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Malleostemon, a new genus of Myrtaceae (subfamily Leptospermoideae, tribe Chamelaucieae) from south-western Australia

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Abstract

Green, J. W. *Malleostemon,* a new genus of Myrtaceae (subfamily Leptospermoideae, tribe Chamelaucieae) from south-western Australia. Nuytsia 4(3): 295-315 (1983). The new genus *Malleostemon* differs from the closely related genera *Thryptomene, Micromyrtus* and *Corynanthera* in having geniculate stamens; in addition, some individuals of all species have an eccentric style-base allied with the placenta, while three species may have a several-flowered inflorescence. Two new species are described, *M. minilyaensis* J. W. Green and *M. pedunculatus* J. W. Green, while four new combinations are made, based on names of species formerly included in *Thryptomene* or *Micromyrtus: Malleostemon hursthousei* (W. V. Fitzg.) J. W. Green, *M. peltiger* (S. Moore) J. W. Green, *M. roseus* (E. Pritzel) J. W. Green and *M. tuberculatus* (E. Pritzel) J. W. Green. All six species are described, illustrated and their distributions mapped.

Introduction

Malleostemon is based principally on the character of the geniculate stamens, in which the large connective gland is situated at an apparent right angle bend at the top of the filament, so that the anther is borne towards the style. This character was noticed by only one author of a previously-published species (see discussion under *Malleostemon roseus).* Among the genera of the Chamelaucieae it appears to be unique to *Malleostemon* and invariable in it; its occurrence in *Baeckea* and related genera is discussed below. *Malleostemon* shows several other character tendencies which do not occur in *Thryptomene, Micromyrtus* or *Corynanthera;* these are also discussed below.

Study methods and specialised terminology are as explained by Green (1979, 1980a and 1980b).

The term peduncle is used here to refer to the stalk of a solitary flower, as this structure is interpreted as homologous with the peduncle of an inflorescence of 2 or more flowers; both types are common in *Malleostemon.*

The terminology used here for bracts and bracteoles may also need some explanation. Whether they are solitary or form part of a 2 or more-flowered inflorescence, the flowers of *Malleostemon* seem always to be subtended by 2 bracteoles. In addition, an inflorescence of 2 or more flowers is usually subtended by 2 further structures, here called bracts. The bracts are situated at the summit of the peduncle, while bracteoles subtend the flower: these positions are usually indistinguishable in practice, however, as pedicellate flowers are always solitary in *Malleostemon.* The term lectoparatype is used here to refer to a syntype not chosen as a lectotype. A character known for only one or two species is usually omitted from the descriptions of species for which it is unknown. Type citations not on specimen labels are indicated by square brackets. The species are described in alphabetical order.

Malleostemon J. W. Green, gen. nov.

Frutex; folia opposita, decussata; *inflorescentia* 1-3-flora; *sepala* herbacea; *stamina* geniculata, 10 vel 5, antisepala et (vel) antipetala; *ovula* 4-8, placentatio apicalis.

Typus: M. roseus (E. Pritzel) J. W. Green

Shrub, erect. *Leaves* sessile or nearly so, opposite, decussate, entire, gland-dotted. *Inflorescence* of 1-3 flowers in the upper axils, each flower subtended by 2 conduplicate bracteoles; if 2-3 flowered the flowers also collectively subtended by 2 conduplicate bracts. *Conflorescence* if present resembling a terminal or subterminal spike-like raceme. *Flowers* small, not exceeding 7 mm across the open petals; *floral tube* obconical, turbinate, campanulate or urceolate, scarcely produced above the ovary, smooth, rugose or with 5 antesepalous ribs; *sepals* 5, herbaceous, except the scarious margins; *petals* 5, white or pink; *stamens* 10, borne on a narrow staminophore and opposite sepals and petals, the antepetalous ones slightly longer than the antesepalous, or stamens 5, antesepalous or antepetalous, occasionally a few 5-stamened flowers in an otherwise 10-stamened species; *stamens* geniculate or hammer-like, owing to the presence of a conspicuous connective-gland opposed to the introrse anther; *anther* bisporangiate (rarely apparently unisporangiate), bilocular or unilocular (Green 1980a), dehiscing by linear stomia converging above; *style* slender, equalling the stamens, the base often eccentric, owing to the vascular trace bending sharply towards the placenta, which arises from a lateral pocket under the disc, sometimes the style-base and placenta central or nearly so; *ovules* 4-8, radially arranged on a peltate placenta. *Fruit* formed from the scarcely enlarged and hardened floral tube together with the often persistent perianth; *seed* solitary, usually filling the fruit, ellipsoid or reniform; *testa* membranous, pale brown or appearing reddish-brown owing to the adherent tanniferous inner ovary wall; *embryo* having a massive, white, fleshy clavate or cylindrical hypocotyl (sometimes known as a radicle), and a short, slender, curved and sometimes twisted neck bearing two minute linear or semiorbicular cotyledons lying against the hypocotyl.

The new genus belongs to the group of genera in the tribe Chamelaucieae containing *Thryptomene, Micromyrtus* and *Corynanthera* (Bentham 1867, Green 1979). It is distinguished from those genera by geniculate stamens, an eccentric style-base having a common origin to the placenta (found in some flowers of all species) and a tendency towards a 2-3 flowered inflorescence (found commonly in *M. hursthousei* and *M. tuberculatus* and occasionally in *M. roseus*); in addition, the sepals are herbaceous-tipped, a character rare in the above genera, the petals, stamens and sometimes sepals are often pink or pink-tinged, and the placenta is peltate.

Malleostemon has six species restricted to the south-west of Western Australia, occurring between Shark Bay and the eastern goldfields north of Esperance. The plants occur mainly in low shrublands, often with mallee species of *Eucalyptus,* on predominantly sandy or clayey soils.

Etymology. The name combines the Latin *malleus,* a hammer, and the Greek *stemon,* a thread or stamen, referring to the geniculate or hammer-like stamens typical of the genus.

Key to the species

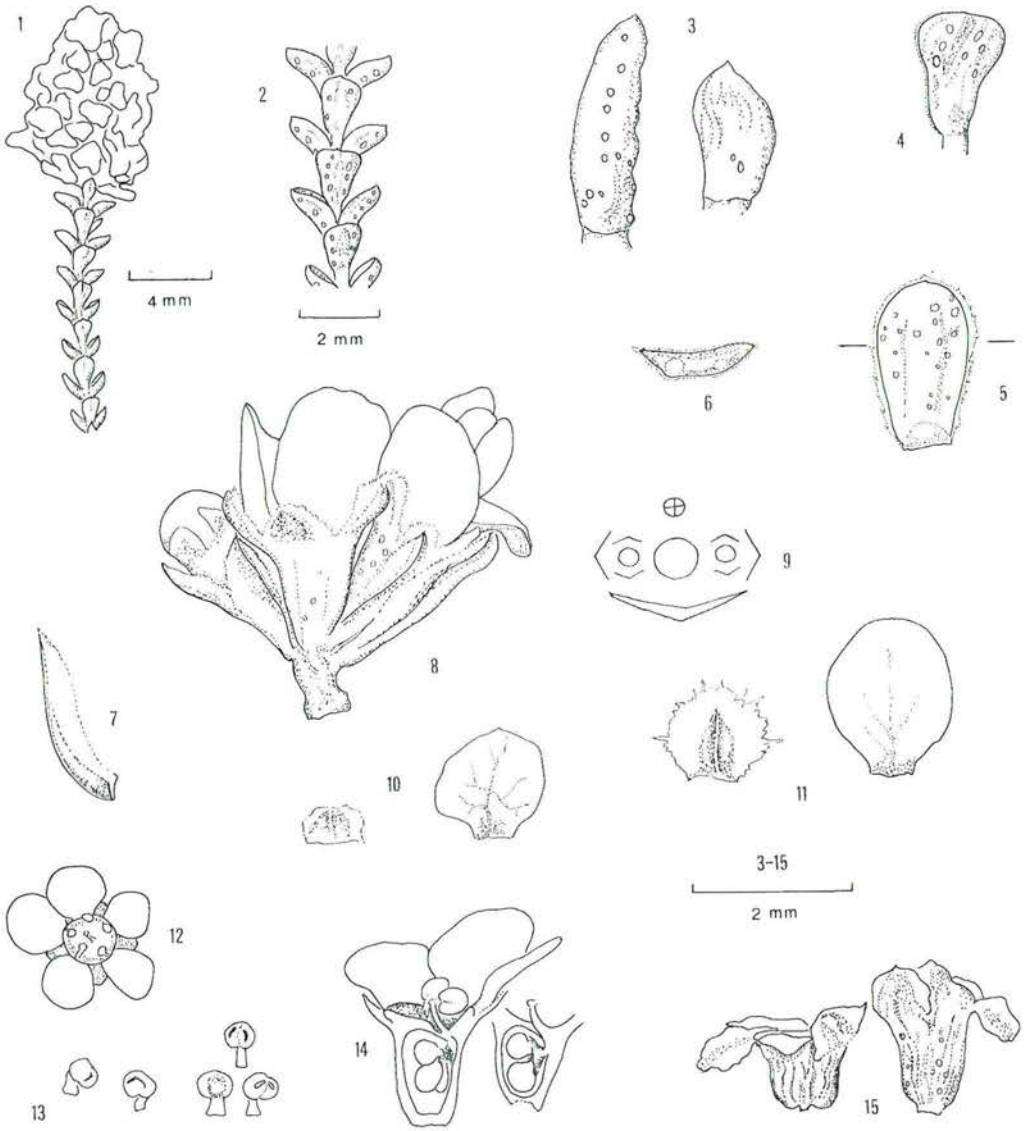
1. Stamens 10
   2. Inflorescence pedunculate
      3. Floral tube campanulate to urceolate; leaves plano-convex, not conduplicate, thick, less than 1 mm wide, oil-glands raised when dry; stamens 5 or 10. . . . . 5. *M. roseus*
      3. Floral tube turbinate to obconic; leaves concavo-convex, more or less conduplicate, mostly 1.5 mm wide, oil-glands immersed; stamens 10. . . . . 3. *M. pedunculatus*
   2. Inflorescence sessile
      4. Leaves peltate, almost spherical, 1 mm thick. . . . . .4. *M. peltiger*
      4. Leaves basifixed, concavo-convex, 0.5 mm thick . . . . 2. *M. minilyaensis*
1. Stamens 5
   5. Leaves 1-3 mm long, plano- or concavo-convex, lacking a terminal mucro; stamens antepetalous; inflorescence 1-several-flowered
      6. Leaves shortly petiolate; stamens above 0.7 mm long; bracts or bracteoles deciduous; flowers solitary or occasionally in triads; stamens 5 or 10
         7. Inflorescence 1-3 flowered, pedunculate; leaves elliptical to oblong, plano-convex; oil-glands raised. . . . . .5. *M. roseus*
         7. Inflorescence 1-flowered, sessile; leaves orbicular, concavo-convex . . . . . .2. *M. minilyaensis*
      6. Leaves broad-based, sessile; stamens below 0.6 mm; bracts or bracteoles prominent, persistent; inflorescence mostly a triad; stamens 5. . . . . .1. *M. hursthousei*
   5. Leaves 3-5 mm long, terete, apex with a recurved mucro; stamens antesepalous; inflorescence mostly a triad . . . . . 6. *M. tuberculatus*

Species descriptions

1. **Malleostemon hursthousei** (W. V. Fitzg.) J. W. Green, comb. nov. (Figures 1-15)

Micromyrtus hursthousei W. V. Fitzg., J. W. Austral. Nat. Hist. Soc. No. 2:22 (1905). *Type*: Murchison district [in sandy soil], October 1902, *E. W. Hursthouse* (holo: NSW7064; iso: PERTH).

