area of Australia.

South Australia: 36 mi SE of Everard Park Stn., *D. E. Symon* 2706 (ADW); Wintinna Ck., 18 mi N of Mt. Willoughby, *A. C. Beauglehole* 20198 (AD).

Western Australia: Elder Creek, 2 mi W of Warburton Mission, *A. S. George* 3799 (PERTH); 30 mi NW of Mt. Davies, *R. H. Knchel* 76 (AD).

Northern Territory: 10½ mi SW of Alice Springs, 27 Sept. 1958, *G. Chippendale* (NT); Kings Canyon, George Gill Range, *A. C. Beauglehole* 20269 (AD).

Maireana scleroptera is similar to some forms of *M. amoena*, especially to the form found towards the eastern limit of the latter's distribution. It is obvious that the two species are closely related and may even at one time have formed part of a continuous cline. As noted in several other species (e.g. *M. lanosa* and *M. lobiflora*) the wall of the fruiting perianth is penetrated in the position opposite the radicle by a canal the outer opening of which is normally obscured by the woolly covering.

7. Maireana brevifolia (R. Br.) P. G. Wilson, comb. nov.

Kochia brevifolia R. Br., Prodromus 409 (1810).—*Salsola brachyphylla* Spreng., Syst Veg. 1:924 (1825), based on above. Type: Australia (south coast), *R. Brown* (syn MEL 41973).

Suaeda tamariscina Lindl. in Mitchell, Journ. Trop. Austral. 239 (1848).—*Enchylaena tamariscina* (Lindl.) Druce, Bot. Soc. Exch. Cl. Brit Isles 4:621 (1917).·*Kochia tamariscina* (Lindl.) Black, Trans. & Proc. Roy. Soc. S. Austral. 47:368 (1923). Type: *T. L. Mitchell* 196, 18 July 1846 (holo: CGE, iso: AD, MEL).

Kochia thymifolia Lindl. in Mitchell, Journ. Trop. Austral. 56 (1848). Type: Mara Creek *T. L. Mitchell*, 12 Feb. 1846 (CGE, photo seen).

Bushy shrub 0·2–1 m high. *Branchlets* slender, striate, sparsely to moderately lanate and with axillary tufts of wool. *Leaves* scattered, fleshy, obovoid to slender fusiform, 2–5 mm long, narrowed at base into a short petiole, glabrous (or sparsely pilose when young). *Flowers* solitary, hermophrodite, ebracteolate, glabrous apart from woolly ciliate lobes. *Fruiting perianth* glabrous; attachment small, not hollowed; tube shallowly hemispherical, thin walled, faintly 10-ribbed, ca. 2 mm diam., wings 5, horizontal, chartaceous, arising from base of perianth lobes, each flabelliform, 2–3 mm long, with delicate brown venation; perianth lobes free to tube, thick and fleshy (sharply demarcated from wings), not completely obscuring the discoidal utricle. (Fig. 5A–B, Map 5.)

Distribution: Found in all mainland Australian states but generally south of 26° of latitude.

Queensland: Armadilla, between the Warrego and Maranoa, *W. Barton* 86 (MEL).

New South Wales: Condobolin, 26 Feb. 1951, *H. K. C. Mair* (NSW).

Victoria: Corio Bay, April 1901, *G. G. Pescott* (MEL).

South Australia: 32 km N of Pt. Augusta, *T. R. N. Lothian* 2659 (AD).

Western Australia: 1 km W of Dukin, *P. G. Wilson* 6456 (PERTH).

Northern Territory: Hermannsburg, Finke R., *G. F. Hill* 64 (MEL, NSW).

Found in light to heavy soils often under slightly saline conditions. An early colonizer of disturbed land.

Maireana brevifolia is very similar to *M. diffusa*. They may be distinguished by differences in leaf shape and by the absence of bracteoles in the former species (see also note with *M. diffusa*).

The original description of *Suaeda tamariscina* was very brief and was based solely on flowering material. Bentham (1870) considered it to be a synonym of *Enchylaena microphylla* and subsequently the two names have

always been considered to be synonymous and have been applied in their combinations under *Kochia* to plants which should correctly be referred to either *M. decalvans* or to *M. microphylla*. In the 19th century literature the epithet '*microphylla*' was adopted (following Bentham) while in the 20th century the earlier epithet '*tamariscina*' was taken up. J. M. Black included *Kochia tamarsicina* in the second edition of his Flora of South Australia (1948) and inadvertently correctly applied the name, for although his description refers to *M. microphylla* (of which he had seen New South Wales material) the one South Australian specimen in his herbarium, determined by him as *K. tamariscina*, is in fact a flowering specimen of *K. brevifolia*.

This species and *M. diffusa* appear to be most closely related to *M. decalvans* and *M. suaedifolia*.

8. Maireana diffusa P. G. Wilson, sp. nov.

Fruticulus virgatus 0·5–1 m altus. *Folia* carnosa, obovoidea vel anguste fusiformia, 3–15 mm longa, breviter petiolata, sparse appresse pubescentia vel glabra. *Flores* solitarii, bibracteolati, bracteolis anguste triangularibus, ca. 0·7 mm longis. *Perianthium* fructificans glabrum, tubus convexus, ca. 2 mm diam., pariete tenui; alae 5, horizontales, flabelliformes, ca. 2 mm longae, tenuiter chartaceae; perianthii lobi libri, inflexi, crassi sed vix carnosi, ad alas ± continui.

Type: 1 km W of Dukin near Cowcowing Lakes, Western Australia, 13 Mar. 1968, *P. G. Wilson* 6461 (holo: PERTH, iso: AD, CANB, K, MEL, NSW).

Virgately branched subshrub 0·5–1 m high. *Branches* slender, striate, with a short, thin, woolly indumentum when young. *Leaves* scattered, fleshy, obovoid and ca. 3 mm long on the short lateral branchlets, narrowly fusiform to 15 mm long on the erect branches, sparsely appressed pubescent to glabrous, narrowed at base into a short flattened petiole. *Flowers* solitary, hermaphrodite, depressed globose, glabrous, with fleshy imbricate inflexed lobes, subtended by a pair of narrowly triangular bracteoles ca. 0·7 mm long. *Fruiting perianth* glabrous; attachment small; tube convex, thin-walled and weak, faintly 10-ribbed, ca. 2 mm diam.; wings 5, horizontal, completely separate and arising from base of perianth lobe, each flabelliform and slightly imbricate, ca. 2 mm long, thinly chartaceous, with fine pale brown radiating veins when dry; upper perianth horizontal, divided to base, lobes broadly imbricate, woolly ciliate, thickened but scarcely fleshy, ± continuous with the wings, the radicular slit extending as an overlap a short way down tube; utricle discoid, glabrous, style short. (Fig. 7G–H, Map 24.)

Distribution: Western Australia, between Dalwallinu and Merredin.

Western Australia: 2 mi W of Kununoppin, Dec. 1963, *C. V. Malcolm* (PERTH); 37 km E of Southern Cross, *P. G. Wilson* 4069 (PERTH).

Found in saline soil, frequently around salt lakes.

This species is similar to *M. brevifolia* but has a much more restricted distribution and is not such a forceful colonizer of disturbed lands. *Maireana diffusa* differs from *M. brevifolia* in having a more slender and lax habit, longer leaves on the older branches, and a pair of bracteoles beneath each flower. In the fruit of *M. diffusa* the perianth lobes are imbricate, flat, and almost cover the utricle; in *K. brevifolia* they are open, thick and fleshy so as to be clearly demarcated from the wings, and do not completely cover the utricle.

9. Maireana oppositifolia (F. Muell.) P. G. Wilson, comb. nov.

Kochia oppositifolia F. Muell., Trans. & Proc. Viet. Inst. Advancem. Sci. 1:134 (1855). Type: Spencer Gulf, 1851, *F. Mueller* (MEL 43944).

Compact subshrub 0·3–1 m high. *Branchlets* finely woolly when young. *Leaves* opposite (or in inland eremean forms alternate and often in tight clusters), sessile, spurred, narrowly ovate and up to 4 mm long to deltoid and ca. 1 mm long (when clustered) obtusely trigonous in cross section, shortly sericeous to glabrescent. *Flowers* predominantly dioecious, shortly lobed. *Fruiting perianth* glabrous except for the pubescent lobes; attachment small, slightly

hollowed; tube broadly obconical to convex, 1·5–2 mm diam., thin walled, ribbed; wings 5, completely free and arising from base of perianth lobes, chartaceous, prominently nerved, unequal, flabelliform, spreading unevenly (the two smaller sub-erect), in all ca. 7 mm diam.; upper perianth very short, lobed to wings. *Utricle* depressed globose; pericarp thinly crustaceous, sparsely woolly; style firm, exserted, ca. 0·7 mm long, lanate. (Map 22.)

Distribution: Western Victoria; coastal or near coastal South Australia; coastal Western Australia as far north as Shark Bay and inland as far north as Lake Moore and Comet Vale.

VICTORIA: Mildura, 25 Jan. 1937, *W. Zimmer* (MEL).

SOUTH AUSTRALIA: Price, Yorke, Peninsula *B. Copley* 3038 (AD).

WESTERN AUSTRALIA: 9 mi S of Pingrup, *K. Newbey* 3083 (PERTH); 38 km NE of Southern Cross on road to Koolyanobbing, *P. G. Wilson* 6437 (PERTH).

Maireana oppositifolia is always associated with saline conditions.

This species varies considerably in habit and in leaf shape and arrangement. The south coast plant is erect with steeply ascending branches and the leaves are opposite, 3–4 mm long. The eremean form found in Western Australia from Shark Bay south east to Norseman is a divaricately branched sub-shrub in which the leaves are alternate and often clustered into compact glomerules. Intermediate forms are found and, at least in part, the plant habit appears to be a phenotypic response to the environment. The fruit in plants from all areas is virtually identical.

Two other species of Chenopodiaceae are similar in the vegetative state to the eremean form of *M. oppositifolia.* The first is *M. glomerifolia* which may be distinguished by its more tightly compacted leaf-clusters that are also more globular. The second is an undescribed species of *Roycea* in which the leaves are similar to those of *M. oppositifolia* but the branches have a coarser indumentum. The *Roycea* species has hermaphrodite flowers, and perianths which are lobed to the base; both it and *M. glomerifolia* have fruit which is unmistakably different from that of *M. oppositifolia.*

10. Maireana enchylaenoides (F. Muell.) P. G. Wilson, comb. nov.

Bassia enchylaenoides F. Muell., Syst. Census Fl. Pl. 1:30 (1882), [non B. *villosa* Wallich ex G. Don (1837)] based on following.—*Enchylaena villosa* F. Muell., Trans. Phil. Inst. Victoria 2:76 (1858).—*Heterochlamys villosa* F. Muell., Sec. Gen. Rep. Gov. Bot. Victoria (1854) nomen.—*Chenolea enchylaenoides* F. Muell., Fragm. 10:92 (1876), nom. illeg. (superfluous name).—*Kochia crassiloba* R. H. Anders., Proc. Linn. Soc. N.S. Wales 51:383 (1926-nom. illeg. (superfluous name).—*Chenolea villosa* (F. Muell.) Ewart, Fl. Vict. 458 (1931).—*Duriala villosa* (F. Muell.) Ulbrich, Nat. Pflanzenfam. ed. 2. 16c:537 (1934).—*Duriala crassiloba* Beadle, Stud. Fl. N.E. New S. Wales pt. 2:199 (1972) nom. inval. Type: "In loamy places near Adelaide and in Bacchus Marsh" (syntypes MEL).

Small perennial to 20 cm high; branches slender, decumbent to erect, sparsely puberulous to villous, arising from a woody rootstock. *Leaves* scattered, somewhat fleshy, narrowly oblong-elliptic, obtuse, 4–10 (20) mm long, sparsely pubescent to villous. *Flowers* solitary, axillary, hermaphrodite, depressed globose, hirtellous, sometimes subtended by a pair of small narrowly triangular bracteoles. *Fruiting perianth* sparsely puberulous, drying black; attachment small; tube slightly convex, thin walled and coriaceous, ± 10 ribbed, ca. 3 mm diam.; wings 5, completely separate and arising from base of perianth lobes, only slightly exceeding tube, in all ca. 4 mm diam., coriaceous, each broadly lunate and unevenly imbricate (auriculate when overlapping), margins somewhat inflated and sometimes incurved; upper perianth completely divided into small deltoid lobes which are continuous with the wings. *Utricle* discoidal; style short. (Map 25.)

Distribution: Southern and eastern Australia in areas S of 28° latitude and with over 300 mm rainfall.

QUEENSLAND: Nindigully, Dec. 1937, *R. Roe* (CANB); Gilruth Plains, *G. H. Allen* 442 (CANB).

NEW SOUTH WALES: Dubbo, *E. Betch* 130 (MEL); Narrandera-Grong Grong, *C. W. E. Moore* 1144 (CANB).

Victoria: Nathalia, Goulburn Valley, *J. H. Willis* 10 (MEL).
South Australia: Moolooloo Stn., Oct. 1920, *B. Beck* (AD).
Western Australia: Fitzgerald River valley, *A. S. George* 10012 (PERTH).

The form taken by the fruit in this species is so similar to that found in *M. brevifolia* and *M. diffusa* as to not justify it being placed in a separate genus.

The nomenclature surrounding this species is somewhat involved, this being partly because all the synonyms cited above are based on the same type. The confusion commenced in 1876 when Mueller transferred the species from *Enchylaena* to *Chenolea*, for he should then have retained the epithet "*villosa*"; the combination "*C. enchylaenoides*" was therefore illegitimate. Subsequently (1882) on transferring the species to the genus *Bassia* (Chenopodiaceae) he was not able to use the epithet "*villosa*" since it had already been used by G. Don* in a genus of the same name but belonging to the Sapotaceae. Mueller was therefore free to use the epithet "*enchylaenoides*" which is to be treated as new. When Anderson in 1926 transferred the species to *Kochia* he should also have adopted the epithet "*enchylaenoides*" (since the epithet "*villosa*" was not available). Anderson's new name "*Kochia crassiloba*" is therefore illegitimate being superfluous.

In the genus *Maireana* I have preferred to reserve the epithet "*villosa*" for that species which has for long been known under this name in the genus *Kochia;* I have therefore taken up the next available epithet for the species here described but which unfortunately has been used in the genus *Kochia* for the plant now referred to *M. tomentosa.*

11. Maireana lobiflora (F. Muell. ex Benth.) P. G. Wilson, comb. nov.

Kochia lobiflora F. Muell. ex Benth., Fl. Austral. 5:184 (1870). Type: Darling River, Victoria Exploring Expedition, 1 Nov. 1860, *Beckler* (iso: MEL).

Decumbent to erect perennial with a woody stock, to 0·5 m high. *Branches* slender, striate, lanate. *Leaves* alternate, linear to very narrowly elliptical, 7–15 (25) mm long, sericeous, ± similar in size and shape throughout the plant. *Flowers* solitary, hermaphrodite; perianth woolly, deeply 5-lobed; ovary woolly. *Fruiting perianth* shortly lanate, coriaceous to crustaceous, attachment small; tube slightly convex, faintly costate; wing horizontal, of 5 spathulate to flabelliform lobes (when broad they may be contiguous along their margins), in all to 10 mm diam.; upper perianth slightly convex, closed over the utricle, radicular slit extending to a short way down tube; erect processes (on upper perianth) 4 + 2, alternating with the perianth lobes (the contiguous pair being placed with one on either side of the radicular slit), processes narrow-spathulate to clavate, to 4 mm long, frequently expanded or lacerated at the apex or deeply bilobed. *Utricle* discoidal, sparsely villous; style villous, shortly exserted. (Fig. 3A–B, Map 17.)

Distribution: Western New South Wales, South Australia, Western Australia, southern portion of the Northern Territory.

New South Wales: SE corner of Cobham Lake, *J. C. DeNardi* 824 (NSW, PERTH).
South Australia: 6 km E of Argepena HS., *T. R. N. Lothian* 3241 (AD).
Western Australia: 14 mi E of Carnegie HS., *A. S. George* 5522 (PERTH).
Northern Territory: 25 mi E of Heavitree Gap, Undoolya Stn., *J. R. Maconochie* 1049 (NT).

This species exhibits considerable variation over its geographical range. In New South Wales, central South Australia and east-central Western Australia the leaves are very narrowly elliptic to linear and the wings in the fruit have prominent intervening sinuses. This is the type form of the species. In the Northern Territory the leaves are narrow-elliptic and thin and the wings of the fruit are broad, touching, and without intervening sinuses, and they may sometimes be partly fused. This has often been identified as *M. lanosa*, but the latter species is also found in the Northern Territory and has a quite different appearance and does not appear to hybridise with *M. lobiflora.*

**Bassia villosa* Wallich ex G. Don. Gen. Hist. 4:36 (1837).

In the southern portion of Australia, over the Nullarbor Plain and eastwards to the Flinders Ranges, is found a form which is decumbent in habit and has small leaves. The wing lobes in the fruit of this form are broad and contiguous and each of the four normally 'single' erect processes is divided to the base.

For comments on the fruit morphology, and intergradation with *M. lanosa*, see notes under the latter species.

12. Maireana lanosa (Lindl.) P. G. Wilson, comb. nov.

Kochia lanosa Lindley in Mitchell, Journ. Exped. Trop. Austral. 88 (1848) Type: [near the Narran R.] 8 Mar. 1846, *T. L. Mitchell* (iso: MEL).

K. lanosa var. *minor* Benth., Fl. Austral. 5:184 (1870). Type: Murchison River, *Oldfield* (MEL).

Open perennial with a woody stock, to 0·5 m high. *Branches* slender, striate, lanate. *Leaves* alternate, somewhat fleshy, elliptic to narrow-elliptic or narrow-obovate, ca. 4 mm long in the upper (fruiting) branches, 10–20 mm long in the lower branches, sericeous. *Flowers* solitary, hemaphrodite, perianth densely woolly, 5-lobed, ovary woolly. *Fruiting perianth* sparsely lanate, coriaeeous to crustaceous; attachment small; tube slightly convex, faintly costate; wing simple, horizontal, 7–12 mm diam., with a single radial (radicular) slit, margin entire or crenulate; upper perianth slightly convex, closed over the utriele, radieular slit extending to a short way down tube; ereet proeesses (on upper perianth) 4 + 2, linear to subulate, 3–4 mm long, alternating with the perianth lobes (the contiguous pair being placed with one either side of the radicular slit). *Utricle* discoidal: pericarp ehartaceous, sparsely villous; style villous shortly exserted. (Map 18.)

Distribution: South-western Qucensland, central and western New South Wales, eastern South Australia, north-western Western Australia, Northern Territory.

Queensland: Yappunga near Thargomindah, April 1885, *Mrs. Spencer* (MEL).

New South Wales: Bambamero (= Lake Pamamaroo) 3 Nov. 1860, *Beckler* (MEL).

South Australia: Nilpena, R. Helms 53 (NSW).

Western Australia: 33 mi S of Learmonth, *A. S. George* 6536 (PERTH).

Northern Territory: 90 km NE of Alice Springs, *M. L. Benda* (AD).

Although very similar to *M. lobiflora*, over most of its range *M. lanosa* is distinct from that speeies (with which it yet appears to be sympatric). *Maireana lanosa* differs from *M. lobiflora* in the following characters: (1) The leaves of the fruiting branches are usually noticeably smaller than those on the vegetative portions of the plant. (2) The wing of the fruit is simple. (3) The erect processes are simple and never clavate. In Western Australia, in the area between the Wooramel River and Boolardy Station, the differenees usually found between the two species are not present and in the same region ean be found plants which differ only in the degree of lobing of the wing, however, because of the distinctiveness of the two taxa elsewhere in Australia, I have retained them as distinct speeies.

Near the west eoast of Western Australia between Learmonth and the Murchison River is found a form with smaller fruits: this is the 'var. *minor*' of Bentham. The characters which distinguish it from the type variety are not sufficiently clear for its status to be maintained.

In both *M. lanosa* and *M. lobiflora* a passage is present in the wall of the tube opposite the radiele, passing outwards to the radieular slit. This passage is identical in form to that found in *M. ciliata* and related speeies and generally in others where the wall of the tube is thick and hard.

The erect proeesses of the fruits of *M. lanosa*, as also in *M. lobiflora*, are presumably homologous to the spines found in most species of *Sclerolaena* (the Australian members of the genus '*Bassia*'). In *Sclerolaena* the spines also alternate with the perianth lobes and, when six in number, also have the 4 + (2) arrangement.

13. Maireana ciliata (F. Muell.) P. G. Wilson, comb. nov.

Kochia ciliata F. Muell., Rep. Babbage's Exped. 20 (1859). Type: Wonnomulla, Emu Springs, between Stuart's Creek and Margareth Creek, Babbage's Expedition (MEL).

Decumbent to erect plant with woody perennial base and slender woody taproot, to 10 cm high. *Branches* slender, woolly. *Leaves* alternate, (linear to) narrow-oblong, acute, ca. 10 mm long, sericeous. *Flowers* solitary, hermaphrodite, in congested leafy spikes and also scattered along branches, densely silky villous; perianth patelliform. *Fruiting perianth* compressed lenticular, pentagonal, ca. 3 mm diam., horny, covered with silky villous indumentum; attachment small; lower surface almost flat to slightly convex, faintly costate; upper surface convex in centre above the utricle otherwise flat and wing-forming with 5 prominent radiating intertepaline ribs which extend to the angles of the wing, the radicular slit passing along one rib to the wing margin which is there notched; perianth lobes horizontal, triangular, not completely obscuring ovary. *Utricle* discoid, sparsely villous above; style firm, exserted. (Fig. 3G–H, Map 20.)

Distribution: Far western New South Wales, central and north eastern South Australia.

New South Wales: Fowlers Gap Station, 29 Aug. 1952, *E. G. Cuthbertson* (NSW).
South Australia: Farina Ck., Flinders Ra., *T. R. N. Lothian* 1037 (AD).

14. Maireana pentagona (Anders.) P. G. Wilson, comb. nov.

Kochia pentagona R. H. Anderson, Proc. Linn .Soc .N.S. Wales 51:385 t.27 (1926).—*Chenolea pentagona* (Anders.) Ewart, Fl. Vict. 458 (1931). Type: Trangie, *A. Morris* 1288 (holo: NSW, iso: ADW).

Prostrate to decumbent plant with small perennial woody base and long fleshy taproot. *Branches* slender, woolly. *Leaves* alternate, linear, acute, 7-12 (20) mm long, appressed villous, often becoming glabrescent, with age. *Flowers* solitary, hermaphrodite, densely woolly villous. Fruiting perianth woolly villous, discoid, ± pentagonal in outline, 2·5-4 mm diam. (without the indumentum), cartilaginous to crustaceous; attachment small; lower surface convex, ribbed, continuous with the narrow horizontal rim (wing) which is sometimes divided into five very short truncate lobes; upper surface raised into a thick, hard ± pentagonal (or star-shaped) ridge or platform formed from the convex thickened bases of the perianth lobes, within the ridge the lobes are depressed and membranous, radicular slit extending to margin of wing. *Utricle* discoid, pubescent; style slender, firm, exserted. (Fig. 3E–F, Map 19.)

Distribution: Central and south western New South Wales, western Victoria, south eastern South Australia.

New South Wales: 55 mi N of Deniliquin, *T. M. Whaite* 1722 (NSW).
Victoria: Kerang, Oct. 1887, *J. Minchia* (MEL).
South Australia: Renmark, Jan. 1917, *J. M. Black* (NSW)
Western Australia: 75 mi N of Carnarvon, *J. S. Beard* 3511 (Kings Park).

The ridge on the upper surface of the fruiting perianth is pentagonal to star-shaped in outline with the five angles extending towards the wing margin. If the wing is very narrow, it may extend as a short acute lobe opposite the angles. If the wing is more developed it may be slightly retuse opposite the angles, thus dividing into five short, truncate lobes. An intermediate condition gives an entire outline to the wing.

The only record for *M. pentagona* from Western Australia comes from an area well isolated from the otherwise known distribution of this species. The specimen is very similar to the Eastern States' plant but has a greater development of the wing in the fruiting perianth.

Maireana pentagona appears to be closely related to *M. ciliata* and *M. coronata;* it is possibly related (but more remotely) to *M. platyptera.*

15. Maireana coronata (Black) P. G. Wilson, comb. nov.

Kochia coronata J. M. Black, Trans. Roy. Soc. S. Austral. 41:43 t.9 (1917). Lectotype: Cootanoorina Creek, 7 May 1891, *R. Helms* (holo: AD, iso: MEL).

Decumbent to erect plant with woody perennial base and slender woody (?) taproot, up to 15 cm high. *Branches* slender, woolly. *Leaves* alternate, linear, acute, 7–20 mm long, appressed villous or sericeous. *Flowers* solitary, hermaphrodite, in congested leafy spikes or scattered along the stems, densely long silky villous; perianth base broad and flat; upper perianth forming a membranous erect cup that is surrounded by a fleshy circular disc (this disc develops in fruit into the corona). *Fruiting perianth* like an inverted academic hat ("mortar-board"), horny, silky villous, with a flat base which is continuous with the narrow circular wing, in all ca. 4 mm diam.; upper surface with a cup-shaped outgrowth (corona) to 2·5 mm high which is soft on the margin but otherwise horny; upper perianth within and towards the base of the corona, horizontal, ± completely obscuring utricle, the radicular slit extending through the corona to the notched margin of wing. *Utricle* discoid, occupying the base of the corona; style firm; exserted (from perianth), eventually deciduous. (Fig. 2F–G, Map 2.)

Distribution: Central and south western Queensland, north western New South Wales, north eastern South Australia, and the south eastern area of the Northern Territory.

Queensland: Longreach, Mitchell District, *S. T. Blake* 6595 (NSW).
New South Wales: 45 mi NNW of Wilcannia on road to White Cliffs, *J. C. DeNardi* 261 NSW).

South Australia: Macumba Stn., Nov. 1950, *E. H. Ising* (AD).
Northern Territory: 12 mi W of Huckitta Stn., *M. Lazarides* 5937 (NSW).

Maireana coronata is similar to *M. ciliata* and, prior to its description by Black, collections of it were identified as the latter species. Bentham (1870) cited three collections under *Kochia ciliata*, one of them (Babbage's Expedition) is the type of this species while the other two (Dallachy and Mitchell) are of *M. coronata*. The two species may be readily distinguished for in fruit the latter possesses a well-developed cup-shaped corona which develops as an outgrowth from the base of the perianth lobes. It is in this position (the base of the perianth lobes) that the wing is formed in most species of Mariana, and it is possible that the corona is homologous to the normal wing while the apparent wing corresponds to the membranous extension of the tube base as found in the perianth of *M. polypterygia*.

16. Maireana dichoptera (F. Muell.) P. G. Wilson, comb. nov.

Kochia dichoptera F. Muell., Fragm. 8:37 (1873). Type: Bowen Downs, *C. W. Birch* (holo: MEL 42067).

Small erect plant to 20 cm high with perennial woody base. Branches slender, woolly. *Leaves* alternate, linear, fleshy, 7–25 mm long, appressed villous. *Flowers* hermaphrodite, solitary or in pairs, very depressed with inflexed perianth lobes, shortly tomentose outside. *Fruiting perianth* sparsely pilosulose, straw-coloured when dry, largely consisting of the six radially positioned vertical wings and a horizontal wing; attachment small; tube flat, ca. 2·5 mm diam., 6-nerved; wings delicate, faintly veined; horizontal wing simple, circular, ± continuous with the tube, ca. 7 mm diam., with a single radial (radicular) slit; vertical wings 4 ± 2 on upper side of perianth and intertepaline in position (the contiguous pair being opposite the radicle with one either side of the radicular slit) attached to the horizontal wing and to the arched upper perianth, ca. 3·5 mm high; upper perianth forming a convex crustaceous ring with short inflexed membranous lobes, the radicular slit extending to wing. *Utricle* discoid; pericarp crustaceous above, sparsely villous around style base. (Fig. 3C–D, Map 25.)

Distribution: Central Queensland.

QUEENSLAND: Tambo, Barcoo, *Schneider* (MEL); near the Alice River, 1884, *C. W. Birch* (MEL).

This species is very similar to *M. pentagona* and its allies in both vegetative and fruiting characters. This resemblance is obscured by the presence of the delicate wings in *M. dichoptera* and by the dense indumentum on the perianth of *M. pentagona*. The wings correspond, however, to the horizontal rim and vertical ridges found in the latter species and in *M. ciliata*.

