TAXONOMIC REVISION OF CHLOANTHACEAE TRIB. PHYSOPSIDEAE (= VERBENACEAE SUBFAM. CHLOANTHOIDEAE TRIB. PHYSOPSIDEAE)

by

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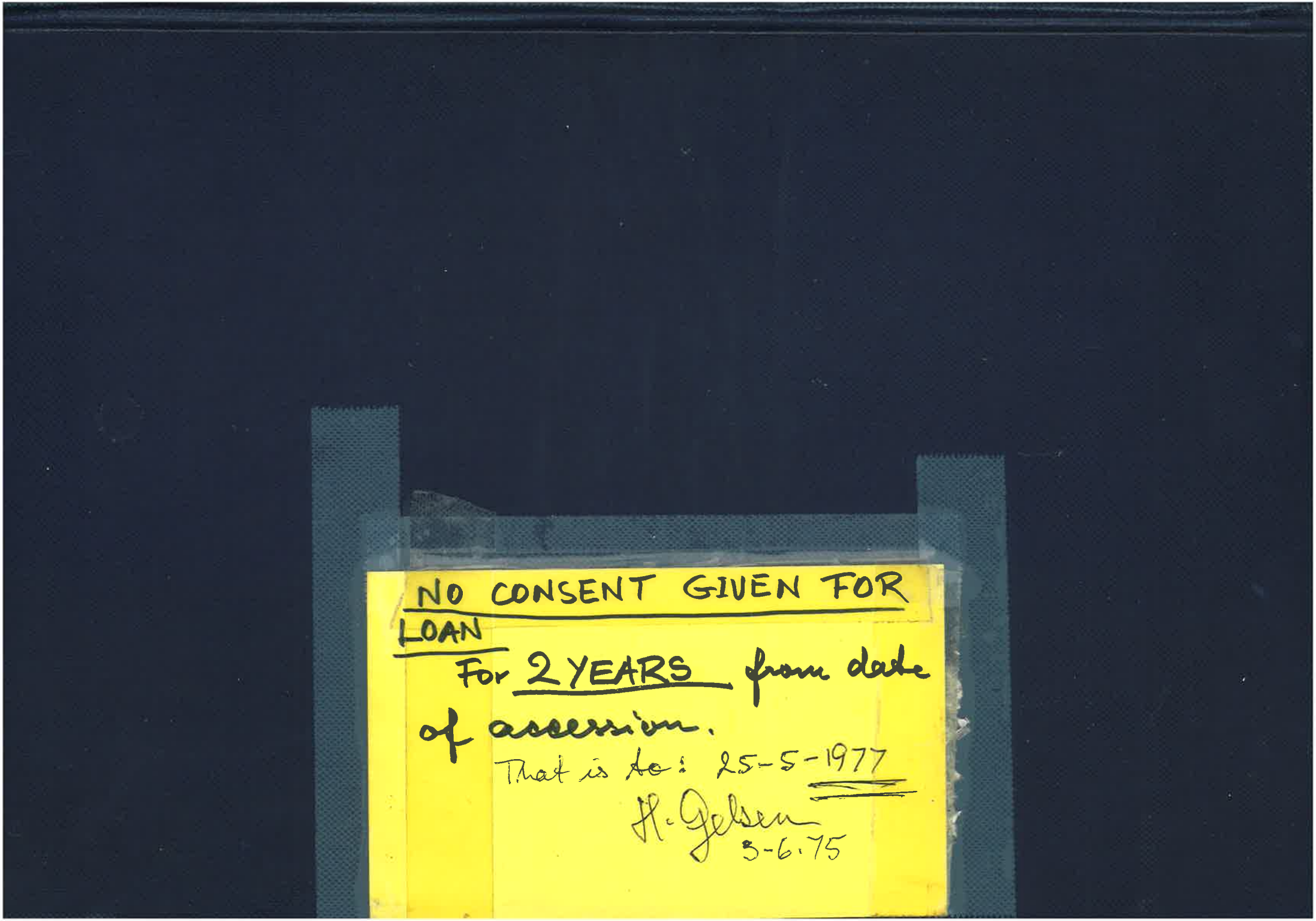
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S U M M A R Y

This thesis contains a taxonomic revision of the genera Dicrastylis Drumm.ex Harv.,Lachnostachys Hook.,Mallophora Endl., Newcastelia FvM. and Physopsis Turcz.. These were included by F.v.Mueller,G.Bentham, J.Briquet and many others in Verbenaceae. Recently, some authors have placed them under Chloanthaceae, Dicrastylidaceae or Stilbaceae,families segregated from,but closely related to, Verbenaceae. Here, the above genera and all other Australian endemic taxa hitherto included in Verbenaceae are regarded as belonging to the family **Chloanthaceae** and the reasons therefore discussed. Also the diagnostic characters of **Chloanthaceae** are examined in the light of justifying the segregation of this family from Verbenaceae.

The present revision is based on herbarium material, supplemented by field studies. The literature has been thoroughly examined. The relationship, phylogeny, distribution and ecology are discussed for each genus. Keys to the taxa recognised are provided, also a detailed new description of each taxon, is for most species, supplemented by a habit sketch of a flowering branch and analytical drawings of the flowers.

Dicrastylis stoechas Drumm. ex Harv. and D. thomasiae S. Moore are treated as taxonomic synonyms of the newly formed combination D. Corymbosa (Endl.) Munir (based on Mallophora corymbosa Endl.). D. carnegiei Hemsl. and D. weddii Bail. are recorded as taxonomic synonyms of D. doranii FvM. and D.lewellinii(FvM.) FvM. respectively. D.doranii var. eriantha FvM. has been transferred to D.costelloi Bail. Thus, the previously described species of Dicrastylis have been reduced to 13 species and 2 varieties. Further, 13 new species, 6 subspecies, 17 varieties and 10 formae are decribed under this genus for the first time, raising the present total of taxa recognised in Dicrastylis to 26 species, 6 subspecies, 19 varieties and 10 formae.

Newcastelia dixonii FvM. et Tate has been excluded from Newcastelia FvM. as it belongs to the family Solanaceae. N.cephalantha var. queenslandica Domin is found to be convarietal with N.cephalantha FvM. var. cephalantha,and two new varieties, var. oblonga and var. tephropepla are described. In addition three new species N.elliptica, N.interrupta and N.velutina are described, raising the number of taxa of Newcastelia FvM. now recognised to 12 species and 3 varieties.

In Lachnostachys,the ten species hitherto described have been reduced to six. L.cliftonii FvM. and L.rodwayana Fitzg. are treated as taxonomic synonyms of L.verbascifolia FvM. and

L.eriobotrya (FvM.)Druce respectively and L.brevispicata E.Pritzel is recognized as a form of L.coolgardiensis S.Moore. L.dempsteri E.Pritzel is regarded as a nomenclatural synonym of L.verbascifolia var. paniculata Ewart. The latter has been transferred to L.ferruginea Hook. Five new formae are described under L.ferruginea . Thus, of the ten species of Lachnostachys hitherto described, only 6 species are now recognized and 2 varieties and 7 formae distinguished on the infraspecific level.

In Mallophora Endl. and Physopsis Turcz., two species are recognized under each genus. One, Mallophora rugosifolia with some characters of the inflorescence similar to those present in Physopsis, is new.

STATEMENT OF ORIGINAL WORK.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University; nor does it include, to the best of my knowledge, any information previously published or written by any other person, except where due reference is made in the text.

M. A. Abid

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I N T R O D U C T I O N

The present study deals with selected genera of "Australian Verbenaceae" (s.lat.) which have been placed by some in Dicrastylidaceae Drumm. ex Harv. and by others in Chloanthaceae Hutch. The majority of botanists, however, have retained them under the tribe Chloantheae Benth. et Hook. or subfamily Chloanthoideae Briq. in Verbenaceae. The genera dealt with here include Dicrastylis Drumm. ex Harv., Lachnostachys Hooker, Mallophora Endl., Newcastelia FvM. and Physopsis Turcz. They are characterized by having ± regular flowers within the above named tribe or subfamily in Verbenaceae, and together with the remaining genera of Chloanthaceae (characterized by zygomorphic flowers) are endemic in Australia and differ from Verbenaceae (sensu stricto) in the following characters:

> Very densely tomentose or cotton - woolly shrubs or shrublets with indumentum often consisting of dendriform hairs, rarely glabrous or scabrid; inflorescence (terminal) dichasial cymes arranged into a spicate, capitate or corymbose - paniculate cluster; flowers each with a bract and 2 lateral bracteoles at the base; ovary not lobed; ovules attached above the middle of the central axis; fruit indehiscent, dry ; seeds always albuminous; endemic in Australia.

It is probable that some of these characters may have induced Dr.Harvey (1855), while describing Drummond's new genus Dicrastylis, to regard it "to be either a Cordiacea with opposite leaves, or the type of a new Order, between Cordiaceae and Verbenaceae".* Accordingly he published the genus Dicrastylis under the name "Dicrastyleae" with an incidental mention "(inter Verbenaceas et Cordiaceas media?)" without a formal description for "Dicrastyleae". Among the remaining four genera examined in this work, Mallophora Endl., Newcastelia FvM. and Physopsis Turcz. were originally described under Verbenaceae while Lachnostachys Hook. was referred to the family Amaranthaceae. All these genera, except Lachnostachys Hook.,were later recorded by F.Mueller (1861 - 1868) under Verbenaceae, but in 1861 he retained Lachnostachys under Amaranthaceae and later, in 1868, placed it in Byttneriaceae ("Buettneriaceae"). Nevertheless, after the publication of Bocquillon's (1863) and Bentham's (1870) accounts of Verbenaceae (s. lat.), F.v.Mueller (1875)

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*Note See Harvey's published letter to W.J.Hooker in Hook.J.Bot. Kew Misc. 7 (1855) 47.

transferred Lachnostachys to the latter family, also describing one new species in that genus. Further, in different parts of his "Fragmenta Phytographiae Australiae", he added two new species to Dicrastylis (1876, 1880) and three to Newcastelia (1875,1876).

The earliest comprehensive account of the Australian Verbenaceae (s.lat.) is found in G.Bentham's"Flora Australiensis" (vol.5, 1870). Because the Australian flora was then still in its early stages of exploration and plant collections from there were scarce, Bentham's Flora contains only about 13 species of the genera here discussed. After publication of Bentham's Flora (vol.5,1870), F.v.Mueller described at intervals the following species, Dicrastylis beveridgei,D.doranii, D.gilesii,D.nicholasii Newcastelia bracteosa,N.chrysotricha, N.hexarrhena,N.cephalantha, N.dixonii FvM. et Tate and Lachnostachys cliftonii. L.cliftonii has now been found to be conspecific with L.verbascifolia, one of the species described earlier by F.Mueller, and Newcastelia dixonii FvM. et Tate is now regarded as belonging to Solanaceae, possibly Anthotroche Endl., and has therefore been excluded from Newcastelia FvM.. However, all these taxa were later catalogued (without description) by F.Mueller in his Census (1882) and "Second Census of Australian Plants (1889)". Tate published in 1889 the first comprehensive Flora of South Austrllia in which he recorded under Verbenaceae only five species each of Dicrastylis and Newcastelia then known to occur in this State. A year later, Bailey (1890) published the "second addition to third supplement of Synopsis of Queensland Flora" and for the first time recorded one species of Newcastelia (N.cephalantha FvM.)from that State. In the following years, Bailey (1891,1895) described Dicrastylis costelloi and D.weddii of which the latter is now found to be conspecific with D.lewellinii (FvM.)FvM.. Later on, he recorded in his Flora (1901) and Catalogue of Queensland Plants (1913) only four species of Dicrastylis (including his two new ones) and two of Newcastelia under Verbenaceae. Previously, Hemsley (1898) also described Dicrastylis carnegiei which is now found to be conspecific with D.doranii FvM.. In 1903, S.Moore described Lachnostachys coolgardiensis and the following year Fitzgerald (1904) also published L.rodwayana which is now regarded as conspecific with L.eriobotrya (FvM.)Druce.

Almost simultaneously, Diels & Pritzel (1904) published a comprehensive account of the West Australian Verbenaceae with four new species, Newcastelia insignis, N.viscida,Lachnostachys brevispicata and L.dempsteri. Of the two Lachnostachys species,

the former is now reduced to L.coolgardiensis f. brevispicata (E.Pritzel)Munir and the latter placed as L.ferruginea Hook. var. paniculata (Ewart)Munir.During the period that has elapsed since the publication of Bentham's Flora (vol.5, 1870), Diels & Pritzel 's (1904) account of Australain Verbenaceae is the most comprehensive one, although it is restricted to Western Australia. These authors have monographed almost all previously published species of West-Australian Verbenaceae. They covered the majority of the then known Australian Verbenaceae but did not include Bailey's two new species (Dicrastylis costelloi and D.weddii) from Queensland. In a few species, the distribution limits are not extended outside Western Australia where they are now known to grow commonly. In 1917, Ewart & Davies published the Flora of Northern Territory which contained only one species of Dicrastylis and two of Newcastelia. Seven species of Dicrastylis and five of Newcastelia are now known to occur in this region. During 1918, J.M.Black described Dicrastylis verticillata endemic in South Australia. Subsequently, Moore (1920,1921) described Dicrastylis thomasiae and Lachnostachys cordifolia respectively. The former is now found to be conspecific with D.corymbosa (Endl.)Munir, and the latter with L.verbascifolia FvM.

Black's "Flora of South Australia" (1st ed.1926, 2nd ed.1943-1957) is much more comprehensive than that by Tate (1889), but, being a regional publication, it contains only six species of Dicrastylis and five of Newcastelia (including N.dixonii FvM. et Tate) in Verbenaceae. Additions and corrections to the second edition (1943-1957) were made by Eichler (1965) to bring it up-to-date. He recommended the transfer of Newcastelia, Dicrastylis and Spartothamnella to the family Chloanthaceae Hutch. and recognized that Newcastelia dixonii FvM. et Tate belongs to Anthotroche Endl. (Solanaceae).

Earlier, Gardner (1931) had published a systematic census of the West-Australian plants, where he listed under Verbenaceae all species previously described in the genera here under consideration, except Dicrastylis thomasiae Moore. He recognized Lachnostachys cordifolia Moore as being conspecific with L.verbascifolia FvM. and placed the former in the synonymy of the latter. Nevertheless, his list contains the names of four species of Lachnostachys [L.brevispicata E.Pritzel, L.rodwayana Fitzg., L.cliftonii FvM. and L.dempsteri E.Pritzel] and one of Dicrastylis [D.carnegiei Hemsl.] which are now found to be conspecific with previously described taxa of these genera. Gardner's list of 1931

contains also Newcastelia dixonii FvM. et Tate which has now been excluded from Verbenaceae (s.lat.). In 1939, Gardner described Physopsis lachnostachya and in 1942 he recognized Pityrodia flexuosa Price as belonging to Dicrastylis, for which he made the new combination D.flexuosa. In 1964, Gardner described two further species, Lachnostachys bracteosa and Newcastelia chrysophylla.

Previous to this, Hutchinson (1959) raised the status of Bentham & Hooker's tribe Chloantheae [to which all the genera here examined belong] to the family Chloanthaceae, differing chiefly from Verbenaceae (s.strict.) in the albuminous seeds. During the same year, Moldenke (1959) published a "Résumé of the world Verbenaceae etc." and referred all the genera of the tribe Chloantheae to the family Stilbaceae. He catalogued all the then described taxa of Verbenaceae, Stilbaceae etc. The names of a few taxa contained therein were found to be incorrect and are recorded in the present work as synonyms. The distribution of two species of Lachnostachys and one of Physopsis is given as occurring in South Australia where these genera do not occur. A few years later, Beard (1965) and Blackall & Grieve (1965) published "A Catalogue of West Australian Plants" and an account of "Western Australian Wildflowers" respectively. They included all the genera here examined under Verbenaceae. Since both these publications are regional in application, the number of species recorded under each genus is fewer than their known total in the whole of Australia. As with earlier authors, some names were recorded which are nomenclatural synonyms of others.

In 1966 H.K.Airy Shaw referred all genera of Australian Verbenaceae (s.lat.) with albuminous seeds to Dicrastylidaceae Drumm. ex Harv., a family name mentioned incidentally by Harvey (1855) with his genus Dicrastylis. This family, Dicrastylidaceae, has now been adopted for the "Australian Verbenaceae" with albuminous seeds by Beard (1970), Moldenke (1971) and some others. Nevertheless, in many recent publications, the genera belonging to Chloanthaceae have been recorded mostly under Verbenaceae and in a few cases under Dicrastylidaceae which is a synonym of Chloanthaceae.

The above records of species of the genera here investigated show that during the period that has elapsed since the publication of Bentham's Flora (vol.5,1870), the number of species of Chloanthaceae in Australia has continued to increase. Many new species as well as new localities for the already described species have been published in various scientific journals within and outside

Australia. The various species of Chloanthaceae are now recorded in the standard regional or state Floras, but these texts are restricted in their application and do not convey our present knowledge. In many cases, the species concept is so narrow that a slight difference in the shape, size or langth of leaves, or in the density of their indumentum, has led to the description of new species. Such a practice had been common in the genus Lachnostachys and/a few instances in Dicrastylis. The characters of the taxa thus described overlapped so much that it has become impossible for subsequent workers to recognize them from the descriptions or keys. Many undescribed taxa escaped discovery because they had been wrongly named in herbarium annotations, and the names of many taxa previously described have been misapplied in much of the taxonomic literature. In fact there has been much confusion in the identification of the taxa of Chloanthaceae in Australia, and the need for a taxonomic revision of the family has long been felt. Symon (1969) made the following remark about taxa of Dicrastylis and Newcastelia that he recorded from the Simpson Desert: "Examination of herbarium specimens at AD and ADW suggest considerable confusion in their identification and when they are revised or more rigorously checked the following may be changed" viz.: Dicrastylis costelloi Bailey, D.doranii FvM., D.doranii var. eriantha, Newcastelia cephalantha FvM. and N.spodiotricha FvM.. Similarly, Chippendale (1971) suggested in his "Check list of Northern Territory Plants" that "much needed are revisions of the important and extensive..... Dicrastylis, Newcastelia..... and the family Scrophulariaceae". [A list of 18 further genera of different families is also included in this quotation].

In view of the difficulties existing in the identification of Chloanthaceae, a taxonomic revision of this family was in urgent demand. It has now been accomplished here for the five genera included in this work, the revision of the remaining genera (i.e. Chloanthes, Cyanostegia, Denisonia, Hemiphora, Pityrodia and Spartothamnella) will, it is hoped, be carried out later.

The present studies are given below in outline; full details of each taxon are recorded in its taxonomic treatment under the relevant genus. The five genera here discussed and all other Verbenaceae (s.lat.) endemic in Australia, are referred in this work to the family Chloanthaceae (Benth.)Hutch. This family is regarded as having two tribes: Physopsideae Briq. and Chloantheae, the former, [Physopsideae Briq.]

comprising the five genera revised in this work. Keys to the genera and species have been prepared and detailed new descriptions are provided for each taxon. Moreover, distribution, ecology and relationship of each is discussed. A habit sketch of a flowering branch from most species is depicted, an enlarged drawing of a single cyme and flower, with longitudinal section of the flower and transverse section of the ovary add to the description. The pollen grain morphology of selected taxa of each genus has been studied, described and figured.

Some of the important results obtained during present studies are recorded under each genus, but a few should be mentioned here.

In Dicrastylis, D.stoechas Drumm. ex Harv. and D.thomasiae S.Moore are found to be conspecific with D.corymbosa (Endl.)Munir [based on Mallophora corymbosa Endl.]. Similarly, both D.carnegiei Hemsl. and D.weddii Bailey are found to be synonymous with D.doranii and D.lewellinii (FvM.)FvM.respectively. D.doranii FvM. var. eriantha FvM. has been transferred to D.costelloi, retaining its rank. As a result of these changes, the number of previously known taxa of Dicrastylis has been reduced to 13 species and two varieties.But the present revision adds descriptions of 13 new species, 6 subspecies, 17 varieties and 10 formae,increasing the total number of taxa now recognized in Dicrastylis to 26 species, 6 subspecies, 19 varieties and 10 formae.

In Newcastelia FvM., N.dixonii FvM. et Tate is found to belong to the genus Anthotroche Endl. in Solanaceae, and has therefore been excluded. Moreover, N.cephalantha FvM. var. queenslandica Domin has been found to be convarietal with the type variety, but two new varieties of this species, var oblonga and var. tephropepla, are described. In addition, three new species N.elliptica, N.interrupta and N.velutina have been described. This raises the total number of its known taxa in Newcastelia to 12 species and 3 varieties.

In Lachnostachys Hook., by contrast to Dicrastylis and Newcastelia, the number of species has been reduced from ten to six. L.cliftonii FvM. and L.rodwayana Fitzg. are found to be taxonomically synonymous with L.verbascifolia FvM. and L.eriobotrya (FvM.)Druce respectively. L.brevispicata E.Pritzel has been transferred to L.coolgardiensis S.Moore, and reduced in rank to f.brevispicata(E.Pritzel)Munir. L.verbascifolia FvM. var.paniculata Ewart [=L.dempsteri E.Pritzel] has been transferred to L.ferruginea Hook. Three new forms, f. obtusifolia (belonging to var.paniculata) f. acutifolia and f. reticulata (belonging to var. ferruginea), are recognized and described. In the genus Lachnostachys Hook.

only 6 species with 2 varieties and 7 forms are now recognized.

In the remaining two genera studied in this work, *Physopsis* Turcz. and *Mallophora* Endl., there is no alteration in the number of taxa. *Mallophora rugosifolia* is described as new and one of the syntype species of *Mallophora*, *M.corymbosa* Endl. (1838), has been recognized as belonging to *Dicrastylis* Drumm. ex Harv. [*D.corymbosa*(Endl.)Munir]. The latter is conspecific with *Dicrastylis stoechas* Drumm. ex Harv. (1855), one of the syntype species of *Dicrastylis*. *D.stoechas*, because of an earlier validly published specific epithet, has now been placed in synonymy. Despite these changes, *Mallophora* and *Physopsis* each consist of two species only.

TAXONOMIC HISTORY

Of the five genera discussed in this work, Mallophora is the earliest known, described by Endlicher during 1838. It was based on two species, M.corymbosa and M.globiflora, the types of which were collected by Roe from Western Australia. The genus was then referred by the author to Verbenaceae trib. Lantaneae, a position subsequently maintained for this genus by Endlicher (1839,1841), Meisner (1840) and Walpers (1845). Schauer (1847) recorded this genus with its two syntype species and their original descriptions, and transferred it from Lantaneae to Verbeneae. Until the present revision of this genus, no additional taxa are known to have been described under it.

Four years after the publication of Mallophora Endl., W.J. Hooker (1842) described the genus Lachnostachys from two of Drummond's Collections from "Swan River Colony", Western Australia. Both collections were figured and described as two distinct species, L.albicans and L.ferruginea. Because the flower structure of these species was misunderstood by the author, he referred the new genus to the family Amaranthaceae. [Characters of Lachnostachys: inflorescence spicate; corolla-tube almost truncate (i.e. almost without lobes); stamens inserted at the margins of the corolla-tube, thus suggesting a staminal-tube; ovules generally only one (of four) maturing to form a seed, and the dissepiment breaking down early from the walls of the ovary to give a first impression of a single-ovuled unilocular ovary]. This family Amaranthaceae was later adopted to accommodate Lachnostachys by Endlicher (1843, 1847), Nees (1845), Moquin (1849), Lindley & Moore (1870) and Pfeiffer (1874). In this family, Endlicher (1843,1847) referred the genus to trib. Achyrantheae subtrib. Aervinae ("Aerveae"); and this position was subsequently maintained by Nees (1845) and Moquin (1849).

A few years after the publication of Lachnostachys, Turczaninow (1849) described simultaneously two new genera Physopsis and Lachnocephalus under Verbenaceae. Both the genera were published with one species each, viz.P.spicata and L.lepidotus respectively. The former was based on Drummond's 4th coll. no. 234 and the latter on Drummond's 4th coll. no. 235 and Gilb's no. 6, all from the south-west of Western Australia. Later on, Walpers (1852) retained both Physopsis and Lachnocephalus under the family Verbenaceae and referred the former to Verbeneae and the latter to Viticeae.

Subsequently, Harvey (1855) published Drummond's manuscript of a new genus Dicrastylis along with three species namely D.fulva, D.reticulata,and D.stoechas. The genus was regarded by Harvey as a type of the new "order Dicrastyleae" between Cordiaceae and Verbenaceae. All the syntype species were based on Drummond's three differnt collections from "Northern districts of the "Swan River Colony",Western Australia. Two years later, F.v.Mueller (1857) also described under Verbenaceae a new genus Newcastelia with one species N.cladotricha. The type species was based on one of F.v.Mueller's own collection (s.n.) from Sturt's Creek, Western Australia. Following this, C.Mueller (1859) record -ed the genus Dicrastylis Drumm. ex Harv. with its three syntype species and their original descriptions under the family ("Order") Phrymaceae, and the latter he placed between Lamiaceae ("Labiatae") and Verbenaceae. During the same period, F.v.Mueller (1859) published yet another new genus Walcottia with one species W.eriobotrya; it was then placed under the family Byttneriaceae ("Buettneriaceae") with the remark "Plantam Verbenaceam quam Buettneriaceae menties"; the new genus was based on a collection by Oldfield & Walcott (s.n.) from Murchison River, Western Australia. During 1861, F.v.Mueller recognized his new genus Walcottia as congeric with W.J.Hooker's Lachnostachys and thus recorded the former as a synonym under the latter, and apparently following Hooker (1842), he placed it under the family Amaranthaceae. Subsequently, Lachnostachys was described by Turczaninow (1863) as his further new genus Pycnolachne under Verbenaceae. The new genus was published with one species P.ledifolia, the type of which is Drummond's 6th coll. no. 220, from between Moore and Murchison Rivers, Western Australia.

In the meantime, Bocquillon (1863) published his "Revue du groupe des Verbénacées" and recorded Lachnocephalus Turcz., Mallophora Endl. and Physopsis Turcz. as three distinct genera. In his arrangement of these taxa, he placed Mallophora Endl. and Physopsis Turcz. with the group having regular flowers and erroneously referred Lachnocephalus Turcz. to the group having irregular flowers. A few years later, F.v.Mueller(1868) described a new species (L.verbascifolia FvM.) under Lachnostachys and referred this genus[with Walcottia as its synonym] back to the family Byttneriaceae ("Buettneriaceae"). In the same place, he recognized Lachnocephalus Turcz. And Pycnolachne Turcz. as con-generic with Mallophora Endl. and Lachnostachys Hook. respectiv-ely, and thus regarded the former two as synonyms under the latter. Since then Lachnocephalus Turcz. and Pycnolachne have always been

treated as synonyms of Mallophora Endl. and Lachnostachys Hook. respectively. Then Lindley & Moore (1870) recorded the genus Lachnostachys under Amaranthaceae and Newcastelia under Verbenaceae. They seem to have followed the original publications in referring these genera to the families under which they appeared in their protologue.

Bentham (1870) published the first comprehensive account of the then known "Australian Verbenaceae" and regarded Bocquillon's arrangement of its genera as un-natural and non-practical. Moreover, in his classification of Verbenaceae, he claimed to have "returned to the old division of the order into the main tribes adopted by Schauer (1847) in De Candolle's Prodromus, with some minor modifications as to a few genera which had been imperfectly known or incorrectly described" [Fl.Aust. 5(1870)32]. Under his modified classification of Verbenaceae, Bentham (1870) placed all the above-mentioned genera and their close relatives under subtrib. Chloanthinae ("Chloantheae") of trib. Viticeae. Within the subtrib. Chloanthinae ("chloantheae"), Dicrastylis, Lachnostachys, Mallophora, Newcastelia and Physopsis were arranged into a group having small and regular flowers with isomerous stamens, and the remaining genera under the group having irregular flowers with non-isomerous stamens. He also prepared a key to the genera and, where appropriate, one to the species also. The tribe and subtribe proposed by Bentham for these genera was later adopted by Ewart & Davies (1917) in their "Flora of the Northern Territory".

Four years after the publications of Bentham's revision of the Australian Verbenaceae, Pfeiffer (1874) listed Dicrastylis, Lachnostachys, Mallophora and Physopsis [not Newcastelia FvM.] with the status given to these taxa in his Nomenclator. According to the references he quotes the genera were placed as follows: Lachnostachys in Amaranthaceae, Mallophora and Physopsis in Verbenaceae and Dicrastylis is recorded as type of a new family ("order"), Dicrastyleae Drumm. ex Harv.

Bentham & Hooker (1876) classified the family Verbenaceae into 8 tribes and also raised the status of Bentham's subtrib. Chloanthinae ("Chloantheae") to trib. Chloantheae segregated from and raised to equal rank with Viticeae and Verbeneae. All the genera previously recorded by Bentham under trib. Viticeae, subtrib. Chloanthinae ("Chloantheae"), were retained under the new tribe Chloantheae. In the key to the genera, the style of Dicrastylis was recorded as "5-fidus", an error subsequently repeated by Briquet (1895), Willis (1957) and Moldenke(1959,1971). After Bentham & Hooker's classification, all the genera of trib.

Chloantheae were registered by F.v.Mueller (1882,1889) under Verbenaceae without referring them to any tribe or subtribe. Nevertheless, Durand (1888),Bailey (1890.1891,1901,1913),Post & Kuntze (1904) and Lemée (1943) followed Bentham & Hooker's system and referred these genera to Verbenaceae trib. Chloantheae.

Subsequently, Briquet, (1895) re-arranged the family Verbenaceae according to Engler & Prantl's system and raised the status of Chloantheae to that of sub-family, Chloanthoideae.He subdivided the latter into three tribes: Achariteae, Chloantheae and Physopsideae, and placed all genera revised in the present work under his new trib. Physopsideae as the only ones belonging to it. Trib. Physopsideae Briquet was accepted by Dalla-Torre and Harms (1904),Gardner (1931,1939), Junell (1934) and Moldenke (1959 1971); the last three authors made a few minor modifications.After Briquet's newly proposed subfamily and tribe, Diels & Pritzel (1904) made a thorough revision of the Western Australian Verbenaceae, and divided Bentham & Hooker's trib. Chloantheae into two new subtribes, Lachnostachydinae and Chloanthinae. They placed all the genera of Physopsideae in their new subtribe Lachnostachydinae and gave a new key to the genera and,where appropriate, keys to the species. Diels & Pritzel's subtribes were later adopted by Gardner (1931), in recording them under Briquets' subfamily Chloanthoideae without mentioning any tribe. In 1939, Gardner followed Briquet's classification of Verbenaceae in recording all the genera of subtrib. Lachnostachydinae under Briquet's tribe Physopsideae. Prior to this,Junell (1934) also adopted Briquet's arrangement of Verbenaceae, but he erroneously labelled subfam. Chloanthoideae as a tribe and trib. Physopsideae and trib. Chloantheae as its subtribes. The emphasis in Junell's work was on showing the relationship of the various groups of Verbenaceae mainly on the bases of their gynoecium morphology. In the following years, Cheel (1937),Black (1957), Willis (1957) and Gardner (1959) recorded the genera belonging here under Verbenaceae without reference to any of the above tribes or subtribes.

Hutchinson (1959) revised his own classification of flowering plants of 1926, and raised the status of Bentham & Hooker's trib. Chloantheae [of Verbenaceae] to a family, Chloanthaceae. All the genera of trib. Physopsideae were placed in the new family with the group having actinomorphic corolla and non-muticous anther bases, characters previously used by Bentham (1870) and Bentham & Hooker (1876) as diagnostic for these taxa. Hutchinson's new family, Chloanthaceae, was later adopted by Bullock (1959),

Buchheim (1963), Eichler (1965), Symon (1969) and Gardner (1972). Moldenke (1959), however, referred all these genera to the family Stilbaceae. He subdivided this family into subfam. Stilboideae and Chloanthoideae, and retained all taxa of the family Chloanthaceae under the latter subfamily within which he arranged the taxa according to Briquet's classification, thus referring all genera with actinomorphic flowers and non-muticous anther-bases to trib. Physopsideae. For reasons of priority, Airy Shaw (1966) incorrectly referred all taxa of Chloanthaceae (Benth.)/Hutch. to Dicrastylidaceae, published invalidly over a century before by Harvey (1855) and based on the then only known genus Dicrastylis. This family name has since been used by George (1967,1972), Beard (1970), Fairall (1970) Maconochie & Byrnes (1971), Moldenke (1971,1973) and Hoogland (1972). In spite of the families CHLOANTHACEAE, STILBACEAE AND DICRASTYLIDACEAE proposed to accomodate the genera dealt with here, they have been retained in Verbenaceae by Takhtajan (1959), Burbidge (1960,1963), Melchior (1964), Gardner (1964,1973), Beard (1965), Blackall & Grieve (1965), Cronquist (1968), Morcombe (1970), Chippendale (1971), Clifford & Ludlow (1972) and Erickson & al. (1973).

In the present revision of Dicrastylis, Lachnostachys, Mallophora, Newcastelia and Physopsis, these genera are accepted as belonging to the family CHLOANTHACEAE. Within this family, they are placed under trib. Physopsideae, a position previously given to them by Briquet (1895) under Verbenaceae. Improved keys to the genera and species are given and all taxa are described in detail. As a result of the present investigations, new species and infraspecific taxa are described in Dicrastylis, Mallophora and Newcastelia. The number of species now accepted in Dicrastylis has nearly doubled and presumed natural groups of species are recognized and given the rank of section. The number of species in Lachnostachys has been reduced to about half, and many names have been relegated to synonymy. In Physopsis, all previously known taxa are accepted.

POLLEN MORPHOLOGY

In connection with the present taxonomic investigation, an attempt has been made to study in detail the morphology of the pollen grains of members of the genera involved in this work. It was hoped that some useful pollen characters might be found which would help in distinguishing these taxa. Although no such characters were found, the present investigation has been useful in showing great similarities of the pollen grains within the Chloanthaceae studied and a close resemblance to those of many genera in Verbenaceae, Stilbaceae, Phrymaceae, Symphoremaceae and Lamiaceae subfam. Prostantheroideae. All these families are considered closely linked with the Chloanthaceae also in some of their vegetative, floral and seed characters. According to the present investigation, it is not possible to distinguish the genera by their pollen characters.

Material and Methods:

This study of pollen grains is based entirely on the material from dry herbarium specimens. All the preliminary investigations were carried out on the pollen material collected and mounted into permanent slides by Australian National University palynological laboratories, Canberra. These slides were first studied at a magnification of X400 with a compound ("light") microscope and all the basic information regarding polarity, symmetry, apertures, shape, size and diameter of pollen grains was recorded. The pollen grains were measured with the help of an ocular - micrometer to determine their shape, size and diameter. All findings were confirmed by re - examining new pollen material from each taxon under a scanning electron microscope and some SEM photographs of the selected pollen material were taken. This was necessary because the shape, number, nature and position of pollen apertures and the exact mode of stratification were not quite easy to discover at the magnification of X400 with the compound ("light") microscope.

For the study under the scanning electron microscope, the pollen material was prepared as follows:- Fully mature pollen - bearing parts (i.e. nearly bursting anthers) were removed from the herbarium specimens by means of a fine forceps. Care was taken not to remove more than one anther from one of the many flowers in a cyme, so that sufficient material is left for subsequent investigation. By handling with the fine forceps, the anther was then shaken a few times above the flat, circular head of a metal stud, approximately 6 mm in diameter, onto a freshly spread thin layer

of very sticky glue of a proprietary brand ("Instant Grip"). The shaking of the anther was repeated until a sufficient number of pollen grainswere released. The above process was carried out under the dissecting microscope to ensure the uniform distribution of pollen grains all over the metal stud. The pollen grains were thus permanently mounted after the glue was dry. They were then very finely coated with gold in a vacuum chamber. After coating, the material was ready for examination and then studies in detail under the scanning electron microscope at magnifications of X1200 to X3000.

Observations: (see photos and charts).

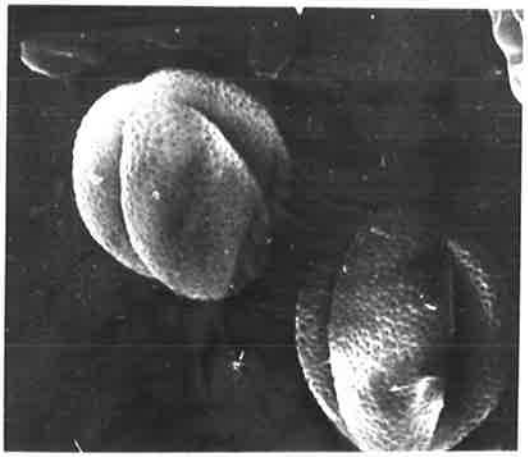
The palynological data recorded in this work are based on the examination of 10 - 15 pollen samples from different herbarium specimens for each taxon. Each sample had more than one dozen pollen grains mounted in different positions. The number of taxa examined is as follow:- Dicrastylis 14 species (including 3 subspecies and 6 varie ties), Lachnostachys 4 species (including 1 variety and 1 form), Mallophora both species, Newcastelia 9 species and Physopsis both species. The restriction in the number of taxa examined is due to the fact that the pollen material was taken only from the specimens of Herb.AD. Had there been some interesting differences between the pollen grains of these taxa, the present studies would have been extended to the material on loan from other herbaria after seeking permission to do so from their curators.

The pollen grains of all the taxa investigated were found to be practically identical in their major morphological characters. They are isopolar, radiosymmetrical and (aperturate) 3 - colpate. They are distinctly fossaperturate in polar view and prolate to sub - prolate in shape. Rarely, however, they may look somewhat prolate - spheroidal in Newcastelia cladotricha F.v.M. The normal grains are mostly small or medium in size varying from (12.8) 16 - 38.4 (44.8)μ in length. Their diameter in polar view is mainly between 12.8μ and 35.2μ . The smallest pollen grains are in Physopsis and Mallophora where the average size is 12.8 - 19.2μ and 19.2 - 22.4μ respectively. In Dicrastylis and Newcastelia, the pollen grains are of both small and medium size and are generally between 19.2μ and 32.0μ in length. In some of the species, however, they are slightly larger. In Lachnostachys, the pollen grains are mostly of medium size, rarely small. The most common size found in this genus is between 25.6 and 35.2μ , occasionally up to 38.4 (44.8)μ .

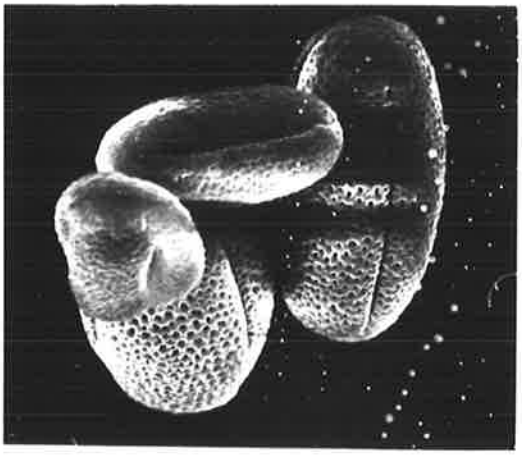
In accordance with the other pollen characters, the sporoderm stratification is also more or less identical in all genera. It is very finely reticulate all over the surface, but the network formed by the sclerine is recognizable only at a high magnification (X1200 to X3000). However, the sporoderm in Physopsis spicata is apparently smooth and the pollen grains on the whole seem shrunken. Probably, the available pollen material of this taxon is not mature and as a result of shrinkage the minute pores in the sclerine network have perhaps been obliterated. This assumption is based on the fact that the sporoderm reticulation in Physopsis lachnostachya is very distinct and identical to that of the spore walls of other genera. The examination of fully mature fresh pollen material of P.spicata is needed to ascertain the exact pattern of its sporoderm stratification.

POLLEN GRAIN PHOTOGRAPHS

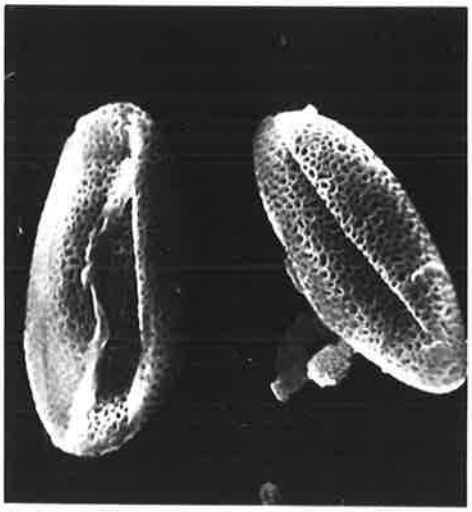
(5 plates)



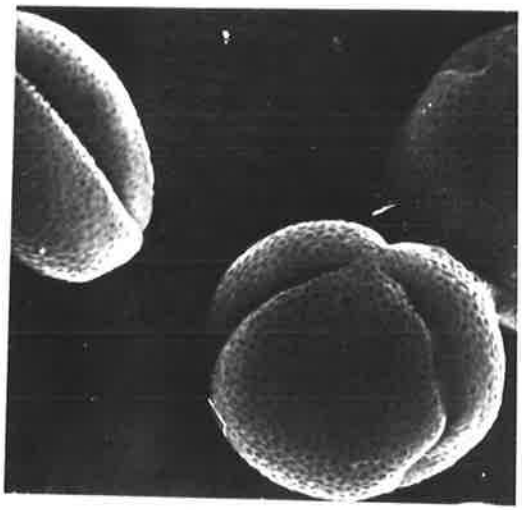
D. beveridgei F.v.M.
X 200



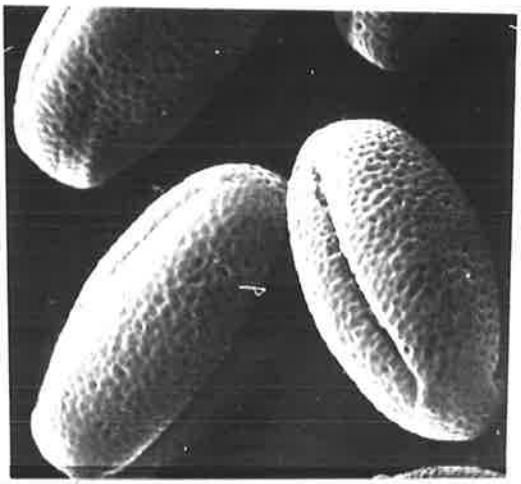
D. brunnea Munir
X 1500



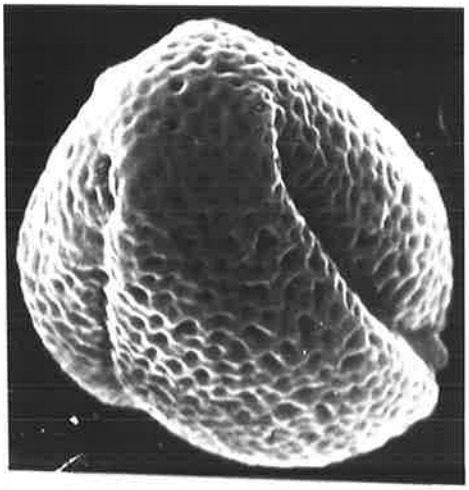
D. corymbosa (Endl.) Munir
X 1500



D. exsuccosa (F.v.M.) Druce
X 1500

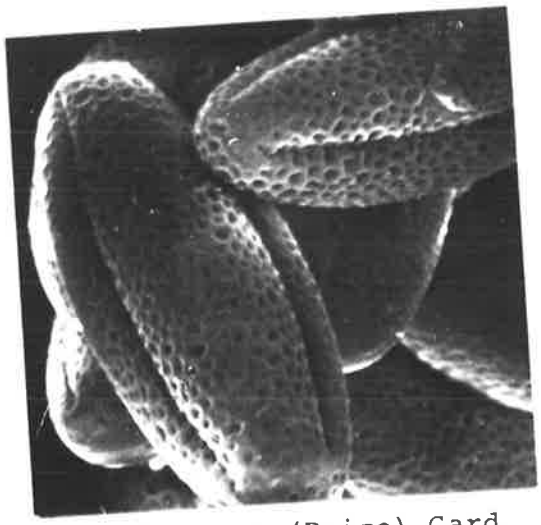


D. gilesii F.v.M.
X 1500

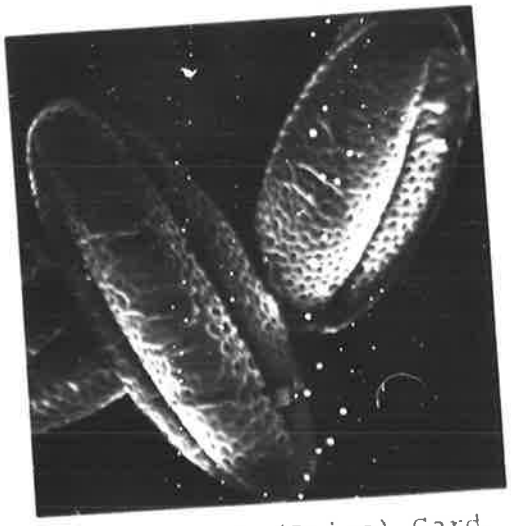


D. gilesii F.v.M.
X 3000

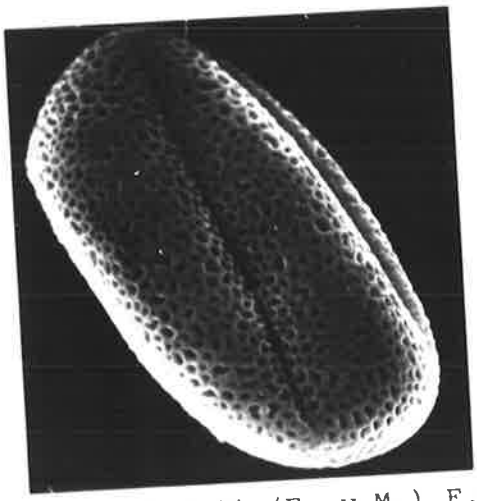
POLLEN GRAINS OF THE GENUS DICRASTYLIS DRUMM. EX HARV.



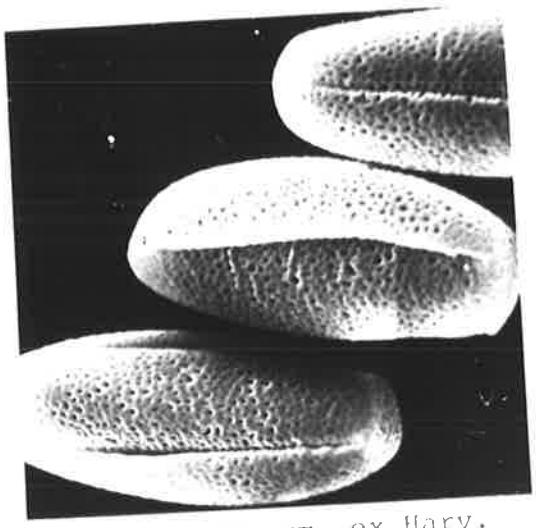
D. flexuosa (Price) Gard.
X 1500



D. flexuosa (Price) Gard.
X 1200

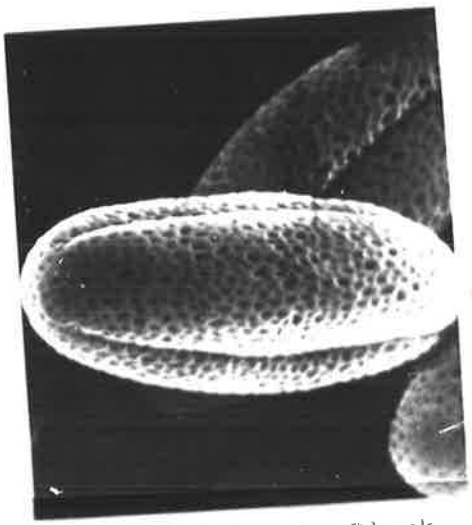


D. lewellinii (F. v.M.) F.v.M.
X 1500



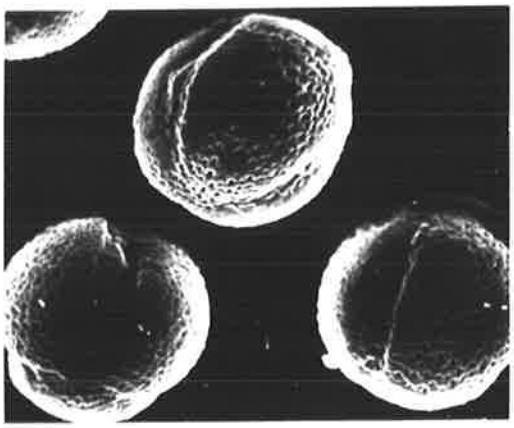
D. fulva Drumm. ex Harv.
X 1500

D. reticulata Drumm. ex Harv.
X 2000

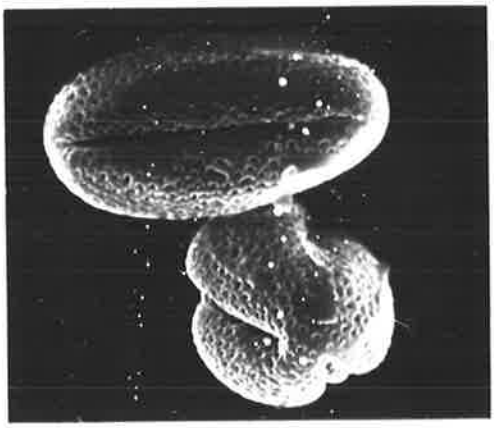


D. verticillata Black
X 1500

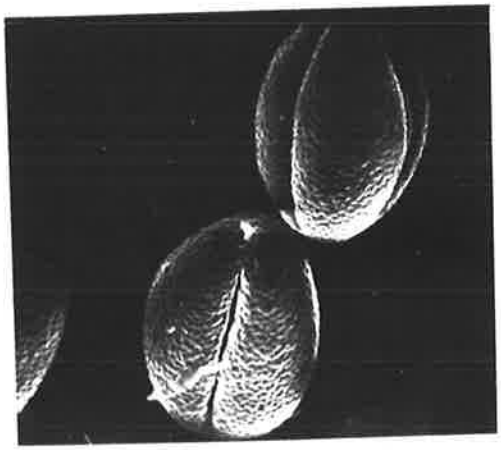
POLLEN GRAINS OF THE GENUS DICRASTYLIS DRUMM. EX HARV.



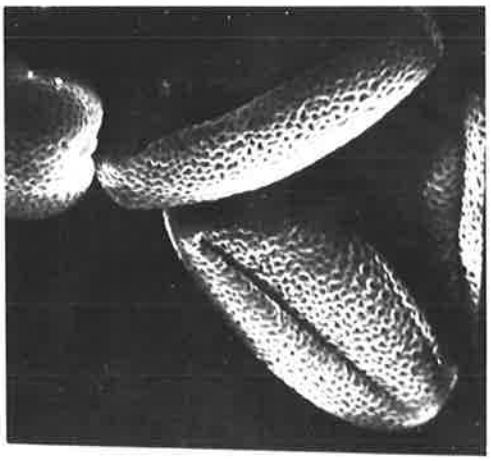
N. cladotricha F.v.M.
X 1200



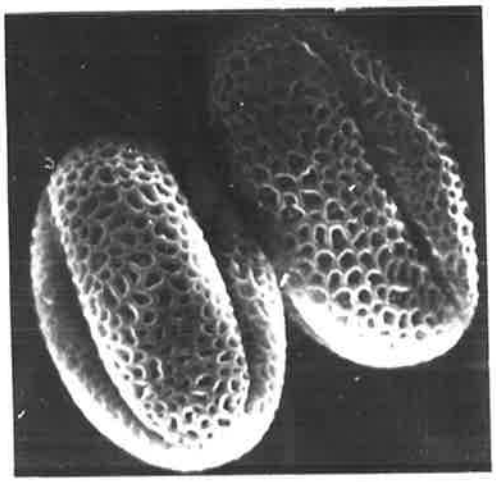
N. interrupta Munir
X 1500



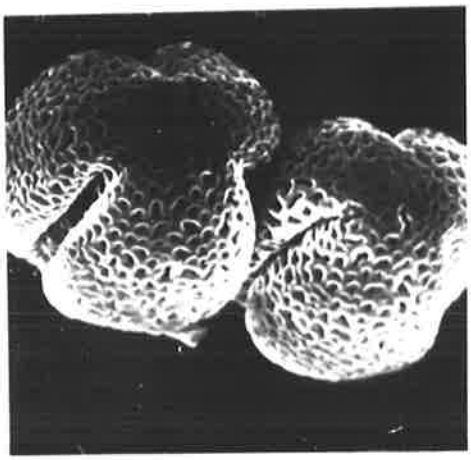
N. interrupta Munir
X 1200



N. hexarrhena F.v.M.
X 1200

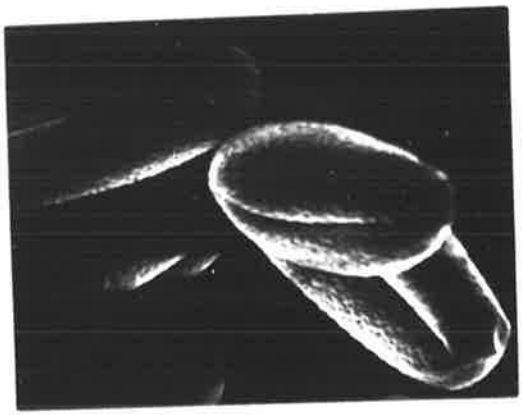


N. spodiotricha F.v.M.
X 1500

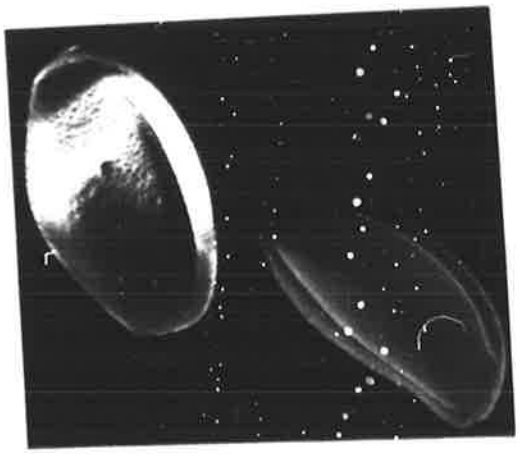


N. viscida F. Fritzel
X 3000

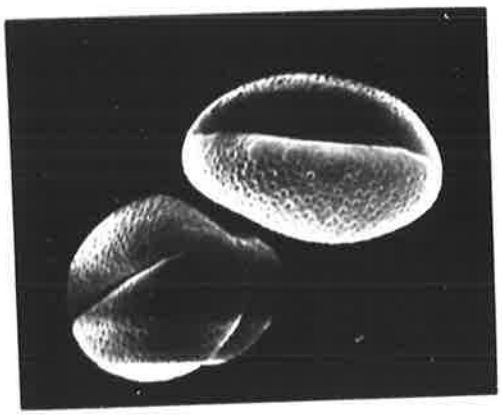
POLLEN GRAINS OF THE GENUS NEWCASTELIA F.v.M.