Shrub, slender, erect, virgate, 0.5-2 m high. *Leaves* loosely imbricate, ovate, 1.5-2.5 mm long, obtuse, concavo-convex. *Inflorescence* shortly pedunculate, mostly a triad subtended by a pair of persistent, broadly lanceolate, concave, membranous, keeled, lateral bracts up to 2.2 mm long, partly obscuring the flowers within, or rarely the inflorescence 1-flowered, subtended only by a pair of lateral, bract-like bracteoles. *Lateral flowers* of a triad each subtended by 2 bracteoles as long as but narrower than the bracts, disposed radially to the stem. *Flowers* sessile, 3 mm long, 3-4 mm wide. *Floral tube* cylindrical-turbinate, 1-1.5 mm long, obscurely 5-ridged, continuous with the sepal midribs. *Sepals* orbicular, 0.5-1.2 mm diameter, the middle herbaceous and keeled, the membranous border finely and irregularly denticulate. *Petals* elliptic to orbicular, clawed, 2-2.5 mm long, white or sometimes pink-tinged. *Disc* concave, shallow, 1.2 mm diameter, continuous laterally with the short, spreading, free part of the tube. *Stamens* 5, antepetalous, 0.3-0.6 mm long, pale pink; *filaments* 0.2-0.3 mm long. *Ovules* 4, rarely 6. *Fruit* scarcely enlarged, somewhat ridged or irregularly wrinkled; no *seeds* found. *Chromosome number* 2n=c. 44 (*Powell* 74103, Mingenew-Mullewa road, 22 Sep. 1974) (voucher in herb. PERTH).



Figures 1-15. *Malleostemon hursthousei*. 1—Upper flowering branch. 2—Phyllotaxy. 3-5—Leaves, dorsal views. 6—Leaf, TS. 7—Bract. 8—Triad inflorescence. 9—Inflorescence diagram, axis at top, subtending leaf at bottom. 10-11—Sepal (left) and petal (right). 12—Flower from above. 13—Stamens, from bud. 14—Longitudinal half-flower showing ovules. 15—Fruits.

1-2, 10, 11 (right), 12-14 from *Beard* 7332; 3-8 from *Hursthouse*, Murchison (Type); 9, 11 (left) from *Monck*, S of Geraldton; 15 from *Lullfitz* L2947.

Selection of specimens examined. WESTERN AUSTRALIA: 9 miles (14.5 km) N of Murchison River, *A. S. George* 7881 (PERTH); 30 miles (48.3 km) E of Geraldton, *J. Long* 50 (PERTH); 0.3 km along Nangetti road from Mingenew-Mullewa road, *B. L. Powell* 74103 (PERTH); 12.7 miles (20.4 km) S of Coorow, 8 Oct. 1967, *W. A. Loneragan* s.n. (UWA).

Distribution and habitat. This species occurs sporadically in the area from the Murchison River to near Winchester, some 160 km SE of Geraldton (Map 1), mostly in shrublands and scrub heath on yellow or sometimes red sand.

Flowering and fruiting period. Flowering, September-November; fruiting, October-November.

Malleostemon hursthousei is closely related to *M. minilyaensis,* as discussed under that species. The present species is usually easily distinguished by the prominent bracts or bracteoles, which often persist even when flowers and sometimes leaves have fallen, and the typically dense conflorescence of tightly packed triads. Also, the stamens are unusually small for the genus. The character 'ovules 2', given in the protologue, appears to be an error. This species may be a sterile hybrid, as it appears to be a polyploid and is not known to produce seeds. (See also note under *M. roseus* about possible hybridization with that species.)

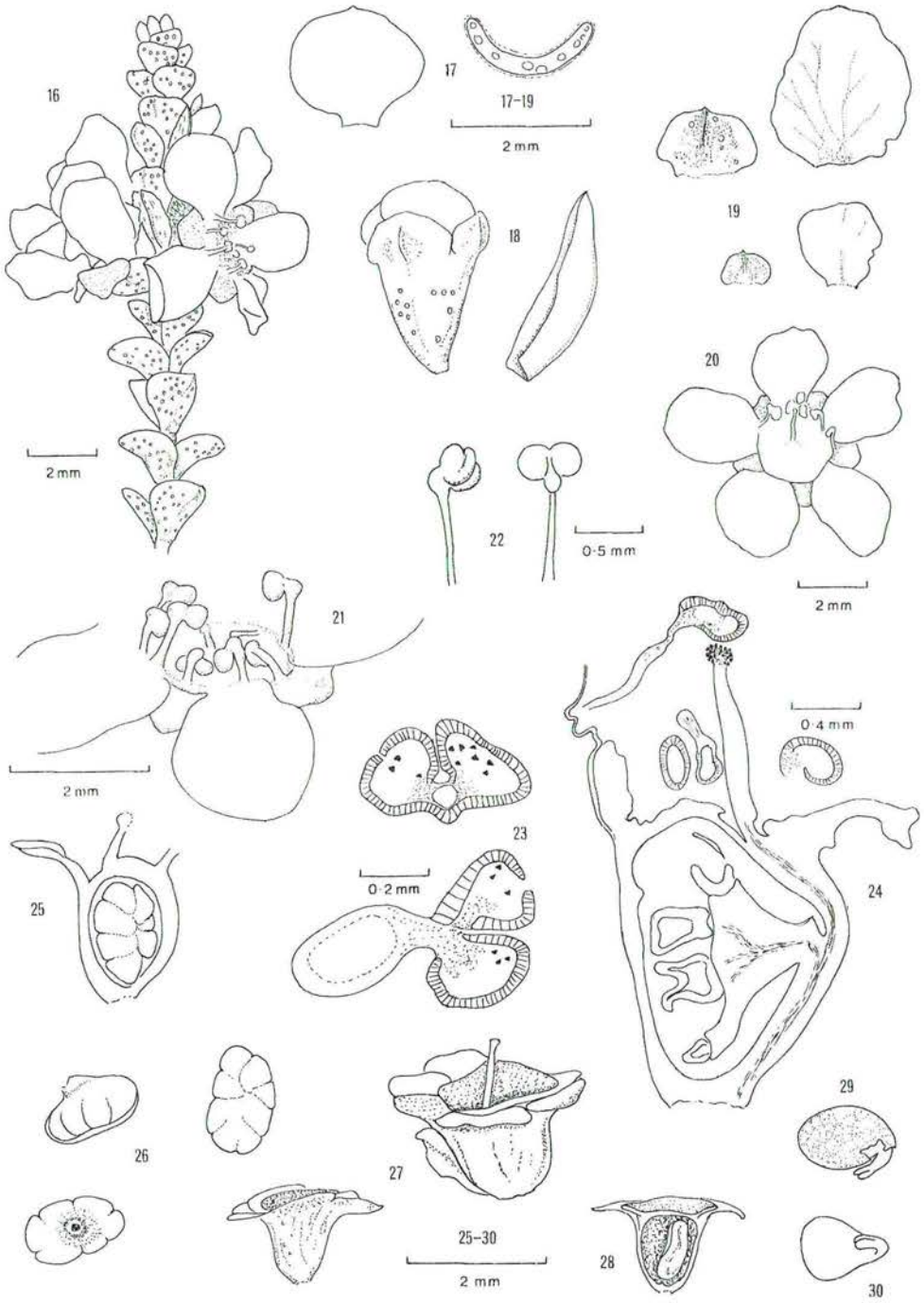
Conservation status. Although not common, it is not thought to be endangered. Of the 15 known collections, one is from a nature reserve.

2. **Malleostemon minilyaensis** J. W. Green, sp. nov. (Figures 16-30)

Frutex; folia orbiculata, supra concava, subtus carinata, basifixa, 1.5-2.5 mm longa; *flores* solitarii, axillares, sessiles; *tubus floris* turbinatus, 5-costatus; *petala* et *sepala* 5; *stamina* 10, antisepala et antipetala; *ovula* 6-8.

Typus: 120.5 km N of Carnarvon, Western Australia, 24 August 1963, *J. S. Beard* 3003 (holo: PERTH; iso: CANB, NSW, PERTH).

Shrub, erect, dense or spreading, 0.5-1.5 m high. *Leaves* crowded, orbicular, 1.5-2.5 mm diameter, apiculate, concave above, keeled below, basifixed. *Inflorescence* a solitary flower in the upper axils; *conflorescence* 8-10 flowered, globular or ellipsoid. *Bracteoles* sharply conduplicate, lanceolate, curved, sometimes undulate, 3 mm long, persistent, the midrib area herbaceous in the upper third. *Flowers* sessile, 3-5 mm long and 9 mm wide. *Floral tube* turbinate, glabrous, 2 mm long, ribs 5, continuous with the sepal midribs. *Sepals* 0.6-1 mm long, broadly elliptic, auriculate, keeled, herbaceous except the narrow, scarious margins or, if largely scarious, having a herbaceous tip. *Petals* orbicular or obovate-oblong, clawed, well-separated at anthesis, 2.5-3 mm long, creamy-white or sometimes tinged pink near the base. *Disc* pale pinkish-brown, flat, 2 mm diameter. *Stamens* 10, 0.7-1.2 mm long, pale pink, occasionally the antesepalous ones lacking; *filaments* 0.5-1 mm long. *Ovules* 6-8. *Fruit* scarcely enlarged, somewhat irregularly ridged or wrinkled, fruiting sepals spreading; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.



Figures 16-30. *Malleostemon minilyaensis*. 16—Upper flowering branch. 17—Leaf, in outline (left) and TS (right). 18—Bud (left) and bracteoles (right). 19—Sepal and petal (right), 2 sets. 20—Flower from above. 21—Flower, oblique from above, showing stamens. 22—Stamens. 23—Anther, TS, one through connective gland. 24—Ovary, LS showing eccentric style, placenta and common vasculature, 25—Longitudinal half-flower showing developing ovules. 26—Ovules. 27—Fruits. 28—Longitudinal half-fruit with seed. 29—Seed with emerging cotyledons. 30—Embryo.

16-26 from *Howard* & *Houston* 338-7; 27-30 from *George* 1455.