17. Maireana eriosphaera P. G. Wilson, sp. nov.

Ramuli graciles, laxi lanati. *Folia* linearia vel angusti oblonga, acuta, ad 10 mm longa, sericea. *Flores* dense spicati in seriebus verticalibus dispositi. *Perianthium* fructificans pedicellatum cum indumento dense sericeo-lanato; tubus hemisphaericus vel turbinatus, 1·5–2·5 mm altus, chartaceus, margine incressato et undulato vel perbreviter 5-lobato vel peranguste alato, rima radiculari in tubum continua; perianthium supernum in lobos minutos acuminatos divisum, inflexum vel demum elevatum in pilis lanatis pericarpio producto.

Type: Upper Rudall River area, ca. 500 km S of Broome, Western Australia, 22 35′S, 122 10′E, quartz gravel and clay, spike brittle with 3 vertical rows of flowers, hairs on flower white, stigma red, 16 Aug. 1971, *P. G. Wilson* 10564 (holo: PERTH, iso: CANB, K, NSW).

Erect loosely branched perennial to 30 cm high, woody at base. *Branches* slender and loosely woolly. *Leaves* alternate, linear to narrow-oblong, to 10 mm long, acute, sericeous. *Flowers* solitary, hermaphrodite, densely covered with a silky-villous indumentum, arranged in vetrical rows in dense terminal spikes 2–10 cm long; floral bracts similar in size and shape to foliage leaves; perianth broadly hemispherical; style lanate with 2–3 long stigmatic lobes which, with the stamens, are long exserted. *Fruiting perianth* on a distinct slender pedicel 0·5–1 mm long, densely covered on tube, wings, and upper surface of perianth lobes by a long spreading silky-lanate indumentum forming a soft ball ca. 10 mm diam., inner surface of tube and of perianth lobes glabrous; tube chartaceous, (hemispherical to) turbinate 1·5–2·5 mm high, 5–10 costate; margin of tube thickened and undulate or of 5 short rounded erect divisions (wing lobes) continuous with tube or sometimes these united to form a very narrow coriaceous horizontal wing, the radial (radicular) slit passing for a variable distance down tube; upper perianth of 5 acuminate lobes ca. 1 mm long, coriaceous at base but otherwise membranous, inflexed or eventually raised up by the dense indumentum which, arising from the pericarp, overflows from the tube. *Utricle* discoidal; pericarp thin, silky lanate above. (Fig. 9A–B, Map 2.)

Distribution: Eremean region of Western Australia.

WESTERN AUSTRALIA: 16 mi N of Norseman, *T. E. H. Aplin* 1844 (PERTH); Nannine Sept. 1903 *W. V. Fitzgerald* (NSW); Rudall River, 22 35′S, 122 10′E, *P. G. Wilson* 10564 (PERTH).

Maireana eriosphaera is normally only found growing within small shrubs, where, presumably, it is protected from animals. It usually occurs in sub-saline soil on the margins of salt lakes or at the base of breakaways.

M. eriosphaera is similar in appearance to *M. carnosa* with which it has been confused in herbaria. In the field the former may be distinguished by its more slender and erect growth and by the flower spikes in which the flowers are vertically arranged contrasting with the spiral arrangement in *M. carnosa*. Other distinguishing characters are the floral indumentum which in *M. carnosa* is finer and more curled (floccose), the perianth shape, and the presence or absence of a pedicel.

M. eriosphaera exhibits considerable variation in the shape and size of the fruiting perianth. In some specimens the margin of the tube (i.e. the erect wing) is only undulate, whereas in others it is 5-lobed. Occasionally the wing is slightly spreading and almost entire. Part of this apparent variation may be due to the stage of development of the fruit for in other characters the species is remarkably constant throughout its range.

18. Maireana carnosa (Moq.) P. G. Wilson, comb. nov.

Echinopsilon carnosus Moq. in DC., Prod. 13/2:136 (1849).—*Chenolea carnosa* (Moq.) Benth., Fl. Austral. 5:190 (1870).—*Bassia carnosa* (Moq.) F. Muell., System. Census Austral. Pl.30 (1882).—*Kochia carnosa* (Moq.) Anders., Proc. Linn. Soc. N.S. Wales 48: 353 (1923). Type: "In Nova-Hollandia seeus Swan-River. (*Drummond!* n.126)." n.v.

Bassia lanuginosa C. T. White, Queensld. Agric. Journ. n.s. 15:216 (1921). Type: Twenty six miles east of the junction of the Mayne and Diamantina Rivers, Western Queensland *F. Pether* (iso: MEL, NSW).

Herbaceous perennial with woody base to 30 cm high. *Stems* sometimes decumbent with ascending branches, loosely woolly. *Leaves* alternate (or sometimes opposite), fleshy, narrow to broad oblong, to 10 mm long (the floral leaves often broader than the stem leaves), silky villous to woolly or glabrescent. *Flowers* solitary, hermaphrodite, spirally arranged in dense terminal leafy spikes, densely covered with long white floccose wool; staminal filaments and style long and slender (3–5 mm). *Fruiting perianths* sessile, enveloped in a thick mass of wool ca. 8 mm diam. and forming stout woolly spikes; attachment very small; tube crustaceous, very shallowly hemispherical, 2–3 mm diam., faintly to prominently costate; wing circular, horizontal, very narrow, to 0·5 mm wide and in all 3–4 mm diam., with a single radial (radicular) slit; upper perianth crustaceous, flat or slightly inflexed in centre, shortly lobed and not completely covering ovary; radicular slit extending to wing; utricle discoidal, pericarp thin, woolly above. (Fig. 9C–D, Map 23.)

Distribution: South east Queensland, northern South Australia, and the temperate and subtropical eremean regions of Western Australia.

Queensland: 26 mi E of Junction of Mayne and Diamantina Rivers, Jan. 1921, *F. Pether* (MEL, NSW).

South Australia: Evelyn Downs, 19 Aug. 1954, *E. H. Ising* (AD).

Western Australia: 5 mi W of Meekatharra, *N. H. Speck* 553 (CANB, PERTH).

Typically an eremean species inhabiting salt flats and sandy subsaline loams.

The type of *Echinopsilon carnosus* was stated by Moquin to be Drummond no. 126. This I have not seen. However, Bentham (1870) cited Drummond 246 and a duplicate of this number in herb. MEL agrees with Moquin's description and may in fact be an isotype.

19. Maireana marginata (Benth.) P. G. Wilson, comb. nov.

Enchylaena marginata Benth., Fl. Austral. 5:182 (1870). Type: "Swan river, *Drummond*, 1st coll." (holo: K).

?E. micrantha Benth., op. cit. 181.—*Bassia micrantha* (Benth.) F. Muell., Syst. Census Austral. Pl. 30 (1882). Type: Western Australia, *Drummond* 4th coll. no. 253 (iso: MEL).

Kochia massonii Ewart, Proc. Roy. Soc. Vict. ser. 2. 20:82 t.10b (1907). Type: Cowcowing, *M. Koch*, Sept. 1904 (holo: MEL, iso: MEL, PERTH).

Prostrate to decumbent herb with a perennial woody stock. *Branches* slender, somewhat woolly when young. *Leaves* alternate, fleshy, linear to narrow-oblong, 5–10 mm long, loosely villous. *Flowers* solitary hermaphrodite, depressed globose, pubescent above, subtended by a pair of deltoid bracteoles ca. 1·5 mm long. *Fruiting perianth* when fresh depressed barrel-shaped and constricted in middle, ca. 3 mm high, 4–5 mm diam. at apex, fleshy, ± flat above and below, papillose on sides and puberulous above, tube with lower half somewhat bulging, smooth, upper half with ten rounded ribs (on drying the upper half of tube becomes very broadly turbinate and thin walled while the lower half forms an expanded slightly spongy base); wing a very narrow horizontal extension to upper perianth, entire except for the radicular slit; upper perianth ± flat, not completely covering utricle, lobed about half way, radial (radicular) slit extending down upper half of tube as a prominent ridge which may itself be longitudinally slit. *Utricle* lenticular, glabrous; pericarp thin; seed with copious endosperm. (Fig. FA–B, Map 11.)

Distribution: Western Australia, South West District from Morawa south-east to Ravensthorpe.

Western Australia: Morawa, July 1903, *C. Andrews* (PERTH); Cunderdin, Sept. 1908, *J. B. Cleland* (NSW); Ravensthorpe, *P. G. Wilson* 7086 (PERTH).

Usually found in heavy soil in woodland.

The holotype of *Enchylaena micrantha* at Kew (K) and an isotype in Melbourne (MEL) both lack any trace of flowers or fruit. The vegetative appearance of these specimens is, however, similar to that of *M. marginata*.

For a comparison of *M. marginata* with *M. excavata*, to which it is closely related, see under the latter species.

20. Maireana excavata (J. M. Black) P. G. Wilson, comb. nov.

Kochia excavata J. M. Black, Trans. et Proc. Roy. Soc. S Austral. 47:368 (1923). Type: Spalding, 4 Nov. 1920 (holo: AD, iso: NSW).

K. villosa var. *humilis* Benth., Fl. Austral 5:187 (1870).—*K. tomentosa* var. *humilis* (Benth.) Black, Fl. S. Austral. 197 (1924) not as to description. Type: "desert country of Victoria and adjoining portion of N.S. Wales" (syn: *Dallachy*, MEL 2114; Darlings River, MEL 42137; Skipton, *W. Whan*, MEL 43929).

Small perennial herb to 20 cm high with a woody base. *Branches* slender, loosely woolly when young. *Leaves* alternate, narrowly oblong-elliptic, 7–12 mm long, somewhat fleshy, tawny appressed villous. *Flowers* solitary, hermaphrodite, with or without a pair of narrow-oblong bracteoles to 1·5 mm long. *Fruiting perianth* fleshy when fresh; depressed barrel-shaped and constricted in middle, ca. 3 mm high, ± flat above, glabrous; tube (on drying) with upper half very broadly turbinate to convex, 10-ribbed, thin walled, lower half expanded into a spongy hollow base which when attached to the plant is filled by the cushion shaped receptacle; wing chartaceous, horizontal, circular and entire, ca. 10 mm diam., faintly nerved and with a single radial (radicular) slit; upper perianth flat, almost obscuring the ovary, deeply lobed, ciliate on the margin otherwise glabrescent, the radicular slit extending from perianth to base of tube as a narrow slit. *Utricle* lenticular; pericarp thin, glabrous; seed with copious endosperm. (Fig. 6G–H, Map 18.)

Distribution: South central New South Wales, western Victoria, south-eastern South Australia.

New South Wales: Wanganella, July 1903, *E. Officer* (NSW).

Victoria: NW of Lake Albacutya, Sept. 1887, *C. French* (MEL).

South Australia: Wilpena Pound, *D. E. Symon* 1419 (ADW).

This species is rather uniform throughout its geographical range. It most closely resembles *M. marginata* from which it differs in having a much larger wing to the fruit. Both species possess bracteoles (although in *M. excavata* these may be present or absent even on different parts of the same plant). Both have a spongy expanded base to the fruit and in both the radicular slit extends the length of the perianth tube.

Bentham cited no specimens after his description of *Kochia villosa* var. *humilis*, but four specimens in herb. MEL which he had seen and were determined as such belong to *M. excavata*. A fifth, "Little River, Fullagor no. 4", is of *M. decalvans*, and a sixth, "Skipton, W. Whan." doubtfully determined as *Kochia villosa* var. *humilis*, consists of a mixture of *Maireana humillima* and *M. excavata* material. In both editions of his Flora of South Australia, J. M. Black misapplied the varietal name, for all the specimens in his personal herbarium which had been so determined by him belong to *M. trichoptera*.

21. Maireana trichoptera (Black) P. G. Wilson, stat. et. comb. nov.

Kochia excavata var. *trichoptera* J. M. Black, Trans. Roy. Soc. S Austral. 47:368 (1923). Lectotype: Wattaker Station [= Wartaka], Gawler Range, 16 Sept. 1912, *S. A. White* (AD 96312082).

K. villosa var. *lasioptera* F. Muell., Fragm. 7:12 (1869). Lectotype: Goginga Glen [= Scrope Range], 17 June 1861, *H. Beckler* (MEL).

Erect woody perennial to 50 cm high. *Branches* slender, closely lanate. *Leaves* somewhat fleshy, semiterete, 5–10 mm long and 1·5–2 mm wide, obtuse, appressed pubescent. *Flowers* solitary, often spicate, hermaphrodite, densely

villous or woolly. *Fruiting perianth* pubescent all over or only on upper surface, often red when fresh; tube (when fresh) ca. 4 mm high, medially constricted, the lower half expanded into an excentric fleshy hollow stipe (the hollow being occupied, when in situ, by the cushion-shaped receptacle), the upper half shortly turbinate, (when dry the lower half (the stipe) shrivels to a varying amount and becomes firm or sometimes spongy, the upper half (the tube proper) becomes shallow and chartaceous); upper perianth flat, thin, shortly lobed, the radicular slit extending to wing and then down the tube as a prominent ciliate ridge; wing simple, horizontal, chartaceous, ± reticulately nerved, ca. 10 mm diam., with a single radial (radicular) slit. *Utricle* plano-convex (flat above); pericarp thin and glabrous; style very short. (Fig. 6E–F, Map 1.)

Distribution: Western New South Wales, north western Victoria, South Australia, non-tropical Western Australia, and the southern portion of the Northern Territory.

New South Wales: Fowlers Gap, Aug. 1955, *N. C. W. Beadle* (NSW).
Victoria: 5 km N of Red Cliffs, 13 Oct. 1972, *T. Henshall* (AD); Piangil, *H. B. Williamson* (AD).

South Australia: Mt. Mary near Morgan, *E. H. Ising* 1962 (AD); Tregalana Stn., *S. Barker* 253 (AD).

Western Australia: 196 mi N of Geraldton, *A. M. Ashby* 1889 (PERTH); 39 mi N of Norseman, 9 Sept. 1962, *T. E. H. Aplin* (PERTH).

Maierana trichoptera is a common and easily recognisable species. It differs very obviously from *M. excavata* (with which it had been included) by its erect habit, semiterete leaves, and more pubescent fruit. In inland localities the plant tends to be more woolly than in coastal areas, a character which shows up most strongly in the fruit.

It is not clear whether Mueller intended to formally describe '*Kochia villosa* var. *lasioptera*' as a new variety, since he cited no material; however, because his variety is here relegated to synonymy this matter is of no nomenclatural importance. The only specimen I could find in the Melbourne Herbarium annoted by Mueller with this name is the one here selected as lectotype (Beckler, 17 June 1861).

Maireana trichoptera was included by Bentham (1870) within his rather broad concept of *Kochia villosa* [var. *villosa*]* and, as noted previously, although named as a distinct variety by Mueller (1869), was never recognised by him or others in any subsequent publication until J. M. Black independently described it as a variety of *K. excavata*.

*As is evidenced by Bentham's citation of the following specimens which are all M. *trichoptera*:—Victorian Expedition, 22 March 1861 (MEL 48955); Near Spencer Gulf, Oct. 1851, F. Mueller (MEL 44139); Great Australian Bight, E. A. Delisser (MEL 42134).

It has been noted in the introductory pages that in all species of *Maireana* the flowers and fruits are methodically orientated in relation to the subtending leaf. This orientation can be readily observed in *M. trichoptera* because of the spicate arrangement of the fruits. When the phyllotaxy is an ascending clockwise spiral the radicle (and therefore also the radicular slit on the wing) occupies a lower right-hand position, and when anti-clockwise a lower left-hand position. The direction of spiral changes at each successive division of branching.

22. Maireana humillima (F. Muell.) P. G. Wilson, comb. nov.

Kochia humillima F. Muell., Fragm. 9:168 (1875). Type: By the Murray, Murrumbidgee, Campaspe, and Edward rivers, *F. Mueller* (syn: "Campaspe" MEL, NSW; "Edwards" AD, MEL).

Small perennial herb branching at the woody base. *Branches* decumbent, slender, lanose. *Leaves* alternate, narrow-elliptical to narrow-obovate, acute, 7–12 (20) mm long, attenuate towards the base, tawny appressed villous. *Flowers* solitary, axillary, hermaphrodite, subtended by a pair of narrowly

ovate bracteoles ca. 1·5 mm long; upper perianth shortly lobed and densely woolly outside, tube glabrous and almost flat. *Fruiting perianth* woolly above and on upper side of wing, otherwise glabrous, dark brown when dry; tube cupular, 1·5–2 mm high, hard and crustaceous, faintly ribbed or smooth with a rounded boss-like base which is somewhat concave at the point of attachment; wing simple, circular, rigidly chartaceous, horizontal, ca. 12 mm diam., faintly nerved, with a radial (radicular) fold which sometimes develops into a slit; upper perianth horizontal, more or less covering ovary, shortly lobed, membranous on margin and thickened towards base, the radicular slit extending to wing and continuing down tube as a prominent rib. *Utricle* very thick, flat on top, pericarp crustaceous above otherwise membranous, very sparsely pilose to glabrous; endosperm copious. (Map 13.)

Distribution: Central New South Wales, south to central Victoria. Usually found in heavy soil.

New South Wales: 7 mi SW of Lockhart, 21 Oct. 1964, *E. F. Constable* (NSW).

Victoria: Charlton, May 1918, *W. W. Watts* (MEL).

Maireana humillima is similar in habit to *M. excavata* but the fruiting perianth may be distinguished by its being woolly above and by the absence of a spongy base. The wing of the fruit is also much firmer than is found in wings of otherwise similar species.

23. Maireana georgei (Diels) P. G. Wilson, comb. nov.

Kochia georgei Diels, Bot. Jahrb. 35:184 f. 20b (1904) Type: Murrin Murrin, *W. J. George* (iso: MEL).

K. stowardii S. Moore, J. Linn. Soc. Bot. 45:189 (1920). Type: Nungarin, *Steward* 793 (BM)

Compact rounded subshrub ca. 40 cm high. *Branchlets* slender, closely lanate. *Leaves* alternate, slender and semi-terete, 8–15 (30) mm long, 1–2 mm wide, fleshy, sparsely to densely sericeous (or glabrescent). *Flowers* solitary, hermaphrodite, ± glabrous except for woolly margin to lobes; tube campanulate: perianth lobes erect with the radicular slit passing halfway down tube; ovary conical and passing into the solid style base, sparsely pubescent. *Fruiting perianth* glabrous except for the lobes: attachment basal or excentric, scarcely sunken; tube turbinate; slightly laterally compressed, thick walled and areolate, upper half somewhat fleshy on the outside when fresh but becoming wrinkled on drying, base solid and rounded, in all ca. 6 mm high and wide (at apex); wing horizontal, 15–20 mm diameter, thinly chartaceous, faintly nerved, with a single radial (radicular) slit; upper perianth completely obscuring ovary, flat, deeply lobed, glabrous except for margins to lobes, the radicular slit extending to wing and part way down tube. *Utricle* discoidal; pericarp thin; style massive, hemispherical, hard but areolate, included within perianth. (Fig. 8A–C, Map 7.)

Distribution: Western Queensland, western and central New South Wales, eremean South and Western Australia, and the Northern Territory.

Queensland: 16 mi NE of Duchess Township, *R. A. Perry* 4026 (AD).

New South Wales: 2 mi W of Cobar, *J. C. DeNardi* 220 (NSW).

South Australia: 7 mi W of Marree, *R. Hill* 415 (AD).

Western Australia: Near Coolgardie, *A. M. Ashby* 171 (AD).

Northern Territory: 13·5 mi E of Alice Springs, *D. J. Nelson* 36 (MEL).

This species shows considerable morphological variability. Plants from central and northern Australia have leaves more slender and more densely sericeous than do plants from southern localities: in the Kalgoorlie to Southern Cross area of Western Australia the leaves may in fact be glabrescent. The fruiting perianth is normally flat on top; however, in plants from central Western Australia the perianth is often laterally compressed and the apex is then curved.

Hybridization between *M. georgei* and *Enchylaena tomentosa* has been observed by the author at several places in Western Australia, wherever, in

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fact, these species are growing together. Many of the herbarium specimens determined as *M. georgei* may also be hybrids, but this condition is not recognizable on imperfect or immature material. The hybrid plants seen in the field have a more lax habit than does *M. georgei* and the fruit, which is intermediate in form between the two species, falls readily even though the seed apparently matures.

M. georgei may be distinguished from *M. turbinata* by the fruiting perianth. In the latter species it has a smooth tube and an entire wing without any radial slit, whereas in *M. georgei* it has a wrinkled tube (in the upper fleshy portion) and an obvious radial slit in the wing.

The type of *K. stowardii* S. Moore, which is at the British Museum, was kindly compared with material of *M. georgei* by Mrs. Susan Downes.

24. Maireana convexa P. G. Wilson, sp. nov.

Ramuli dense sed tenuiter lanati. *Folia* linearia vel semiteretia, 10–20 mm longa, ± sericea. *Perianthium* fructificans satis amplum; tubus late turbinatus ca. 3 mm altus et ad apicem 5 mm latus, basi rotundata, pariete crasso, duro; ala chartaeca ca. 15 mm diam., rima radiculari praesenti; perianthium supernum convexum, durum, breviter lanatum.
Type: 19 km E of Leonora, Western Australia, loose straggly subshrub 2 m high, fruit golden, 26 Aug. 1968 *P. G. Wilson* 7269 (holo: PERTH, iso: CANB, K, MEL, NSW).

Open divaricately branched subshrub 1–2 m high. *Branchlets* slender, closely woolly. *Leaves* alternate, linear to narrowly semi-terete, 10–20 mm long, ca. 1·5 mm broad, fleshy, ± sericeous. *Flowers* solitary, hermaphrodite; tube campanulate, glabrous; upper perianth erect, deeply lobed and woolly. *Fruiting perianth:* attachment small, central; tube broadly turbinate, ca. 3 mm high and 5 mm wide at apex, smooth, base rounded, wall thick hard and areolate; wing horizontal, chartaceous, ca. 15 mm diameter, faintly nerved, with a single radial (radicular) slit; upper perianth convex, hard, shortly woolly, lobed almost to base with the radicular slit extending to wing and half way down tube as a narrow overlap. Utricle turbinate; pericarp woolly; style massive, hard, and conical, included within perianth. (Fig. 8G–H, Map 20.)

Distribution: Western Australia, between 25° and 30° latitude as far east as the 123° of longitude (Laverton westwards).

Western Australia: Laverton, Sept. 1909, *J. H. Maiden* (NSW); 20 mi SE of Mileura HS, *N. H. Speck* 691 (CANB, PERTH).

This species is similar to *M. georgei* and shares with that species the large fruit and massive conical style. It may be distinguished by the larger, looser habit of the plant, and by the fruit which has a convex woolly upper perianth. *M. convexa* is rather uniform in appearance throughout its geographical range. To the pasturalists of the Gascoyne area of Western Australia it is known as the 'mulga bluebush' (D. G. Wilcox, pers. comm.).

25. Maireana turbinata P. G. Wilson, sp. nov.

Ramuli dense sed tenuiter lanati. *Folia* subteretia, obtusa, 5–7 mm longa, ± appresse villosa. *Perianthium* fructificans aureum glabrum; tubus turbinatus saepe ad basim ± attenuatus, crustaceus, laevis, nitidus; ala chartacea, 14–20 mm diam., integra, rima radiculari absenti; perianthium supernum applanatum; stylus conicus, sparse lanatus.
Type: 80 km S of Rawlinna, Nullarbor Plain, Western Australia, 3 Sept. 1968, *P. G. Wilson* 7673 (holo: PERTH, iso: CANB, K, MEL, NSW).

Divaricately branched subshrub 30–60 cm high. Branchlets closely white lanate. *Leaves* alternate, subterete, obtuse, 5–7 mm long, sparsely to moderately appressed villous. *Flowers* solitary, axillary, hermaphrodite, glabrous except for the woolly margin to perianth. *Fruiting perianth* golden brown when mature, glabrous; attachment small; tube turbinate, often somewhat attenuate at the soild base, crustaceous, smooth and glossy; wing chartaceous, ± horizontal, simple, without any radial slit, 14–20 mm diameter,

very faintly nerved; upper perianth flat and completely obscuring ovary, shortly lobed, the radicular slit extending to wing. *Utricle* depressed; pericarp membranous below and chartaceous above; style solid and conical, sparsely woolly, included within perianth.

Distribution: South western Queensland, central and western New South Wales, north western Victoria, South Australia, and south eastern Western Australia (east of Kalgoorlie). (Fig. 8D–F, Map 3.)

QUEENSLAND: Bowen Downs, 1873, *Birch* (MEL).

NEW SOUTH WALES: Corona, Barrier Ra., *M. Collins* 12 (NSW); Balranald, Lucas 91 (MEL).

VICTORIA: Kulkyne State Forest, *H. I. Aston* 166 (MEL); Mildura, *N. M. E. McDonald* 19 (MEL).

SOUTH AUSTRALIA: Yudnapinna, Oct. 1943, *N. T. Burbidge* (ADW); Kimba, *M. W. Caulfield* 259 (AD).

WESTERN AUSTRALIA: Kalgoorlie, *C. H. Ostenfeld* 342 (PERTH); 2 mi S of Reid, *T. E. H. Aplin* 1666 (PERTH).

Maireana turbinata has usually been determined in herbaria as '*Kochia georgei*'. For further comment see note under this latter species.

A plant which appears to be a hybrid between *M. turbinata* and *Enchylaena tomentosa* has been collected at Paralana Hot Springs, ca. 115 km ENE of Leigh Ck, S.A. (*R. H. Kuchel* 2678, AD). The mature fruit is about the size of that found in the former species but it has a rounded tube with an erect entire wing. The fruiting perianth when fresh was 'bright orange coloured and fleshy'. The seed was fertile and two plants which were produced from them in the Botanic Garden, Adelaide, bore similar but much smaller fruit (fide Hj. Eichler in litt.). Similar specimens are represented by the following collections: Scrope Range, New South Wales, 1860, *H. Beckler* (MEL 48999); Broken Hill, Sept. 1924, *A. Morris* (AD 9631053); Manangatang, Victoria, 1972, *R. Johnston* (PERTH); Roopena Stn., Eyre Peninsula, *S. Barker* 263 (AD).

In none of these is it indicated whether the plants were growing with *M. turbinata* and *E. tomentosa*, but from the known distribution of the two species this would appear to have been possible.

26. Maireana murrayana (Ewart et Rees) P. G. Wilson, comb. nov.

Kochia murrayana Ewart et Rees, Proc. Roy. Soc. Vict. ser. 2. 22:16 (1909). Type: Mt. Narryer, Murchison River, 10 Nov. 1908 (holo: MEL, iso: PERTH).

Subshrub ca. 0·3 m high, densely and closely lanate on branches and leaves. *Branches* stout, bearing on older portions the hard prominent leaf bases. *Leaves* alternate, sessile, thick and fleshy, narrowly oblong, obcuneate, ca. 20 mm long, convex below, rounded at apex. *Flowers* hermaphrodite, solitary, globose, densely woolly. *Fruiting perianth* large; attachment broad (ca. 2 mm diam.), flat; tube turbinate, 3–4 mm high, smooth, glabrous, with thick and woody walls; wing simple, horizontal, flat, chartaceous, ca. 20 mm diam., glabrous below, sparsely woolly to glabrescent above, with a single radial (radicular) slit; upper perianth slightly convex, thick, hard, densely woolly, completely obscuring utricle, ca. 8 mm diam., shortly lobed with the radicular slit extending to wing and a short distance down tube. *Utricle* turbinate surrounded by long woolly hairs which arise from base of cavity; pericarp thin, sparsely woolly above; base of style (included portion) hard and turbinate, upper (exserted portion) slender but deciduous. (Fig. 8I–J.)

Distribution: Known only from two collections (including the type) made between the Upper Gascoyne and Murchison Rivers, Western Australia.

WESTERN AUSTRALIA: Dairy Creek Stn., *D. G. Wilcox* 164 (PERTH).

27. Maircana astrotricha (L. A. S. Johnson) P. G. Wilson, comb. nov.

Kochia astrotricha L. A. S. Johnson, Contr. N.S. Wales Nat. Herb. 1:343 (1951). Type: Silverton, New South Wales, *I. M. Pidgeon* and *J. W. Vickery* (holo: NSW 7945).

Rounded divaricately branched shrub to 1 m high covered on branches and leaves with a close dendritic tomentum. *Leaves* alternate succulent, narrowly to broadly obovoid, attenuate at the base into a short petiole, in all 5–10 mm long. *Flowers* polygamo-dioecious, the male hemispherical and the female globose, sometimes minutely bibracteolate; perianth densely tomentose outside, shortly lobed with the radicular split extending to tube. *Fruiting perianth* dentritically tomentose except for the glabrous wing; base small, slightly hollowed; tube turbinate, ca. 3 mm high, thick-walled and smooth except for a faint radicular ridge; upper perianth convex, thick, deeply lobed and completely obscuring ovary; wing simple, chartaceous, horizontal, with a single radial slit, 15–20 mm diam., pale to dark brown when dry; pericarp tomentulose, style included or slightly exserted, embryo thick, endosperm small to absent. (Map 12.)