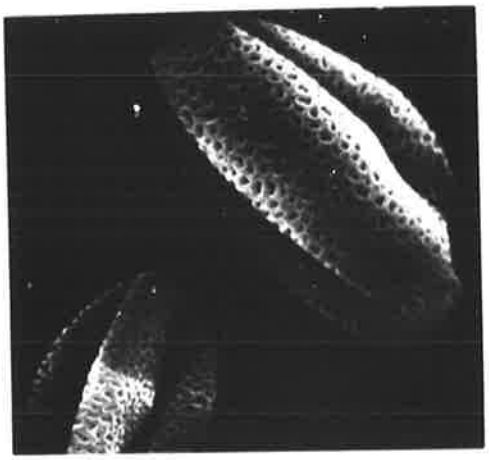
1. L. coolgardiensis Moore
X 1200



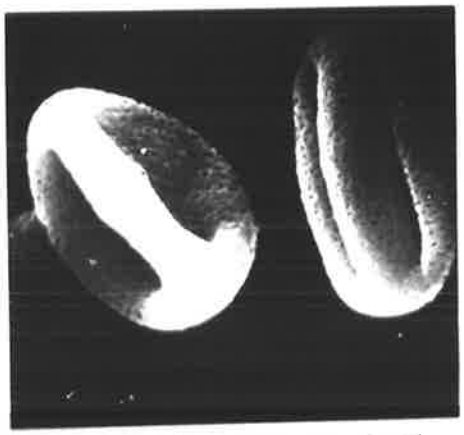
2. L. eriobotrya (F.v.M.) Druce
X 1500



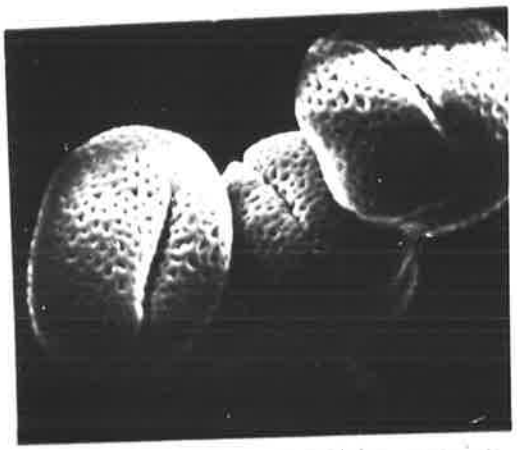
3. L. eriobotrya (F.v.M.) Druce
X 1500



4. M. globiflora Endl.
X 1500

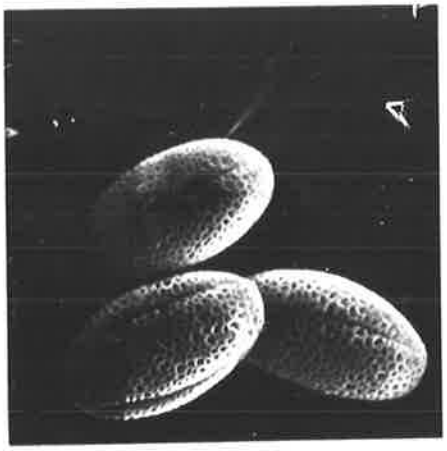


5. M. globiflora Endl.
X 1500

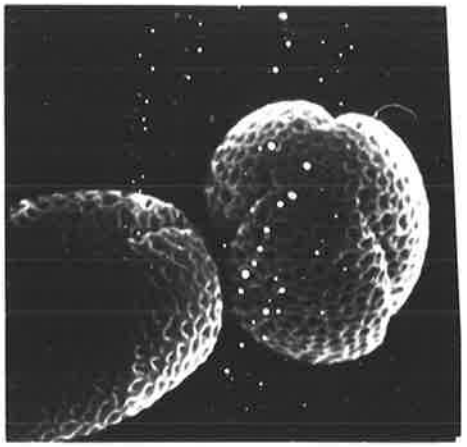


6. M. rugosifolia Munir
X 1500

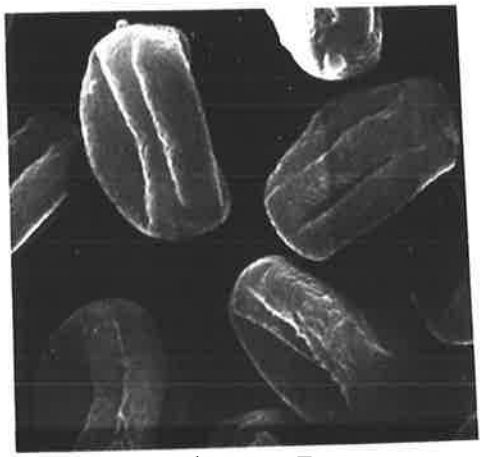
POLLEN GRAINS OF THE GENERA LACHNOSTACHYS HOOK. AND MALLOPHORA ENDL.
1-3 LACHNOSTACHYS: 4-6 MALLOPHORA.



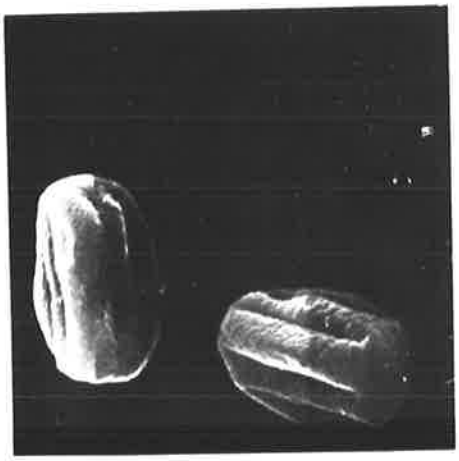
P. lachnostachya Gard.
X 1500



P. lachnostachya Gard.
X 3000



P. spicata Turcz.
X 2000



P. spicata Turcz.
X 2000

POLLEN GRAINS OF THE GENUS PHYSOPSIS TURCZ.

DISTRIBUTION OF GENERA

All five general of trib. Physopsideae Briq. are endemic to Australia (see map 1). Three of them, Lachnostachys Hook., Mallophora Endl. and Physopsis Turcz. are restricted to the south-western part of Western Australia, while Dicrastylis Drumm. ex Harv. and Newcastelia F.v.M. are distributed in the dry parts of South Australia, Western Australia, Northern Territory and Queensland. The only Physopsideae known from New South Wales is one species, Dicrastylis lewellinii (F.v.M.)F.v.M., recorded from the northern border adjacent to Queensland.

None of the five genera are known to occur in Tasmania, Victoria, the south-eastern part of South Australia, the northern and north-eastern parts of Queensland, the northern portion of the Northern Territory [i,e. north of Lat. 16° S] and the northern part of the Kimberley Division in Western Australia.

The greatest representation of trib. Physopsideae is in Western Australia where three of the five genera are endemic, and where the remaining two are represented by more species than in any other state or territory. In the other states (including the Northern Territory, but excluding Victoria and Tasmania), only Dicrastylis and Newcastelia occur, in varying numbers of species. The Northern Territory comes second to Western Australia, and Dicrastylis is represented there by seven species and Newcastelia by five species. Third comes South Australia with six species of Dicrastylis and three of Newcastelia. Fourth is Queensland, with New South Wales last; the former has one species of Dicrastylis and four of Newcastelia, while the latter has only a single Dicrastylis species.

The following table shows the number of species of the individual genera in each state / territory.

Genera	W.Aust.	N.T.	S.Aust.	Qld.	N.S.W.	Vic.
Dicrastylis Drumm.ex Harv.	23 spp. 18 [endemic]	7 spp. one [endemic]	6 spp. one [endemic]	1 sp.	1 sp.	-
Newcastelia FvM.	10 spp. 5 [endemic]	5 spp.	3 spp.	4 spp. 2 [endemic]	-	-
Lachnostachys Hook.	6 spp. all [endemic]	-	-	-	-	-
Mallophora Endl.	2 spp. all [endemic]	-	-	-	-	-
Physopsis Turcz.	2 spp. all [endemic]	-	-	-	-	-
Total number of species per genera per state/territory.	$\frac{43}{5}$	$\frac{12}{2}$	$\frac{9}{2}$	$\frac{5}{2}$	$\frac{1}{1}$	Nil.

From the table and the distribution of various species (see maps 1 - 18) it is evident that the present centre of known diversity of the trib. Physopsideae is in the south-western part of Western Australia.

LEGEND FOR MAP 1

DICRASTYLIS

LACHNOSTACHYS

MALLOPHORA

NEWCASTELIA

PHYSOPSIS

TROPICAL ZONE
(SUMMER RAIN)

TEMPERATE ZONE
(WINTER RAIN)

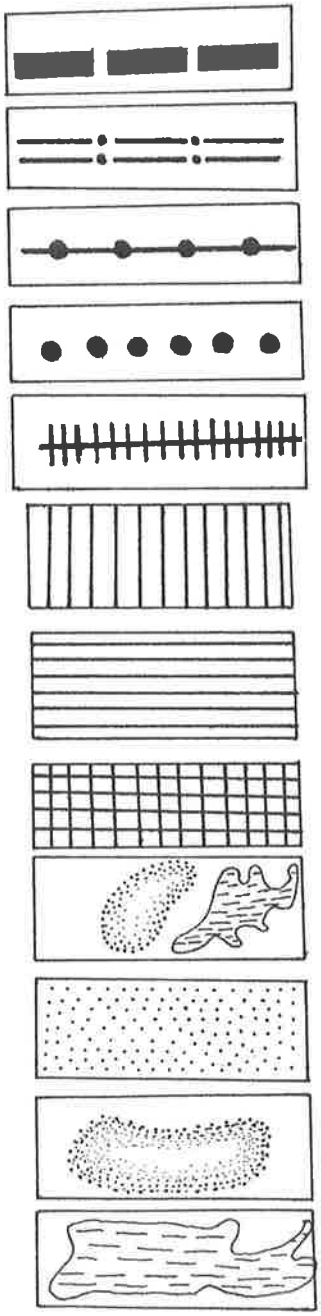
MACPHERSON MACLEAY OVERLAP

EREMAEAN ZONE

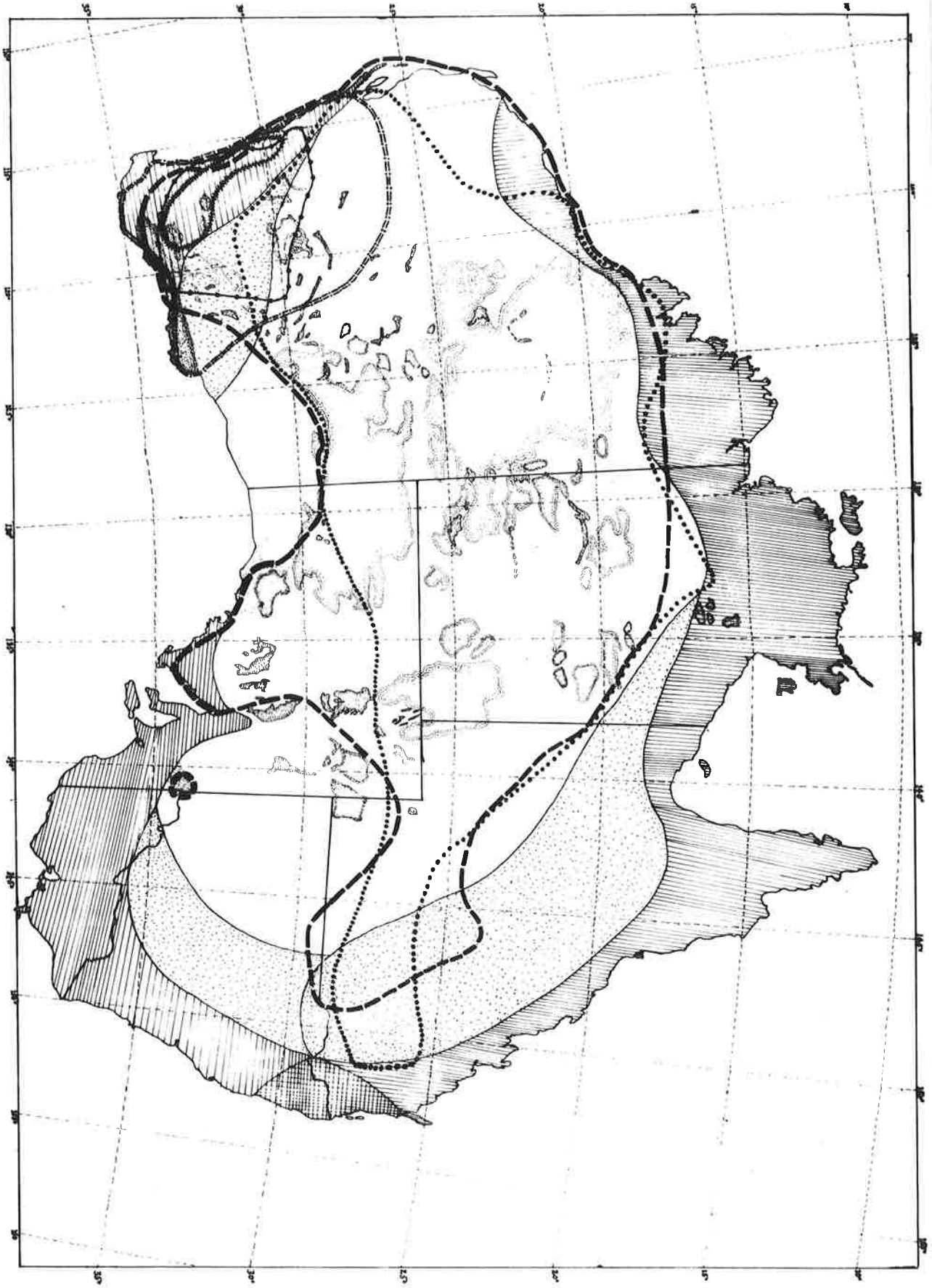
INTERZONE AREAS
(SEMI-DESERT AREAS)

SAND DUNE AREAS

DRY SALT LAKES



MAP 1



E C O L O G Y and B I O L O G Y
(see maps 1 and 2)

E C O L O G Y:

The five genera here discussed show individual preferences for the climatic zones* defined by Burbidge (1960). Of these, Dicrastylis and Newcastelia occur predominantly in the Eremaean Zone, while Lachnostachys, Mallophora and Physopsis are found chiefly in the Temperate Zone. The tropical Zone has a meagre representation of the two eremaean genera only.

The three temperate genera are based in the south-west corner of Western Australia; Physopsis is a strictly Temperate Zone genus, the most limited of all in area and habitat in this region with chiefly winter rainfall. The other two Temperate Zone genera, Lachnostachys and Mallophora, extend from the same winter rainfall corner into the south-western subtemperate Interzone or occasionally further into the border areas of the dry Eremaean Zone.

The two remarkable Eremaean Zone genera, Dicrastylis and Newcastelia, extend almost throughout this huge arid region. Newcastelia is absent from the Temperate Zone, but two species enter the Tropical Zone in the west (Pilbara district), while two other species are recorded at the eastern limits of distribution in Queensland, beyond the Eremaean Zone in the sub - tropical Interzone.

Dicrastylis, by contrast, is also present in the Temperate Zone; there is one species in South Australia (Eyre Peninsula); but in Western Australia there are about eight further species restricted to the south-western corner of the state. In the Tropical Zone, Dicrastylis is represented by one species (Pilbara district), and one also in the subtropical Interzone in Queensland. The species are listed below for these extended distributions.

Species of Dicrastylis and Newcastelia outside the Eremaean Zone.

Temperate Zone		Tropical Zone	
D.corymbosa(Endl.)Munir	W.A.	D.cordifolia Munir	Pilbara W.A.
D.fulva Drumm.ex Harv.	W.A.	N.cladotricha F.v.M.	Pilbara W.A.
D.glauca Munir	W.A.	N.spodiotricha F.v.M.	Pilbara W.A.
D.incana Munir	W.A.	Subtropical Interzone	
D.morrisonii Munir	W.A.	D.lewellinii(F.v.M.)F.v.M.	Qld. & NSW.
D.obovata Munir	W.A.	N.interrupta Munir	Qld.

* The climatic zones referred to in this chapter are from Burbidge (1960) and are shown here in map 1.

Temperate Zone contd.		Subtropical Interzone contd.	
D.reticulata Drumm.ex Harv.	W.A.	N.velutina Munir	Qld.
D.velutina Munir	W.A.		
D.verticillata Black	S.A.		
Newcastelia	Absent		

Physiographically, all these genera occur predominantly in the central, southern and south-western parts of the Great Western Plateau, excluding the Nullarbor Plain. None of them are at present known to exist in the Eastern Coastlands, Eastern Highlands nor the southern and northern-most parts of the Central Lowlands. They do not occur north of 16 degrees south latitude [i.e. in the Kimberley region, Arnhem Land and the country around the Gulf of Carpentaria] in the Great Western Plateau. The species of all these genera are psammophilous and are characteristic of both the sandy deserts of the western centre of Australia and the temperate sandheath of South-Western Australia, "the latter being their original habitat" (Gardner, 1944).

The main soil types in which these plants grow are fairly generally sandy, sandy - loam, clayey - sandy or gravelly - sandy apparently with sand as a major component in the composition. In the Eremaean Zone, the soil is generally loose and dry mostly with no subsoil - water directly available to plants. Therefore, many of the species examined (e.g. Dicrastylis gilesii and D.exsuccosa) are found growing along the western slopes of sand hills and in stony - gravelly - sandy soil respectively, in the Petermann Ranges. One species of Newcastelia (N.viscida) is also found in gravelly - sandy soil and two other species of Dicrastylis (D.corymbosa and D.parvifolia) in clayey - sand. The two latter species occur in the winter rainfall areas where the soil in some places seems calcareous. It has also been observed that some species of the predominantly psammophilous genus Lachnostachys (L.coolgardiensis and L.verbascifolia) have the capacity to regenerate in areas where the vegetation has been destroyed by fire. On the whole, almost all the taxa examined in the field seem to grow better in disturbed soil, especially along the road - sides.

The vegetation mainly associated with these plants in the central and western parts of Australia consists of Triodia, Eremophila, Grevillea, Acacia, Cassia and Casuarina (tree) species. In a few localities, one or two of these genera may be absent or replaced by others, such as Dodonaea, Eucalyptus, Hakea, Halgania, Haloragis, Myoporum, Ptilotus, Solanum and Thryptomene species.

Nevertheless, in any dry country associations of Dicrastylis, Newcastelia or their closely related genera, Triodia occurs more often than any other genus and plays a dominant role in the plant community. In some associations, there are a few annuals or seasonal weeds as well, but almost all the localities observed in the field are nearly free of climbers or twiners. Towards the south and south-west in Western Australia, instead of tall Casuarina trees a shrubby Casuarina species (? C.campestris) is common along with Acacia, Eucalyptus and Melaleuca species, which are the dominant shrubs and trees in the area.

The major vegetation types where these genera occur vary with change in climatic zones. (see maps 1 and 2). The three most temperate genera will now be dealt with.

Physopsis is recorded from the Temperate Savannah Woodland (Gardner, 1944) in Western Australia where Acacia and Eucalyptus are dominant. The soil of the whole area is chiefly red - brown intersected by zones of lateritic sand - heaths more prominent in its eastern and northern parts (Prescott, 1944; Taylor, 1960).

The genus Mallophora is also restricted to the south-western part of Western Australia where it occurs chiefly to the east-north-east of the Savannah Woodland and in the south-west of the Sclerophyllous Woodland. The latter is predominantly a mallee area of solonized brown soil (i.e. "mallee soil") intersected by lateritic sandplains (Wood, 1960). All the sandy areas where Mallophora species occur are to a great extent free from Sclerophyllous Woodland formation. Within this area, the genus is generally associated with Acacia, Casuarina, Dodonaea, Hakea and certain other representatives of the Proteaceae.

Another genus limited to the south-western part of Western Australia is Lachnostachys, which occurs in both Savannah Woodland and Sclerophyllous Woodland, and extends further northwards into the south-western part of the Mulga Bush country in the Eremaean Zone. Of the six known species of this genus, L.albicans, L.bracteosa and L.ferruginea occur in sandy places in the Temperate Savannah Woodland and Sclerophyllous Woodland only, while L.eriobotrya, L.coolgardiensis and L.verbascifolia extend from the Sclerophyllous Woodland into the Mulga Bush country. The dominant vegetation in this last area consists of Triodia, Acacia, Eremophila, Grevillea and sparsely occurring Eucalyptus species. Genreally, the area is sandhill country with mainly sandy - loam soil of brown or red - brown colour. In many places, the soil is somewhat saline with accumulations of lime and gypsum at shallow depth. Surface stones are also common in some areas. All Lachnos-

tachys species, whether growing in arid or temperate habitat, are covered with densely woolly indumentum.

Turning now to the two eremaean genera, Dicrastylis and Newcastelia are much more widely distributed and seem to occur in almost all major vegetation types in the Eremaean, except Saltbush Steppe in the Nullarbor Plain and all other plant communities where Saltbush is dominant.

They also share the temperate south-west of Western Australia with the three smaller genera. Newcastelia does not extend into the regions of higher rainfall to the south-west beyond the Sclerophyllous Woodland. But many species of Dicrastylis, growing chiefly on sandy places, do enter the wetter Temperate Savannah Woodland as well, where Lachnostachys, Mallophora and Physopsis also occur. But no member of these genera is found in the even wetter Mesophytic or Sclerophyllous Forests in the far south-west. Nor are they found in the far north in the Savannah Woodland or Monsoon Woodland of the Kimberley region. However, three species do extend from the Eremaean Triodia Steppe into the north-western sandstone Savannah formation in the Pilbara district of the Tropical Zone. These species are Dicrastylis cordifolia, Newcastelia cladotricha and N.spodiotricha.

In the southern and south-western part of Australia, both these eremaean genera are found in the lateritic sand - plains and solonized brown soil (i.e. "mallee soil"), but in the western, central and northern parts of the continent they occur mainly on desert sand - hills, sand - plains and desert sand - loam types of soils.

One of the main vegetation types where Dicrastylis and Newcastelia are common in Western Australia is Mulga Bush country, in which Acacia, Triodia, Eremophila, Grevillea, Cyanostegia, Pityrodia and Thryptomene are among the dominant genera. Similarly, in the Triodia Steppe of Western Australia and in the Spinifex sand plains of Western Australia and the Northern Territory, Dicrastylis and Newcastelia grow mainly in association with Acacia, Cassia, Crotalaria, Brachysema, Eremophila, Grevillea, Sida, Thryptomene, Triodia and Hakea species. Moreover, some sparsely growing Eucalyptus trees are also found within the above association in the north-western Eremaean Zone in the Northern Territory.

In South Australia, both Dicrastylis and Newcastelia are known chiefly from the north-western sand - hill country. Towards the far north-west, they occur mainly in an Acacia - Triodia type of association, but near the north-eastern border of the Nullarbor

Plain, Acacia is gradually replaced by Eucalyptus species. The habitat in the north-east of South Australia, south-south-west of Queensland and south-east of Northern Territory is generally in sandy soil, where Triodia is common along the sandridges. In these areas, two species of Dicrastylis, D.costelloi and D.lewellinii, and three of Newcastelia, N.cephalantha, N.interrupta and N.velutina are known to occur chiefly between the sandridges and near the foot of sand - hill slopes. According to collectors' field notes, the general plant communities recorded in this region are not very different from the vegetation of sand - hills and sand - plains of the Central and Western parts of Australia. In this region, Dicrastylis and Newcastelia occur chiefly in association with Triodia, Acacia, Grevillea, Atalaya, Crotalaria, Dodonaea, Eremophila, Eucalyptus, Hakea, Sida and Trichodesma species, or various selctions of these genera. But Acacia, Triodia, Eremophila and Grevillea are nearly always among them.

B I O L O G Y:

The stem, leaves and flowers of almost all the taxa here examined are covered with a densely woolly indumentum of branched hairs. This is usually considered as a xerophytic character and applies to nearly all the Eremaean Zone taxa of Dicrastylis and Newcastelia growing in the arid interior of Australia. However, all the few species of Mallophora and Physopsis, the majority of Lachnostachys and about eight species of Dicrastylis with a similar vestiture are found in the non - arid Temperate Zone which is very wet during the winter rainy season. Therefore, the presence of practically identical and equally dense woolly indumentum in the closely related taxa of dry as well as wet climates seems to weaken the theory that the presence of dense woolly indumentum is a feature of xerophilous plants. The summer in the temperate habitats may be dry and hot, however. In these particular genera, the factors responsible for the presence of similar vestiture in all taxa seem very stable; (but see D.glauca Munir). The dense woolly indumentum doubtless benefits the Eremaean Zone species as a protection against the extreme weather conditions and loss of moisture through transpiration.

In the following species, Dicrastylis linearifolia, Lachnostachys bracteosa, Newcastelia viscida and N.chrysotricha, the leaves and older parts of stem and branches are generally covered with a thick layer of epidermal secretion which normally exudes from the tips of hairs and is deposited gradually over the surface. This may have protective significance. In many species, the

stomata on the lower side of the leaves are concealed by the recurved or revolute margins and this is a feature known to help in the conservation of plant moisture otherwise lost through stomatal transpiration.

The colour variation observed in the flowering shoots of some Dicrastylis species is quite interesting. In this respect, a gradation in the inflorescence colour of D.exsuccosa and of D.gilesii has been noticed among the plants growing in the same or different populations. Both species occur in the central Eremaean sand - plains where there is no assured rainfall during any month in the year. In D.exsuccosa, the inflorescence may be golden - yellow, greyish - yellow, greyish - orange or any mixture of these colours, whereas, in D.gilesii it may be purplish, yellowish - purple, greyish - purple or any composition of these colours. These colours are in the indumentum itself, rarely in the cells beneath.

Flowers in Mallophora and Physopsis are always tetramerous, but there is great irregularity in the number of flower parts in many species of Dicrastylis, Lachnostachys and Newcastelia. The number of parts in different flowers of the same species is not constant, whether they grow in the same inflorescnece or on different plants of the same or different populations. Such irregularities are more common in various taxa of Dicrastylis and Newcastelia, less so in Lachnostachys.

Most of the specimens examined are generally free of disease, but occasionally, in a few central Australian species of Dicrastylis, namely D.beveridgei, D.doranii and D.gilesii, gall formation in some parts of leaves and inflorescence has been observed.

Fresh flowers in most of the taxa are without any noteworthy fragrance, but some collectors have noted the presence of some sweet - scented smell in a few Eremaean Zone species.

Propagation by stem cuttings did not succeed in three species of as many genera (Dicrastylis verticillata, Newcastelia viscida and Lachnostachys coolgardiensis). However, a small branch from D.verticillata with a few rootlets did establish itself in a greenhouse pot, although the growth rate was slow. In a six months' period, it added only two or three pairs of new leaves, not very healthy in appearance. According to field observations, the main primary branching in most species takes place near the soil surface or almost at ground level. Some species of these genera, namely Dicrastylis beveridgei, D.costelloi, Lachnostachys coolgardiensis and Newcastelia elliptica, do sometimes spread by

means of stolons and a few of them may cover an area up to 4 metres in diameter.

The chief method of reproduction, however, seems to be by seed. But the germination and survival of seedlings are very dependant upon the availability of sufficient rainwater, the supply of which is so erratic in the arid habitat favoured by this group. The fruit is generally dry and indehiscent with a hard endocarp which cannot split open easily unless sufficient moisture is available. It is normally free of any special mechanism that could ensure its wide distribution by animals. In most of the taxa the presence of tomentum all over the fruit seems to help in their dispersal by wind. The woolly indumentum of a persistent calyx also assists in fruit distribution.

There is little information regarding the method of pollination in these genera, but some species of Dicrastylis, Lachnostachys and Newcastelia observed in the field seem chiefly entomophilous.

LEGEND FOR MAP 2

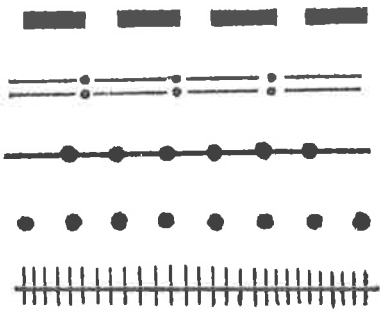
DICRASTYLIS

LACHNOSTACHYS

MALLOPHORA

NEWCASTELIA

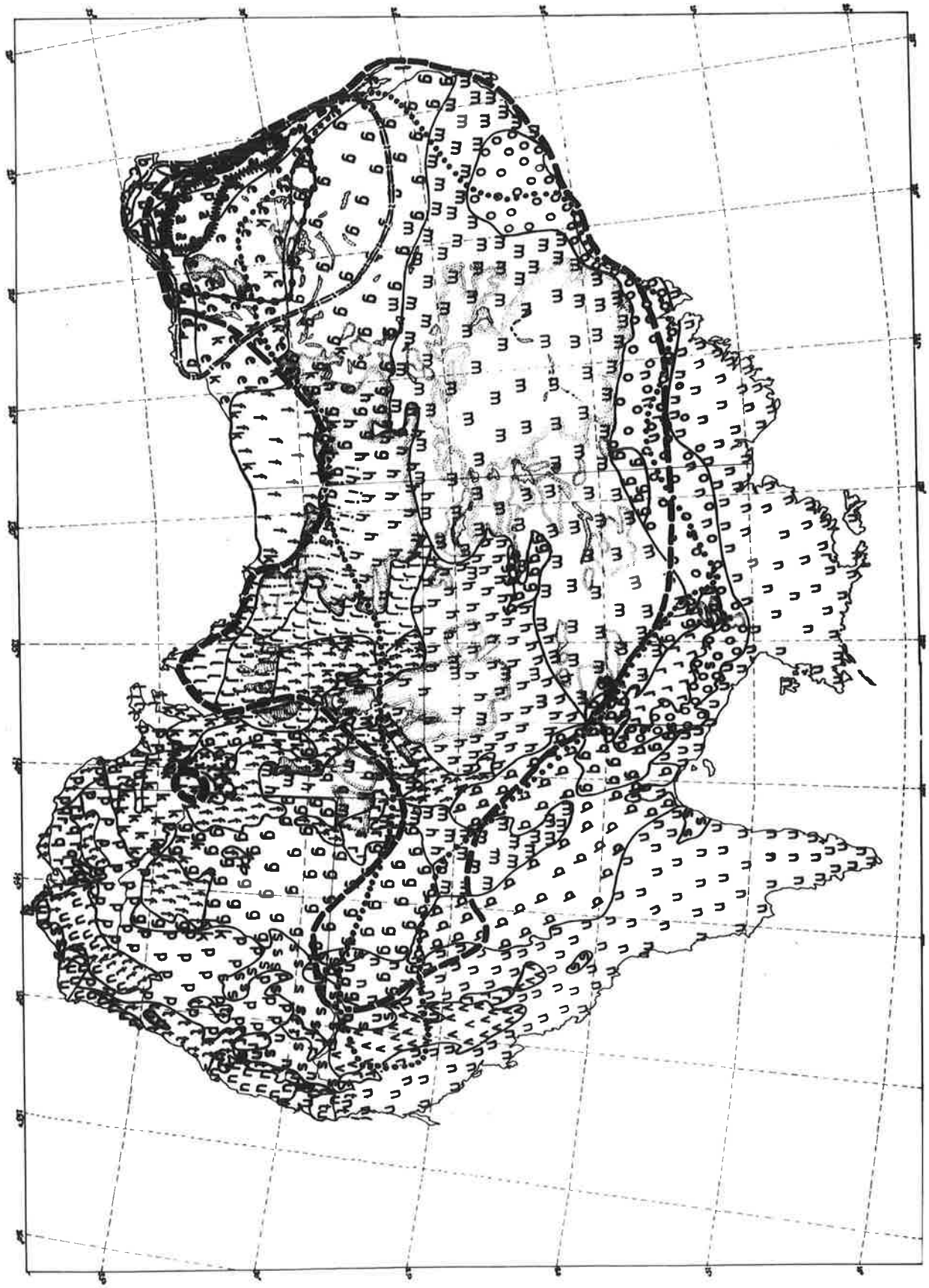
PHYSOPSIS



a	=	Temperate Savannah Woodland
b(&t)	=	Temperate Sclerophyllous Forest
c(&u)	=	Mesophytic Forest
d	=	Sand-heath
e(&p)	=	Sclerophyllous Woodland
f	=	Salt-Bush Shrubland
g	=	Mulga Bush Formation
h	=	Mulga and Spinifex Formation
i	=	Mulga - Mallee - Spinifex Formation
j	=	Woodland of Acacia
k	=	Semi-arid Mallee
l	=	Sclerophyllous Mallee
m	=	Triodia Steppe (mainly "Hummock" and "Tussock" grassland).
n	=	Monsoon Woodland
o	=	Savannah and open Savannah Woodland
p(&e)	=	Sclerophyllous Woodland
q	=	Shrub Savannah formation and "Tussock" grassland
r	=	"Tussock" grassland (mainly Astrebla, Poa, Danthonia, Gahnia and Cladium spp.)
s	=	Tree and Low tree Savannah
t(&b)	=	Temperate Sclerophyllous Forest
u(&c)	=	Wet Sclerophyllous Forest
v	=	Low Layered Forest (dominated chiefly by low trees or tall shrubs of Eucalyptus and Acacia spp.)
x	=	Low Woodland (comprising mainly Casuarina and Myoporum spp.)

Note: The terminology used for the various vegetation types and their delimitations have been adopted from Blake (1938), Crocker (1946), Gardner (1944), Prescott (1929, 1932), Specht (1972), Williams (1959) and Wood (1960). Many of the names of the vegetation types are peculiar to individual States of Australia.

MAP 2



RELATIONSHIP AND PHYLOGENY

All the genera belonging to the family Chloanthaceae (Benth.) Hutch. have hitherto been retained by many under Verbenaceae but some of its genera have been referred by a few authors to the families Myoporaceae, Stilbaceae, or Lamiaceae subfam. Prostantheroideae. With the exception of Verbenaceae (s.str.), these families and the subfamily Prostantheroideae agree with each other chiefly in their albuminous seeds. The family Verbenaceae (s.str.), however, seems very close to Chloanthaceae. The two families have the following characters in common : leaves decussate, exstipulate; flowers tubular; calyx persistent; stamens equal, epipetalous; anthers 2 - celled, longitudinally dehiscent and ovary mostly 4 - ovuled. However, Verbenaceae differs from Chloanthaceae in the following characters: range in habit from herbs, shrubs to trees; hairs simple or stellate, never dendriform; inflorescence usually spicate, racemose or paniculate; without bracteoles; ovary often lobed; ovules in most genera near the base; fruit a succulent drupe or if dry, separating into nutlets; seeds not albuminous. In contrast to Chloanthaceae which are restricted to Australia, Verbenaceae (s.str.) are widely distributed in both hemispheres.

In many characters, Myoporaceae also seem closely related to Chloanthaceae. They agree with each other in having the following characters in common: flowers tubular, calyx persistent, stamens epipetalous, anthers longitudinally dehiscent, ovary non - lobed, ovules pendulous, anatropous and seeds albuminous. Both families are predominantly endemic to Australia. The family Myoporaceae, however, may be easily distinguished in the following characters: leaves in most species being alternate; flowers often axillary, solitary or in clusters of 2, 3 or more; bract small or none; bracteoles absent; anther - cells finally confluent at summit into a single cell; ovary 2 - 4 - celled with 2 ovules in each cell or ovules in 2 - 3 - pairs superposed; fruit dry, or succulent drupes; seeds as many as the number of ovary cells.

There are also many common characters between Stilbaceae and Chloanthaceae. Both these families have the following characters in common: leaves simple, exstipulate, mostly with recurved margins; corolla tubular; stamens epipetalous; anthers longitudinally dehiscent, lobes free, divergent in the lower halves; and seeds albuminous. However, Stilbaceae differs from Chloanthaceae in the following characters: leaves verticillate; inflorescence spicate or racemiform; bracteoles absent; ovary 2 -locular; ovules basal,

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Note: Family names are underlined here for convenient reading.

erect, on long funicles. Stilbaceae are endemic in South Africa and Chloanthaceae in Australia.

Lamiaceae subfam. Prostantheroideae are also related to Chloanthaceae. Both familes have the following characters in common: flowers tubular; bracteoles two; calyx persistent; stamens epipetalous; ovaries 4 - celled, one ovule in each; seeds albuminous. However, the subfamily Prostantheroideae can be readily distinguished in the following characters from Chloanthaceae: plants mostly aromatic, stem usually 4 - angled, stamens didynamous, ovary lobed, ovules basal or erect in each cell and the fruit of four nutlets.

The five genera of Chloanthaceae with regular flowers form the tribe Physopsideae Briq. , and all remaining genera with zygomorphic flowers belong to the tribe Chloantheae. Both tribes are related to each other chiefly by their inflorescence being primarily cymose, each flower being supported by a bract and two lateral bracteoles, ovary not lobed, ovules attached "laterally" (i.e. on the central axis) above the middle, fruit, indehiscent, dry (rarely with a more or less fleshy exocarp in a few genera of the tribe Chloantheae), and seeds always albuminous. However, the tribe Physopsideae Briq. may be easily identified by its flowers being mostly regular, corolla fairly generally lobed and stamens isomerous with the corolla lobes. These characters were considered by Diels & Pritzel (1904) as primitive and not derived. According to them, Physopsideae constitue a closely related group of genera which, similar to Myoporaceae, Lamiaceae subfam. Prostantheroideae and Anthocercis [in Solanaceae] occupy such an isolated position in the Australian Tubiflorae, that their segregation into a family of their own would be at least as justified as that of Myoporaceae. However, the arrangement of their leaves (i.e. decussate), structure of the gynoecium, presence of albumen in the seeds and also the secretion of somewhat similar essential oils, warrant their relationship with Chloantheae and Lamiaceae. [I have not observed any essential oils in Physopsideae. The statement by Diels & Pritzel require re- examination].

Within the tribe Physopsideae Briq. the relation of the flower parts of its five genera are very varied, but, according to Diels & Pritzel (1904), they seem to form a continous line of progression. In Mallophora Endl. and Physopsis Turcz. the flowers are 4 -merous, in Dicrastylis Drumm. ex Harv. normally 5 -merous whereas in Newcastelia FvM. and Lachnostachys Hook. they are

5-8-merous. Among these genera, Dicrastylis Drumm. ex Harv. appears to be a primitive type because many of its characters appear to be not derived. In this genus, the inflorescence is comparatively less [or often not] contracted into heads or spikes, the corolla is deeply lobed, the stamens are always of the same number as the corolla-lobes and the style is very deeply 2-branched. It agrees with Mallophora in its corolla, stamens and style characters, but the inflorescence in the latter is contracted into heads of 4-merous flowers and the style is much less deeply divided. Similarly, the lobed corolla with the equal number of stamens in Physopsis Turcz. also agrees with Dicrastylis Drumm. ex Harv. but the spicate inflorescence, 4-merous flowers and entire (undivided) style in the former at once distinguish it. The 4-merous flowers bring Mallophora Endl. and Physopsis Turcz. closer to each other than any other two genera of Chloanthaceae. These two genera differ from each other chiefly in their inflorescnnces. In Physopsis, the flowers are arranged in spicate inflorescences while in Mallophora they form corymbosely arranged subglobose woolly clusters. A probable connecting link between the inflorescence types of these genera has been found in Mallophora rug sifolia, in which the overall shape of the inflorescence is ± corymbose, but the flowers, in almost each cluster, are arranged in an elongated spike similar to those found in Physopsis. In this genus the inflorescence is contracted into elongated spikes, the corolla is less deeply incised, and the style is not lobed. In these characters Physopsis resembles Newcastelia FvM. The latter has spicately elongated flower-clusters, short and less deeply incised corolla-lobes, 5 - 6 stamens emerging between the lobes [when exserted] and undivided style, bringing this genus close to Lachnostachys Hook. In Lachnostachys Hook., the contraction of its inflorescence into spikes is similar to those in Newcastelia FvM., but the corolla-tube is almost truncate or occasionally very minutely lobed and the stamens [usually ranging 5-8] are inserted at the rim of the corolla-tube.

In this way, there is apparently a transition from Dicrastylis Drumm. ex Harv. [having less (or often not) contracted inflorescence with fairly generally pentamerous flowers, very much incised corolla-tube and deeply branched style.] to Lachnostachys Hook. [where the inflorescence is contracted into spikes, flowers are generally 5-8merous, corolla tube not incised into lobes and the style is undivided]. Keeping in view the above-mentioned characters, the genus Dicrastylis Drumm. ex Harv. may be considered as an original type in comparison with the other genera of

Chloanthaceae with regular flowers. Therfore, Pritzel [in Diels & Pritzel (1904)]suggested that the five regular-flowered genera of"Lachnostachydinae" E.Pritzel form such a continuous scale of steps from deeply incised corolla-tube and style in Dicrastylis Drumm. ex Harv. to complete fusion of these organs in Lachnostachys Hook., that the combination of these two genera would mean a coalescence of the others simultaneously, whereby nothing would be gained. From the relationship point of view, the arrangement of these (five) genera has been suggested by him in the following linear sequence;- Dicrastylis, Mallophora, Physopsis Newcastelia and Lachnostachys. Nearly the same type of arrangement but with Lachnostachys Hook. in the beginning of the sequence and Dicrastylis Drumm. ex Harv. at the last was previously published by Bentham (1870) and Bentham & Hooker (1876), apparently in consideration of their relationship with each other. This sequence was subsequently maintained by F.v.Mueller (1882,1889), Blackall & Grieve (1965) and a few others without any mention of their relationship. Briquet (1895) has arranged these genera by recording both the 4-merous genera Mallophora and Physopsis in the beginning followed by 5-merous Dicrastylis onwards to 5-6-merous Newcastelia and 5-8-merous Lachnostachys at the end.

In the present revision of Physopsideae, Diels & Pritzel's view is accepted to the extent of regarding Dicrastylis as the most primitive type among the present day genera as it shows many characters considered to be not derived. Nevertheless, the sequence proposed by Pritzel of linear relationship between all five genera of Physopsideae seems unrealistic. The evolution of the present-day genera of Physopsideae probably stems from an ancestral hypothetical "Proto-Dicrastylis" more or less in three branches (see diagram); the linear sequence only demonstrates relative position in a graded series of modifications.

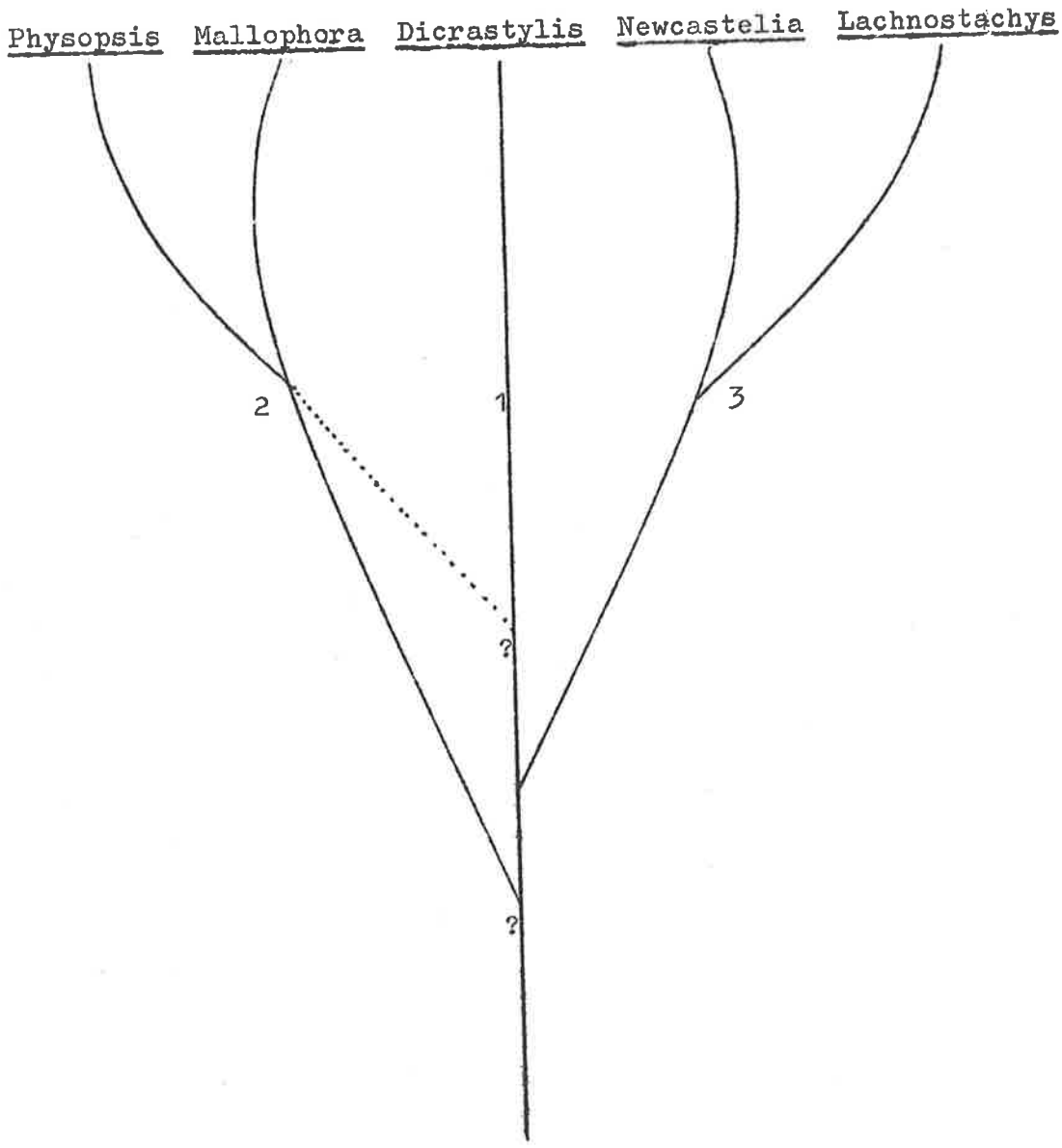
(1) Dicrastylis retains the greatest number of primitive characters.

(2) Physopsis and Mallophora, show a reduction in the number of perianth segments and stamens.

(3) Newcastelia and Lachnostachys show an increase in the number of perianth segments and stamens.

It is uncertain, which of the branches, (2) or (3), developed first.

(See diagram).



HYPOTHETIC PHYLOGENETIC RELATIONSHIP OF THE GENERA OF CHLOANTHACEAE TRIB. PHYSOPSIDEAE.

TRENDS OF DIVERSIFICATION IN CHLOANTHACEAE TRIB. PHYSOPSIDEAE.

GENERA	INFLORESCENCE	PERIANTH AND ANDROECIUM	COROLLA	STAMEN INSERTION	STYLE
Dicrastylis Drumm. ex. Harv.	Not always contracted into heads or spikes.	Often 5-merous.	Deeply lobed.	In corolla throat, exserted or subexserted.	Deeply 2-branched. 
Mallophora Endl.	Contracted into heads or spikes.	4-merous	Deeply lobed.	In corolla throat sub-exserted.	Shortly 2-lobed 
Physopsis Turcz.	Contracted into elongated spikes.	4-merous.	Lobed in the upper half only	In the middle of corolla-tube, included.	± notched 
Newcastelia FvM.	Contracted into elongated spikes, sometimes into sub-globose heads.	5-6(-7)-merous.	Shortly lobed towards the apex.	In corolla-tube or between corolla-lobes, exserted or included.	Entire to notched 
Lachnostachys Hook.	Contracted into elongated spikes.	(5-)6-8(-9)-merous.	Truncate or very minutely lobed at the apex.	At rim of corolla-tube, exserted.	Entire to notched 

TAXONOMIC TREATMENT

(Note: The use of new names and new combinations in this thesis does not constitute valid publication.)

C H L O A N T H A C E A E (Benth.)Hutch.

Chloanthaceae (Benth.)Hutchinson, Fam.Fl.Pl.ed.2, 1 (1959) 396; A.A.Bullock, Taxon 8 (5) (1959) 165; G.Buchheim, Willdenowia 3 (3) (1963) 376; Hj.Eichler, Suppl.Black's Fl.S.Aust.(ed.2) (1965) 266; D.E.Symon, Trans.R.Soc.S.Aust. 93 (1969) 33; C.A.Gardner, W.Aust. Wildfls.Vol.B (1972) 152.

T y p u s: Chloanthes R.Brown, Prod.Fl.Nov.Holland. (1810) 513.

Verbenaceae trib.Viticeae subtrib.Chloanthinae ("Chloantheae") Bentham, Fl.Aust. 5 (1870) 33,37; A.J.Ewart & O.B.Davies, Fl.N. Territory (1917) 235.

Verbenaceae trib.Chloantheae Bentham in Benth. & Hook.f.Gen.Pl. 2 (1876) 1132,1139 - Basionym; Th.Durand, Gen.Phan. (1888) 319; F.M.Bailey, Cat.Ind.Natur.Pl.Qld. (1890) 35,110; F.M.Bailey, Qld. Fl.4 (1901) 1164; T.V.Post & O.Kuntze, Lex.Gen.Phan. (1904) 688; E.Pritzel in L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 493; F.M.Bailey, Cat.Qld.Pl. (1913) 381; A.Lemée, Dict.Descript.Syn. Gen.Pl.Phan. 8b (1943) 650,653;

Verbenaceae subfam. Chloanthoideae Briquet in A.Engler & K.Prantl, Pflanzenfam. IV, 3a (1895) 144,160; J.Briquet, Mém,Soc.Physiq.Hist. Natur.32, pt.2 (8) (1896) 33; C.G.Dalla-Torre & H.Harms, Gen.Siphonogam. (1904) 431; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; S.Junell, Symb.Bot.Upsal.4 (1934) 61 ["Tribus Chloanthoideae"]; H.Melchior, A.Engler's Syllabus Pflanzenfam, ed.12, 2 (1964) 436.

Stilbaceae subfam. Chloanthoideae Moldenke, Résumé Verbenac.etc. (1959) 403.

Dicrastylidaceae Drumm. ex Harv. in Hook. J.Bot. & Kew Misc. 7 (1855) 56, nom.inval.[Code 1972, Art.32 (3)]; L.Pfeiffer, Nomencl. Bot. 1 (2) (1874) 1064; H.K.Airy Shaw, Kew Bull. 18 (2) (1965)256; H.K.Airy Shaw in Willis, Dict.Fl.Pl. and Ferns, ed.7, (1966) 351; A.S.George, J.R.Soc.W.Aust. 50 (1967) 103; J.S.Beard, W.Aust.Pl. ed.2, (1970) 113; A.R.Fairall, Aust.Native Pl.Cult. (1970) 104; J.R.Maconochie & N.Byrnes, Muelleria 2 (2) (1971) 135; H.N.Moldenke, Fifth Summary Verbenac.etc.2 (1971) 750; A.S.George,Nuytsia 1 (3) (1972) 289.

T y p u s: Dicrastylis Drumm. ex Harv. in Hook. J.Bot. & Kew Misc. 7 (1855) 56.

Verbenaceae auct. non J.St.-Hil.: R.Brown, Prod.Fl.Nov.Holland. (1810) 510 p.p.; S.L.Endlicher, Gen.Pl.2 (1836) 632 p.p.; S.L. Endlicher, Ann.Wien.Mus.2 (1838) 206; C.F.Meisner, Pl.Gen. (1840) 290 p.p.; S.L.Endlicher, Gen.Pl.2, Suppl.1 (1841) 1401 p.p.; D.N.F.Dietrich, Synop.Pl.3 (1843) 370 p.p.; W.G.Walpers, Rep.Bot. Syst.4 (1845) 3 p.p.; J.Lindley, Veg.King. (1847) 664 p.p.; J.C. Schauer in DC., Prod.11 (1847) 522 p.p.; N.Turczaninow, Bull.Soc. Nat.Mosc.22 (2)(1849) 34 p.p.; W.G.Walpers, Ann.Bot.Syst.3 (1852) 231 p.p.; F.v.Mueller, Fragm.1 (1859) 123 p.p.; F.v.Mueller, Fragm. 2 (1861) 60 p.p.; F.v.Mueller, Fragm.3 (1862) 21 p.p.; H.Bocquillon, Rev.Verbenac. (1863) 100 - 139 p.p.; N.Turczaninow, Bull.Soc. Nat.Mosc.36 (2)(1863) 194 - 226 p.p.; F.v.Mueller, Fragm. 4 (1864) 80, 161 p.p.; F.v.Mueller, Fragm. 6 (1868) 151 p.p.; F.v.Mueller, Fragm.8 (1873) 49; F.v.Mueller, Fragm.9 (1875) 3 p.p.; F.v.Mueller, Fragm. 10 (1876) 13, 73 p.p.; F.v.Mueller, Fragm. 11 (1880) 86; F.v.Mueller, Pl.N.W.Aust. (1881) 12; F.v.Mueller, Cens. Aust.Pl.1 (1882) 103 p.p.; F.M.Bailey, Synop.Qld.Fl. (1883) 374 p.p.;C.Moore Cens.Pl. N.S.W. (1884) 52 p.p.; F.v.Mueller, Syst. Vic. Pl. 2 (1885) 43 p.p.; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 171 p.p.; R.Tate, Trans.R.Soc.S.Aust.11 (1889) 98 p.p.; R.Tate, Trans.R.Soc. S.Aust.12 (1889) 113 p.p.; F.v.Mueller, Trans.R.Soc.S.Aust. 13 (1890) 105 p.p.; R.Tate, Fl.S.Aust. (1890) 155, 254 p.p.; C.Moore, Fl. N.S.W. (1893) 354 p.p.; C.Moore et E.Betche, Fl. N.S.W. (1893) 355 p.p.; F.v.Mueller et R.Tate, Trans.R.Soc.S.Aust. 16 (1893) 375; R.Tate in B.Spencer (ed.): Horn.Sc.Exped.3 (1896) 174 p.p.; L.Diels, Pflanzenw. W.Aust. (1906) 278; W.A.Dixon, Pl. N.S.W. (1906) 235 p.p.; J.H.Maiden et E.Betche, Cens. N.S.W. Pl. (1916) 177 p.p.; S.M.Moore, J.Linn.Soc.Bot. 45 (1920) 188; E.H.Pelloe, Wildfls. W. Aust. (1921) 100; J.M.Black, Fl.S.Aust.ed.1, (1926) 478 p.p.; K.Domin, Bibl.Bot. 89 (1929) 551 p.p.; A.J.Ewart, Fl.Victoria (1931) 973 p.p.; C.M.Eardley, Trans.R.Soc.S.Aust. 70 (1946) 152; A.B. Rendle, Class.Fl.Pl.ed.4, 2 (1956) 500 p.p.; J.M.Black, Fl. S.Aust. ed.2, (1957) 719 p.p.; G.H.M.Lawrence, Taxon.Vasc.Pl. (1958) 686 p.p.; C.A.Gardner, Wildfls. W.Aust. (1959) 127; N.C.W.Beadle et al., Pl.Syd.Dist. et Blue Mt. (1963) 413 p.p.; J.S.Beard, Cat. W. Aust.Pl. ed.1, (1965) 91 p.p.; W.E.Blackall et B.J.Grieve, W.Aust. Wildfls. 3 (1965) 559 p.p.; T.Y.Harris, Wildfls. Aust.,ed.6, (1966) 164; N.C.W.Beadle et al., Fl.Syd.Reg. (1972) 505 p.p.; G.M.Chippendale, Proc.Linn.Soc. N.S.W. 96 (4) (1972) 256 p.p.; H.T.Clifford et G.Ludlow, Fam.Gen.Qld.Pl. (1972) 123 p.p.; J.H.Willis, Pl. Victoria Vol.2 (1973) 579 p.p.; C.A.Gardner, Wildfls. W.Aust., ed. 11, (1973) 118.