Selection of specimens examined. WESTERN AUSTRALIA: 16 miles (25.7 km) S of Minilya river, *C. H. Gittins* 1512 (BRI, NSW); 7 km N of Boologooro, *C. A. Howard & T. F. Houston* 338-7 (PERTH); Talisker Station, Sep. 1981, *A. Holm* s.n. (PERTH); Yaringa north, *J. Galbraith* 248 (AD, MEL); 436 mile peg (701.5 km) North West Coastal Highway, *A. M. Ashby* 2236 (AD, PERTH); N of Murchison River, *C. A. Gardner* 13313 & 13316 (PERTH); Ajana, 20 Aug. 1963, *A. M. Ashby* s.n. (AD).

Distribution and habitat. This species occurs from the Minilya river, north of Carnarvon, to Ajana, north of Geraldton. Though most collections have been made along the North West Coastal Highway, the occurrence at Talisker, some 100 km east of Hamelin Pool, is suggestive of an inland distribution, largely uncollected owing to the scarcity of roads (Map 1). The only recorded habitat detail is 'sandplain'.

Flowering and fruiting period. Flowering, August (mostly)-September; fruiting, August-September.

Malleostemon minilyaensis is closely related to *M. hursthousei*, which differs in having 5 stamens, 4-6 ovules, obovate-oblong leaves, and smaller flowers. The species are allopatric except for an overlap near Ajana where they nonetheless remain morphologically distinct: *M. minilyaensis* extends northwards almost to the Minilya River, while *M. hursthousei* is distributed southwards to near Winchester.

Conservation status. With only 10 known collections, mostly from agricultural or pastoral areas and none known from National Parks or reserves, this species is possibly endangered.

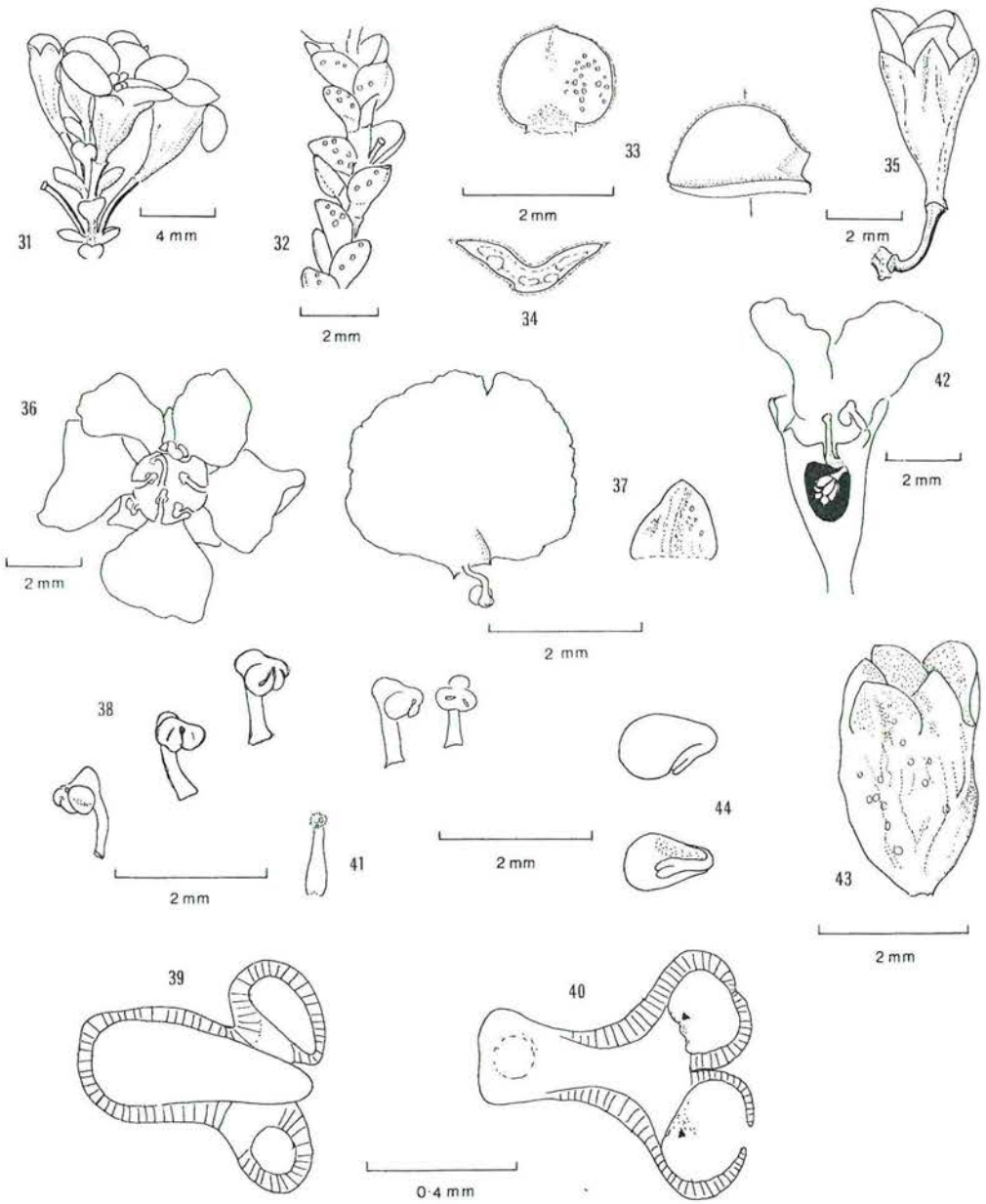
Etymology. The epithet refers to the Minilya River, to the north-east of Carnarvon, where the species approaches the northern limit of its range.

3. **Malleostemon pedunculatus** J. W. Green, sp. nov. (Figures 31-44)

Frutex; folia orbiculata ad obovata, 1-3 mm longa; *flores* solitarii, axillares, pedunculati; *tubus* turbinatus ad obconicus, rugosus; *petala* et *sepala* 5; *stamina* 10, antipetala quam stamina antisepala longiora; *ovula* 4-6.

Typus: 35 km ENE of Tamala homestead, 26 deg. 42 min. S lat. x 113 deg. 43 min. E long., August-September 1980, *C. A. Howard* and *T. F. Houston* 331-5 (holo: PERTH).

Shrub, erect or spreading, 1-1.7 m high. *Leaves* orbicular to obovate, naviculate, 1-2(3) mm long, 0.7-1.2 mm wide, obtuse, sparsely gland-dotted; subsessile or the *petiole* up to 0.4 mm long; *glands* not raised. *Inflorescence* a solitary flower in the upper axils, scarcely conflorescent, often flowering prolifically. *Bracteoles* linear-lanceolate, herbaceous except the narrow, scarious margins, 1.2-1.8 mm long, inconspicuous and early deciduous. *Peduncles* (1)2-3(4) mm long, usually exceeding or at least equalling the leaves. *Flowers* solitary, axillary, often prolific, 2-5 mm long and up to 7 mm across the petals. *Floral tube* 3 mm long, turbinate to obconical, glabrous, rugose or with 5 indistinct longitudinal ridges, opposite the sepals, often green with sparse, golden oil glands. *Sepals* broadly triangular, auriculate, imbricate, keeled, 0.5-0.8 mm long and 1 mm wide. *Petals* orbicular or obovate, narrowing at the base, not clawed but well-separated at anthesis, 2-3 mm long, 2-2.8 mm wide, white, sometimes suf-



Figures 31-44. *Malleostemon pedunculatus*. 31—Upper flowering branch. 32—Phyllotaxy. 33—Leaf, dorsal (left), and oblique (right) views. 34—Leaf, TS. 35—Flower and peduncle. 36—Flower from above. 37—Petal (left) and sepal (right). 38—Stamens. 39—Anther, TS showing gland protruding between loculi. 40—Anther, TS below gland. 41—Style. 42—Longitudinal half-flower showing style, cupular disc and ovules. 43—Fruit. 44—Embryos.

31-42 from *Howard* & *Houston* 331-5 (Type); 43-44 from *Beard* 7068

fused pink, margins minutely denticulate. *Disc* flat or slightly convex, 1.2 mm diameter, contained within the short free part of the tube. *Stamens* 10, 0.8-1.2 mm long, pale pink, the antepetalous ones longer; *filaments* 0.5-0.8 mm long. *Ovules* 4-6. *Fruit* somewhat swollen, narrow-ovoid, fruiting sepals erect; *seed* solitary, ellipsoid, 1.3 mm long; embryo having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.

Selection of specimens examined. WESTERN AUSTRALIA: Shark Bay area, near Useless Loop salt mine, Sep. 1976, *J. Elliot* s.n. (PERTH); Tamala Station, *T. E. H. Aplin* 3519 (PERTH); Between Hamelin and Tamala, *J. S. Beard* 7068 (PERTH); Between Hamelin Pool and Shark Bay, *W. E. Blackall* 4581 (PERTH); Between Hamelin and Nanga, *J. S. Beard* 6765 (NSW, PERTH); 0.5 mile (0.8 km) along a track 8 miles (12.8 km) from Kalbarri, *A. R. Fairall* 1206 (PERTH).

Distribution and habitat. This species is concentrated near the southern shores of Freycinet Estuary, Shark Bay, with an outlying occurrence near Kalbarri; a single collection from 305 mile peg Norseman-Hyden road, (Nelson ANU17342—PERTH) is probably erroneous (Map 2). Label details of associated vegetation include heath and scrub, including *Banksia ashbyi* and 'bowgada' (*Acacia ramulosa*), occurring mainly on sand, sometimes red.

Flowering and fruiting period. Flowering, August-October; fruiting, October.

Malleostemon pedunculatus was first collected in 1940 by W. E. Blackall, who noted 'sp. nov.' on the label. The species is easily recognized by the erect, rather elongated floral tube, tapering into a long peduncle. It has no close relatives in the genus.