Distribution: Western New South Wales, central and northern South Australia, and the Northern Territory south of Alice Springs.

New South Wales: 27 mi NW of Menindee, *J. H. Leigh* W261 (NSW).

South Australia: Andamooka Island, Lake Torrens, *J. Z. Weber* 1353 (AD).

Northern Territory: Ayers Rock, *D. E. Symon* 80 (ADW).

Usually found in well-drained stony or gravelly soil in open situations.

Most herbarium specimens seen of this species have been female plants, a few have had hermaphrodite flowers and one specimen had only male flowers. Since normally only fruiting material is gathered it may be assumed that *M. astrotricha* is predominantly dioecious.

Prior to its description this species had either been confused with *M. sedifolia* or had the name '*Kochia planifolia*' wrongly applied to it. *M. astrotricha* may be readily distinguished from these, and from superficially similar species, by the dentritic hairs which make up its indumentum.

28. Maireana sedifolia (F. Muell.) P. G. Wilson, comb. nov.

Kochia sedifolia F. Muell., Trans. & Proc. Vict. Inst. Advancem. of Sci. 1:134 (1855). Lectotype: Wentworth, Darling River, *Mrs Ford* 12 (holo: MEL, iso: NSW); for lectotypification see L. A. S. Johnson, Contr. N.S. Wales Nat. Herb. 1:344 (1951).

Divaricately branched compact dioecious shrub ca. 1 m high covered with a close bluish grey woolly tomentum. *Leaves* alternate, fleshy, narrowly obovoid, 4–8 mm long, rounded at apex and slightly narrowed to a sessile base. *Flowers* in pairs, normally only one maturing, closely woolly, the female globular and the male hemispherical with short lobes. *Fruiting perianth* straw-coloured or pale brown when dry; attachment slightly concave; tube hemispherical to turbinate, ca. 2 mm high and 2–3 mm wide at apex, firm but thin-walled except for the thick base, sparsely woolly; wing simple, horizontal, chartaceous, ca. 10 mm diam., glabrous, with faint radial nerves and a single radial (radicular) slit; upper perianth flat or slightly convex, closely woolly, deeply lobed with the tips usually infolded, radicular slit extending to wing. *Utricle* plano-convex (flat above); style short and thick, woolly. (Map 15.)

Distribution: South western New South Wales, north western Victoria, South Australia, south eastern Western Australia, southern Northern Territory.

New South Wales: Broken Hill, Jan. 1920, *A. Morris* (NSW); 30 mi W of Wentworth, 20 Aug. 1946, *J. Vickery* (NSW).

Victoria: Mildura, 5 Sept. 1912, *H. B. Williamson* (MEL).

South Australia: 75 mi S of Innamincka, 1 June 1967, *H. J. de S. Disney* (NSW); Mt. Mary, 19 Sept 1964, *A. Hall* (AD); Koonalda Cave, *D. E. Symon* 4690 (NSW).

Western Australia: Reid, *E. McCramm* (PERTH); Lake Nyanga, Jan. 1962, *W. H. Bulter* (PERTH).

Northern Territory: Carmichael Crag, George Gill Ra., *G. Chippendale* (NT 10369).

This species is often found in calcareous soils and is one of the principal shrub species over much of the southern eremean area of Australia. It is the species most frequently referred to as 'blue-bush'.

Maireana sedifolia has frequently been confused in herbaria with *M. astrotricha*. The two may be readily distinguished by the woolly indumentum of *M. sedifolia* which is made up of simple (not branched) hairs and by the flowers of this species being consistently in pairs.

29. Maireana spongiocarpa (F. Muell.) P. G. Wilson, comb. nov.

Kochia spongiocarpa F. Muell., Vict. Nat. 3:92 (1886). Lectotype: *J. Cotter*, Carlaroo (cited by Mueller as 'Caiwarro') (MEL 44100, iso:? NSW 126230).

Woody perennial or dwarf shrub to 30 cm high. *Branchlets* thin, densely white lanate with smooth curly hairs. *Leaves* well spaced, alternate, fleshy, narrowly terete or fusiform, 8–15 mm long, acute, glabrous, dark green. *Flowers* hermaphrodite, solitary, subglobular, glabrous except for the woolly margin to lobes. *Fruiting perianth* glabrous, usually dark brown when dry; attachment small; tube spongy, swollen and subglobular, easily crushed, ca. 8 mm high and wide, rounded at base, inner layer fibrous; upper perianth flat and closed, very shortly lobed with the radicular slit extending to wing; wing simple, horizontal, entire, 12–15 mm diameter, thinly chartaceous, very faintly nerved, very shortly decurrent (opposite the radicle) as a fused double vertical membrane on to the tube. *Utricle* shortly and truncately turbinate, glabrous, situated in upper half of tube. (Fig. 4C–D, Map 6.)

Distribution: Western New South Wales, northern and central South Australia, southern portion of the Northern Territory.

New South Wales: Barrier Range, 1889, *Mrs Irvine* (MEL).

South Australia: Mt. Parry, Sept. 1883, *R. Tate* (MEL); Pedirka, *T. R. N. Lothian* 4663 (AD).

Northern Territory: 11 mi SW of Delny HS., *G. Chippendale* 6479 (NT); 27 mi E of Bagots Ck., George Gill Ra., *G. Chippendale* (NT 3588).

The wing in the position opposite the radicle is usually indented or partly slit. At this point it is actually divided and the two ends turn downwards along the tube but with their inner faces fused. The small vertical wing so formed is apparently homologous (and develops in a similar manner) to the vertical wings in *M. triptera*.

The inner fibrous layer of the perianth tube has a similar form to that found in the tube of *M. triptera*, *M. erioclada* and *M. pentatropis;* that is, the lower half of the tube is solid or, in the case of *M. spongiocarpa*, consists of a solid core surrounded by a thick spongy layer.

The fruit of *M. spongiocarpa* differs most noticeably from that of *M. campanulata* in the presence of the short vertical wing on the tube.

30. Maireana campanulata P. G. Wilson, sp. nov.

Ramuli dense sed tenuiter tomentosi, pilis breviter ramulosis. *Folia* gracilia, teretia, acuta, 8–15 mm longa, glauca, glabra. *Perianthium* fructificans campanulatum, glabrum; tubus spongiosus, cupulatus, ca. 6 mm diam., basi rotundata; perianthium supernum applanatum; ala chartacea, integra, angusta, ca. 10 mm diam., rima radiculari absenti.

Type: 3 mi W of Santa Teresa Mission, Northern Territory, 17 Aug. 1956, *M. Lazarides* 5734 (holo: NSW, iso: MEL, PERTH).

Grey dwarf shrub 20–60 cm high. *Branchlets* very closely tomentose with pale fawn shortly branched hairs. *Leaves* slender-terete, acute, 8–15 mm long, succulent, glaucous, glabrous (when mature). *Flowers* hermaphrodite, solitary, ovoid, glabrous. *Fruiting perianth* campanulate, glabrous, attachment small; tube spongy, cup-shaped, ca. 6 mm high and wide, rounded at base, inner layer fibrous; upper perianth very shortly lobed, ± flat except for the short upturned lobes in centre, radicular slit very short; wing thinly chartaceous, horizontal, entire, rather narrow, ca. 10 mm diam., with no radial slit. *Utricle* hemispherical, glabrous, situated in upper half of tube (the lower half being spongy); style included, stout. (Fig. 4A–B, Map 23.)

Distribution: Western Queensland, northern South Australia, and the Northern Territory.

QUEENSLAND: South of Selwyn, *C. H. Gittens* 695B (NSW).
SOUTH AUSTRALIA: Balcanoona, Flinders Range, *Hj. Eichler* 19632 (AD).
NORTHERN TERRITORY: 24 mi S of Alice Springs, *R. Swinbourne* 406 (AD, NSW).

This plant is found in well drained situations such as the rocky slopes of hills.

M. campanulata is similar in appearance to *M. spongiocarpa*. It differs from that species in having more slender leaves (which are glaucous, not dark green), in the smaller fruit which has no vertical wing, and in the different stem indumentum (very closely tomentose with shortly branched hairs).

31. Maireana polypterygia (Diels) P. G. Wilson, comb. nov.

Kochia polypterygia Diels in Diels et Pritzel, Bot. Jahrb. Syst. 35:183 fig. 20 E-F (1904). Type: Gascoyne R. near Carnarvon, *Diels* 3711 (B, n.v., destroyed?).

Compact undershrub ca. 70 cm high. *Branchlets* closely lanate. *Leaves* alternate, fleshy, semiterete to spathulate (rounded below), appressed pubescent, 8–15 mm long. *Flowers* solitary, usually dioecious, glabrous apart from the pubescent lobes. *Fruiting perianth* glabrous apart from pubescent lobes; attachment small; tube cupular, 2·5–4 mm high, weakly crustaceous (slightly fleshy when fresh), with a horizontal wing at apex and base and several imperfectly developed vertical wings, these all chartaceous and faintly nerved; apical (horizontal) wing circular, 7–10 mm diam., usually with a single radial (radicular) slit from the margins of which a pair of vertical wings run down the tube to meet with the basal (horizontal) wing, the latter is similar to (but slightly smaller than) the apical wing and is attached to the tube at or slightly above the base, in addition to the pair of vertical wings connected to the radicular slit up to four other vertical wings may be to some extent developed as outgrowths from the ribs; upper perianth convex, firm, lobed to the wing. *Utricle* plano-convex (flat above), glabrous, occupying the lower half of the tube; style slender puberulous, included. (Fig. 7C–D, Map 9.)

Distribution: North western Western Australia between Exmouth Gulf and Shark Bay.

WESTERN AUSTRALIA: 14 mi E of Bullara HS., *A. S. George* 1250 (PERTH); 21 km E of Carnarvon, *P. G. Wilson* 8380 (PERTH); 5 mi W of Hamelin Stn., *J. W. Green* 1441 (PERTH).

Found principally in loam or clay soils on 'salt bush flats'.

32. Maireana triptera (Benth.) P. G. Wilson, comb. nov.

Kochia triptera Benth., Fl. Austral. 5:185 (1870). Type: "N.S. Wales. Darling river, Victorian Expedition; Mount Murchison, *Giles*. W. Australia, *Drummond*." (syn: "Between Yuin and the Murchison River, Giles" MEL).

[*K. triptera* var. *pentaptera* auct. non Black: Black, Fl. S. Austral. 199 (1924); Ewart, Fl. Vict. 461 (1931).]

Compact bluish green subshrub to 50 cm high, glabrous except for slight pubescence in leaf axils and occasional pilosity on young shoots. Branches striate. *Leaves* dense, succulent, slender and semi-terete, acute, ca. 1 cm long. *Flowers* usually hermaphrodite, solitary, ovoid, perianth deeply lobed. *Fruiting perianth* glabrous, glossy, dark brown to black when dry, frequently congested along branches; tube turbinate, crustaceous, lower half hard and solid; wings chartaceous, in two series: vertical wings 5 (one or two of which are sometimes undeveloped), alternate to perianth lobes, running length of tube and fusing with horizontal wing; horizontal wing flat, ca. 8 mm diam., entire, without a radicular slit but radially sulcate opposite the radicle; upper perianth flat, the lobes imbricate, hard, and completely covering ovary, radicular slit extending to wing. Utricle hemispherical, pericarp thick and hard at apex, style short and included. (Map 16.)

Distribution: North western Queensland, central and western New South Wales, north western Victoria, South Australia, central Western Australia from Marble Bar south to Kalgoorlie, southern half of the Northern Territory.

QUEENSLAND: Mt. Isa, May 1952, *Mrs. M. Morris* (BRI).

NEW SOUTH WALES: Broken Hill, 20 Apr. 1920, *A. Morris* (ADW); 30 mi W of Euston, *T. M. Whaite* 1841 (NSW).

VICTORIA: 13 mi SE of Mildura University, 11 Apr. 1948, *B. Easterbrook*, n.v. (MEL?, cited by Gauba, Vict. Nat. 66:13 (1949)).

SOUTH AUSTRALIA: 5 mi E of Coober Pedy, 5 Dec. 1960, *D. E. Symon* (ADW); Lilydale, 15 Aug. 1967, *S. Barker* (AD).

WESTERN AUSTRALIA: 24 km E of Dalgety HS., *P. G. Wilson* 8480 (PERTH); 64 mi N of Paynes Find, *K. Allan* 88 (PERTH); 5 mi S of Giles, *R. H. Kuchel* 181 (AD).

NORTHERN TERRITORY: 11 mi W of Arltunga Ruins, *D. E. Symon* (ADW); 250 mi N of Alice Springs, *C. E. F. Allen* 673 (NSW).

This species although widely distributed exhibits very little regional variation. It may be readily distinguished from both *M. erioclada* and *M. pentatropis* (which species also have vertical wings on the perianth tube) by the absence of hairs on the mature branchlets. Occasionally small bracteoles are present but these are sometimes obscured by the pubescence in the leaf axil.

33. Maireana erioclada (Benth.) P. G. Wilson, comb. nov.

Kochia triptera var. *erioclada* Benth., Fl. Austral. 5:185 (1870).—*K. erioclada* (Benth.) Gauba, Vict. Nat. 65:163 (1948). Lectotype: Western Australia, *J. Drummond* 432 (iso: MEL 42072).

Bushy undershrub to 60 cm high. *Branches* densely and closely lanate. *Leaves* alternate, spreading, fleshy, narrowly obovoid to clavate, to 10 mm long, glabrous, apex rounded. *Flowers* solitary, hermaphrodite, ovoid, glabrous apart from the woolly ciliate lobes; tube shortly hemispherical 5-ribbed; upper perianth erect and divided to tube into broad imbricate lobes. *Fruiting perianth* glabrous (not glossy); attachment small; tube narrow-funnelform (the lower half solid), with 5 vertical semi-circular chartaceous wings that alternate with the perianth lobes and which are connate to the horizontal wing and to the tube throughout its length; horizontal wing simple, ca. 12 mm diam., somewhat radially sulcate at attachment to vertical wings, with a single radial (radicular) slit one edge of which is continuous with a vertical wing while the other passes into a short flap which passes downwards to become fused to the same vertical wing; upper perianth convex, divided to wing into broad soft imbricate lobes. *Utricle* turbinate, saucer-shaped at apex, pericarp thin and glabrous, style short, included. (Map 24.)

Distribution: South western New South Wales, north western Victoria, southern South Australia and southern Western Australia (except for the south-west district). A frequent invader of disturbed areas along roadsides.

NEW SOUTH WALES: Near Balranald, 31 Aug. 1962, *M. E. Phillips* (PERTH ex CBG).

VICTORIA: Manangatang, *H. B. Williamson* 2761 (MEL).

SOUTH AUSTRALIA: Kyancutta, Eyre Peninsula, *B. J. Blaylock* 1236 (AD).

WESTERN AUSTRALIA: 37 mi E of Widgiemooltha, 16 Aug. 1958, *R. Filson* (PERTH).

Kochia triptera var. *erioclada* Benth. was based on two collections, one from Western Australia which was in effect chosen by Gauba (1948) as the lectotype, and the other which was cited by Bentham as 'Murray desert, Herb. F. Mueller'. I have been unable to find the latter specimen in the herbarium of the Royal Botanic Garden, Melbourne.

Maireana erioclada has consistently five wings which are connate to the tube throughout its length and in these characters it may be distinguished from *M. pentatropis*. For comments on possible hybridization between the two see notes under the latter species.

34. Maireana pentatropis (Tate) P. G. Wilson, comb. nov.

Kochia pentatropis Tate, Trans. Roy. Soc. S. Austral. 7:67 (1885). Lectotype: Aroona Range, Lake Torrens, *R. Tate* (MEL 43977), cf. Gauba, Vict. Nat. 66:13 (1949).

K. ostenfeldii Paulsen, Dansk Bot. Arkiv 2:60 (1918). Type: Kalgoorlie, *Ostenfeld* 324 and 326 (syn: PERTH no. 324).

K. decipiens Gauba, Vict. Nat. 65:165 (1948). Type: Loveday, 15.xi.1942, *E. Gauba* (MEL).

Erect woody perennial to 60 cm high. *Branches* closely white lanate and shortly pilose in leaf axils. *Leaves* fleshy, subterete, ca. 10 mm long, glabrous (sometimes long pilose when young). *Flowers* hermaphrodite, solitary, ovoid, usually somewhat dorsiventrally compressed; tube hemispherical, glabrous; perianth erect, shortly 5-lobed with the radicular slit extending into the tube, densely woolly villous towards margin; ovary and style glabrous. *Fruiting perianth* glabrous except for the densely woolly ciliate perianth lobes, dark brown when dry; tube turbinate, ca. 4 mm high, lower half solid, walls crustaceous, with 3–5 vertical fan-shaped wings which alternate with the perianth lobes and are usually restricted to the lower half of the tube; horizontal wing circular, flat, to 12 mm diam., simple with a single radial (radicular) slit; upper perianth convex or arched, the lobes imbricate and densely woolly-pilose towards margin, radicular slit passing into apex of tube. *Utricle* turbinate, thin walled, saucer-shaped at apex, style included. (Map 10.)

Distribution: Western New South Wales, north western Victoria, South Australia (south of 29° latitude), central and south eastern Western Australia.

New South Wales: 18 mi NW of Wilcannia, *E. F. Constable* 4628 (NSW); Euston, *A. Morris* 1501 (NSW).

Victoria: 21 mi SW of Mildura, *J. Cullimore* 45 (MEL); Cardross Lake, 4 mi W of Red Cliffs, Aug. 1940, *J. H. Willis* (MEL).

South Australia: Tallaringa Well, ca. 140 km W of Coober Pedy, *T. R. N. Lothian* 3795 (AD); Morgan, *D. E. Symon* 3567 (ADW).

Western Australia: Lake Austin, *T. E. H. Aplin* 2542 (PERTH); 22 mi E of Zanthus, *R. D. Royce* 5592 (PERTH).

The vertical wings on the tube are normally 3–5 but occasionally at the radicular slit a narrow wing develops on both sides giving six wings in all. These are usually restricted to the base of the tube but occasionally may extend to the horizontal wing and then have a similar appearance to those of *M. erioclada*. The latter condition is met with in some specimens from New South Wales and South Australia and is found in the lectotype of the species.

Maireana pentatropis had, previous to Dr. Gauba's papers on the subject, been confused with *M. erioclada* with which it is sympatric over much of its range. In *M. erioclada* the tube is narrower, the vertical wings always 5 and they consistently extend to the top of the tube where they fuse with the horizontal wing. In addition the upper perianth in *M. erioclada* is only slightly convex and only sparsely ciliate. Further distinguishing characters are found in the indumentum and leaves. In *M. erioclada* the indumentum is entirely closely woolly whereas in M. pentatropis the branches are shortly pilose in the leaf axils, and the leaves of young shoots are often long pilose.

35. Maireana schistocarpa P. G. Wilson, sp. nov.

Ramuli dense tomentosi. *Folia* anguste teretia, carnosa, 5–12 mm longa, acuta, appresso villosa. *Perianthium* fructificans debile, praeter alam glabram sparse pilosum, in statu, sicco stramineum; tubus late turbinatus ca. 2 mm altus; ala chartacea, 12–15 mm diam. leviter nervata, rima radiculari praesenti et in tubum continua; rima tubo per alas verticales marginata; perianthium supernum erectum, pryamindale, ca. 4 mm altum, lobis incurvis.

Type: 12 mi W of Huckitta Stn., Northern Territory, 9 Sept. 1957, *M. Lazarides* 5940 (holo: NSW, iso: PERTH).

Divaricately branched subshrub 0·5–1 m high. *Branchlets* densely tomentose. *Leaves* slender-terete, fleshy, 5–12 mm long, acute, appressed villous with simple hairs. *Flowers* hermaphrodite, solitary or rarely paired, globular, densely tomentose, shortly lobed with the radicular slit extending almost to base of perianth; ovary and style pilose. *Fruiting perianth* soft and easily crushed, sparsely pilose both inside and outside except on wing, straw-coloured when dry; attachment small; tube broadly turbinate, ca. 2 mm high, with a vertical slit opposite the radicle extending half way down; wing ± horizontal, simple, chartaceous, 12–15 mm diam., very faintly nerved, with a single radial (radicular) slit from whose margins the wing passes down

the tube as two membranes, one either side of the vertical slit on the tube; upper perianth erect and pyramidal, ca. 4 mm high, the short rounded lobes incurved and closing apex of fruit. *Utricle* truncately turbinate, thin walled, pilose; style pilose, included. (Fig. 10C–D, Map 8.)

Distribution: South western Queensland, north western New South Wales, central South Australia, southern portion of the Northern Territory.

Queensland: Dynevar Lakes, 24 mi W of Thargomindah, 24 Sept. 1963 *M. E. Phillips* (NSW). New South wales: 36 mi W of Wilcannia, 20 Sept. 1949, *D. McFarlane* (NSW); White Cliffs, July 1906, *E. P. O'Reilly* (NSW).

South Australia: Yudnapinna, ca. 75 km NW of Port Augusta, Aug. 1955, *F. M. Hilton* (AD); 30 mi W of Mabel Ck. HS., *N. Forde* 321 (CANB).

Northern Territory: 8 mi N of Kulgera, *S. A. Parker* 177 (NT); 4 mi E of The Garden HS., *D. J. Nelson* 1278 (NSW, NT); Mt. Riddock Stn., *P. K. Latz* 3160 (PERTH).

This species may be distinguished from *M. pyramidata*, to which it is most closely allied, by its longer and more slender leaves which have an indumentum of simple hairs only, and by the fruiting perianth in which the wing passes down the tube on either side of the radicular slit.

Maireana schistocarpa is apparently a local although widespread species. From the data on herbarium specimens it would appear to be associated with a variety of habitats such as sand dunes, quartzite hills, and beneath mulga on red sand flats.

36. Maireana pyramidata (Benth.) P. G. Wilson, comb. nov.

Kochia pyramidata Bentham, Fl. Austral. 5:186 (1870). Type: Lachlan R., *A. Cunningham* (n.v.); sandhills near the Darling, *H. Beckler* (syn: MEL); Murray desert (syn: MEL).

K. lobostoma F. Muell., Vict. Nat. 3:92 (1886).—*K. pyramidata* var. *lobostoma* (F. Muell.) F. Muell, ex Moore et Betche, Handb. Fl. N.S. Wales 110 (1893). Type: Between the Lachlan and Darling Rivers, *J. Bracknell* (MEL).

Compact divaricately branched subshrub ca. 1 m high. *Branchlets* lanate (sometimes sparsely so). *Leaves* spreading, subterete, acute, 2–6 mm long, shortly appressed pubescent the indumentum being made up of fine woolly hairs with short branchlets (dendritic) and with scattered coarse smooth trichomes. *Flowers* predominantly unisexual (the plants frequently dioecious), shortly woolly. *Fruiting perianth* pale brown to black when dry; attachment small; tube flat to shortly turbinate, thin walled and readily crushed, sparsely puberulous; wing chartaceous, horizontal, simple, to 12 (16) mm diam. (often much smaller), entire or with a single radial (radicular) slit, faintly nerved; upper perianth erect, pyramidal, 2–4 mm high, puberulous, soft, lobed about half way with the radicular slit usually extending to the wing. *Utricle* turbinate to ovoid, thin walled, glabrous to sparsely pilose, extending above the wing into the cavity formed by the upper perianth; style pubescent and, with the stigmas, included. (Fig. 10A–B, Map 9.)

Distribution: Central and western New South Wales, north western Victoria, central and eastern South Australia, central Western Australia between 22° and 31° latitude.

New South Wales: 10 mi W of Broken Hill, *L. A. S. Johnson* 637 (NSW); Cobar, Nov. 1921, *E. Reuss* (NSW).

Victoria: 3 mi NE of Red Cliffs, *J. Cullimore* 13 (MEL); Junction of Murray and Darling Rivers, 1889, *Mrs. Holding* (MEL.)

South Australia: Tarcoola, 21 Sept. 1920, *E. H. Ising* (ADW); Manunda HS., 35 km SE of Yunta, *N. N. Donner* 352 (AD).

Western Australia: Upper Rudall River area, *P. G. Wilson* 10448 (PERTH); Lake Throssell, *A. S. George* 4685 (PERTH).

Herbarium specimens show considerable variation both in leaf and in fruit characters. Most of this variation is probably due to differences in growth conditions, for plants collected at different times from the same locality may exhibit marked changes in leaf and fruit size. Variations in the perianth may be found in different fruits on the same plant, such as the radicular slit in the wing which is sometimes manifest as also the radicular slit in the upper

perianth. Occasionally a vertical membrane connects the wing to the upper perianth at the position otherwise occupied by the radicular slit, but this membrane does not extend downwards on to the tube as it does in *M. schistocarpa*.

Maireana pyramidata is often found growing with *M. sedifolia*. It is apparently less palatable to sheep than the latter and under grazing pressure it may take over in what were previously mixed communities of the two species.

37. Maireana melanocoma (F. Muell.) P. G. Wilson, comb. nov.

Kochia melanocoma F. Muell., Fragm. 12:14 (1882). Type: Gascoyne River, 1882, *J Forrest* (holo: MEL).

Diffuse woody perennial to 50 cm high, glabrous except for small tufts of wool in leaf axils. *Branches* slender, striate, frequently bearing persistent leaf bases. *Leaves* fleshy, semiterete to very narrowly fusiform, 10–20 mm long (smaller on flowering shoots), acute glaucous. *Flowers* spicate, solitary, hermaphrodite, glabrous. *Fruiting perianth* glabrous (but bearing hair-like emergences), pale green to gold or pale red when fresh, black when dry; attachment small; tube convex to shortly turbinate, smooth, thick walled and crustaceous with a thick hard base; wing horizontal, simple, finely nerved, 12–14 mm diam., without any radial slit; upper perianth prominently convex (entirely obscuring utricle), thick and hard, shortly lobed, covered with numerous hair-like emergences up to 6 mm long. *Utricle* discoidal; pericarp glabrous, crustaceous above; style hard and shortly exserted. (Fig. 7E–F, Map 22.)

Distribution: North western portion of eremean Western Australian.

Western Australia: Nannine, Sept. 1903, *W. V. Fitzgerald* (NSW, PERTH); 4 mi from Wongawol to Carnegie Stn., *A. R. Fairall* 1933 (PERTH).

Maireana melanocoma may be readily distinguished from other species because of the hair-like emergences on the fruit. These emergences coalesce at their base to form a thick hard covering to the perianth.

This species is similar in fruit, and in leaf and stem morphology, to *M. thesioides*, to which it is probably most closely related. It is usually found on rocky hillsides but has also been recorded from a variety of other habitats.

38. Maireana cannonii (J. M. Black) P. G. Wilson, comb. nov.

Kochia cannonii J. M. Black, Trans. & Proc. Roy. Soc. S. Austral. 43:29 tab. 6 (1919). Lectotype: Leigh Creek, 12 Aug. 1918, *W. A. Cannon* (AD, iso: MEL).

Small much branched subshrub. *Branchlets* very closely woolly. *Leaves* opposite, fleshy, sessile, semi-terete, 5–6 mm long, shortly sericeous; base broad somewhat spurred; apex recurved. *Flowers* solitary, densely pilosulose. *Fruiting perianth* strongly depressed, sparsely pilosulose above, glabrous below; attachment broad and flat, ca. 0·7 mm diam., tube shortly hemispherical, ca. 2·5 mm diam., crustaceous, faintly ribbed; wing simple; circular, horizontal chartaceous, faintly nerved, ca. 6 mm diam., with a single radial (radicular) slit; perianth slightly convex, shortly lobed, the radicular slit extending to wing; utricle pilosulose; style hard and exserted. (Map 25.)

Distribution: South Australia, between Pt. Pirie and Leigh Creek.

South Australia: Telowie, 22 Sept. 1906, *J. M. Black* (AD); Port Augusta, anon. (AD); Between Flinders Range and Lake Torrens, *Mrs J. P. Richards* (MEL).

Apparently a rare species and known only from the specimens cited above.

39. Maireana platycarpa P. G. Wilson, sp. nov.

Ramuli tomentosi. *Folia* plerumque opposita, linearia vel naviculiformia, sessilia, dense sericea. *Perianthium* fructificans valde depressum; tubus planus vel leviter convexus, 4–6 mm diam., crustaceus vel cartilagineus, glaber; ala integra, (10) 15–23 mm diam., chartacea, infra glabra, supra lanato puberula vel glabrescens; perianthium supernum convexum, lanato puberulum; stylus teres, durus, 1·5–2 mm longus, prominente exsertus.