Amaranthaceae auct. non Jussieu: W.J.Hooker, Ic.Pl.1, N.S., (1842) t.414, t.415; S.L.Endlicher, Gen.Pl.2, Suppl.3 (1843) 64 p.p.; V.E.Nees in Lehm.Pl.Preiss. 1 (1845) 626 p.p.; S.L.Endlicher, Gen. Pl.2, Suppl. 4 (1848) 43 p.p.; T.Moquin in DC., Prod.13 (1849) 231 p.p.; F.v.Mueller, Fragm. 2 (1861) 140; J.Lindley et T.Moore, Treasury Bot. pt.2 (1870) 654.

Myoporaceae auct. non R.Brown: De Candolle, Prod. 11 (1847) 701 p.p.; M.E.Spach, Hist.Natur.Veg.Phan. 9 (1840) 227 p.p.; W.V.Fitzgerald, J.R.Soc.W.Aust. 3 (1918) 208 p.p.

Phrymaceae auct. non Schauer: C.Mueller in Walp.,Ann.Bot.Syst. 5 (1859) 703 (quoad Dicrastylis Drumm. ex Harv.).

Byttneriaceae auct. non R.Brown: F.Mueller, Fragm.1 (1859) 241, "Buettneriaceae"; F.Mueller, Fragm.6 (1868) 158 (quoad Lachnostachys Hook.).

Labiatae auct. non Jussieu: F.Mueller, Fragm.10 (1876) 59 (quoad Depremesnilia FvM.).

Shrubs or shrublets, often very densely tomentose, cotton - woolly or clothed with much - branched (±dendriform) hairs,rarely glabrous or scabrid. Stem erect, branched (primarily near the base) cylindrical, solid, woody. Leaves cauline and ramal, simple, exstipulate, sessile, or subsessile, decussate or verticellate, rarely spiral, reticulate unicostate, often very densely clothed with branched (±dendriform) hairs, rarely glabrous or scabrid, mostly very strongly rugose or bullate, entire, often with recurved margins. Inflorescence terminal or axillary, dichasial, arranged mostly in spicate, capitata or corymbose - paniculate clusters. Flowers 4 - 8 - merous, each with a bract and 2 bracteoles at the base of their pedicels, actinomorphic or zygomorphic. Calyx gamosepalous, 4 - 8 - lobed, non accrescent, mostly densely hairy outside, glabrous inside. Corolla gamopetalous, 4 - 8 - lobed or truncate, regular, unequally lobed or 2 - lipped; lobes imbricate. Androecium: 4 - 8 stamens, epipetalous, inserted in the corolla tube, or on the rim of the truncate corolla; filaments filiform; anthers dorsifixed, 2 - lobed; lobes ± oblong, mostly free and divergent in the lower halves, longitudinally dehiscent, often muticous at the base. Disk absent. Gynoecium: bicarpellary, syncarpous, with 2 - 4 - locular superior ovary; ovules 1 - 2 in each locule, attached "laterally" (i.e. axillary) above the middle;

ovary not lobed; style terminal on ovary, slender, almost entire at the tip, shortly 2 - lobed or deeply 2 - branched. Fruit: indehiscent, dry , rarely drupe, 1 - 2 - seeded; seeds with albuminous endosperm and straight ambryo.
Distribution: Endemic in Australia.

C o m m e n t s:

The family name "Dicrastyleae" Drumm. ex Harv. (1855) was published without any description. It was based upon one new genus Dicrastylis, for which a description was provided. Airy Shaw (1965) has attempted to justify the name Dicrastylidaceae by applying Article 42 of the International Code, in which a monotypic new genus based upon a species is validated by a combined "descriptio generico - specifica". He, therefore, regarded the generic description of Dicrastylis as a combined "familio - generic" one.

In fact, the provision of a combined generic and specific description (in Article 42) cannot be extended to names of families with one genus only as there is no specific Article in the Code to cover this case. The Code requires a description for every new name, which in this particular case was first provided by Hutchinson (1959) under the family name Chloanthaceae. Therefore, the name "Dicrastyleae" is regarded here as not validly published [Code 1972, Art. 32 (3)].

Verbenaceae subfam. Chloanthoideae trib. Physopsideae Briquet in A.Engler & K.Prantl, Pflanzenfam. IV, 3a (1895) 144, 162 ;C.G.Dalla-Torre & H.Harms, Gen.Siphonogam. (1904) 432; S.Junell, Symb.Bot.Upsal,4 (1934) 62 ["subtrib. Physopsideae"]; C.A.Gardner in Hook. Ic.Pl.V,4 (1939) t.3383,t.3384 ["Tribus Physopsieae."]; H.Melchior, A.Engler's Syllabus Pflanzenfam., ed. 12, 2 (1964) 436.

T y p u s: Physopsis Turczaninow, Bull.Soc.Nat.Mosc. 22 (2) (1849) 34.

Verbenaceae trib. Chloantheae subtrib. Lachnostachydinae Pritzel in L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 493; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111 [trib."Chloanthoideae"....].

T y p u s: Lachnostachys Hooker, Ic.Pl. (1842) t.414.

Stilbaceae subfam. Chloanthoideae trib. Physopsideae Moldenke, Résumé Verbenac.etc. (1959) 404, nom.inval. (Code 1972, Art.32(3)).

Dicrastylidaceae trib. Physopsideae Moldenke, Fifth Summary Verbenac.etc.2 (1971) 742,751, nom.inval. (Code 1972, Art. 32 (3), 36), nom.illeg. (Code 1972, Art. 19).

KEY TO THE FAMILY CHLOANTHACEAE, ITS TRIBES AND THE GENERA OF TRIB. PHYSOPSIDEAE

1 (a). Herbs, shrubs or trees, glabrous or covered with simple or ± stellate hairs; inflorescence spicate, racemose or paniculate cymes; pedicels without bracteoles; ovary often lobed; ovules attached near the base (erect) or axile above the middle; fruit drupe or berry, if dry then separating into small nuts or pyrenes; seeds without albumen. Distributed widely both in the northern and southern hemispheres.....Verbenaceae.

(b). Shrubs or shrublets, very densely tomentose, cottony - woolly or clothed with much branched or dendriform hairs, rarely glabrous or scabrid; inflorescence dichasial cymes arranged mostly into spicate, capitate or corymbose panicles; pedicels with 2 - bracteoles at the base; ovary not lobed; ovules always attached "laterally" (axile) above the middle; fruit indehiscent, dry; rarely drupe; seeds albuminous. Endemic in Australia.....Chloanthaceae...2.

2 (a). Flowers zygomorphic, heteromerous; corolla mostly ± 2 - lipped or unequally 5 - lobed; stamens 4,..... .....Trib. Chloantheae.

(b). Flowers actinomorphic or nearly so, isomerous; corolla regular or nearly so, 4 - 8 - lobed; stamens 4 - 8.....Trib. Physopsideae...3.

3 (a). Perianth 5 - 8 -merous.....5.

(b). Perianth 4 -merous.....4.

4 (a). Flowers in dense spikes; stamens included; style entire (not lobed).....Physopsis.

(b). Flowers in ± capitate clusters; heads solitary or in corymbose panicles; stamens scarcely exserted; style shortly 2 - lobed towards the apex.....Mallophora.

5 (a). Style deeply 2 -branched; corolla usually 5 - merous.....Dicrastylis.

(b). Style entire or very minutely 2 - lobed at the end; corolla (5-)6 - 8 - merous.....6.

6.(a). Corolla with distinct lobes; stamens inserted between the lobes, included or exserted.....Newcastelia.

(b). Corolla-tube truncate, not lobed; stamens inserted at the rim of the corolla-tube, exserted..... Lachnostachys .

D I C R A S T Y L I S J.Drummond ex W.H.Harvey

DICRASTYLIS Drumm. ex Harv.

Dicrastylis J.Drummond ex W.H.Harvey, Hooker J.Bot.Kew Misc. 7 (1855) 56; C.Mueller,Walp.Ann.Bot.Syst.5 (1859) 703; G.Bentham, Fl.Aust.5 (1870) 42- "Dicrastyles"; L.Pfeiffer, Nomencl.Bot. 1 (1874) 1064; G.Bentham & J.D.Hook., Gen.Pl.2 (1876) 1132,1140 - "Dicrastyles"; F.v.Mueller, Cens.Gen.Pl.Indig.Aust. (1882) 41; F.v.Mueller, Cens.Aust.Pl.1(1882) 103; Th.Durand, Gen.Phan. (1888) 319 -"Dicrastyles"; F.v.Mueller, Sec.Cens.Aust.Pl.1(1889) 172; R.Tate, Trans.R.Soc.S.Aust. 12 (1889) 113; R.Tate, Fl.Extra-Tropic. S.Aust. (1890) 155,254; F.M.Bailey, Dept.Agric.Bot.Bull. 4 (1891) 14 -"Dicrastyles"; J.Briquet in Engl.& Prantl,Pflanzenfam.IV, 3a (1895) 164- "Dicrastyle"; J.Briquet, Mém.Soc.Physiq.Hist.Natur. Geneve, 32(2),no.8 (1896) 52 - 54- "Dicrastyles"; F.M.Bailey, Qld. Fl.4 (1901) 1164,1166 -"Dicrastyles"; T.V.Post & O.Kuntze, Lexic. Gen.Phan. (1904) 172,688 -"Dicrostylis"; L.Diels & E.Pritzel, Bot. Jahrb.Syst.35 (1904) 495,496 -"Dicrastyles";C.G.Dalla-Torre & H. Harams, Gen.Siphon.(1904) 432,no.7173;L.Diels, Pflanzwelt.W.Aust. (1906) 278- "Dicrastyles"; F.M.Bailey, Cat.Qld.Pl.(1913) 381 - "Dicrastyles"; J.H.Maiden, Aust.Veg.(1914) 174;A.J.Ewart & O.B. Davies, Fl.N.T. (1917) 237 -"Dicrastyles"; E.H.Pelloe, Wildfls.W. Aust. (1921) 100; J.M.Black, Fl.S.Aust.ed.1,(1926) 480;C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111 -"Dicrastyles"; S.Junell,Sym.Bot. Upsal,4 (1934) 66 -"Dicrastyles"; C.A.Gardner, J.R.Soc.W.Aust. 28 (1944) LVII -"Dicrastyles";J.M.Black, Fl.S.Aust.ed.2,(1957) 722; J.C.Willis, Dict.Fl.Pl.and Ferns,ed.6, (1957) 215; C.A.Gardner, Wildfls.W.Aust. (1959) 127,132 -"Dicrastyles"; J.Hutchinson, Fam. Flower.Pl. ed.2,1(1959) 397 -"Dicrastyles"; H.N.Moldenke, Résumé Verbenac.etc. (1959) 278,404,422; N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 96; H.Melchior in Engl.,Syll.Pflanzenfam. ed.12, 2(1964) 436; J.S.Beard, W.Aust.Pl. (1965) 92 -"Dicrastyles"; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 559,561; Hj.Eichler, Suppl. Fl.S.Aust.ed.2(1965) 266; H.K.A.Shaw in J.C.Willis', Dict.Fl.Pl. and Ferns, ed.7, (1966) 351; M.Morcombe, Aust.Wildfls. (1970) 94; J.S. Beard, W.Aust.Pl.ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1&2 (1971) 475,751,786; G.M.Chippendale, Proc.Linn. Soc.NSW. 96 (1972) 211;H.T.Clifford & G.Ludlow, Key Fam. & Gen. Qld.Fl.Pl. (1972) 124; C.A.Gardner, Wildfls.W.Aust.ed.11 (1973)118.

T y p u s: D.fulva J.Drummond ex W.H.Harvey, Hooker J.Bot.Kew Misc. 7 (1855) 56 - lectotype.

Typification:

The genus Dicrastylis Drumm. ex Harv. was published with three species viz.: D.fulva, D.reticulata and D.stoechas but the

author did not name any one of them as the type species. Since the type for this genus has not been selected, therefore, it is necessary to choose a lectotype from among the syntypes. All the three syntypes are endemic in the south-west of Western Australia, with D.fulva comparatively northern in position , wider in distribution and more characteristic of the features of the genus as a whole. Therefore, it has been designated here as the lectotype species of Dicrastylis Drumm. ex Harv.

Number of species: 26.

Description:

Perennial shrubs or undershrubs, densely covered with a cottony - woolly branched tomentum. Stem erect, branched, ± cylindrical, solid, woody. Leaves cauline and ramal, simple, exstipulate, sessile, or petiolate, decussate or verticillate,sometimes ± spiral, reticulate unicostate, entire or crenate, flat or with recurved (-revolute) margins, herbaceous. Inflorescence terminal or axillary, cymose; cymes pedunculate, lax or crowded into subglobose woolly clusters (heads), arranged into corymbose, pyramidal or spicate panicles, or the cymes sessile, congested to form decussate or verticillate clusters. Flowers 5 -merous, (rarely more or less than 5 -merous), bracteate, sessile or pedicellate, complete, regular, (sometimes corolla unequally lobed), hermaphrodite, hypogynous. Calyx gamosepalous, mostly 5 -lobed, (rarely more or less than 5 -lobed), densely tomentose outside, glabrous inside. Corolla gamopetalous, mostly 5 -lobed, (rarely more or less than 5 -lobed), often shortly hairy outside, tomentose (sometimes villous) inside; lobes entire or crenate at the apex, mostly equal, sometimes unequal. Androecium: 5 stamens, (rarely more or less than 5), epipetalous, inserted in the corolla-tube, exserted or scarcely so; anthers 2 -lobed, dorsifixed; lobes non - appendiculate, ± oblong, free and divergent in the lower halves, longitudinally dehiscent. Gynoecium: bicarpellary, syncarpous, tetralocular superior ovary, with axile placentation; ovule one in each locule, attached to the central axis above the middle; style deeply 2 -branched, exserted or scarcely so. Fruit dry, indehiscent, 1 - 2 seeded; seeds albuminous.

Distribution: (Maps 1 and 2).

The genus Dicrastylis is endemic in Australia. It is known to occur in South Australia, Western Australia, Northern Territory, Queensland and just across its southern border in New South Wales. However, so far it has not been recorded from any other (interior)

part of New South Wales or Victoria. Like the genus Newcastelia FvM., the majority of Dicrastylis species are known from Western Australia. Among the 26 accepted species (including 13 new ones), 6 are recorde for South Australia, 23 for Western Australia, 7 for Northern Territory and one for Queensland and New South Wales. According to the known distribution of these species, D.beveridgei FvM., D.exsuccosa (FvM.)Druce and D.lewellinii (FvM.)FvM. are more wide-spread than the rest, being found in at least three of the five states (and territories) where this genus is known to occur. The first three named are recorded from South Australia, Western Australia and Northern Territory, while the last one (D.lewellinii FvM.) is known from South Australia, Northern Territory, Queensland and New South Wales. Similarly, D.costelloi Bail. is distributed in South Australia and Northern Territory and D.gilesii FvM. in the Northern Territory and Western Australia. Of the other 20 species, D.verticillata Black is endemic to [Eyre Peninsula]South Australia and D.petermannensis Munir to the Petermann Ranges in the Northern Territory. There is no known species endemic in Queensland or New South Wales. All the remaining 18 species are endemic to Western Australia. These are:- D.brunnea Munir, D.cordifolia Munir, D.corymbosa (Endl.)Munir, D.flexuosa (Price) Gardner, D.fulva Drumm. ex Harv., D.georgei Munir, D.glauca Munir, D.incana Munir, D.linearifolia Munir, D.micrantha Munir, D.microphylla Munir, D.morrisonii Munir, D.nicholasii FvM., D.obovata Munir, D.parvifolia FvM., D.reticulata Drumm. ex Harv. D.sessilifolia Munir and D.velutina Munir. In addition to these, all three new sub - species of D.exsuccosa [viz.: ssp. cinerea Munir, ssp. elliptica Munir and ssp. wilsonii Munir] are also limited to Western Australia.

Distribution in South Australia is mainly to the north -northwest, with one species [D.verticillata Black] from the south. The latter seems to occur in an area where no other taxon [at least of isomerous flowered genera) of Dicrastylidaceae is known to grow.

In Western Australia, this genus is distributed chiefly in the South-Western Province and the Eremean Province, with only 3 species extending to the border districts of the Northern Province. They represent two species [D.cordifolia Munir and D.doranii FvM.] from the Dampier District and one [D.exsuccosa (FvM.)Druce] from the Ord District. The last, D.exsuccosa (FvM.)Druce, is the only known species occurring very far north, where no other taxon of trib. Physopsideae is known to occur.

Species occurring in different Botanical Provinces of Western Australia are as follows:-

S.W.Province	Eremean Province.	Eremean and S.W.Province	Eremean and Northern Prov.
D.corymbosa (Endl.) Munir.	D.brunnea Munir	D.micrantha Munir.	D.cordifolia Munir.
D.fulva Drumm. ex. Harv.	D.doranii FvM.	D.parvifolia FvM.	D.exsuccosa (FvM.) Druce.
D.glauca Munir	D.exsuccosa (FvM.) Druce.		D.doranii FvM.
D.incana Munir	D.flexuosa (Price) Gard.		
D.morrisonii Munir	D.georgei Munir		
D.obovata Munir	D.gilesii FvM.		
D.reticulata Drumm. ex Harv.	D.linearifolia Munir		
D.velutina Munir	D.microphylla Munir		
	D.nicholasii FvM.		
	D.sessilifolia Munir		

The main distribution in the South Western Province is in the Avon, Eyre, Irwin and Stirling Districts, few species are known in the Darling District and none in the (southern-most) Warren District, In the Eremean Province, most of the species occur in the Coolgardie, Austin and Carnegie Districts, a few in Ashburton district but none in the Eucla District.

In the Northern Territory, there are 7 known species all distributed south of 18 degrees south latitude. Of these, D.petermannensis Munir is endemic to the Petermann Ranges and the remaining six spread over to the neighbouring states. Among these, D.costelloi Bail. and D.lewellinii (FvM.)FvM. are distributed chiefly to the south, D.beveridgei FvM. and D.gilesii FvM. to the south-west and D.doranii FvM. and D.exsuccosa (FvM.)Druce to the western and central areas.

The only known Dicrastylis species in Queensland is D.lewellinii (FvM.)FvM. occurring in the southern part with two localities just across the (southern) border in New South Wales. However, Bailey (1901,1913) has recorded four Dicrastylis species from Queensland, viz.: D.costelloi Bail,D.doranii FvM., D.lewellinii (FvM.)FaM. and D.weddii Bail. The present (author)

Note:- The Botanical Provinces and Districts of Gardner & Bennetts (1956) are used to record the distribution of Western Australian

writer does not agree with Bailey' record, because he seems to have misunderstood some of the above taxa while distinguishing them from each other. In the present treatment, therefore, D.weddii Bail. is found conspecific with D.lewellinii (FvM.)FvM.. D.costelloi Bail. was recorded (by Bailey) from the western side of the Queensland - Northern Territory border. The occurrence of D.doranii FvM. in Queensland is based on C.Winnecke's collection which is now identified as a variety of D.costelloi Bail.Actually, Bailey confused D.doranii FvM. with D.costelloi Bail. as he also confused Newcastelia cladotricha FvM. with one undescribed taxon [now named N.interrupta Munir] from St.George. Both D.doranii FvM. and N.cladotricha FvM. are distributed chiefly in the Eremean Province of Western Australia. Therefore, with the exception of D.lewellinii (FvM.)FvM., no other Dicrastylis species is known to occur in Queensland.

The following table shows the number of Dicrastylis taxa known to exist in various states/territories in Australia. In this table the subspecific taxa are also recorded but these are not included in the totals for each state/territory.

Taxa	S.A.	W.A.	N.T.	Qld.	Vic.	N.S.W.
D.beveridgei FvM.						
ssp.beveridgei						
var.beveridgei	x	-	x	-	-	-
var.lanata Munir	x	x	x	-	-	-
ssp.revoluta Munir	-	x	x	-	-	-
D.brunnea Munir						
var.brunnea	-	x	-	-	-	-
var.pedunculata Munir	-	x	-	-	-	-
D.cordifolia Munir						
var.cordifolia Munir	-	x	-	-	-	-
var.barnetii Munir	-	x	-	-	-	-
var.purpurea Munir	-	x	-	-	-	-
D.corymbosa (Endl.) Munir	-	x	-	-	-	-
D.costelloi Bailey						
var.costelloi	x	-	x	-	-	-
var.eriantha (FvM.) Munir	-	x	x	-	-	-
var.globulifera Munir	x	-	-	-	-	-

Taxa	S.A.	W.A.	N.T.	Qld.	Vic.	N.S.W.
contd.						
var.violacea Munir	x	-	x	-	-	-
D.doranii FvM.	x	x	x	-	-	-
D.exsuccosa (FvM.) Druce						
ssp.exsuccosa						
var.exsuccosa	-	x	x	-	-	-
var.lanceolata Munir	-	x	x	-	-	-
var.tomentosa Munir						
f.tomentosa	-	x	-	-	-	-
f.albo-lutea Munir	-	x	x	-	-	-
f.lachnophylla Munir	x	x	-	-	-	-
ssp.cinerea Munir	-	x	-	-	-	-
ssp.elliptica Munir	-	x	-	-	-	-
ssp.wilsonii Munir	-	x	-	-	-	-
D.flexuosa (Price) Gard.	-	x	-	-	-	-
D.fulva Drumm. ex Harv.						
f.fulva	-	x	-	-	-	-
f.angustifolia	-	x	-	-	-	-
D.georgei Munir						
var.georgei	-	x	-	-	-	-
var.cuneata Munir	-	x	-	-	-	-
D.gilesii FvM.						
var.gilesii						
f.gilesii	-	x	x	-	-	-
f.densa Munir	-	x	x	-	-	-
var.bagotensis Munir						
f.bagotensis	-	x	x	-	-	-
f.brevipila Munir	-	x	x	-	-	-
f.irregularis Munir	-	x	-	-	-	-
var.laxa Munir	-	-	x	-	-	-
D.glauca Munir	-	x	-	-	-	-
D.incana Munir	-	x	-	-	-	-
D.lewellinii (FvM.) FvM.	x	-	x	x	-	x
D.linearifolia Munir	-	x	-	-	-	-

Taxa	S.A.	W.A.	N.T.	Qld.	Vic.	N.S.W.
contd.						
D.petermannensis Munir	-	-	x	-	-	-
D.micrantha Munir	-	x	-	-	-	-
D.microphylla Munir	-	x	-	-	-	-
D.morrisonii Munir	-	x	-	-	-	-
D.nicholasii FvM.	-	x	-	-	-	-
D.obovata Munir	-	x	-	-	-	-
D.parvifolia FvM.	-	x	-	-	-	-
D.reticulata Drumm. ex Harv.	-	x	-	-	-	-
D.sessilifolia Munir	-	x	-	-	-	-
D.velutina Munir	-	x	-	-	-	-
D.verticillata Black	x	-	-	-	-	-
Total number of species recorded for each state/territory	6	23	7	1	-	1

[- = Absent; x = Present]

In view of the overall distribution pattern of Dicrastylis, it seems likely that the centre of diversity of this genus is in Western Australia.

C o m m e n t s:

The name Dicrastylis seems to be a latinized Greek form (of dicroos, forked; stylos, style), alluding to the deeply 2 - brnached style.

In two different places, F.v.Mueller (1874,1880) erroneously spelled this genus as "Dicrastyles", but subsequently he used the original orthography, Dicrastylis. Many workers (including Bentham, 1870), maintained the non - original spelling with the ending "es". Post & Kuntze (1904) also by mistake recorded this genus as "Dicrostylis".

Relationship:

The genus is closely allied to Mallophora Endl. in having deeply incised corolla-tube, strictly isomerous stamens [with the calyx and corolla-lobes] and distinctly 2 -lobed style. However, the latter can be readily distinguished by its inflorescence being contracted into woolly flower-heads, the flowers 4 -merous and the

style comparatively much less deeply divided.

Dicrastylis Drumm. ex Harv. is also related to Physopsis Turcz. in which the corolla-tube is lobed in the upper half and the stamens are isomerous with the calyx and corolla lobes, but the inflorescence in the latter is contracted into spikes, the flowers are tetramerous and the style is entire (not lobed).

Cymes in ± Pyramidal panicle

D. brunnea
D. doranii
D. exsuccosa
D. gilesii
D. petermannensis
D. sessilifolia

Inflorescence greyish-tomentose; corolla-lobes crenate

D. doranii

Inflorescence golden-yellow, purplish-yellow, purplish-grey or greenish-grey corolla-lobes entire

D. brunnea
D. exsuccosa
D. gilesii
D. petermannensis
D. sessilifolia

Inflorescence golden-yellow or greyish-orange; flowers not forming any (headlike) clusters

D. exsuccosa

Inflorescence purplish-yellow, purplish-grey or greenish-grey; flowers often congested to form (headlike) woolly clusters

D. brunnea
D. gilesii
D. petermannensis
D. sessilifolia

Cymes in sessile clusters

D. petermannensis

Cymes pedunculate or sometimes in subsessile clusters

D. brunnea
D. gilesii
D. sessilifolia

Cymes purplish-yellow or purplish-grey; peduncle purplish-grey or greenish-grey; corolla entire

D. brunnea
D. gilesii

INFLORESCENCE (DICRASTYLIS Drumm.ex Harv.)

Cymes in spike-like panicle having few branches near the base

D. beveridgei
D. costelloi
D. lewellinii

Cymes in subglobose clusters; corolla purplish violet; stamens & style exserted.

D. lewellinii

Cymes in spike-like panicles; corolla white or yellowish-white; stamens & style scarcely exserted.

D. beveridgei
D. costelloi

Calyx tomentum yellow

D. beveridgei

Calyx tomentum grey or violet

D. costelloi

Cymes (pedunculate) in corymbose panicle

D.fulva
D.glauca
D. incana
D.linearifolia
D.micrantha
D.morrisonii
D.nicholasii
D.obovata
D.parvifolia
D.reticulata
D.corymbosa
D.velutina

Flowers much congested forming subglobose (heads) clusters

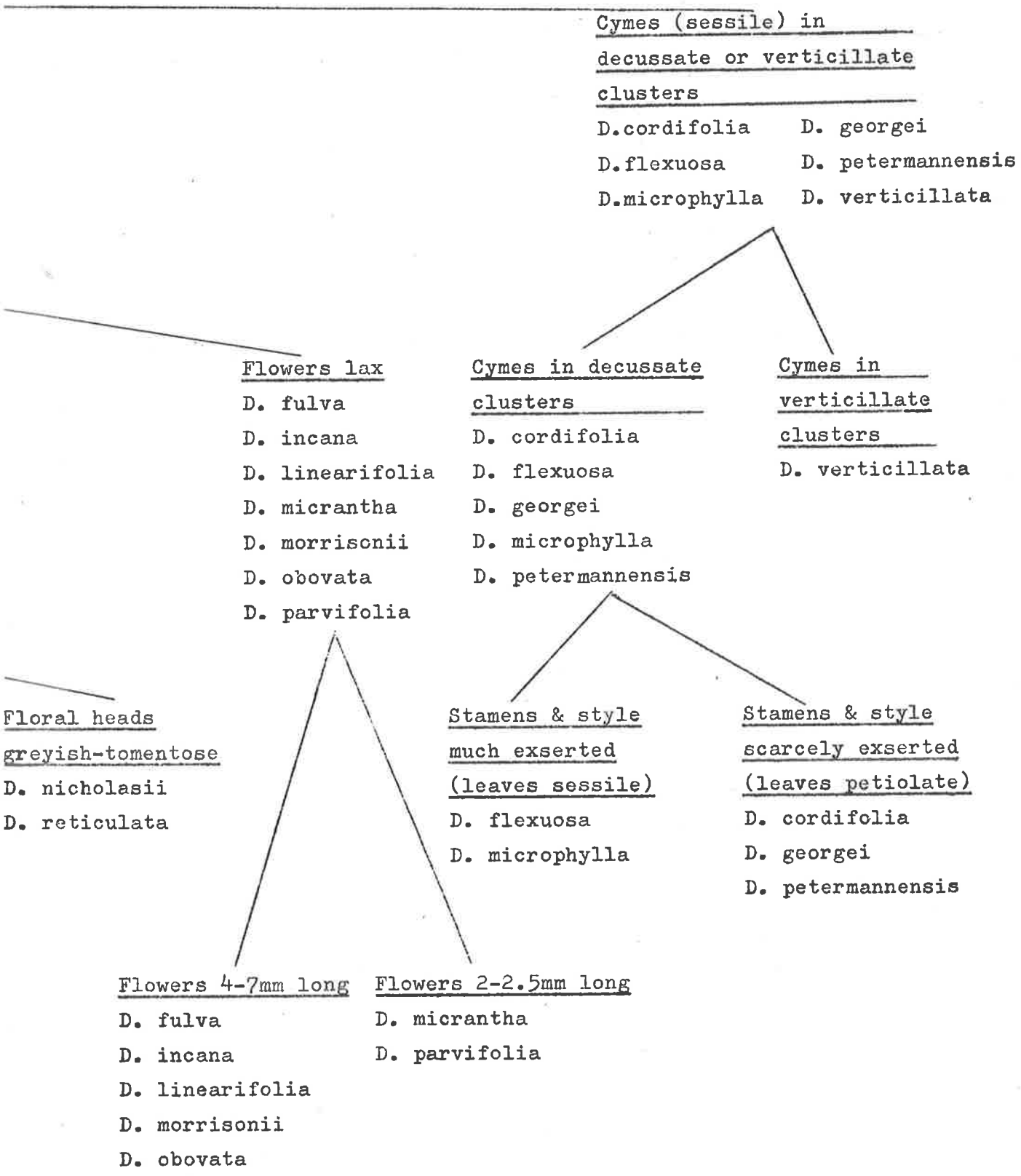
D. glauca
D. nicholasii
D. reticulata
D. corymbosa
D. velutina

Floral heads white-woolly

D. glauca
D. corymbosa
D. velutina

Cymes greenish-grey; peduncle reddish-purple; corolla-lobes crenate

D. sessilifolia


Cymes (sessile) in decussate or verticillate clusters
D.cordifolia
D.flexuosa
D.microphylla
D. georgei
D. petermannensis
D. verticillata
Flowers lax
D. fulva
D. incana
D. linearifolia
D. micrantha
D. morrisonii
D. obovata
D. parvifolia
Cymes in decussate clusters
D. cordifolia
D. flexuosa
D. georgei
D. microphylla
D. petermannensis
Cymes in verticillate clusters
D. verticillata
Floral heads greyish-tomentose
D. nicholasii
D. reticulata
Stamens & style much exserted (leaves sessile)
D. flexuosa
D. microphylla
Stamens & style scarcely exserted (leaves petiolate)
D. cordifolia
D. georgei
D. petermannensis
Flowers 4-7mm long
D. fulva
D. incana
D. linearifolia
D. morrisonii
D. obovata
Flowers 2-2.5mm long
D. micrantha
D. parvifolia

Summary of the Sections of Dicrastylis Drumm. ex. Harv.

Section 1. Verticillatae Munir, sect.nov.

Cymes sessile, in decussate or verticillate sessile clusters, the lower clusters mostly axillary; leaves petiolate or sessile.

Section 2. Dicrastylis

Cymes pedunculate, arranged in a ± lax corymbose panicle, apparently congested due to dense long tomentum, not forming compact subglobose heads (clusters).

Section 3. Corymbosae Munir, sect.nov.

Cymes pedunculate, much congested, forming a ± compact subglobose [head-like] cluster.;cluster (head) corymbosely arranged.

Section 4. Spicatae Munir, sect.nov.

Cymes arranged in an elongated spike-like panicle often with a few branches or peduncles near the base; leaves sessile,decussate, scattered or in whorls of 3, linear or very narrowly linear - lanceolate, margins recurved.

Section 5. Pyramidatae Munir, sect.nov.

Cymes arranged in a ± pyramidal panicle; leaves shortly petiolate or sessile, decussate, ± elliptic - lanceolate, elliptic - oblong or ovate - lanceolate, margins seldom recurved.

Note: These sections appear with formal Latin diagnoses on appropriate pages among the descriptions of species to which they apply. See "Index to Scientific Names".

KEY TO THE SECTIONS, SPECIES AND INFRASPECIFIC TAXA OF DICRASTYLIS Drumm. ex Harv.

1 a. Cymes in ± pyramidal panicles or in sessile clusters on terminal spike - like panicle with a few branches or peduncles near the base.....19.

b. Cymes in subglobose cluster - heads, verticillate or decussate when sessile, terminal corymbose when pedunculate; or cymes arranged in ± lax corymbose panicle.....2.

2 a. Cymes pedunculate, in corymbose panicles; leaves sessile or sub - sessile (shortly petiolate in D.linearifolia).....8.

b. Cymes sessile, often in verticillate or decussate clusters; leaves petiolate or sessile.....3.

3 a. Flower - clusters close together forming a ± continous spike on the main axis of inflorescence, creamy tinged with yellow; leaves lanceolate, 2.5 - 6 cm long, petiolate.....*D.petermannensis.

b. Flower - clusters somewhat separated, forming an interrupted spike, greenish - grey, purplish - pink or violet; leaves cordate - sub - cordate, oblong, ovate - oblong, elliptic or narrowly linear - lanceolate, not more than 3.5 cm long, sessile or petiolate.....Sect. Verticillatae...4.

Section Verticillatae

4 a. Leaves and flower - clusters verticillate; the anterior corolla - lobe 4 - 5 times larger than the other four..... .....D.verticillata.

b. Leaves and flower - clusters decussate; corolla - lobes almost equal (in D.flexuosa, the anterior corolla - lobe slightly larger).....5.

5 a. Leaves oblong or narrowly ovate - oblong, sessile, (0.5-)1 - 1.7(-1.8) cm by (0.1-)0.2 - 0.4 cm; with recurved margins... .....*D.microphylla.

b. Leaves elliptic, ovate or cordate, petiolate or sessile, 1 - 3.5 cm by 0.5-2.5(-3) cm, with non - recurved margins.....6.

6 a. Leaves sessile; corolla irregular, petals violet - blue; stamens and style exserted.....D.flexuosa.

b. Leaves petiolate; corolla regular, petals purplish - pink; stamens and style scarcely exserted.....7.

Note: The names with an asterisk * are new species.

7 a. Leaves ovate - subcordate, ovate - rotund or broadly elliptic, 1 - 3.5 by 0.8 - 2.5(-3) cm; flower clusters 1 - 2.5 cm in diameter, subsequent pairs separated by internodes of the rachis; calyx tomentum thick, hairs up to 2.7 mm.....*D.georgei.

A1. Leaves ovate - subcordate or ovate - rotund, truncate or sinuate at the base of lamina....var.georgei.

A2. Leaves broadly elliptic, cuneate towards the base....var.cuneata.

b. Leaves cordate, rarely somewhat ovate - cordate, 1 - 2 by 0.7 - 1.8 cm; flower clusters 0.6 - 1 cm in diameter, subsequent pairs close, forming a ± continous spike; calyx tomentum thin, hairs up to 1.5 mm .....*D.cordifolia.

A1. Leaves cordate; cymes all sessile; peduncles and young shoots purplish - grey or greenish - grey....B.

B1. Petioles to 4 mm long; calyx - tomentum green -ish - grey, hairs 0.5 - 1 mm long.....var.cordifolia.

B2. Petioles to 10 mm long; calyx - tomentum purplish - grey, hairs 1 - 1.5 mm long.....var.barnettii.

A2. Leaves ± ovate - subcordate; cymes of lower inflorescence shortly pedunculate; peduncles and young shoots purple.....var.purpurea.

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8 a. Cymes much congested, forming ± compact subglobose, often woolly, cluster - heads.....Sect. Corymbosae...15.

b. Cymes in ± lax panicles or apparently congested owing to the dense thick tomentum. not forming compact subglobose heads.. .....Sect. Dicrastylis...9.

Section Dicrastylis

9 a. Leaves typically obovate.....*D.obovata.

b. Leaves variously shaped, not obovate.....10.

10a. Leaves shortly petiolate, green above, grey pubescent underneath, margins entire, non - recurved; stem prominently golden - orange or rust coloured.....*D.linearifolia.

b. Leaves sessile, greyish - green or fulvescent - tomentose, margins crenulate, ± recurved or revolute; stem greyish or fulvescent - tomentose.....11.

11a. Flowers 4 - 7 mm long; calyx-tomentum thick, hairs 1 - 2.5 mm long.....13.

b. Flowers 2 - 2.5 mm long; calyx - tomentum thin; hairs 0.2 - 0.4 mm long.....12.

12a. Leaves linear or linear - oblong, up to 1.5 by 0.3 cm; stem greyish - tomentose; calyx glandular outside; corolla tomentose in throat, anterior - lobe somewhat enlarged; ovary glandular, style much exserted.....D.parvifolia.

b. Leaves narrowly elliptic, up to 3.5 by 1.5 cm; stem fulvescent - tomentose; calyx non - glandular outside; corolla almost glabrous in throat, lobes equal; ovary non - glandular, style scarcely exserted.....*D.micrantha.

13a. Plant greyish - tomentose all over; leaves lanceolate or narrowly elliptic - oblong, margins entire, recurved or revolute; corolla - lobes almost equal.....14.

b. Plant fulvescent - tomentose all over; leaves narrowly elliptic or elliptic - oblong; margins crenate - crenulate, flat; corolla - lobes unequal.....D.fulva.

A1. Leaves elliptic to elliptic - oblong, fulvescent - tomentose, margins crenulate.....f.fulva.

A2. Leaves narrowly elliptic or oblong, dark greyish - green above, greenish - grey tomentose beneath, margins distinctly crenate.....f.angustifolia.

14a. Leaves narrowly lanceolate, decussate; pedicels of terminal flowers of each dichasium 2 - 4 mm long; calyx - tomentum dense, up to 1.6 mm long.....*D.incana.

b. Leaves ± oblong, decussate or spiral; pedicels of terminal flowers of each dichasium 4 - 8 mm long; calyx - tomentum lax, up to 2.5 mm long.....*D.morrisonii.

Section Corymbosae

15a. Cymes (heads) 5 - 6 mm in diameter, not woolly; peduncles slender, sparsely tomentose (leaves linear, up to 1.2 by 0.3 cm, margins recurved).....D.nicholasii.

b. Cymes (heads) more than 6 mm in diameter, woolly tomentose; peduncles thick, densely woolly tomentose.....16.

16a. Stem greyish - fulvescent tomentose; leaves ovate, sometimes oblong - ovate, margins distinctly crenate, recurved near the base only; flower - heads greyish - tomentose, bracts leafy.....D.reticulata.

b. Stem white - woolly tomentose or glaucous; leaves narrowly triangular - ovate or oblong, margins ± crenulate, revolute

throughout; flower - heads white woolly, bracts not leafy (diffuse undershrubs with the aspect of Filago or Gnaphalium .....17.

17a. Leaves narrowly triangular - ovate; cymes (heads) with distinct peduncles [1 - 3(-4) cm long]; flower - heads 1 - 2 (-2.5) cm in diameter.....*D.velutina.

b. Leaves oblong; cymes (heads) sessile or subsessile, sometimes with short peduncles [0.3 - 1 cm long]; flower - heads 0.8 - 1.5(-2) cm in diameter.....18.

18a. Stem and leaves densely white - woolly; leaf surface concealed by the dense woolly tomentum; corolla - lobes equal.. .....D.corymbosa.

b. Stem and leaves glaucous; leaves clearly rugose above, the midrib distinct on the under - surface; anterior corolla - lobe larger than the others.....*D.glauca.

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19a. Cymes arranged in ± pyramidal panicle; leaves decussate, shortly petiolate or sessile, ± elliptic - lanceolate, ovate - lanceolate or elliptic - oblong, margins usually not recurved.....Sect. Pyramidatae..22.

b. Cymes arranged in an elongated spike - like panicle often with a few branches or peduncles near the base of spike, or forming sessile and pedunculate subglobose flower - clusters (heads); leaves sub - opposite or verticillate, sessile, linear or very narrowly linear - lanceolate, margins recurved.....Sect. Spicatae..20.

Section Spicatae

20a. Flowers (cymes) in subglobose clusters; calyx hairy on the upper half inside; corolla purplish - blue, lobes entire, the anterior one larger than the others; stamens and style much exserted.....D.lewellinii.

b. Flowers (cymes) in an elongated terminal spike - like panicle with a few branches or peduncles near the base of spike; calyx glabrous inside; corolla white or yellow, lobes crenate, equal; stamens and style included or scarcely exserted.. .....21.

21a. Inflorescence and shoot tips whitish - grey, purplish - violet or purplish - grey tomentose.....D.costelloi.

A1. Inflorescence whitish - grey tomentose.....B.

B1. Cymes close together on the slender rachis; leaves often with narrowly recurved margins..... .....var.costelloi.

B2. Cymes distant from each other on the thick rachis; leaves with broadly recurved margins or almost flat.....var.eriantha.

A2. Inflorescence purplish - violet or purplish - grey tomentose.....C.

C1. Cymes ± globular, purplish - grey tomentose..... .....var.globulifera.

C2. Cymes ± ovoid, not globular, purplish - violet tomentose.....var.violacea.

b. Inflorescence and shoot tips golden - yellow tomentose..... .....D.beveridgei.

A1. Leaves linear or linear - lanceolate, margins recurved.....ssp. beveridgei.

B1. Leaves and calyx thin - tomentose; flowers ± lax in clusters; clusters non - globose, close together on the slender rachis..... .....var.beveridgei.

B2. Leaves and calyx thick - tomentose; flowers (congested) almost hidden under the woolly tomentum; clusters subglobose, distant from each other on the thick rachis...var.lanata.

A2. Leaves narrowly elliptic to elliptic - oblong, margins distinctly revolute.....ssp. revoluta.

Section Pyramidatae

22a. Inflorescence greyish - tomentose; corolla - lobes crenate.. .....D.doranii.

b. Inflorescence golden - yellow, purplish - yellow, purplish - grey or greenish - grey tomentose; corolla - lobes entire, (crenate in D.sessilifolia).....23.

23a. Inflorescence purplish - yellow, purplish - grey or greenish - grey; flowers congested in head - like woolly clusters.... .....24.

b. Inflorescence often distinctly golden - yellow, sometimes greyish - orange; flowers not forming any head - like clusters.....D.exsuccosa.

A1. Leaves lanceolate, dark - green or dark - brown above, distinctly rugose; branchlets hairy; calyx - tomentum 0.5 - 1 mm thick, not woolly; calyx - lobes distinct; inflorescence ± lax....ssp.exsuccosa.

B1. Leaves not crowded towards the apex, narrowly lanceolate; dark - green above; basal peduncles up to 3(-4) cm long, slender, less than 1 mm in diameter, hairy.....var.lanceolata.

B2. Leaves often crowded towards the apex, broadly lanceolate; dark - green to dark - brown above; basal peduncles usually less than 3 cm long, thick, 1 mm or more in diameter, tomentose.....var.exsuccosa.

A2. Leaves variously shaped and coloured (rarely lanceolate), rugose or densely covered with woolly tomentum; branchlets densely tomentose; calyx - tomentum 1 - 2.5 mm thick, very woolly; calyx - lobes hidden under the woolly tomentum; inflorescence ± congested.....C.

C1. Calyx - lobes glabrous inside; leaves narrowly elliptic, ovate or almost lanceolate, more than 2.3 cm long.....D.

D1. Leaves ovate or almost lanceolate, very densely tomentose, rugae and reiculation hidden under the dense, woolly tomentum; calyx - tomentum golden - yellow, purplish - yellow or pale - yellow.....E.

E1. Leaves ovate - lanceolate or lanceolate, brownish - yellow, pale greenish - yellow or dark - green above, greyish - yellow or brownish - yellow beneath, often up to 6(-10) cm long.....var.tomentosa.

F1. Leaves broadly ovate - lanceolate, brownish - yellow above.....G.

G1. Young apical shoots and calyx - tomentum golden - yellow.....f.tomentosa.

G2. Young apical shoots and calyx - tomentum purplish -yellow or pale - yellow.....f.lachnophylla.

F2. Leaves narrowly lanceolate, dark - green above.....f.albo-lutea.

E2. Leaves ovate, bluish - grey or greyish - green above, greyish beneath, up to 3(-4.5) cm long.....ssp.cinerea.

D2. Leaves narrowly elliptic, cuneate towards the base, sparsely thin tomentose, distinctly rugose above, reticulate beneath; calyx - tomentum greyish - orange.....ssp.elliptica.

C2. Calyx - lobes hairy in the upper half inside; leaves broadly elliptic - ovate to orbicular, up to 2.3 cm long (thin - tomentose, distinctly rugose above, reticulate beneath)...ssp.wilsonii.

24a. Brandlets greenish - grey, creamy - grey or purplish - grey; leaves broadly elliptic - ovate or lanceolate, often petiolate (sessile in D.sessilifolia);flower - clusters (cymes) greenish - grey, purplish - grey or creamy tinged with yellow. .....25.

b. Branchlets rusty - brown; leaves ± elliptic - oblong, sessile or nearly so, obtuse, cuneate towards base; flower - clusters (cymes) purplish - yellow.....*D.brunnea.

A1. Flower - clusters (cymes) sessile or on short [up to 2.5(-3) cm], thick peduncles.....var.brunnea.

A2. Flower - clusters (cymes) often on long [up to 5.5(-6.5)cm], slender peduncles.....var.pedunculata.

25a. Cymes sessile, arranged decussately in terminal spicate clusters, creamy tinged with yellow.....*D.petermannensis.

b. Cymes pedunculate, in ± pyramidal panicle or nearly so, greenish - grey or purplish - grey.....26.

26a. Leaves narrow - lanceolate, sessile, decussate, verticillate or scattered; peduncles of cymes reddish - purple, often 3 - 4 at a node; corolla - lobes crenate.....*D.sessilifolia.

b. Leaves broadly elliptic - ovate or lanceolate, shortly petiolate, decussate; peduncles of cymes purplish - grey or greenish - grey, decussate; corolla - lobes entire..... .....D.gilesii.

A1. Inflorescence ± congested; flowers crowded into woolly - tomentose clusters (heads); calyx - tomentum thick, hairs up to 3.5 mm long (except var. bagotensis f.brevipila).....B.

B1. Cyme peduncles in the lower half of an inflorescence 1 - 2.5(-3.5)cm long, the terminal ones often in the axil of leafy bracts.....var.gilesii.

C1. Flower - clusters (cymes) congested only towards the end of an inflorescence, young shoots, peduncles and apical leaves purplish - grey tomentose;(cyme) peduncles 1.5 - 2.5(-3.5) cm long.....f.gilesii.

C2. Flower - clusters congested throughout; young shoots, peduncles and apical leaves greenish - grey tomentose; (cyme) peduncles 1(-1.5) cm long.....f.densa.

B2. Cyme peduncles in the lower half of an inflorescence 2 - 4.5(-5.5) cm long, the terminal ones often in the axil of non - leafy bracts.....var.bagotensis.

D1. Calyx - tomentum thick and woolly, hairs up to 2.5 mm long.....E.

E1. Flowers almost constantly 5 -merous.....f.bagotensis.

E2. Flowers often varying, with 5 - 9 calyx -lobes, corolla - lobes, stamens; 2 - 5 stylar - lobes and sometimes 2 ovaries in one flower.....f.irregularis.

D2. Calyx - tomentum thin, not woolly, hairs up to 1.3 mm long.....f.brevipila.

A2. Inflorescence ± lax; flowers not crowded to form any distinct clusters (heads); calyx - tomentum thin, hairs up to 1.3 mm long.....var.laxa.

Sectio 1. Verticillatae Munir, sect.nov.

Cymae sessiles in fasciculas sessiles decussatas vel verticillatas dispositae, fasciculi inferiores plerumque axillares, folia petiolata vel sessilia.

T y p u s: Dicrastylis verticillata Black, Trans.Roy.Soc.S.Austral. 42 (1918) 53.

Cymes sessile, in decussate or verticillate sessile clusters, the lower clusters mostly axillary; leaves petiolate or sessile.

Dicrastylis verticillata J.M.Black in Trans.R.Soc.S.Aust.42 (1918) 53,t.7; J.M.Black, Fl.S.Aust.ed.1,(1926) 483,t.43;J.M.Black, Fl.S.Aust.ed.2, (1957) 725,fig.1036; H.N.Moldenke, Résumé Verbenac. etc.(1959) 208; Hj.Eichler, Suppl.Black's Fl.S.Aust.ed.2, (1965) 266; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 346.

T y p u s: B.P.Bowering s.n.: Hundred of Goode, north of Murat Bay, Eyre Peninsula, South Australia, -XII.1917 (AD holotype; K).

Description: (Fig. 1).

A low shrub, clothed with branched white tomentum. Stem erect, branched, cylindrical, woody, 25 - 65 cm long, grey - tomentose; branchlets three at a node, rarely opposite (decussate). Leaves mostly in whorls of three, sometimes more, sessile, exstipulate, narrow - linear, sometimes narrowly linear - lanceolate, obtuse, with recurved margins, 0.7 - 2.2 cm long, 2 - 4 mm broad, rugose and pubescent above, becoming almost glabrous in the old leaves, densely grey - tomentose beneath. Inflorescence terminal on branches, cymose; cymes almost sessile or on very reduced peduncles, arranged in distant verticillate clusters of 3 cymes, each cyme bears 3 flowers, (one terminal and two lateral). Flowers 5 -merous, bracteate, 6 - 7 mm long, zygomorphic, tomentose; bracts elliptic - ovate, 4 - 8 mm long, 2 - 5 mm broad, abruptly tapering towards the apex, entire, sometimes shortly crenulate and recurved towards the apex, reticulate, densely tomentose and sparsely glandular outside and on the inner face near the tip only, glabrous inside, ciliate at the margins; bracteoles lanceolate, 4 - 6 mm long, 1 - 2 mm broad, tomentose and sparsely glandular outside,glabrous within, ciliate along the margins. Calyx 5 -lobed, 4 - 5 mm long, densely tomentose and sparsely glandular outside, glabrous inside, lobes linear, 3 - 4 mm long, almost free to the base; tube shallow hardly 1 mm long. Corolla white, unequally 5 -lobed in the upper half, 5 - 6 mm long; lobes ± orbicular, tomentose outside,glabrous inside, unequal, the anterior lobe much larger than the rest, 2 - 3 mm long, nearly as broad, 4 - 5 times the area of the other four; tube 3 - 4.5 mm long, nearly equalling the calyx-lobes, wider at the mouth, narrowed towards the base, tomentose inside and outside, excepting the glabrous basal part. Stamens 5,exserted, inserted in the corolla-tube; filaments filiform, glabrous,longer than the four short corolla-lobes; anthers 2-lobed, dorsifixed, lobes oblong, free and very divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - obovoid, 1 - 2 mm in diameter, densely clothed with white branched tomentum, 4-locular, 4 -ovuled; style long, exserted, densely covered with long bran-

-ched tomentum, deeply 2 -branched; lobes filiform, glabrous in the upper half, hairy towards the base, stigmatic at the tip. Fruit dry, indehiscent, 2- 2.5 mm in diameter, tomentose.

Specimens examined:

SOUTH AUSTRALIA:- C.R.Alcock s.n.: at Pine Hill, Cowell - Whyalla Highway, ca. 60 km south-west of Whyalla, Eyre Peninsula, -X.1963 (AD).- C.R.Alcock 874: ca. 15 km north of Arno Bay, road-side, Lincoln Highway, 22.XII.1965 (AD).- C.R.Alcock 875:Lincoln Highway, north of Cowell, near "Pine Hill Reserve", 22.XII.1965 (AD).- B.P.Bowering s.n.: Hundred of Goode, N. of Murat Bay, -XII.1917 (AD holotype,K - isotype).-G.H.Clarke s.n.: from prop-erty of E.Adler, Yalanda, via Cowell, Eyre Peninsula, 29.XI.1939 (ADW).- J.B.Cleland s.n.: 30 miles W. of Kimba, Eyre Peninsula, 14.XI.1955 (AD,ADW).-N.N.Donner 4688: 26 miles west of Kimba, 12.IX.1973 (AD).-A.J.Hicks s.n.:MEL40939: Maltee, about 60 miles N.W. of Streaky Bay, -XI.1953 (MEL).- A.J.Hicks 39: loc.cit., 5.XII.1953 (K).- R.Hill 1507: 34 km E. of Kyancutta, 16.I.1965 (A,AD,AAU - n.v.,MO,RSA - n.v.).- F.Hall s.n.: ca. 75 km south of Port Augusta, near Spencer Gulf, north-east coast of Eyre Peninsula, 23.I.1971 (AD).- D.N.Kraehenbuehl 529: between Cowell and Arno Bay, 27.XI.1961 (AD,W;NE,CAL,TI,-n.v.).- W.S.Reid s.n.: Lake Everard, Eyre Peninsula, 30.IX.1966 (ADW).- W.S.Reid s.n.: Kondoolka, Eyre Peninsula, 1.X.1966 (ADW).- K.D.Rohrlach 91: Buckleboo, Eyre Peninsula, 1.II.1955 (AD,P;AAU - n.v.).- K.D. Rohrlach 148: Pinkawillinie, Eyre Peninsula, 15.II.1959 (AD,K).- D.E.Symon s.n.: 13 miles N. of Koonibba siding, Eyre Peninsula, 30.IX.1959 (ADW).- D.E.Symon 3824: Old Coach Road, 3 - 4 miles west of Stony Pinch ± 24 miles N.E. of Overland Corner, Calperum Stn.,11.X.1965 (ADW).- D.E.Symon 4212: Hambidge Reserve, Eyre Peninsula,9.X.1966 (ADW).- J.W.Wrigley CBG037694: 17 miles from Cowell, towards Kimba - (AD).

Distribution: (Map 3).

D.verticillata is restricted in its distribution chiefly to Eyre Peninsula, South Australia. The only outside collection is from Calperum Station, ± 24 miles north-east of Overland Corner, near Renmark on the River Murray.

Within Eyre Peninsula, it occurs to the north-east, north-west and in the central part only. To the north-east, it is known between Whyalla and Arno Bay, along the Lincoln Highway. In the central part it has been collected from Yalanda, Kimba, Buckleboo and Hambidge Reserve. So far, its presence in the south and south

-west of the peninsula is not known. The most northerly collections are from Lake Everard and Kondoolka, and towards north-west it has been reported from Hundred of Goode and Koonibba just north of"Murat Bay" (now Denial Bay).

E c o l o g y:

Little is known of this species; the only available indication regarding its habitat is by Kraehenbuehl 529 (AD), between Cowell and Arno Bay, who collected it from "Red sandhills". It is a perennial shrub of low height, clothed with branched white tomentum. The present writer saw one plant growing in a low - lying sandy soil along the roadside near Kimba.

Flowering and fruiting seem to take place from November to January.

C o m m e n t s:

The verticillate arrangement of leaves and cymes, and the conspicuously large anterior corolla-lobes gives this species the aspect of a member of Labiatae. However, it may be easily distinguished from the latter by its perfect 5 stamens and deeply 2 - branched style. Within the family Chloanthaceae , D.verticillata apparently seems nearest to Chloanthes and Pityrodia where the leaves in many of their species are arranged in whorls of three and the corolla is two - lipped. But the arrangement of flowers in these genera is not in distant verticillate clusters, as in D.verticillata; moreover, in Chloanthes and Pityrodia, the number of stamens in a flower is only 4 and the style is not deeply 2 -lobed.