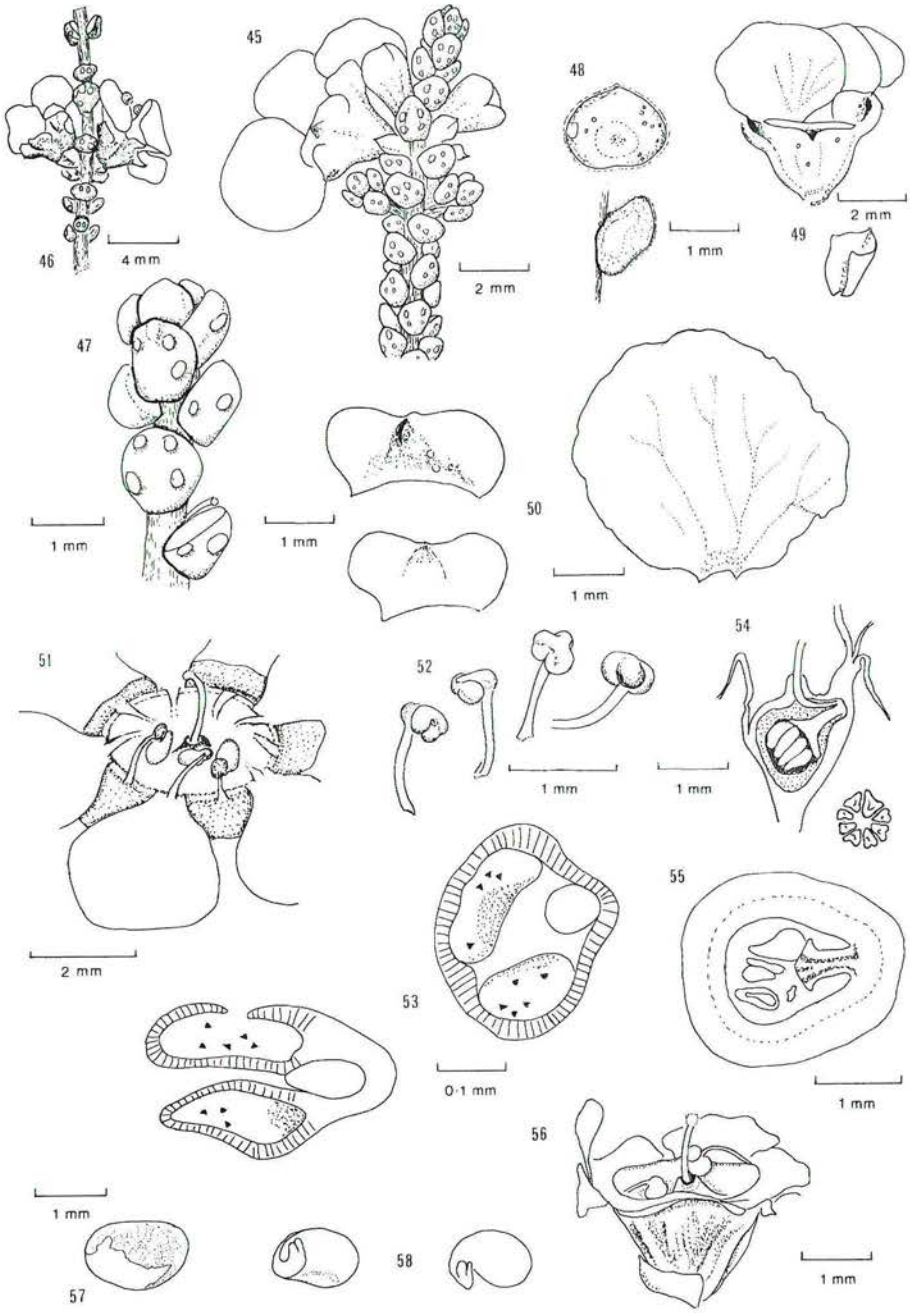
Conservation status. Though known from only 11 collections, this species probably occurs in a National Park and has also been cultivated in South Australia.

Etymology. The epithet refers to the long peduncles which can exceed the leaves.

4. **Malleostemon peltiger** (S. Moore) J. W. Green, comb. nov. (Figures 45-58)

Micromyrtus peltigera S. Moore, J. Linn. Soc. Bot. 45:200 (1920). *Type*: Coolgardie [district], 1899, *L. G.* [*?L. C.*] *Webster* s.n. (holo: BM, presum., not seen; iso: NSW 136165).

Shrub, spreading, straggly, commonly 0.6-1.5 mm rarely 2 m high. *Leaves* imbricate at first, becoming distant, orbicular or nearly so, 1-1.5 mm diameter, thick, peltate, concave above, flattened-carinate below, sometimes almost spherical, drying grey-green, sparsely glandular. *Inflorescence* a solitary flower in the upper axils; *conflorescence* of 1-6 flowers globular, terminal, subterminal or lateral. *Flowers* sessile, 5 mm long, 6-8 mm wide. *Bracteoles* imbricate, broadly obovate, up to 1.5 mm long and 2.4 mm wide, scarious, sometimes pink-tinged, the midrib keeled. *Floral tube* turbinate, 1.2-1.8 mm long, smooth or irregularly ridged, drying dark brown, 5 or 10-ribbed, 5 of the ribs continuous with the sepal midribs. *Sepals* imbricate, subreniform, up to 1 mm long and 2 mm wide, scarious, pink-tinged in one specimen having white petals. *Petals* obovate or elliptic to orbicular, shortly clawed, up to 3 mm diameter, white or rarely pink. *Disc* about 1.2 mm diameter, deep pink, slightly convex or flat, more or less submersed within the free part of the tube, cupular



Figures 45-58. *Malleostemon peltiger*. 45-46—Upper flowering branches. 47—Phyllotaxy. 48—Leaf, ventral view (upper) and vertical section (lower). 49—Flower (upper) and bracteole (lower). 50—Sepals (left) and petal (right). 51—Flower, oblique, from above. 52—Stamens. 53—Stamens, TS through anthers. 54—Longitudinal half-flower, TS ovules. 55—Ovary, TS through placenta. 56—Fruit. 57—Seed. 58—Embryos.

45 from *Wemm* 913B; 46-53, 55 from *Beard* 6735; 54 from *Blackall* 4555; 56-58 from *Lullfitz* L2907.

around the style base. *Stamens* 10, 0.8-1.5 mm long, the antesepalous ones longer; *filaments* 0.7-1.5 mm long, pale pink. *Ovules* 5-8. *Fruit* scarcely enlarged, fruiting sepals spreading; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.

Selection of specimens examined. WESTERN AUSTRALIA: E of Nerren Nerren, *J. S. Beard* 7112 (PERTH); 96 km S of Billabong, North West Coastal highway, *G. Perry* 587 (PERTH); 9 miles (14.5 km) N of Murchison river bridge, *R. V. Smith* 66/301 (MEL, PERTH); Near Mullewa, Oct. 1961, *D. H. Perry* s.n. (PERTH); Near Southern Cross, *C. A. Gardner* 1118 (PERTH).

Distribution and habitat. This species has a range similar to that of *M. roseus,* often being recorded from the same localities, but is much less common; moreover its distribution is disjunct between Mullewa and Southern Cross (Map 2). It has been recorded from open heath and scrub containing *Eucalyptus eudesmoides, Actinostrobus, Hakea* and *Acacia,* on yellow or red sand.

Flowering and fruiting period. Flowering, August-November, (mostly October); fruiting, September, November.

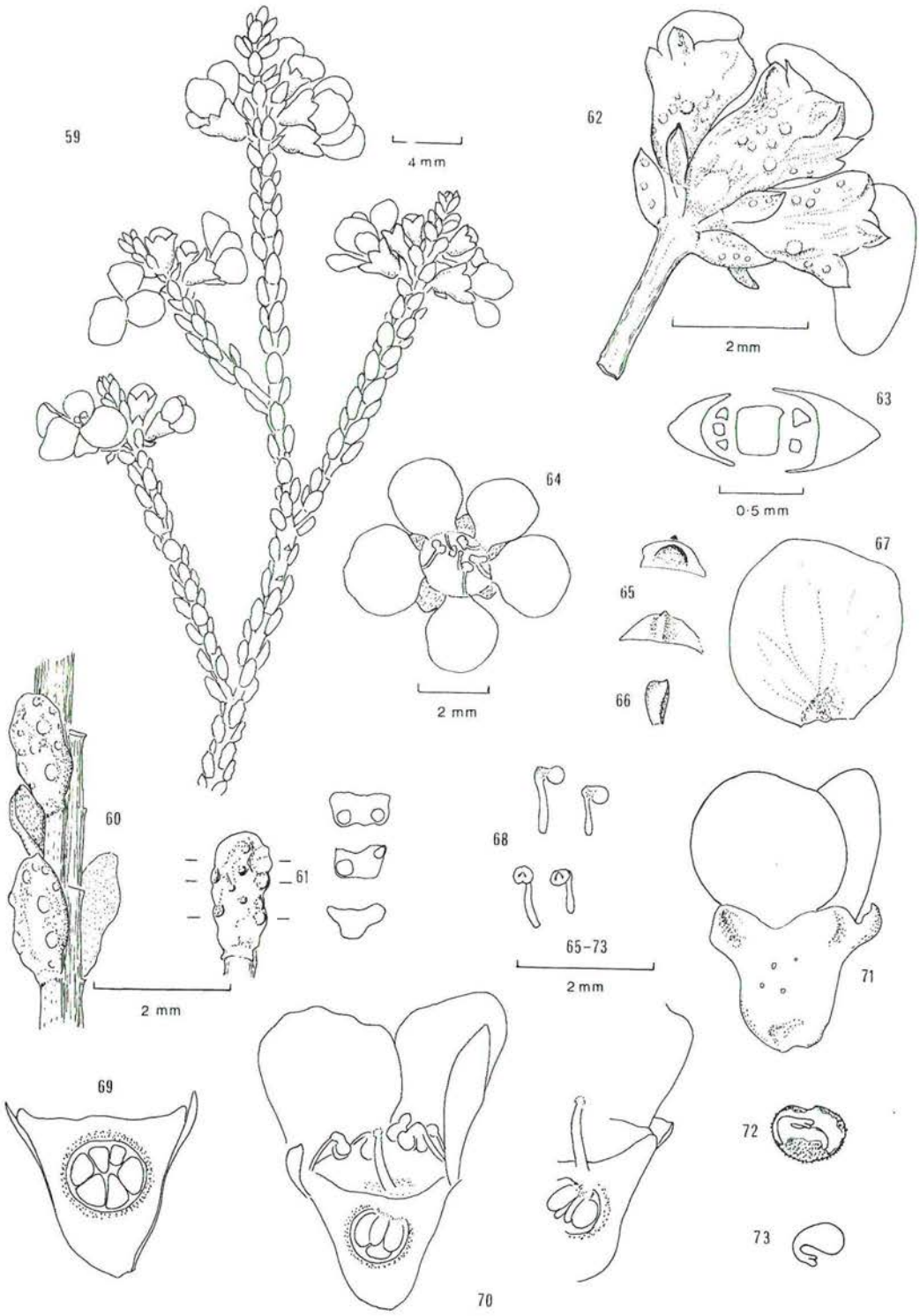
Malleostemon peltiger is closely related to *M. roseus,* being distinguished by the peltate leaves which are unknown in other species of the *Thryptomene* group (see Discussion). Both this character and the relationship to *M. roseus* were noted by the original author (Moore 1920) who nonetheless failed to record the occurrence of the eccentric style-base allied with the placenta, here noted as a generic tendency and most consistently found in this species. Moore also missed the chief diagnostic character of the genus, the geniculate stamens, contenting himself with 'staminibus 10 subglobularis'.

Conservation status. Not endangered, having been collected in one National Park, a nature reserve and a proposed nature reserve.

5. **Malleostemon roseus** (E. Pritzel) J. W. Green, comb. nov. (Figures 59-80)

Thryptomene rosea E. Pritzel in Diels and Pritzel, Bot. Jahrb. Syst. 35: 413-414 (1904). *Lectotype* (here selected): Coolgardie goldfields [pr. Southern Cross in fruticetis arenosis], October 1901, *Pritzel* 862 (NSW loan no. 75/41 383)—*Micromyrtus rosea* (E. Pritzel) S. Moore, J. Linn. Soc. Bot. 45: 200 (1920).