Type: 80 km N of Laverton, Western Australia, clay flat, 27 Aug. 1968, *P. G. Wilson* 7326 (holo: PERTH, iso: CANB, K).

Brittle much branched undershrub to 60 cm high. *Branches* woolly. *Leaves* usually opposite, linear to semiterete or naviculiform, 7–12 mm long, obtuse to acute, sessile, densely sericeous (at least when young). *Flowers* hermaphrodite, solitary, ovoid, with a flat glabrous base and closely woolly perianth. *Fruiting perianth* very depressed, pale gold when dry; attachment small; tube flat or slightly convex, 4–6 mm diam., smooth or faintly ribbed, crustaceous or cartilaginous, glabrous; wing continuous with tube, simple, flat or somewhat recurved around stem, (10) 15–23 mm diam., chartaceous, entire, with a single radial (radicular) slit, faintly nerved, glabrous below, sparsely woolly puberulous to glabrescent above; upper perianth convex, lobed almost to wing, woolly puberulous. Utricle plano-convex (rounded above), sparsely pubescent, pericarp cartilaginous, style terete, hard, prominently exserted, 1·5–2 mm long, stigmas caducous. (Fig. 6C–D, Map 19.)

Distribution: Western Australia from Norseman north westwards to Carnarvon.

WESTERN AUSTRALIA: Between Jigalong and Rabbit Proof Fence, *R. D. Royce* 1558 (PERTH); Gwalia, Nov. 1903, *W. V. Fitzgerald* (NSW); 11 km E of Norseman, *P. G. Wilson* 6046 (PERTH).

Maireana platycarpa is distinctive in having a flattened fruit and a hard prominently exserted style. Towards the southern and south eastern limits of its distribution a form is found which differs from the northern plant in having more slender branches, thinner and less pubescent leaves, and much smaller fruits (ca. 10 mm diameter).

Maireana platycarpa grows in a variety of habitats, such as margins of salt lakes, samphire swamps, and rocky hillsides. It appears to be very palatable to stock and, for this reason, in pastoral country it is often only found growing within a bush of another plant where it is protected from grazing.

The relationships of *M. platycarpa* are possibly with *M. cannonii*, *M. ciliata* and *M. pentagona*, all of which have a flat perianth and hard exserted style.

40. Maireana glomerifolia (F. Muell. et Tate) P. G. Wilson, comb. nov.

Kochia glomerifolia F. Muell. et Tate, Trans. Roy. Soc. S. Austral. 16:345 (1896). Lectotype: Mt. Narryer, Murchison R., *J. Tyson* (MEL 43916).

Rigid, open, divaricately branched subshrub to 60 cm high. *Branchlets* brittle, woolly, covered with compact woolly glomerules of leaves. *Leaves*, towards the apex of elongating branches, alternate, fleshy, sessile, ± appressed and deltoid, ca. 1·5 mm long and woolly, elsewhere minute and densely glomerulate. *Flowers* polygamo-dioecious, solitary, arranged in short terminal spikes; perianth woolly; female flower with woolly ovary and no staminodes; male flower with shortly exserted stamens and a vestigial ovary. *Fruiting perianth* firmly chartaceous, pink to red when mature; attachment small; tube patelliform, faintly ribbed, glabrous; wing simple; horizontal, thin, slightly crenulate, faintly nerved, to 15 mm diam., with a single radial slit, upper surface sparsely woolly; upper perianth convex and deeply lobed, not obscuring ovary, the lobes imbricate and coriaceous, two with a pair of erect cylindrical to narrow oblong processes 3–4 mm long, and one with a single process, the other two perianth lobes without processes. *Utricle* biconvex, woolly above, pericarp crustaceous, style short. (Fig. 6A–B, Map 11.)

Distribution: Central eremean area of Western Australia. Usually found in sub-saline areas.

WESTERN AUSTRALIA: 20 mi N of Kalgoorlie, *R. C. Carolin* 5741 (NSW); Cue, July 1903, *Cecil Andrews* (PERTH); Colurabi, 195 km N of Laverton, *P. G. Wilson* 7395 (PERTH).

This species may be readily recognised, even in the vegetative condition, by the compact glomerules of minute leaves which cover the branches.

The fruit is similar to that found in *M. atkinsiana* but differs in having a radicular slit in the wing and upper perianth.

41. Maireana atkinsiana (W. V. Fitzg.) P. G. Wilson, comb. nov.

Kochia atkinsiana W. V. Fitz., J. W. Austral. Nat. Hist. Soc. 2:31 (May 1904). Lectotype: Nannine, Sept. 1903 (NSW 126272).

A rigid, brittle, intricately branched subshrub to 60 cm high. Branchlets sparsely woolly. Leaves alternate, well spaced, or clustered on dwarf shoots, narrowly to broadly obovoid, sparsely appressed pubescent, 5–10 mm long; apex usually rounded; base narrowed into a short petiole. Flowers dioecious, in pairs, shortly woolly outside; male with shortly exserted stamens and vertigial ovary, female with woolly ovary but no staminodes. Fruiting perianth firmly chartaceous, pink to red when mature; attachment small; tube patelliform, 10-ribbed, glabrous, wing simple; horizontal, thin, slightly crenulate otherwise entire, faintly nerved, with no radial slit, to 18 mm diam.; upper perianth convex and lobed to wing, ± obscuring ovary, sparsely woolly, lobes imbricate and thickened at base and from which arise, on two of them, a pair of erect narrow-oblong processes ca. 6 mm high, and on a third a single process, the other two perianth lobes without processes. *Utricle* biconvex, sparsely woolly; pericarp crustaceous; seed without endosperm; embryo circular. (Map. 27.)

Distribution: Western Australia from Shark Bay south to near Watheroo and as far east as Laverton. Usually found around salt lakes.

Western Australia: 2 mi W of Yuna, *A. M. Ashby* 2213 (PERTH); near Laverton, *W. E. Blackall* 392 (PERTH).

The fruit in *M. atkinsiana* lacks any apparent radicular canal or slit, which condition is presumably linked to the chartaceous nature of the perianth. The circular embryo (in which the radicle is not directed outwards) is also associated with the absence of need to have a point of emergence. Even so, the radicle is always constant in its position, as may be seen by its relation to the 5 erect processes. These processes arise from three of the perianth lobes (a solitary one and two pairs) and are identical in form and position with those found in *M. glomerifolia*, whereas in *M. prosthecochaeta*, *M. lanosa*, and *M. lobiflora*, the erect processes alternate with the perianth lobes.

The cotyledons in the embryo are flattened and obovate. Instead of the normal incumbent position in relation to the radicle they become twisted into an accumbent situation. This arrangement is also found in other large flat-fruited species such as *M. glomerifolia* and *M. platycarpa*.

42. Maireana prosthecochaeta (F. Muell.) P. G. Wilson, comb. nov.

Kochia prosthecochaeta F. Muell., Fragm. 12:14 (1882). Type: Gascoyne River, *J. Forrest;* between Yuin and Murchison River, *E. Giles* (syntypes MEL).

Open densely leaved subshrub to 60 cm high, glabrous. *Branches* erect, somewhat fleshy, the older portions marked by prominent persistent leaf bases. *Leaves* alternate, succulent, semiterete, acute, to 4 cm long, 2–3 mm wide, erect (becoming reflexed with age), bright green when fresh. *Flowers* hermaphodite, solitary in the leaf axils and minutely bibracteolate, glabrous, crowded towards the apex of the branches and forming leafy spikes. *Fruiting perianth* dark brown when dry, glabrous outside and sparsely pilose within; attachment broad, flat, 2–3 mm diam.; tube turbinate, ca. 5 mm high and 4 mm wide (at apex), smooth with a prominent radicular ridge, crustaceous except for the thick solid base; wing simple, horizontal, ca. 15 mm diam., finely nerved, the radicular split usually reaching only part way to tube; upper perianth flat and completely obscuring ovary, crustaceous, lobes short and imbricate, radicular slit extending to wing, at the base of the lobes and alternating with them arise 4 erect linear processes to 4 mm long (no process is present at the radicular slit). *Utricle* shortly turbinate with thin pericarp; style base massive, solid and hemispherical, sparsely covered with multicellular hairs and enclosed within perianth. (Fig. 2A–B, Map 8.)

Distribution: North western Western Australia from Cue north to the Gascoyne River.

WESTERN AUSTRALIA: Cue, Aug. 1903, *C. Andrews* (NSW); Mount Phillips Stn., on Thomas R., 24 Sept. 1971, *R, O'Farrell* (PERTH).

The only notes on the habitat preferences of this species are found on two herbarium specimens, of which one indicates that it grows in 'moist salt places' and the other that it is found in 'rough hilly country, growing on top of hills'.

The erect processes of the perianth are not homologous to those found in *M. glomerifolia* or to those in *M. atkinsiana* (where they are epi-tepalous), but are apparently comparable to those found in *M. lanosa* and *M. lobiflora*. However, in the latter two species a lobe (or lobes) is present opposite the radicle while in *M. prosthecochaeta* this position is bare.

43. Maireana thesioides (C. A. Gardn.) P. G. Wilson, comb. nov.

Kochia thesioides C. A. Gardn., J. Roy. Soc. W. Austral. 27:172 (1942). Lectotype: Between Meekatharra and Laverton, July 1931, *C. A. Gardner* 232 (PERTH).

Straggly erect woody perennial ca. 1 m high, glabrous except for axillary tufts of wool. *Branches* slender, striate, often drooping. *Leaves* well scattered, fleshy, narrowly fusiform, acute, 5–15 mm long, narrowed at base into a distinct petiole. *Flowers* solitary; hermaphrodite, ovoid, glabrous outside except for woolly ciliate margin to perianth lobes. *Fruiting perianth* glabrous outside, somewhat woolly within; attachment small; tube turbinate, smooth, ca. 3 mm high, crustaceous, thick and rounded at base; wing chartaceous, simple, horizontal, 10–15 mm diam., finely nerved, with a single radial (radicular) slit; upper perianth convex, crustaceous, shortly to deeply lobed, completely obscuring ovary, the radicular slit extending to wing and then continues down tube as a narrow ridge. *Utricle* turbinate; pericarp thin, style conical, hard, ca. 1 mm high, included within perianth; endosperm copious. (Map 17.)

Distribution: Western and central Western Australia.

WESTERN AUSTRALIA: Errabiddy Stn., *D. G. Wilcox* 167 (PERTH); 29 km N of Cleary, *P. G. Wilson* 6088a (PERTH); Leonora, *C. A. Gardner* 2122 (PERTH).

Found on stony flats or in sub-saline areas. Often surviving only where protected from stock by other shrubs.

44. Maireana suaedifolia (P. G. Wils.) P. G. Wilson, comb. nov.

Kochia suaedifolia P. G. Wils. in Eichler, Suppl. J. M. Black's F. S. Austral. 122 (1965). Type: Ooldea Soak, *J. B. Cleland* (AD).

Open, spreading, dark bluish green subshrub 0·5–2·5 m high, glabrous except for small tufts of wool in leaf axils. *Branches* slender, striate, glaucous, dark purple when dry. *Leaves* alternate and well spaced, succulent, narrower at base, those on the fruiting branchlets fusiform and ca. 5 mm long, on main branches slender-terete and up to 25 mm long. *Flowers* hermaphrodite, solitary, glabrous, subtended by a pair of lanceolate bracteoles ca. 1 mm long. *Fruiting perianth* glabrous, pink when fresh; tube thin walled, shortly hemispherical, ca. 3 mm diam., faintly costate; attachment small, not hollowed; wing chartaceous, horizontal, simple with a single radial slit, entire, 8–12 mm diam., when dry with very faint venation; upper perianth flat, lobed to wing with the radicular slit extending slightly down tube. *Utricle* plano-convex (flat above), glabrous. (Map 6.)

Distribution: Southern South and Western Australia.

SOUTH AUSTRALIA: 30 mi NW of Cowell, 6 Nov. 1936, *J. B. Cleland* (AD); 80 mi N of Renmark, 6 Jan. 1921, *J. B. Cleland* (AD).

WESTERN AUSTRALIA: Boulder, *C. V. Malcolm* 631 (PERTH); Ravensthorpe, 3 Sept. 1947, *J. H. Willis* (MEL).

This species is very poorly represented in herbaria. It is widely distributed but apparently now rare, probably due to its being readily eaten by stock.

From the information provided with a few of the collections it would appear that the plant normally grows in slightly saline soils.

Maireana suaedifolia is similar to *M. decalvans*. It differs from that species in having completely glabrous branchlets, fusiform leaves (which are conspicuously narrowed at their base), and bibracteolate flowers.

45. Maireana decalvans (Gandoger) P. G. Wilson, comb. nov.

Enchylaena decalvans Gandoger, Bull. Soc. Bot. France 66:224 (1919). Type: Wimmera, Victoria, *F. M. Reader* (LY).

Kochia villosa var. *tenuifolia* F. Muell. ex Benth., Fl. Austral. 5:182 (1870) p.pte. lectotypica.—*K. tomentosa* var. *tenuifolia* (Benth.) Black, Fl. S. Austral. 197 (1924). Lectotype: "Box forest before Canal", *L. Leichhardt* (MEL 48953).

Tufted to bushy subshrub ca. 50 cm high. *Branches* slender, striate, sparsely lanate to glabrous, frequently densely lanate in leaf axils. *Leaves* alternate, fleshy, slender and terete to narrow fusiform, 5–8 mm long, glabrous (or rarely sparsely villous.) *Flowers* hermaphrodite, solitary depressed, globose, glabrous but sparsely ciliate on lobes. *Fruiting perianth* glabrous; tube shallowly hemispherical, ca. 3 mm diam. faintly costate, chartaceous; attachment small, not hollowed; wing chartaceous, horizontal, simple with a single radial slit, ca. 8 mm diam., with fine pale brown radially anastomosing nerves; upper perianth flat, ± lobed, somewhat fleshy at first with membranous margin to lobes, radicular slit extending to wing. *Utricle* discoid, glabrous, not completely obscured by upper perianth. (Map 20.)

Distribution: South eastern Queensland, eastern New South Wales, southern and north western Victoria, and southern South Australia.

Queensland: Wallumbilla, May 1916, *C. T. White* (AD).

New South Wales: Wychuca, *D. L. W. Henderson* 410 (NSW).

Victoria: Nathalia, May 1902, *E. Pescott* (MEL).

South Australia: Patawalonga Ck., near Adelaide, *D. N. Kraehenbuehl* 286 (AD).

This species has frequently been confused with *M. microphylla*. It may be distinguished from that species by the woolly indumentum on the stem, the larger and more fleshy leaves, the more lax inflorescence, and by the larger fruit in which the wing has an entire margin. From *M. suaedifolia* it may be distinguished by the more dense foliage, the stem indumentum, by the leaves being scarcely narrowed at their base, and by the absence of bracteoles.

Maireana decalvans is sometimes an early invader of cleared land. It is usually found in heavy soil, frequently in areas which are seasonally waterlogged.

Five collections were cited by Bentham for *K. villosa* var. *tenuifolia* of which all except one (the Dalton collection) have been seen by me in herb. MEL. The Leichhardt, Murray, and part of the Barton collection (MEL 48952) are of *M. decalvans*, while the Woolls and the rest of the Barton collection (MEL 48954) are of *M. microphylla*.

46. Maireana rohrlachii (P. G. Wils.) P. G. Wilson., comb. nov.

Kochia rohrlachii P. G. Wilson in Eichler, Suppl. Black's Fl. S. Austral. 123 (1965). Type: Buckleboo, Eyre Peninsula, *K. D. Rohrlach* 270 (AD).

Intricately branched subshrub to 1 m high. *Branchlets* slender, often flexuose when young, closely lanate. *Leaves* alternate, fleshy, obovoid to narrowly fusiform, 3–8 mm long, glabrous (rarely villosulose), sometimes caducous. *Flowers* solitary, hermaphrodite, depressed globose, glabrous. *Fruiting perianth* glabrous, pale brown when dry; attachment slightly hollowed; tube broadly turbinate to hemispherical, ca. 2 mm high and 3 mm diam. at apex, thin walled and easily crushed, faintly costate; wing simple, horizontal or undulate, thinly chartaceous, 12–16 mm diam., with a single radial (radicular) slit and close pale brown radial nerves; upper perianth flat, thin, lobed, open in centre, the radicular slit extending to wing. *Utricle* plano-convex (flat above), glabrous. (Map 7.)

Distribution: Found from northern Eyre Peninsula in South Australia eastwards to western Victoria.

Victoria: Gooroc, 1 Mar. 1898, *G. P. Scott* (MEL); near Quambatook, 13 Mar. 1971 *N. Macfarlane* (PERTH).

South Australia: Between Snowtown and Brinkworth, *B. Copley* 990 (AD); Marino Rocks to Halletts Cove, 10 Mar. 1964, *H. M. Cooper* (AD).

Maireana rohrlachii is very similar to *M. decalvans* and to *M. suaedifolia*. It differs from both in its divaricate habit of branching and its densely woolly stems.

47. Maireana microphylla (Moq.) P. G. Wilson, comb. nov.

Enchylaena microphylla Moquin in DC., Prod. 13/2:128 (1849).— *Kochia microphylla* (Moq.) F. Muell., Fragm. 8:148 (1874). Type: "In Nova-Hollandia (h. Hook.f)" holo: P).

?*E. tomentosa* R. Br. var. *leptophylla* Benth., Fl. Austral. 5:182 (1870). Type: Near Gainsford, *Bowman* (MEL).

?*K. tomentosa* f. *tenuis* Domin, Biblio. Bot. 89:622 (1921). Type: "Bei Barcaldine und auf der Dividing Range bei Jericho (Domin Ill. 1910)." n.v.

[*K. villosa* var. *tenuifolia* auct. non Benth. sensu lectotypica: Benth., op.cit. 186, pro parte, as to the Woolls and a portion of the Barton colln. (MEL 48954) cited.]

[*K. tamariscina* auct. non (Lindl.) Black: Beadle, Evans et Carolin, Flora Sydney Region 191 (1972).]

Divaricately branched bushy shrub to 1 m high. *Branchlets* slender, attenuate, sparsely strigose or appressed villosulose to glabrous. *Leaves* alternate, slender, sub-terete, 2–4 (10) mm long, glabrous to very sparsely strigose or villous. *Flowers* solitary forming dense leafy spikes, hermaphrodite, depressed, perianth glabrous to sparsely villous. *Fruiting perianth* thin but slightly fleshy, glabrous to sparsely villous above (lobes sparsely ciliate), dark brown when dry; tube shallowly hemispherical, 1·5–2 mm diam.; attachment small and not hollowed; wing (when present) horizontal, simple (sometimes lobed opposite the tepals), chartaceous, with a single radial slit, ca. 7 mm diam., crenulate on margin, pale brown; upper perianth lobed, open in centre, radicular slit extending to top of tube. *Utricle* convex above, glabrous. (Map 10.)

Distribution: South eastern Queensland and eastern New South Wales.

Queensland: Mundubbera, *H. S. McKee* 10215 (NSW); 5·5 mi N of Wandoan, *N. H. Speck* 1971 (NSW).

New South Wales: Gunning Gap, 13 mi WNW of Forbes, *B. Whitehead* 973 (NSW); Flemington, near sheep sale yards, 14 Aug. 1906, *E. Cheel* (NSW).

Maireana microphylla appears to be an early colonizer of disturbed land, especially in areas having a poor soil, and, according to notes on herbarium sheets, a relatively recent introduction to the Sydney district.

This species is rather variable both in vegetative and fruit morphology. The common form found in New South Wales is a divaricately branched shrub, very shortly villous and with short leaves. In eastern Queensland is found a form with slender leaves (up to 10 mm long) which with the slender flexuous branches are somewhat villous. A further form found in various parts of New South Wales is almost glabrous. The fruiting perianths do not always develop wings and it was on material in this condition that the species was first described. The name *Enchylaena tomentosa* var. *leptophylla* Benth. is based on what appears to be the Queensland form mentioned above but in which the wing had also not developed.

Material of *M. microphylla* in which the wing had developed was placed by Bentham (1870) in *Kochia villosa* var. *tenuifolia* F. Muell. ex Benth., under which name he also included material of *M. decalvans* (see note under this species).

The name '*Kochia tamariscina*' (based on *Suaeda tamariscina* Lindl.) has in the past been considered to be either a synonym of, or the correct name for, the species here described. The type of *S. tamariscina* is, however, a specimen of *M. brevifolia* in which the wings of the fruit have not developed.

Maireana microphylla may be distinguished from *M. decalvans*, with which it has frequently been confused, by the different indumentum (woolly in *K. decalvans*), the more compact inflorescence, and the crenulate wing margin.

48. Maireana microcarpa (Benth.) P. G. Wilson, comb. nov.

Kochia villosa var. *microcarpa* Benth., Fl. Austral. 5:187 (1870).—*K. microcarpa* (Benth.) P. G. Wilson in Eichler, Suppl. to J. M. Black's F.l S. Austral. 123 (1965). Type: "Darling and Lachlan rivers, Victorian and other Expeditions" (syn: Nangawera to Yellowintchi Vict. Explor. Exped. 29 Dec. 1860, MEL, NSW; Between Darling and Lachlan, *Burkitt*, MEL).

Erect perennial ca. 40 cm high. *Branches* slender, striate, loosely white woolly when young. *Leaves* alternate, fleshy, subterete to obovoid, obtuse, 3–5 (10) mm long, glabrous. *Flowers* solitary, hermaphrodite, depressed, glabrous. *Fruiting perianth* glabrous, (pale to) dark brown on wing otherwise pale brown to grey; attachment small, usually slightly raised from tube and with depressed centre; tube cupular with rounded base, ca. 1·5 mm high, 2 mm diam., ± costate and with a prominent radicular rib, crustaceous; wing simple, horizontal, firmly chartaceous, 5–6 (8) mm diam., with a single radial (radicular) slit, margin usually recurved; upper perianth flat or concave, completely obscuring utricle, shortly lobed, crustaceous, radicular slit extending to wing. *Utricle* discoidal glabrous; style very short, included. Map 22.

Distribution: Western New South Wales, northern South Australia, and south eastern portion of the Northern Territory.

New South Wales: Near Oxley, 12 Dec. 1970, *B. M. Alchin* (NSW).

South Australia: 6 km S of Ilbunga, *T. R. N. Lothian* 4640 (AD).

Northern Territory: Simpson Desert, 2 mi W of New Andado HS., *A. C. Beauglehole* 28020 (ADW, NT).

Maireana microcarpa exhibits very little variation apart from size and intensity of colouration of the fruit, which characters may both be due to variation in growth conditions.

49. Maireana ovata (Ising) P. G. Wilson, comb. nov.

Kochia ovata Ising, Trans. Roy. Soc. S. Austral. 78:112 (1955). Type: Evelyn Downs *E. H. Ising* 3563 (holo: AD; iso: NSW).

Subshrub to 0·3 m high. *Branches* with numerous lateral branchlets, densely tomentose. *Leaves* alternate, sessile, erect, narrowly ovate to narrowly triangular, 2–5 mm long, tomentose to villous-tomentose, congested towards the apex of the branchlets. *Flowers* solitary, hermaphrodite; upper perianth shortly villous. *Fruiting perianth* pale gold when dry, glabrous apart from the shortly villous upper perianth; attachment small; tube hemispherical, 1·5 mm diam., 1 mm high, smooth apart from a slight radicular ridge, woody; wing simple, entire (without a radicular slit), horizontal, (2·5) 4–6 mm diam., translucent with faint radial venation; upper-perianth woody, obscuring the ovary, shortly villous, radicular slit extending to wing. *Utricle* plano-convex (flat above); style thickened, included. Map 19.

Distribution: North western New South Wales westwards to Coober Pedy in South Australia.

New South Wales: 4·8 km SE of Old Corona Well, *J. C. DeNardi* 714 (NSW, PERTH).
South Australia: Beltana, 17 Aug. 1921, *J. B. Cleland* (AD).

Maireana ovata is similar to *M. tomentosa* subsp. *urceolata* and, as in that subspecies, sometimes has only a slight development of the wing in the fruit. In the original description the wing was described as being "1-fissa vel irregularis". This observation was probably made on an immature or deformed fruit for the wing on material I have seen (including the type) is consistently entire.

50. Maireana tomentosa Moquin, Chenop. Enum. 96 (1840). Type: Shark Bay, Western Australia, *Gaudichaud* 68 (iso: MEL, PERTH, fragments). (non *Kochia tomentosa* F. Muell.)

Kochia tomentosa F. Muell. var. *enchylaenoides* Black, Trans. Proc. Roy. Soc. S. Austral. 47:368 (1923).—*K. enchylaenoides* (Black) Black, op. cit. 51:379 (1927).—*Chenolea blackii* Ewart, F.l Vict. 462 (1931), nom. inval. Type: Yellow Cliff near Charlotte Waters, 15 July 1921, *S. A. White* (holo: AD, iso: NSW).

Open subshrub 0·2–1 m high. *Branches* tomentose. *Leaves* alternate, fleshy, semiterete, (3) 5–8 mm x 1 mm, woolly villous. *Flowers* solitary, hermaphrodite, almost glabrous except for the woolly margin to the shortly lobed perianth. *Fruiting perianth* glabrous (or almost so); attachment small, not exserted; tube hemispherical or cupular 1–1·5 mm high, 1·5–2·5 mm wide at apex, smooth, strongly crustaceous or woody; wing simple, without a radial slit, horizontal, (6) 8–11 mm diam., straw-coloured to brown when dry, with no apparent (or only indistinct) venation, upper perianth flat or raised to form an annular disc, scarcely lobed and entirely obscuring ovary, woolly ciliate, the radicular slit extending as an overlap to the wing. *Utricle* thick and discoid; style short and conical, included.

Fruiting perianth with tube cupular, woody, glossy ... subsp. *urceolata*
Fruiting perianth with tube hemispherical, thickly crustaceous, dull .... subsp. *tomentosa*

subsp. **tomentosa**

Leaves obtuse to acuminate, moderately woolly-villous. *Fruiting perianth:* tube hemispherical, 1 mm high, thickly crustaceous, dull or glossy; wing with no apparent venation; upper perianth glabrous apart from woolly ciliate margin to lobes, usually sunken in central membranous portion. Fig. 9G–H, Map 21.

Distribution: Western Australia from just N of the tropic of Capricorn, south to Norseman and the southern portion of the Northern Territory.

Western Australia: 9 mi N of Learmonth, A. S. George 1303 (PERTH); 80 km N of Laverton, P. G. Wilson 7325 (PERTH); Lake Cowan, P. G. Wilson 6065a (PERTH).

Northern Territory: 23 mi S of Alice Springs, *R. Swinbourne* 424 (AD).

This subspecies is somewhat variable both in vegetative and fruit morphology. Some of the apparent variation is probably due to different growth conditions and on present knowledge there appear to be no grounds for recognising further infraspecific taxa.

subsp. **urceolata** P. G. Wilson, subsp. nov.

Folia laxe lanata apice rotundato. *Perianthium* fructificans: tubus cupularis, saepe ad apicem constrictus 1·5 mm altus, lignosus; perianthium supernum crassum, lignosum, in centro lanatum.

Type: Evelyn Downs, ca. 120 km SW of Oodnadatta, South Australia, 3 Sept. 1955, *E. H. Isling* 3990 (holo: AD).

Leaves rounded at apex, loosely woolly villous. Fruiting perianth: tube deeply hemispherical or cupular, often slightly constricted at apex, 1·5 mm high, woody, glossy; wing with faint radial venation; upper perianth somewhat woolly-pilosulose in centre and with woolly-ciliate margin, thick and woody all over. Fig. 9E–F, Map 21.

Distribution: North western New South Wales, central South Australia and west of the Flinders Range.

New South Wales: Fowlers Gap, May 1956, *N. W. C. Beadle* (NSW); Umberumberka, *A. Morris* 722 (NSW).

South Australia: Leigh Creek, *T. R. N. Lothian* 2038 (AD); Beltana, 17 Aug. 1921, *J. B. Cleland* (AD).

This subspecies is geographically isolated from the typical subspecies and is uniform over its range. In its fruiting characters it can be readily distinguished from subsp. *tomentosa* while it differs (as noted in the descriptions) also in vegetative characters. In its indumentum and in the shape and glossy surface of the perianth tube it shows close similarities with *M. ovata*, to which species it is probably most closely related. I have not placed it under that species because of its overall appearance which, irrespective of possible phylogenetic relationships, makes it more convenient to consider this subspecies as part of *M. tomentosa*.

There has been considerable confusion over the application of the name *Kochia tomentosa* F. Muell. (1849). Bentham (1870) apparently assumed it to be based on *Maireana tomentosa* Moq. (1840) and to be conspecific with

K. villosa Lindl. (1848), and therefore, following the nomenclatural conventions of his day, he took up the last name. These names are here considered to be referable to three distinct species. Bentham's action arose partly through a misinterpretation of the application of the name *K. tomentosa* F. Muell. This name was intended by Mueller to be that of a new species (not a new combination) and refers to the same species as that redescribed by Bentham under the name '*K. appressa*'.