The size of the plant has not been recorded in the protologue nor is there any such information on the herbarium labels bearing collectors' annotations. The average minimum and maximum plant height has been roughly calculated here by measuring herbarium specimens both with and without roots, and the same has been recorded in the description here. The exact plant size, cannot be established without studying different plant populations in their natural habitat. The ovary is basically 4 -locular with one ovule in each cell, but at the maturing stage, two of the four cells gradually obliterate to give the appearance of a 2 - locular ovary. Such a change has also been observed in other species of this genus.

Relationship:

Akin to D.cordifolia, D.flexuosa and D.georgei in having distant sessile cymose flower - clusters, but can be readily

distinguished by its leaves and cymes being verticillate and the anterior corolla-lobes much larger. The leaves and cymes in all the other species are decussate, corolla-lobes equal, (except D.flexuosa,which has a somewhat larger anterior - lobe). D.verticillata is also closely related to D.lewellinii and D.parvifolia in having sessile linear leaves with recurved margins, exserted stamens and style, and larger anterior corolla-lobe,) but the leaves and cymes in all the latter species are not verticillate, and the anterior corolla - lobe is not as markedly developed as in D.verticillata.

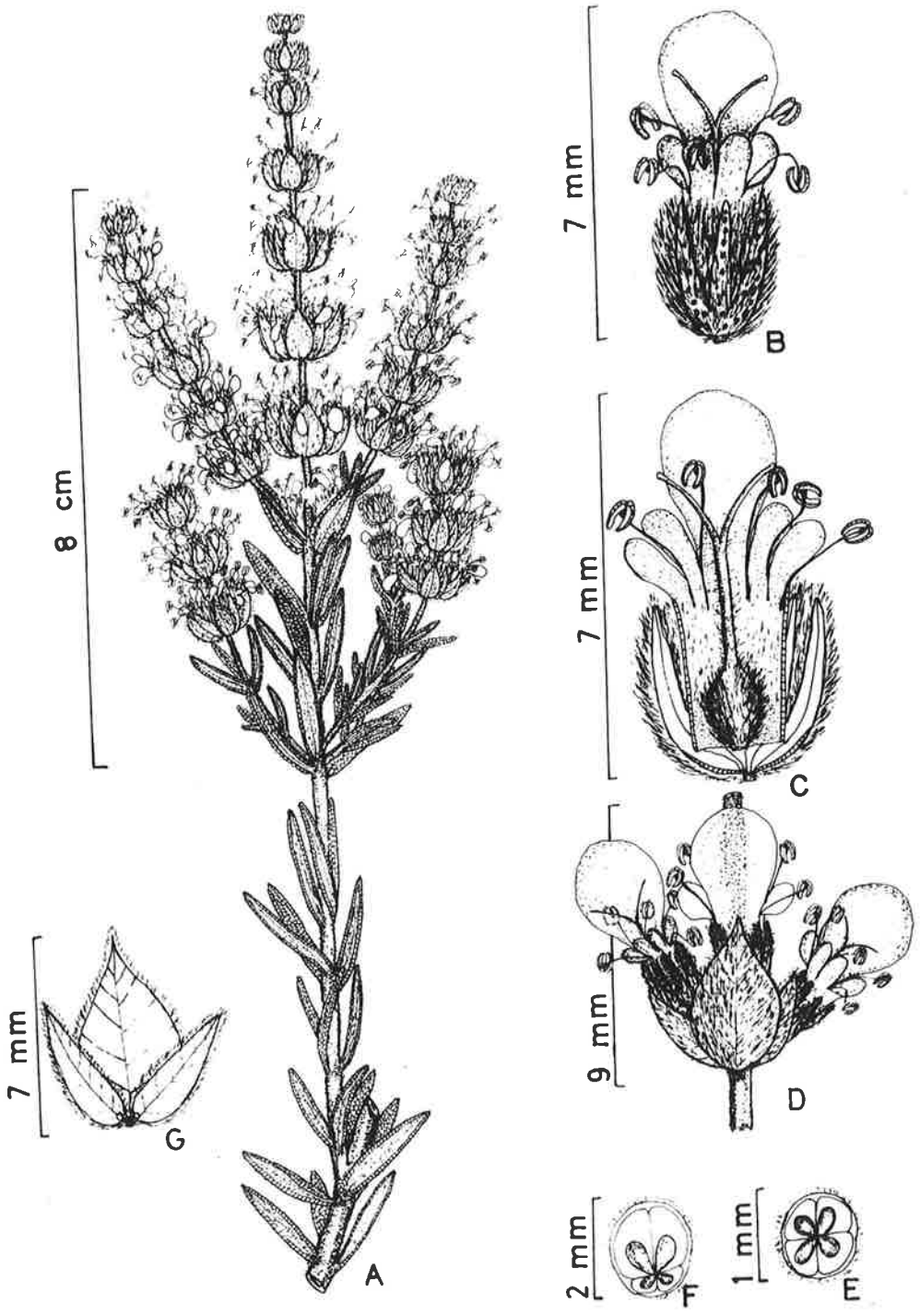


Fig. 1 — Dicrastylis verticillata Black (D.N. Kraehenbuehl 529:AD). A, flowering branch; B, flower; C, flower longitudinally cut open; D, enlarged cyme showing flowers and bracts; E, T.S. of young ovary; F, T.S. of mature ovary; G, bract and bracteoles viewed from inside.

Dicrastylis microphylla Munir, sp. nov.

Frutex effusus 60 -90 cm altus caule tomento viridi - cinereo ramulis gracilibus tomentosissimis; folia decussata sessilia parva usque ad 1.7 cm longa 0.4 cm lata oblonga vel anguste ovato - oblonga margine recurva; cymae bracteatae decussatae sessiles unaquaeque cum septem floribus fasciculis subglobosis sessilibus versus apices ramorum dissitis; flores sessiles bracteati pentameri; calyx extra dense tomentosus intra glaber quinquelobus; corolla malvina quinqueloba tubo usque ad 4.5 mm longo extra glabro intra villoso lobis oblongo - ovatis integris extra pilosis intra glabris; stamina 5 exserta; ovarium globosum tomento albosericeo dense vestitum; stylus exsertus tomentosus profunde bilobatus prope apices loborum glaber; fructus non visus.

Quoad folia sessilia decussata cymas sessiles decussatas fasciculos subglobosos dissitos et stamina cum stylo exserta ad D.flexuosam proxime accedit, sed ob folia parva oblonga vel ovato-oblonga margine recurva facile distinguitur.

T y p u s: A.S.George 5804: from Cundeelee Mission, north of Zanthus, Western Australia, 21.IX.1963 (PERTH holotype).

Description: (Fig. 2).

A spreading shrub of 60 - 90 cm high. Stem erect, branched, cylindrical, woody, densely covered with greenish - grey branched tomentum; branchlets decussate, slender, very hairy. Leaves sessile, decussate, ± oblong or narrowly ovate - oblong, obtuse, with recurved margins, (0.5-)1 - 1.7(-2) cm long, (1-)2 - 4 mm broad, rugose above, reticulate beneath, tomentose all over. Inflorescence cymose; cymes sessile, sometimes subsessile in the basal axillary pairs, bracteate, decussate, crowded into distant sessile clusters towards the end of branches, each cyme 7-flowered; clusters ± subglobose, well - spaced along the central axis (rachis) 1 - 1.8(-2) cm in diameter, the lower - most cluster always in the axil of leafy bracts; central axis purplish - mauve, slender, ± 1 mm in diameter, sparsely tomentose. Flowers 5 -merous, bracteate, sessile, regular, 6 - 8 mm long (including stamens and style), bracts opposite, sessile, ovate or narrow elliptic - ovate, entire, acute, reticulate, densely covered with brnached tomentum outside, glabrous inside, 3 - 3.5 mm long, 1.3 - 1.5 mm broad near the base; bracteoles ± oblong, obtuse, hairy outside, glabrous inside, 1 - 1.5 mm long, ± 0.5 mm broad. Calyx deeply 5 -lobed, densely covered with greenish - grey tomentum outside, glabrous inside, 3.5 - 4 mm long; tomentum much brnached, 2.5 - 3.5 mm long; lobes narrowly

linear - lanceolate, acute, 3 - 3.5 mm long, 0.5 - 0.8 mm broad, almost free to the base; tube very shallow, ± 0.5 mm deep. Corolla "mauve", tubular, 5 -lobed at the apex, 5 - 6 mm long; lobes ± oblong - ovate, obtuse, entire, 1.5 - 2.5 mm long, 1 - 1.5 mm broad, densely hairy outside, glabrous inside; tube long, cylindrical, 4 - 4.5 mm long, shortly villous - tomentose inside, glabrous outside. Stamens 5, exserted, inserted in the corolla - throat; filaments filiform, glabrous, the free exserted part 2 - 3 mm long, the lower part completely attached to the corolla-tube; anthers 2 -lobed, dorsifixed, oblong, yellowish - brown, 1 - 1.2 mm long, 0.7 - 0.8 mm across; lobes free and divergent in the lower halves; longitudinally dehiscent. Ovary ± globose, very densely clothed with whitish - silky tomentum, 1 - 1.5 mm in diameter, 4 -locular, with one ovule in each cell; style exserted, filiform, deeply 2 -branched in the upper half, densely covered with branched tomentum, 5.5 - 6.5 mm long (including lobes), the lower undivided part ± 3 mm long; lobes unequal, sparsely tomentose in the lower part, glabrous near the stigmatic tip, 2.5 - 4 mm long. Fruit not seen.

Specimens examined:

No other collection of this taxon is available for study excepting the type and its un - mounted duplicates.

Distribution: (Map 3).

The only known locality of this species is near Cundeelee Mission, north of Zanthus. This place is to the east of Kalgoorlie, inside the Aboriginal Reserve.

E c o l o g y:

Little is known regarding the ecology of this species, but like many other taxa of this genus, it seems to grow in a dry eremean habitat. It is a densely tomentose shrub with spreading branches and purplish - grey flowers. According to collector's annotation, George 5804 (PERTH), from Cundeelee Mission, W.A., is recorded as "spreading shrub of ± 70 cm". The plant is found growing in "gravelly red loam" and is noted to have "mauve" flowers.

Flowering and fruiting seem to take place chiefly during August - November.

C o m m e n t s:

In addition to the designated holotype, there are seven unmounted duplicates (isotypes)of the type collection which are still to be distributed.

Among all the species having their cymes arranged decussately in distant sessile subglobose clusters, D.microphylla can be easily identified by its small leaves with recurved margins.

Relationship:

Of all the species of Dicrastylis with the type of inflorescence just described, D.microphylla seems more closely related to D.flexuosa by its sessile leaves and exserted stamens and style. However, it may be easily distinguished by its leaves being oblong, or narrowly ovate - oblong, recurved along the margin, smaller, [measuring (0.5-)1 - 1.7(-1.8) cm by (1-)2 - 4 mm]. The leaves in D.flexuosa are ovate, not recurved along the margin, larger, measuring 1 - 2.7 cm by 0.5 - 1.1 cm.

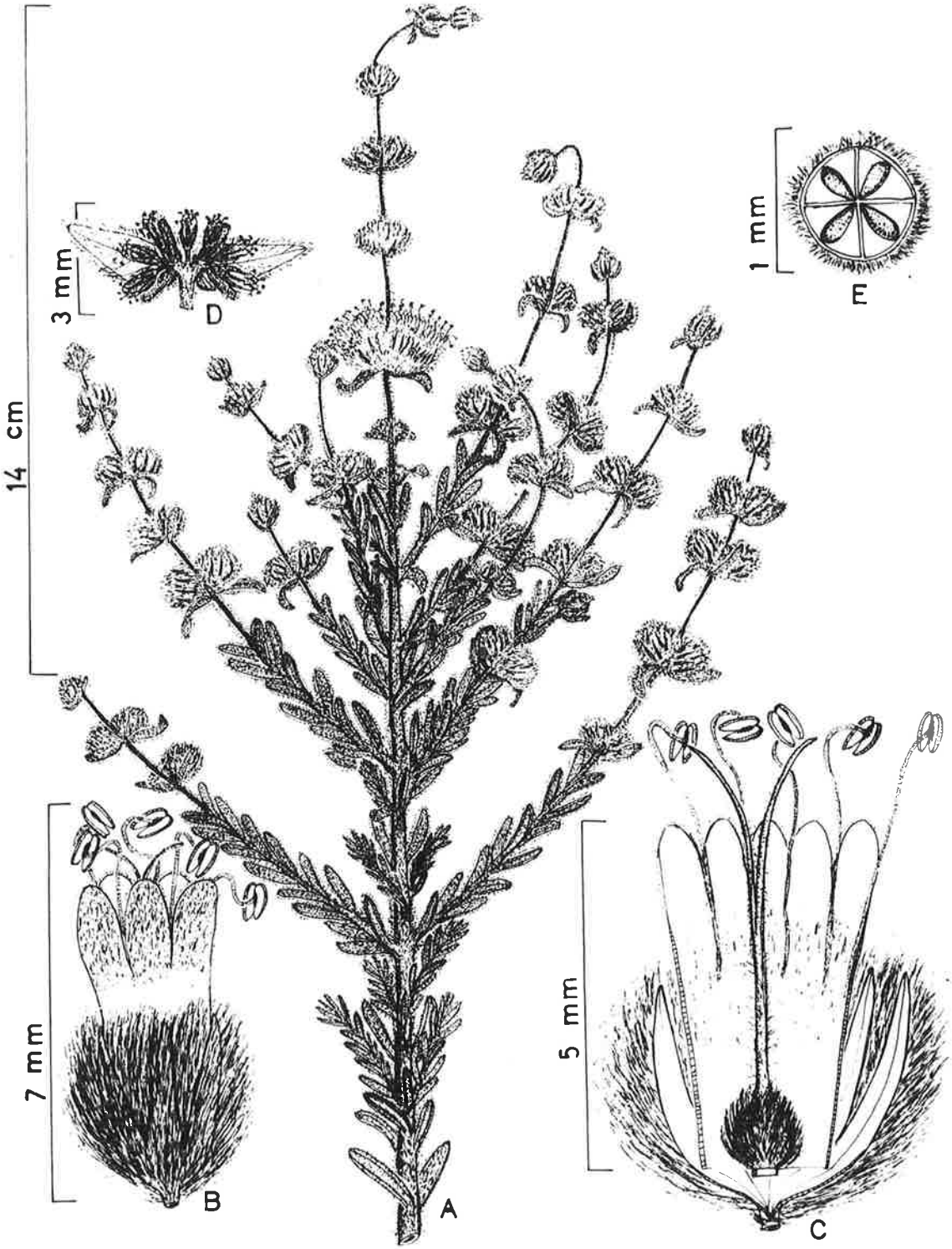


Fig. 2 — Dicrastylis microphylla Munir (A.S. George 5804: PERTH - holotype).

A, flowering branch; B, flower; C, flower vertically cut open; D, Cyme; E, T.S. ovary.

Dicrastylis flexuosa (Price) C.A.Gardner in J.R.Soc.W.Aust.27(1942) 191; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls.3 (1965) 562; J.S.Beard, W.Aust.Pl.ed.2,(1970)113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 345,475,603.

T y p u s: W.H.Ince s.n.: loc.incert., Western Australia, 23.VI . 1908 (K holotype).

Pityrodia flexuosa Price in Kew Bull. (1910) 384, Basionym; H.N. Moldenke, Résumé Verbenac.etc. (1959) 210.

Description: (Fig. 3).

A branched shrub, 60 - 95 cm high, clothed all over with white branched tomentum. Branchlets cylindrical, decussate, densely tomentose, divided into nodes and internodes; basal internodes short and thick, the distal ones long and slender; upper nodes bearing sessile axillary flower clusters. Leaves decussate,sessile, exstipulate, ovate, sometimes ± oblong - ovate, 1 - 2.7 cm long, 0.5 - 1.1 cm broad, obtuse, rugose, crenate at the margins,densely covered with branched woolly - tomentum concealing the surface and the margins. Inflorescence cymose; cymes sessile, decussate, each 7 - flowered, subtended by a foliose bract and two bracteoles, congested (in pairs) at the nodes to form distant subglobose clusters on the central axis; clusters 1 - 2 cm in diameter,densely woolly- tomentose; bracts ovate, obtuse, foliose, distinctly reticulate and glabrous inside, woolly - tomentose outside; bracteoles lanceolate, glabrous inside, woolly - tomentose outside; primary axis (main peduncle) slender, reddish - purple, densely tomentose towards the base, sparsely hairy in the upper part. Flowers 5 - merous, sessile, 7 - 9 mm long, somewhat irregular, densely tomentose. Calyx 5 -lobed, about 4 - 5 mm long, densely tomentose outside, glabrous inside, with numerous minute glands on the lobes; lobes linear, acute, almost free to the base, nearly 3.5 - 4 mm long, ± 1 mm broad, tube very shallow, hardly 0.5 mm deep. Corolla violet - blue, somewhat irregular, unequally 5 -lobed, tubular, 7 - 8.5 mm long; lobes elliptic - ovate, spreading, tomentose outside, glabrous inside, ciliate at the margins, the larger anterior lobes about 2 - 3 mm long, mostly 2 - 3 times the langth of the other four lobes; tube enclosed by the calyx, ± cylindrical, glabrous outside, tomentose inside the throat, 5 - 7 mm long. Stamens 5, much exserted, inserted in the corolla - throat; filaments filiform, as long as the four short corolla-lobes, sometimes longer; anthers 2 -lobed, dorsifixed; lobed oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary

globose, ± 1 mm in diameter, densely clothed with white tomentum, 4 -locular, with one ovule in each cell; style long, exserted, densely tomentose, deeply 2 -branched, 7 - 10 mm long (including the lobes); lobes 2 - 4 mm long, filiform, hairy in the lower halves, glabrous above, stigmatic at the apex.

Specimens examined:

WESTERN AUSTRALIA:- W.E.Blackall 4233 & 4433: between Menzies and Broad Arrow, 15.IX.1939 and - IX.1939 (PERTH).- W.E.Blackall s.n.:Yandal Station, north of Leonora, -VIII.1939 and -IX.1939 (PERTH).- G.E.Brockway s.n.,CANB26640: N.E. of Wiluna, 14.X.1947 (CANB,PERTH).- C.A.Gardner 7908: 10 miles west of Wiluna, 16.X. 1945 (PERTH).- N.H.Speck 1336: 32 miles E. of Wiluna, 31.VIII. 1958 (AD,BRI,CANB,MEL- p.p.,alter parte Anthotroche sp.).- Stan Gratte's party for A.M.Ashby 3454: Wiluna, 16.VIII.1970 (AD).- W.H.Ince s.n.: loc.incert.,23.VI.1908 (K- holotype of Pityrodia flexuosa Price).

Distribution: (Map 3).

Endemic to the Eremean Province of Western Australia. The main distribution is to the north-east and west of Wiluna. A few collections have come from Yandal Station to the north of Leonora, and also between Menzies and Broad Arrow. All these localities come under Diel's (1906) Botanical districts "Austin" and "Coolgardie", of the temperate regions of Western Australia.

E c o l o g y:

According to collector's annotations, D.flexuosa is a small shrub of low height growing in red sand. Blackall 4233 (PERTH), from between Menzies and Broad Arrow is described as "Dense rounded shrub, 2 - 3 feet high". The flower colour is notes as "pale - violet". Blackall s.n. (PERTH),from Yandal Station, N. of Leonora has "Fls. purple". A subsequent collection by Blackall (s.n.) from the above locality is annotated as "Fls. violet". Brockway s.n. (PERTH), N.E. of Wiluna, is collected from "spinifex country". Gardner 7908 (PERTH), from 10 miles west of Wiluna is collected from "red sand", the flower colour is recorded as "blue". Speck 1336 (AD,BRI,CANB,MEL), from 32 miles east of Wiluna, is described as "Shrub to 2 ft."; the habitat is recorded as "slightly saline areas of spinifex sand plain".

Flowering and fruiting seems to occur mostly from the middle of August to end of January. According to Blackall and Grieve (1965), the flowering period lasts "Sept. - Jan."

C o m m e n t s:

Due to the irregular corolla, this taxon was originally described as a species of Pityrodia, apparently ignoring its five perfect stamens and deeply 2 - branched style. In order to show its relationship with Pityrodia, the author has cited in the first part of the protologue "affinis P.Bartlingii, Benth., et aliis speciebus sectionis Chloanthopsis, Diels; a ceteris speciebus Pityrodiae antheribus haud appendiculatis, ab omnibus ramulis superioribus tenuibus glabrescentibusque, floribus minoribus distinctissima".

It appears from the above remarks, that the author's judgment is based mainly on the irregular nature of its corolla, which is a common feature in the genera Pityrodia and Chloanthes; he overlooked the number of stamens and distinctly 2 - branched style, a prominent character of Dicrastylis. The plant was later correctly identified by Gardner (1942) while he was engaged on critical comparative studies in the Herbarium of the Royal Botanic Gardens, Kew. He identified a specimen, collected by Dr.W.E.Blackall between Menzies and Broad Arrow with Ince's plant, described by Price as Pityrodia flexuosa. Having found the latter with "nearly regular corolla", 5 perfect stamens and a two - branched style, he recognized it as the genus Dicrastylis and thus transferred it from Pityrodia to the latter genus as Dicrastylis flexuosa (Price) Gardner.

Two specimens of Speck's collection (no.1336) in Herb.CANB. and MEL are a mixture of D.flexuosa and some Anthotroche species of Solanaceae.

Relationship:

Among all the species having distant sessile flower-clusters, (cymes), D.flexuosa may be easily distinguished by its leaves being ovate - oblong; corolla violet - blue, irregular and stamens and style much exserted. It is closely related to D.verticillata in having distant sessile cymose flower - clusters, $\pm$ irregular corolla and exserted stamens and style, but the leaves and cymes in the latter are verticillately arrnged, three at a node, the leaves are narrow - linear with recurved margins and anterior corolla - lobe is much larger than in D.flexuosa. The decussate arrangement of distant sessile cymose flower - clusters is similar to those in D.georgei and D.cordifolia, but the leaves in both these species are petiolate and different in shape; corolla regular; stamens and style scarcely exserted.

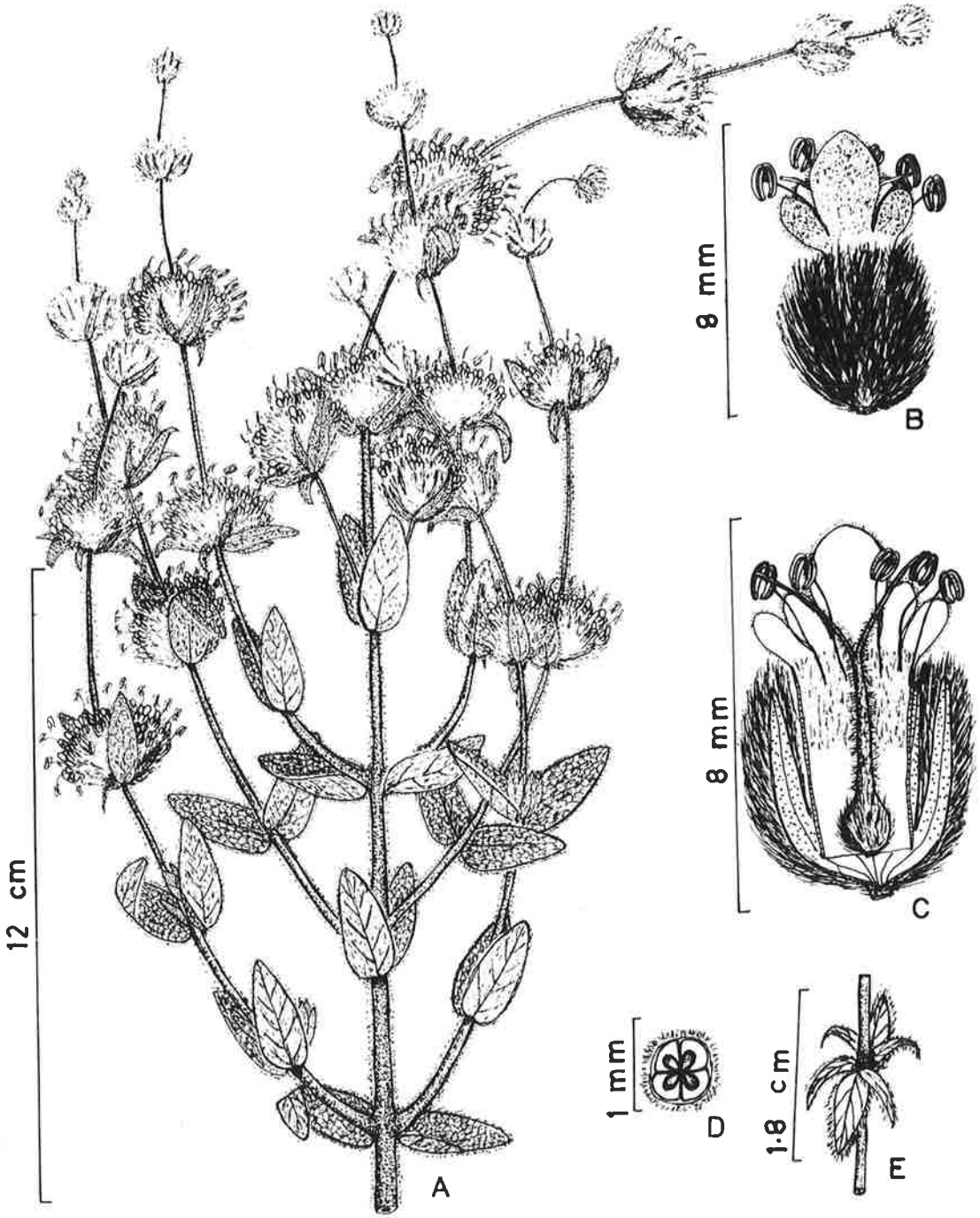


Fig. 3 — Dicrastylis flexuosa (Price) Gard. (C.A. Gardner 7908: PERTH).

A, flowering twig; B, flower; C, flower vertically cut open; D, T.S. ovary; E, bracts and bracteoles in a cyme.

Dicrastylis georgei Munir, sp. nov. var. georgei

D.gilesii auct. non F.v.Mueller: C.A.Gardner, W.Aust.Wildfls. B. (1972) 152 & 153t., p.p.-(quoad spec. from Hamersley Range, Mundiwindi and Sandstone, W.Aust.).

Frutex tomentosus usque ad 1 m altus tomento ramulorum purpureo vel cinereo - purpureo; folia decussata petiolata ovato - cordata vel ovato - rotundata 1 - 3.5 cm longa 0.8 - 2.5(3) cm lata margine plana ad basim interdum truncata dense tomentosa petiolis 0.5 - 1(2) cm longis; cymae decussatae sessiles fasciculis sessilibus subglobosis 1 - 2.5 cm diam. versus apices ramorum dissitis tomento subroseo vel purpureo - cinereo pedunculis crassis purpureis vel cinereo - purpureis; flores sessiles bracteati pentameri raro hexameri vel heptameri; calyx extra dense tomentosus intra glaber quinquelobus raro sexlobus vel septilobus lobis intra glandulosis; corolla purpurea vel subrosea tubularis ad apicem plerumque quinqueloba raro sexloba vel septiloba intra dense sericeo - tomentosa extra in dimidio superiore purpureo - tomentosa;stamina plerumque 5 raro 6 vix exserta filamentis lobos corollae subaequantibus; ovarium globosum tomentosum quadriloculare quadriovulatum; stylus vix exsertus tomentosus profunde bilobatus lobis glabris subaequalibus; fructus non visus.

Quoad folia petiolata fasciculos sessiles dissitos et stamina cum stylo vix exserta ad D.cordifoliam accedit, sed ob folia majora et fasciculos permajores distinguiture.

T y p u s: A.S.George 1007: south of Roy Hill, Western Australia, 23.VIII.1960 (PERTH holotype).

Description: (Fig. 4).

A branched tomentose shrub of up to 1 metre high. Stem erect, branched, cylindrical, woody; branchlets with purple to greyish - purple tomentum, terminating in purplish or pale - pink inflorescence. Leaves petiolate, decussate, ovate - subcordate to ovate-rotund, obtuse, often somewhat truncate or sinuate at the base of lamina; lamina 1 - 3.5 cm long, 0.8 - 2.5(-3) cm broad, rugose above, reticulate underneath, densely tomentose all over, the rugae and reticulation sometimes concealed by the dense tomentum; petiole 0.5 - 1(-2) cm long, slender, tomentose. Inflorescence cymose; cymes sessile, decussate, arranged in distant subglobose woolly clusters towards the end of branches; (cyme-) clusters pale -pink or purplish - grey tomentose, 1- 2.5 cm in diameter; rhachis [main central axis] thick, purple or greyish - purple tomentose. Flowers 5 -merous, rarely 6 - 7 -merous, bracteate, sessile, 5 - 6

mm long, crowded into subglobose sessile cymes. Calyx generally 5 -lobed in the upper half, sometimes 6 - 7 -lobed, very densely woolly - tomentose outside, glabrous inside, ± 3 mm long; lobes linear - lanceolate, ± 2 mm long, 0.5 - 1 mm broad near the base, glabrous but glandular inside; tube shallow, nearly half the langth of lobes; tomentum branched, purplish - grey or pale - pink. Corolla purple or pale - pink, tubular, usually 5 -lobed towards the apex, sometimes 6 - 7 - lobed, 4 - 5 mm long, densely silky - tomentose inside, shortly purple - tomentose in the upper half outside; lobes short, elliptic - oblong, obtuse, ± 1 mm long; tube cylindrical, 3 - 4 mm long. Stamens usually 5, sometimes 6, scarcely exserted, inserted in the corolla-throat; filaments short, glabrous, nearly as long as the corolla-lobes; anthers 2 -lobed, dorsifixed; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, densely tomentose, 4 - locular with one ovule in each cell; style scarcely exserted, deeply 2 -branched in the upper half, densely tomentose; lobes subequal, glabrous, stigmatic at the end. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 4037: 1225 km on North West Coastal Highway, 1.VIII.1971 (AD).- H.F.M.Broadbent 2010: Marillana Station between Wittenoom and Roy Hill, 5.VI.1954 (BM,CANB).- A.S.George 9169: ± 16 miles N.E. of Giralia Homestead south of Exmouth Gulf, 4.VIII.1967 (PERTH).- F.W.Humphreys s.n.: from Onslow to Carnarvon Road, 24.VII.1964 (PERTH).

Distribution: (Map 3).

This species is recorded from the north-western part of Western Australia. The recorded distribution is to the south-south-west of Roy Hill near the Great Northern Highway and to the south of Exmouth Gulf (and Onslow) along the North West Coastal Highway.

E c o l o g y:

Little is known about the ecology of this species, but the pattern of its distribution shows that it grows chiefly in the dry eremean areas. It is a tomentose spreading shrub, occurring chiefly in sandy places. According to Broadbent 2010 (BM), from between Wittenoom and Roy Hill, it is "2 $\frac{1}{2}$ ft. bush with pink flowers growing in red sand". George 1007 (PERTH), from south of Roy Hill, is recorded to grow "in red sand". The flowers are noted as "pale - pink". Another collection of George 9169 (PERTH), from ± 16 miles north-east of Giralia Homestead, south of Exmouth Gulf,

is annotated as "spreading shrub 40 cm tall. Corolla pink." The habitat is given "red sand among shrubs".

Flowering and fruiting seem to occur mainly during June to September.

C o m m e n t s:

Among the specimens examined, some of them have been erroneously annotated as "D.gilesii FvM."; a name widely used for material other than true D.gilesii. The latter species agrees with D.georgei in its calyx - tomentum being long and dense; corolla purplish - pink; stamens and style scarcely exserted. However, D.gerogei can be easily distinguished by its leaves being much smaller [measuring 1 - 3.5 by 0.8 - 2.5 cm], ovate - subcordate to ovate - rotund, often truncate or sinuate at the base, petiole slender and cymes crowded into distant subglobose sessile clusters. The leaves in D.gilesii are larger [measuring 4.5 - 8.5 by 1.5 - 3 cm], more or less ovate - lanceolate, neither truncate nor sinuate at the base and cymes arranged into ± pyramidal panicle at the end of branches.

Flowers in D.georgei are normally 5 -merous and ovary 4 - locular with deeply 2 -lobed style, but in a few flowers the sepals and petals are 6 - 7 -lobed (agreeing in number), but stamens 5 - 6 and ovary with 3 -branched style. The stamens in such flowers arealways one less than the number of perianth lobes. A 3-branched style was found only in one 5 -partite flower, but one of the filaments is 2 -lobed with an anther only on one lobe. Such abnormalities have also been noticed in a few other species of this genus.

Relationship:

Allied closely to D.flexuosa in having distant subglobose sessile clusters along the rhachis of the inflorescence (central axis), but can be easily distinguished by its leaves being petiolate; corolla purplish - pink, equally lobed and stamens and style scarcely exserted. D.georgei seems also closely related to D.cordifolia in having distinctly petiolate leaves, distant sessile clusters along the rhachis and scarcely exserted stamens and style. However, it may be readily identified by its larger leaves and much larger cyme - clusters measuring 1 - 2.5 cm in diameter, those in D.cordifolia are 0.6 - 1 cm in diameter.

D.georgei Munir var. cuneata Munir, var.nov.

Varietas a typo ob folia late elliptica cuneataque distingui-

-tur.

T y p u s: R.Carolin 7717: 22 miles from Roy Hill on Wittenoom Road, 7.VIII.1970 (SYD).

Diagnosis:(Fig. 4a).

This taxon differs from the type variety by its leaves being broadly elliptic, cuneate towards the base.

Specimens examined:

WESTERN AUSTRALIA:- E.T.Bailey 1 - 35: 43 miles north of Mundiwindi, 6.XI.1951 (PERTH).- H.F.M.Broadbent 743: north of Mundiwindi, 11.V.1953 (BM).- W.H.Butler 1172: 35 miles east of Wittenoom, 4.III.1959 (PERTH).- R.D.Royce 1595:5 miles north of Jiggalong, Rabbit Proof Fence, 13.V.1947 (PERTH).-? Leg. s.n.: loc. incert.- (PERTH).

Distribution: (Map 3).

This variety is recorded from the north-western part of Western Australia. The distribution is restricted between 22 and 24 degrees south latitude and between 118 and 121 degrees east longitude. Within this area, two localities are to the west of Roy Hill between Roy Hill and Wittenoom and all the rest are recorded from Mundiwindi and Roy Hill.

E c o l o g y:

Much of what is true of the type variety is true also of var. cuneata. According to information gathered from annotations, it commonly occurs in sandy soil. Carolin 7717 (SYD), 22 miles from Roy Hill on Wittenoom Road is noted as "shrub to 1 metre high with pink flowers". Broadbent 743 (BM), from north of Mundiwindi, is collected from "Red sand". Royce 1595 (PERTH), 5 miles north of Jiggalong is annotated as "low branching shrub, 2 feet tall and 4 - 5 feet in diameter. Fls. pink." The habitat is given "sandy soil in Triodia - Acacia association."

Flowering and fruiting seem to occur mainly during August - November, but flowering has also been noticed on the specimens collected during March and May.

Relationship:

var. cuneata is closely related to the type var. georgei. For the distinctive characters see the diagnosis of this variety.

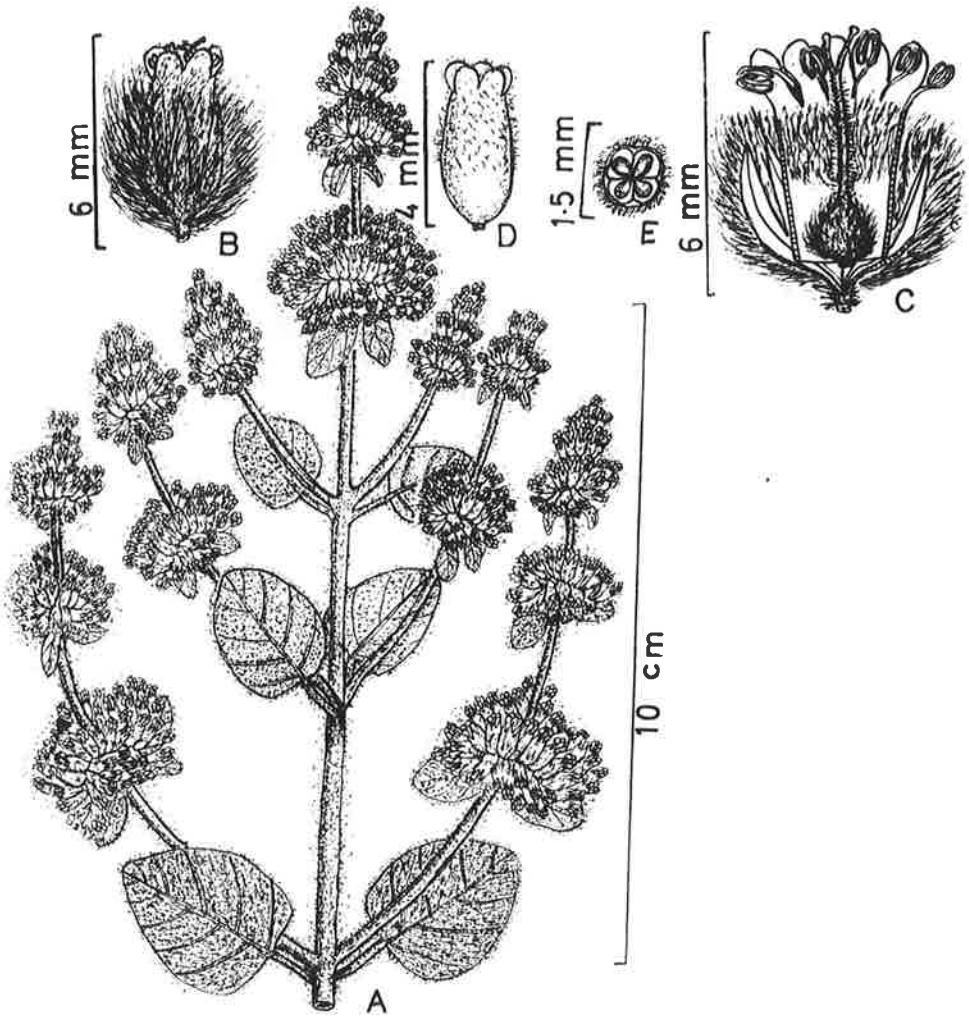


Fig. 4 — Dicrastylis georgei Munir var. georgei (A.S. George 1007: PERTH - holotype).

A, flowering branch; B, flower; C, flower vertically cut open; D, corolla tube; E, T.S. ovary.

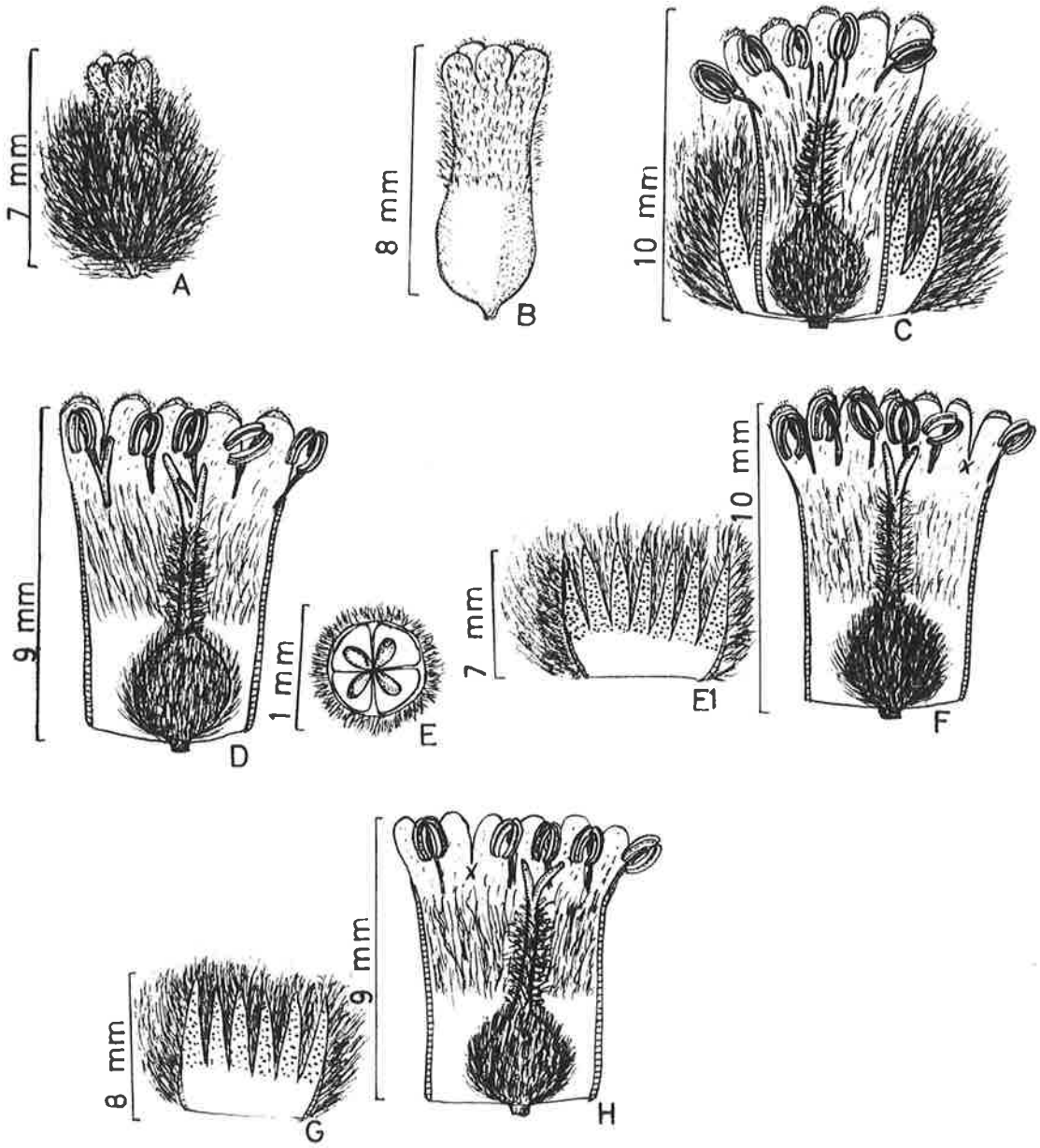


Fig. 4a — Dicrastylis georgei Munir var. cuneata Munir (R.C. Carolin 7717: SYD - holotype).

Showing abnormality in the flower parts. A, 5-merous flower; B, corolla-tube of 5-merous flower; C, 5-merous flower vertically cut open; D, 5-merous flower with one filament 2-lobed and style 3-lobed; E, T.S. ovary; E1, 7-lobed calyx spread open; F, corolla-tube vertically cut open to show its 7-lobes and 6 stamens; G, 6-lobed calyx spread open; H, 6-lobed corolla-tube cut open to show 5 stamens.

Dicrastylis cordifolia Munir, sp. nov.

Frutex effusus ramosissimus usque ad 75 cm altus et 60 cm diam. prope terram ramificans; folia decussata petiolata cordata vel subreniformia infra distincte reticulata supra rugosa parce tomentosa; inflorescentia ramosissima terminalis; cymae decussatae per rhachim in fasciculos subglobosos sessiles dispositae; flores pentameri sessiles cinereo - rosei ad extremitates ramulorum in fasciculos sessiles dispositi; calyx extra tomento viridi - cinereo intra glaber quinquelobus interdum sexlobus; corolla purpureo - rosea extra intraque tomentosa quinqueloba lobis rotundatis integris; stamina 5 raro 4 vix exserta ad faucem corollae inserta filamentis lobos corollae aequantibus lobis antherae oblongis; ovarium plus minusve globosum tomentosum quadriloculare quadriovulatum; stylus vix exsertus inaequaliter bilobatus in dimidio inferiore tomentosus lobis glabris; fructus non visus.

T y p u s: H.A.Johnson 9758: about 200 miles south-south-west of Broome, Western Australia, 4.VIII.1962 (NT holotype; K,NSW).

Description: (Fig. 5).

A spreading shrub, 45 - 80 cm tall, 30 - 65 cm in diameter. Stem "branching close to ground", cylindrical, woody, densely clothed with greyish tomentum, often ending in a much - branched inflorescence. Leaves decussate, petiolate, nearly cordate, sometimes sub - reniform or narrowly ovate - cordate, 1 - 2 cm long, 0.7 - 1.8 cm broad, ± sparsely tomentose, prominently dark green and rugose above, greenish - grey with distinct reticulation beneath; petiole 2 - 4 mm long, densely covered with grey tomentum. Inflorescence cymose; cymes sessile, arranged decussately into subglobose clusters towards the end of branches; clusters (a pair of cymes) 0.6 - 1 cm in diameter, closely borne on the main central axis. Flowers 5 -merous, sessile, bracteate, 3 - 4 mm long. Calyx 5-lobed, occasionally 4 - or 6-lobed, ± 2 mm long, greenish - grey thin tomentose outside, glabrous inside; lobes lamceolate, scarcely 1 mm long; tube shallow, nearly equalling the lobes; outside tomentum of much-branched hairs, 0.5 - 1 mm long. Corolla purplish - pink, 5-lobed towards the apex, 2 - 2.5 mm long; lobes short, rounded at the apex, short - tomentose outside; tube ± cylindrical nearly double the length of its lobes, villous - tomentose inside, short - tomentose outside. Stamens 5, occasionally 4, scarcely exserted, inserted in the corolla-throat; filaments as long as the corolla-lobes, glabrous; anthers 2 -lobed, dorsifixed; lobes oblong,

free and divergent in the lower halves, longitudinally dehiscent. Ovary globose, ± 1 mm in diameter, densely tomentose, 4-locular, each locule with one ovule; style unequally 2 -branched, scarcely exserted, densely tomentose on the un-branched lower part; lobes (branches) glabrous, stigmatic at the tip. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- A.S.George 9152: 4 miles west of Swindells Field, Great Sandy Desert, 31.VII.1967 (PERTH).- H.A.Johnson 9758: about 200 miles south-south-west of Broome, 4.VIII.1962 (NT holotype; K,NSW - isotypes).- H.A.Johnson 9749:about 150 miles south of Broome, 1.VIII.1962 (CANB,NT,PERTH).- H.W.Wilson 24:11.5 miles south of Seven Well, no.8 Canning Stock Route, 23.IX.1942 (PERTH).

Distribution: (Map 4).

D.cordifolia is recorded from the north-western part of Western Australia. The known distribution is to the south-west of Broome along the Great Northern Highway, and near Swindells Field in the Great Sandy Desert.

E c o l o g y:

According to collectors' field notes, D.cordifolia is mainly found in sandy - loam or gravelly - loam soil. Johnson 9758 (NT, K,PERTH), from 200 miles south-south-west of Broome is noted to grow "near stony outcrops amongst former sandy loam soil". Johnson 9749 (CANB,NT,PERTH), 150 miles south of Broome is found growing "in sandridges and flats". George 9152 (PERTH), 4 miles west of Swindells Field is annotated as "much - branched spreading shrub to 70 cm tall, 2 metres broad; wool creamish; corolla pale pink". The plant is collected from "gravelly - loam"soil "in depression with Acacia and Spinifex" association. Wilson 24 (PERTH), from 11.5 miles south of Seven Well is described as "50 - 70 cm high; branching close to ground" level. It was growing "close to sand ridges".

Flowering and fruiting seem to take place chiefly from August to October.

C o m m e n t s:

Of all the known species of Dicrastylis, this is the only one with cordate leaves. The upper young leaves below the inflorescence are ± reniform to ovate - cordate, not distinctly rugose above and very densely tomentose all over, while the fully developed lower leaves are always cordate, rugose above and sparsely

tomentose.

Petals in the young stage ar e purplish - pink, but in the mature flowers the colour becomes paler. All the collections made during early August have purplish - pink corolla while the late September collections have whitish- pale flowers.

Relationship:

D.cordifolia is closely related to D.georgei in its leaves being petiolate; cymes forming sessile subglobose clusters towards the end of branches; stamens and style scarcely exserted. However, it can be easily distinguished by its leaves being distinctly cordate (sub-reniform); cyme clusters smaller, not more than 1 cm in diameter, more closely set along the main central axis and calyx - tomentum greenish - grey, thinner (hairs 0.5 - 1 mm long).

D.cordifolia Munir var. barnetii Munir, var. nov.

Varietas ab aliis ob petiolos longiores usque ad 1 cm longos laminas minus rugosas et supra plus dense tomentosas fasciculos per rhachim confertos et tomentum calycis subpurpureo - cinereum 1 - 1.5 mm longus distinguitur.

T y p u s: G.B.Barnett s.n.: from Carnarvon, loc.incert., Western Australia,- (PERTH holotype).

var. barnetii differs from the type variety by its leaves having a longer petiole (up to 1 cm long), lamina more densely tomentose but less rugose above; flower - clusters more closely set; calyx - tomentum purplish - grey, 1 - 1.5 mm long.

Specimens examined:

WESTERN AUSTRALIA:- G.B.Barnett s.n.: from Carnarvon, loc.incert,- (PERTH holotype).- A.S.George 10818: near upper Rudall River, - 22° 35'S, 122° 03'E, 23.V.1971 (PERTH).

Distribution: (Map 4).

This variety is recorded from the north-western part of Western Australia. The only known distribution is near Carnarvon along the North West Coastal Highway and in the upper part of Rudall River to the south-west of Great Sandy Desert.

E c o l o g y:

Not much is known about the ecology of var. barnetii, but in this respect, it seems to agree much with the type variety. According to George 10818 (PERTH), from upper Rudall River, it is a

"spreading shrub of about 40 cm tall, growing in red sand on steppe or sometimes in previously burnt places".

Relationship:

var. barnetii is closely related to the type variety. For the distinctive characters see diagnosis.

D.cordifolia Munir, var. purpurea Munir, var. nov.

Varietas ab aliis ob folia plus minusve ovato - subcordata inflorescentiam laxam cymas pedunculatas et surculos peduculosque purpureos distinguitur.

T y p u s: J.N.Casey s.n.: Betio, Oakover River, Canning Stock Route, - 1954 (PERTH - holotype).

var. purpurea differs from other known varieties of this species by its leaves being ± ovate - subcordate, inflorescence somewhat lax; cymes pedunculate in the lower part of inflorescence; young shoots and peduncles purple tomentose.

Specimens examined:

WESTERN AUSTRALIA:- J.N.Casey s.n.: Betio, Oakover River,- 1954 (PERTH holotype).- R.D.Royce 1838: 20 miles north of Lookout Rock, 20.V.1947 (PERTH).

Distribution: (Map 4).

This variety is recorded from the north-western part of Western Australia. The only known localities are to the south-west of Great Sandy Desert.

E c o l o g y:

According to collectors' field notes, this variety occurs chiefly in sandy soil of spinifex country. Casey s.n.(PERTH), from Oakover River is described as "spreading shrub of 1 $\frac{1}{2}$ to 2 feet high, growing in spinifex burn places". Royce 1838 (PERTH), from north of Lookout Rock is annotated "12 inches tall shrub, spreading over an area of 2 to 3 feet in diameter". The plant is collected from "sandy soil in valley between sand hills".

Flowering and fruiting seem to take place fromAugust to November.

Relationship:

var. purpurea is closely related to the type variety. For the the distinctive characters see diagnosis above or key to the infraspecific taxa of D.cordifolia.

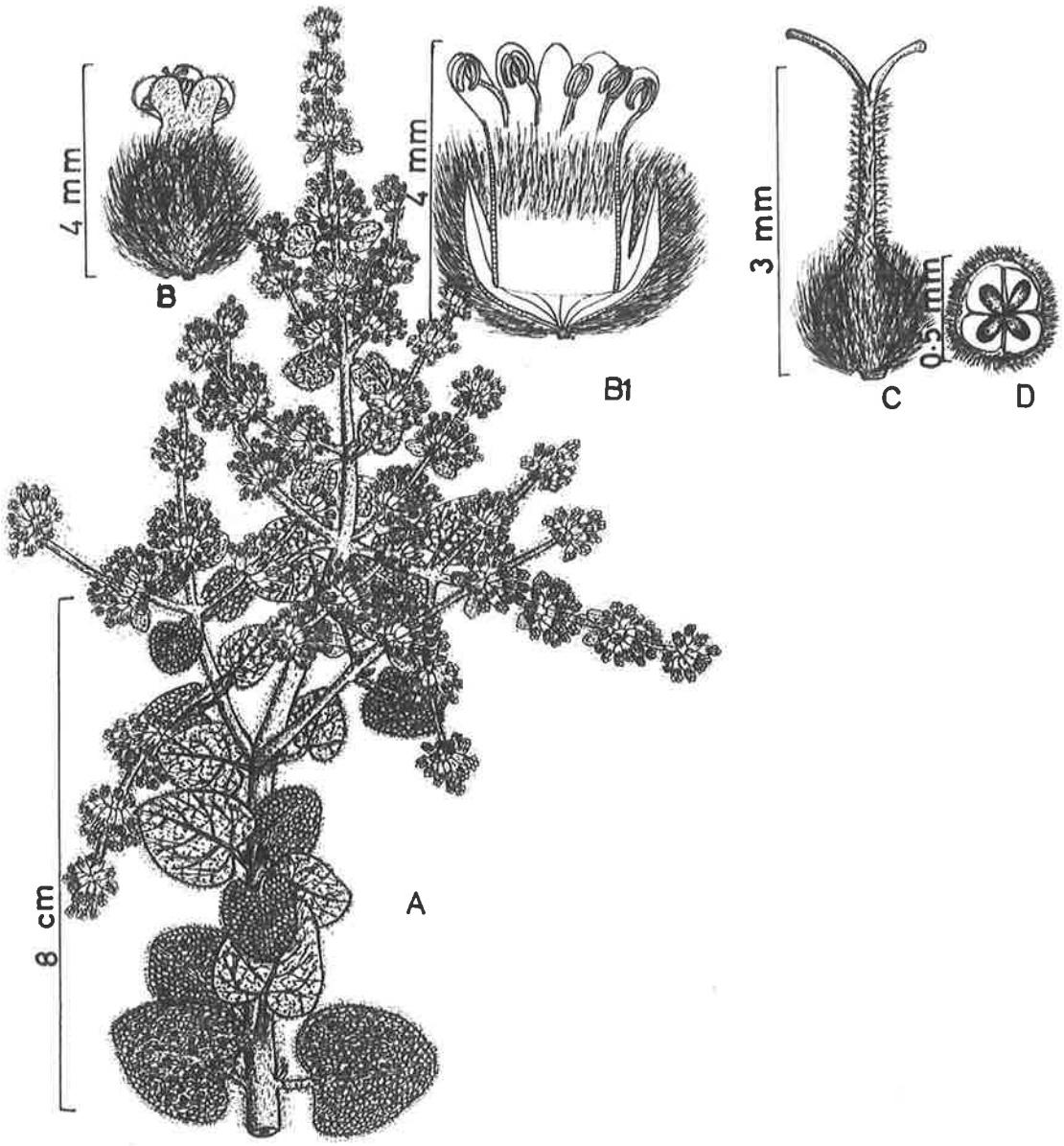


Fig. 5 — Dicrastylis cordifolia Munir var. cordifolia (H.A. Johnson 9758: NT - holotype).