Shrub, erect, virgate, commonly 0.5-1.5 m high and wide or sometimes almost prostrate or up to 3.5 m high. *Leaves* distant, appressed or spreading, typically elliptic to obovate, 1-2.5 mm long, 0.5-1 mm wide, thick, flat to convex above, rounded below, often subglaucous, with several oil-glands protruding somewhat on drying. *Inflorescence* 1-(rarely 2-3)-flowered, in the upper axils; *conflorescence* globular, about 5-flowered. *Peduncle* 0.7-1.5 mm long. *Bracteoles* lanceolate, scarious, carinate, 1.4 mm long, persistent. *Flowers* 3-4.5 mm long, 4-5 mm wide, abundant, often showy. *Floral tube* companulate to cylindrical, smooth or sometimes longitudinally wrinkled, sometimes of a hyaline or parchment-like consistency, up to 2.5 mm long and 2 mm wide. *Sepals* triquetrous, 0.5 mm long, prominently keeled, margins scarious, narrower than the herbaceous centre. *Petals* orbicular, 2 mm diameter, pale to deep pink or sometimes white or pale yellow. *Disc* up to 2 mm diameter, shallowly concave, deep pink. *Stamens* 10, or rarely 5, 0.8-1.6 mm long, the antepetalous


59
4 mm
62
2 mm
63
0·5 mm
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2 mm
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60
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2 mm
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65–73
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69
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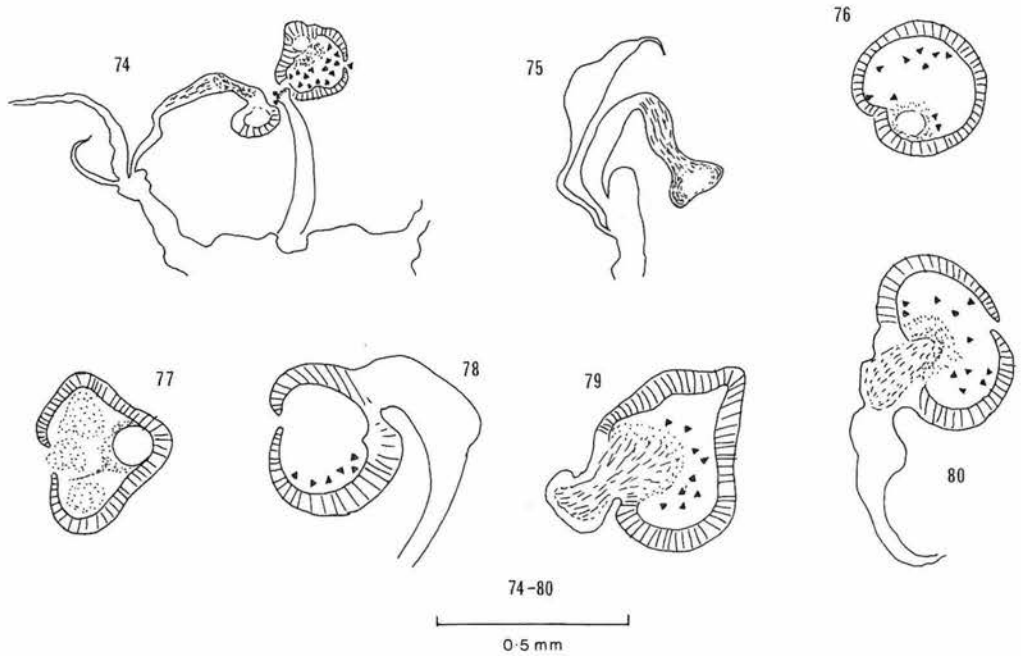


Figures 59-80. *Malleostemon roseus.* 59—Flowering branch. 60—Phyllotaxy. 61—Leaf, dorsal view (left) and TS (3 positions, right). 62—Inflorescence. 63—Floral phyllotaxy. 64—Flower from above. 65—Sepals, ventral (upper) and dorsal (lower) view. 66—Sepal, vertical section. 67—Petal. 68—Stamen. 69—Floral tube cut longitudinally to show ends of ovules. 70—Longitudinal half-flower and part half-flower showing stamens, style, ovary, ovules and tannin cells (dotted). 71—Fruit. 72—Seed. 73—Embryo. 74-80—Stamens, selection of TS and LS showing unilocular, possibly unisporangiate anthers.

59, 67 from *Wilson* 3519; 60-62 from *Shaw* 609; 63, 65-66, 71, 74-80 from *Green* 4638; 64 from *Stacey* 692; 68-70 from *Green* 4658; 72 from *Gardner* 12022; 73 from *A. R. Main,* 61 mi W of Coolgardie, 6 Dec. 1953.

longer; *filaments* 0.6-0.8 mm long. *Ovules* 4-6. *Fruit* somewhat swollen at the base, sometimes hollow beneath the ovary, fruiting perianth erect, stamens sometimes persisting; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* covered by a persistent, papillose, red-brown, tanniniferous layer of the inner ovary wall. *Chromosome number* n=11 (*Powell* 76014, cultivated) or n=22 (*Powell* 73014, N of Damboring, 12 Aug. 1973) (vouchers in herb. PERTH).

Selection of specimens examined. WESTERN AUSTRALIA: Butcher's track E of Meadow station, *J. S. Beard* 6832 (NSW, PERTH); 14.5 miles (23.3 km) S of Wannoo, 17 Sep. 1968, *M. E. Phillips* s.n. (CBG, NSW); 64 miles (103 km) N of Murchison River bridge, *D. E. White* 630814 (PERTH); Kirkalocka station 7 miles (11.3 km) E of homestead, *J. S. Beard* 6662 (PERTH); Near Youanmi, 24 Oct. 1963, *C. A. Gardner* s.n. (PERTH); East Yuna reserve, on E boundary, *J. W. Green* 4638 (PERTH); 6 miles (9.7 km) W of Mullewa, *K. Newbey* 2143 (PERTH); 97 miles (156.1 km) SW of Paynes Find, *J. W. Green* 4658 (PERTH); Between Carnamah and Perenjori, *J. S. Beard* 7356 (PERTH); 9 miles (14.5 km) NNW of Ballidu, 13 Sep.

1968, *M. E. Phillips* s.n. (CANB, PERTH); 10 km N of Southern Cross towards Bullfinch, *R. J. Cranfield* 666 (PERTH); Karalee, *L. Diels* 5571 (lectoparatype) (PERTH); 18 km W of Coolgardie towards Southern Cross, *A. E. Orchard* 4189 (AD, PERTH).

Distribution and habitat. This species is common and widespread, occurring from N of the Murchison River to the eastern goldfields, extending inland as far as Youanmi (Map 3). It has been recorded chiefly on sandy and sometimes loamy, clayey or lateritic soils, in heathland and shrubland communities, associated with *Melaleuca, Acacia, Casuarina, Cyanostegia, Pityrodia, Balaustion* and *Verticordia.*

Flowering and fruiting period. Flowering, July-December, mostly August-November with a peak in October; fruiting, December.

Though both syntypes agree with the original description, the large NSW specimen of Pritzel 862 is preferred to the two PERTH fragments of Diels 5571 for the purpose of lectotypification. It is presumed that the holotype in herb. B is destroyed.

Malleostemon roseus is distinguished from the other species of the genus by the smooth, campanulate or urceolate floral tube which dries usually to a smooth, parchment-like consistency, as well as by the flowers which are usually numerous with pink to deep pink petals. The protologue (Diels & Pritzel 1904) contains the first reference to the principal generic character: 'filamentis incurvis apice geniculatis'. The species was also said to be distinguished by the structure of the ovary, though the placentation was described as central, affixed under the style, with no mention of the style-base or placentation being eccentric. Their observation of the relationship of *M. roseus* to *M. tuberculatus* is referred to below, under the latter species. Several specimen labels record white flowers, from sporadic localities including Meadow station, Nerren Nerren station, Cue and Karale, while one collection, from Yorkrakine, is annotated: 'flowers pale yellow'. The red-brown, papillose seed coat is quite different from that of the other species owing to the adherent ovary wall layer. This can be seen to consist in the flower of several layers of thin-walled cells with safranin-positive inclusions which are assumed to be tannin. *Malleostemon roseus* is closely related to *M. peltiger,* which differs from it in the leaves and flowers (see discussion under *M. peltiger).*

A variant from the Murchison River area, having long peduncles, broad leaf bases, leaves with apiculate tips and a glandular-tuberculate floral tube, may possibly represent a hybrid with *M. hursthousei.* It is excluded from the above description.

Conservation status. Not endangered owing to widespread occurrence and inclusion in National Parks and nature reserves.

6. **Malleostemon tuberculatus** (E. Pritzel) J. W. Green, comb. nov. (Figures 81-91)

Thryptomene tuberculata E. Pritzel in Diels & Pritzel, Bot. Jahrb. Syst. 35:411-412 (1904). *Type:* Near Coolgardie [in fruticetis arenosis flor. m. Nov.], 30 October 1901, *Diels* 5231 (holo: B, presum. destroyed; iso: PERTH, 2 fragments).

Shrub, slender, erect, virgate, 1-2 m high. *Leaves* distant, erect, linear, almost terete, to 7 mm long, 0.4-0.6 mm diameter, grooved above, rounded below, acute; mucro terminal, recurved, to 0.8 mm long; *oil glands* several, raised-tuberculate on