J. M. Black's description of *K. tomentosa* var. *enchylaenoides* was based on a specimen of *M. tomentosa* in which the wing had scarcely developed. It is otherwise typical of that species.

51. Maireana integra (P. G. Wils.) P. G. Wilson, comb. nov.

Kochia integra P. G. Wilson in Eichler, Supplement to J. M. Black's F. S. Austral. 122 (1965). Type: Giles, Rawlinson Range, Western Australia, *R. H. Kuchel* 180 (holo: AD).

Bushy subshrub 0·3–1 m high. *Branches* slender, tomentose. *Leaves* alternate, slender, semiterete 5–14 x 1 mm, obtuse, tomentose. *Flowers* solitary, hermaphrodite; tube glabrous, upper perianth tomentose. *Fruiting perianth* pale to dark brown when dry; attachment small; tube hemispherical, 1 mm high and 2·5 mm diam. at apex, faintly costate but with a prominent radicular ridge, crustaceous, glabrous; wing simple without a radial (radicular slit), horizontal, ca. 10 mm diam., glabrous, the venation usually indistinct or absent; upper perianth shortly tomentose, very shortly lobed, flat thick and crustaceous towards the margin, sunken and membranous in centre, radicular slit prominent and extending as an overlap to wing. *Utricle* plano-convex (flat above); pericarp thin and glabrous. (Map 13.)

Distribution: Central and western New South Wales, South Australia, eremean Western Australia, and the Northern Territory south of 20° latitude.

Generally found on well-drained, sandy or loamy plains.

New South Wales: Boppy Mtn. E of Cobar, July 1903, *J. L. Boorman* (NSW).
South Australia: Emu Clay Pans, *N. Forde* 355 (AD).
Western Australia: 18 mi E of Warburton Mission, *A. S. George* 8724 (PERTH).
Northern Territory: 12½ mi S of Deep Well Siding, 3 Sept. 1956, *G. Chippendale* (NSW).

Although widely distributed, this species exhibits little morphological variation and even in the vegetative condition may be distinguished from other species by its slender semi-terete leaves and woolly indumentum. Previous to its description, *M. integra* had usually been confused with *M. villosa* (or one of its supposed synonyms). It may be readily separated from that species by the characters mentioned above (in *M. villosa* the leaves are flattened and the indumentum appressed villous) and by the fruit which in *M. villosa* is typically glabrous or glabrescent above and has a radial slit to the wing. Some forms of *M. tomentosa* are similar to *M. integra* and they may integrate in far eastern Western Australia and in the southern portion of the Northern Territory, but in doubtful cases I have distinguished the former species by its glabrous fruits.

In western New South Wales and southern Queensland is found a plant which is somewhat intermediate in morphology between *M. integra* and *M. villosa*. Early collections made in the area where it is now found are clearly referable to one or other of these species but recent collections contain a large proportion of the intermediate form. It is possible that this form is of hybrid origin and has arisen following land disturbance by agricultural activities. The characters distinguishing it from *M. integra* (sensu stricto) are as follows: 1) Indumentum loosely woolly to appressed villous. 2) Perianth tube obviously costate. 3) Wing more prominently veined and usually with a radial fold opposite the radicle. 4) Upper perianth tending to be shortly villous (rather than woolly).

The little evidence there is available from data provided on herbarium labels suggests that the hybrid (?) plant is found principally on rocky hillsides. The following collections represent this form:

New South Wales (all herb NSW): Mootwingii Historic Site, *J. C. DeNardi* 877; Mootwingee National Park, *J. C. DeNardi* 302; Quarry View Stn., *P. Martenz* 67/75; Fowlers Gap, *J. H. Leigh* W168; Dolo Hill, 35 mi W of Wilcannia, 27 May 1955, *Johnson* and *Constable;* Gairdner Creek-Euriowie, 31 May 1955, *E. F. Constable;* Lightning Ridge *H. Salasoo* 3834.

Queensland (herb. CBG): 14 mi W of Charleville, 22 Sept. 1963, *M. E. Phillips* 369; St. George, 25 Aug. 1969, *M. E. Phillips* 429.

In a collection from the George Gill Range, Northern Territory (*A. C. Beauglehole* 23217, PERTH) the upper perianth of the fruit has 4 short erect processes inter-tepaline in position. This is the arrangement for the processes found in *M. lanosa* and *M. lobiflora*. The specimen is otherwise normal for *M. integra* (as are other specimens seen from the same district) and it would seem that the abnormality is unlikely to have been due to hybridisation.

52. Maireana villosa (Lindl.) P. G. Wilson, comb. nov.

Kochia villosa Lindl. in Mitchell, J. Trop. Austral. 91 (1848).—*K. tomentosa* var. *lindleyana* Domin, Biblio. Bot. 89:622 (1921). Type: Narran River, *T. L. Mitchell* (holo: CGE, photo seen, see note).

Small open undershrub to 50 cm high. *Branches* slender, striate, minutely to loosely lanate. *Leaves* alternate, flattened, linear to very narrow-oblong or narrow obovate, acute, attenuate at base, 5–12 mm long somewhat fleshy, appressed villous. *Flowers* hermaphrodite, solitary or in pairs, glabrous apart from ciliate margin to lobes. *Fruiting perianth* pink to green when fresh, drying brown, attachment small or slightly tumid; tube broadly turbinate, faintly 5-costate, ca. 1 mm high, thin walled and easily crushed; wing simple, horizontal (infolded when young), chartaceous, with a single radial (radicular) slit, 7–10 mm diam., with dark brown radially anastomosing veins (when dry); upper perianth flat (or slightly raised around margin), shortly lobed, glabrous or sparsely pilose, ciliate. *Utricle* plano-convex (flat above), glabrous or sparsely pilose. (Fig. 10E–F, Map 4.)

Distribution: Western Queensland, northern New South Wales, northern South Australia, Western Australia between latitudes 21° and 29°, Northern Territory.

Normally found on plains in loam or sand.

Queensland: S of Selwyn, *C. H. Gittens* 683 (NSW).

New South Wales: Cobar, *G. M. Cunningham* 877 (NSW); W of Byrock, *D. L. W. Henderson* 409 (NSW).

South Australia: 35 km W of Everard Park HS, *D. J. E. Whibley* 1148 (AD); 2 mi S of Emu, *R. A. Perry* 5598 (AD).

Western Australia: 142 km N of Sandstone, *C. A. Gardner* 14451 (PERTH); Giles, *A. S. George* 4936 (PERTH); Upper Rudall River, *P. G. Wilson* 10451 (PERTH).

Northern Territory: Ayers Rock, *Hill & Lothian* 748 (AD); Haasts Bluff Reserve, 3 Sept 1957, *J. B. Cleland* (AD).

This species has generally been confused with *M. tomentosa* Moq., both in Floras and in herbaria. The latter species may be readily distinguished by its semi-terete woolly leaves and the entire wing (without a radial slit) of the fruit. A note on the nomenclatural confusion which has existed is given under *M. tomentosa*.

M. villosa is evidently closely related to *M. planifolia*. For a large part of their range these two species grow in the same general area and plants intermediate in form between them are commonly collected. This intermediate form is also found in districts distant from any recorded presence of *M. planifolia* (such as in western New South Wales) and for this reason no certain conclusions can be made as to its origin. Herbarium material of this form has been generally identified by the author as "*Maireana villosa* [-*planifolia*?] to indicate the possible influence of *M. planifolia*.

Maireana villosa (and the intermediate form) is usually found in loam or sandy soil on plains whereas *M. planifolia* appears to be restricted to rocky slopes of hills or mountains. Representative specimens are cited below.

New South Wales: 2 mi W of Cobar, *J. C. DeNardi* 222 (NSW); Tilpa, Oct. 1920, *G. Turner* (NSW); Byrock, Sept. 1885, *E. Betche* (NSW).

South Australia: 48 km W of Talleringa Well, *T. R. N. Lothian* 3845 (AD).

Western Australia: 20 mi S of Victoria Spring, *R. Helms* (NSW); 103 km N of Kalgoorlie, *N. H. Speck* 916 (MEL).

Northern Territory: 21 mi S of Alice Springs, *R. Swinbourne* 402 (NT); 2 mi S of Mt. Davidson, *J. R. Maconochie* 1009 (NT).

A plant which is possibly a hybrid between *M. villosa* and *M. integra* is found in western New South Wales. This is discussed under the latter species.

Mitchell cited the collection of *Kochia villosa* as being made on 10th March on the bank of the R. Narran, whereas the apparent type specimen in CGE is labelled March 6, 1846, 15 miles N of the ford of the Darling. Such apparent discrepancies are frequently found in the collections cited by Mitchell.

53. Maireana planifolia (F. Muell.) P. G. Wilson, comb. nov.

Kochia planifolia F. Muell., Fragm. 1:213 (1859). Type: Between the Geraldine mine and Port Gregory, *A. Oldfield* (holo: MEL; iso: NSW, both labelled "Murchison R.").

K. tomentosa var. *platyphylla* Ising, Trans. Roy. Soc. S. Austral. 57:185 (1933). Type: Snake Gully near Pedirka, *E. H. Ising* 2839 (holo: AD, iso: MEL).

Open, loosely branched undershrub 0·5–1 m high. *Branches* slender, striate, closely lanate. *Leaves* alternate, flattened, narrowly obovate to obovate, obtuse, (5) 8–15 mm long, sparsely to densely appressed pubescent. *Flowers* hermaphrodite, solitary or in pairs (normally only one maturing); tube glabrous; upper perianth closely lanate. *Fruiting perianth* straw-coloured to pale brown when dry; attachment boss-like, slightly hollowed and with tumid margins, usually bearing a small tuft of wool when detached; tube broadly turbinate, smooth or faintly costate, thinly crustaceous; wing horizontal (never infolded even when young), simple with a single radial (radicular) slit, 10–14 mm diam., translucent without apparent venation; upper perianth flat, lobed almost to margin, shortly lanate all over. *Utricle* plano-convex, sparsely lanate above. (Map 3.)

Distribution: Northern South Australia, Western Australia between 22° and 31° of latitude, southern portion of the Northern Territory.

Apparently restricted to the rocky slopes of hills or mountains.

South Australia: Evelyn Downs, 16 Sept. 1955, *E. H. Ising* (AD); Mt. Morris, Musgrave Ra., *Hj. Eichler* 17373 (AD).

Western Australia: 25 mi E of Bullara on road to Yanrey, *A. S. George* 1204 (PERTH); Cundeelee (between Zanthus and Queen Victoria Spring), *P. Boswell* R 35 (PERTH).

Northern Territory: Learmonth Park, Docker R., *J. Maconochie* 787 (AD); Mt. Olga, *G. Chippendale* (NT 2900).

Maireana planifolia is rather uniform in appearance over its entire geographical range. A form which is apparently morphologically intermediate between *M. planifolia* and *M. villosa* is found in areas where the latter species occurs (but not always the former). Further notes on this form will be found under *M. villosa*.

The plant referred to as *Kochia planifolia* by J. M. Black, Fl. S. Australia (1924) and ed. 2 (1948) is the species subsequently described by L. A. S. Johnson as *K. astrotricha* (= *Maireana astrotricha*).

54. Maireana melanocarpa P. G. Wilson, sp. nov.

Ramuli teretes lanati. *Folia* semiteretia 3–5 mm longa, ca. 1 mm lata, lanata, apice rotundato. *Perianthium* fructificans atrobrunneum vel nigrum, glabrum; tubus brevite hemisphaericus, 2 mm latus, 1 mm altus, solide crustaceus; ala ad 6 mm diam., venis prominentis atro brunneis ornatis, rima radiculari praesenti; perianthium supernum margine convexo duro, centro depresso membranaceo.

Type: Mt. Lyndhurst, South Australia, 9 April 1955, *F. M. Hilton* 1335 (holo: ADW 11829).

Much branched subshrub. *Branchlets* terete, woolly. *Leaves* alternate, spreading, semiterete, 3–5 mm long, ca. 1 mm wide, woolly, apex rounded. *Flowers* solitary, glabrous apart from the woolly ciliate margin to lobes. *Fruiting perianth* dark-brown to black when mature, glabrous; attachment small; tube shortly hemispherical, ca. 2 mm wide and 1 mm high, faintly costate, rigid and firmly crustaceous; wing simple, horizontal, to 6 mm diam., with prominent dark-brown venation and a single radial (radicular) slit; upper perianth thickened and convex around margin, membranous and sunken in centre, lobes very short and not apparent, radicular slit prominent, passing as an overlap to wing and continuing down tube as a prominent ridge. *Utricle* discoidal, glabrous. (Fig. 5E–F, Map 11.)

Distribution: South Australia, west of the North Flinders Ranges between Beltana and Lake Watherstone.

South Australia: Lake Watherstone, 1 July 1883, herb. *R. Tate* (AD); Beltana, Aug. 1887, *J. G. O. Tepper* 227a (AD); between Flinders Range and Lake Torrens, *Mrs T. P. Richards* (MEL).

This species has been only infrequently collected, but from the five specimens seen it would appear to be very constant in its features.

Maireana melanocarpa is similar to *M. villosa*, *M. tomentosa* and *M. integra*. From *M. villosa* it may be distinguished by its leaf shape and indumentum (flattened and villous in *M. villosa*) and from *M. tomentosa* and *M. integra* by its fruit (wing without a radicular slit and without obvious venation in these two species).

55. Maireana radiata (P. G. Wils.) P. G. Wilson, comb. nov.

Kochia radiata P. G. Wils. in Eichler, Suppl. Black's Fl. S. Austral. 124 (1965). Type: ca. 20 km N of Ceduna, South Australia, *P. G. Wilson* 1510 (holo: AD).

Erect densely branched subshrub ca. 0·3 m high. *Branches* slender, closely white lanate or the indumentum eventually dark brown. *Leaves* alternate, ± erect, fleshy, narrowly ovate to semi-terete, 2–4 mm long, closely lanate to glabrescent. *Flowers* hermaphrodite, solitary, axillary, sub-globular, tube glabrous, upper perianth densely woolly. *Fruiting perianth* glabrous except for the densely woolly upper perianth; attachment small, flat or concave; tube hemispherical, brittle or sometimes almost woody, faintly costate, ca. 1·5 mm diam., 0·7–1 mm high; wing simple, horizontal, chartaceous, 5–6 mm diam., translucent between the fine dark brown radial nerves, with a single radial (radicular) slit; upper perianth slightly convex, ca. 1·5 mm diam., hard, densely woolly, very shortly lobed, completely obscuring utricle, radicular slit extending to wing and passing over the radicular canal which passes through the tube wall. *Utricle* plano-convex (flat above), glabrous; style narrow-conical, hard, included (Map 8.)

Distribution: South western New South Wales, north western Victoria, southern South Australia, southern Western Australia (east of Ravensthorpe).

New South Wales: Near "Bidura", NW of Balranald, *J. H. Leigh* W257 (NSW).

Victoria: 13 mi WNW of Nowingi, 4 Sept. 1966, *E. R. Rotherham* (MEL).

South Australia: 10 mi E of Mannum, 24 Aug. 1946, *J. Vickery* (ADW); 20 km E of Minnipa, *Hj. Eichler* 19523 (AD).

Western Australia: Eucla, *J. D. Batt* 58 (MEL); 9½ mi W of Balladonia, 28 Sept. 1960, *B. G. Briggs* (NSW).

Found principally in woodland, often in calcareous soil.

Although widely distributed this species exhibits practically no regional variation. It may be readily recognised by the small erect slightly woolly leaves and by the prominently nerved wing to the fruit. In many herbarium specimens the wool on the older parts of the plant has become dark brown, and this again provides a useful distinguishing character.

56. Maireana appressa (Benth.) P. G. Wilson, comb. nov.

Kochia appressa Benth., Fl. Austral. 5:188 (1870).—*K. tomentosa* var. *appressa* (Benth.) Black, Fl. S. Austral. 197 (1924). Lectotype: Lake Tyrell, Herb. F. Mueller (MEL 44117).

K. tomentosa F. Muell., Rep. Babbage's Exped. 20 (1859). Lectotype: "Margareth Creek", Babbage Expedition (MEL 44118).

K. brownii F. Muell., Rep. Babbage's Exped. 20 (1859) p.p., nom. inval.

Divaricately branched subshrub 10–60 cm high, loosely white tomentose all over. *Leaves* alternate, suberect (if small) to spreading, narrowly deltoid to narrowly oblong, 2–5 (8) mm long. *Flowers* solitary, hermaphrodite, subspherical, glabrous except for woolly ciliate margin to lobes, or rarely the upper perianth pubescent. *Fruiting perianth* glabrous (rarely the upper perianth pubescent), straw-coloured when dry; attachment excentric on a hollow stipe (to 1 mm long) produced from the base of the tube; tube turbinate, 1–2 mm high, thin walled and easily crushed, faintly costate and sometimes with a radicular ridge; wing simple, ca. 10 mm diam., chartaceous, faintly nerved, with a radial (radicular) slit; upper perianth usually slightly sunken, completely covering the ovary, with ridges extending radially from between the lobes, radicular slit extending to tube. *Utricle* lenticular; pericarp thin; style short, included. (Map 26.)

Distribution: Found south of 24° latitude in the drier areas of all mainland states of Australia.

Queensland: Nynevor Downs, *C. T. White* 11904 (NSW).

New South Wales: 18 mi SE of Wilcannia, *J. C. DeNardi* 246 (NSW).

Victoria: Lake Tyrell, *W. W. Watts* 1065 (MEL).

South Australia: Port Pirie, *B. Copley* 1350 (AD).

Western Australia: Lake Cowcowing, *P. G. Wilson* (E, NSW, PERTH).

Northern Territory: 12 km N of Henbury, *J. B. Cleland* (AD).

Often found growing in saline or gypseous soils but also occurs under a variety of other conditions.

There are four specimens in herb. MEL which appear to be syntypes (or isosyntypes?) of this species. Of these, three belong to *M. appressa* as lectotypified here, while the fourth, which is one of two labelled 'Murray desert' (MEL 44116), is referable to *M. radiata*.

57. Maireana aphylla (R. Br.) P. G. Wilson, comb. nov.

Kochia aphylla R. Br., Prod. 409 (1810).—*Salsola aphylla* (R. Br.) Spreng., Syst. Veg. 1:925 (1825).—*K. villosa* var. *aphylla* (R. Br.) F. Muell. ex Maiden et Betche, Census N.S. Wales Pl. 70 (1916). Type: South coast of Australia (near Pt. Augusta), *R. Brown*, n.v.

K. brownii F. Muell., Rep. Babbage's Exped. 20 (1859) p.p., nom. inval.

Rounded, divaricately branched subshrub 0·5–2 m high. *Branchlets* striate, glabrescent to somewhat lanate, often spinescent. *Leaves* small, alternate narrow to slender and semiterete, 1–4 (8) mm long, fleshy, sparsely to densely woolly or glabrescent, very shortly spurred at base (the attachment to the stem being very small), frequently caducous. *Flowers* predominantly dioecious, solitary, occasionally minutely bracteolate; male perianth campanulate, ca. 1·5 mm high, very shortly lobed and slightly woolly, radicular slit and bulge extending a short way down tube, sometimes developing a short irregular wing; female perianth sub-spherical, ca. 1 mm high, tube glabrous with a prominent radicular bulge, glabrous, lobes woolly and closed over ovary, ovary glabrous with a pair of slender attenuate stigmas. *Fruiting perianth* straw coloured when dry, glabrous except for the sparsely woolly upper perianth; base small, sometimes tumid on margins or occasionally produced into a very short hollow stipe; tube hemispherical to turbinate, 1–2 mm high, smooth or faintly 5-ribbed with a prominent radicular bulge; wing horizontal, simple, ca. 8 mm diam., chartaceous, faintly to prominently radially veined with a single radial slit; upper perianth thick and forming a convex disc open in centre, radicular overlap prominent. *Utricle* hemispherical (truncate above), pericarp coriaceous on upper surface otherwise chartaceous. (Map 27.)

Distribution: Widespread in arid and semi-arid areas of Australia in all mainland States except Western Australia where it is limited to the Carnarvon-Wiluna region; also found in southern South Australia as far south as Yorke Peninsula and the Murray River.

QUEENSLAND: Charleville, *S. T. Blake* 5343 (NSW).

NEW SOUTH WALES: Broken Hill, *A. Morris* 172 (NSW); 10 mi S of Warri Gate, Olive Downs Stn., *L. A. S. Johnson* 1042 (NSW).

VICTORIA: Mildura, *H. B. Williamson* 1450 (MEL).

SOUTH AUSTRALIA: Bolivar, *A. J. K Watkin* (ADW); Yudnapinna, *R. L. Croker* (ADW).

WESTERN AUSTRALIA: 115 km E of Carnarvon, *P. G. Wilson* 8420 (PERTH).

NORTHERN TERRITORY: 33 mi N of Alice Springs, *D. J. Nelson* 682 (NSW).

Usually found on heavy soils often in places which are seasonally waterlogged.

Maireana aphylla is often attacked by an insect which causes the formation of compact woolly galls 1 cm or more in diameter. These galls presumably gave rise to the common name 'cotton bush' by which this plant has been known for over a century.

In the central eremean areas of Australia the leaves and branches of *M. aphylla* are closely woolly while in southern South Australia and southern Victoria they are almost glabrous.

58. Maireana stipitata P. G. Wilson, sp. nov.

Ramuli albo-tomentosi. *Folia* semiteretia, 6–10 mm longa, obtusa, carnosa, sparse vel dense tomentosa, pilis dendriticis. *Perianthium* fructificans ± dorsiventraliter compressum; tubus brevissimus, late turbinata 0·5–1 mm altus, dense papillosa, pariete tenui debili, basi in stipitem prominentum 1·5–3 mm longum producto; ala chartacea undulata 10–14 mm diam. glabra, rima radiculari praesenti; perianthium supernum margine convexo papilloso, centro pubescenti.

Type: 315 km N of Geraldton [on North West Coastal Highway to Carnarvon], Western Australia, 9 Aug. 1966, *A. M. Ashby* 1882 (holo: AD, iso: PERTH).

Divaricately branched subshrub to 1 m high. *Branchlets* white tomentose. Leaves alternate, fleshy, semiterete, 6–10 mm long, obtuse, sparsely to densely tomentose with dendritic hairs. *Flowers* unisexual or hermaphrodite, solitary, dorsiventrally compressed; tube broadly deltoid, glabrous; upper perianth erect, irregularly lobed, pilose on upper part, radicular slit extending to tube; style sparsely woolly. *Fruiting perianth* somewhat dorsiventrally compressed; tube very short, broadly turbinate, 0·5–1 mm high, thin walled and easily crushed, densely papillose, produced at base into a prominent terete solid stipe 1·5–3 mm long, attachment excentric; wing simple, chartaceous, undulate, 10–14 mm diameter, finely veined, glabrous, with a single radial (radicular) slit; upper perianth completely obscuring ovary, pubescent in centre or all over, bordered by a raised ring of papillose tissue, radicular slit extending to wing. *Utricle* broadly turbinate; pericarp membranous below and crustaceous at the truncate apex. (Map 17.)

Distribution: Western Australia, near Shark Bay and in the Dampier Archipelago.

WESTERN AUSTRALIA: 13 mi E of Denham, *T. E. H. Aplin* 3314 (PERTH); Shark Bay, Oct. 1877, *F. Mueller* (MEL).

Distinctive features of *M. stipitata* are the dorsiventrally flattened fruiting perianth and its solid stipe. The former feature is also found in some forms of *M. georgei*.

Excluded Names

Kochia brachyptera (F. Muell.) F. Muell. ex Benth., Fl. Austral 5:189 (1870) = *Bassia brachyptera* (F. Muell.) Anders. = *Sclerolaena* sp.

decaptera F. Muell., Fragm. 9:75 (1875) = Abutilon sp.-See Gauba, Viet. Nat. 66:13 (1949).

fimbriolata F. Muell., Fragm. 9:75 (1875) = *Sclerolaena* sp.

stelligera (F. Muell.) F. Muell. ex Benth., Fl. Austral. 5:189 (1870) = *Bassia stelligera* (F. Muell.) F. Muell. = *Sclerolaena* sp.

triptera var. *pentaptera* Black, Fl. S. Austral. 199 (1924) = *K. decaptera* F. Muell. q.v.

Maierana stelligera F. Muell., fragm. 1:139 (1859) = *Bassia stelligera* (F. Muell.) F. Muell. = *Sclerolaena* sp.

Acknowledgements

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The help provided by the directors of the various Australian herbaria who arranged for material to be sent on loan, and who made available the facilities of their institutions, is also gratefully acknowledged.

References

Aellen, P. (1961. In Hegi, Illustrierte Flora von Mitteleuropa ed. 2. III. 2: 705.

Allioni, C. (1766). Mel. Phil. Mathém. Soc. Turin **3**:177.

Anderson, R. H. (1923). Proc. Linn. Soc. N.S. Wales **48**:317–355.

Baillon, H. E. (1887). Histoires des plantes **9**:177. Paris.

Bentham, G. (1870). *Kochia* and *Chenolea*. Flora Australiensis **5**:183–192.

Bentham, G. (1880). In G. Bentham and J. D. Hooker, Genera Plantarum **3**:59–63. Tribe Chenolea. London.

Bisalputra, T. (1960). Anatomical and morphological studies in the Chenopodiaceae. Austral. J. Bot. **8**:226–242.

Bluff, M. J. et al. (1836–38). *Kochia*. Compendium Flora Germanicae ed. altera. **1**:439. Norimbergae.

Brown, R. (1810). *Kochia*. Prodromus florae Novae Hollandiae et insulae Van-Diemen p. 409. London.

Domin K. (1921). Bibliotheca botanica **89**:623.

Hermann, F. (1956). Flora von Nord-und Mitteleuropa. Stuttgart.

Ising, E. H. (1964). Trans. Roy. Soc. S. Austral. **88**:63–110.

Kuntze, O. (1891). *Bassia*. Revisio generum plantarum **2**:546. Leipzig.

Ledebour, C. F. (1829). *Kochia*. Flora Altaica **1**:411–417. Berlin.

Maerklin, G. F. (1801) *Willemetia*. J. Bot. (Schrader) 1800 (1):329–330.

Moquin-Tandon, C. H. (1834a). *Villemetia*. Ann. Sci. Nat. Ser. 2. **1**:206–211.

Moquin-Tandon, C. H. (1834b). Ann. Sci. Nat. Ser. 2. 2–127.

Moquin-Tandon, C. M. (1840). Chenopodearum monographica enumeratio p. 95. Paris.

Mueller, F. von (1859). Fragmenta Phytographiae Australiae **1**:139.

Mueller, F. von (1869). Fragmenta Phytographiae Australiae **7**:13.

Mueller, F. von (1882a). Fragmenta Phytographiae Australae **12**:12–14.

Mueller, F. von (1882b). Systematic Census of Australian Plants. p. 30, 140. Melbourne.

Necker, N. J. de (1790). *Willemetia*. Elementa Botanica **1**:50. Neuwied.

Roth, A. W. (1801). *Kochia*. Eine neue Pflanzengattung. J. Bot. (Schrader) 1800 (1):303–320.

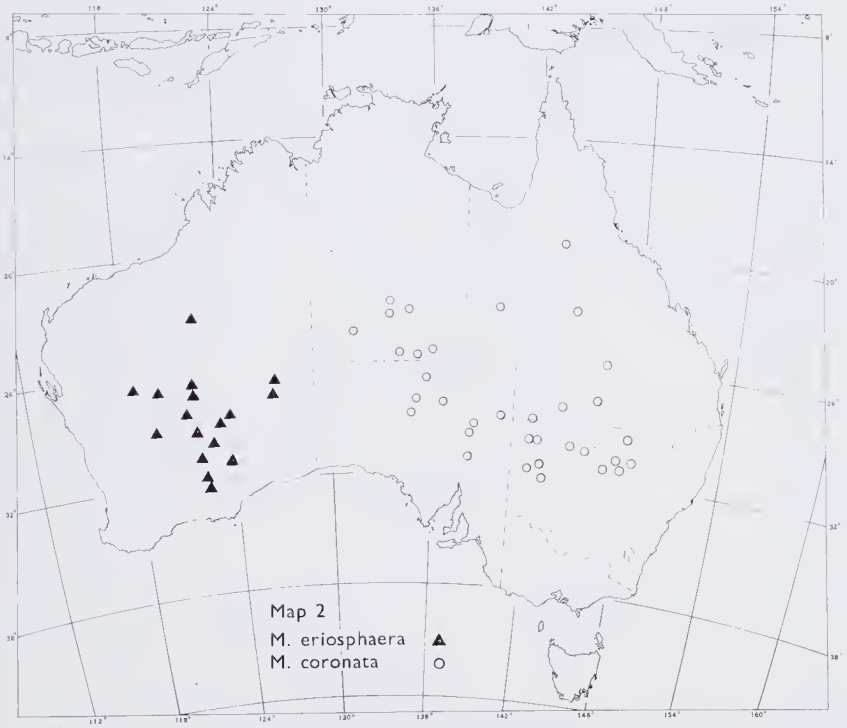
Soyer-Willemet, M. F. (1834). Notes sur les genres qui out recu le mon de *Willemetia*.— Ann. Sci. Nat. Ser. 2. **2**:127–128.