A, flowering twig; B, flower; B1, flower longitudinally cut open; C, pistil; D, T.S. ovary.

Sectio 2. Dicrastylis

Cymae pedunculatae in paniculas corymbosas plus minusve laxas dispositae, ut videtur propter tomentum longum densum confertae, nec tamen fasciculas subglobosas confertas formant.

T y p u s: Dicrastylis fulva Drumm. ex Harv., Kew J.Bot. 7 (1855) 56.

Cymes pedunculate, arranged in a ± lax corymbose panicle, apparently congested due to dense long tomentum, not forming compact subglobose heads (clusters).

Dicrastylis obovata Munir, sp. nov.

Frutex ramosus ramulis cylindricis puberulis perfoliatissimis internodiis folia brevioribus; folia decussata sessilia coriacea obovata usque ad 1.5 cm longa 0.7 cm lata puberula appressa saepe superposita; cymae pedunculares in paniculas corymbosas dispositae; flores bracteati pedicellati pentameri pedicellis 2 - 4 mm longis; calyx 1 - 2 mm longus extra cinereo - tomentosus intra glaber quinquelobus tubo brevissimo lobis lanceolatis plus minusve 1 mm longis; corolla albo - cremea extra puberula ad faucem parce tomentosa quinqueloba interdum quadriloba tubo lobos plus minusve aequanti lobis ellipticis vel elliptico - obovatis obtusis 1 - 2 mm longis; stamina 5 interdum 4 exserta ad faucem corollae inserta filamentis filiformibus longis glabris antheris plus minusve orbicularibus lobis antherae oblongis; ovarium plus minusve globosum plus minusve 1 mm diam. omnino dense albo - tomentosum; stylus vix exsertus dense tomentosus profunde bilobatus lobis glabris.

T y p u s: R.D.Royce 10231: Frank Hann National Park, west of 90 mile Tank, west of Salmon Gums, 10.XII.1971 (PERTH holotype).

Description: (Fig. 6).

Shrub 60 - 90 cm tall. Stem erect, branched, cylindrical, woody; branchlets puberulus, profusely leafy below the inflorescence, often concealed by the leaves in the apical parts, the internodes shorter than the leaves. Leaves sessile, decussate, obovate, entire, obtuse, 0.7 - 1.5 cm long, 3 - 7 mm broad, puberulus, ± vertically adpressed, coriaceous or nearly crustaceous when dry, the tips of the lower pairs often overlap the bases of the next higher pairs. Inflorescence a panicle of corymbosely arranged cymes, each panicle 3.5 - 6 cm by 2 - 2.5 cm in outline. Flowers 5 -merous, sometimes 4 -merous, bracteate, with a bracteole on either side of the bract, pedicellate, 5 - 6 mm long, greyish - tomentose; pedicel 2 - 4 mm long, greyish - tomentose. Calyx 5 -lobed in the upper half, tubular below, 1 - 2 mm long, densely covered with short greyish - tomentum on outside, glabrous within; lobes short, lanceolate, ± 1 mm long; tube short, almost as long as the lobes. Corolla pale or white, 5 -lobed towards the apex, sometimes 4 - lobed, 4 - 5 mm long, puberulus outside, sparsely hairy inside the throat; lobes ± elliptic to elliptic - obovate, rounded at the tip, glabrous within, 1 - 2 mm long, nearly as broad; tube almost as long as the lobes. Stamens 5, sometimes 4, much exserted, inserted at the base of corolla-lobes; filaments long, filiform, glabrous; anthers 2-lobed, dorsifixed, nearly orbicular in outline; lobes

± oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globular, nearly 1 mm in diameter, densely white - tomentose all over, 4 -locular with one ovule in each cell; style somewhat thick, 1 - 1.5 mm long, scarcely exserted, deeply 2 -branched, densely white - tomentose; lobes partly exserted, glabrous, stigmatic at the end. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- F.W.Humphreys s.n.: 46.2 miles east of Lake King Crossroad, 14.XI.1965 (PERTH).- F.W.Humphreys s.n.:46.3 miles east of Lake King Crossroad, 14.XI.1965 (PERTH).- R.D.Royce 10231:Frank Hann National Park, west of 90 mile Tank, west of Salmon Gums, 10.XII.1971 (PERTH, holotype).

Distribution: (Map 4).

This species is recorded from the South Western Province of Western Australia. The known localities are to the south-west of Norseman between Lake King and Salmon Gums.

E c o l o g y:

Little is known about the ecology of the species, but it seems to occur chiefly in the winter rainfall summer drought areas of Western Australia. The plant is a branched puberulus shrub with adpressed obovate leaves and pale or white flowers arranged in corymbose panicles. According to Royce 10231 (PERTH), from west of Salmon Gums, it is a shrub 2 - 3 ft. tall with white flowers, growing chiefly in "sandy soil".

Flowering and fruiting seem to take place mainly from September to December.

C o m m e n t s:

Among all the known species of Dicrastylis, this is the only one with obovate leaves. The stem internodes are rather shorter than the leaves and are often concealed by the latter in the apical parts. Moreover, the tomentum on stem and leaves is very short and are scarcely visible to the unaided eye. Flowers are basically pentamerous, but occasionally 4 -merous flowers are also found in the same inflorescence.

Relationship:

D.obovata is closely related to D.linearifolia in its cymes being arranged into corymbose panicle; flowers greyish - white - tomentose; corolla sparsely hairy in the throat; stamens exserted

and anthers ± orbicular in outline. However, it may be easily distinguished by its vertically adpressed obovate leaves and somewhat greenish - grey puberulus stem. The leaves in D.linearifolia are linear - lanceolate, stem prominently golden - orange and the corolla-throat is much less hairy.

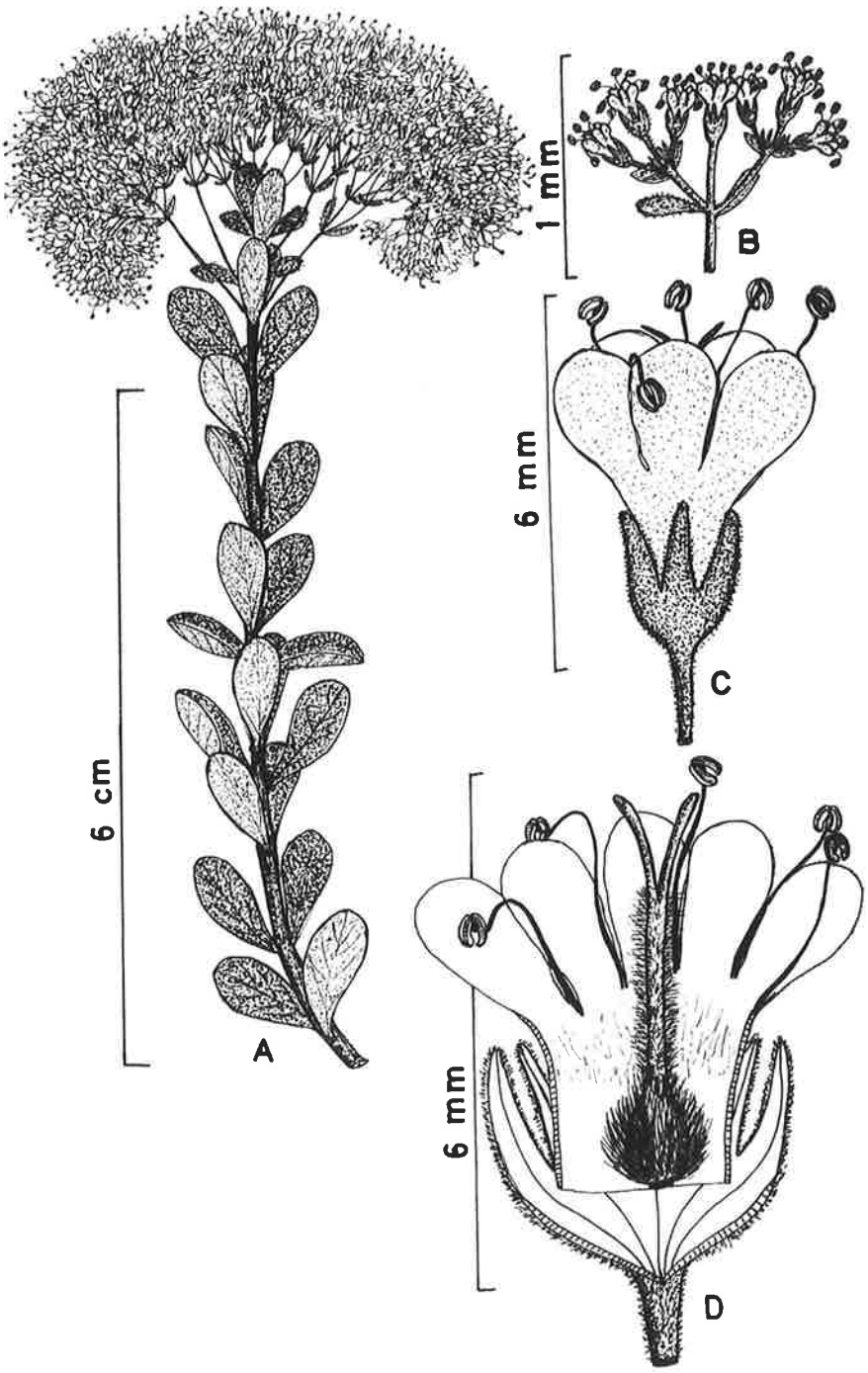


Fig. 6 — Dicrastylis obovata Munir (R.D. Royce 10231: PERTH - holotype) A, flowering branch; B, cyme; C, flower; D, flower vertically cut open.

Dicrastylis linearifolia Munir, sp. nov.

Frutex 1 - 2.5 m, altus caule ramisque fere glabris strato epidermico crasso aureo - aurantiaco vel ferrugineo tectis; folia subsessilia vel breviter petiolata lineari - lanceolata 1.2 - 4 cm longa 2 - 4 mm lata supra viridia infra cinereo - pubescentia margine plana integra; cymae laxae in paniculas corymbosas dispositae; flores bracteati pedicellati pentameri cinereo - albi pedicellis 1 - 2 mm longis; calyx 1.5 - 2 mm longus extra cinereo-pubescens intra glaber quinquelobus; corolla albo - cremea extra pubescens intra fere glabra quinqueloba tubo lobos plus minusve aequanti lobis plus minusve elliptico - obovatis obtusis ad apicem rotundatis; stamina 5 exserta ad faucem corollae inserta filamentis filiformibus antheris fere orbicularibus lobis antherae oblongis; ovarium globosum plus minusve 1 mm diam. dense tomentosum quadriloculare; stylus exsertus dense tomentosus profunde bilobatus lobis filiformibus glabris.

T y p u s: A.M.Ashby 4496: 473 mile post on North West Coastal Highway, Western Australia, 12.XII.1971 (AD holotype).

Description: (Fig. 7).

A much - branched tall shrub, 1 - 2.5 metres high. Stem erect, branched, cylindrical, woody, covered with a thick (epidermal) layer of golden - orange or somewhat rusty colour. Leaves decussate, sub-sessile or shortly petiolate, linear to linear - lanceolate, entire, somewhat acuminate, ± cuneate towards the base, green and indistinctly rugose above, grey - pubescent beneath, 1.2 - 4 cm long, 2 - 4 mm broad; petiole short, 1 - 2 mm long. Inflorescence cymose; cymes lax, arranged in a corymbose panicle. Flowers 5 - merous, pedicellate, bracteate, with 2 bracteoles at the base, greyish - white, 5 - 6 mm long; pedicels 1 - 2 mm long, greyish - pubescent. Calyx 5 -lobed, 1.5 - 2 mm long, shorter than corolla-tube, greyish - pubescent outside, glabrous inside; lobes lanceolate, 1 - 1.5 mm long; tube shorter than the lobes. Corolla 5 - lobed in the upper half, whitish, 4 - 5 mm long, puberulus outside, almost glabrous or very sparsely hairy inside the throat; lobes ± elliptic - obovate, obtuse, rounded at the apex, 2 - 2.5 mm long, 1 - 2 mm broad; tube nearly as long as lobes. Stamens 5, exserted, inserted in the corolla throat; filaments long, filiform, glabrous; anthers 2 -lobed, dorsifixed, ± rounded in outline; lobes oblong, narrowed towards the base, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, densely tomentose, ± 1 mm in diameter, 4 -locular, with one ovule in each cell; style

long, exserted, deeply 2 -branched, up to 5 mm long, densely tomentose on the un-branched lower part; lobes (branches) filiform, glabrous, stigmatic at the end. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 4496: from 473 mile post along North West Coastal Highway, 12.XII.1971 (AD holotype).- H.Demarz 707: Meadow turn off, Carnarvon Road, 17.XI.1968 (PERTH).- C.A. Gardner 14274: Cistern 1, 40 km north of Murchison River, 20.XII. 1962 (PERTH, 4 spec.).- F.W.Humphreys s.n.: 415 $\frac{3}{4}$ mile post on Carnarvon Road, 14.XII.1964 (PERTH).- F.Lullfitz 4553: 435 mile post Carnarvon - Geraldton section of North West Coastal Highway, 7.XII.1965 (PERTH).- F.Lullfitz 1954: Binnu, 18.XI.1962 (PERTH).- F.Lullfitz 2185: loc.incert., -(PERTH).- F.Lullfitz 5956: 436 mile post on North West Coastal Highway, north of Murchison River, 11.XII.1966 (PERTH).

Distribution: (Map 4).

D.linearifolia is recorded from the South-Western Province of Western Australia. The known distribution is between Geraldton and Carnarvon along the North West Coastal Highway.

E c o l o g y:

Little is known about the ecology of this species. In view of its recorded distribution, it seems to occur mainly in the winter rainfall summer drought areas of sandy habitat. According to Demarz 707 (PERTH), from Meadow turn - off Carnarvon Road, it is a "loose shrub of up to 7 feet high; leaves small, grey; flowers white, in dense clusters". It was growing in "red sand". Lullfitz 5956 (PERTH), from 436 mile post along the North West Coastal Highway is annotated as having "stem fawn and tan; leaves green on top, grey beneath; flowers white". Lullfitz 4553 (PERTH), from 435 mile post along Carnarvon - Geraldton Road is noted as "erect grey shrub to 5 feet; stem golden". Lullfitz 1954 (PERTH), from Binnu, is described as a "floriferous erect shrub, to 7 feet; leaves green on top, white underneath". Gardner 14274 (PERTH), 40 km north of Murchison River is annotated as "frutex circa 1.5 m altus, ramis erectus, luteo - tomentosis; folia olivaceis; fl. albis". The plant was found in "arenosis apertis".

Flowering and fruiting seem to occur chiefly from October to January.

C o m m e n t s:

The golden - orange stem covering of D.linearifolia is distinct from all the known species of this genus. It appears to be a somewhat scurfy epidermal layer which often ruptures irregularly and comes off in small pieces. Under the microscope, it appears like a glutinous - powdery mass, with small fine hairs mixed with it. It is likely, that as in Newcastelia viscida and a few other species of that genus, the stem covering of D.linearifolia may well be the glutinous exudation from the tips of its ahirs. In a few specimens, where the outer golden - orange covering has split aprt, the green stem - bark beneath is quite distinct from the outer covering.

According to collectors' field notes, this species is probably the tallest known taxon(up to 7 feet high) in the genus.

The siotypes of this newly described species in Herb.AD are still to be distributed.

Relationship:

D.linearifolia is closely related to D.obovata in its cymes being arranged into a lax corymbose panicle; stamens and style exserted; corolla almost glabrous or very sparsely hairy inside the throat. However, it may be easily distinguished by its stem being distinctly golden - orange and leaves linear to linear - lanceolate with a very short petiole.

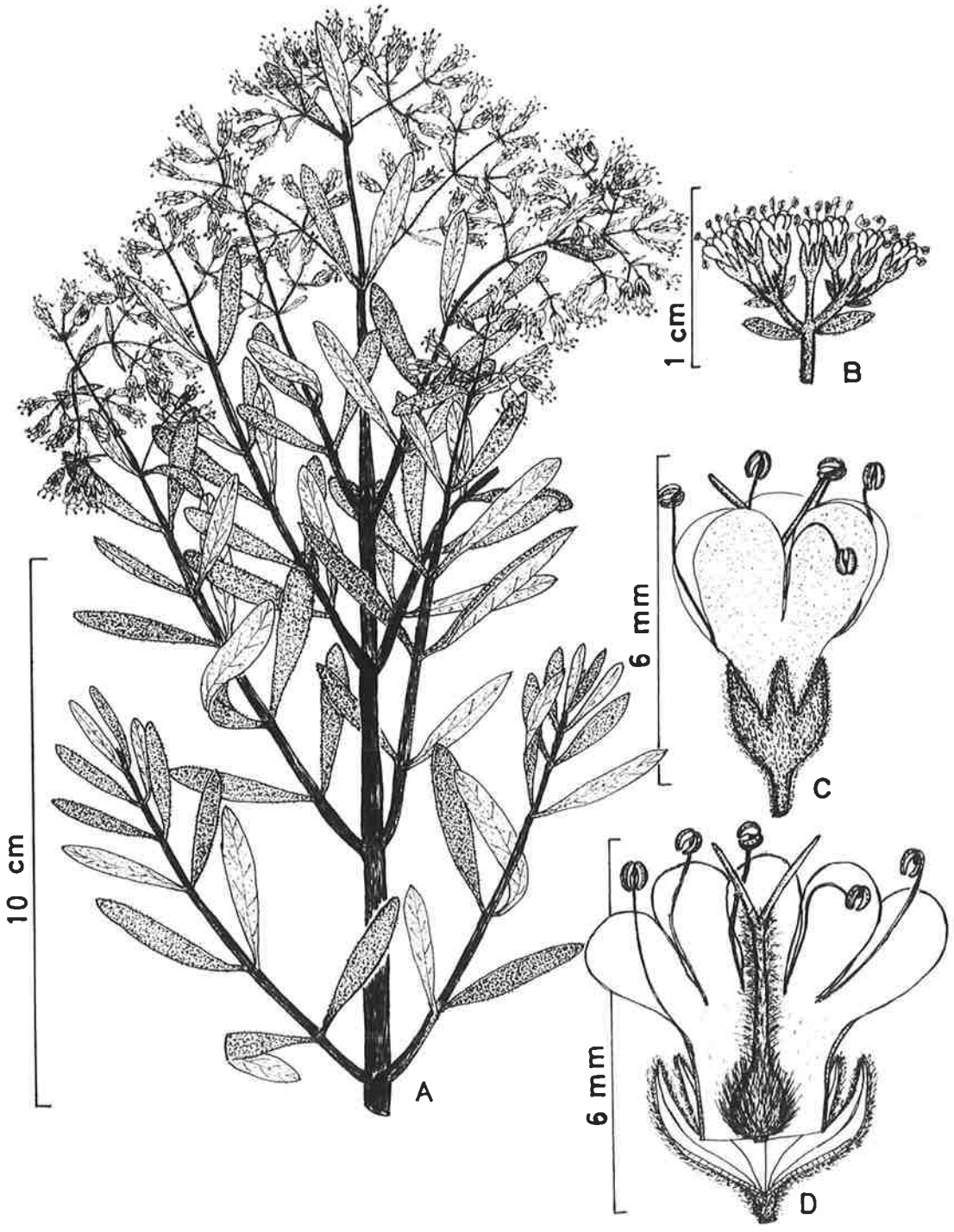


Fig. 7 — Dicrastylis linearifolia Munir (A.M. Ashby 4496; AD -- holotype).

A, flowering twig; B, cyme; C, flower; D, flower vertically cut open.

Dicrastylis parvifolia F.v.Mueller, Fragm.2 (1861) 160;F.v.Mueller, Fragm.6 (1868) 155; G.Bentham, Fl.Aust.5 (1870) 43; F.v.Mueller, Fragm.10 (1876) 15; F.v.Mueller, Cens Aust.Pl.1 (1882) 103; F.v.Mueller,,2nd Cens.Aust.Pl.1 (1889) 172; F.v.Mueller & R.Tate, in Trans.R.Soc.S.Aust.16 (1896) 375; L.Diels & E.Pritzel in Bot. Syst. Jahrb.35 (1904) 496-499; J.M.Black, Trans.R.Soc.S.Aust.42 (1918) 54 , in obs.; S.Moore, Journ.Linn.Soc.Bot.45 (1920) 188; Ostenfeld, Contrib.W.Aust.Bot.3 (1921) 111-"D.panifolia"; C.A.Gardner, Enum. Pl.Aust.Occ.3 (1931) 111; S.Junell in Symb.Bot.Upsal.4 (1934) 66 - "D.parviflora"; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208, 278; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls.3 (1965) 262; J.S.Beard, W.Aust.Pl.(1965) 92; J.S.Beard, W.Aust.Pl.ed.2,(1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 346,475, 476.

T y p u s: G.Maxwell s.n.,MEL40917: "Ad flumen East River juxta sinum Stokes Inlet", Western Australia, -(MEL lectotype).

D.rosmarinifolia N.Turczaninow, Bull.Soc.Nat.Mosc. 36(2)(1863)226.

T y p u s: J.Drummond 4th coll. no.236: South West Australia, - 1848 (KW holotype;BM,CGE,K,LE,MEL,W).

Mallophora globiflora auct. non Endl.:G.Bentham,Fl.Aust.5 (1870) 226 p.p. -(quoad spec.Drummond no.72: New Hollandia -G).

Typification:

With the original description of D.parvifolia,the author has mentioned G.Maxwell's collection (s.n.) from East River,Western Australia, without selecting a type. It is therefore necessary to choose a lectotype from amongst G.Maxwell's (syntype) collection. There are four syntypes preserved in Herb.MEL. The locality of one specimen is recorded as "S.W.Australia" and the remaining three are annotated as "East River". The latter three have all been identified as "Dicrastylis parvifolia" in Mueller's own handwriting. It seems, that Mueller most likely used these specimens in describing this taxon but he failed to designate any one of them as a type. Among these three, the one preserved under the number MEL40917 seems most characteristic of this species and is selected here as the lectotype.

Description: (Fig. 8).

A greyish shrub of 30 - 60 cm tall, clothed all over with short branched tomentum. Stem erect, branched, cylindrical,woody,

greyish - tomentose; branchlets slender, opposite (decussate), leafy. Leaves sessile, decussate, sometimes ± verticillate on the main stem, 5 - 15 mm long, 1 - 3 mm broad, linear to linear - oblong, obtuse, with slightly recurved margins, faintly rugose above, densely grey - tomentose concealing the rugose surface, old leaves somewhat glabrescent. Inflorescence cymose, forming ± branched corymbose panicles. Flowers 5 -merous, bracteate, pedicellate, small, 2 - 2.5 mm long, greyish tomentose; pedicels minute, about 0.5 mm long, densely tomentose; bracts and bracteoles ± lanceolate, tomentose outside, glabrous inside. Calyx 5 -lobed at the apex, rarely 4 -lobed, tubular in the lower half, 1 - 1.5 mm long, densely covered with short branched tomentum and white glands outside, glabrous inside; lobes oblong, ± obtuse, 0.7 - 1 mm long, more than half the langth of calyx; tube shallow, 0.3 - 0.5 mm long. Corolla white, tubular, unequally 5 -lobed at the apex, 1.5 - 2.3 mm long; lobes spreading, elliptic - oblong, rounded at the apex, tomentose and sparsely glandular outside, glabrous inside, ± 1.2 - 1.7 mm long, much larger than the tube, the anterior - lobe somewhat larger than the others; tube shallow, hardly 0.5 mm deep, glabrous outside, densely tomentose inside. Stamens 5, much exserted, inserted in the corolla-tube; filaments long, filiform, glabrous, much longer than the corolla - lobes; anthers 2 -lobed, dorsifixed, ± orbicular in outline, brownish; lobes ± oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± elliptic - ovoid, about 0.5 mm in diameter, glandular and densely tomentose, 4 - locular, with one ovule in each cell; style long, much exserted, deeply 2 -branched, 2 - 2.5 mm long, densely tomentose in the lower half; lobes filiform, almost free to the base, tomentose in the basal half, glabrous above, stigmatic at the tip.

Specimens examined:

WESTERN AUSTRALIA:- C.Andrews 66: 100 miles S. of Coolgardie, -.X.1903 (PERTH).- A.M.Ashby 780: Doodlakine, ca. 195 km east-north-east of Perth, 21.XI.1963 (AD).- A.M.Ashby 1452: near Bullabulling, ca. 70 km west-south-west of Kalgoorlie, 23.XI.1964 (AD).- E.T.Bailey 557: Muntadgin, -IX.1945 (CANB,PERTH).-J.B.Batt s.n.,MEL40908: between Dundas Hills and Lake Lefroy, -1893 (MEL).- J.S.Beard 2380: 30 miles south of Norseman, 6.X.1962 (PERTH).-* W.E.Blackall 3345: 16 miles N. of Beacon, 7.X.1937)(PERTH).- C.Brooks 776: Wallaroo, near Kalgoorlie, -XII.1914(BM).- N.T.Burbidge 2631: 22 miles S. of Coolgardie, 19/IX.1947 (AD,CANB).- W.H.Butler s.n.: Queen Victoria Springs, 26.I.1959 (PERTH).- *J.S.Beard 3304: north of Bullaring, 25.V.1964 (PERTH).

E.M.Canning s.n., CBG029520: 34.1 miles from Coolgardie towards Southern Cross, 8.IX.1968 (CBG).- E.Cronin s.n.,MEL40909: Coolgardie, near Lake Lefroy, -1893(MEL).- N.N.Donner 4563: 35 km west of Coolgardie, 5.IX.1973 (AD).- J.Drummond 72: loc.incert,-(G).- J.Drummond 95: Swan River, -1849(KW).- J.Drummond 176: interior of S.W.Australia, loc.incert, -1849(K,LE,MEL).- J.Drummond 236, 4th coll. (sphalm 286 in MEL40918): S.W.Australia, loc.incert,-1848 (KW -holotype;BM,CGE,K,LE,MEL -2 spec.,W- isotypes of D.rosmarinifolia Turcz.).- A.Eaton s.n., MEL40907: source of Blackwood River, -1889 (MEL).- W.V.Fitzgerald s.n.,NSW106624: Cunderdin, -XI.1907 (NSW).- C.A.Gardner 1086: Carrabin, Coolgardie distr.,24.XI.1920 (PERTH).- C.A.Gardner 11139: 27 miles southwards from Coolgardie, 5.XI.1953(PERTH).- J.W.Green 1336: Karalee, 31.V.1957 (PERTH).- A.S.George 1999: Oldfield River, Ravensthorpe - Esperance Road, 4.XII.1960(PERTH).- A.S.George 4240: $\frac{1}{2}$ mile N. of Queen Victoria Rocks, 22.IX.1962(PERTH).- A.S.George 5956: Ponton Creek, between Zanthus and Cundeelee Mission, 9.XI.1963(PERTH).- B.J.Grieve s.n., UWA978: Tammin, 25.XI.1959(UWA).- R.Helms s.n.,AD97113281 & AD97113282: 30 miles N.W. from Lake Lefroy, 10.XI.1891 (AD,K,MEL, PERTH,NSW).- H.S.King & D.C.Lefroy s.n.,MEL40906: Yilgarn near Mt. Moore, -1889(MEL).- M.Koch 1249: Cowcowing,-IX.1904 (MEL,PERTH, NSW,W).- M.Koch 1249: Jibberding, -X.1905 (AD,K,E).- M.Koch 2912: Yerbillon, 26.X.1923(K,MEL,PERTH,NSW).- M.Koch 2980: Merredin, 15.XI.1923(MEL,MO,NSW).- J.Knox "65x084": 84 miles east of Southern Cross, -X.1965(PERTH).- F.Lullfitz L154: Marne Siding, 21.XII. 1961(PERTH).- F.Lullfitz 3153: 173 mile post, Wubin - Paynes Find Road., 18.XII.1963 (PERTH).- G.Maxwell s.n.: Oldfield River and Young River,-(K).- G.Maxwell s.n.,MEL40917,MEL40920,MEL41228: East River, (MEL lectotype;K,MEL - isolectotypes).- G.Maxwell s.n., MEL40903: loc.incert.,-(MEL probably isolectotypes from East River). A.Meebold 18485: Tammin, -VI.1933 (F,K,M).- Merral s.n.,MEL40904: Golden Valley,-1888 (MEL).- F.v.Mueller s.n.,MEL40913: Ularing Young,-(MEL).- A.A.Munir 5238: 35 km west of Coolgardie, 5.IX.1973 (AD).- K.Newbey 1123: 23 miles east of Hyden, 13.X.1963 (PERTH).- C.H.Ostenfeld 1115: Tammin, 6.X.1914(C).- T.R.Pearce 6: Hyden Area, -.VII.1965(PERTH).- M.E.Phillips s.n.,CBG025095: 31 miles N. of Salmon Gums 6.XI.1962 (AD,CBG).- G.Sewell s.n.,MEL40905: Mt. Caroline near Mt. Stirling, -1889(MEL).- J.Staer s.n.: Cunderdin, -.X.1905(E,UC).- F.Stoward 864:Wongan Hills,19.II.1916(K).-F.Stoward 375: Mt.Marshall, -1916(BM).- C.Taylor s.n.,MEL40901: from Thomas River,-1887 (MEL).- G.H.Thiselton-Dyer 119: no.8 pumping stn., 24 m. W. Coolgardie,-1903(K).- M.D.Tindale 40 & E.M.Bennett s.n., NSW130335: 25.7 miles S.W. of Coolgardie on Great Eastern Hwy.,

9.III.1970 (PERTH).- C.L.Webster 58: Coolgardie,-1898(NSW).- C.T. White 5477: 7 miles south of Coolgardie, 14.XI.1927 (A,BRI,PERTH).- W.Webb s.n.,MEL40916: loc.incert.,-1893(MEL).-L.C.Webster s.n.: Coolgardie District,-1902(BM).- F.W. & C.W.Went A189: between Wubin and Wongan Hills, 10.IX.1962(MO).- A.Wilson s.n,UWA977: Bruce Rock,-VII.-(UWA).- ? Leg.UWA974: Trayning,-X.1918 (UWA).

Distribution: (Map 4).

This species is found in the south-western part of Western Australia. The known localities are chiefly between 30 and 34 degrees south latitude and between 116 and 124 degrees east longitude. It is common to the south-south-west of Coolgardie, and between Coolgardie and Cunderdin alongside the Great Eastern Highway. Along the Great Northern Highway, it occurs between Wubin and Payne's Find and to the north of Cunderdin it grows about Cowcowing, Trayning and near Lake Moore. To the south of Coolgardie, this species is distributed along the Coolgardie - Esperance Highway and between Esperance and Ravensthorpe. The only other major area of its occurrence is to the south of Merredin near Bruce Rock, Bullaring Hyden and Muntadgin.

E c o l o g y:

This species grows chiefly in winter rainfall - summer drought areas of Western Australia. According to collector's field notes the plant is a greyish - tomentose shrub growing chiefly in sandy habitats. Beard 2380 (PERTH), from 30 miles south of Norseman, is annotated as "small semi-woody 12" tall plant growing in clumps". The flowers are said to be "white". Beard's subsequent collection no.3304 (PERTH), from north of Bullabulling is noted as "glaucous shrub 12" high, branching from rootstock". The habitat is said to be "sand heath". Blackall 3345(PERTH), from 16 miles N. of Beacon is said to have "small white heads". Burbidge 2631(AD), 22 miles S. of Coolgardie is recorded as a "low shrub". Gardner 1086(PERTH), from Carrabin is recorded as "small compact shrub with flowers white". The plant was collected from "sandy soil". Green 1336 (PERTH), from Karalee, is recorded as "rounded shrub 30 cm high and 50 cm broad". The habitat is given as "sand heath". George 1999(PERTH), from Oldfield River along Ravensthorpe - Esperance Road is described as a "small erect shrub ± 30 cm; fls. white". The habitat is recorded as "sandy soil near river". George 4240 (PERTH),from $\frac{1}{2}$ mile N. of Queen Victoria Rock is annotated as "shrub to 30 cm; fls. ± white". Koch 2912 (PERTH), from Yerbillon is remarked as "perennial $\frac{3}{4}$ ft.high". Koch 2980 (NSW), from

Merredin is note as "shrub 1 foot high, densely branched".Lullfitz 3153 (PERTH), 173 mile post along Wubin - Paynes Find Road is recorded as "shrub 12" x 24" with white umbels". Newbey 1123 (PERTH), from 23 miles east of Hyden is noted as "15 inches high shrub growing in sandy - clay". Phillips CBG025095 (CBG), 31 miles N. of Salmon Gums is described as "shrub 2 ft. high".Tindale 40 & Bennett s.n.,(PERTH), 25.7 miles S.W. of Coolgardie is noted as " 6" - 1' high upright plant in red sandy loam, on sand plain". White 5477 (PERTH), 7 miles S. of Coolgardie is annotated to grow "on sand plain". The plant height and flower colour are recorded "shrub about 2 ft; fls. white".

According to the writer's field observations, it is a small bushy plant of up to 60 cm tall, growing chiefly in snady - clayey soil along the roadside. The plant is covered with short greyish-tomentum and has very small leaves, and minute purplish - green flowers. Other plants growing in association with it are chiefly Acacia, Baekea, Eremophila, Grevillea, Eucalyptus (mallee) and Triodia species.

Flowering and fruiting seem to occur chiefly from October to January. According to Blackall & Grieve (1965), the flowering period is "July - Nov.", but Diels & Pritzel (1904) have recorded "flor. Oct.,Nov." Beard (1965,1970) has noted the flowering period " 5 - 12 " i.e. from May to December.

C o m m e n t s:

In the protologue of this species, Mueller described the corolla as bilabiate. "Corolla majuscula bilabiate, lobo labii inferi medio ceteris conspicue majore". Bentham (1870) partly agreed with Mueller by calling "one of the corolla-lobes larger than the others" but has refrained from calling it bilabiate. Black (1918) compared the corolla of D.verticillata with D.parvifolia and remarked that the flower of D.verticillata "bears resemblance to D.parvifolia which also has one of the corolla - lobes larger than the others".

During present investigations, the examination of many flowers from different collections has revealed that the corolla in D.parvifolia is only subequally 5 -lobed with the anterior lobe slightly larger than the others, not "bilabiate" (sensu stricto) as described in Mueller's protologue. In fact, the anterior corolla - lobes in young flowers seem larger than the others but in a fully mature flower the difference is not much. Thus, the subequal corolla - lobes of D.parvifolia are not so diverse in size as in distinctly bilabiate corolla of D.verticillata; the

anterior lobe of the latter is almost three times as long as the other four lobes. The corolla of *D.verticillata* resembles more closely that of *D.flexuosa* in which the anterior - lobe is relatively larger than in *D.parvifolia*. Black (1918) could not establish relationship between *D.flexuosa* and *D.verticillata*, because the former was then known as a species of *Pityrodia*; however, he pointed out the relationship of *D.verticillata* with the genus *Pityrodia* by the remark that "in the large lowest lobe of the corolla and the verticillate, arrangement of the leaves in threes it stands near several species of *Pityrodia*". [Trans.R.Soc.S.Aust. 42 (1918) 53-54].

Among Max Koch's collections of this species, his no.1249 seems to have come from two different localities with different collecting dates. There are six specimens under the no.1249, out of which the two in Herb.AD and E were collected during October from Jibberding, but the years of collecting are noted 1905 and 1904 respectively. The other four specimens preserved in Herb. MEL,NSW,PERTH and W, also bearing the same collection number 1249, were gathered from Cowcowing in 1904. Among these, those in Herb.MEL and W were gathered during September while the two others in Herb. NSW and PERTH were collected during October. From this information it appears that the above-mentioned six specimens bearing the same collection number belong to the following four collections of Max Koch.

Coll.	No.	Locality	Date	Herb.
1	1249	Cowcowing	Sept. 1904	MEL
1	1249	Cowcowing	Sept. 1904	W
2	1249	Jibberding	Oct. 1904	E
2	1249	Cowcowing	Oct. 1904	NSW
3	1249	Cowcowing	Oct. 1904	PERTH
4	1249	Jibberding	Oct. 1905	AD,K

The probable reason for this unusual practice may be that the collector wanted to record all different collections of the same species under one number. However, he does not seem consistent in this practice because his collection numbers 2192 and 2980 also belong to this species. In order to solve this mystery, the consultation of Koch's field diary may give some clue to his way of maintaining his collections.

The type of this species was collected by G.Maxwell, from "East River," near Stokes Inlet Bay. Actually, there are two rivers entering this Bay, the one flowing from the north-west is Young River and the other flowing from the north-east is Lort River. There is no other river here with the name "East River".

It appears, that perhaps by mistake Maxwell named the Lort River as "East River" due to its eastern position from Stokes Inlet Bay. The other possibility is that during the time of Maxwell's visit to this area, the Lort River was either without any name and the collector named it as "East River" mainly due to its eastern position from Young River and Stokes Inlet Bay, or the river was then known by that name and was later renamed as Lort River.

The leaves in D.parvifolia are the smallest of all the known species of this genus. Moreover, the flowers are among the smallest in the genus, the other species with such small flowers is D.micrantha but the leaves in the latter are comparatively very large and different in shape.

The glands outside the calyx and corolla are distinctly visible (under the microscope) in the fully mature flowers, but less so at younger stages.

Relationship:

Allied closely to D.micrantha in having corymbosely arranged panicled cymes, small flowers (2 - 2.5 mm long), shortly tomentose calyx and exserted stamens and style, but may be easily distinguished by its stem being greyish - tomentose; leaves very small, linear, with recurved margins; calyx glandular - tomentose; corolla unequally 5 -lobed, tomentose in throat, very sparsely glandular outside; ovary glandular - tomentose and style much exserted. In the shape of leaves, D.parvifolia is nearer to D.beveridgei, D.lewellinii and D.verticillata, but the small leaf size and corymbose inflorescence easily distinguish it from these species.

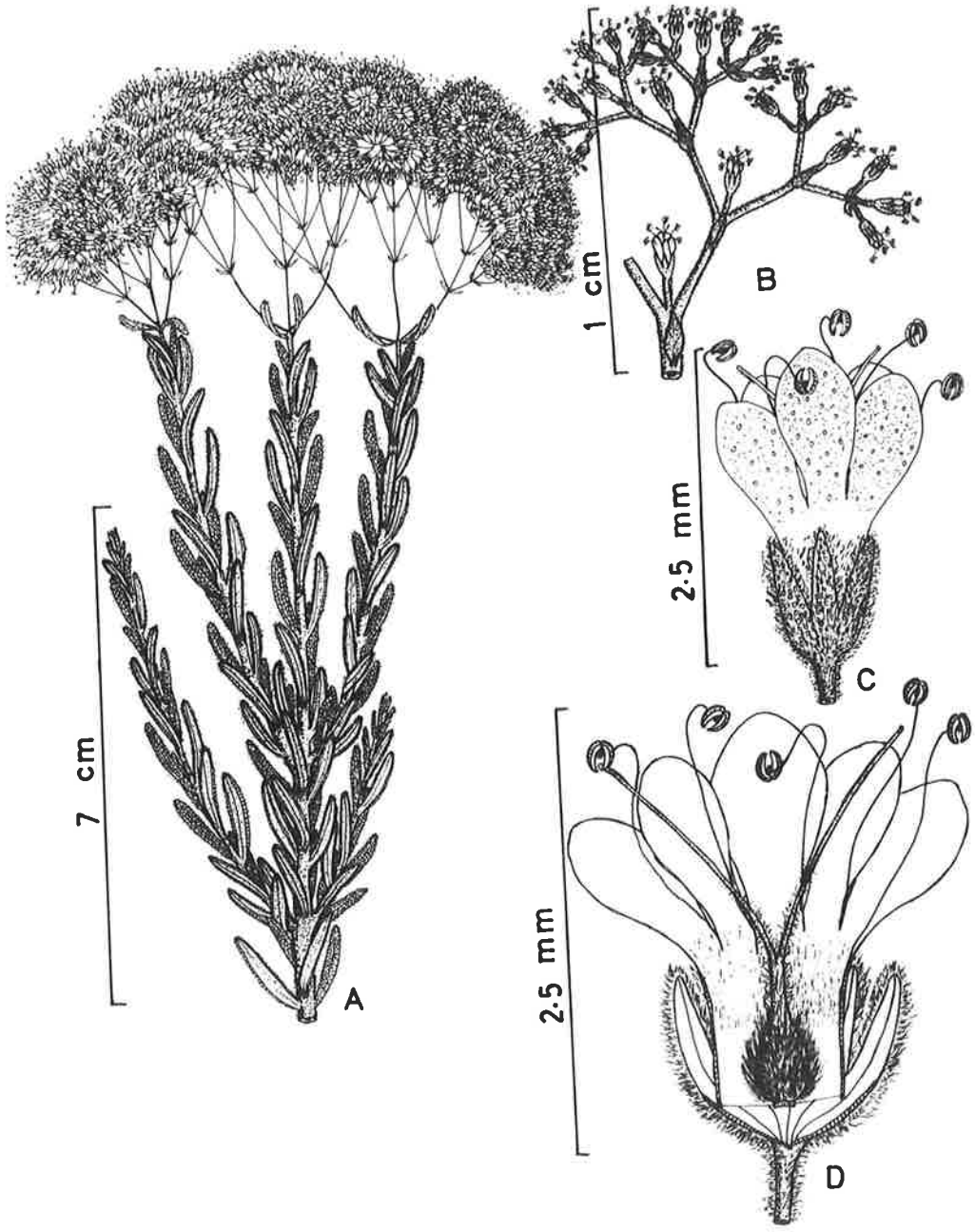


Fig. 8 — Dicrastylis parvifolia F.v.M. (A.M. Ashby 1452: AD).
A, flowering branch; B, enlarged cymes; C, flower; D, dissected flower.

Dicrastylis micrantha Munir, sp. nov.

Frutex ramosus tomentosus 60 - 100 cm altus caule erecto cylindrico fulvi - tomentoso; folia decussata sessilia anguste elliptica obtusa crenata tomento cinereo - viridi; cymae pedunculares in paniculas corymbosas dispositae; flores bracteati pedicellati pentameri raro tetrameri parvi 2 - 2.5 mm longi tomento viridi - cinereo juveniles interdum tomento - purpureo; calyx plus minusve 1 mm longus extra cinereo - tomentosus intra glaber quinquelobus interdum quadrilobus; corolla alba fere 2 mm longa quinqueloba interdum quadriloba tubo lobos aequanti fere glabro lobis elliptico - obovatis obtusis plus minusve 1 mm longis extra pubescentibus; stamina 5 raro 4 exserta ad faucem corollae inserta filamentis filiformibus glabris antheris nigris plus minusve orbicularibus lobis antherae oblongis in dimidio inferiore discretis divergentibus; ovarium plus minusve ellipticum ca. 0.5 mm diam. non glandulosum dense tomentosum quadriloculare quadriovulatum; stylus vix exsertus dense tomentosus profunde bilobatus lobis plus minusve porrectis versus apicem glabris; fructus non visus.

T y p u s: E.A.Shaw 610: ca. 175 km north of Geraldton, Irwin District, Western Australia, 2.X.1966 (AD holotype; isotypes still to be distributed).

Description: (Figs. 9 and 10).

Branched tomentose shrub of 60 to 100 cm tall. Branches cylindrical, woody, densely clothed with tawny tomentum. Leaves decussate, sessile, narrowly elliptic - oblong, obtuse ± crenate, rugose above, distinctly reticulate beneath, 1.5 - 3.5 cm long, 0.4 - 1(-1.5) cm broad, greenish - grey-tomentose all over. Inflorescence cymose; cymes pedunculate, arranged in flat - topped corymbose panicle. Flowers 5 -merous, sometimes 4 -merous, pedicellate, bracteate, small, congested, 2 - 2.5 mm long, greenish - grey - tomentose, tomentum sometimes purplish when young; pedicel about 1 mm long, greenish - grey - tomentose. Calyx 5 -lobed, sometimes 4 -lobed, about 1 mm long, densely greenish - grey - tomentose outside, glabrous inside; lobes minute oblong - lanceolate; tube shallow, shorter than the lobes. Corolla white, 5 -lobed, sometimes 4 -lobed, nearly 2 mm long, pubescent outside on the lobes only, glabrous inside, sometimes sparsely hairy in the throat; lobes ± elliptic - obovate, rounded at the apex; tube as long as the lobes, glabrous inside and outside. Stamens 5, sometimes 4, exserted, inserted between the bases of corolla-lobes; filaments long, filiform, glabrous, brownish; anthers 2-lobed, dorsifixed,

± orbicular in outline; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± elliptical, about 0.5 mm in diameter, 4-locular with one ovule in each cell, densely tomentose; style about 2 mm long, filiform, deeply 2-branched, scarcely exserted, densely tomentose; lobes ± porrect, tomentose in the lower half, glabrous above, stigmatic at the apex.

Specimens examined:

WESTERN AUSTRALIA:- K.Baird UWA987: Carnarvon - Geraldton Road, near Geraldton, - IX.1968 (UWA).- E.M.Bennett 1477: 436 miles North West Coastal Highway, 2.X.1966 (PERTH).- H.Demarz 711: 441 $\frac{1}{2}$ mile post on Carnarvon Road, 130 miles North of Geraldton, 17.XI.1968 (PERTH).- *J.N.Hutchinson s.n.: Geraldton District loc. incert, 9.X.1966 (PERTH).- F.Lullfitz L1962:410 miles post North West Coastal Highway, 20.XII.1962 (PERTH).- F.Lullfitz L4294: 426 mile post on N.W.Coastal Highway, 20.X.1965 (PERTH).- F.v.Mueller s.n., MEL40859,MEL40860: near Shark Bay, -X.1877 (MEL).- M.E. Phillips CBG025852,CBG025853: ca. 14.5 miles south of Wannoo, 17.IX.1968 (CBG,PERTH).- S.B.Rosier 385: North of Gabbin, 27.X. 1963 (PERTH).- R.D.Royce 5344: Goddard Creek, north of Zanthus, 27.I.1956 (PERTH).- E.A.Shaw 610:ca. 175 km north of Geraldton, 2.X.1966 (AD holotype).*A.S.George 10368:16m.S.Wannoo,N.W.Coastal Highway, 9.IX.1970 (PERTH).

QUEENSLAND:- B.A.Barlow 398:collected in Western Australia and cultivated at Myall Park, 4 miles north of Glenmorgan, Darling Downs, south-east Queensland, 6.X.1962 (BRI).- S.L.Everist s.n.: loc.incert., -IX.1962 (BRI).

Distribution: (Map 4).

This species is recorded from the south-western part of Western Australia. The known distribution is chiefly to the north of Geraldton along the North West Coastal Highway, but a few collections are known from north of Gabbin and Zanthus about 210 km north-east of Perth. Collections from Queensland are from the cultivated plants, collected by D.M.Gordon in Western Australia and grown by him at Myall Park in south-east Queensland.

E c o l o g y:

In its ecological requirements, D.micrantha seems to agree closely with D.fulva. According to Demarz 711 (PERTH), 441 $\frac{1}{2}$ mile post on Carnarvon Road, is annotated as "erect shrub of up to 3 ft. tall with white flowers". This plant he collected from "red sand". Shaw 610 (AD), ca. 175 km north of Geraldton is collected from "deep sand by the roadside". Bennett 1477 (PERTH), from 436

miles along North West Coastal Highway is recorded as a "shrub, 2 feet tall; flowers white; leaves corrugated beneath". Lullfitz 1962 (PERTH), from 410 mile post along North West Coastal Highway is noted as "shrub 18 inches tall; flowers white; (inflorescence) dense flat heads". Phillips CBG025852,CBG025853 (CBG,PERTH), from 14.5 miles from Wannoo is noted as "1 metre high shrub with purplish flowers". George 10368 (PERTH), from 16 miles south of Wannoo is annotated as "shrub to 1 metre high; flowers white". It was collected from "red sand" growing in association "with Acacia - Eucalyptus shrubs".

Flowering and fruiting seem to occur chiefly from September to December.

C o m m e n t s:

The inflorescence of D.micrantha is a panicle of corymbosely arranged cymes, similar to those in D.fulva and D.parvifolia. The number of flowers in an ultimate cyme varies from three to seven (rarely eight), depending upon suppression or survival of its lateral flower - buds. The number of flowers observed in different such cymes of the same inflorescence is shown in fig. 10.

A majority of the flowers are 5 -merous, but a few 4 -merous are also found in the same inflorescence. Sometimes, one of the stamens in a 5 -merous flower is missing. Such variation is also observed in a few other species of this genus.

This species is cultivated by D.M.Gordon at "Myall Park", Queensland, from seeds collected in Western Australia, but the locality and date are unknown.

Relationship:

D.micrantha is closely related to D.fulva in its stem being densely tawny tomentose; inflorescence of corymbosely arranged cymes; corolla-throat almost glabrous inside; stamens exserted. However, it may be easily distinguished by its leaves being narrowly elliptic - oblong, greenish - grey - tomentose; flowers smaller, 2 - 2.5 mm long; calyx - tomentum greenish - grey, very short, 0.2 - 0.4 mm long. The leaves in D.fulva are broadly elliptic - oblong, fulvescent - tomentose; flowers 4 - 5 mm long; calyx - tomentum whitish - grey, 1- 2.5 mm long. D.micrantha is also related to D.parvifolia in its inflorescence arrangement, but the latter species may be readily distinguished by its narrow - linear leaves with recurved margins.

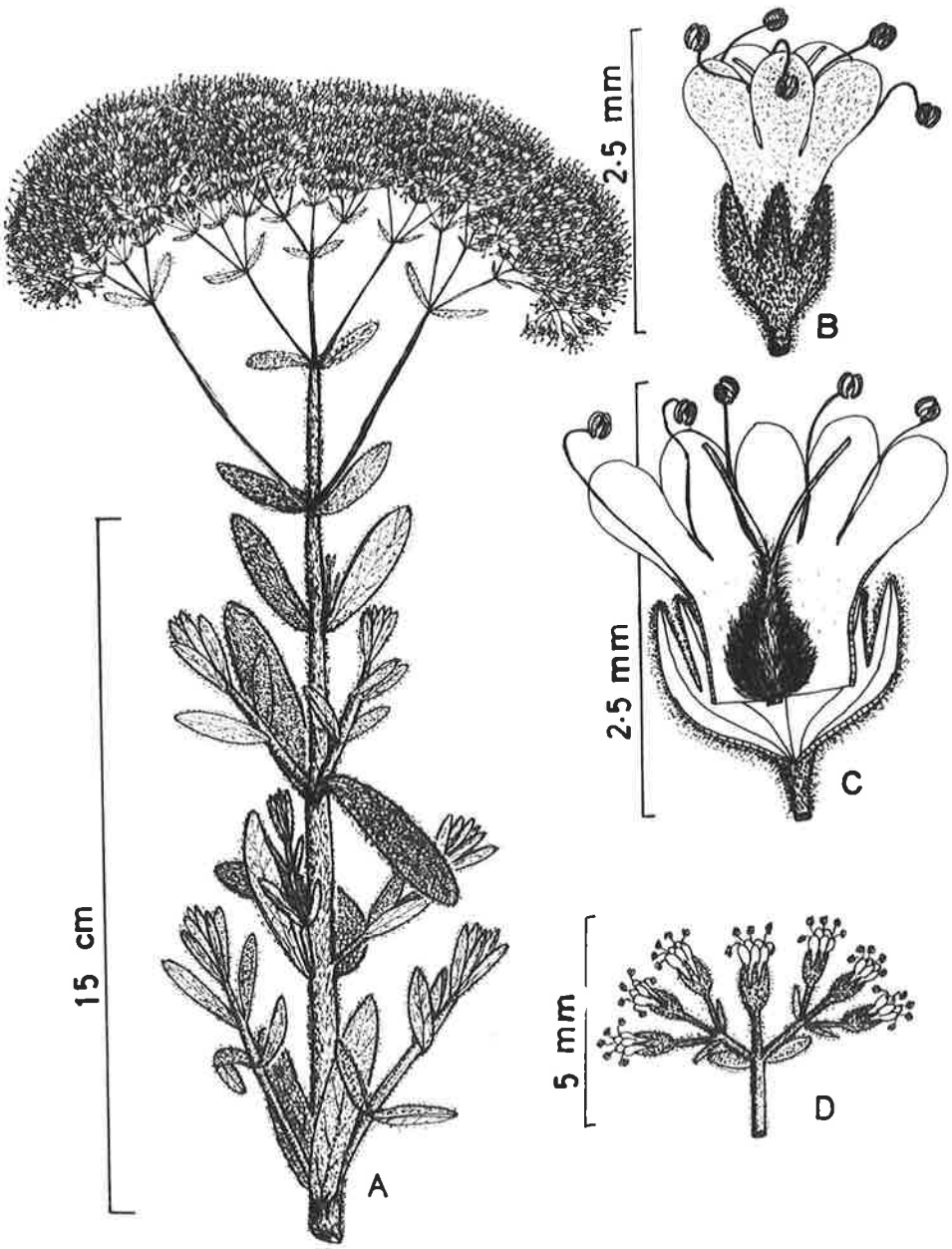


Fig. 9 — Dicrastylis micrantha Munir (E.A. Shaw 610: AD - holotype). A, flowering branch; B, flower; C, flower longitudinally cut open; D, cyme.

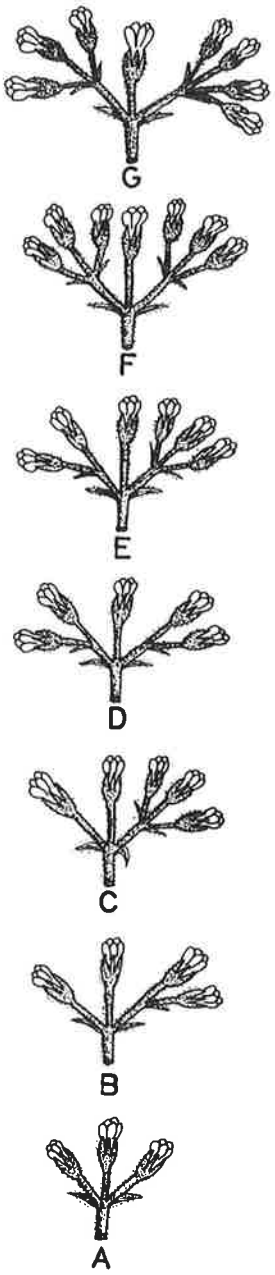


Fig.10. — Dicrastylis micrantha Munir (E.A. Shaw 610: AD - holotype). Showing number of flowers involved in a cyme. A, 3-flowered; B, 4-flowered; C, 5-flowered; D, 5-flowered; E, 6-flowered; F, 7-flowered; G, 8-flowered.