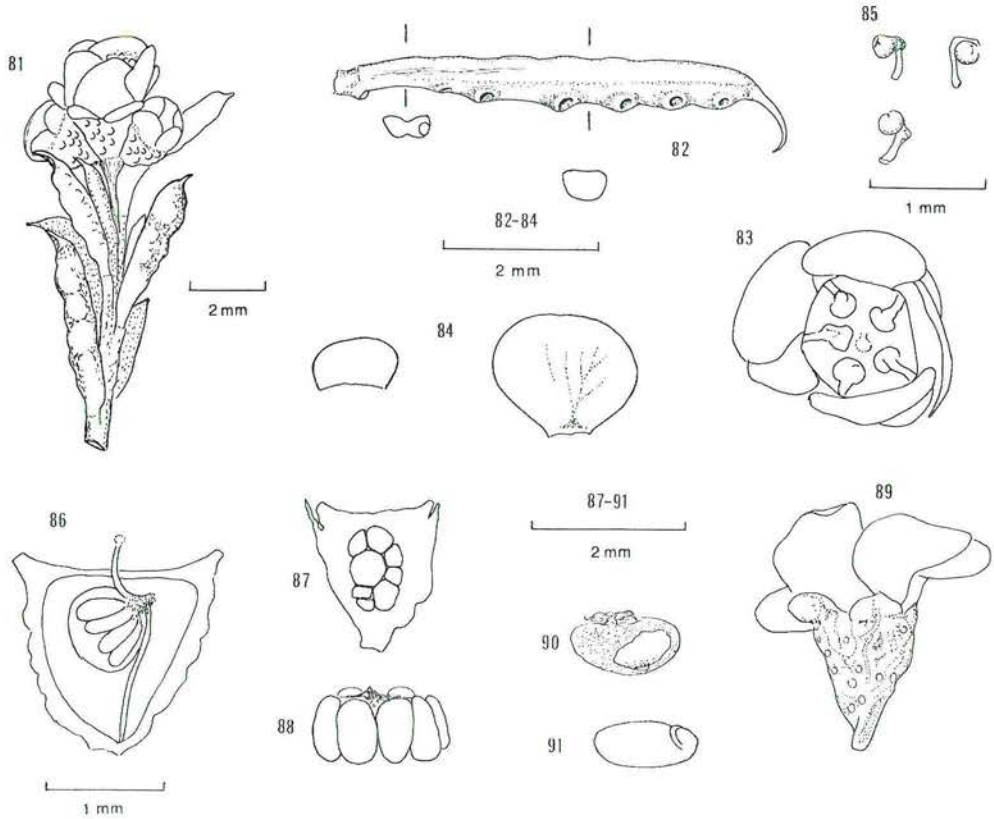
drying. *Inflorescence* solitary in the upper leaf axils, typically a triad, rarely 1-2 or 4-6-flowered, scattered or forming a globular or ovoid conflorescence. *Peduncle* terete or lorate, 2-4 mm long. *Bracts* lanceolate, herbaceous except the scarious margins, 0.8 mm long, often persistent. *Pedicels* mostly absent or up to 0.2 mm long. *Bracteoles* early deciduous, broad-lanceolate, reddish, 0.2-0.5 mm long in the bud. *Flowers* 2.5-3 mm long, 2.5-4 mm wide across the open petals, often profuse. *Floral tube* campanulate to obconical, glabrous, rugose, not regularly 5-ribbed, about 1 mm long, 0.5 mm wide under the sepals. *Sepals* broadly depressed-ovate, imbricate, petaloid or scarious, 0.3-0.5 mm long, 0.8 mm wide, much shorter than the petals, often suffused pink. *Petals* orbicular or elliptic, narrowed at the base though not clawed, well-separated, 1 mm long, pink or white. *Disc* shallowly concave, 1-2 mm diameter, scarcely exceeded by the spreading free part of the tube. *Stamens* 5, antesepalous, 0.7 mm long, pale pink; *filaments* 0.5 mm long. *Ovules* 6-8. *Fruit* scarcely enlarged, irregularly wrinkled, fruiting perianth erect; *seed* solitary, narrow-ellipsoid or almost reniform; *embryo* obloid-cylindrical, neck very short, curved, not twisted sideways, cotyledons almost sessile, semiorbicular, lying flat against the hypocotyl. *Chromosome number* n=c. 22 (*Powell* 74047, S of Payne's Find, 15 Aug. 1974) (voucher in herb. PERTH).

Selection of specimens examined. WESTERN AUSTRALIA: Murchison river crossing, North West Coastal Highway, *D. R. Bellairs* 911 (PERTH); W of Wuraga, *A. M. Ashby* 5180 (AD, PERTH); c. 2.5 miles (4 km) S of Paynes Find, *B. L. Powell* 74047 (PERTH); 80 km SW of Paynes Find, *J. W. Green* 4656 (PERTH); Pindar, *W. E. Blackall* 641 (PERTH); 6 miles (9.7 km) E of Mullewa, 20 Sep. 1968, *M. E. Phillips* s.n. (BRI, CBG, MEL, NSW); Mingenew, *W. D. Campbell* 56 (BRI); 4 miles (6.4 km) S of Tardun, *J. W. Green* 1534 (PERTH); Beanthiny Hill, *C. A. Gardner* 12058 (PERTH); 50 miles (80.5 km) SW of Yalgoo, 13 Oct. 1953, *H. F. & M. Broadbent* s.n. (CANB); Pinnacles rocks, 30 miles (48.3 km) S of Jurien Bay, *J. Hart* 15 (PERTH); NE of Mukinbudin, *P. de Rebeira* 36 (PERTH); Mount Churchman, *C. A. Gardner* 13532 (PERTH); Muntadgin, Sep. 1947, *E. T. Bailey* (PERTH); 33 miles (53. 1 km) E of Hyden, *F. Lullfitz* 3827 (PERTH); 13 km N of Southern Cross, *R. J. Cranfield* 663 (PERTH); 70 miles (112.7 km) E of Southern Cross, *W. E. Blackall* 944 (PERTH); Between Callion and Mussons Soak, *J. S. Beard* 6253 (PERTH); Coolgardie, *C. A. Gardner* 830 (PERTH).

Distribution and habitat. This species has a wide distribution from the Murchison River to the eastern goldfields, around Kalgoorlie (Map 4). It is associated with mallee *Eucalyptus,* tall shrublands or scrub containing *Acacia, Grevillea, Eremophila* and *Casuarina,* on soils including yellow sand, laterite, clays and loams, often associated with granite.

Flowering and fruiting period. Flowering, July-November, mostly August-October; fruiting, November.

Malleostemon tuberculatus is the species most consistently displaying the character of a several-flowered inflorescence, noted as a generic tendency absent in *Thryptomene* or *Micromyrtus,* as redefined by the removal of four species to what is now *Malleostemon.* Though maintained until now in *Thryptomene,* on the basis of the antesepalous stamens, the present species might equally well have been placed in *Micromyrtus,* owing to the apical placentation, as noted by the original author (in Diels & Pritzel 1904: 'ovulis 6-8 in placenta laterali orbiculari disciformi affixis') who even pointed out the similarity of the species in this respect to what is now *Malleostemon roseus:* 'forma placenta *T. roseae* similis'. This point was also observed



Figures 81-91. *Malleostemon tuberculatus*. 81—Upper flowering branch. 82—Leaf, lateral view (upper) and TS (2 positions, lower). 83—Flower from above. 84—Sepal (left) and petal (right). 85—Stamens. 86—Longitudinal half-flower showing style, placenta and ovules. 87—Longitudinal half-flower showing developing ovules. 88—Ovules, lateral. 89—Fruit. 90—Seed. 91—Embryo.

81-83, 87-88 from *Green* 4657; 84 from *Scrymgeour* 1535; 85-86 from *Green* 4656; 89-91 from *Ashby* 2029.

by Blackall, who noted on one of his specimen labels (Blackall 641—PERTH): '6 ovules pendulous from summit of ovary'. Fortunately consideration of this problem is now averted by the discovery of the generic character of geniculate stamens which, together with characters of the inflorescence and ovary, places the species firmly in *Malleostemon*. *Malleostemon tuberculatus* is unusual in the shape of the embryo, its curved though untwisted neck, and the shape and disposition of the cotyledons.

Conservation status. Not endangered owing to widespread occurrence including one reserve and in the vicinity of others. Often associated with rocky areas or peaks relatively protected from alienation.

Discussion

When Bentham (1867) published his treatment of the tribe Chamelaucieae, none of the six species here included in *Malleostemon* had been described. Consequently he was not in a position to appreciate the significance of *Malleostemon's* chief diagnostic character, the geniculate stamens, which links what might be termed the

'Thryptomene group' (*Thryptomene, Micromyrtus, Corynanthera* and *Malleostemon*) with the *'Baeckea* group' (*Baeckea, Scholtzia* and *Astartea*). According to M. E. Trudgen (pers. comm.), who is presently carrying out revisionary studies in the latter group, the geniculate stamen character forms part of a syndrome, best developed in *Baeckea* sections *Babingtonia* (Lindl.) Benth. and *Harmogia* (Schauer) Benth., where the filaments vary from obviously geniculate to straight.

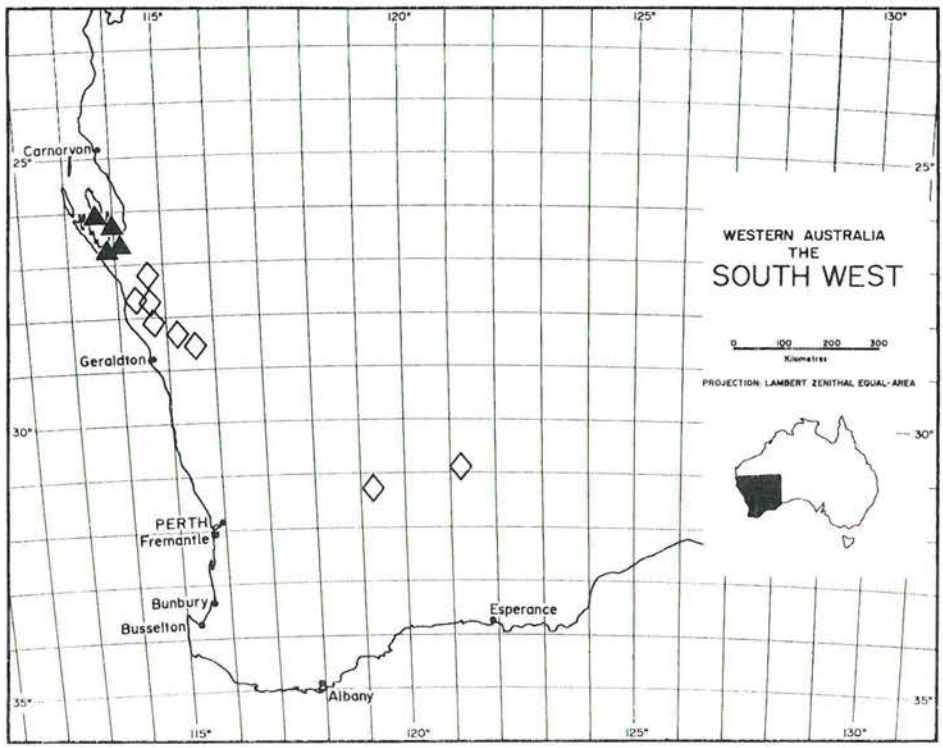
The character of the 'eccentric style base', in which the stylar vascular trace and the placenta have a common origin, is in a sense a consequence of the style being central in the disc and the ovary unilocular. *Malleostemon* seems to differ from other genera of the Chamelaucieae in often having a distinctly leaning style, the base of which clearly leads to a pocket in an upper corner of the ovary cavity (formed at anthesis by the breakdown of the loosely fibrous inner ovary wall) from which the placenta also arises. This arrangement, which is not always evident, but has been seen at least once in each species, may well represent another link between the above groups, being perhaps a stage in the evolution of the unilocular ovary from a multilocular progenitor such as *Baeckea.* This is further supported by the writer's observation (unpub.) in *Thryptomene* and *Micromyrtus* of the rare occurrence of a bilocular ovary in occasional flowers of some specimens—once in a type specimen! Trudgen (loc. cit.) believes that the character of radially-arranged ovules also links the two groups, though this character is of little significance in distinguishing *Malleostemon* from the rest of the *Thryptomene* group. In general, the unilocular character seems reliable enough to justify recognizing the tribe Chamelaucieae (equivalent to the *Chamelaucium* alliance of Briggs & Johnson 1979). Briggs and Johnson have recognized within the *Chamelaucium* alliance two suballiances, the *Baeckea* and *Chamelaucium* suballiances: *Malleostemon* would fall into the second on the basis of its unilocular ovary, yet might be even better placed in an alliance of its own, reflecting its intermediate nature.