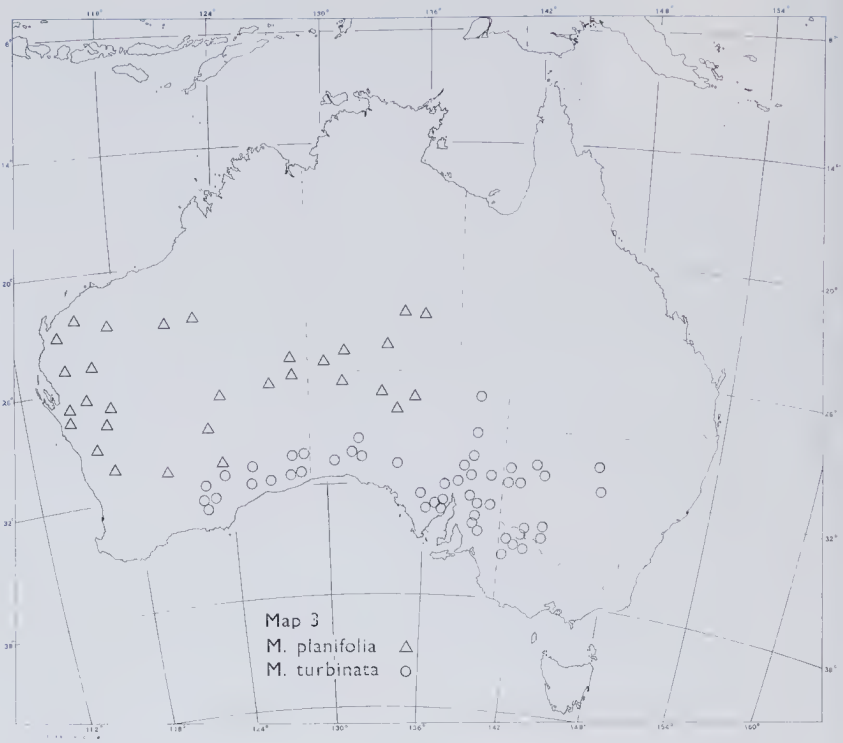
Sprengel, K. P. J. (1825). Systema vegetabilium **1**:924. Gottingen.

Ulbrich, E. (1934). In Engler et Prantl, Die Naturlichen Pflanzenfamilien. ed. 2. 16c:533.

Volken, G. L. A. (1893). In Engler et Prantl, Die Naturlichen Pflanzenfamilien III. 1a:70.

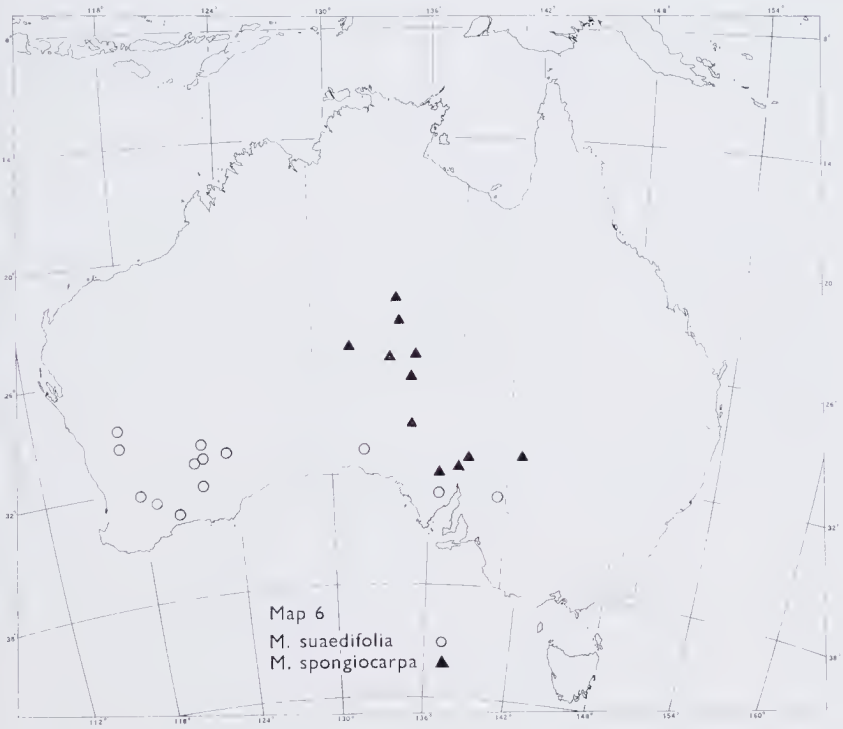

Map 1
M. trichoptera


Map 2
M. eriosphaera
M. coronata


Map 3
M. planifolia △
M. turbinata ○


Map 4
M. villosa ○


Map 5
M. brevifolia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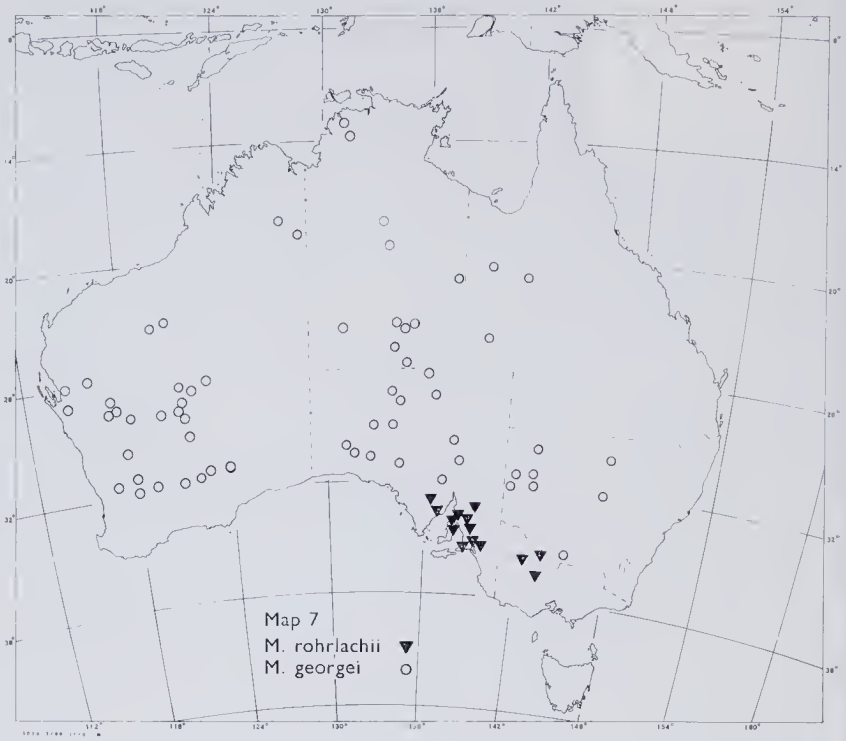
M. spongiocarpa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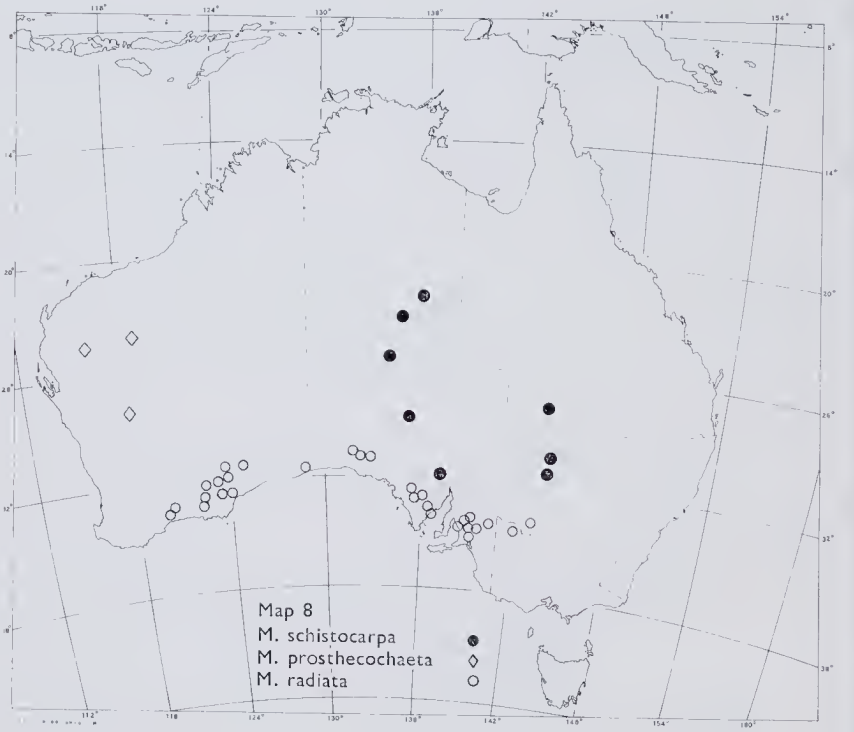
M. rohrlachii
M. georgei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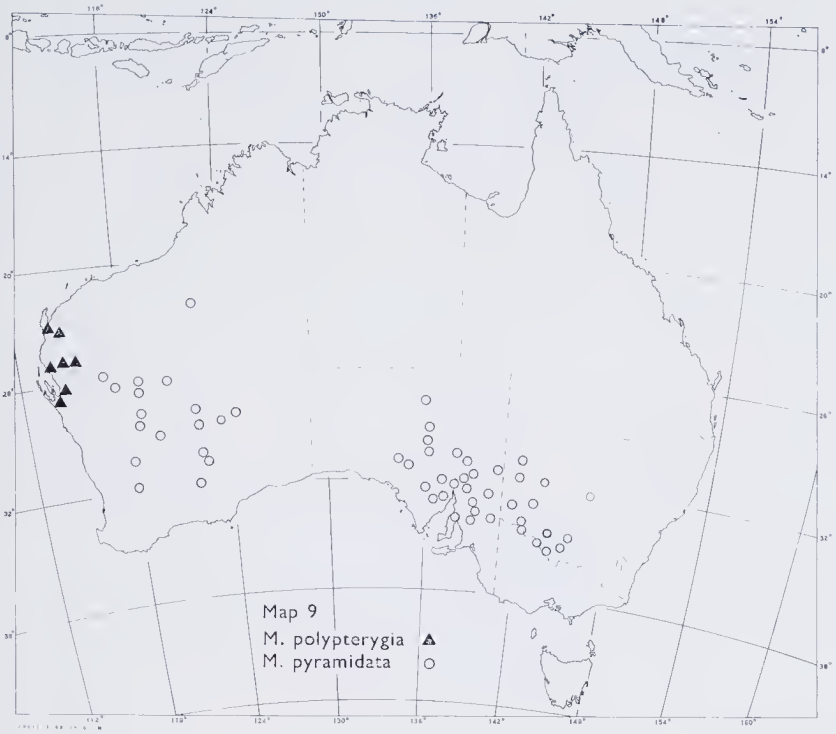
M. prosthecochaeta
M. radiata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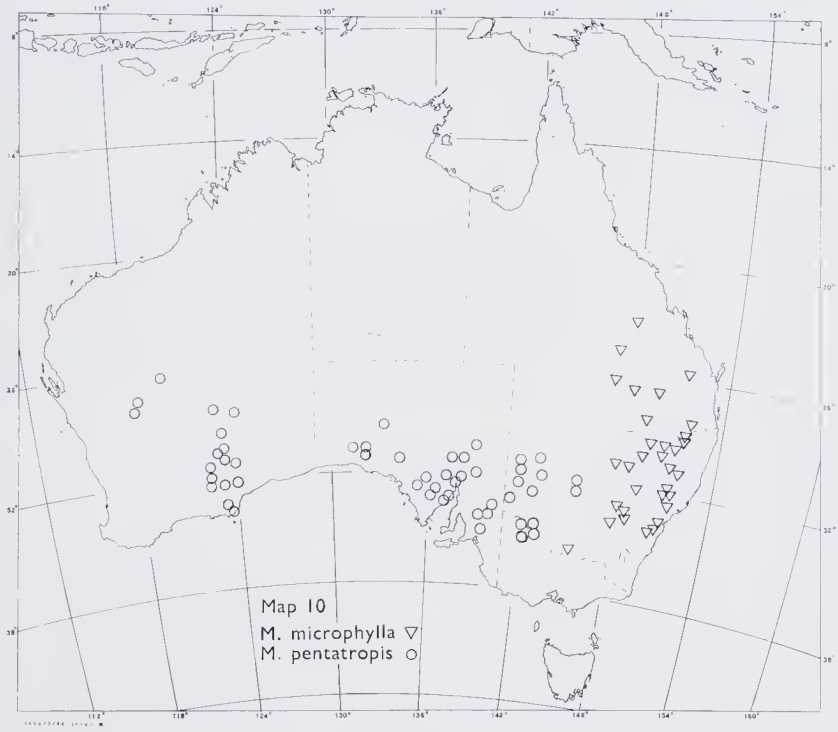
M. pyramidata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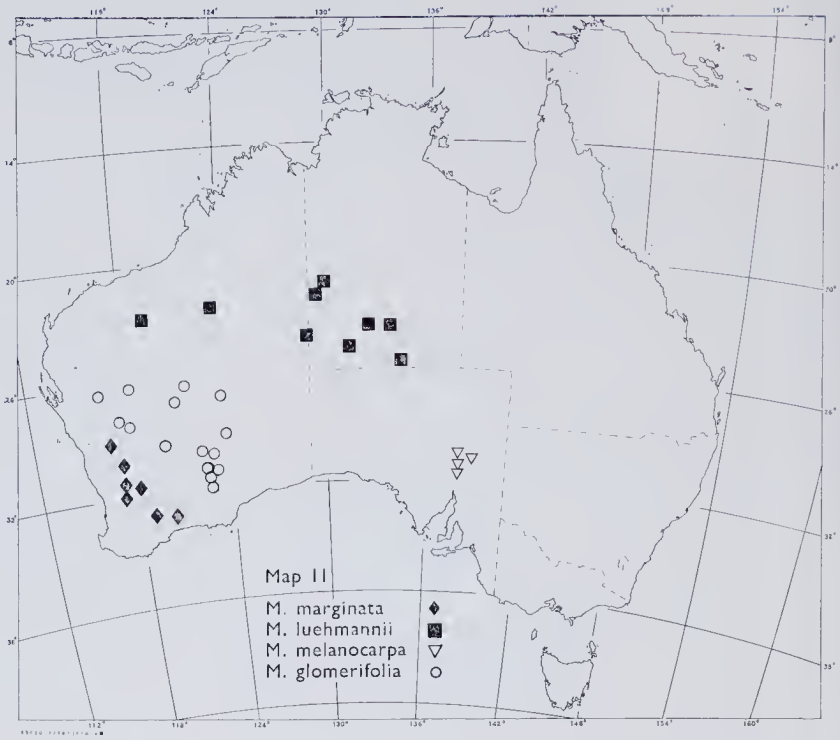
M. pentatropis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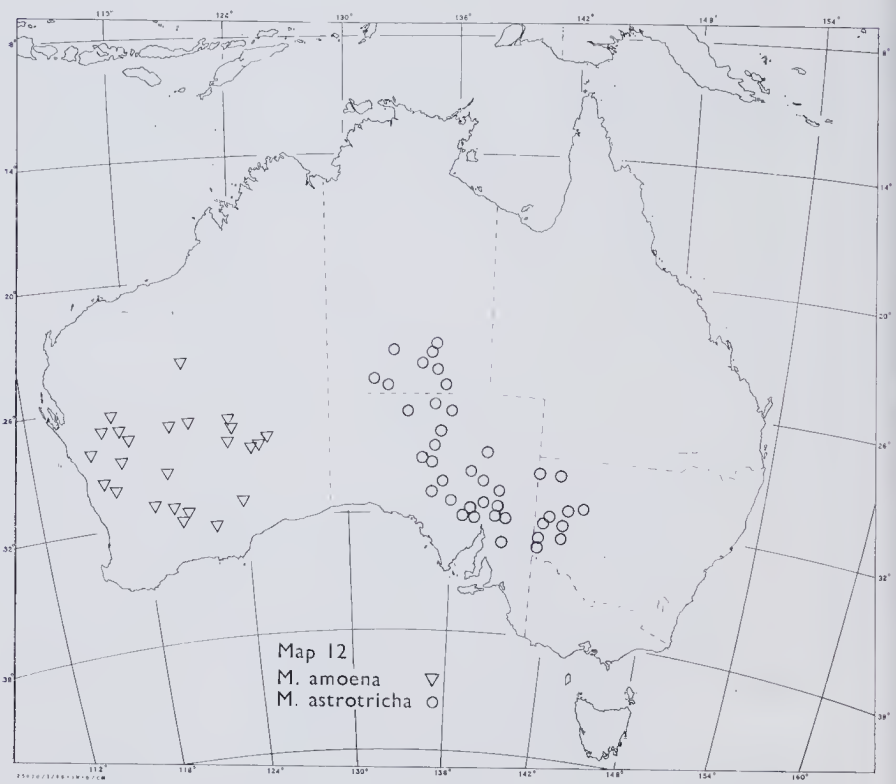
M. marginata
M. luehmannii
M. melanocarpa
M. glomerifolia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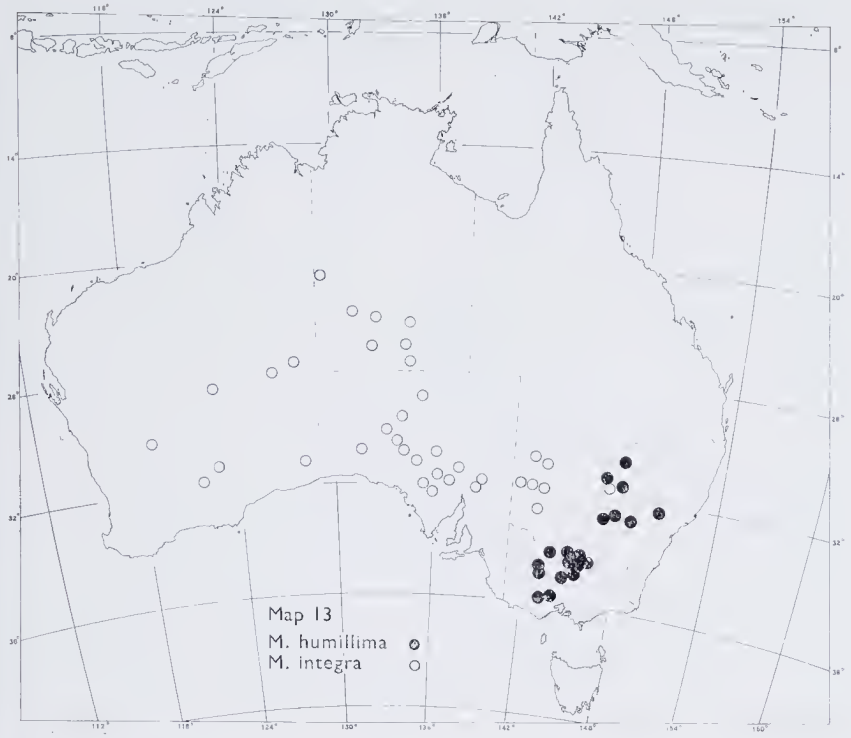
M. astrotricha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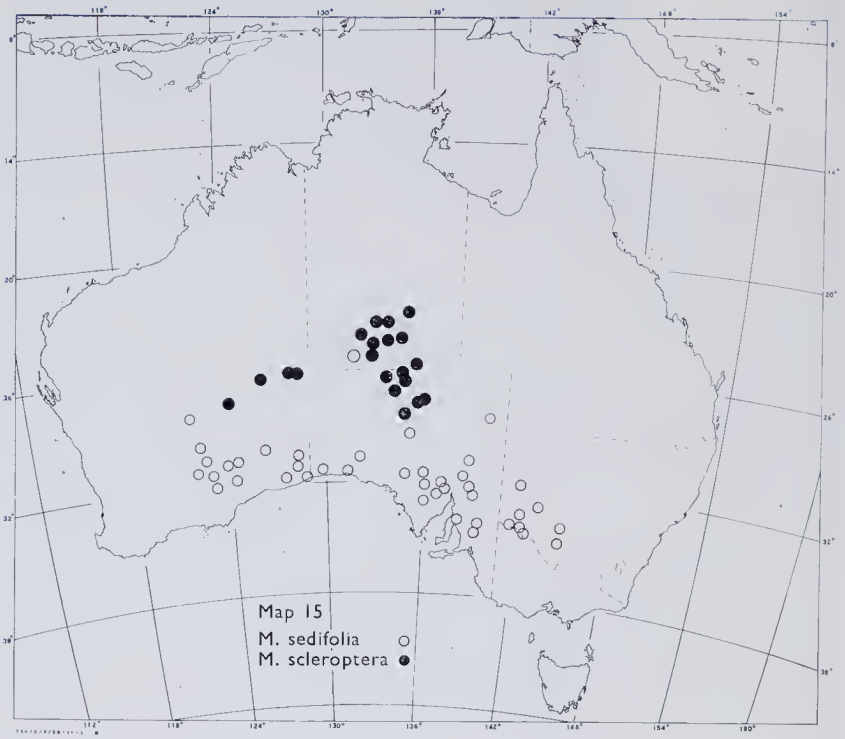
M. humillima
M. integra


Map 14
M. sclerolaenoides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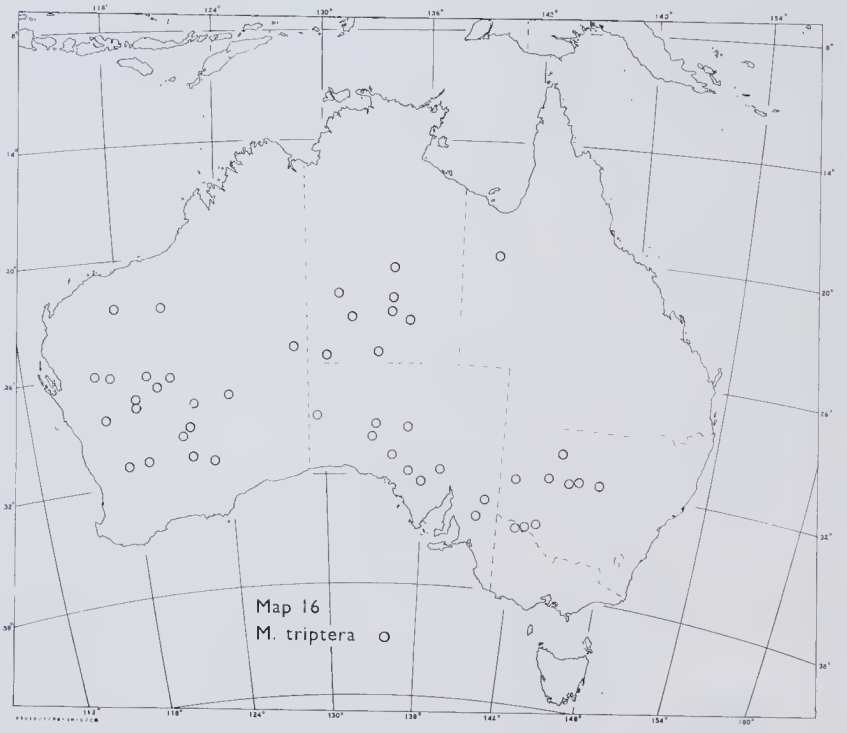
M. sedifolia
M. scleroptera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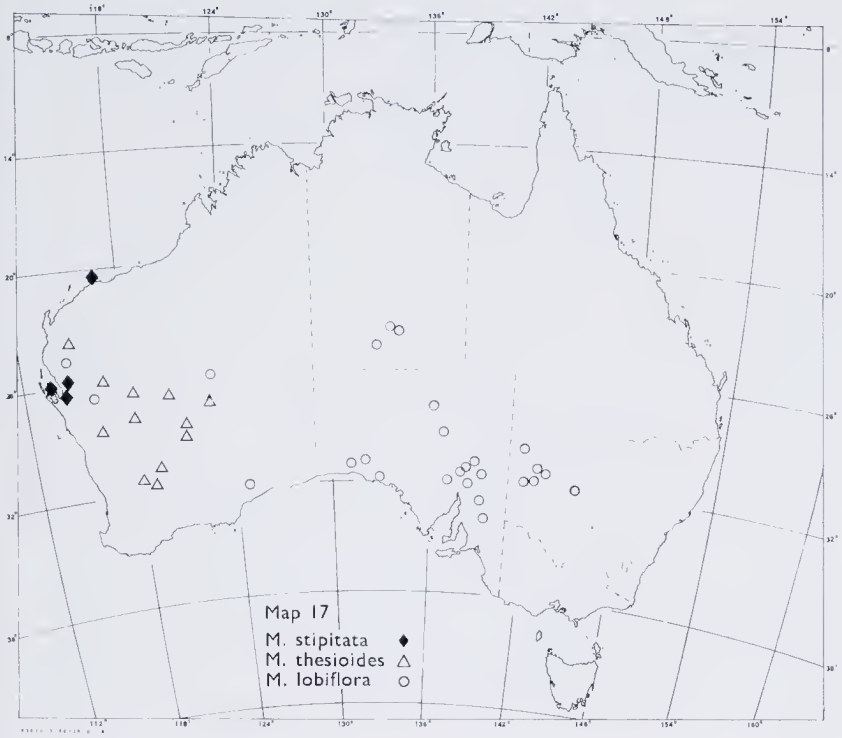
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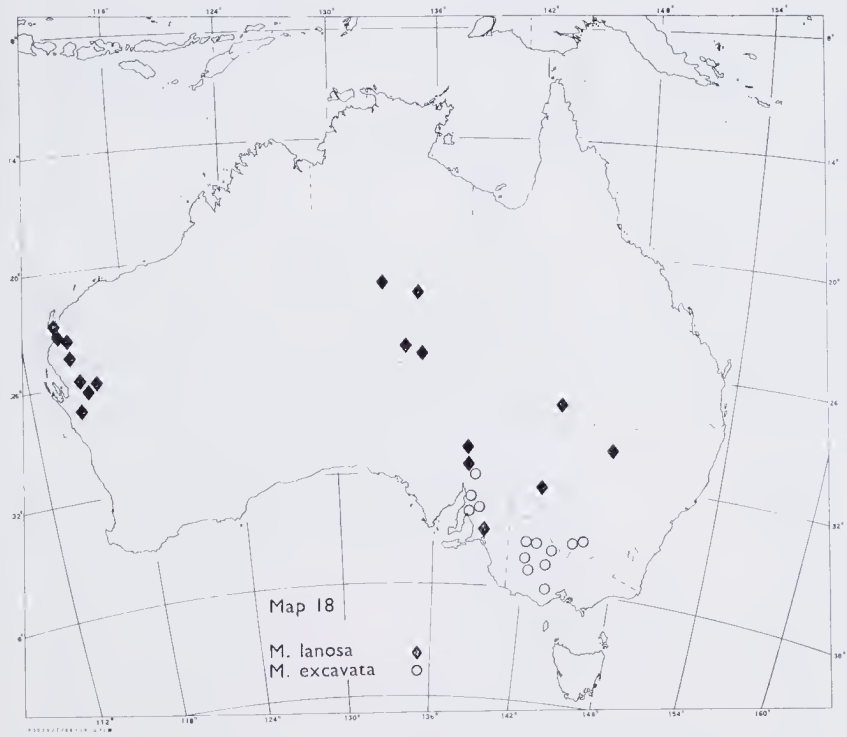
M. thesioides
M. lobiflora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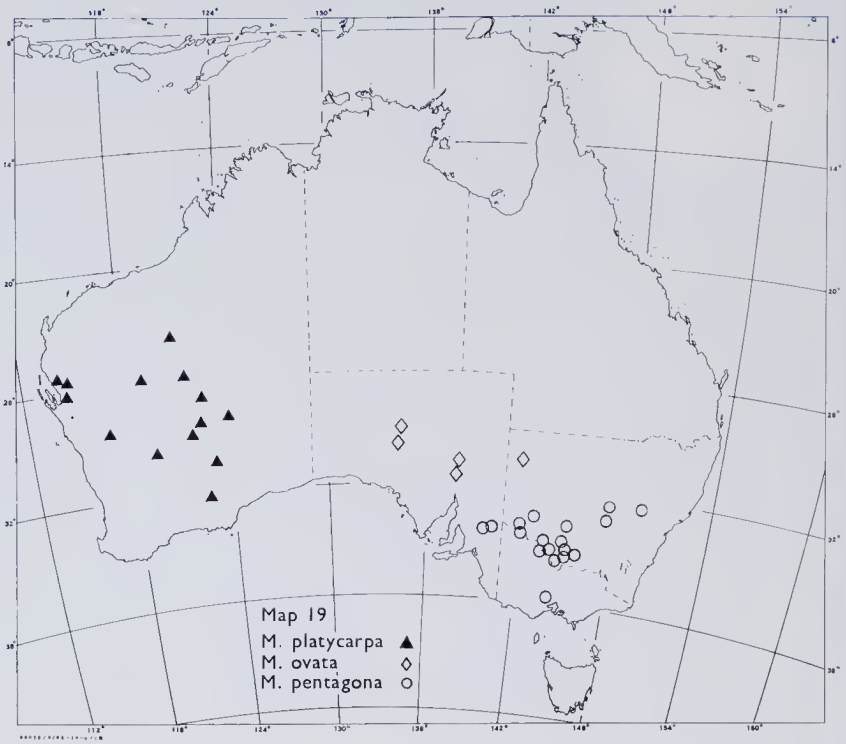
M. lanosa
M. excavata