Dicrastylis fulva J.Drummond ex W.H.Harvey in Hook. J.Bot.Kew Misc. 7 (1855) 56; C.Mueller in Walp.,Ann.Bot.Syst.5 (1859) 703; F.v. Mueller, Fragm.1 (1859) 244, in obs.; F.v.Mueller, Fragm.2 (1861) 160; F.v.Mueller, Fragm.6 (1868) 155 ; G.Bentham, Fl.Aust.5 (1870) 43; F.v.Mueller, Fragm.9 (1875) 4; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103 ; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 497,499, fig.55 F,G,H; L.Diels, Pflanzenw.W.Aust. (1906) 279,fig.65 F,G,H; S.Moore, in J. Linn.Soc.Bot.45 (1920) 188; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278;W.E.Blackall & B.J.Grieve, W.Aust.Wildfls.3 (1965) 563; J.S.Beard, W.Aust.Pl. (1965) 92; A.Moriya, List Pl.Spec.Coll.Aust.(1969) 13,MS.;A.Moriya, List Colour Slides Aust.Wildfls. (1969) 14,MS; J.S.Beard, W.Aust. Pl.ed.2,(1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 345,475.

T y p u s: J.Drummond s.n. 6th Coll.: loc.incert.,"northern districts", Western Australia,-1851 (K holotype; M,MEL40849,MEL40851, MEL40854,MEL40856,MEL40857,MEL41230).

Pityrodia myriantha F.v.Mueller, Fragm.1 (1859) 236,244;F.V.Mueller, Fragm.2 (1861) 160.

T y p u s: A.Oldfield s.n.,MEL40855: Murchison River,-(MEL holotype;K).

Description: (Fig. 11).

A shrub 60 - 90 cm tall, densely clothed with greyish - fulvescent branched tomentum. Stem erect, branched, cylindrical, woody, densely covered with brownish branched hairs. Leaves sessile, decussate, ± elliptic or elliptic - oblong, 1 - 3.2 cm long, 0.5 - 1 cm broad, somewhat crenulate along the margins, obtuse, somewhat rugose above, densely clothed with greyish - fulvescent tomentum concealing the wrinkles, sparsely hairy in the old leaves. Inflorescence cymose; cymes forming corymbose panicles; peduncles slender, densely greyish - brown hairy. Flowers 5 -merous, sometimes 4 -merous, pedicellate, bracteate,4 - 5 mm long, greyish - white tomentose, the flower buds congested to form globular woolly clusters, but becoming more lax after anthesis; pedicels 2 - 4 mm long, sometimes up to 6 mm in the terminal flowers, filiform, densely tomentose; bracts small, caducous, 1 - 2 mm long, lanceolate, tomentose on the back, glabrous inside. Calyx usually 5 -lobed, sometimes 4 -lobed, 1 - 2 mm long, densely covered with branched tomentum outside, glabrous inside; lobes subequal,

lanceolate, free to the middle of calyx, 0.5 - 1 mm long; tube ± as long as the lobes. Corolla white, subequally 5 -lobed, sometimes 4 -lobed, ± campanulate, 3 - 4 mm long; lobes spreading, elliptic - oblong, rounded at the apex, hairy outside, glabrous within, 1.5 - 2 mm long, almost as long as the tube, the anterior-lobe somewhat larger than the others; tube broader at the summit, narrowed towards the base, glabrous outside, sparsely hairy inside. Stamen 5, sometimes 4, exserted, inserted in the corolla-tube; filaments long, filiform, glabrous, longer than the corolla - lobes; anthers 2 -lobed, dorsifixed, brownish - black, ± orbicular in outline; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± elliptic - obovoid, 0.5 - 1 mm in diameter, densely white tomentose, glandular, 4 -locular, with 4 - ovules; style deeply 2 -branched to the middle, scarcely exserted, densely tomentose in the lower half, glabrous above; lobes filiform, nearly as long as the lower undivided part of the style, glabrous, with a few hairs near the base, stigmatic at the apex.

Specimens examined:-

WESTERN AUSTRALIA:- A.M.Ashby 753: Wubin, 18.IX.1963 (AD).- Cultivated by G.E.Lang from Wubin.-J.S.Beard 1990: 392 miles peg Carnarvon Hwy, 26.IX.1962 (PERTH).- J.S.Beard & F.Lullfitz 943: Wilroy, 4.XII.1962 (PERTH).- W.E.Blackall 4803: between Yuna and Dartmoor, N.E. of Geraldton, 19.IX.1940(PERTH).- H.F.M.Broadbent 1767:56 m. S.W. of Yalgoo, 13.X.1953 (BM,K).- G.E.Brockway 33: near Youanmi, -.X.1934 (PERTH).- G.E.Brockway s.n.: 28 miles N. of Ajana,-X.1947 (CANB,PERTH).- G.E.Brockway s.n.,CANB21646 & CANB 26647: Murchison District,-X.1947 (CANB , PERTH).- N.T.Burbidge 4695: 2 miles N. of Perenjori, 8.XII.1955 (CANB,PERTH).-A.C.Burns 69:300 mile post on Mullewa - Morawa road S. of Mullewa,22.IX.1968 (PERTH).- A.C.Burns 117: East of Yuna, N.E. of Geraldton, 19.XI. 1968 (PERTH).- W.H.Butler s.n.: Mt.Magnet, 2.X.1951 (PERTH).- W.H.Butler s.n.: Caron Water Reserve, -I.1964(PERTH).-W.D.Campbell 74: Irwin River district,-X.1907 (BM).- L.Diels & E.Pritzel 502: Northampton,-XI.1901 (PERTH).- J.Drummond s.n., MEL40849,MEL40851, MEL40854,MEL41230: loc.incert., -1851 (M,MEL isotypes).-J.Drummond s.n.,MEL40857: Murchison River,-1851 (MEL ? isotype).-Duncan 12: Greenough River, -1883 (MEL).- C.A.Gardner 2016: Ajana,Murchison River, 27.IX.1926 (PERTH).- C.A.Gardner 12014: near Yuna,24.X.1958 (PERTH).- C.A.Gardner s.n.: Northampton, -XII.1931 (PERTH).- C.A.Gardner s.n.: Canna Siding,-XI.1933 (BM,PERTH).-C.A.Gardner 7780:6 miles W. of Pindar, 10.X.1945 (PERTH).- C.A.Gardner 7783:

18 miles E. of Pindar, 10.X.1945 (PERTH).- C.A.Gardner s.n.: loc. incert.,-VIII.1963 (PERTH).- C.A.Gardner & W.E.Blackall s.n.: near Ajana, N. of Geraldton, -IX.1926 (PERTH).- R.Helms s.n., NSW106618 & NSW106619: Northampton,-X.1891 (NSW).-E.D.Hursthouse s.n.,NSW106620: Minginew,-X.1903 (NSW).- K.F.Kenneally 12: Dorre Island, Shark Bay,16.XII.1973 (PERTH).- M.Koch 1250 & 1301: Cowcowing,-IX.1904 (NSW,W).- M.Koch 1301: Jibberding,-X.1905 (MEL).- M.Koch 1301: Cowcowing,-X.1904 (K).- R.Latham 7: 40 km N.E.Morawa, -X.1964 (PERTH).- F.Lullfitz L1186: South of Pindar,2.X.1962(PERTH).- F.Lullfitz L3165: 218 $\frac{1}{2}$ mile post Wubin - Payne's Find Road, 19. XII.1963 (PERTH).- F.Lullfitz L4596: 266 mile post on Wilroy to Buntine Road, S.E. of Mullewa, 9.XII.1965 (PERTH).- P.Luff & P.Birrel s.n.,AD96416182: 10 miles from Three Springs on Eneabba Road, 7.X.1963 (AD).- J.H.Maiden s.n.,NSW106616 & NSW106617: Pindar, -.X.1909 (NSW).- J.H.Maiden v 19: Northampton, -.X.1909 (NSW).- J.H.Maiden v 20: Pindar,-.X.1909 (NSW).- Martin 32: Dirk Hartog Island, -.(MEL).- A.Morrison s.n.: Bowes, 1.XI.1903 (BM).- A.Morrison s.n.: State farm, Chapman River,1.XI.1903 (E,PERTH).- F.v.Mueller s.n.,MEL40858: north of the Arrowsmith River,-XI.1877 (MEL).- F.v.Mueller s.n.,SING044211: loc.incert.,-(SING).- F.v. Mueller s.n., MEL41229: Murchison River, -(MEL).- A.Oldfield a.n., Murchison River,-(K 2-spec. isotypes,MEL holotype of Pityrodia myriantha FvM.).- A.Oldfield s.n.,MEL41235: Port Gregory,-(MEL).- W.Parret 1637: 1 mile south of Wubin, 28.XI.1965 (UC).-M.E.Phillips s.n.,CBG027723: 4 miles inland from Kalbarri on Old Road,18.IX. 1968 (CBG).- Sanfood s.n.: loc.incert., S.W.Australia, 1839 (K).- G.Sewell s.n.,MEL40852: between the Rivers Murchison and Irwin, -(MEL).- J.Staer s.n.: Minginew,-X.1905 (E).- F.Stoward 128: Yandanooka, -1915 (BM).- D.J.E.Whibley 3126: ca. 8 km W. of Mullewa, 5.X.1969 (AD).- R.F.Thorne 24509: 20 miles S. of Mullewa, 14.IX. 1959 (AD).- ?Anon. s.n.: loc.incert.,-(M).

Distribution: (Map 4).

Endemic to south-western part of Western Australia. The known distribution is between 25 and 32 degrees south latitude and between 113 and 119 degrees east longitude. The main occurrence is to the north-north-east and south-south-east of Geraldton on either side of the Highways. To the north of Geraldton, it has been collected along the North West Coastal Highway near Northampton, Port Gregory, Ajana, Murchison River and a little farther. A few collections are made from near Kalbarri and also at Dirk Hartog Island and Darre Island. To the north-east of Geraldton it occurs along Chapman River, Greenough River, east of

Yuna and in the surroundings of Mullewa, Pindar and Mt.Magnet. South of Mullewa, it occurs near Wilroy, Canna, Perenjori, Caron, Wubin, Minginew, Three Springs and to the north of Arrowsmith River. Some scattered localities to the east and south-east of Geraldton are near Youanmi, Cowcowing and along Wubin - Payne's Find Road.

E c o l o g y:

According to Collectors' field notes, this species is a woody or semi - woody plant of up to 90 cm high. The common habitat is a sandy soil and the flower colour is often noted as white. Beard 1990 (PERTH), 392 mile peg Carnarvon Hwy. is annotated as "semi-woody plant, 2 ft.,fls.white, buds pinkish, scented". The habitat is shown "sand plain". Beard & Lullfitz 943 (PERTH), from Wilroy is noted "In red sand.Fls.White, 60 cm high". Blackall 4803 (PERTH), between Yuna and Dartmoor, N.E. of Geraldton, is recorded as "Shrub 1 metre, fls. white", Brockway 33 (PERTH), near Youanmi is collected from "sand plain country". Burbidge 4695 (PERTH), 2 miles N. of Perenjori is a "spreading shrub 2 - 3 feet" high, growing in "sandplain heath". Gardner 7780 (PERTH), 6 miles west of Pindar, was growing "in red sand". The plant is said to be "bushy, 2 ft. high ", with "fls. White". Gardner & Blackall s.n.(PERTH), near Ajana is annotated as "fls. white; on sandheaths". Lullfitz L1186 (PERTH), south of Pindar is described as " 18" tall; flat heads; white - tinged grey; fls. woolly"; the plant was growing in "red soil".

Flowering and fruiting seem to occur from September to December. This observation is quite in accordance to the Beard's records of "West Australian Plants" (1965,1970) and Blackall & Grieve's "Wildfls. of W.Aust.".(1965). Diels & Pritzel (1904)have noted "flor. m.Nov." i.e. flowering month November.

C o m m e n t s:

D.fulva is one of the three syntype species of Dicrastylis. Originally all three were doubtfully considered by the author "in between Verbenaceae and Cordiaceae".A few years later, C.Mueller (1859) placed them all under Phrymaceae. During the same year, F.v.Mueller (1859) described a conspecific collection (by A. Oldfield) from Murchison River as Pityrodia myriantha. However, he soon realized its relationship with D.fulva, and recorded his opinion: "Huic Affines Credo Dicrastylis fulvan et D.reticulatum J.Drumm.ex Harvey in Hook.Kew Misc.VII.56 & 57". In May, 1861, he again pointed out the resemblance of unequal corolla-lobes of

P.myriantha and D.fulva, and remarked that "Pithyrodia myriantha est hujus generis species, et forsan eadem ac Dicrastylis fulva (J.Dr.in Kew Misc.VII.56).Corolla satis inaequaliter lobatam bilabiatam vidi". (Fragm.2:168). Subsequently, in March, 1868, he recorded D.fulva and other known species of the genera Dicrastylis, Chloanthes and Pityrodia, but made no mention of P.myriantha. On the contrary, the type of P.myriantha, collected by Oldfield from Murchison River, was included with the type of D.fulva, and both were cited under the latter species. It is at this stage that Mueller recognized P.myriantha and D.fulva as conspecific and thus merged the former with D.fulva (Fragm.6:155). In 1870,Bentham recorded P.myriantha as a synonym of D.fulva and also recorded under the latter (name) all those specimens which Mueller noted in his Fragmenta under D.fulva.

The isotypes of Pityrodia myriantha FvM. at Herb.K.(2-spec) and another collection by A.Oldfield (at Herb.MEL41235) from Port Greogory are annotated as "Pityrodia myriantha F.v.Mueller var. eriantha F.v.Mueller". The varietal name (eriantha) is not known ever to have been published by Mueller.

The type of this species was collected by J.Drummond from the "Northern districts", Western Australia. This area is north of "Swan River Colony" from where Drummond made several collecting expeditions to the south and north. D.fulva was collected during his "long and interesting tour of eighteen months' duration, to the northward of the Swan River". The time of this lengthy tour is approximately from the middle of 1850 to the end of 1851. [Hook.J.Bot.Kew Misc.4 (1852) 188]. There is no information in the protologue nor on the herbarium labels of Drummond's collection regarding the date of collection, locality or collection number of this species. The locality indicated at the end of the original publication is "Northern districts", which could be any place to the north of "Swan River Colony" up to the Murchison River. However, it is clear, that during his "eighteen months lengthy tour" (1850-51), Drummond had "lately travelled from the Moore River to the Murchison (latitude 27 $\frac{1}{2}^{o}$ south), and taken several excursions to the east and west of Dandaragan" [Hook.J.Bot.kew Misc.5 (1853) 115]. In fact, the area to the north of Moore River up to Murchison River is the one where D.fulva is chiefly recorded. Among Drummond's collection of this species, the locality on one specimen is labelled "Murchison River" and all the rest are annotated "W.A." i.e. Western Australia . Therefore, the type locality is somewhere around the Murchison River, probably along the North West Coastal Highway where this species is now known to grow commonly.

The exact date of its collection could not be ascertained because all the specimens are without any date or collection number. However, it is certain that Drummond collected this species in the later half of 1851 when he "lately travelled from the Moore River to the Murchison". This was his "6th and final collection of 14 sets of 225 species each, to Hooker and subscribers, from Murchison River, Champion Bay and southwards to Dandragan."[Erickson (1969) 140 & 168]. On the bottom line of the label, sticking to the lectotype sheet, is written "F.Mueller 1869 (Com.5/69)". This information seems to have been added afterwards and should not be mistaken or confused with the actual collector (Drummond) or the date/year of collection (1851).

Blackall & Grieve (1965) have recorded the distribution of this species within Diel's Botanical districts "Austin" and "Irwin". Nearly the same is indicated by Beard (1965,1970) though he has followed the Botanical districts and provinces proposed by Gardner & Bennetts (1956). Both these records may be supplemented by adding the north-western part of the Coolgardie district, from where M.Koch made two collections of this species. The exact locality of his collection is "Cowcowing", between Lake Wallambin and Lake Cowcowing.

The place of Morrison's collection from "State farm,Chapman River" is not clear in the modern maps. This locality is about 40 miles N.E. of Geraldton, and should not be confused with the "Chapman River" in the Kimberley division, where this species is not known to occur. In most of the modern maps and atlases, only the Chapman River in Kimberley division is shown and the (old) small river of this name, located to the west-north-west of Greenough River (and north-east of Geraldton) is missing.

Relationship:

Closely akin to D.micrantha Munir in its cymes being arranged in corymbose panicles, leaves elliptic - oblong and stamems much exserted. However, it may be readily identified by its flowers being larger, 4- 5 mm long; calyx - tomentum longer; corolla tomentose only in the throat, the anterior lobe longer than the others and the ovary glandular - tomentose. D.fulva is also related to D.parvifolia which species likewise has corymbose inflorescence, ± large anterior corolla-lobe, exserted stamens and glandular - tomentose ovary, but the leaves in D.parvifolia are much smaller, congested and with recurved margins; calyx and corolla glandular outside amd corolla - throat more densely tomentose.

Dicrastylis fulva Drumm. ex Harv. forma angustifolia Munir, f.nov.

Forma a typo ob folia elliptico - angustata vel anguste oblonga supra atrocinereo - viridia infra viridi - cinerea margine manifeste crenata et tomentum breve distinguitur.

T y p u s: A.C.Burns 74: 300 mile peg on Mullewa - Morawa Road, S. of Morawa, Western Australia, 22.IX.1968 (PERTH holotype).

The form angustifolia differs from the type form in its leaves being narrowly elliptic - angustate, distinctly crenate along the margins, dark greyish - green above, greenish - grey beneath and shortly tomentose.

Specimens examined:

WESTERN AUSTRALIA:- A.C.Burns 74: 300 mile peg on Mullewa - Morawa Road, S. of Morawa, 22.IX.1968 (PERTH, type).- E.T.Bailey 1 - 9: between Morawa and Yalgoo,-1951 (PERTH).- R.Latham 45:loc. incert. probably near Morawa,-(PERTH).

Distribution: (Map 4).

This taxon is limited to the south-west of Western Australia. The main distribution is to the south of Morawa and between Morawa and Yalgoo. Both these localities are to the south-east of Geraldton.

Relationship:

f.angustifolia is closely related to the type form. For the distinctive characters see key to the species.

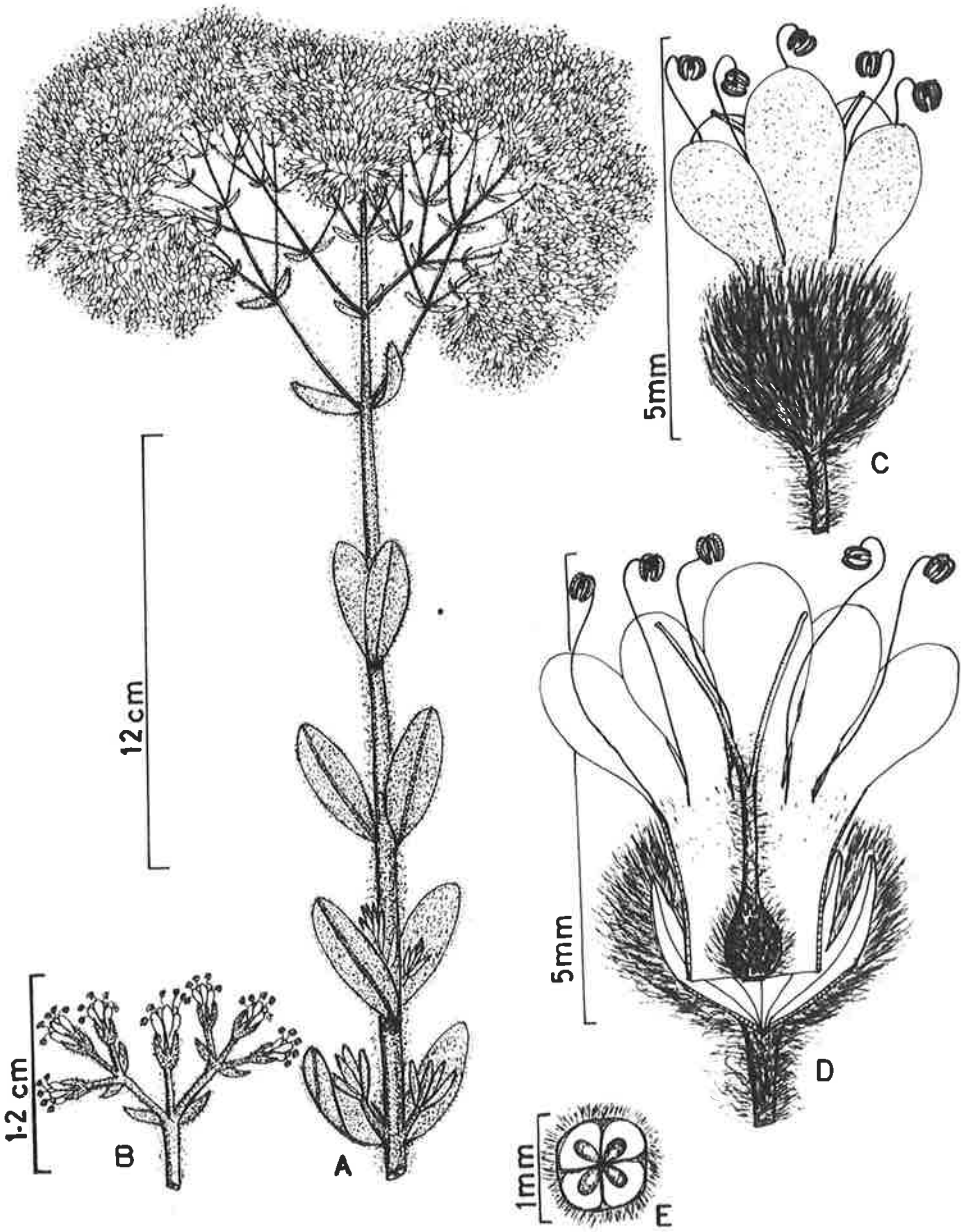


Fig. 11 — Dicrastylis fulva Drumm. ex Harv. (A.C. Burns 117: PERTH). A, flowering twig; B, cyme; C, flower; D, flower vertically cut open; E, T.S. ovary.

Dicrastylis incana Munir, sp. nov.

Frutex erectus tomentosus caule ramoso cylindrico in partibus superis tomentoso inferis puberuloso; folia decussata sessilia anguste lanceolata supra rugosa margine recurva; inflorescentia cymosa; cymae in paniculas corymbosas laxas fasciculatae; flores bracteati pedicellati pentameri tomentosi pedicellis filiformibus 2 - 4 mm longis; calyx extra tomento denso ramoso usque ad 1.6 mm longo intra glaber quinquelobus; corolla alba extra tomentosa subaequaliter quiqueloba tubo 1.5 - 2 mm longo intra parce tomentosa lobis plus minusve elliptico - obovatis; stamina 5 vix exserta ad faucem corollae inserta antheris dorsifixis plus minusve orbicularibus lobis anguste elliptico - oblongis in dimidio inferiore discretis; ovarium elliptico - ovoideum usque ad 1 mm diam. dense tomentosus; stylus vix exsertus dense tomentosus profunde bilobatus lobis glabris; fructus non visus.

T y p u s: M.E.Phillips CBG020641: 35 miles from Geraldton towards Mullewa, Western Australia, 30.IX.1962 (CBG holotype).

Description: (Fig. 12).

A grey tomentose shrub. Stem erect, branched, cylindrical, woody, densely clothed with a thick (? epidermal) grey covering, the lower leafless portion puberulus, the upper young leafy brnachlets densely covered with branched tomentum. Leaves sessile, decussate, somewhat scattered in the lower part, narrowly lanceolate, ± obtuse, deeply recurved along the margins, rugose above, 1.2 - 2.5 cm long, 2 - 4 mm broad, young leaves densely grey - tomentose, the old ones sparsely hairy above. Inflorescence cymose; cymes forming head-like loose clusters arranged into a corymbose panicle. Flowers 5-merous, occasionally 4 -merous, bracteate, pedicellate, 4 - 5 mm long; pedicels grey - tomentose, 2 - 4 mm long. Calyx 5-lobed, 2.5 - 3 mm long, densely tomentose outside, glabrous inside; lobes linear - lanceolate, ± equalling the corolla-tube, 1.5 - 2.5 mm long, ± 0.5 mm broad, almost free to the base; tube shallow, hardly 0.5 mm deep. Corolla white, unequally 5-lobed, occasionally 4-lobed (due to fusion of the two lobes), 3.5 - 4.5 mm long, shortly tomentose outside, sparsely hairy inside the tube and on the lower part of the lobes; lobes elliptic - obovate, 1.5 - 2 mm long, glabrous along the periphery outside and on the upper half inside, the three anterior lobes somewhat larger than the other two, sometimes one lobe larger than the other four; tube 1.5 - 2 mm long. Stamens 5, rarely 4, scarcely exserted, inserted in the corolla-throat; filaments somewhat thick

towards the base, not reaching the tip of corolla-lobes; anthers 2-lobed, dorsifixed, ± orbicular in outline; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - obovoid, ± 1 mm in diameter, densely tomentose, 4 - locular, with one ovule in each cell; style scarcely exserted, deeply 2-branched in the upper half, densely tomentose in the lower half; lobes (branches) ± porrect, glabrous, stigmatic at the end. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- M.E.Phillips CBG020641:35 miles from Geraldton towards Mullewa, 30.IX.1962 (CBG holotype).

Distribution: (Map 4).

D.incana is recorded from the west-south-west of Western Australia. The only known locality is between Geraldton and Mullewa along the Greenough River.

E c o l o g y:

Little is known about the ecology of this species. According to collector's field notes it is a "grey shrub with white flowers", occurring chiefly in "sand plain".

Flowering and fruiting seem to take place in the months from September to December.

C o m m e n t s:

Like a few other species of this genus, the corolla in D.incana is quite often unequally 5 -lobed, sometimes 4 -lobed due to the fusion of two lobes. In the latter case, one of the five stamen is also found reduced to a staminode.

Relationship:

D.incana is closely related to D.morrisonii in its leaves being deeply recurved along the margins, rugose above; cymes' (clusters) arranged into a corymbose panicle; corolla unequally lobed, sparsely hairy inside. However, it may be readily distinguished by its leaves being more narrowly lanceolate; cymes more congested; pedicels shorter (2 - 4 mm) and leafy bracts larger.

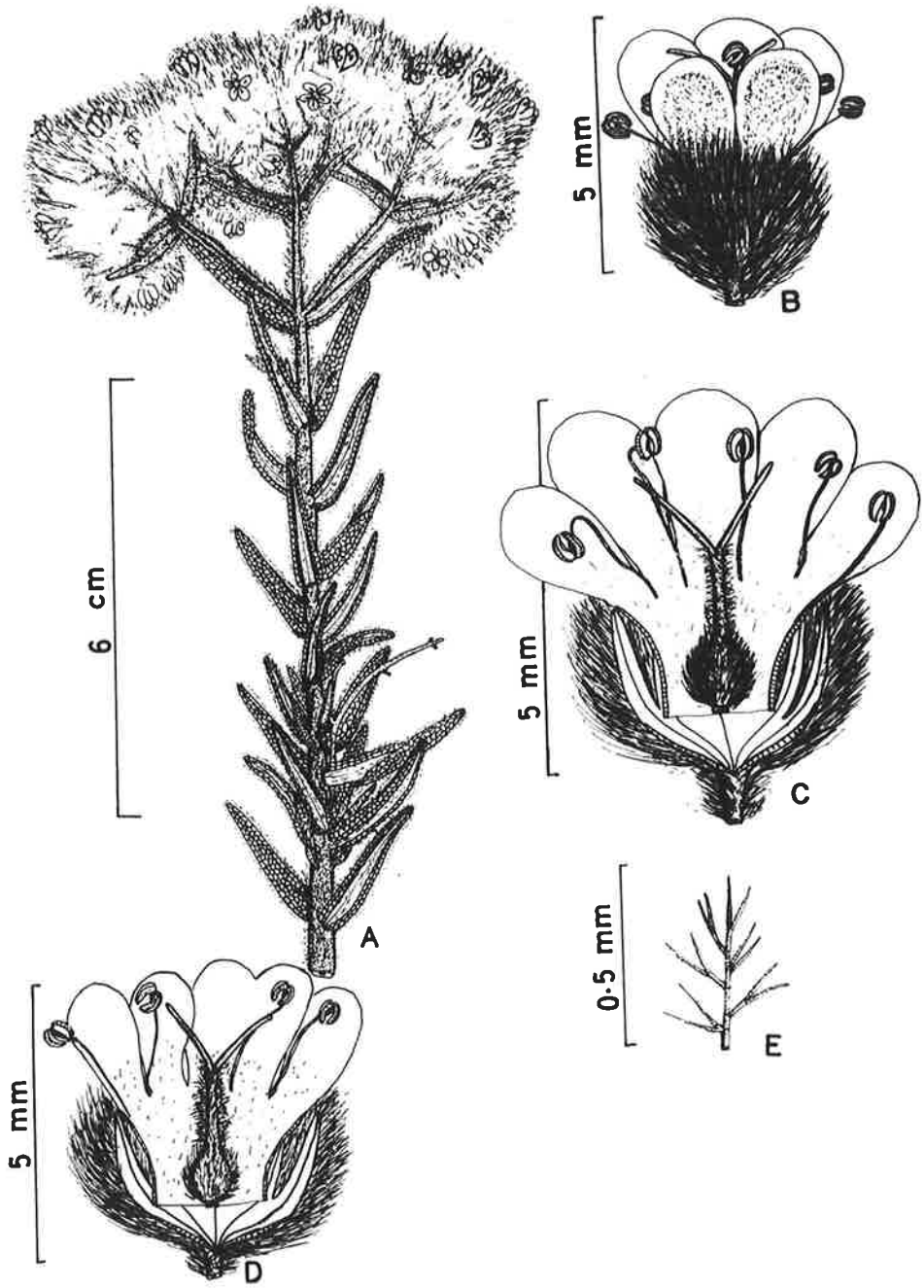


Fig. 12 — Dicrastylis incana Munir (M.E. Phillips 020641: CBG - holotype).

A, flowering branch; B, flower; C, flower longitudinally cut open; D, dissected flower with 5 sepals, 4 petals (by fusion of two) and 4 stamens; E, calyx tomentum.

Dicrastylis morrisonii Munir, sp. nov.

Frutex tomento cinereo caule ramoso lignoso lanato - tomentoso; folia decussata vel dispersa sessilia plus minusve oblonga obtusa 1 - 2.5 cm longa 0.2 - 0.6 cm lata supra rugosa infra lanato - tomentosa margine recurva; cymae pedunculares perlanatae in paniculas corymbosas laxas fasciculatae; flores bracteati pedicellati pentameri tomentosi pedicellis pergracilibus tomentosis 4 - 8 mm longis; calyx extra dense cinereo - tomentosus pilis usque ad 2.5 mm longis intra glaber quinquelobus tubo brevissimo lobis lineari - lanceolatis base tenus fere discretis; corolla alba extra tomentosa ad faucem parce tomentosa subaequaliter quinqueloba tubo lobos aequanti lobis elliptico - oblongis ad apicem rotundatis lobo antico alios majore; stamina 5 exserta ad faucem corollae inserta filamentis filiformibus glabris antheris plus minusve orbicularibus nigris lobis antherae anguste elliptico - oblongis in dimidio inferiore discretis divergentibus; ovarium elliptico - ovoideum plus minusve 1 mm diam. dense tomentosum quadriloculare quadriovulatum; stylus vix exsertus dense tomentosus profunde bilobatus; fructus non visus.

T y p u s: A.Morrison s.n.: State Farm, Upper Chapman River, north -east of Geraldton, Western Australia, 5.XI.1903 (PERTH holotype).

Description: (Fig. 13).

A tomentose shrub; branchlets cylindrical, woody, densely clothed with branched grey tomentum. Leaves decussate or somewhat scattered, sessile, oblong, sometimes oblong - lanceolate, ±obtuse, with deeply recurved margins, rugose and sparsely hairy above, densely woolly - tomentose beneath, 1 - 2.5 cm long, 0.2 - 0.6 cm broad. Inflorescence cymose, woolly - tomentose; cymes forming a ± lax corymbose panicle. Flowers 5 -merous, bracteate, pedicellate, white woolly - tomentose, 4 - 5 mm long; pedicels up to 8 mm long, slender, densely covered with long grey tomentum. Calyx 5 -lobed, densely greyish - tomentose outside, glabrous inside, 1.5 - 2.5 mm long; lobes linear - lanceolate, 1 - 2 mm long, almost free to the base; tube shallow, hardly 0.5 mm long; tomentum up to 2.5 mm long. Corolla unequally 5 -lobed, whitish - grey tomentum outside, sparsely hairy inside 3 - 4 mm long; lobes elliptic - oblong, rounded at the apex, 1.5 - 2.5 mm long, sparsely hairy inside, glabrous along the periphery outside, the anterior lobes somewhat larger than the others; tube almost as long as the lobes, glabrous near the base outside. Stamens 5, exserted, inserted at the base of corolla - lobes; filaments long, filiform, glabrous;

anthers 2-lobed, dorsifixed, ± rounded in outline; lobes narrowly elliptic - oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± elliptic - ovoid, about 1 mm in diameter, 4 - locular, with one ovule in each cell, densely white tomentose; style scarcely exserted, deeply 2-branched, densely tomentose below and in the lower half of the lobes (branches); branches glabrous in the upper half, stigmatic at the tip. Fruit not seen.

Specimens examined:

The holotype is the only available specimen for examination.

Distribution: (Map 4).

The only known locality is about 60 km north-east of Geraldton in Western Australia.

E c o l o g y:

Nothing is known about the ecology of this species, but it seems to occur in the winter rainfall eremean area. The most likely flowering period is from October to December.

C o m m e n t:

The pedicels and the calyx - tomentum of the flowers of D.morrisonii are among the longest known in the genus, measuring up to 8 mm and 2.5 mm respectively.

Relationship:

D.morrisonii is closely related to D.incana in its leaves being rugose above, recurved along the margins; cymes arranged in corymbose panicle; corolla unequally lobed, sparsely hairy inside. However, it may be easily distinguished by its leaves being ± oblong, obtuse; inflorescence comparatively lax; flowers with longer pedicel (up to 8 mm) and flower - bracts smaller, linear. The leaves in D.incana are narrowly lanceolate;inflorescence somewhat congested; flower pedicels 2 - 4 mm long and bracts large, leafy.

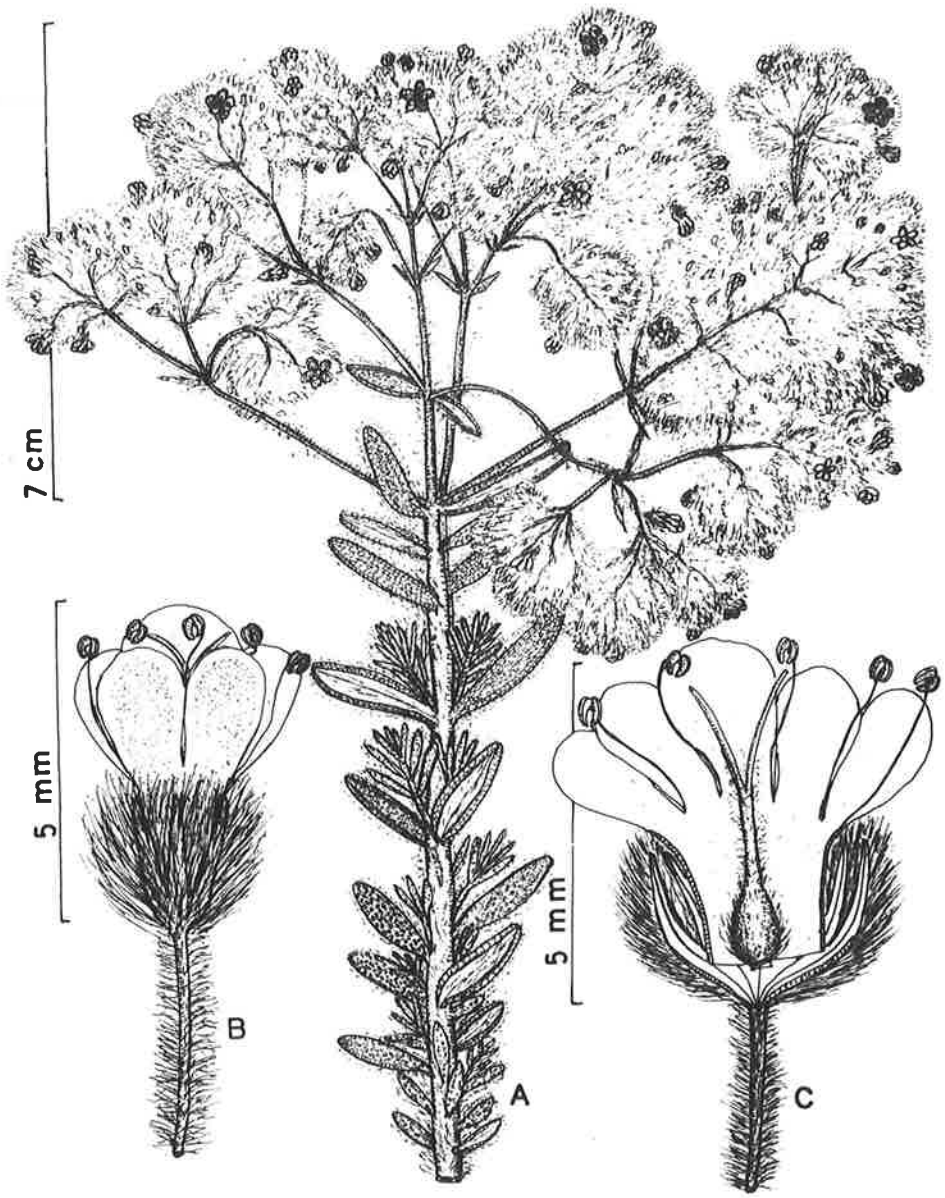


Fig. 13 — Dicrastylis morrisonii Munir (A. Morrison s.n.: PERTH - holotype).

A, flowering branch; B, flower; C, flower vertically cut open.

Sectio 3. Corymbosae Munir, sect.nov.

Cymae pedunculatae confertissimae in fasciculas subglobosas plus minusve confertas corymbose dispositae.

T y p u s: Dicrastylis corymbosa (Endl.) Munir.

Cymes pedunculate, much congested, forming a ± compact subglobose [head-like] cluster; cluster (head) corymbosely arranged.

Dicrastylis nicholasii F.v.Mueller, Fragm.10 (1876) 15;F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; F.v.Mueller & R.Tate,Trans.R.Soc.S.Aust.16 (1896) 375;L.Diels & E.Pritzel, Bot.Jahrb.Syst.35 (1904) 497; C.A.Gardner,Enum.Pl. Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278; J.S.Beard, W.Aust.Pl.(1965) 92; J.S.Beard, W.Aust.Pl.ed. 2,(1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc.1,(1971) 346,476.

T y p u s: J.Young s.n.,MEL40890: "Ad fontes eremi Victoria Springs", Western Australia, ___(MEL holotype).

Description: (Fig. 14).

A greyish - tomentose (probably small) shrub. Stem erect, branched, cylindrical, woody, densely clothed with greyish -woolly branched tomentum. Leaves sessile, decussate, sometimes ±verticillate, linear - oblong or very narrowly elliptic - oblong, 0.5 - 1.2 cm long, 2 - 4 mm broad, rugose, with shortly recurved margins, densely covered with greyish - woolly tomentum concealing the rugose surface. Inflorescence terminal, cymose; cymes capitate, pedunculate, many - flowered; heads 0.6 - 1 cm in diameter, bracteate, greyish - woolly tomentose, each 7 - flowered, subtended by 2 - bracts and 4 - bracteoles; peduncle very slender,1.5 - 2.2(-2.5) cm long, purplish - violet, sparsely covered with branched tomentum; bracts elliptic - lanceolate, 3.5 - 5 mm long, glabrous inside, densely woolly - tomentose outside; bracteoles ± lanceolate, 2 - 3 mm long,glabrous inside, tomentose outside. Flowers 5 -merous, sessile, bracteate,5 - 6 mm long, regular, greyish - tomentose. Calyx 5 -lobed, 3 - 4 mm long, densely tomentose outside, glabrous inside; lobes lanceolate, almost free to the base, 2.5 - 3 mm long, ± 1 mm broad at the base; tube shallow, 0.5 - 1 mm deep. Corolla "deep blue", tubular, equally 5 -lobed at the apex, 4 - 5.5 mm long; lobes ± oblong, short, 1 - 1.5 mm long, densely tomentose outside, sparsely so on the inner faces; tube ± cylindrical, almost equalling the calyx, 3 - 4 mm long, sparsely short - tomentose outside, densely long - tomentose within, glabrous near the base on both the surfaces. Stamens 5, scarcely exserted, inserted in the corolla-throat; filaments short, glabrous;free part as long as the corolla - lobes,1 - 1.5 mm long; anthers dorsifixed, 2 -lobed, yellowish, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary globose, ± 1 mm in diameter, densely white - tomentose, 4 -locular, with one ovule in each cell; style long, exserted, deeply 2 -branched,4 - 6 mm long, densely tomentose; lobes fili-

-form, 2 - 2.5 mm long, tomentose in the lower three fourths, glabrous towards the apex, stigmatic at the tip.

Specimens examined:-

WESTERN AUSTRALIA:- R.Helms s.n.: Elder Explo.Exped.,Camp 57, Victoria Desert, 20.IX.1891 (AD,MEL).- R.Helms s.n.,AD97205186: Elder Expl.Exped.,Camp 58, 21.IX.1891 (AD).- J.Young s.n., MEL 40890: Queen Victoria Springs, -(MEL holotype)

Distribution: (Map 5).

D.nicholasii is known from the Eremean Province of Western Australia. It is recorded from near Queen Victoria Springs and at Camp 57 of the Elder Exploring Expedition. Queen Victoria Springs is ca. 125 miles N.E. of Kalgoorlie, and the site of camp 57 is ca. 35 miles farther in the same direction. Both the localities come under Gardner & Bennett s' (1956) Botanical district "Eucla", and Diel's (1906) Botanical district "Coolgardie".

E c o l o g y:

Due to limited collections and lack of collectors' field information, little is known about the ecology of this species. However, from the known localities of its occurrence, it appears to grow in dry places of more or less sandy habitat. The plant is a greyish - tomentose small shrub with "Blue" flowers.

Flowering and fruiting seem to occur mostly from October to December.

C o m m e n t s:

This is one of the rare species of this genus as it has not been re - discovered since 1891. The second and last collection was made from ca. 35 miles N.E. of the type locality, by R.Helms, during September, 1891.

Beard (1965,1970) has recorded the distribution of this species in "Ord district, Northern Province", where it is not known to exist. In fact, no species of Dicrastylis except D.exsuccosa (= D.ochrotricha FvM.)has so far been collected from as far north as "Ord district".

In the protologue, the lower leaves are described as " $\frac{2}{3}$ - 1" " long, corolla "deep blue" and the "flowering peduncles often alternate". Actually, the maximum leaf - length in the type itself and in all the other specimens examined is not more than 1.2 cm. Colour of its corolla seems "blue", though it has completely faded in the dried specimen. Beard (1965,1970) has noted

the flower colour as "yellow", which is most unlikely in this species. As an editor of "West Australian Plants", he has clearly indicated in the "Editor's Preface", that the information recorded "was obtained from collector's labels on specimens preserved in the West Australian Herbarium". However, among the specimens examined, there is not found even a single such specimen of D.nicholasii in Herb. PERTH. It therefore appears that the collector may have misidentified some yellow - flowered species of this genus with D.nicholasii and the same was compiled by Beard. This view is now strengthened by a recent communication from the Curator of Herb.PERTH, who has mentioned in his letter (no. 632/71, dated 28th Sept.,1971) to the acting Keeper of Herb. AD that "for some time there has been a collection of a plant referred variously to D.gilesii and D.ochrotricha and currently placed in the folder with D.nicholasii in this Herbarium". Further, he says that "it is possible that the inflormation regarding D.nicholasii was taken from this specimen" [by Beard (1965,1970].

As described in the protologue, the flowering peduncles (of the cymes) in the type specimen are distinctly alternate, but in Helm's collection from Victoria Desert, they are often 3 - 4 arising from a single node.

Relationship:

D.nicholasii is closely related to D.lewellinii in its leaves being sessile, linear - oblong, greyish - tomentose, with recurved margins and cymes (fls.) congested into heads or subglobose clusters. However, it can be easily distinguished by its leaves being shorter in length; flower - clusters smaller (measuring 5 - 6 mm in diameter); peduncle very slender, purplish - violet; flowers mostly 5 -merous; stamens scarcely exserted. Flower - clusters in D.lewellinii are 0.7 - 1.5 cm in diameter; peduncle greyish - tomentose; flowers mostly 4 -merous; stamens much exserted.

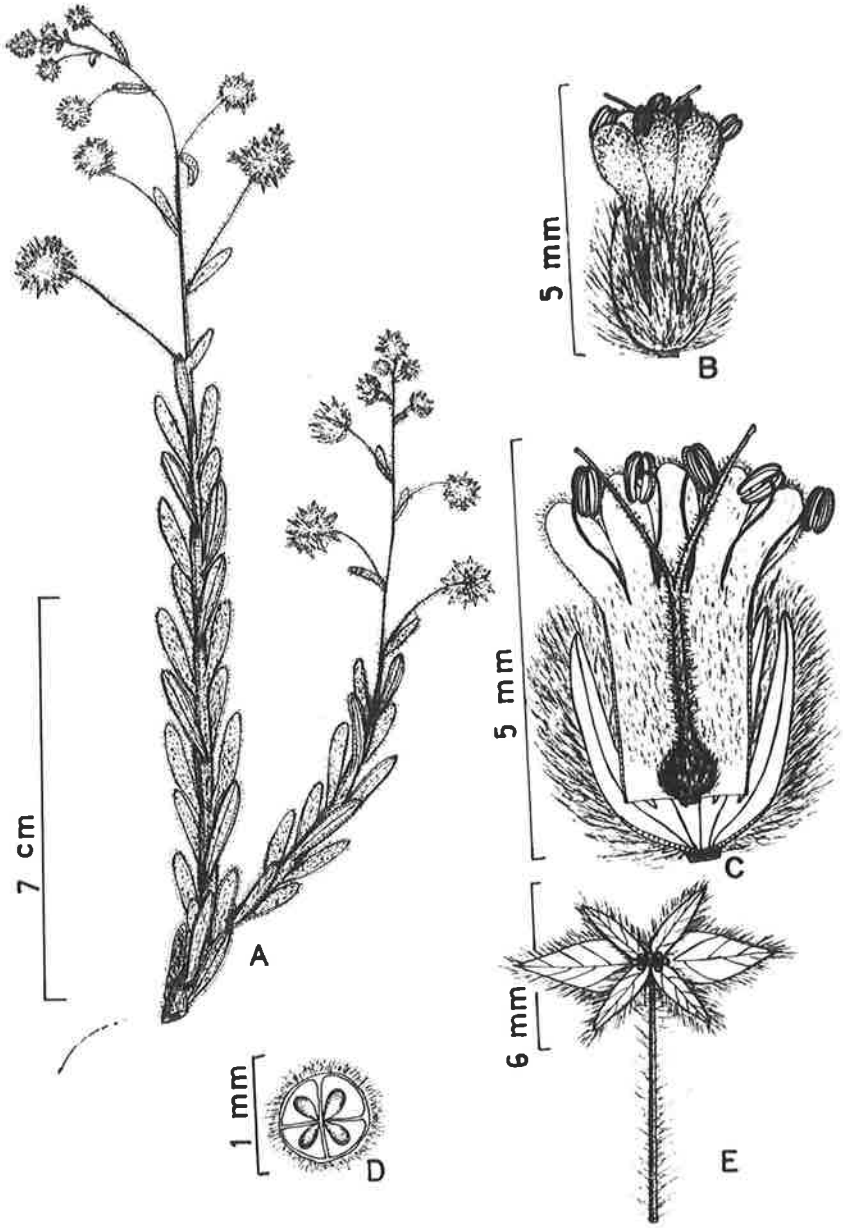


Fig. 14 — Dicrastylis nicholasii F.v.M. (Young s.n., MEL 40890: MEL - holotype).

A, flowering twig; B, flower; C, flower vertically cut open; D, T.S. ovary; E, bracts and bracteoles of a cyme.

Dicrastylis reticulata J.Drummond ex W.H.Harvey in Hook.,J.Bot. Kew Misc.7 (1855) 57; C.Mueller, Walp.Ann.Bot.Syst.5 (1859) 703; F.v.Mueller, Fragm.6 (1868) 155; G.Bentham, F.Aust.5 (1870) 43; F.v.Mueller, Fragm.9 (1875) 4 ; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; J.Briquet in Engl. & Prantl, Pflanzenfam.IV, 3a (1895) 164, in obs.; L.Diels & E. Pritzel, Bot.Jahrb.Syst. 35 (1904) 498,499; C.A.Gardner, Enum.Pl. Aust.Occ.3 (1931) 111; G.Chippendale, Trans.R.Soc.S.Aust. 81 (1958) 40; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278; J.S.Beard, W.Aust.Pl.(1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 562; J.S.Beard, W.Aust.Pl.ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 346,475,476.

T y p u s: J.Drummond 4th Coll. no.94: loc.incert.,"Northern districts",Western Australia,-? "1848" (K holotype; CGE,E,G,K,KW, MEL,NSW,P,W).

Description: (Fig. 15).

Shrub of 60 - 120(-150) cm high, densely clothed with branched tomentum. Stem erect, branched, cylindrical, woody, densely clothed with greyish - fulvescent tomentum, sometimes with purplish tomentum in the distal part. Leaves sessile, decussate, sometimes ± verticillate on the old stem, ovate to oblong - ovate, 0.8 - 2 cm long, 0.3 - 1 cm broad, rugose and pubescent above, reticulate and hoary - tomentose beneath, (the hairs not dense enough to conceal the rugae or the reticulation), obtuse, crenate, papyraceous when old, the margins often revolute in young leaves, sometimes the basal part of the fully mature leaves recurved. Inflorescence cymose; cymes congested into subglobose woolly heads, mostly 13 - 15 flowered, sometimes less; heads greyish - fulvescent tomentose, bracteate, 1 - 2.5 cm in diameter, several together in terminal corymbs or solitary on the lateral branches, each with two large bracts at the base; bracts sessile, broadly elliptic-ovate, obtuse, 0.6 - 1 cm long, 0.5 - 0.7 cm broad, ± papyraceous when dry, reticulate, sparsely glandular and tomentose outside, glabrous inside; bracteoles subsessile, narrowly elliptic - ovate, 5 - 8 mm long, 2 - 4 mm broad, somewhat papyraceous when dry, reticulate, sparsely glandular and tomentose outside, glabrous inside. Flowers 5(-6)-merous, shortly pedicellate, 5 - 6 mm long, greyish - tomentose; pedicels ± 1 mm long, greyish - tomentose. Calyx 5 -lobed, sometimes 6 -lobed, 2.5 - 3.5 mm long, densely clothed with branched tomentum outside, glabrous inside; lobes oblong, almost free to the base, 2 - 2.7 mm long, 0.6 - 0.8 mm broad at the base; tube shallow, 0.5 - 0.7 mm deep. Corolla white,

spreading, tubular, equally 5 -lobed towards the apex, sometimes 6 -lobed, 4.5 - 5 mm long; lobes ± elliptic, somewhat narrowed towards the apex, 1.3 - 1.6 mm long, nearly as broad, sparsely hairy outside and towards the base within; tube 3.2 — 3.4 mm long, narrow at the base, gradually broader towards the apex, glabrous outside, sparsely tomentose inside. Stamens 5, sometimes 6, exserted, inserted in the corolla throat; filaments long, filiform, glabrous, free part longer than the corolla-lobes; anthers 2-lobed, dorsifixed, ± orbicular in outline, yellowish - brown; lobes oblong, somewhat recurved, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - oblong, 1 - 1.5 mm long, 0.6 - 0.7 mm in diameter, densely tomentose, minutely glandular, 4 -celled, with one ovule in each cell; style long, exserted, deeply 2 -branched towards the apex, 4 - 4.5 mm long, densely tomentose on the lower undivided part; lobes 2 - 2.5 mm long, filiform. glabrous, often recurved, stigmatic at the apex.

Specimens examined:

WESTERN AUSTRALIA:- W.E.Blackall s.n.: near Narembeen, -IX. 1929 (PERTH).- W.E.Blackall 3940: between Kalannie and Pithara, 14.IX.1938 (PERTH).- E.Cronin s.n.,MEL40921: Coolgardie, near Lake Lefroy, -1893 (MEL).- E.Cronin s.n.,MEL40971: source of the Blackwood River, -1893 (MEL).- J.Drummond 94, 4th Coll.: loc.incert. Northern districts,- ?"1848" (K-holotype;CGE,E,G,K,KW,MEL,NSW,P, W — isotypes).- M.Eaton s.n.,MEL40923: eastern sources of Swan River, - 1888 (MEL).- C.A.Gardner 8501: Yorkrakine Hill, N. of Tammin, 3.X.1946 (PERTH).- C.A.Gardner 9483: Granite Hill, 4 m. E. from Kumminin South, 19.X.1949 (PERTH).- A.S.George 9197: Yorkrakine Rock, N. of Tammin, 12.IX.1967 (PERTH).- J.H.Gregory s.n.: Northam, -1901 (K,PERTH).- E.H.Ising s.n.,AD966080969: Wubin, Avon District, 12.IX.1925 (AD).- Leake s.n.: Kellerberrin, -1901 (BM,PERTH).- F.Lullfitz L1738: east of Pingelly, 20.XI.1962 (PERTH).- K.Newbey 1569: Mount Stirling, 20.XI.1964 (PERTH).- G.Sewell s.n., MEL40925: Mt.Caroline near Mt.Stirling,-1889 (MEL).- J.S.Wells s.n.,MEL40926: Boxvale 50 miles E. of York,-(MEL).- M.Ybeal s.n., MEL40922: York, 19.X.1889 (MEL).

Distribution: (Map 5).

D.reticulata is known from the south-western part of Western Australia. The main distribution is between 30 and 34 degrees south latitude and between 116 and 122 degrees east longitude. Most of the localities are to the east-south-east and north-east of Perth, and along the Great Eastern Highway. Localities along

the Highway are mostly between the eastern source of Swan River and Lake Lefroy. To the east it also occurs between York and South Kumminin and to the south-east the distribution extends to the source of Blackwood River. A few localities to the north-east of Perth are chiefly between Pithara and Kalannie.

Blackall & Grieve (1965) have recorded the distribution within Diel's botanical districts Avon, Coolgardie and Irwin. Similarly, Beard (1965,1971) has restricted this species to Gardner & Bennett's (1956) botanical districts Avon and Coolgardie only. Both the above records may be supplemented by including with them the Stirling district, which represents the southern - most locality near the source of the Blackwood River.

E c o l o g y:

Little information is available in this respect. According to collector's field notes, this species is a small branched shrub of up to 4 feet in height, growing in granite rocky soil. The flowers are said to be "white". Gardner 8501 and 9843 (PERTH), from N. of Tammin and E. of South Kumminin respectively are annotated "fls. white - among granite rocks". George 9197 (PERTH), Yorkrakine Rock, N. of Tammin is recorded a "much - branched shrub to 1.5 metres, corolla white - at base of granite rock". Lullfitz L1738 (PERTH) east of Pingelly is noted as " 4 ft. shrub, white heads, white stems". The habitat is "granite rocks with K.sericea". Newbey 1569 (PERTH), from Mt. Stirling is reported as " 2 ft. 6 ins. high in granite soil". According to Beard (1965), the plant is a "compact shrub 6", fl. white"- the habitat is noted as "sand heath", which is quite different from the records of others.