The anther description given by Davis (1966) for the Myrtaceae (tetrasporangiate), already requiring modification following the discovery of a trisporangiate anther in *Corynanthera* (Green 1979), now appears to need further revision, for *Malleostemon* seems to have bisporangiate and possibly even unisporangiate anthers.

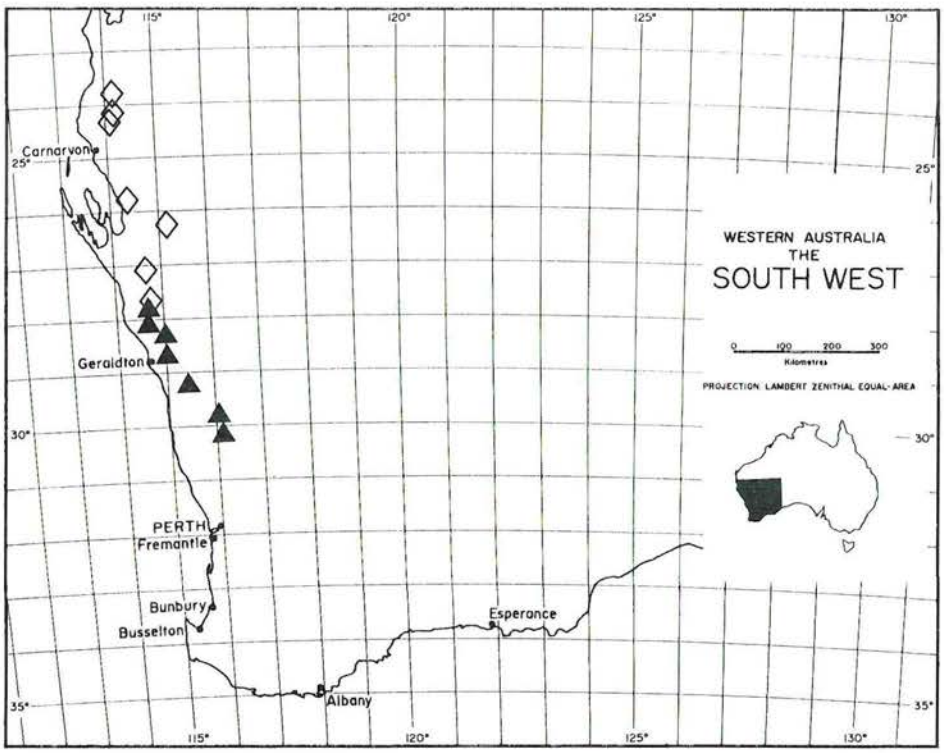
The embryo seems to vary little within *Malleostemon*, its systematic significance being at the subtribal level (Bentham 1867) and above. Embryo morphology seems to provide a further link between the *Thryptomene* group and *Baeckea*, judging by Bentham's (1867) comments on the subtribes of the Chamelaucieae. Landrum's (1981) findings on the relevance of embryos to the classification of the Myrtoideae suggest the possible usefulness of embryo characters in determining a phylogeny for the Leptospermoideae.

In the formal descriptions the term obdiplostemonous has been avoided, because the staminophore is narrow and only a single whorl of stamens is evident on the receptacle. The four 10-stamened species nevertheless have antepetalous stamens exceeding the antesepalous, suggesting that, technically, the flowers may be obdiplostemonous.

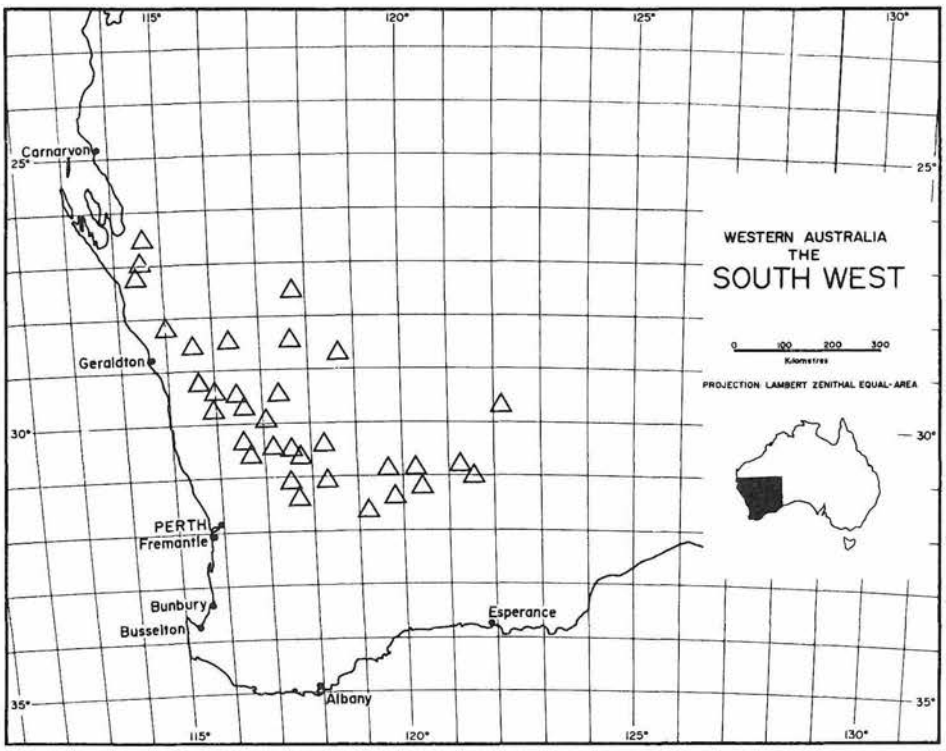
The inflorescence of several species of *Malleostemon* is of interest because of the occurrence of the triad (to use the terminology of Briggs & Johnson 1979), which has not been found in any other species of the *Thryptomene* group. In *Malleostemon*, several-flowered inflorescences other than triads have also been observed, *M. tuberculatus* having up to six flowers in the inflorescence. This may represent



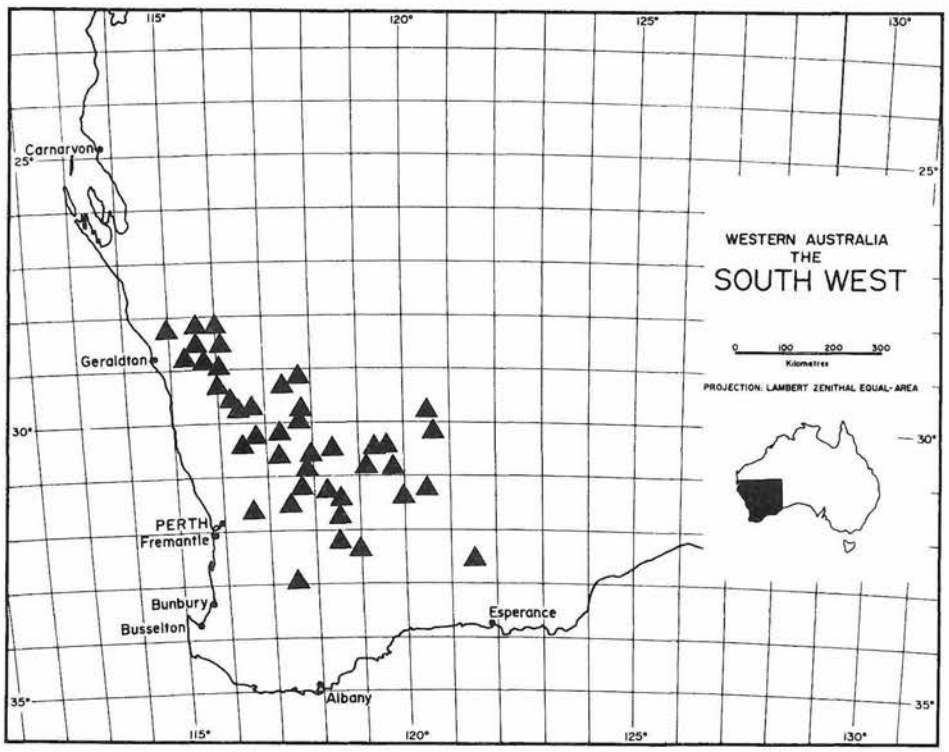
Map 1. Distribution of *Malleostemon hursthousei* (closed triangles) and *M. minilyaensis* (open diamonds).



Map 2. Distribution of *Malleostemon pedunculatus* (closed triangles) and *M. peltiger* (open diamonds).



Map 3. Distribution of *Malleostemon roseus.*



Map 4. Distribution of *Malleostemon tuberculatus.*

another link with *Baeckea*, in which species of section *Babingtonia*, with predominantly solitary flowers, not uncommonly have triads, while one species may have up to 14 flowers per inflorescence (Trudgen loc. cit.).

The limited number of chromosome counts available (Rye 1979) suggests a base of n=11, found in *M. roseus*, and a series of presumed polyploid derivatives: *M. hursthousei* (2n=c. 44), *M. tuberculatus* (n=c. 22) and another population of *M. roseus* (n=22). These data are insufficient to suggest possible evolutionary trends.

A systematic search through herbarium material located only a very few fruits containing seeds, and none at all in *M. hursthousei.* The last point is hardly significant in the circumstances but, taken together with the evidently tetraploid nature of *M. hursthousei,* may be indicative of a hybrid origin of that species.

Several lines of future research are suggested by the present study. These include: anther relationships with genera in other tribes; anatomical investigation of the "eccentric style" character; cyto-evolutionary studies; development of the triad inflorescence; anatomy and development of stamen number and position; significance of tannin in the ovary wall of *Malleostemon roseus;* and significance of embryo morphology in classification.

Acknowledgements

It is a pleasure to acknowledge the assistance of my colleagues who readily discussed problems and provided ideas. In particular I want to thank Mr Paul G. Wilson who also provided essential guidance in nomenclatural matters and wrote the Latin descriptions. All those assisting on the technical side are thanked, particularly Mr R. J. Cranfield for his many hours of patient dissection and slide preparation. Herbarium directors and their staffs are thanked for making large and extended loans of specimens.

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Index to collections seen

In this Index the collectors' numbers are ordered by the leading digit, eg. 2236, 315, 4947.