(3)44205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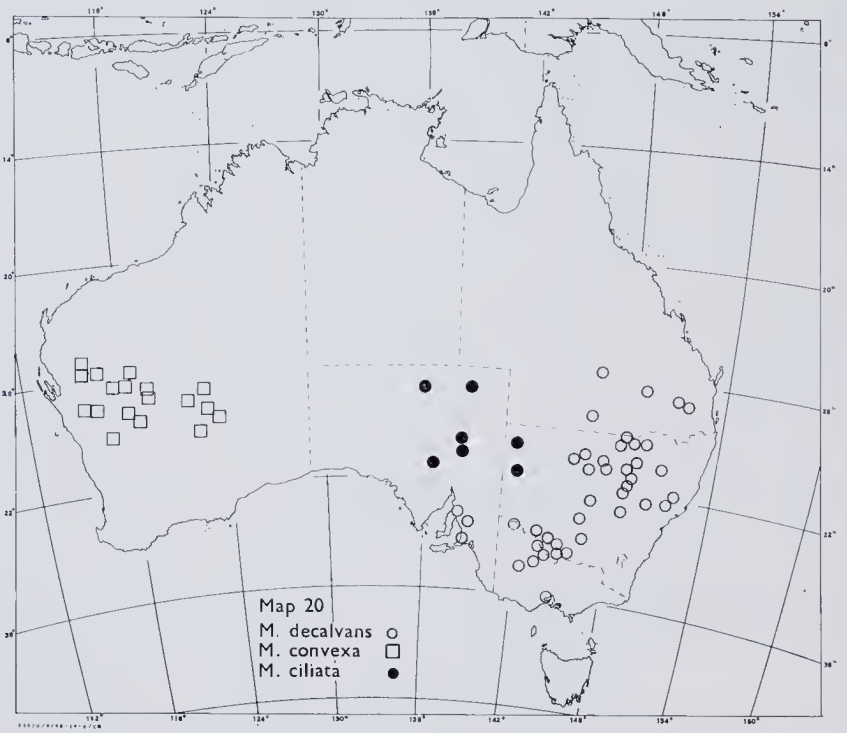
M. ovata
M. pentagona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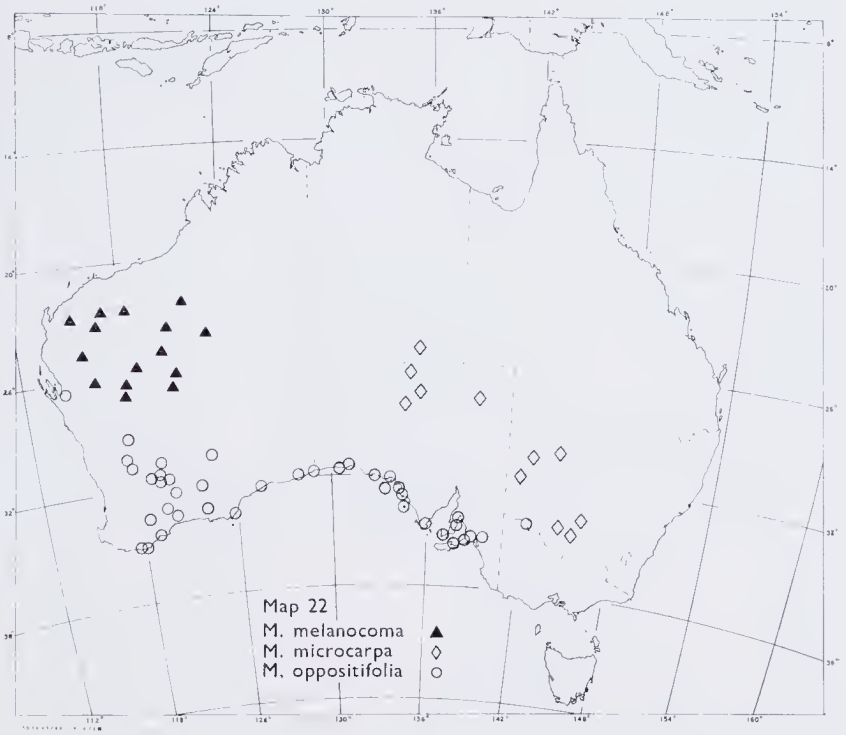
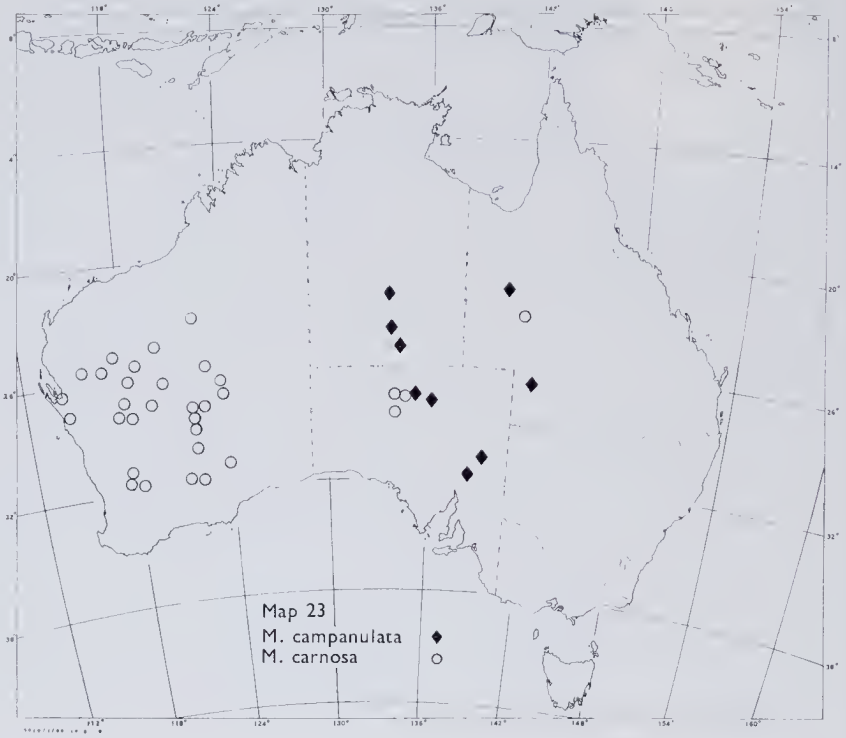
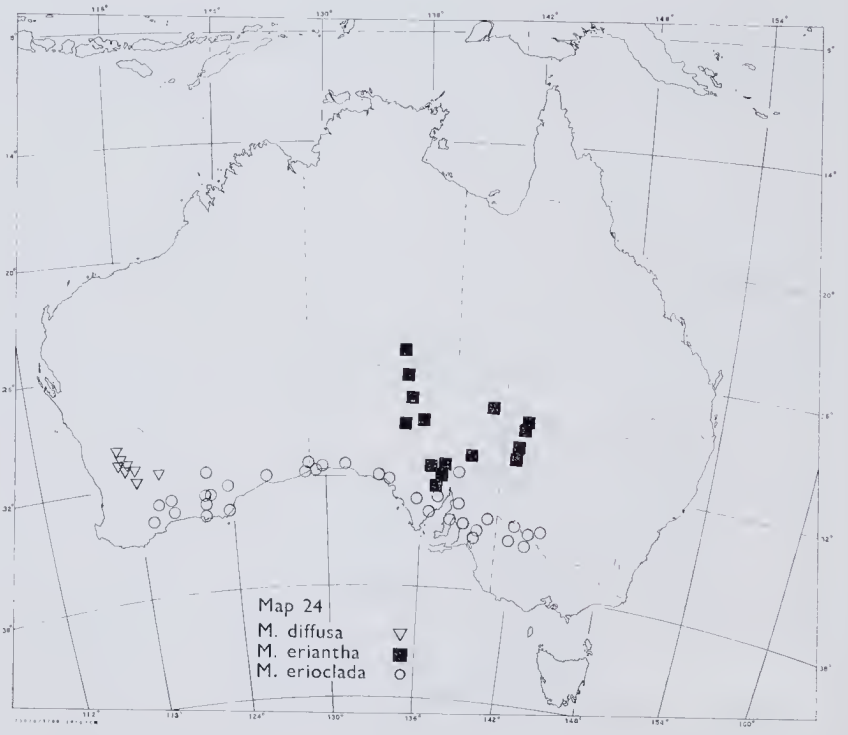
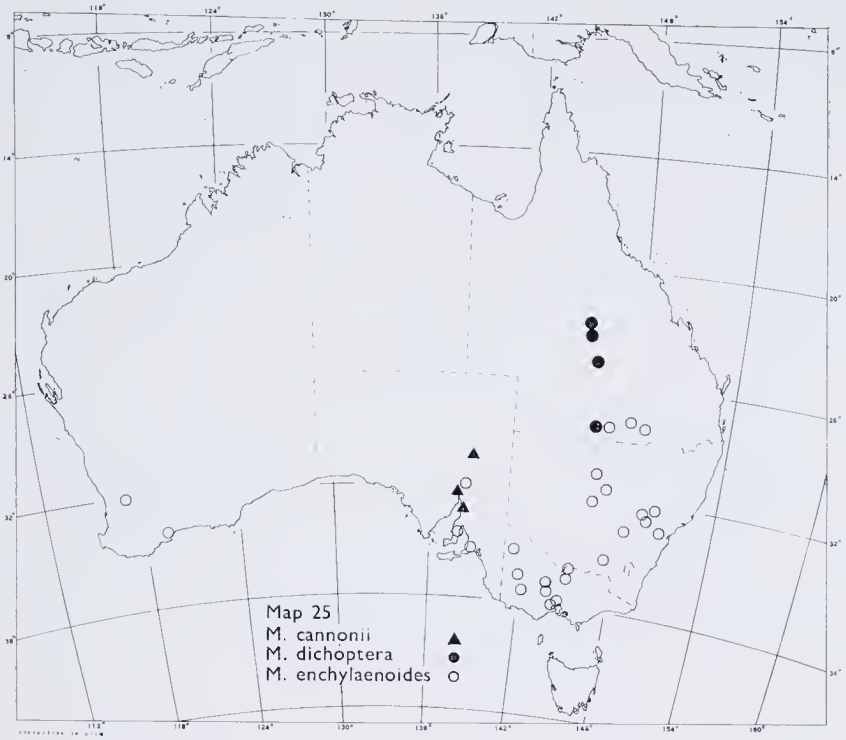
M. decalvans
M. convexa
M. ciliata

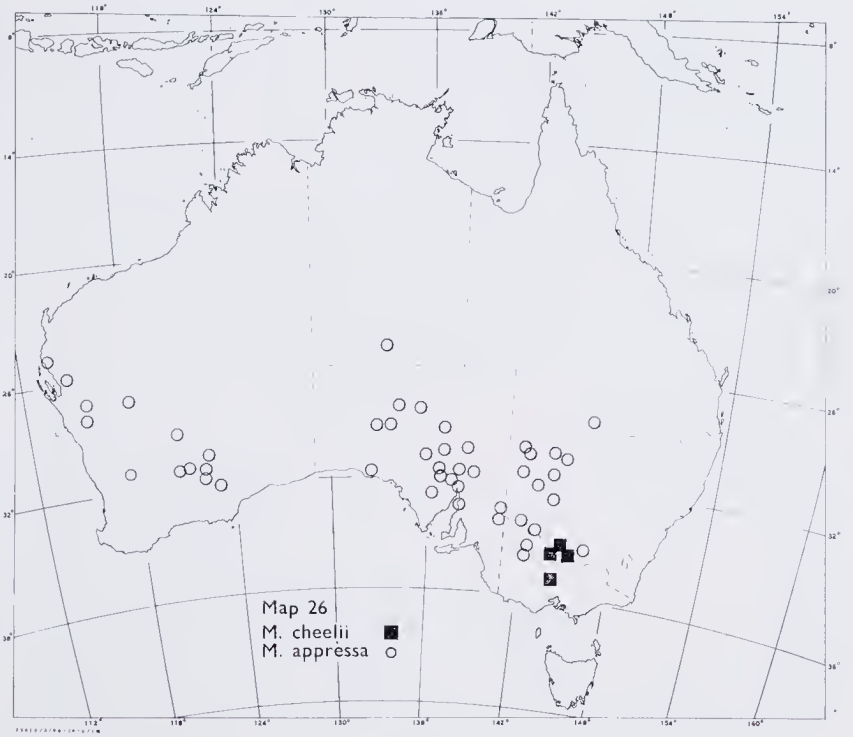

Map 21
M. tomentosa subsp. urceolata
M. tomentosa subsp. tomentosa

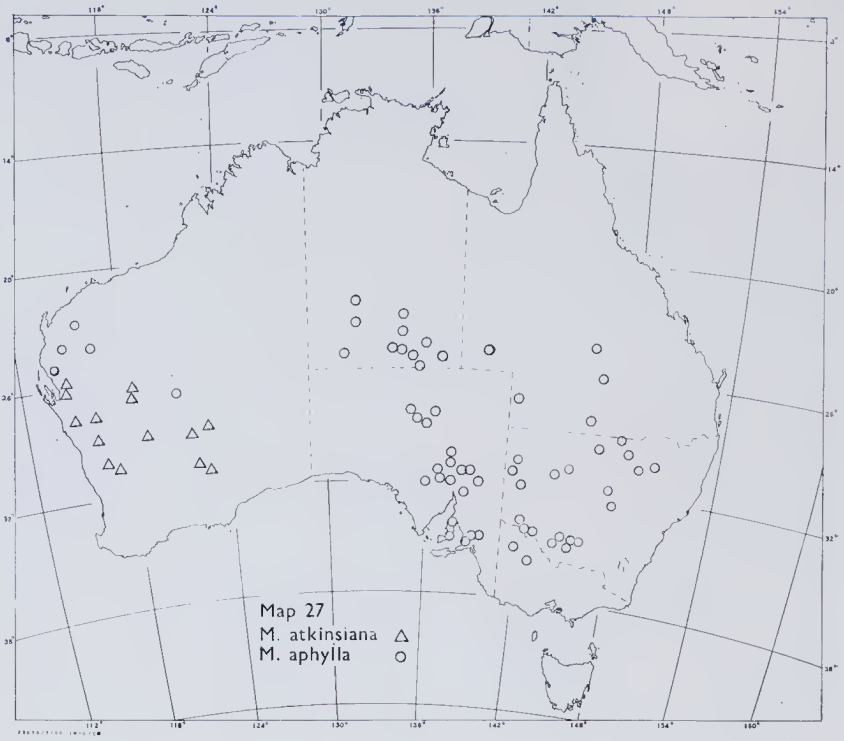

Map 22
M. melanocoma
M. microcarpa
M. oppositifolia


Map 23
M. campanulata
M. carnosa


Map 24
M. diffusa
M. eriantha
M. erioclada


Map 25
M. cannonii
M. dichoptera
M. enchylaenoides


Map 26
M. cheelii
M. appressa


Map 27
M. atkinsiana
M. aphylla

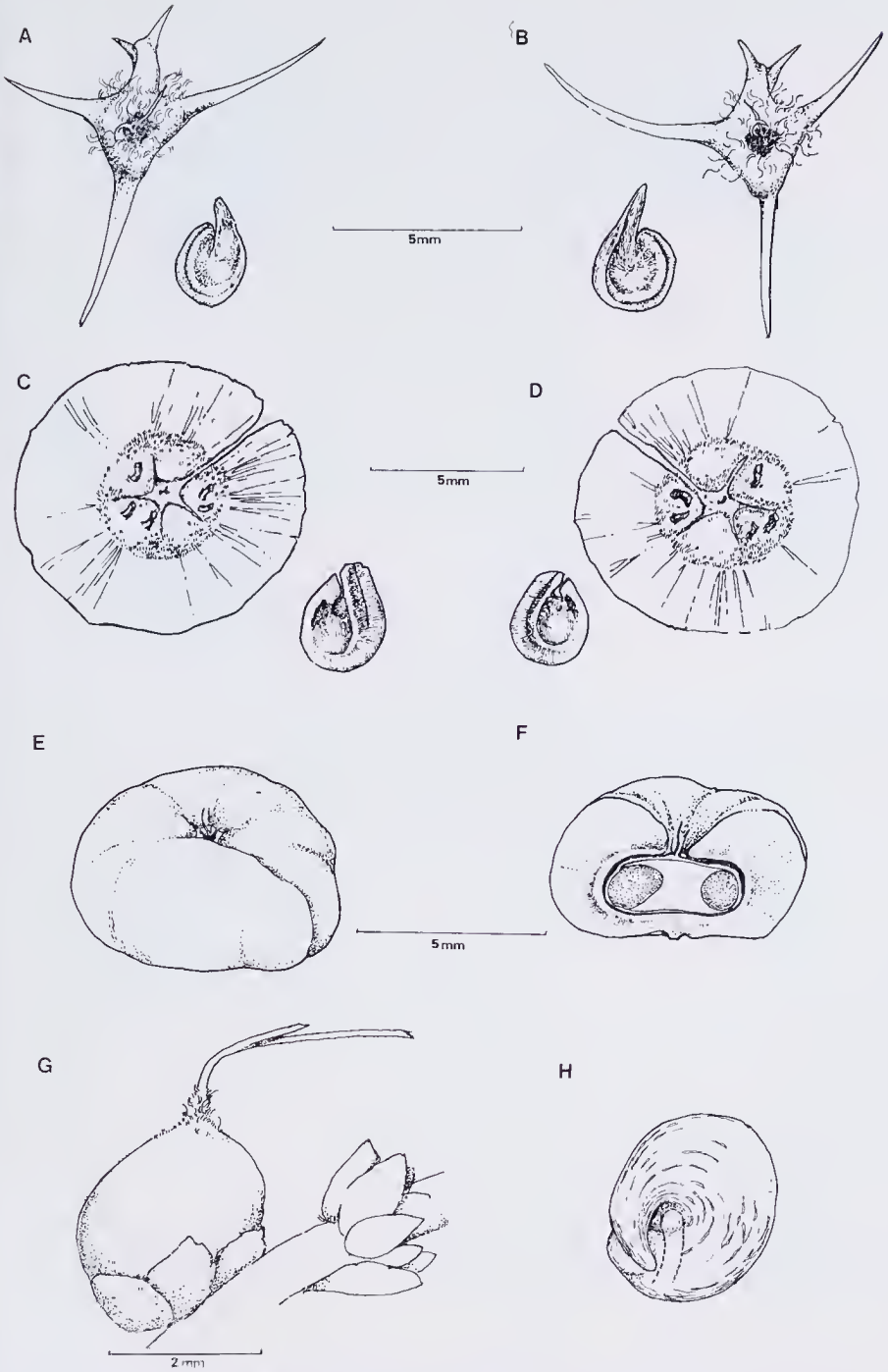


Figure 1. *Bassia costata:* (A) Dextrorse fruit and embryo, (B) Sinistrorse fruit and embryo. *Maireana glomerifolia:* (C) Sinistrorse fruit and embryo, (D) Dextrorse fruit and embryo. *Enchylaena tomentosa:* (E) Fruit, (F) L.S. of fruit. *Roycea spinescens:* (G) Fruit, (H) Embryo.
(A-B from P. Wilson 8985, C–D from P. Wilson 7560, E–F from P. Wilson 10411, G–H from P. Wilson 10964).

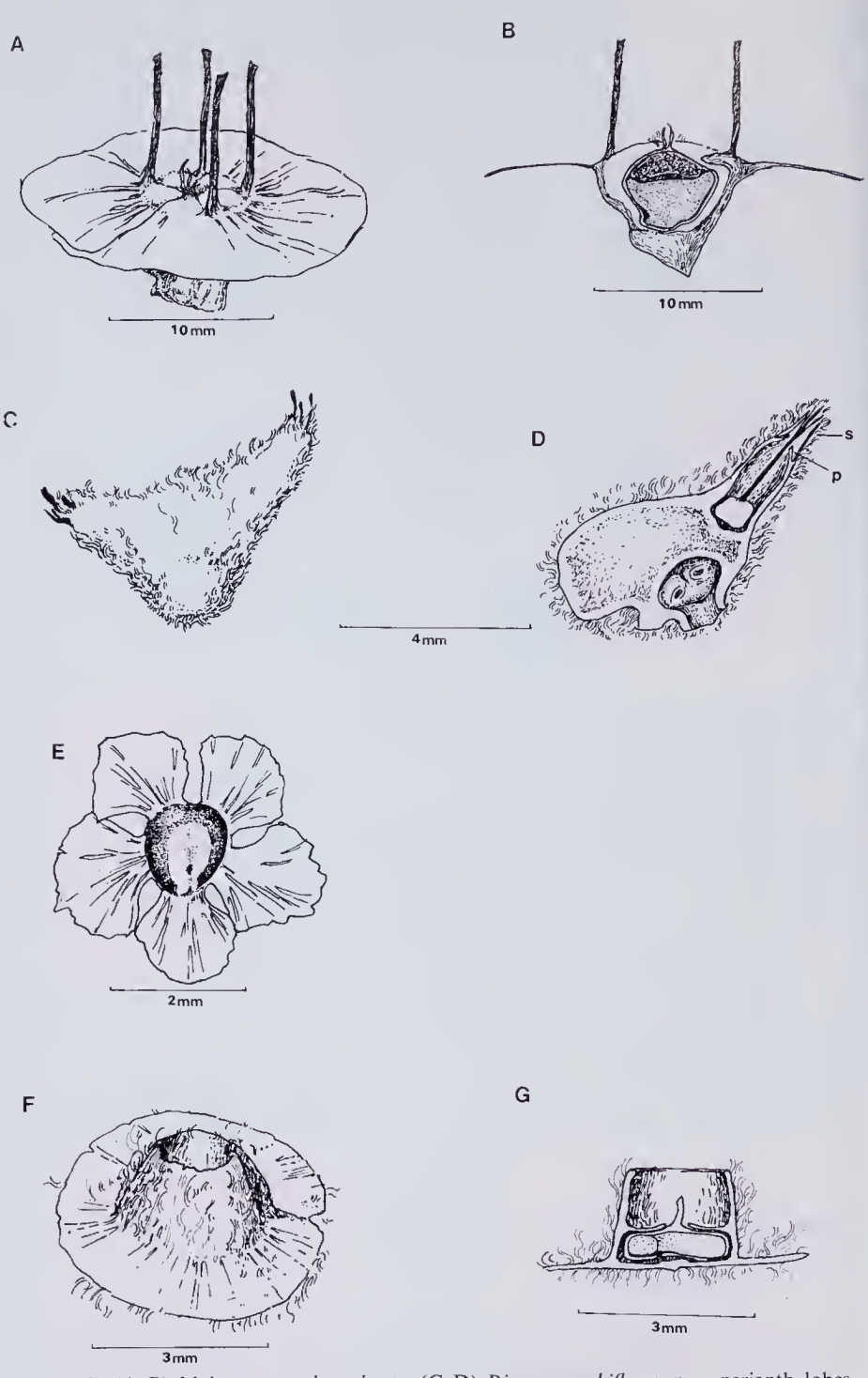


Figure 2. (A–B) *Maireana prosthecochaeta;* (C–D) *Dissocarpus biflorus*, p = perianth lobes, s = spines; (E) *Kochia stellaris*, from below, dissected to show embryo; (F–G) *Maireana coronata*.
(A–B from R. O'Farrell s.n., C–D from R. Kuchel 2863, E from P. Aellen 977, F–G from E. H. Ising, 3 August 1955).

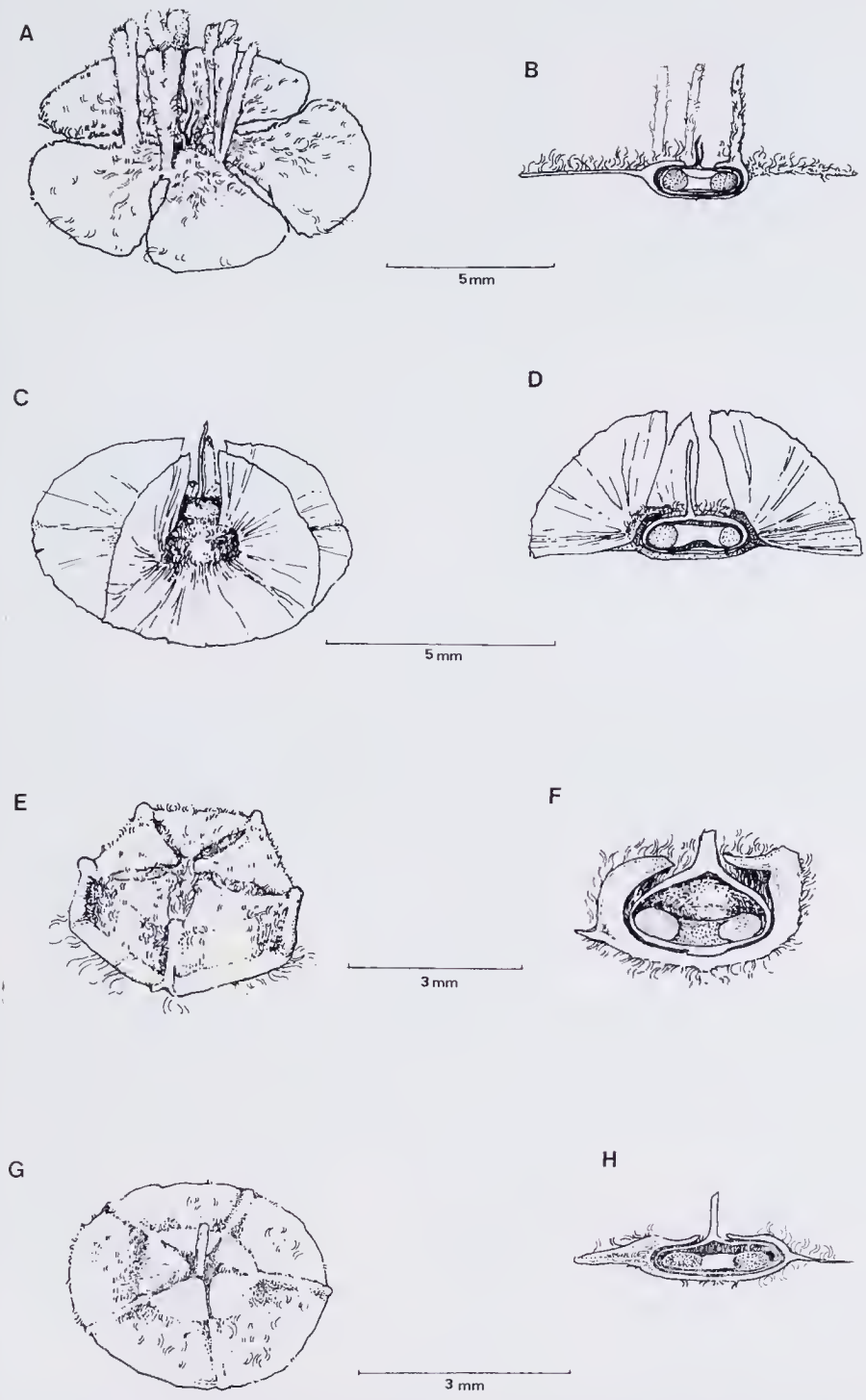


Figure 3. (A–B) *Maireana lobiflora;* (C–D) *M. dichoptera;* (E–F) *M. pentagona;* (G–H) *M. ciliata.*
(A–B from R. Helms s.n., C–D from Schneider s.n., E–F from Eckert s.n., G–H from M. Koch 122).