The flowering and fruiting seem to take place from September to December. This observation is quite in accordance with the records of Blackall & Grieve (1965) and Beard (1965,1970). Diels & Pritzel (1904) have restricted the flowering period to December, they state "flor. m. Dec."

C o m m e n t s:

The type of D.reticulata (Drummond's 4th Coll.no.94) is the second known collection of Dicrastylis, the first collection (by Roe s.n.) being the holotype of D.corymbosa (Endl.)Munir. Drummond 's 4th collection was gathered late in 1846 or early 1847 from the south-west of Western Australia. It belongs to his 4th collection of 400 " sp. " from "King George Sound, Stirling Range, Porongorups, Mt.Manypeaks, Cape Riche and West Mt.Barren, and from N. and E, of Moore R." [Erickson (1969) 112 - 117, 168]. The author has not

indicated a definite type locality in the protologue, but has simply noted "Hab. Northern district (n.94)", which means, some locality to the north of Swan River Colony, and "n.94" stands for collection number 94 of the 4th collection. Of Drummond's collecting localities named above, D.reticulata is not known to occur in any one of those to the south of Swan River Colony. Therefore, it is most likely that the type specimen was collected from the "Northern districts", (probably) east of Moore River where this species is now known to grow commonly.

The date of collection noted with the holotype and some of the isotypes is "1848", apparently recorded sometime after the actual year of collection. The date (year only) written on the holotype sheet is being maintained here with the type citation, but the actual date of collection is probably late 1846 or early 1847.

The corymbosely arranged subglobose flower - heads surrounded by distinct foliose bracts and bracteoles is a prominent character of this species.

Relationship:

D.reticulata is closely related to D.corymbosa in its cymes being congested into subglobose woolly heads; heads corymbosely arranged; stamens much exserted. However, it may be easily distinguished by its stem and leaves being fulvescent - tomentose;leaves ovate or oblong - ovate, crenate, distinctly reticulate beneath; heads larger, up to 2.5 cm in diameter, distinctly bracteate , greyish - fulvescent tomentose. The stem. leaves and flower -heads in D.corymbosa are white woolly.

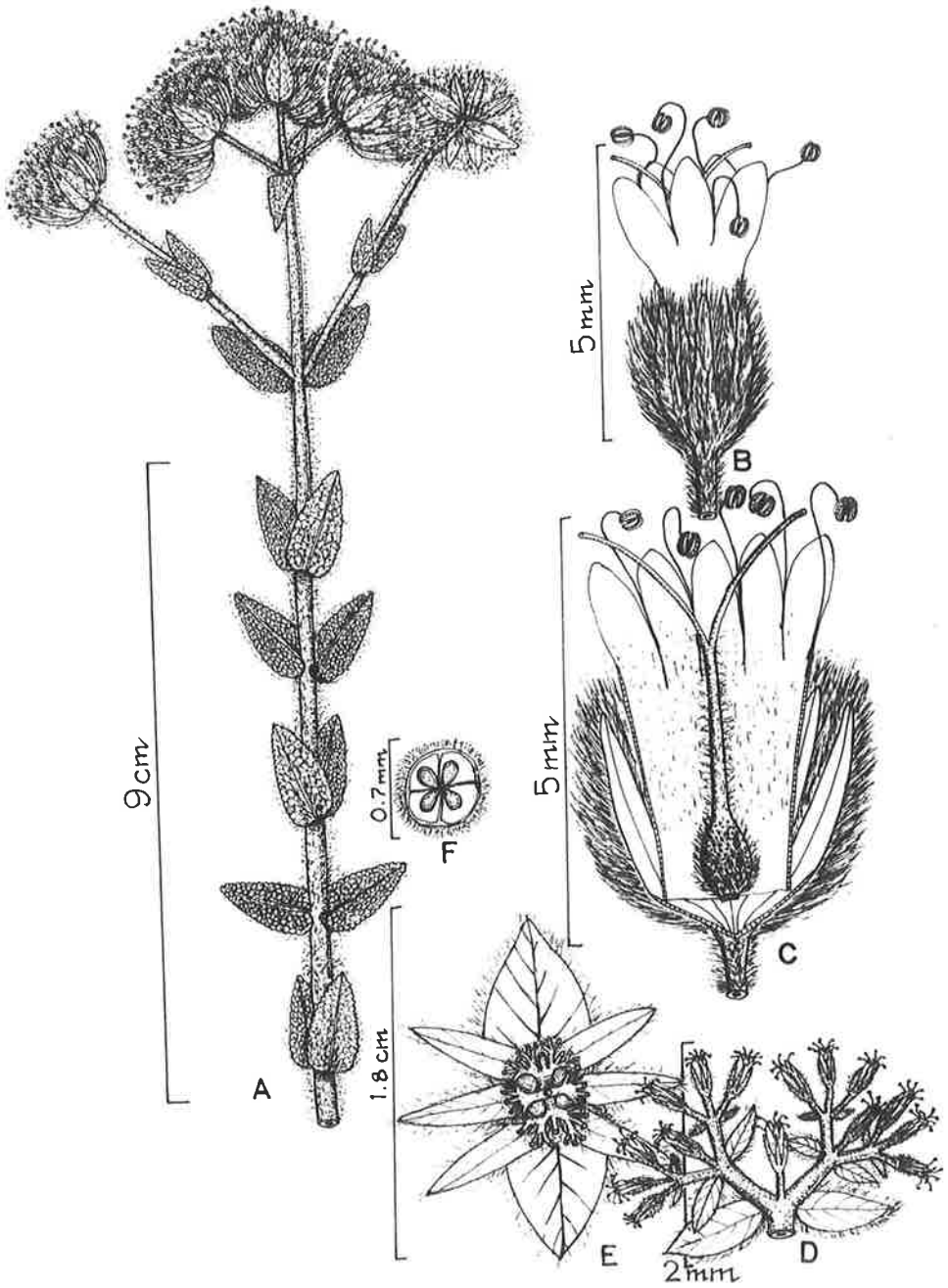


Fig. 15 — Dicrastylis reticulata Drumm. ex Harv. (J. Drummond 4th Coll. no. 94: K - holotype).

A, flowering twig; B, flower; C, flower vertically cut open; D, cyme; E, bracts and bracteoles viewed from above, the flowers having been removed.

Dicrastylis velutina Munir, sp. nov.

Frutex usque ad 60 cm altus tomento albo - lanato caule ramoso cylindrico; folia decussata sessilia anguste triangulari - ovata plus minusve oblonga 0.7 - 1.5(2) cm longa 2.5 - 6(8) mm lata supra rugosa dense lanata margine crenata recurva vel revoluta; cymae in fasciculos corymbosos subglobosos 1 - 2(2.5) cm diam. dispositae pedunculis crassis non foliatis bracteatis 1 - 3(4) cm longis tomentosis; flores bracteati pedicellati pentameri interdum tetrameri extra tomentosi intra glabri in fasciculos subglobosos lanatos conferti pedicellis brevibus plus minusve 1 mm longis bracteis minutis supra glabris infra tomentosis; calyx extra tomento albo - lanato intra glaber quinquelobus interdum quadrilobus tubo brevissimo lobis lineari - oblongis 1.5 - 2 mm longis base tenus fere discretis; corolla alba inaequaliter quinqueloba interdum quadriloba tubo plus minusve cylindrico extra glabro intra parce tomentoso; stamina 5 interdum 4 exserta ad faucem corollae inserta filamentis filiformibus planis glabris antheris dorsifixis brunneo - luteis lobis antherae oblongis in dimidio inferiore discretis divergentibus; ovarium elliptico - ovoideum plus minusve 1 mm diam. dense tomentosum; stylus exsertus dense tomentosus profunde bilobatus lobis filiformibus glabris; fructus non visus.

T y p u s: A.M.Ashby 1363: from Bindi Bindi, ca. 155 km north-north-east of Perth, Western Australia, 18.XI.1964 (AD holotype).

N o t e: By mere typographic error, the name of this species happened to appear in the legend of its accompanying distribution map as "D.velunina". The proposed specific epithet is velutina which is correctly spelled here.

Description: (Figs. 16 and 17).

A white woolly - tomentose shrub of up to 60 cm tall. Stem erect, branched, cylindrical, woody, densely clothed with the same tomentum with sometimes a thick basal covering of short brown hairs. Leaves sessile, decussate, narrowly triangular - ovate, sometimes ± oblong, rugose above, crenate and revolute along the margins, (0.3-)0.7 - 1.5(-2) cm long, (1-)2.5 - 6(-8) mm broad, densely white - woolly all over. Inflorescence of corymbosely arranged dense white - woolly cymose heads; heads subglobose, pedunculate many - flowered, each (0.8-)1 - 2(-2.5) cm in diameter, subtended by 3 pairs of bracts, supported by 2 more leafy - bracts at the base; bracts opposite, sessile, elliptic - ovate, 4 - 6 mm long, 1.5 - 3 mm broad, densely tomentose outside, almost glabrous inside; peduncles long, non - leafy, 1 - 3(-4) cm long, very densely

tomentose. Flowers 5 -merous, sometimes 4 -merous, bracteate, pedicellate, 4 - 5 mm long; pedicels short, ± 1 mm long, tomentose; bracts minute, tomentose outside, glabrous inside. Calyx 5 -lobed, sometimes 4 -lobed, 2 - 2.5 mm long, densely covered with white - woolly tomentum outside, glabrous inside; lobes linear - oblong, almost free to the base, 1.5 - 2 mm long, ± 0.5 mm broad; tube shallow, hardly 0.5 mm deep. Corolla white, tubular, unequally 5-lobed towards the apex, sometimes 4 -lobed ± 4 mm long; (the anterior lobe somewhat longer in the 5 -lobed corolla); lobes ovate-oblong, obtuse, glandular and densely tomentose on the outside, usually glabrous inside, sometimes with a few scattered hairs on the inner face, ± 1 mm long; tube ± cylindrical, somewhat broader towards the apex, glabrous outside, sparsely tomentose inside, ± 3 mm long. Stamens 5, sometimes 4, exserted, inserted in the corolla throat; filaments somewhat flattened, filiform, glabrous, slightly longer than the corolla-lobes, 1 - 1.5 mm long; anthers 2 -lobed, dorsifixed, ± orbicular in outline, brownish - yellow, 0.5 - 0.7 mm long; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - ovoid, about 1 mm in diameter, densely tomentose, intially 4 -locular with one ovule in each cell, but becoming 2 -locular with 2 -ovules in each cell when mature; style long, exserted, deeply 2 -brnached in the upper half, 3.5 - 4 mm long, densely tomentose on the undivided lower part; lobes glabrous, filiform, more or less equalling the lower undivided part, stigmatic at the tip.

Specimens examined:

WESTERN AUSTRALIA:- T.E.H.Aplin 607: 103 mile peg, Great Eastern Highway, 2.II.1960 (PERTH).- A.M.Ashby 783: Wyola, ca. 145 km east-northeast of Perth, 21.XI.1963 (AD).- A.M.Ashby 1363:Bindi Bindi, ca. 155 km north-north-east of Perth, 18.XI.1964 (AD holotype).- C.A.Gardner s.n.:Yorkrakine, N. of Tammin and S. of Wyalkatchem, -XII.1921 (PERTH).- C.A.Gardner s.n.:Wongan Hills, -XII. 1924 (PERTH).- F.W.Humphreys s.n.:174.7 miles from Perth on road between Dumbleyung and Lake Grace, 14.XI.1965 (PERTH).- K.Newbey 1025: 1 mile east of Lake Grace, 12.X.1963 (PERTH).

Distribution: (Map 5).

This species is recorded from the south-western part of Western Australia, It occurs between 30.27 and 33.25 degrees south latitude, and between 116.22 and 118.25 degrees east longitude. The southern localities are near Lake Grace, and the northern ones towards Wongan Hills and Bindi Bindi. Along the Great Eastern

Highway, there are collections from near Wyola and Tammin. The other known occurrence is between Tammin and Wyalkatchem.

E c o l o g y:

Little is known about the ecology of this species but it seems to grow in a temperate climate of pronounced winter rainfall areas receiving little or no summer rains. The habitat seems to be both gravel - loam and sandy - loam. According to Newbey 1025 (PERTH), from 1 mile east of Lake Grace, it is a "1 feet tall shrub, growing in gravel - loam" soil. Gardner s.n. (PERTH), from Wongan Hills, is recorded as "erect spreading 9 - 18 inches high, flowers white". The habitat is noted as "Sand - heath".

The flowering and fruiting apparently occurs chiefly from October to January.

C o m m e n t s:

The available collections of this species have shown a continuous graded variation in plant height and in various other characters. These variations are found to coincide with the distribution pattern (including climatic conditions) from south to northwards. No significant difference is found in the number of flower-parts, but a continuous graded variation is observed in the size of plant, colour and length of indumentum hairs, size of leaves, length of peduncles and diameter of flower-heads. The following table shows this range of variation examined in different collections of this species.

Locality	Height of Plant	Indumentum on stem
Southern-most collections from around Lake Grace	up to 22.5(-30) cm	Short, dense, greyish - white
Intermediate collections from along the Great Eastern Hwy.	22.5 - 30(-35) cm	Long, dense, white - woolly
Sub-intermediate collections from (N. of the Great E.Hwy.) from Wongan Hills and Yorkrakine.	22.5 - 45 cm	Long, dense, greyish - woolly, with thick basal covering of light brownish short hairs.
Northernmost collections from Bindi Bindi	35 - 60 cm	Long, dense, greyish - woolly, with thick basal covering of deep brown short hairs

Size of leaves	Length of peduncles	Diameter of flower-head	Vestiture on corolla-lobes
3 - 7 mm x 1 - 2 mm	1 - 1.3 cm	0.8 - 1.3 cm	Densely tomentose and glandular outside, glabrous inside.
5 - 12mm x 2 - 4 mm	1 - 2 cm	1 - 1.5(-2)cm	Densely tomentose and glandular outside, glabrous inside.
5 - 14mm x 2 - 5 mm	1 - 3 cm	1.5 - 2 cm	Densely tomentose and glandular outside, glabrous inside.
12- 20mm x 6 - 8 mm	2 - 4.5 cm	1.5 - 2 cm	Same as above but sparsely hairy on the inside too.

Relationship:

Allied closely to D.corymbosa in having sessile leaves with revolute margins, corymbosely arranged white - woolly globose flower - heads and stamens and style exserted, but can be easily distinguished by tis leaves being somewhat triangular - ovate; peduncles distinct, longer and non - leafy and the anterior corolla - lobe slightly larger than the others.

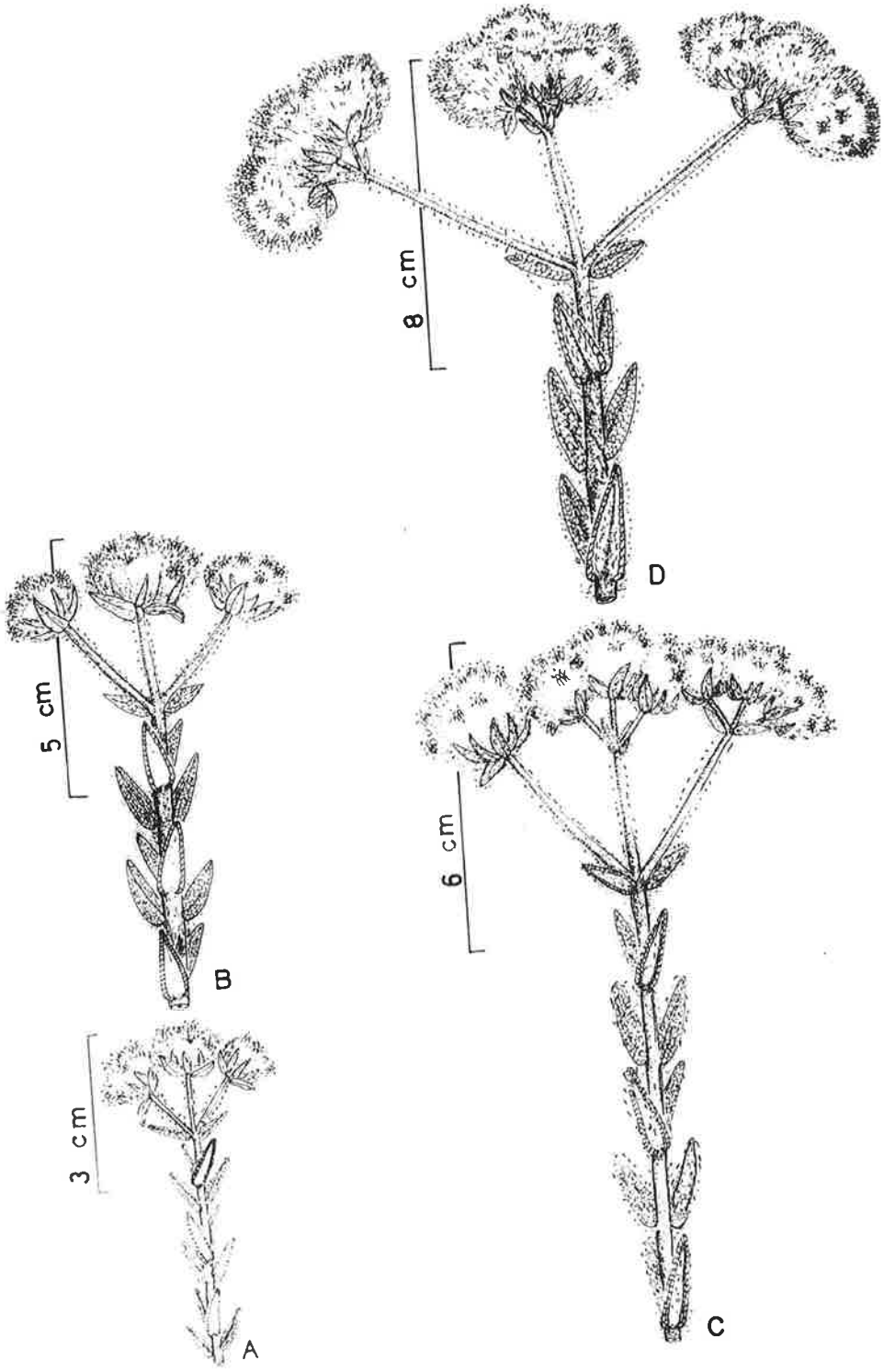


Fig. 16 — Dicrastylis velutina Munir (A, F.W. Humphreys s.n.: PERTH; B, A.M. Ashby 783: AD; C, C.A. Gardner s.n.: PERTH; D, A.M. Ashby 1363: AD - holotype).

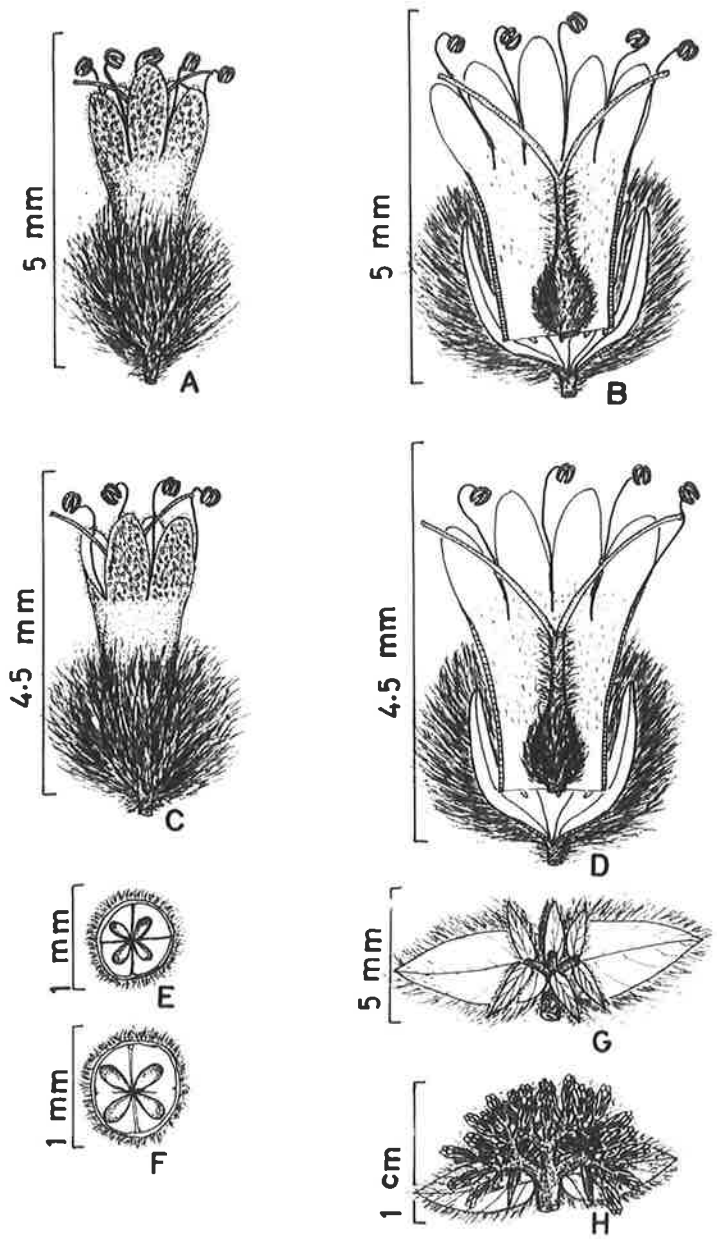


Fig. 17 — Dicrastylis velutina Munir (A.M. Ashby 1363: AD - holotype). A, 5-merous flower; B, 5-merous flower vertically cut open; C, 4-merous flower; D, 4-merous flower vertically cut open; E, T.S. young ovary; F, T.S. mature ovary; G, bracts and bracteoles of a cyme, the flowers being removed; H, cyme.

Dicrastylis corymbosa (Endl.) Munir, comb. nov.

Mallophora corymbosa S.L.Endlicher, Ann.Wien.Mus 2 (1838) 207 - Basionym; S.L.Endlicher & E.Fenzl, Nov.Stirp.Dec.no.8 (1839) 65; D.N.F.Dietrich, Synop.Pl.3 (1843) 612; W.G.Walp.,Rep.Bot.Syst. 4 (1845) 72; J.C.Schauer in DC.,Prod.11 (1847) 530; F.v.Mueller, Fragm.6 (1868) 154; H.N.Moldenke, Résumé Verbenac.etc.(1959) 209; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 347.

T y p u s:Roé s.n.: "Novae Hollandiae austro occidentalis interioribus", - (W,holotype).

Dicrastylis stoechas J.Drummond ex W.H.Harvey in Hooker, J.Bot.Kew Misc.7 (1855) 57; C.Mueller in Walp.,Ann.Bot.Syst.5 (1859) 703; F.v.Mueller, Fragm.6 (1868) 155; G.Bentham, Fl.Aust.5 (1870) 44; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Sec.Cens.Aust. Pl.1 (1889) 172; J.Briquet in Engl. & Prantl,Pflanzenfam.IV, 3a (1895) 164, in obs.; J.Briquet, Soc.Physiq.Hist.Natur.Geneve, 32 (2), no.8 (1896) 76; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35(1904) 499, fig.55 - J; L.Diels, Pflanzenwelt.W.Aust.(1906) 279, fig. 65 -J; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278; J.S.Beard, W.Aust.Pl.(1965)92; W.E.Balckall & B.J.Grieve, W.Aust.Wildfls.3 (1965) 562; J.S.Beard, W.Aust.Pl.ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 346,475,476 ——— syn. nov.

T y p u s:J.Drummond 5th Coll.Suppl. no.95; "Northern districts", Western Australia, -? 1847 (K holotype; BM.CGE,E,G,KW,LE,MEL,NSW, P,W).

D.thomasiae S.Moore, J.Linn.Soc.Bot. 45 (1920) 209; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208; H.N.Moldenke, Fifht Summary Verbenac.etc.1 (1971) 346 ——————————— syn. nov.

T y p u s: Miss Thomas s.n.: loc.incert., - (BM holotype).

Description: (Fig. 18).

A much - branched undershrub, 15 - 45 cm high, diffuse, with the appearance of some species of Filago or Gnaphalium, densely clothed with branched woolly tomentum. Stem much branched, cylindrical, woody, white - woolly tomentose. Leaves sessile, decussate, sometimes ± verticillate, oblong, obtuse, with revolute margins, 0.5 - 1.5 cm long, 0.2 - 0.5 cm broad, thick, soft, densely covered

with woolly tomentum, the rugose surface concealed under the white wool. Inflorescence ± corymbose, of dense terminal white woolly cymose heads; heads subglobose, many flowers (normally 15 - flowered each), 1 - 1.5(-2.5) cm in diameter, subtended by small opposite leafy bracts; bracts sessile, oblong - ovate, 6 - 7 mm long, 2.5 - 3 mm broad, densely white woolly outside, glabrous or sparsely tomentose inside. Flowers 5 -merous, pedicellate, bracteate, 4.5 - 5 mm long; pedicels short, 1 - 1.5 mm long, tomentose; bracts minute, tomentose outside, glabrous inside. Calyx 5 -lobed, 2.5 - 3 mm long, sparsely glandular and densely woolly tomentose outside, glabrous inside; lobes oblong, almost free to the base, 2 - 2.5 mm long, ± 0.5 mm broad; tube very shallow, ± 0.5 mm deep. Corolla white, tubular, equally 5 -lobed towards the apex, 4 - 4.5 mm long; lobes oblong, narrowed towards the apex, 1 - 1.5 mm long, glandular and densely tomentose outside, almost glabrous or very sparsely hairy inside; tube ± cylindrical 3 - 4 mm long, glabrous outside, sparsely short tomentose in throat. Stamens 5, exserted, inserted in the corolla throat; filaments filiform, glabrous, 1.5 - 1.7 mm long; anthers 2 -lobed, dorsifixed, ± orbicular in outline, 0.3- 0.4 mm across, brownish-yellow; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± elliptical, 1.5 - 2 mm long, ± 1 mm in diameter, glandular and densely tomentose, initially 4 - locular, 4 - ovuled, but in fully mature ovary only one ovule is seen in a large single cell, the 3 remaining cells gradually obliterate and their ovules shrink; style long, exserted, deeply 2 - branched, 3 - 4.5 mm long, sparsely glandular and tomentose on the undivided lower part; lobes sub - equal, filiform, glabrous, recurved, almost equalling the lower undivided part of the style or slightly shorter, stigmatic at the tip.

Specimens examined:-

WESTERN AUSTRALIA:- A.Adams s.n.,MEL40936: Mangowine, -1889 (MEL).- E.T.Bailey 671: Muntadgin, -IX.1945 (CANB,PERTH).- E.T. Bailey 232: ? Muntadgin.-(CANB).- W.E.Blackall 860: near Campion, 3.X.1931 (PERTH).- W.E.Blackall 3807: 46 miles N. of Wubin, 6.IX. 1938 (PERTH).- A.Crawford 69: between Victoria Springs and W. extr. of Great Bight, -1887 (MEL).- J.Cronin s.n.,MEL40970: Coolgardie, - 1894 (MEL).- J.Cronin s.n.,MEL40928: source of the Blackwood River, -1893 (MEL).- W.Dawkins s.n.: Badjaling, -XI. 1922 (PERTH).- J.Drummond 95, 5th Coll.Suppl.: loc.incert., "Northern districts," [various dates, see obs.] (K- holotype; BM, CGE,E.G,KW,LE,MEL,NSW,P,W - isotypes of D.stoechas Drumm.ex Harv.).-

J.Drummond s.n.,MEL40929 & MEL40933: loc.incert.,-? 1849 (MEL ? probably isotypes of D.stoechas).- A.Eaton s.n.,MEL40928: eastern source of the Swan River, - 1889 (MEL).- W.V.Fitzgerald s.n., NSW106627, SING055212: Cunderdin, -XI.1903 (NSW,SING).- W.V. Fitzgerald s.n.,NSW106628: Cunderdin, -XI.1907 (NSW).- H.J.Forrest s.n.,MEL40937: loc.incert., -1890 (MEL).- C.A.Gardner s.n.: Bendering,-XI.1920 (PERTH).- C.A.Gardner 1760: Carrabin, 6.X.1922 (PERTH).- C.A.Gardner 2769: Campion, 29.IX.1931 (PERTH).- A.S. George 6063: 27 miles E. of Hyden, 1.VII.1964 (PERTH).- M.Heal s.n., MEL40935: loc.incert.,-1890 (MEL).- F.Lullfitz L3835: 47 miles east of Hyden, 24.XI.1964 (PERTH).- J.H.Maiden v.8.,NSW106629: Tammin,-IX.1909 (NSW).- F.v.Mueller s.n.: Upper Blackwood River, - (M).- Roë s.n.: loc.incert., -(W).- A.A.Munir 5254 & 5256: 25 km north of Kondinin, 6.IX.1973 (AD).- A.Rogers for J.G.O.Tepper 4 , MEL40932: Nilgarn Goldfields, -1891 (MEL).- J.Staer s.n.: Cunderdin,-X.1905 (E,UC).- Miss Thomas s.n.: loc.incert.-(BM holotype of D.thomasiae S.Moore).

Distribution: (Map 5).

This species is known from the south-western part of Western Australia. At present it is restricted between 29 and 33 degrees south latitude and between 116 and 124 degrees east longitude. It is found mainly along the Great Eastern Highway between Northam and Coolgardie. To the south of this Highway, it occurs especially around Kundinin and Hyden, but it has been recorded from as far south as the sources of the Blackwood River. To the north of the Highway it is chiefly between Wubin and Payne's Find (near Lake Monger), and near Lake Brown to the north of Merredin. Elsewhere, it has been collected from north of Coolgardie near Nilgarn Goldfield (now abandoned) and to the south-east of Queen Victoria Springs towards the Great Australian Bight.

All the above localities come under Gardner & Bennett's (1956) botanical districts Stirling,Avon, Coolgardie and Austin. The distribution of this species shown by Blackall & Grieve (1965) and Beard (1965,1970) may be supplemented by the above information, because the former have restricted its distribution to Coolgardie District only while the latter has not included the Stirling district.

E c o l o g y:

This species occurs mainly in the winter rainfall (temperate) region, but few collections have come from the border areas of the dry eremean zone. According to collectors' field notes, the common

habiat is andy soil. Blackall 860 (PERTH), from near Campion, is annotated as "Compact shrub, 6 ins. high, fls. white, in white woolly head". Blackall 3807 (PERTH), 46 miles N. of Wubin is noted as "1 foot high shrub with white flowers". Fitzgerald s.n. (SING, NSW), from Cunderdin, is recorded as "lax erect habit, 2 ft. high; infl. white." Gardner s.n. (PERTH), near Bendering, is annotated as "small much - branched shrub". The habitat is "Yellow sand heath!" Gardner 2769 (PERTH), near Campion, is noted as "Shrub ± diffuse; flrs. white; habitat yellow sand". Lullfitz L3835 (PERTH), from 47 miles east of Hyden is described as " 9" - 18" herb, white flowers".

The present writer has seen it growing along the roadside in much - disturbed sandy - gravelly soil. Other plants commonly associated with it are Acacia, Casuarina, Grevillea and Pityrodia loricata shrubs. The plant itself is a greyish - woolly undershrub resembling certain species of Gnaphalium. Young flower - heads (buds) are purplish - grey but becoming white - woolly when fully mature.

The flowering and fruiting seem to take place from October to December. According to Blackall & Grieve (1965), the flowering period of this species lasts from September to December. Beard (1965,1970) has recorded the flowering months "9 - 2" i.e. September to February, but Diels & Pritzel (1904) has restricted the flowering period to November only.

C o m m e n t s:

Dicrastylis stoechas is one of the three syntypes of its genus, described in the year 1855. Prior to this, Endlicher (1838) based his new genus Mallophora on Roe's two different collections from the interior of Western Australia. These were regarded as two distinct (syntype) species of his new genus, M.globiflora Endl. and M.corymbosa Endl. [Ann.Wien.Mus.2 (1838) 206 - 207]. During present investigations, Mallophora corymbosa Endl. has been found to be conspecific with Dicrastylis stoechas Drumm. ex Harv., therefore, they have been amalgamated under one name. Since M.corymbosa Endl. (1838) was published earlier than D.stoechas Drumm. ex Harv. (1855), in accordance with the rule of priority, a new combination is made for the old specific epithet corymbosa which is here transferred to Dicrastylis. This change to D.corymbosa (Endl.) Munir, results in the well known name D.stoechas Drumm. ex Harv. being reduced to synonymy; the less known name of M.corymbosa Endl. also becomes a synonym.

After examining the holotype of D.thomasiae S.Moore, this species is also found conspecific with D.corymbosa (Endl.) Munir

(=D.stoechas Drumm. ex Harv.) and is thus reduced here as a synonym under the latter. The type of S.Moore's species was collected by Miss Thomas from some unknown locality in Western Australia, and consists of a small portion of an inflorescence branch with only three pairs of leaves. The author distinguished it as a new species mainly on the basis of its somewhat "larger indumentum, flat, oblong leaves and densely headed flowers". In fact, the leaves have recurved margins similar to D.corymbosa (=D.stoechas) and the indumentum and dense flower - heads are in no way different from the latter species. The confusion seems to have occurred due to insufficient type material (of D.thomasiae) and apparently the author's inability to check or compare it with the type and other material of D.stoechas at Herb. BM.CGE,E,G,K, KW,LE,MEL,NSW,P and W.

The type of D.stoechas is Drummond's second collection of Dicrastylis, gathered from "Mullean" during late 1847 or early 1848, as a supplement to his 5th collection for Hooker and subscribers [Erickson (1969) 118 -22, 168]. On the holotype sheet of D.stoechas, the year of collection is written "1850", but the same information noted with its isotypes in herb. E,NSW and P is "1849". Moreover, the year on one isotype sheet in Herb. G is written "1848" and the others in Herb. BM,CGE,KW,MEL and W are without any date or year of collection. It seems, that the date of this collection was probably recorded subsequent to the actual date of collection, and is therefore different and probably incorrect. However, since all these specimens belong to Drummond's 5th collection supplement, and bear the same collection number "95", therefore they undoubtedly belong to one and the same gathering.

The type of D.stoechas is recorded to have come from the "Northern districts", which locality may be to the north of Swan River Colony from where Drummond made several collecting expeditions to the north and south. In order to find out the exact type locality of D.stoechas, the following information may be of some help. The type is noted to have come from Drummond's 5th collection, collected from "Mullean". The latter probably refers to the whole group of vast granite rocks in the vicinity of Mt. Caroline and Mt.Stirling, which is known to the natives as "Mullean" This name was probably introduced to Drummond by his native companion who accompanied him during his 5th collecting expedition (Erickson, 1969). As D.stoechas is well represented around Mt. Caroline and is not known to occur near the south - coast or Stirling Range, it appears that the type of this taxon was most probably collected from the vicinity of Mt.Caroline or Mt.Stirling.

Moreover, it seems that Drummond's concept of "Northern districts" does not necessarily mean any locality to the north of the Swan River Colony, but apparently he used the term "Northern districts" for all three syntype species of this genus collected from north and south of the Swan River Colony.

It has been observed, that some collections of this species, preserved in Herb.MEL, show confusion regarding their collectors. For instance, one of the four twigs on the isotype sheet of D.stoechas (MEL40930) bears a field note "C" and the other one is with number "95". They are all conspecific, but the former appears to have been collected from a different plant by Drummond, and does not belong to the isotype. Similarly, Miss Adam's Collection no.MEL40936, consists of four small pieces of the same plant, but the date and locality on the field note and herbarium label are different. The herbarium label is annotated "Mangowine, W.A. 1891", but the field note, written in same handwriting, reads "Interior of Western Australia 1889". Since the year of collection and localities do not correspond, it appears that the field notes belongs to some other sheet and is stuck here wrongly, or that two different collections have been indiscriminately mounted on the same sheet. Another such confusion is observed in MEL40928 where four consoecific specimens are mounted (separately) in the four corners of one herbarium sheet. The two in the top and one in the lower right hand corner are without root, and appear to have been collected from the same plant, but the one in the lower left hand corner is with its root and does not belong to the other three. The herbarium label here is annotated "E. source of Swan River 1889 Miss Alice Eaton" and the field note pasted on top of it, in different handwriting, reads "source of the Blackwood River W.Aust. 1893 Miss Cronin". It is obvious therefore, that this herbarium sheet is a mixture of two different collections by different collectors. It is not possible, however, to give an indication as to which of these two collections belong to whom.

As described by Bentham (1870), the ovary in the type specimen of D.stoechas is apparently single - celled with one ovule, but this is only in the very advanced stage of development. In the many flowers examined from different collections, it has been observed that the ovary in the flower bud is 4 - celled with four ovules, but at anthesis and onwards two of the four cells gradually obliterate and their ovules shrink. On the contrary, the two other cells simultaneously enlarge and their ovules increase in size. At this stage, the ovary appears to be 2 - celled with one ovule in each. At infructescence stage, however, the cell wall separating

the two enlarged cells often disintegrates to give an aspect of a single - celled ovary with two lateral ovules. Sometimes, even one of the two ovules also shrivels leaving only one ovule to form a single seed in a unilocular fruit. (see fig. 18).

The tomentum on the style is much longer than the tomentum on the ovary.

Relationship:

This species is closely allied to D.glauca in its leaves being sessile, oblong, with recurved margins; flower - heads white - woolly tomentose, ± corymbosely arranged, mostly sessile or with very short peduncles (i.e. main central axis below the flowers); corolla - lobes glandular and tomentose outside. However, D.corymbosa may be easily identified by its stem and leaves being very densely white - woolly tomentose, the leaf surface (rugae) concealed by the dense woolly tomentum and the corolla - lobes equal. The anterior corolla - lobe in D.glauca is somewhat larger than the rest.

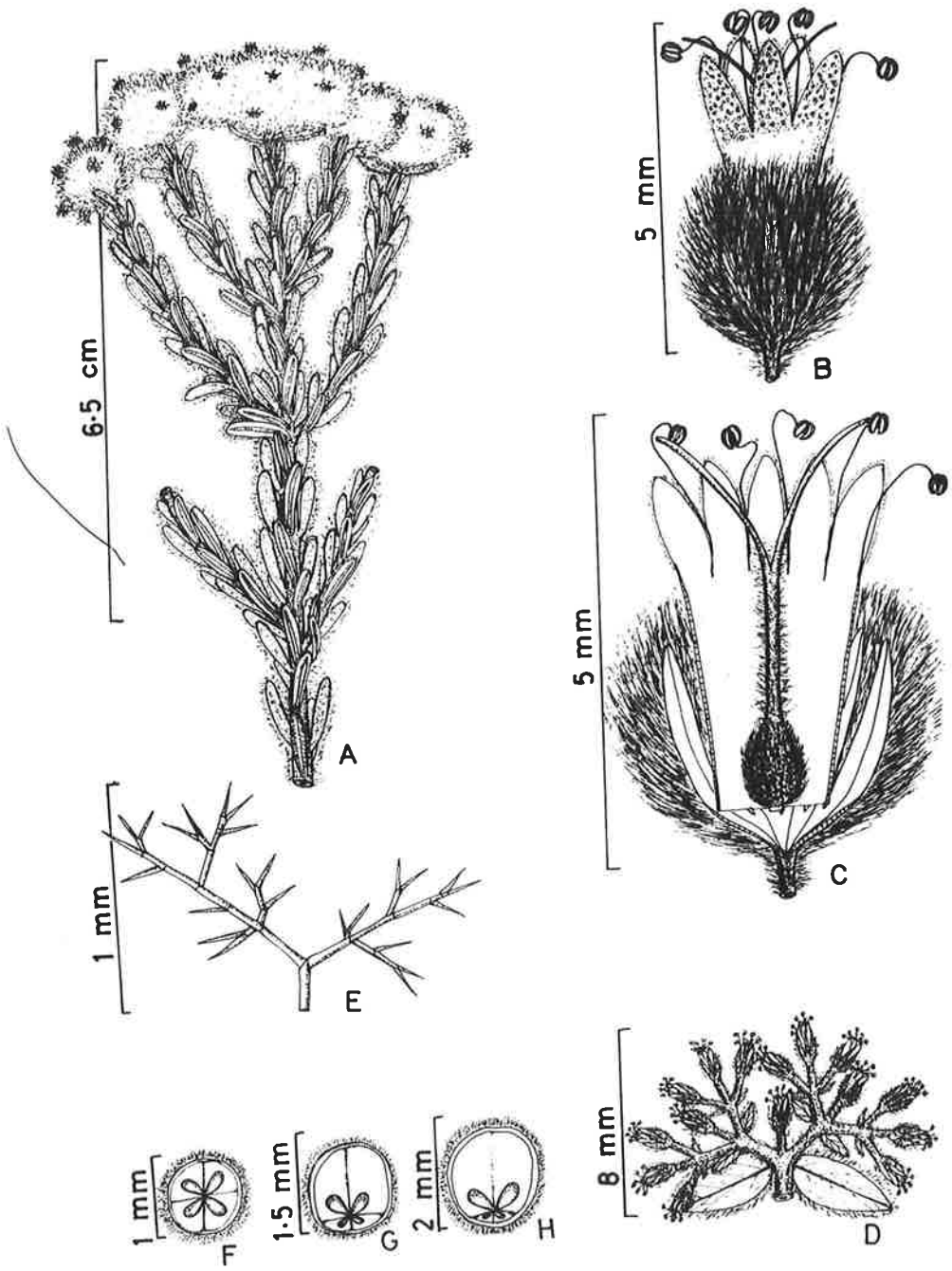


Fig. 18 — Dicrastylis corymbosa (Endl.) Munir (J. Drummond 5th Coll. Suppl. no. 95; G - isotype).

A, flowering twig; B, flower; C, flower longitudinally cut open; D, cyme; E, calyx tomentum; F, T.S. of ovary from bud; G, T.S. of young ovary; H, T.S. mature ovary.

Dicrastylis glauca Munir, sp. nov.

Suffrutex 11 - 30 cm altus caule multum ramoso cylindrico glauco; folia decussata sessilia oblonga 0.4 - 1(1.5) cm longa 1 - 3(4) mm lata glauca supra manifeste rugosa margine recurva infra costis manifestis; cymae in fasciculos albo - lanatos confertim dispositae fasciculis corymbosis globosis 0.5 - 1 cm diam.; flores bracteati pedicellati conferti plerumque pentameri raro tetrameri pedicellis plus minusve 1 mm longis bracteis minutis; calyx extra albo - lanatus intra glaber quinquelobus raro quadrilobus tubo usque ad 0.5 mm longo lobis oblongis base tenus fere discretis; corolla alba tubularis saepe quinqueloba raro quadriloba tubo intra parce tomentoso lobo antico alios majore lobis extra glandularis intra glabris; stamina 5 raro 4 exserta; ovarium plus minusve ellipticum ca. 1 mm diam. dense glandulosum; stylus exsertus dense tomentosus profunde bilobatus lobis glabris; fructus non visus.

T y p u s: C.A.Gardner s.n.: sandy places, Newdegate, Western Australia, -XII.1926 (PERTH holotype).

Description: (Fig. 19).

Erect sub-shrub, 11 to 30 cm tall, with the appearance of D.corymbosa but very much less hairy. Stem branched, cylindrical, woody, glaucous. Leaves sessile, decussate, oblong, obtuse, with revolute margins, 0.4 - 1(-1.5) cm long, 1 - 3(-4) mm broad, glaucous, distinctly rugose above and at the margins, midrib distinct on the under - surface. Inflorescence of dense, terminal, white - woolly cymose heads; heads ± corymbose, globose, sessile or very shortly pedunculate, many - flowered, 0.5 - 1 cm in diameter, each subtended by two leafy bracts; bracts opposite, sessile, elliptic - oblong, 3 - 6 mm long, 1.5 - 2.5 mm broad, densely white - woolly - tomentose below, almost glabrous or sparsely hairy above. Flowers 5 -merous, sometimes 4 -merous, bracteate, pedicellate, 3.5 - 4.5 mm long; pedicels short, ± 1 mm long, tomentose; bracts minute, tomentose below, glabrous above. Calyx 5-lobed, sometimes 4-lobed, 1.5 - 2 mm long, densely white - woolly tomentose outside, glabrous inside; lobes oblong, almost free to the base, 1.2 - 1.8 mm long, 0.3 - 0.5 mm broad; tube shallow, less than 0.5 mm deep. Corolla white, tubular, unequally 5 -lobed towards the apex, (the anterior lobe larger than the others), sometimes 4-lobed, 3 - 4 mm long; lobes oblong, obtuse, glandular and densely tomentose outside, glabrous inside, 0.5 - 1 mm long; tube ± cylindrical, somewhat wider towards the top, glabrous outside,

sparsely hairy inside, 2.5 - 3 mm long. Stamens 5, sometimes 4, exserted, inserted in the corolla throat; filaments filiform, glabrous, as long as the corolla-lobes or slightly longer, 0.5 - 1 mm long; anthers 2-lobed, dorsifixed, ± orbicular in outline, brownish - yellow, 0.3 - 0.4 mm across; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptical, ± 1.5 mm long, 1 mm in diameter, glandular and tomentose, initially 4 - locular and 4-ovuled, but the fully mature ovary is 2-locular or even unilocular due to dissolution of cell walls; style long, exserted, deeply 2-branched, 2 - 2.5 mm long, densely tomentose on the undivided lower part; lobes filiform, glabrous, somewhat recurved, almost equalling the undivided basal part, stigmatic at the apex. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- J.S.Beard 3940: between Newdegate and Lake Grace, 14.I.1965 (PERTH).- W.E.Blackall 3204: near Hyden, -X.1933 (PERTH).- Cronin s.n., MEL40931: eastern source of the Blackwood River, -1889 (MEL).- C.A.Gardner s.n.: Newdegate, -XII. 1926 (PERTH holotype).- Muir s.n., MEL40938: towards the Tone River, -1880 (MEL).

Distribution: (Map 5).

This species is known to occur in the south-western temperate region of Western Australia. The present distribution is between 32 and 34 degrees south latitude and between 117 and 119 degrees east longitude. To the north it occurs near Hyden and towards the south it is recorded from near the eastern sources of Blackwood and Tone Rivers. The only other two known localities are between Newdegate and Lake Grace. In its distribution, D.glauca overlaps its closely related species D.corymbosa, near the eastern source of Blackwood River.

E c o l o g y:

This species is known to grow in sandy places, chiefly in temperate winter rainfall areas. The stem and leaves are mostly covered with a whitish bloom that rubs off easily. According to Beard 3940 (PERTH), collected from between Newdegate and Lake Grace, it is a "prostrate glaucous plant with white flowers", growing in association with "mallee". Blackall 3204 (PERTH), from near Hyden is noted as "low dense shrub, 8 - 12 inches high". Gardner s.n. (PERTH), from Newdegate, is found growing in "sandy places". The plant is reported to be a "small diffuse shrub with white flowers".

The flowering and fruiting seems to take place from November to January.

C o m m e n t s:

This taxon is notable for its temperate distribution as detailed above, which partly overlaps that of its nearest relative, D.corymbosa. The Gnaphalium - like white- woolly flower - heads and sessile leaves with recurved margins resemble D.corymbosa so much that most of the specimens examined here have been previously identified by others with the latter species. D.glauca is a small undershrub with stem and leaves being glaucous and the anterior corolla-lobes larger than the others.

Relationship:

D.glauca is closely related to D.corymbosa in its leaves being oblong, sessile, with recurved margins and cymes congested into corymbosely arranged subglobose white - woolly heads. However, it may be easily distinguished by its stem and leaves being glaucous; leaves distinctly rugose above, with midrib prominent beneath; anterior corolla-lobe larger than the others.

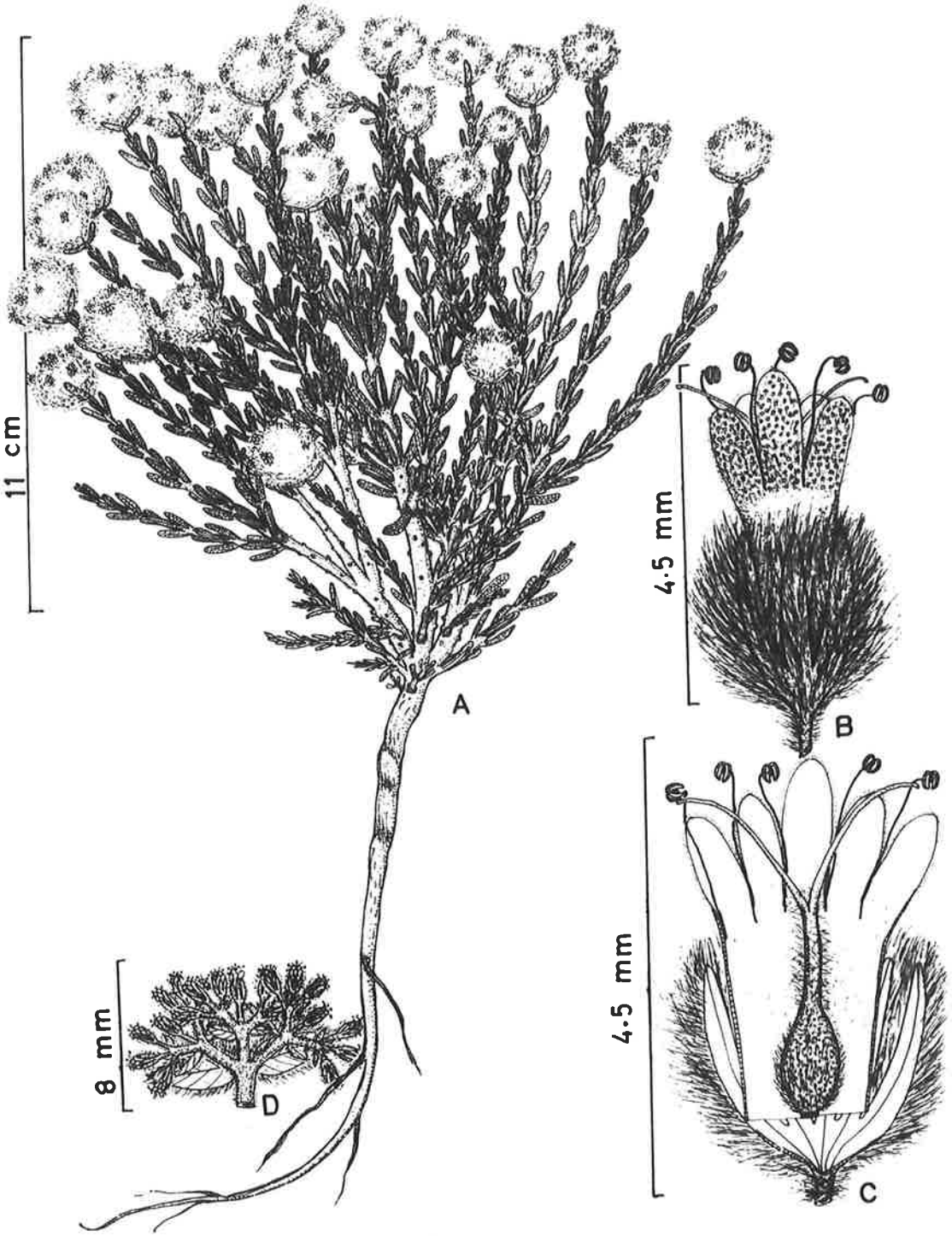


Fig. 19 — Dicrastylis glauca Munir (C.A. Gardner s.n.: PERTH - holotype).

A, habit drawing; B, flower; C, flower vertically cut open; D, cyme.

Sectio 4. Spicatae Munir, sect.nov.

Cymae in paniculas elongatas spiciformes saepe prope basin pedunculis vel paucis ramis dispositae, folia sessilia decussata vel dispersa vel verticillata terna linearia vel peranguste lineari - lanceolata margine recurva.

T y p u s: Dicrastylis beveridgei F.v.Mueller., Fragm.8 (1873)50.

Cymes arranged in an elongated spike-like panicle often with a few branches or peduncles near the base; leaves sessile, decussate, scattered or in whorls of 3, linear or very narrowly linear - lanceolate, margins recurved.

Dicrastylis lewellinii (F.v.M.) F.v.Mueller, Fragm.11 (1880) 86, 137; H.Kempe, Trans.R.Soc.S.Aust.3 (1880) 136; R.Tate, Trans.R.Soc. S.Aust.3 (1880) 78; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Trans.R.Soc.S.Aust.8 (1886) 13; F.v.Mueller, Sec.Cens. Aust.Pl.1 (1889) 172; R.Tate, Trans.R.Soc.S.Aust. 12 (1889) 113; R.Tate, Fl.Extra-Tropic.S.Aust. (1890) 156,254; R.Tate, Horn.Sc. Exped.Bot. 3 (1896) 174; F.M.Bailey, Qld.Fl.4 (1901) 1167; L.Diels & E.Pritzel, Bot. Jahrb.Syst.35 (1904) 500; F.M.Bailey, Cat.Qld. Pl. (1913) 381; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278; Hj.Eichler, Suppl.Fl.S.Aust.(1965) 266; G.Chippendale, Trans.R. Soc.S.Aust.81 (1958) 4D; G.Chippendale, Trans.R.Soc.S.Aust. 82 (1959) 334; R.E.Winkworth, Aust.J.Bot.15 (1967) 122; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 345,475,476; G.Chippendale, Proc.Linn.Soc.NSW 96 (1972) 256.

T y p u s: E.Giles s.n.,MEL40879: MacDonnell Ranges, Northern Territory, Australia,- (MEL holotype).

Chloanthes lewellini F.v.Mueller, Fragm.8 (1873) 50 - Basionym; E.Giles, Aust.Twice Trav. 2 (1889) 356.

T y p u s: E.Giles s.n.,MEL40879: loc.cit.,-(MEL holotype).

[Pityrodia lewellini F.v.Mueller, Coll.,Fragm.8 (1873) 50, pro syn. nom. inval.]

Dicrastylis weddii F.M.Bailey, Bot.Bull.Dept.Agric.Qld.10 (1895) 24; F.M.Bailey, Qld.Fl.4 (1901) 1167; F.M.Bailey, Cat.Qld.Pl.(1913) 381, f.360; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208; H.N. Moldenke, Fifth Summary Verbenac.etc.1 (1971) 346,475 - syn. nov.

T y p u s: Jos.Wedd 740: St.George, Maranoa District, Queensland, - III.1895 (BRI holotype; K).

Description: (Fig. 20).