Alexander, Waddouring (PERTH) (6); *Anon.*, East Yuna Reserve (PERTH) (4); *Anon.*, nr Southern Cross (PERTH) (5); *Aplin* 3519 (PERTH) (3); *Ashby* 2029 (AD) (6); *Ashby* 2236 (AD, PERTH) (2); *Ashby* 315 (AD) (5); *Ashby* 4947 (AD, PERTH) (5); *Ashby* 5180 (AD, PERTH) (6); *Ashby* 5378 (AD) (5); *Ashby* 5391 (PERTH) (4); *Ashby* 5391A (PERTH) (1); *Ashby* 5395 (AD) (6); *Ashby*, Ajana (AD96428075) (2); *Bailey*, Muntadgin (PERTH) (6); *Barker* 2178 (AD) (4); *Barker*, 20 mi E of Perenjori (PERTH) (5); *Barrett* 5 (PERTH) (6); *Beard* 1983 (PERTH) (1); *Beard* 1993 (PERTH) (4); *Beard* 2617 (PERTH) (6); *Beard* 3003 (PERTH) (2); *Beard* 5141 (PERTH) (6); *Beard* 5146 (PERTH) (5); *Beard* 6195 (NSW, PERTH) (6); *Beard* 6253 (PERTH) (6); *Beard* 6521 (PERTH) (6); *Beard* 6662 (PERTH) (5); *Beard* 6698 (NSW, PERTH) (6); *Beard* 6722, 6735 (NSW, PERTH) (4); *Beard* 6736 (NSW, PERTH) (5); *Beard* 6765 (NSW, PERTH) (3); *Beard* 6832 (NSW, PERTH) (5); *Beard* 7068 (PERTH) (3); *Beard* 7112 (PERTH) (4); *Beard* 7113, 7146, 7356, 7980 (PERTH) (5); *Beard* 7214 (PERTH) (6); *Beard* 7332 (PERTH) (1); *Beard* 7954 (PERTH) (6); *Bellairs* 911 (PERTH) (6); *Bennett* 1481 (PERTH) (4); *Blackall* 3299 (PERTH) (5); *Blackall* 3350, 3500 (PERTH) (5); *Blackall* 3412 (PERTH) (6); *Blackall* 3424A (PERTH) (6); *Blackall* 3785 (PERTH) (6); *Blackall* 3790 (PERTH) (6); *Blackall* 4555 (PERTH) (4); *Blackall* 4581 (PERTH) (3); *Blackall* 4724 (PERTH) (4); *Blackall* 641 (PERTH) (6); *Blackall* 720 admixture (PERTH) (6); *Blackall* 944 (PERTH) (6); *Blackall*, nr Narembeen (PERTH) (6); *Blackall*, nr Southern Cross (PERTH) (5); *Blockley* 1010 (PERTH) (5); *Blockley* 473 (PERTH) (5); *Broadbent*, 50 mi SW of Yalgoo (CANB) (6); *Brockway* 6 (PERTH) (5); *Burbidge* 64 (PERTH) (4); *Burns* 3, 4, 5-5 June 1968 (PERTH) (6); *Burns* 46 (PERTH) (5); *Burns* 5-6 Nov. 1965 (PERTH) (5); *Burns* 65, 101, 106, 107 (PERTH) (1); *Burns* 84 (PERTH) (5); *Burns* 85 (PERTH) (4); *Burns* 96 (PERTH) (4); *Burns*, Wicherina (PERTH) (1); *Campbell* 56 (BRI) (6); *Campbell*, Nagade, Mingenew (PERTH) (6); *Chadwick* 1700 (PERTH) (1); *Chapman*, Coorow-Winchester (PERTH) (1); *Chapman*, nr Morawa (PERTH) (6); *Cole* 3/21 (PERTH) (5); *Cranfield* 663 (PERTH) (6); *Cranfield* 666 (PERTH) (5); *De Rebeira* 204 (PERTH) (6); *De Rebeira* 36 (PERTH) (6); *Delahunty*, Wubin (PERTH) (5); *Demarz* 1882 (PERTH) (4); *Demarz* 256 (PERTH) (5); *Demarz* 2601 (PERTH) (6); *Demarz* 5124 (PERTH) (6); *Demarz* 5158 (PERTH) (3); *Demarz* D5588 (PERTH) (6); *Demarz* D7429 (PERTH) (6); *Demarz* D7557 (PERTH) (5); *Diels & Pritzel* 517 (PERTH) (5); *Diels* 5231 (PERTH) (6); *Diels* 5571 (PERTH) (5); *Doing*, 50 mi W of Coolgardie (CANB) (5); *Elliot*, nr Useless Loop (PERTH) (3); *Fairall* 1038 (PERTH) (6); *Fairall* 1206 (PERTH) (3); *Forrest*, nr Lake Deborah (MEL) (6); *Franks*, nr Coolgardie (PERTH) (5); *Galbraith* 248 (AD, MEL) (2); *Galbraith*, Wilroy (MEL) (6); *Gardner* 1118 (PERTH) (4); *Gardner* 12022 (PERTH) (5); *Gardner* 12058 (PERTH) (6); *Gardner* 12087 (PERTH) (6); *Gardner* 12159 (PERTH) (5); *Gardner* 12254 (PERTH) (5); *Gardner* 12458 (PERTH) (6); *Gardner* 13286, 13314 (PERTH) (4); *Gardner* 13313, 13316 (PERTH) (2); *Gardner* 13344 (PERTH) (6); *Gardner* 13532 (PERTH) (6); *Gardner* 13536 (Perth) (5); *Gardner* 14372 (PERTH) (6); *Gardner* 2669 (PERTH) (6); *Gardner* 6457 (PERTH) (6); *Gardner* 7776 (PERTH) (5); *Gardner* 830 (PERTH) (6); *Gardner*, 50 mi N of Northampton (PERTH) (4); *Gardner*, Cue (PERTH) (5); *Gardner*, Karalee (PERTH) (5); *Gardner*, Yorkrakine (PERTH) (5); *Gardner*, nr Korrelocking (PERTH) (5); *Gardner*, nr Youanmi (PERTH) (5); *George* 14345 (PERTH) (6); *George* 1455 (PERTH) (2); *George* 1489 (PERTH) (5); *George* 5673 (PERTH) (6); George 7881 (PERTH) (1); *Gittins* 1512 (BRI, NSW) (2); *Gray*, Trayning (PERTH) (6); *Green* 1521 (PERTH) (6); *Green* 1527 (PERTH) (5); *Green* 1534 (PERTH) (6); *Green* 1545A (PERTH) (6); *Green* 1575 (PERTH) (6); *Green* 4638, 4658 (PERTH) (5); *Green* 4656 (PERTH) (6); *Green* 4657 (PERTH) (6); *Gregory*, Northam (PERTH) (6); *Grieve*, Ballidu area (UWA) (6); *Grieve*, Kellerberrin-Doodlakine (UWA) (5); *Hart* 15 (PERTH) (6); *Holm*, Talisker station (PERTH) (2); *Howard* and *Houston* 331-5 (PERTH) (3); *Howard* and *Houston* 338-7 (PERTH) (2); *Humphries* M31343 (PERTH) (5); *Hursthouse*, Murchison dist. (NSW7064, PERTH) (1); *Kelso*, Coolgardie (PERTH) (5); *Koch* 1091 (NSW, PERTH) (5); *Loneragan*, 12.7 mi S of Coorow (UWA) (1); *Long* 50 (PERTH) (1); *Luff* and *Birrel* 34 (AD) (5); *Lullfitz* 2476 (PERTH) (6); *Lullfitz* 3827 (PERTH) (6); *Lullfitz* L1622, 2031 (PERTH) (5); *Lullfitz* L2890, 2984, 2991, 3078, 3215 (PERTH) (5); *Lullfitz* L2897, 2907 (PERTH) (4); *Lullfitz* L2947 (PERTH) (1); *Main*, 61 mi W of Coolgardie (PERTH) (5); *Main*, Bonnie Rock-Wialki dist. (PERTH) (6); *Mason*, Wanarra sta. (PERTH) (6); *Mason*, nr Lake Monger (PERTH) (5); *McGauran*, Geraldton (PERTH) (4); *Merrall*, Golden Valley (MEL) (6); *Monck*, S of Geraldton (PERTH) (1); *Mueller*, N of Murchison R (MEL76002) (5); *Muir* 209 (PERTH) (6); *Muir* 63 (PERTH) (6); *Nathan*, bet. Coolgardie and Bullabulling (PERTH) (5); *Nelson* ANU17340, 17342 (PERTH) (3); *Newbey* 1546 (PERTH) (5); *Newbey* 1690 (PERTH) (6); *Newbey* 2041 (PERTH) (6); *Newbey* 2087 (PERTH) (6); *Newbey* 2095 (PERTH) (6); *Newbey* 2143 (PERTH) (5); *Newbey* 2199 (PERTH) (2); *Newbey* 6062 (PERTH) (5); *Newbey* 8983 (PERTH) (5); *Newbey* 8995 (PERTH) (6); *Newbey* 9442 (PERTH) (6); *O'Grady*, Gnangara (PERTH) (5); *Orchard* 4189 (AD, PERTH) (5); *Paust* 1288 (PERTH) (4); *Perry, D. H.*, Yuna (PERTH) (1); *Perry, D. H.*, nr Yuna (PERTH) (5); *Perry, D. H.*, prope Mullewa (PERTH) (4); *Perry, G.* 587 (PERTH) (4); *Phillips*, 18 mi S of Morawa (PERTH) (5); *Phillips*, 2 mi N of Tardun (CBG019320, NSW) (5); *Phillips*, 3 mi E of Mullewa (CBG038976) (6); *Phillips*, 6 mi E of Mullewa (BRI, CBG038685, MEL, NSW) (6); *Phillips*, 9 mi NNW of Ballidu (CANB036524, PERTH) (5); *Phillips*, Daisy Downs, 12 mi fr. Mullewa (CBG013832, NSW) (4); *Phillips*, N of Murchison R (BRI, CBG622585) (4); *Phillips*, Pindar (AD, CBG027475) (6); *Phillips*, c.14 mi S of Wannoo (PERTH) (5); *Phillips*, c.14.5 mi S of Wannoo (CBG034980, NSW) (5); *Powell* 73104 (PERTH) (5); *Powell* 74047 (PERTH) (6); *Powell* 74103 (PERTH) (1); *Pritzel* 862 (NSW) (5); *Rogerson* 315 (PERTH) (5); *Rosier* 372 (PERTH) (6); *Rosier* 376 (PERTH) (5); *Royce* 5046 (PERTH) (6); *Royce* 5491 (PERTH) (6); *Royce*, Chandler (PERTH) (6); *Russell*, Jibberding (PERTH) (5); *Rye* 76014 (PERTH) (5); *Sargent*, Latham (PERTH) (6); *Scrymgeour* 1479, 1521 (PERTH) (5); *Scrymgeour* 1535 (PERTH) (6); *Sewell*, Swan R (MEL) (6); *Sharr* 3610 (PERTH) (5); *Shaw* 609 (AD, PERTH) (5); *Smith* 66/301 (PERTH) (4); *Smith* 66/412 (PERTH) (5); *Stacey* 254 (PERTH) (5); *Stacey* 688, 692, 693 (PERTH) (5); *Storr*, 12 mi NW of Wialki (PERTH) (6); *Thomson*, bet. Geraldton and Mullewa (PERTH) (4); W----, c. 50 mi W of Mullewa (UWA) (5); *Webster* 65 (NSW) (5); *Webster*, Coolgardie (NSW136165) (4); *Wemm* 913B (PERTH) (4); *Whibley* 4647 (AD) (5); *White* 5473 (BRI) (5); *White* 630814 (PERTH) (5); *White*, 7 mi S of Coolgardie (PERTH) (5); *Willis*, 58 mi W of Coolgardie (MEL, NSW136238) (5); *Wilson* 11576 (PERTH) (5); *Wilson* 3519 (PERTH) (5); *Wittwer* 1234 (PERTH) (6); *Wittwer* 1244 (PERTH) (5).