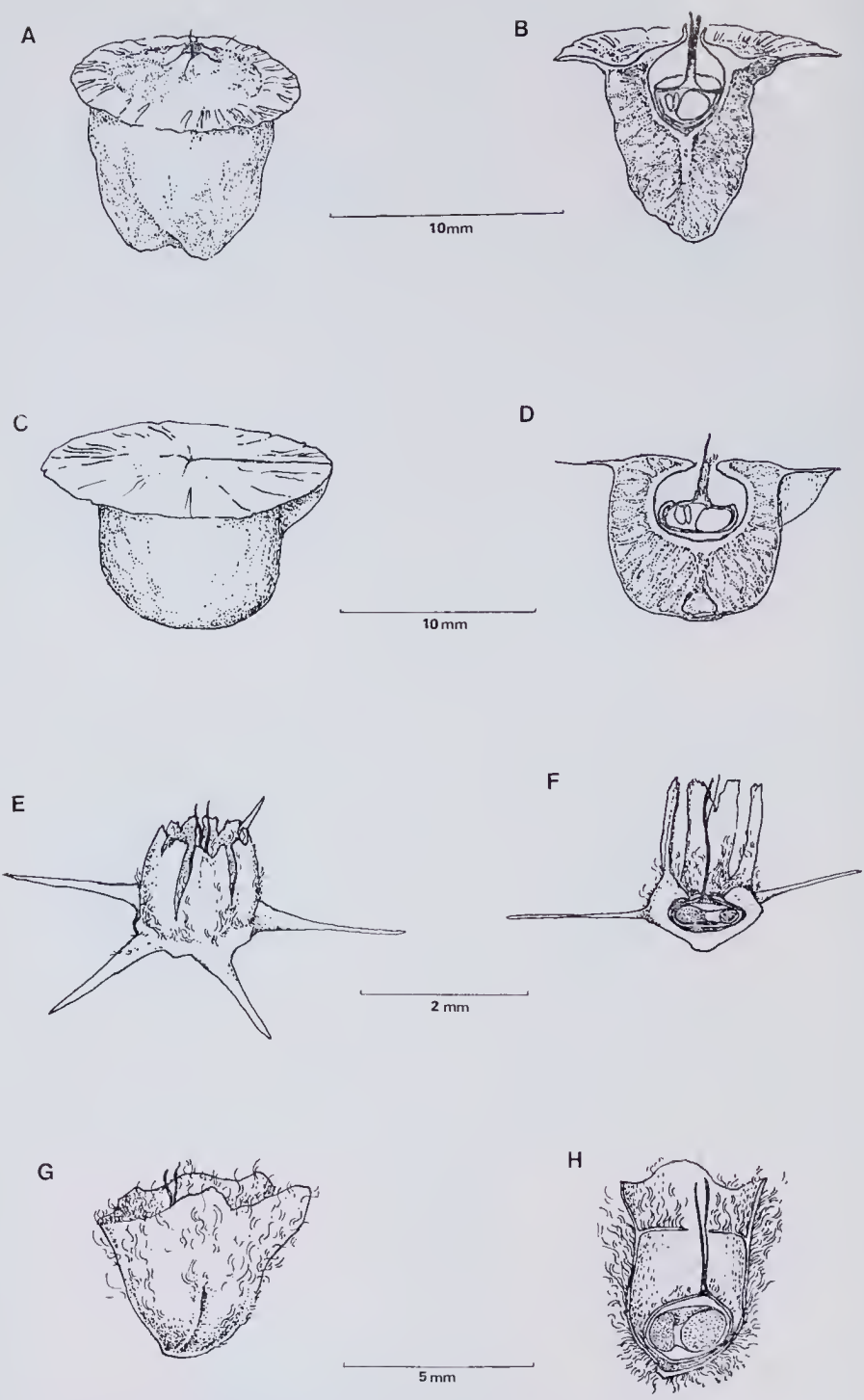


Figure 4. (A–B) *Maireana campanulata*; (C–D) *M. spongiocarpa;* (E–F) *M. sclerolaenoides;* (G–H) *M. eriantha.*
(A–B from R. Kuchel 1085, C–D from N. Lothian 4594, E–F from P. Wilson 3114, G–H from J. Z. Weber 1447).

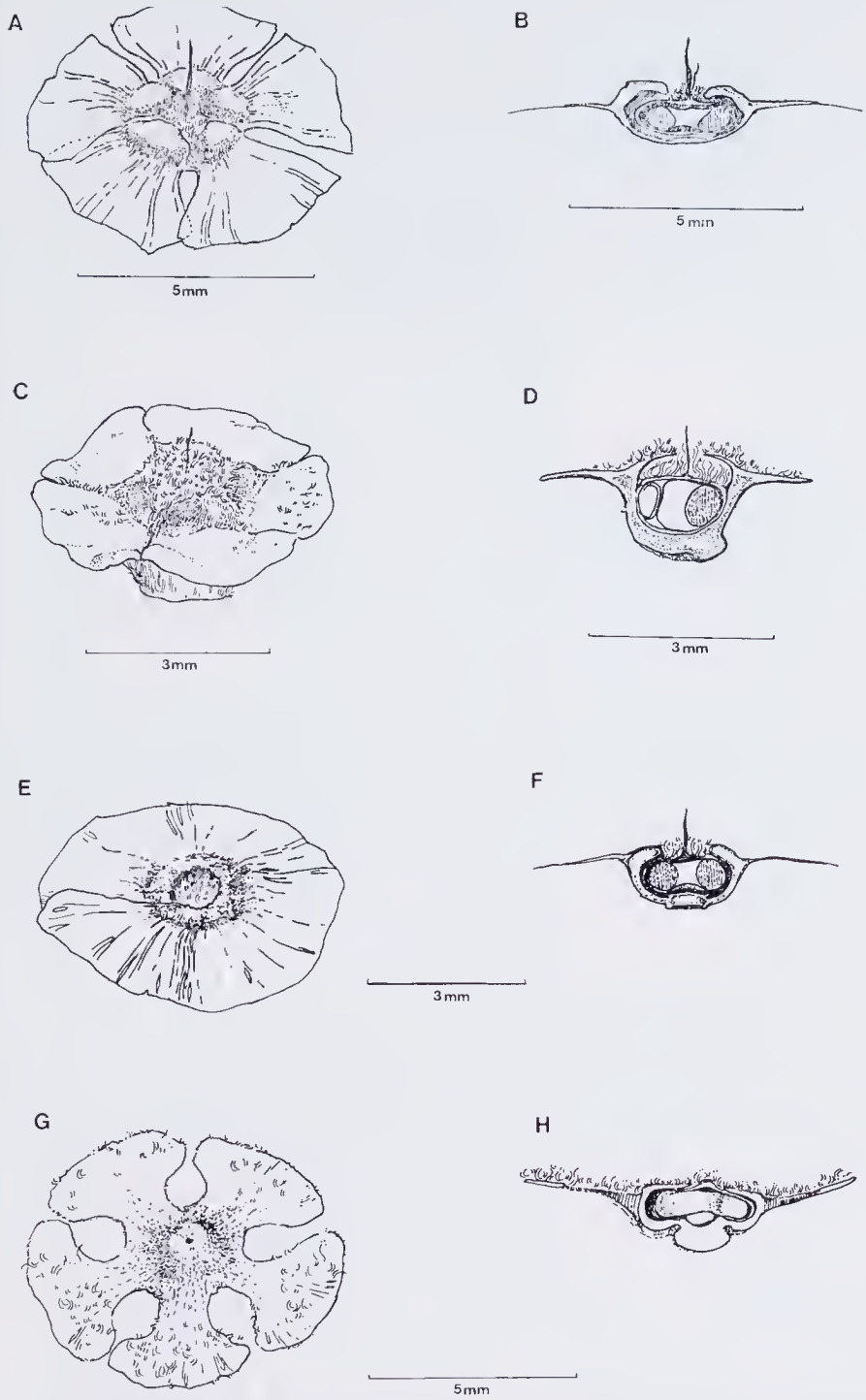


Figure 5. (A.–B) *Maireana brevifolia;* (C–D) *M. amoena;* (E–F) *M. melanocarpa;* (G–H) *M. cheelii.*
(A–B) from T. E. H. Aplin s.n., C–D from P. Wilson 6479, E–F from P. Richards s.n., G–H from D. L. Henderson s.n.).

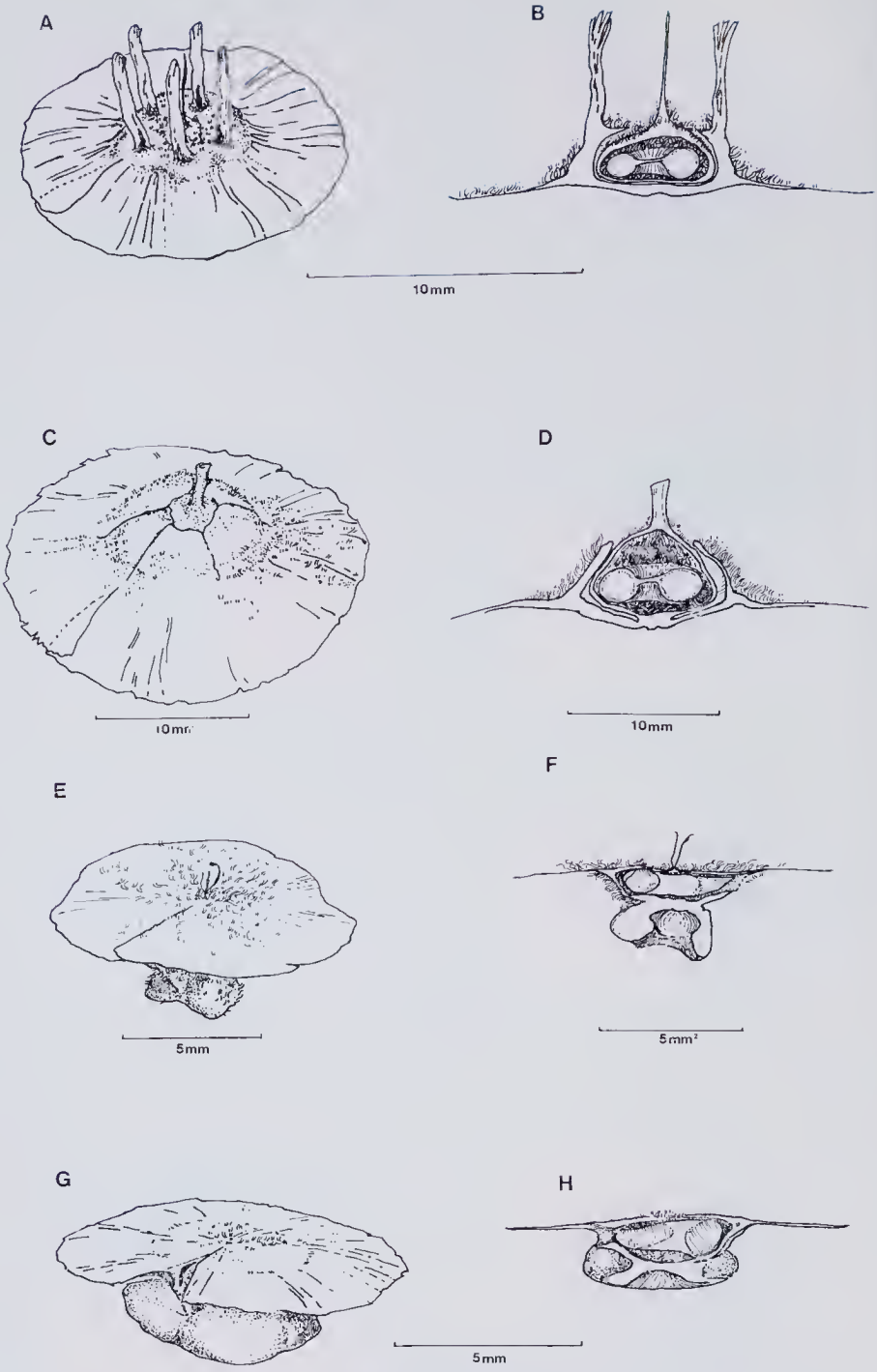


Figure 6. (A–B) *Maireana glomerifolia;* (C–D) *M. platycarpa;* (E–F) *M. trichoptera;* (G–H) *M. excavata.*
(A–B from P. Wilson 8826, C–D from C. V. Malcolm s.n., E–F from A. S. George 4151, G–H from R. Wallace 186.)

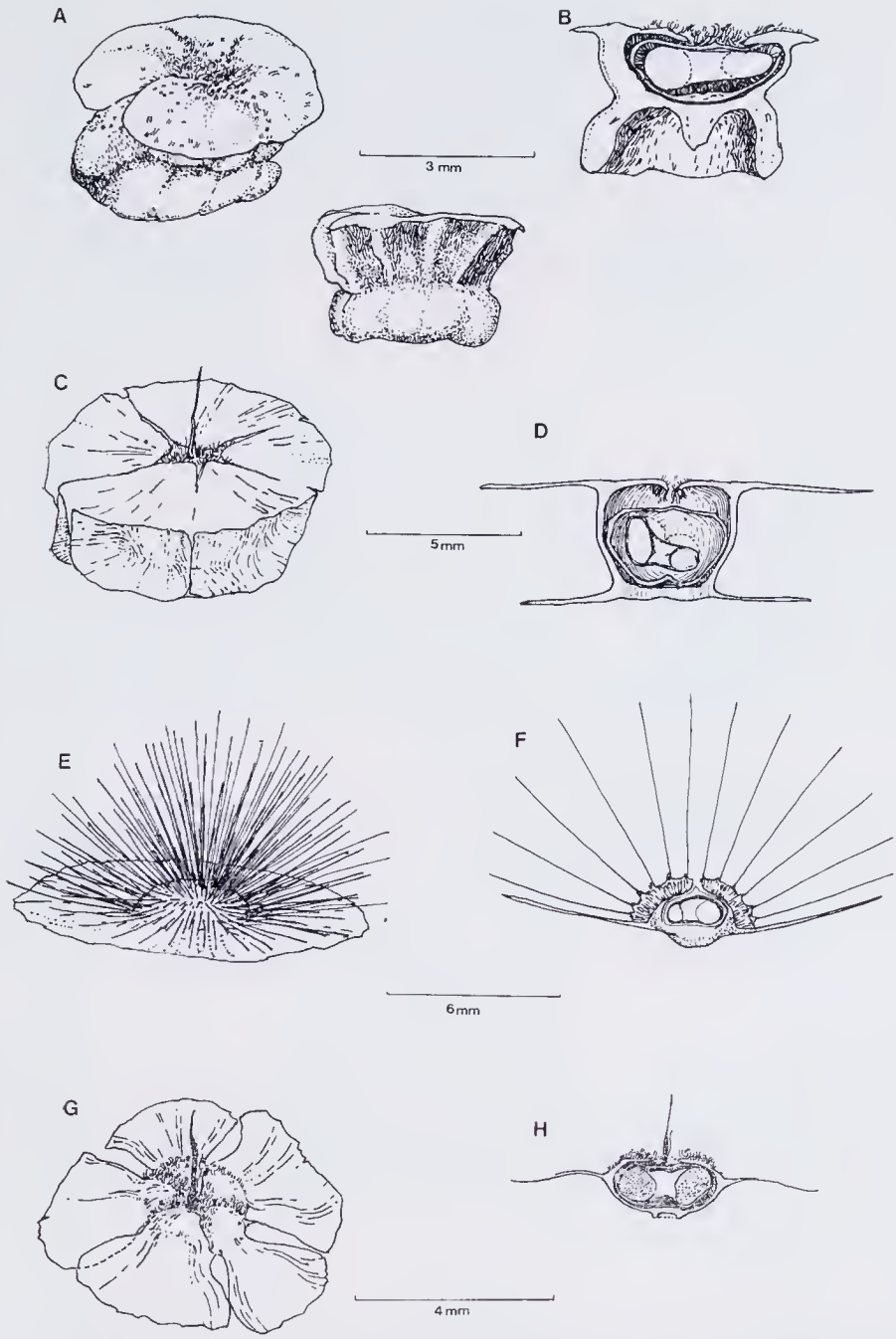


Figure 7. (A–B) *Maireana marginata;* (C–D) *M. polypterygia;* (E–F) *M. melanocoma;* (G–H) *M. diffusa.*
(A–B from P. Wilson 7086, C–D from A. S. George 1250, E–F from A. S. George 999, G–H from P. Wilson 6420.)

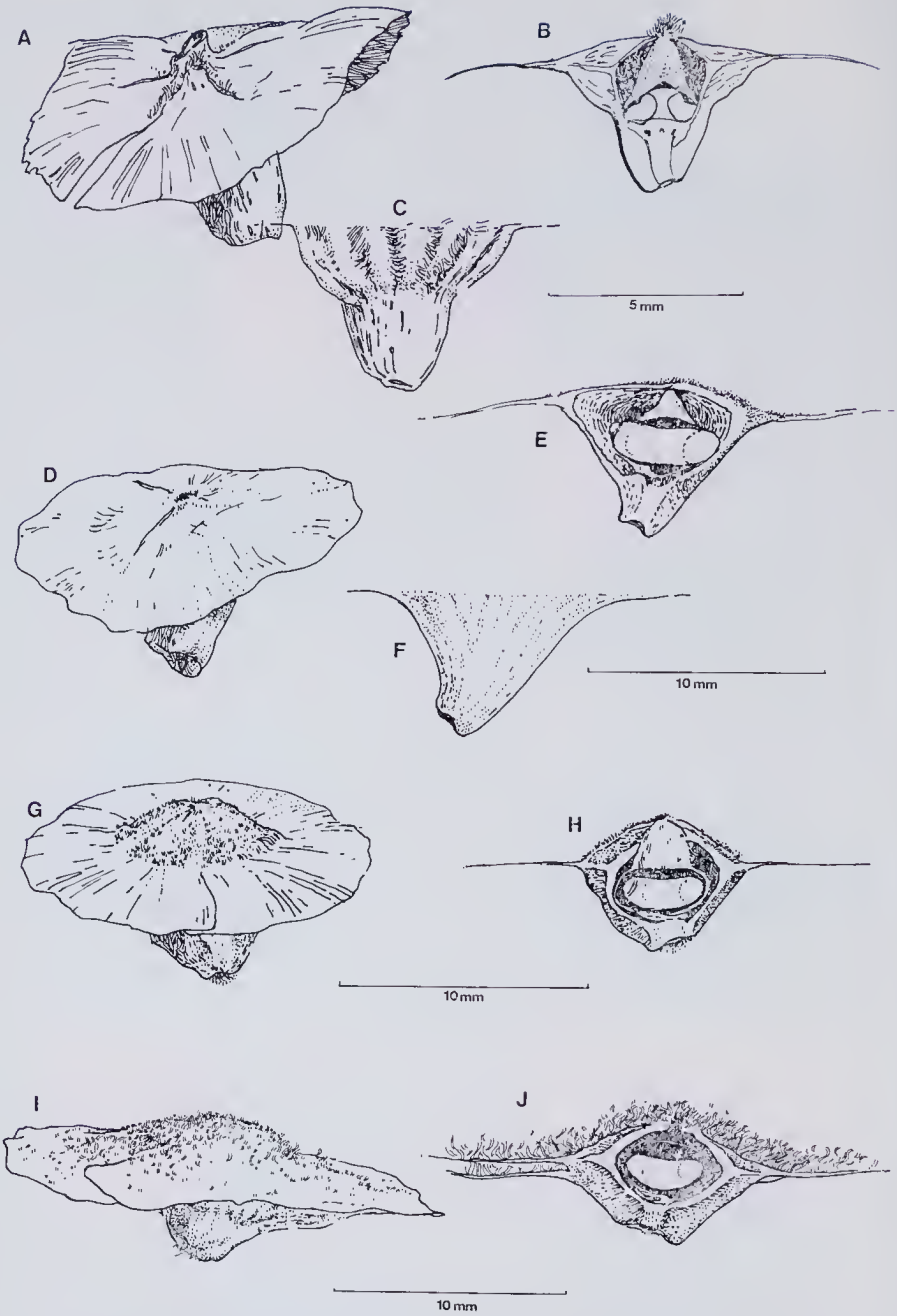


Figure 8. (A–C) *Maireana georgei;* (D–F) *M. turbinata;* (G–H) *M. convexa;* (I–J) *M. murrayana.*
(A–B from K. Newbey 1544, D–F from P. Wilson 7595, G–H from F. H. Sharr 2731, I–J from D. L. Wilcox 164.)

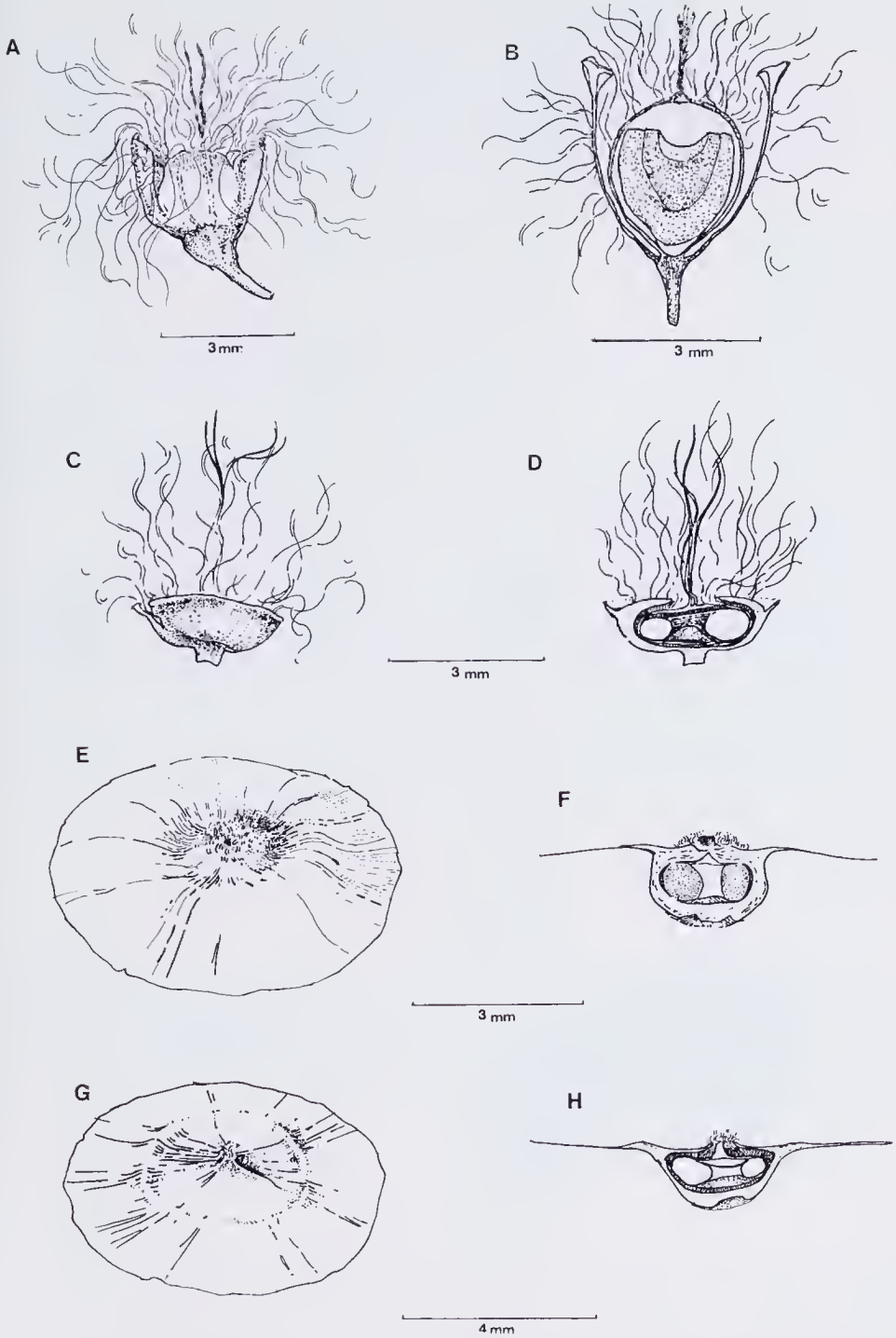


Figure 9. (A–B) *Maireana eriosphaera;* (C–D) *M. carnosa;* (E–F) *M. tomentosa* subps. *urceolata;* (G–H) *M. tomentosa* subsp. *tomentosa.*
(A–B from P. Wilson 10564, C–D from A. Ashby 2597, E–F from J. B. Cleland s.n., G–H from P. Wilson 10486).

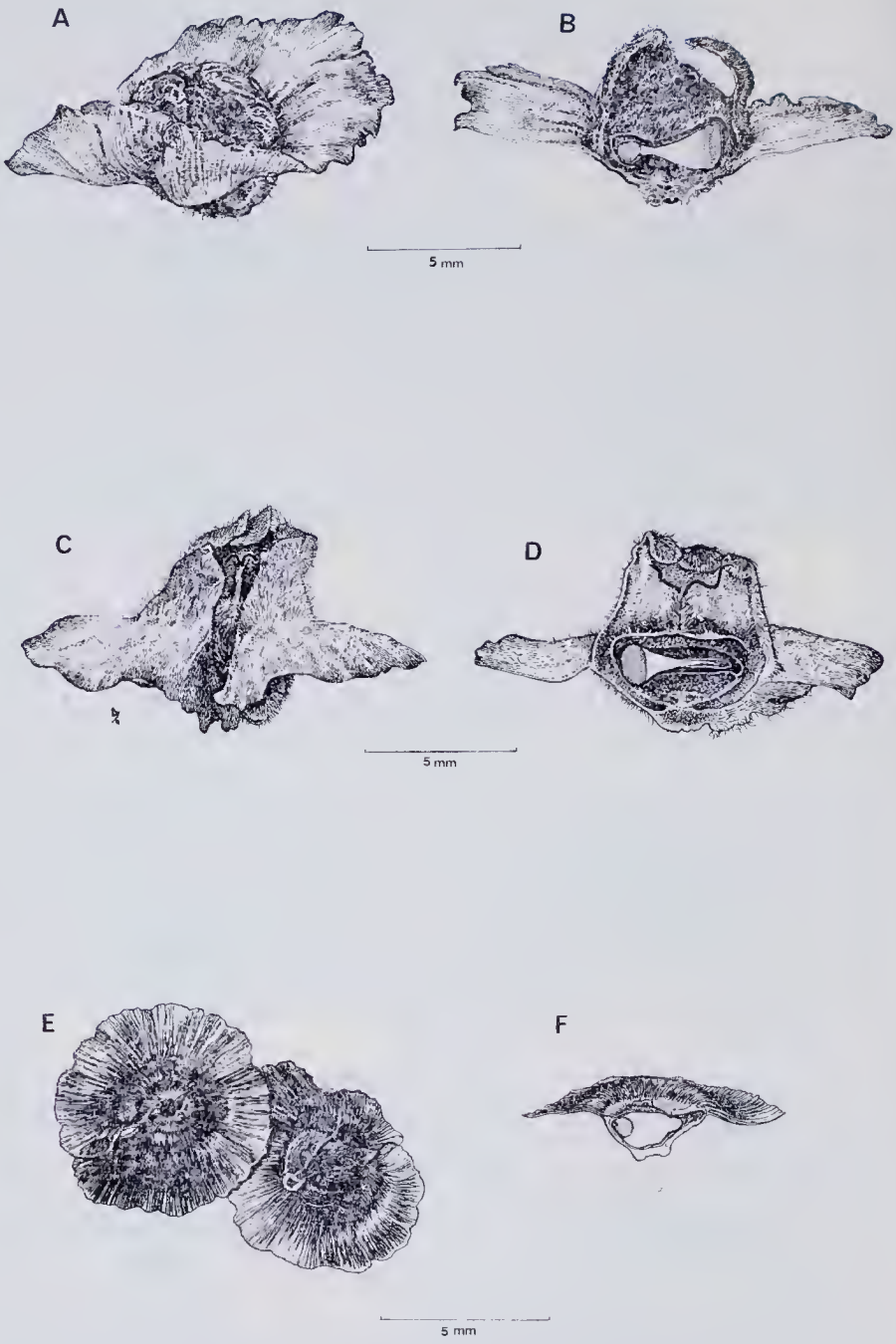


Figure 10. (A–B) *Mairecana pyramidata;* (C–D) *M. schistocarpa;* (E–F) *M. villosa.* (A–B from P. Wilson 9894, C–D from P. K. Latz 3160, E–F from A. S. George 4936).

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