A 30 - 60 cm tall shrub. Stem erect, branched,cylindrical, woody, greyish tomentose, the basal old stem glabrescent. Leaves sessile, mostly in whorls of 3 at a node or sub - opposite,linear or linear - lanceolate, (0.7-)1 - 2(-2.5) cm long, 0.2 - 0.6 cm broad, with recurved margins, densely greyish - tomentose. Inflorescence of subglobose flower clusters terminal on branches or forming an irregularly interrupted (sometimes branched),spike. Clusters (cymes) often pedunculate, sessile or subsessile when young, solitary towards the apex, often in whorls of 3 towards the base, mostly 7 - flowered, sometimes 5 - flowered, 0.7 - 1.5 cm

in diameter at anthesis, each subtended by 2 large bracts and 4 bracteoles, sometimes two or all the four bracteoles suppressed; peduncles up to 2 cm long, tomentose; bracts ± elliptic - ovate, shorter than the calyx, 3.5 - 4 mm long, 3 - 3.2 mm broad, acute, ± rounded at the base, densely greyish - tomentose outside, glabrous inside; bracteoles elliptic - ovate, 3 - 3.5 mm long, 1.3 - 1.5 mm broad, tomentose outside, glabrous inside. Flowers 5 -merous, bracteate, sessile or very shortly pedicellate, 8 - 9 mm long; pedicels 1 - 2 mm long, tomentose. Calyx 5 -lobed, rarely 4 -lobed, 5 - 6 mm long; lobes narrowly lanceolate, longer than the tube, 3 - 3.5 mm long, 1 - 1.2 mm broad at the base, tomentose outside and on the upper half inside; tube 2 - 2.5 mm long, tomentose outside, glabrous inside. Corolla purplish - blue, tubular, 5 -lobed in the upper half, rarely 4 -lobed, 7 - 8.5 mm long, tomentose outside, silky - villous inside; lobes elliptic or elliptic - oblong, nearly equal in the terminal flower of a cluster, the anterior lobe somewhat larger in the lateral flowers, the larger anterior - lobe 3 - 3.5 mm long, 2.1 - 2.3 mm broad, the other lobes 2 - 2.5 mm long, 1.2 - 1.5 mm broad; tube almost cylindrical, 5 - 6 mm long. Stamens usually 4, sometimes 5 in the terminal flower of a cluster, exserted, inserted in the corolla throat; filaments glabrous, filiform, longer than corolla - lobes, 3.5 - 4 mm long; anthers 2 -lobed, dorsifixed, oblong, brownish - yellow, ± 1.5 mm long, 0.8 mm broad, lobes free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globular, densely tomentose, 1 - 1.3 mm in diameter, 4 -locular, with one ovule in each cell; style long, exserted, deeply 2 -branched, 6 - 7 mm long (including lobes), the lower undivided part 4 - 5 mm long; densely covered with branched hairs; lobes somewhat recurved in old flowers, filiform, 2 - 2.5 mm long, glabrous, with few branched hairs near the base, stigmatic at the apex. Fruit dry, indehiscent, ± globose, densely silky hairy, ± 3 mm long, 2 - 2.5 mm in diameter.

Specimens Examined:

NEW SOUTH WALES:- K.Robinson s.n., NSW106632: Elleslie Station, 50 miles due east of Barringun N.S.W. side of Queensland border, - I.1961 (NSW).- R.D.B.Whalley s.n., NSW106633: "Ellerslie", 50 mile east of Enngonia, 17.X.1961 (NSW).

NORTHERN TERRITORY:- J.E.Barnes 2435: Connor's Well, 4.VII. 1952 (NT).- N.T.Burbidge, M.Gray & P.L.Chinnick 4340: Hamilton Downs, 26.IX.1955 (CANB).- N.Byrnes 1118: 10 m. South Aileron, 22.XI.1968 (CBG,NT).- G.Chippendale 729: 25 miles S. of Aileron,

14.XII.1954 (AD,CANB,MEL,NSW,NT).- G.Chippendale 773: 25 miles south of Alice Springs, 11.1.1955 (AD,BRI,MEL,NSW,NT,PERTH).- G.Chippendale 1706: no.2 Desert Bore, Hamilton Downs, 29.IX.1955 (AD,BRI,CANB,MEL,NSW,NT,PERTH).- G.Chippendale 4186: 14.1 mile N.Central Mt.Wedge, 30.IV.1958 (AD,BRI,CANB,MEL,NSW,NT).- G.Chippendale 7439: Desert Bore, Mt.Allan Station, 9.XI.1960 (AD, CBG,MEL,NT).- J.Coppock 4614: Lake Bennett area, - IV.1958 (NT),- J.B.Cleland s.n.,AD97120309: Mt.Patricia, 22.VIII.1936 (AD).- J.B.Cleland s.n.,AD95811024: Mt.Wedge Stn.25.VIII.1957 (AD).- ? Leg. MEL40880: Lake Amadeus, - (MEL).- R.Hill & H.W.Caulfield s.n.,AD96208096 & AD96208103: 60 miles north of Alice Springs, -VII.1953 (AD).- H.A.Johnson 71: 63 miles north of Alice Springs, 20.X.1956 (AD).- H.Kempe 162, MEL40881 & MEL40883: Finke River, -XII.1879 (MEL).- P.K.Latz 163: 19m. E. of Jervois Copper Mine, Jervois Stn., 12.IX.1968 (AD,BRI,NT).- J.R.Maconochie 473: 8 mile E. Desert Block House, 13.X.1967 (AD,NT).- J.R.Maconochie 477: 1 m. W. Desert Block House, 13.X.1967 (AD,NT,PERTH).-J.Must 146: 64 m. N.Alice Springs, Stuart Highway, 18.VII.1968 (AD,NT).- R.A.Perry 4108: Argadargada Station: 16.XI.1953 (CANB).- R.Tate s.n., AD97113323: Missionary Plain, -1894 (AD).- R.E.Winkworth 384: 32 miles south-west of Napperby Station, 1.VII.1954 (NT).- R.E.Winkworth 1372: 36 miles north-west of Hamilton Downs, 29.IX. 1955 (NT).- C.Winnecke s.n., MEL40882: loc.incert.,- 1883 (MEL).- ? Leg. NSW50299: Connors Well, -X.1939 (AD,NSW).-

QUEENSLAND:- G.H.Allen s.n.,BRI113977: Gilruth Plains near Cunnamulla, Warrego Distr., 17.XI.1941 (BRI,GH).- M.S.Clemens s.n. BRI113980,F1252578: Charleville, 8.X.1945 (BRI,F).- M.S.Clemens s.n.: loc.cit., 14.XI.1945 (GH).- J.Ebersohn s.n.,BRI033181: Calabah, 75 m. S.W. of Charleville, Boatman Road, 28.III.1962(BRI)- S.L.Everist & C.T.White 40: between Shamrock Wells and Cunnamulla, 25.V.1936 (BRI).- S.L.Everist 1941: 12 m. E. of Yalleroi, Henley Park. Mitchell Distr., 6.XII.1939 (BRI,GH).- S.L.Everist 4071: Cuddapan, ± 80 miles W.S.W. of Windorah, 27.VIII.1949,(BRI,CANB, US).- D.M.Gordon 122: Bollon - Cunnamulla Rd., 26.X.1949 (BRI).- E.Jarvis s.n.,BRI113982: between Emerald and Longreach, -X.1913 (BRI).- S.Roe 18: Bollon - Cunnamulla Rd.,-X.1938 (BRI).- R.Roe 7742: Nindigully, -XI.1938 (CANB,MEL).- C.J.Swinburne s.n., BRI113983: Lancevale, ±20 miles S.W. of Jericho, Mitchell Distr. 14.VII.1940 (BRI).- D.E.Symon s.n.,ADW32069: Tanbar, S.W. of Windorah, -IX.1966 (ADW).- J.Wedd 740: St.George, Maranoa Distr. -III.1895 (BRI,K,holotype and isotype respectively of D.weddii F.M.Bailey).- J.Wedd s.n.,BRI113984: St.George,-VI.1895 (BRI).- K.Williams 132: 55 miles N. of Thylungra on Quilpie - Windora Rd, 29.IX.1968 (BRI).

SOUTH AUSTRALIA:- F.L.Hill 842: Maralinga, 25.X.1956 (BM).- F.L.Hill 835: loc.cit.,24.X.1956 (BM).- D.E.Symon 3394: Lake Complex, S. of Lake Bring, 20.II.1965(ADW).- H.Bowen 329: S. Maralinga, -IX.1956 (K).- R.Schomburgk 17: loc.incert.,-VII.1884 (K).- H.Turner s.n.,AD95952055: 1 mile south Maralinga, Nullarbor Plain, 1.XII.1959 (AD).- H.Turner s.n.,AD96434029: Maralinga, ca. 30 km north of Watson, N.E. of Bore 13, 27.VIII.1960(AD).-H.Turner s.n.,AD96434028: loc.cit.,5.IX.1960 (AD).- H.Turner s.n.,AD96434081: 0.5 mile.S.S.W. of Maralinga, 29.V.1960 (AD).- H.Turner s.n., AD96122055: Maralinga, 6 miles E.N.E. "RBI" area, 18.X.1960 (AD).- S.Warne 20102: near Maralinga,-(AD).

Distribution: (Map 6).

This species is endemic to Australia. The main distribution is in Northern Territory, Queensland, South Australia and just near the Qld. - NSW border in New South Wales.

In the Northern Territory, it occurs mainly to the south-south-west and north-north-west of Alice Springs, between 22 and 25 degrees south latitude and between 130 and 136 degrees east lonigitude. The eastern localities are near Jervois Range and the southern ones are around the Finke River and Missionary Plains. Along Stuart Highway, this species is common up to 65 miles north of Alice Springs and to the north-west its distribution extends to Lake Bennett and Mt.Allan.

In Queensland this species is known to grow between 24 and 30 degrees south latitude and between 141 and 149 degrees east longitude. The southern and south-eastern localities are aminly east and north-east of Cunnamulla, while the northern localities are along the road between Blackall and Jericho. Along Mitchells Highway it occurs around Charleville. The westernmost localities are to the north-west of Cunnamulla and south-west of Windorah.

In South Australia, it occurs to the west-north-west around Maralinga and Lake Bring. Two localities in New South Wales are just near the NSW - Qld. border to the north-north-east of Bourke. These places are 50 miles due east of Barringun and Enngonia respectively.

E c o l o g y:

D.lewellinii is known to grow in the dry eremean zone of Northern Territory, Queensland and South Australia. It is one of the many drought resistant species, occurring mostly in sandy soil of spinifex (Triodia)country. The plants re-grow quickly after fire, and apparently have a well - developed root system. Leaves

are brittle and the flower colour is pale - blue. According to Barnes 2435(NT), from Connor's Well, it is a "small shrub in red soil, Mulga Country". Byrnes 1118 (CBG,NT), 10 miles south of Aileron is annotated to occur in "spinifex desert grassland.Sandy red soil". The plant is noted as "small shrub, ± 18" with blue flowers". Chippendale 729,773,1706,4186 & 7439 (AD,BRI,CANB,MEL, NT), from Aileron, Sth. of Alice Springs, Hamilton Downs, Central Mt.Wedge and Mt.Allan Station respectively are described as "1 - 2 feet high, spreading, grey, subshrub". The flowers are noted as "blue, lilac - blue and blue mauve". Regarding the habitat, the plant is said to grow "in patches along road side and common in deepred sand". Latz 163 (AD,BRI,NT), from Jervois Stn., is recorded as "Rare in red sandy soil", the association is noted as "spinifex and mallee community", and the size of the plant and colour of its flowers are noted "rather erect subshrub to 1 $\frac{1}{2}$ ft. high, fls. violet, leaves aromatic when crushed". Maconochie 473 (AD,NT), 8 miles E. of Desert Block House is annotated as "small perennial blue bush like shrub to 18" high. Flowers in clusters at tip, bluish in colour. Growing in sandy spinifex country". Must 146 (AD, NT), from 64 miles N. of Alice Springs, is also described as "small perennial shrub to 18" high, growing on sandy spinifex plain."

The above - cited ecological remarks are quoted from Northern Territory collections. In respect of habit, habitat and the colour of flowers, the collectors' field observations on the collections from Queensland and South Australia are nearly the same as above.

Flowering and fruiting occur chiefly in the months September to December.

C o m m e n t s:

After carefully examining the holotye of D.weddii Bail., [collected by J.Wedd (no.740) from St.George, during March,1895], it is found conspecific with D.lewellinii FvM. and is therefore reduced here as a synonym of the latter. J.Wedd's second collection (s.n.) of this species, from St.George, was made during June,1895, i.e. one month after the publication of D.weddii Bail. and three months after his first collection from the same locality. The latter collection, though taken by the same person, from the same locality and in the same year, should not be confused with the type itself. This is important because the author (Bailey) has not cited any collection (with the collector's name) in the protologue of D.weddii.

The type of D.lewellinii was collected by E.Giles from Macdonnell Ranges, Northern Territory. It was initially named

(annotation only) by F.v.Mueller as Pityrodia lewellinii, which name he never published. Later on, he identified it with the genus Chloanthes, and published it as Ch.lewellinii, with Pityrodia lewellinii as its synonym. [Fragm8 (1873) 50]. In the protologue of this species, he described the corolla - lobes as "semioblongi, inferior tres longiores". About the stamens, he records "Stamina quatuor fertilia setacea, lobes corollae aequantia; quintum capillare ananthereum praesens vel absens". From this information, it appears that Mueller found the corolla bilabiate or unequally lobed and the number of fertile stamens 4 only. Both these characters are very prominent in the genus Chloanthes, therefore, it seems that Mueller mistook this species for one of that genus. Subsequently however, he recognized Kempe's collection from Finke River as conspecific with E.Gile's specimen (from Macdonnell Ranges), the latter already named and published as Ch.lewellini. However, during February, 1880, he identified both these collections with Dicrastylis, and transferred Ch.lewellini to the genus Dicrastylis. Both the above-mentioned collections are also cited under it [Fragm.11 (1880) 86].

In the description of D.lewellinii, not much is said about the corolla-lobes, but the number of stamens is noted "5 vel 4". A careful examination of many flower - heads from different collections has shown, that each is generally 7 - flowered,rarely 5 - or more than 7 -flowered. In 7 -flowered heads, there is a terminal flower with two lateral groups of 3 flowers each. It has been observed, that almost all th flowers in the lateral position have 4 stamens and their anterior corolla - lobe is somewhat larger than the others. The number of stamens in the terminal flowers are 4 - 5 (often 5) and the corolla -lobes are nearly equal. In a rare case, the number of calyx or corolla - lobes is 4 each, and the number of stamens may be reduced to 3. Only in one terminal flower, the style is found to have 3 distinct branches which seems an abnormal case. (see fig.20 G).

The floral - clusters are not uniformly arranged on the central axis of the inflorescence. Generally, the proximal old clusters are arranged in whorls of three and are often shortly pedunculate, but the distal young clusters are mostly sessile, and are 1 or 2 per node towards the summit.

J.Ebersohn's collection no.BRI033181 is noted to have been collected from "Calabah, 75 miles S.W. of Charleville, Boatman Road." The locality "Calabah" seems to be a small place, not found in any available map of Queensland, but the "Boatman Road" is 75 miles S.E. of Charleville, not "S.W.", as recorded by the collector.

Relationship:

Allied closely to D.beveridgei FvM. and D.costelloi Bail. in having linear - lanceolate grey leaves with recurved margins, but can be readily distinguished by its flowers being crowded into large (0.7 - 1.5 cm diameter) clusters; calyx - lobes tomentose on the upper half inside; corolla purplish - blue with anterior lobe often larger than the others and stamens usually 4, much exserted.

Fig. 20. — Dicrastylis lewellinii (F.v.M.) F.v.M. (G. Chippendale 7439: CBG).

A, flowering branch; B, cyme; C, bracts and bracteoles of a cyme, the flowers being removed; D, lateral flower; E, lateral flower vertically cut open to show the somewhat larger anterior corolla-lobe and 4 stamens; F, terminal flower cut open showing equal corolla-lobes and 5 stamens; G, terminal flower cut open showing abnormal 3-lobed style.

Dicrastylis costelloi F.M.Bailey, Dept.Agric.Qld.Bot.Bull. 4(1891) 14,var.costelloi; F.M.Bailey, Qld.Fl.4 (1901) 1166; F.M.Bailey, Cat. Qld.Pl. (1913) 381; J.M.Black,Trans.R.Soc.S.Aust. 41 (1917) 631, 645,t.42; J.M.Black, Fl.S.Aust.ed.1 (1926) 482,t.42 - 1 and 3; J.M.Black, Fl.S.Aust.ed.2 (1957) 723, fig.1035 - 1 and 3; G.Chippendale, Trans.R.Soc.S.Aust. 82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208,278; D.E.Symon, Trans.R.Soc.S.Aust. 93 (1969) 33; H.N.Moldenke, Fifth Summary Verbenac.etc.1 (1971) 345,475; G.Chippendale, Proc.Linn.Soc.NSW. 96 (1972) 256.

T y p u s: M.Costello s.n.,BRI010407: near Lake Nash, on the border between Queensland and Northern Territory, Australia,=VIII. 1891 (BRI holotype).

D.doranii auct. non F.v.Mueller: R.Tate, Trans.R.Soc.S.Aust. 3 (1880) 78; R.Tate, Trans.R.Soc.S.Aust. 12 (1889) 113; R.Tate, Fl. S.Aust. (1890) 155,254; F.M.Bailey, Qld.Fl.4 (1901) 1167, pro parte (quoad spec. C.Winnecke s.n.); F.M.Bailey, Cat.Qld.Pl.(1913) 381; J.M.Black, Fl.S.Aust.ed.1, (1926) 483,t.42 - 2; J.M.Black, Fl.S.Aust.ed.2, (1957) 724,fig. 1035 - 2.

Description: (Fig. 21).

A greyish tomentose shrub, 45 - 75(-90) cm high. Stem erect, brnached, cylindrical or smmewhat terete, woody, densely covered with short, branched tomentum. Leaves sessile, ± decussate, sub-opposite or in whorls of 3, linear, sometimes very narrowly linear - lanceolate, obtuse, with recurved - revolute margins, 1 - 2.5 (-3) cm long, 0.2 - 0.4(-0.6) cm broad, densely greyish tomentose when young, the older ones glabrescent and rugose. Inflorescence cymose; cymes arranged into an elongated, terminal, spike - like panicle with often a few branches (or peduncles) near the base of spike, white - tomentose, each cyme usually 7 -flowered, sometimes more, bracteate, sessile along the terminal spike - like panicle, often at the end of short lateral branches near the base of spike. Flowers 5 -merous, bracteate, sessile or very shortly pedicellate, 4 - 4.5 mm long, each subtended by a bract and two bracteoles; bracts linear - lanceolate, 2 - 2.5 mm long, 0.4 - 0.5 mm broad, with dense branched tomentum outside, glabrous inside; bracteoles linear - lanceolate, 1.2 - 1.5 mm long, 0.2 - 0.3 mm broad, with dense branched tomentum outside, glabrous inside. Calyx 5 -lobed, with dense branched toemtnum outside, glabrous inside, 2.5 - 3 mm long; lobes deltoid, ± 1 mm long, nearly as broad at the base; tube shallow, 1.3 - 1.5 mm long. Corolla white, tubular, 5 -lobed towards the apex, 4 - 4.2 mm long; lobes oblong, rounded and

crenate at the top, 1.2 - 1.6(-2.5) mm long, 1 - 1.3(-1.7) mm broad, densely covered with branched white tomentum outside, glabrous inside and near the tip outside; tube cylindrical, 2.5 - 3 mm long, shortly tomentose in the upper half outside, densely villous - tomentose inside the throat. Stamens 5, scarcely exserted, inserted in the corolla throat; filaments glabrous, shorter than the corolla - lobes; anthers 2 -lobed, dorsifixed, pale - brown, ± orbicular in outline, 0.7 - 0.8 mm long, ± 0.7 mm broad, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - globose, densely white tomentose, 0.6 - 0.8 mm in diameter, 4 -locular with one ovule in each cell; style somewhat included or scarcely exserted, deeply 2 - branched, 2.5 - 2.8 mm long (including lobes), densely covered with branched tomentum on the undivided part; lobes glabrous, stigmatic at the end. Fruit dry, indehiscent, obovoid - globose, 3 - 3.3 mm in diam -eter, shortly tomentose, usually 1 - seeded.

Specimens examined:

NORTHERN TERRITORY:- G.Chippendale 1730: 2 miles W. no.2 Desert Bore, Hamilton Downs, 23.IX.1955 (NT).- G.Chippendale 3131: 30.2 miles E. Elkedra Homestead, 23.X.1956 (AD,BRI,CANB,NSW,NT).- G.Chippendale 3911: 12.6 miles N. of Horseshoe Bend, 11.X.1957 (AD,BRI,CANB,NSW,NT).- G.Chippendale 3935: 8.9 miles E. of New Crown Homestead, 12.X.1957(BRI,CANB,MEL,NSW,NT).- G.Chippendale 3955: 38.8 miles N.E. of Charlotte Waters, 13.X.1957 (BRI,CANB, NSW,NT).- G.Chippendale 6616: 10 miles S. Lilla Creek, 9.IX.1959 (AD,MEL,NT,NSW,PERTH).- M.Costello s.n.: near Lake Nash,-VIII.1891 (BRI holotype; AD,BM,K - isotypes).- E.H.Ising s.n.,AD966080970: Finke, 25.VIII.1931 (AD).- J.R.Maconochie 496: 15 miles N. of Andado Homestead, Simpson Desert, 15.XI.1967 (AD,NT).- J.F.Miles s.n.,CANB24357: loc.incert., -IV.1948 (CANB).- E.Ryko s.n.: Bundooma, -1953 (PERTH p.p. -quoad Leg. April & Oct.11, 1953).- W.F.Schartz s.n.,MEL40819,MEL40820: Charlotte Waters, -1889 (MEL).- D.E.Symon 20467: 6 miles W. of Palmer River, on road 8 miles Henbury to Ayers Rock, 10.VI.1953 (ADW).- C.Winnecke s.n.,MEL40816: loc.incert. -1883 (MEL).

SOUTH AUSTRALIA:- Andrews 65: vicinity of Lake Eyre,-XI.1875 (K).- G.C.Cornwall 239: 10 km east-north-east of Purni Bore, Simpson Desert, 11.VI.1972 (AD).- E.H.Ising s.n.,AD966080965, AD966080967,AD966080968,AD966080984,AD97113309: Pedirka,26.VIII. 1932 (AD).- Lewis s.n.,MEL40822: Lake Eyre,-(MEL).- W.S.Reid s.n., ADW20820: Oodnadatta Reserve, 7.XII.1957 (ADW).- R.Tate s.n., AD97113308: Lake Eyre,-(AD).- S.A.White s.n.,AD97205188: Lake

Perigundi, Coopers Creek, 12.X.1916 (AD).- P.Wigg s.n.,ADW19136: West of Todmorden, 2.II.1958 (ADW).

Distribution: (Map 6).

This species is known from the dry eremean parts of Northern Territory and South Australia. There are several collections from the Northern Territory but only a few are known from South Australia. The Northern Territory loclaities are mainly to the south-south-west of Alice Springs along the Finke River and to the west of Palmer River between Henbury and Ayers Rock. The localities to the north-west of Alice Springs are near Hamilton Downs and to the north-east they are recorded from near Elkedra and Lake Nash.

In South Australia, this species is distributed near Lake Eyre and north-west of it towards the Northern Territory border.

E c o l o g y:

D.costelloi is a sandy soil species, growing in the arid parts of Northern Territory and South Australia. According to collector's field notes it is common on top of sandridges but rare in deep red sand between the ridges. Chippendale 3131 (AD,BRI,CANB,NT), from 30.2 mile east of Elkedra, N.T., is noted as 15 inches tall grey subshrub, occurring "infrequently in deep re d sand,associated with Triodia pungens". His subsequent collection nos. 3911 (AD, BRI,CANB,NT), from N. of Horseshoe Bend; 3935 (BRI,CANB,MEL,NT), from E. of New Crown; 3955 (BRI,CANB,NT), from N.E. of Charlotte Waters; 6616 (AD,MEL,NT,PERTH), S. of Lilla Creek, are individually noted as shrubs or subshrubs of either 9",12",18" or 30" high. The inflorescence is recorded as "grey" and habitat is said to be "rare in deep red sand between the ridges, common on top of ridges". In one case the association of this species with Triodia basedowii is recorded. All these collections come from the Northern Territory. Maconochie 496 (AD,NT), from N. of Andado, N.T., is annotated as "small - leaved perennial shrub to 18" high. Growing commonly on eastern slopes of sand dunes, generally absent on western slopes". The collections from South Australia are without ecological remarks, but there should not be any difference in their habitat, because they grow under the same environmental conditions.

Flowering and fruiting seem to occur chiefly from October to December.

C o m m e n t s:

Before this species (D.costelloi) received any taxonomic status, it was identified by R.Tate (1890) as D.doranii, and due

to the recurved margins of its leaves, he placed it near D.beveridgei and D.lewellinii. Almost a year later, Bailey (1891) recognized M.Costello's collection from Lake Nash as a distinct species, and in December, 1891, he published it under the name D.costelloi. In the protologue, Bailey regarded this species as close to D.beveridgei F.v.Mueller and described its stamens "exserted as in all previously described species". Later on, in his Queensland Flora (1901), he recorded both D.costelloi and D.doranii, and cited C.Winnecke's collection from Central Australia under the latter. As that specimen of Winnecke's is now found to belong D.costelloi var.eriantha, its inclusion under D.doranii seems improper. So far, D.doranii FvM. has not been recorded from any part of Queensland because it is distributed mainly in the Eastern Division in Western Australia and over its eastern border in South Australia and Northern Territory.

Black (1926,1957) recorded both the above-named species, and following Mueller (1886), he retained the variety eriantha under D.doranii. After studying the text, the accompanying plate of D.doranii, and the specimens cited (by Black) under it, the conclusion has been reached that D.doranii sensu Black is not different from D.costelloi Bailey, therefore, both are treated here as the same species. D.doranii var.eriantha sensu Black is now named here as D.costelloi var violacea. Similarly, the records of D.doranii and its var. eriantha by Eardley (1946), Chippendale (1959) and Symon (1969), all belong to D.costelloi and its varieties eriantha and violacea. Likewise, D.doranii sensu Tate (1880, 1889,1890) falls under D.costelloi, but it is not possible to refer it to any particular variety because Tate has not cited any specimen with his records.

In the protologue, the stamens are stated to be exserted and the hairs in the corolla-throat are described as simple. Actually, the stamens are somewhat included or very slightly exserted and the hairs in the corolla throat are branched.

The two collections of this species by C.Winnecke, from "Central Australia", are now preserved in Herb.MEL, under the numbers MEL40816 and MEL40817. The former belongs to the type variety and the latter is a syntype of eriantha.

As recorded above, the type of this taxon was collected during August, 1891. The dates noted on the isotype label at Kew are "Aug.92" and "Oct.1892", which seem to be the dates of annotation or communication. This should not be confused with the actual date of collection. D.costelloi was described almost 8 to 10 months earlier than the dates on the isotype sheet in Kew.

Relationship:

D.costelloi is closely related to D.beveridgei in having sessile linear leaves with recurved margins, an elongated terminal spike-like panicle with often a few branches or peduncles near the base of the inflorescence, crenate corolla-lobes and scarcely exserted stamens and style. However, it may be easily disitnguished by its greyish - tomentose inflorescence, which in D.beveridgei is golden -yellow.

D.costelloi Bailey var.eriantha (FvM.)Munir, comb.nov.

D.doranii FvM. var.eriantha FvM.,Trans.R.Soc.S.Aust.8 (1886) 13, pro parte -(quoad spec. Ch.Winnecke s.n.,MEL40817)- Basionym; F.M. Bailey, Qld.Fl.4 (1901) 1167; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 345

T y p u s: Ch.Winnecke s.n.,MEL40817: "Central Australia", -1883 (MEL -lectotype).

D.doranii auct. non FvM: D.E.Symon, Trans.R.Soc.S.Aust.93 (1969) 33, pro parte -(quoad spec. Symon 4342: AD,ADW;4388:A[illegible],ADW,CANB,K).

Typification:

Mueller based this var. eriantha on Ch.Winnecke's collection from Central Australia, but at the end of the protlogue he quotes H.Kempe's collection from the Finke River as convarietal to Winnecke's plants. Actually, they are two different taxa belonging to D.costelloi and D.beveridgei respectively. Since Mueller did not select any type for this variety, it is necessary to choose a lectotype for it. H.Kempe's specimen no.372 (MEL40818) has a golden - yellow inflorescence and thus belongs to D.beveridgei FvM. This being a different species, cannot have any preference over the conspecific syntype. Among Winnecke's collections from Central Australia, the specimen no.MEL40816 belongs to the type variety of D.costelloi Bailey and the no.MEL40817 is annotated by Mueller as "Dicrastylis doranii FvM. var. eriantha". The latter specimen, represents in general all the characters of D.costelloi and agrees fully with the description of var.eriantha. Therefore, it is being chosen here as the lectotype of this variety.

This taxon differs from the type variety by its inflorescence being lax, cymes distantly borne on the axis of a terminal spike-like panicle and leaves with broadly recurved margins or almost flat.

Specimens examined:

NORTHERN TERRITORY:- C.M.Chalmers & K.B.Warnes 3: MacDonald Downs Station, -XII.1968 (AD).- R.Millington s.n.,NT15484: Andado Area, Simpson Desert, 19.X.1968 (CANB,NT).- R.Millington s.n., NT12078: Andado 15 miles north Andado Homestead, 3.II.1967 (NT).- D.E.Symon 4342: Amerada Petroleum Corporation No.1,Hale River, Simpson Desert, 1.XI.1966 (AD,ADW).- D.E.Symon 4388: loc.cit.2. XI.1966 (AD,ADW,CANB,K).- J.McDouall Stuart 202: loc.incert., "interior of Australia", -1859 (K).

WESTERN AUSTRALIA:- A.S.George 8446: ± 52 miles east of Neale Junction, 11.X.1966 (PERTH).

Distribution: (Map 6).

This variety occurs chiefly in Northern Territory with only one odd locality in the Eastern Division of Western Australia. The latter is represented by a solitary collection from the Great Victoria Desert to the west of Serpentine Lakes. In Northern Territory, the main distribution is to the south-east and north-east of Alice Springs, in the Simpson Desert and around MacDonald Station respectively.

E c o l o g y:

In general this agrees well with that of the type variety. Millington s.n.,NT12078 (NT), 15 miles north of Andado Homestead is noted to grow on "West slope of sand dune on stable slope below crest". Symon 4342 (AD,ADW), from No.1 Hale River, Simpson Desert is annotated as "occasional on the interdune flats, sprawling shrub wider than high, flowers white". George 8446 (PERTH), 52 miles E. of Neale Junction, W.A.,is recorded as "40 cm high shrub with white flowers". It was found growing "in red sand on Triodia Steppe".

Flowering and fruiting seem to take place mostly from October to December, but probably extends to February in rare cases.

C o m m e n t s:

Before D.costelloi Bailey (1891) received taxonomic status, the var. eriantha was published by Mueller (1886) as a narrow-leaved variety of D.doranii FvM. The more conspicuous tomentum, two or more superposed glomerules of flowers and involute woolly - tomentose calyces are the main characters on the basis of which it was considered (by Mueller) as a distinct variety. Since all these characters are generally found in D.costelloi Bailey, and the basic pattern of its inflorescence also agrees with the latter,

therefore, it is regarded here as conspecific with D.costelloi Bailey and is thus transferred from D.doranii FvM. to D.costelloi Bailey, with the same rank.

Bailey (1901) has followed Mueller in recording this taxon as a variety of D.doranii FvM. He has also quoted full reference to (type) Ch.Winnecke's collection from Central Australia. It appears, that Bailey had not seen the actual type but has apparently cited it from Mueller's publication. Had Bailey seen the type, he being the author of D.costelloi could easily have identified it with his species and avoided its citation under D.doranii FvM. Similarly, another collection of Ch.Winnecke's, from Central Australia, is cited under D.doranii FvM. The latter is now preserved in Herb. MEL under the number MEL40816 and belongs to the type var. of D.costelloi Bailey.

Relationship:

Due to greyish - white inflorescence this is closest to the type variety. For the distinctive characters see key to the species.

D.costelloi Bailey var. globulifera Munir, var.nov.

Varietas ab aliis ob flores in fasciculos purpureo - cinereos globosos confertos distinguitur.

T y p u s:E.H.Ising s.n.,AD966050523: Macumba Station, South Australia, 3.IX.1931 (AD Holotype).

This variety differs from other related taxa by its flowers being congested into globular flower - heads.

Specimens examined:

SOUTH AUSTRALIA:- E.H.Ising s.n.,AD966120047: about 5 miles east of Macumba Homestead, 3.IX.1931 (AD).- E.H.Ising s.n., AD966080971: loc.cit.,3.IX.1931 (AD).

Distribution: (Map 6).

The only known locality is near Macumba, to the north-east of Oodnadatta, South Australia.

E c o l o g y:

Little is known of this variety, but it seems to grow in dry sand - hill country.

C o m m e n t s:

This variety seems to be somewhat of an intermediate between

the type variety and var. violacea.

Relationship: see Comments above.

D.costelloi Bailey var. violacea Munir, var.nov.

T y p u s: T.R.N.Lothian 1722: 61 km east of Dalhousie Springs, South Australia, 2.VIII.1963 (AD holotype).

D.doranii auct.non F.v.M.: R.Tate, Horn.Exped.Bot. (1896) 174.

D.doranii FvM. var.eriantha auct.non F.v.M.: J.M.Black, Fl.S.Aust. ed.1,(1926) 483; C.M.Eardley, Trans.R.Soc.S.Aust. 70 (1946) 152, 169; J.M.Black, Fl.S.Aust.ed.2, (1957) 725; G.Chippendale, Trans. R.Soc.S.Aust. 82 (1959) 334; Hj.Eichler, Suppl. J.M.Black's Fl.S. Aust.ed.2, (1965) 266; D.E.Symon, Trans.R.Soc.S.Aust. 93 (1969) 33 pro parte -(quoad spec. Crocker C16 - 17 - AD;Lothian 1600, 1700,1722 -AD); H.N.Moldenke, Fifth Summary Verbenac.,Dicrastylidac. etc.1 (1971) 345 - (quoad spec. Chippendale 2520, Lazarides 5742 & 5864 - US); G.Chippendale, Proc.Linn.Soc.NSW 96 (1972) 256.

Varietas ab aliis ob inflorescentiam dilute purpureo - violaceam et fasciculos non globosos distinguitur.

From other taxa of D.costelloi, this variety is distinct in having a light purple - violet inflorescence and non - globular flower clusters (heads).

Specimens examined:

NORTHERN TERRITORY:- A.C.Beauglehole 27853: 57 miles N.N.W. of Old Andado H.S., Simpson Desert, 27.VII.1968(NT).- G.Chippendale 2520:8.6 m. W. 14 bore, Sandover S.R., 15.VIII.1956 (AD,BRI, CANB,MEL,NT,PERTH,US).- G.Chippendale 2758: 21.3 m. S.E. Horseshoe Bend H.S., 4.IX.1956 (BRI004887,BRI113975,NT,NSW).- J.B.Cleland 65:Rumbalara, 25.VIII.1931 (AD,NSW).- J.B.Cleland s.n.,AD97120341: loc.cit.,23.VIII.1932(AD).- R.L.Crocker s.n.,AD95833113,AD95836110, AD95836111: between Camp 16 & 17, 350 km east of Bundooma,Simpson Desert, 25.VI.1939(AD).- R.Hill & H.W.Caulfield s.n.,AD96208098: Erldunda, 50 miles N. of S.Aust.border, -VIII.1953 (AD).- M.Lazarides 5742: 21 miles S.S.E. of Santa Teresa Mission, 18. VIII.1956 (AD,BRI,CANB,MEL,NT,NSW,PERTH,US).- M.Lazarides 5864: 31 miles N.W. of Wauchope, 27.VIII.1956 (AD,BRI,CANB,MEL,MO,NT, NSW,PERTH,US).- R.G.Lyons s.n.,AD97207310: Airstrip Lat. 25° 54' Long. 136° 36', 11.IX.1971 (AD).- E.Ryko s.n.:Bundooma,- 1953 (PERTH -p.p. quoad spec.Leg.Oct.5 1953).- S.A.White s.n.,

AD97205192 & AD95847016: between Charlotte Waters and Boggy Flat, 14.VII.1921 (AD).-

SOUTH AUSTRALIA: D.Ashton s.n., AD96218083: Lake Eyre Basin, Simpson Desert, -VIII.1961 (AD).- G.C.Cornwall 238: 10 km east-north-east of Purni Bore, 11.VI.1972 (AD).- F.S.Jones s.n., AD966032938 & AD97205191: Oodnadatta, -(AD).- T.R.N.Lothian 1600: 38 miles east of Dalhousie Springs, 10.VIII.1963 (AD).- T.R.N. Lothian 1700: loc.cit., 10.VIII.1963 (AD).- T.R.N.Lothian 1722: 61 km east of Dalhousie Springs, 11.VIII.1963 (AD - Type).- T.R.N. Lothian 4870: S. of Hamilton Creek, ca. 2 $\frac{1}{2}$ km S. of Pedirka Siding, 30.VII.1968 (AD).- F.J.Mitchell s.n., AD97003361: Dalhousie Springs, 6.VIII.1968 (AD).- C.Sturt s.n.: loc.incert., -1844 - 6 (BM).- S.A.White s.n., AD97208250: between Dalhousie and Blood s Creek, 13.VIII.1913 (AD).

Distribution: (Map 6).

As is true of the type variety, the var. violacea is distributed in the more southerly part of the Northern Territory and northern - most part of South Australia. The Northern Territory localities are mainly to the south and south-east of Alice Springs towards the South Australian border. To the north and north-east of Alice Springs, it is known from Wauchope along Stuart's highway, and near 14 bore along Sandover Highway respectively.

The South Australian localities are to the north-north-west of Lake Eyre around Pedirka and to the east of Dalhousie Springs beside the Simpson Desert.

E c o l o g y:

According to collector's remarks the ecological requirements of this taxon are the same as for the typical variety. It grows in the dry eremean part of Central Australia on either side of the border between the Northern Territory and South Australia. Chippendale 2520 (AD,BRI,CANB,MEL,NT,PERTH), from 14 Bore, Sandover, is noted as "1 $\frac{1}{2}$ - 2' high subshrub with infl. pale purple. Infrequent in deep red sand, near river bank". Chippendale 2785 (BRI,NT,NSW), from S.E. of Horseshoe Bend is recorded as "Dense grey subshrub 2 $\frac{1}{2}$ ' high, inflorescence red - purple. Rare in deep red sand". Lazarides 5742 (AD,BRI,CANB,MEL,NT,NSW,PERTH,US), from S.S.E. of Santa Teresa Mission is annotated as "densely hairy sprawling, grey under-shrub 6 - 9 inches high and 12 - 18 inches wide. Inflorescence reddish". The habitat is noted "occasional on sand dune with Triodia basedowii". Lazarides 5864 (AD,BRI,CANB,MEL,MO, NT,NSW,PERTH,US) from 31 miles N.W. of Wauchope is noted as "Erect

subshrub to 1 ft. high and 2 ft. in diameter. Flowers and branches white". The habitat is said to be on "top of sand dune in deep coarse red sand with Plectrachne Schinzii and Grevillea stenobotrya". Ryko s.n.(PERTH) from Bundooma is recorded "Dense shrub 3 ft. high, sand binder on tops and sides of sandhills".

The flowering and fruiting period is the same as for the type variety.

C o m m e n t s:

This variety violacea has often been mistaken for D.doranii FvM. and its var. eriantha FvM. Black (1926) was the first to describe the "Pink - flowered collections from Oodnadatta and Charlotte Waters as var. eriantha FvM. of D.doranii FvM. His concept of this variety was followed by Eardley (1946), Chippendale (1959), Eichler (1965) and Symon (1969) who also regarded the plants with "Pink" or "violet" flowers as "D.doranii FvM. var. eriantha FvM." Similar annotations are also noticed on the herbarium labels of many other collections of this variety.

Relationship:

This variety is nearest to the var. globulifera, but may be easily distinguished by its light - purplish - violet inflorescence and non - globular flower clusters.

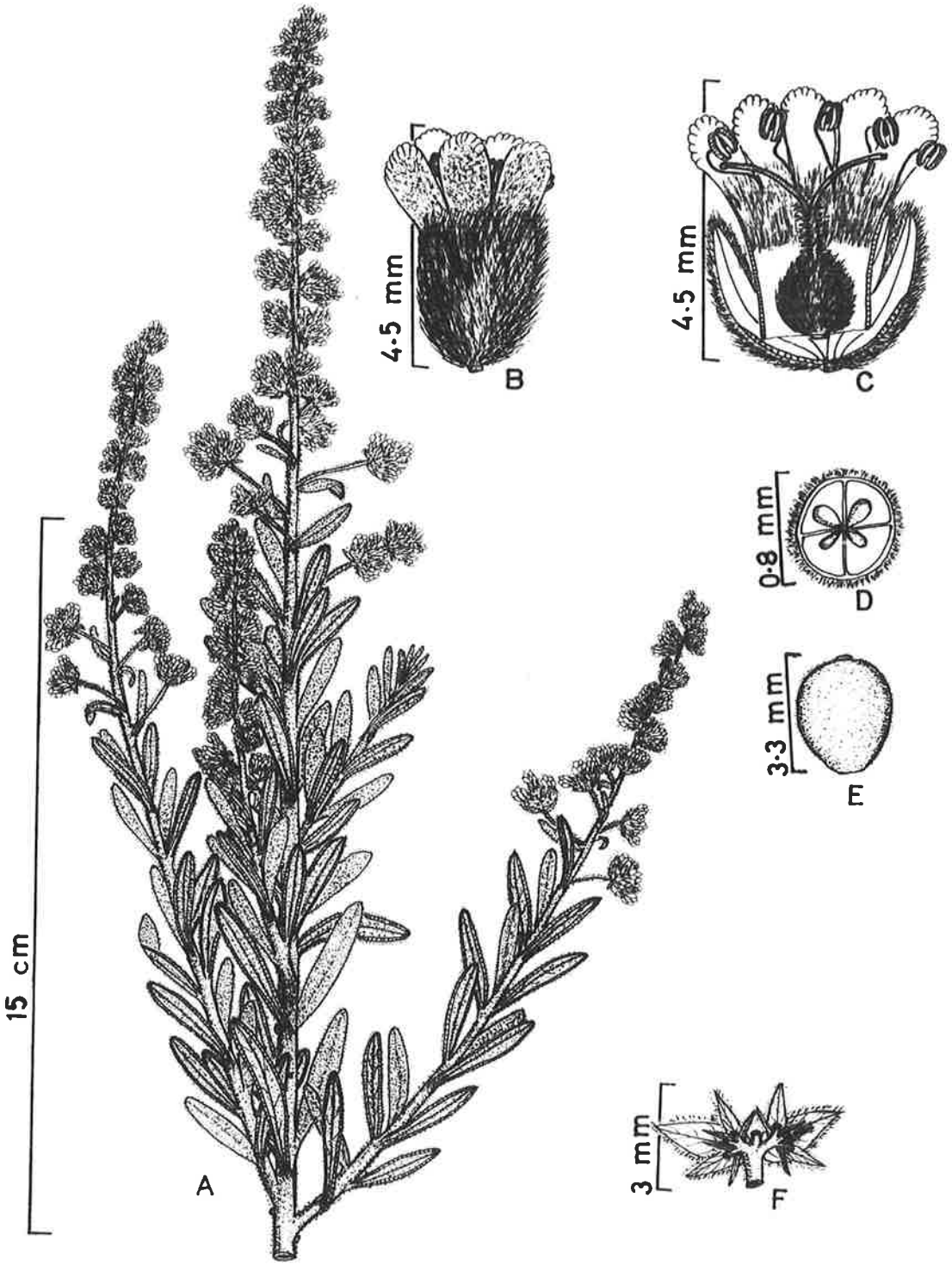


Fig. 21 — Dicrastylis costelloi Bailey (J.R. Maconochie 496: AD) A, flowering twig; B, flower; C, flower longitudinally cut open; D, T.S. ovary; E, fruit; F, bracts and bracteoles in a cyme; the flowers being removed.

Dicrastylis beveridgei F.v.Mueller, Fragm.8 (1873) 50, ssp. beveridgei ; F.v.Mueller, Fragm.9 (1875) 4; R.Tate, Trans.R.Soc. S.Aust.3 (1880) 78; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v. Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; E.Giles, Aust.Twice Trav. 2 (1889) 356; R.Tate, Trans.R.Soc.S.Aust.12 (1889) 113; R.Tate, Fl.S.Aust. (1890) 156, 254; R.Tate, Horn.Exped.Bot. (1896) 174; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 498,499;G.Chippendale Trans.R.Soc.S.Aust. 82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc.(1959) 208,278; H.N.Moldenke, Fifth Summary Verbenac. etc. 1 (1971) 345,475; G.Chippendale Proc.Linn.Soc.NSW 96 (1972) 256.

T y p u s: E.Giles s.n.,MEL40805: between Mt.Udor and Giles Range, Northern Territory, - 1872 (MEL holotype).

D.doranii auct.non F.v.Mueller: L.Diels & E.Pritzel, Bot.Jahrb. Syst. 35 (1904) 499, pro parte-(quoad spec. H.Kempe 372 - MEL).

D.doranii FvM. var. eriantha FvM.,Trans.R.Soc.S.Aust.9 (1886) 13 - pro parte (quoad spec. H.Kempe 372 -MEL).

Description:

A compact spreading shrub up to 1 metre high, ± 1 (-2) metres in diameter, densely clothed with short branched tomentum. Stem branched, spreading, cylindrical, woody, densely greyish - toment -ose, always golden - yellow at shoot tips. Leaves sessile, usua-lly in whorls of three, sometimes opposite or scattered, narrow-linear, with recurved margins, obtuse, 1 - 2.5(-2.8) cm long, 1.5 - 3(-5) mm broad, faintly rugose, densely covered with grey-ish branched tomentum. Inflorescence cymose, golden - yellow; cymes sessile or occasionally with short peduncle, arranged into a spike - like panicle with sometimes a few short branches near the base, bracteate, generally 3 - 7 - flowered, closely borne on the slender axis of the spike. Flowers 5 -merous, rarely 4 - merous, bracteate, sessile, 3.5 - 4 mm long, each with a small bract and two minute bracteoles at the base; bracts linear - lanceolate, 1 - 1.3 mm long, 0.2 - 0.3 mm broad, densely covered with branched tomentum outside, glabrous inside, Calyx golden - yellow, subglobose, 5 -lobed, rarely 4 -lobed, 2 - 2.5 mm long, densely clothed with golden - yellow branched tomentum outside, glabrous inside; lobes deltoid, obtuse, ± 1 mm long; tube shallow, 1 - 1.5 mm long. Corolla white, tubular, 5 -lobed towards the apex, rarely 4 -lobed, 3 - 4 mm long; lobes oblong, obtuse, crenate at the apex, glandular and densely stellate - tomentose

outside, glabrous inside and near the apex outside, 1 - 1.5 mm long, ± 1 mm broad; tube cylindrical, 2 - 2.5 mm long, glabrous outside, densely villous in the throat. Stamens 5, rarely 4, somewhat included or scarcely exserted, inserted in the corolla-throat; filaments filiform, glabrous, 1 - 1.2 mm long; anthers 2 - lobed, dorsifixed, ± orbicular in outline, 0.4 mm. long, nearly as broad, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary subglobose - obovoid, densely white - tomentose, 1.5 - 2 mm in diameter, tetralocular, with one ovule in each cell; style deeply 2 - branched, somewhat included or scarcely exserted, 1.7- 2.8 mm long (including lobes), the lower undivided part densely covered with branched tomentum; lobes glabrous, 0.5 - 1 mm long, stigmatic at the end. Fruit obovoid, shortly tomentose, ± 2.5 mm in diameter.

Specimens examined:

NORTHERN TERRITORY:- B.Alright 19: 10 miles W. Musgrave Ranges, between Musgrave and Mann Range, on border of N.T. and S.A., -VIII. 1967 (NT).- G.Chippendale 613: 1 m. N. Obenga Well, Angas Downs, 24.XI.1954 (ADW,BRI,CANB,MEL,NSW,NT).- C.Dunlop 1948: 70miles W. Ayers Rock. 25.X.1970 (NT).- C.Dunlop 2019: 35 miles N.E. Mt. Davies Camp, 1.XI.1970 (AD,NT).- E.Giles s.n.,MEL40813: Mount Olga,-(MEL).- E.Giles s.n.,MEL40805: between Mt.Udor and Giles Range,-1872 (MEL holotype).- H.Kempe 372:MEL40818: Finke River, -1880 (BM,MEL -syntypes of D.doranii FvM. var.eriantha FvM.).- M.Lazarides 6058: 17 miles S. of Central Mt.Wedge Station,19.IX. 1956 (CANB,MEL,NT,PERTH,US).- M.Lazarides 6170: near Ayers Rock. 8.X.1956 (AD,BRI,CANB,NSW,NT).- A.A.Munir 5116: 10 km west of Curtin Springs, 22.VIII.1973 (AD).- A.A.Munir 5149: 3 km west of Ayers Rock, 24.VIII.1973 (AD).- R.F.Thornton s.n.,MEL40811:Tempe Downs, near Charlotte Waters, -XII.1887 (MEL).

SOUTH AUSTRALIA:- N.N.Donner 3918B: 60 km W. of Vokes Corner, 17.VII.1972 (AD).- B.Lay 73: Edolden Rockhole, 50 km E.N.E. of Barton, 24.X.1970 (AD).- W.S.Reid s.n.,ADW33630: Serpentine Lakes Road, W.A.- S.A. border S. of the Aboriginal Reserve, 28.VI.1967 (ADW).- W.S.Reid s.n.,ADW36237: Kondoolka, Eyre Peninsula, 30.IX. 1966 (ADW).- Tietkins 20,MEL40812: Ooldea, north of Fowler's Bay, -(MEL).- Tietkins s.n.,AD97205190: Ooldea, -1897 (AD).

Distribution: (Map 7).

The type sub - species beveridgei is recorded from South Australia and Northern Territory, only. The known localities in South Australia are chiefly along the south-eastern fringe of the

Great Victoria Desert near Serpentine Lake and in Maralinga and Kondoolka area. In Northern Territory, the distribution is chiefly to the south-west of Alice Springs towards the Musgrave and Petermann Ranges. One locality to the south of Alice Springs is along the Finke River and two north-west of that town, are near Mt.Udor and Giles Range.

E c o l o g y:

Much of what is true of D.costelloi is true also of this species. According to information gathered from collectors' annotations, it commonly occurs in deep red sand and desert clayey sand. The plant size seems to increase more by lateral spreading than in height. Chippendale 613 (ADW,BRI,CANB,MEL,NT), from Angas Downs, is noted as "Small spreading subshrub;fls. creamy yellow; common in deep red sand". Dunlop 1948 (NT), from 70 miles west of Ayers Rock is recorded as "highly fragrant spreading shrub of ± 40 cm high". The association is noted"with Triodia basedowii, desert poplar, Gyrostemon tepperi". Dunlop's second collection no.2019 (AD,NT), 35 miles north-east of Mt.Davies Camp is reported as "low compact spreading bush; flowers yellow". The habitat is given "sand dune with Dodonaea attenuatum". Lazarides 6058 (CANB, MEL,NT,PERTH), from 17 miles south of Mt.Wedge Station is noted as "low, grey, spreading sub-shrub to 1 ft. high and 2 $\frac{1}{2}$ ft. in diameter". The habitat is said to be "Common in desert clayey - sand with Casuarina decaisneana and Triodia basedowii". Lazarides 6170 (AD,BRI,CANB,NT), from Ayers Rock is annotated as "Occasional in deep coarse sand with Triodia Plectrachne grassland". Lay 73 (AD), from Edoldeh Rockhole is recorded as "Dense herbaceous shrub 3 metres wide and 1 metre high". The habitat is noted "sandy soil, Casuarina cristata woodland".

According to the present writers field observations, this species is mostly 45 - 90 cm tall, spreading by stolons over an area of up to 2.5 metres in diameter. It grows commonly in sandy spinifex country with Acacia, Casuarina, Eremophila, and Triodia species. Flowering and fruiting occur chiefly during October - December.

C o m m e n t s:

Among all the specimens examined, the leaves and tomentum are somewhat larger in South Australia collections. Black (1926, 1957) describes the leaves of this species as "resembling those of D.doranii". Actually, Black has mistaken D.costelloi, for D.doranii, because the linear leaves with recurved margins in

D.costelloi resemble very closely those of D.beveridgei.The leaves in D.doranii are narrowly elliptic or elliptic - lanceolate and their margins are not quite recurved.

The locality of R.F.Thornton's collection no.MEL40811 is "Tempe Downs near Charlotte Waters". Geographically, Tempe Downs is to the south-west of Alice Springs and Charlotte Waters to the south. The two localities are separated by nearly 200 miles and thus cannot be regarded as "near". Some collections of this species have come from Tempe Downs area but no such record is known from Charlotte Waters or its vicinity. It appears, therefore,that the collector has confused the exact locality (Tempe Downs) by recording "near Charlotte Waters".

Moldenke (1959,1971) has erroneously attributed this species to Hemsley wh in fact published D.carnegiei as a new species of this genus. The latter, however, has now been found conspecific with D.doranii FvM. and is reduced to a synonym.

Relationship:

In many respects D.beveridgei is closely related to D.costelloi, but can be easily identified by its shoot tips and inflorescence being golden - yellow. (See comments under D.costelloi).

D.beveridgei F.v.M. ssp. beveridgei var. lanata Munir, var.nov.

D.beveridgei F.v.Mueller: J.M.Black, Trans.R.Soc.S.Aust. 41 (1917) 386; J.M.Black, Fl.S.Aust.ed.1,(1926) 480;T.H.Johnston & J.B. Cleland, Trans.R.Soc.S.Aust. 66 (1942) 101; J.M.Black, Fl.S.Aust. ed.2, (1957) 723, fig.1034.

Varietas a typo ob folia lineari - lanceolata tomento longo flores in tomentum lanatum fere absconditos fasciculos discretos subglobosos saepe in axe crasso paniculae spiciformis irregulariter dispositos et tomentum calycis longius lanatumque distinguitur.

T y p u s: N.Forde 1512:CANB196313: 37 miles east -south-east of Coffin Hill, South Australia, 20.X.1960 (CANB, holotype).

This taxon differs from the type variety by its leaves being linear - lanceolate, long - tomentose; flowers almost concealed in the woolly - tomentose clusters; clusters distinct,subglobose, often discontinuously borne on the thick axis of the spike-like panicle and calyx tomentum longer and woolly.

Specimens examined:

NORTHERN TERRITORY:- A.C.Beauglehole 20242: Mt.Ebenezer turn off from Alice Springs Road, S.W. of Alice Springs, 8.X.1966 (NT).-

G.Chippendale 6400: 14m. S. Lake Amadeus, 30.VI.1959 (AD,NT).- N.T. Learmouth s.n.,MEL40948: near Ayers Rock,-X.1952 (MEL).

SOUTH AUSTRALIA:- Bate s.n.,AD97205189: Ooldea Soak,-VIII. 1927 (AD).- C.H.Bowen 141: Maralinga, 10 miles W. Sandhill, -IX. 1956 (K,NSW).- J.B.Cleland s.n.,AD966042052: Barton, Nullarbor Plain, 20.VII.1926 (AD).- J.B.Cleland s.n, AD966042020: Ooldea, Nullarbor Plain, 20.VIII.1939 (AD).- J.B.Cleland s.n.,AD966042053: loc.cit., 8.X.1954 (AD).- J.B.Cleland s.n.,AD966042054: loc.cit., 14.XI.1954 (AD).- J.B.Cleland s.n.,AD966042021: north of Emu Junction, 6.VII.1961 (AD).- G.C.Cornwall 234: south-west corner of Everard Park Station, 5.VI.1972 (AD).- N.N.Donner 3886: 229 km west of Mabel Creek Homestead, 16.VII.1972 (AD).- N.N.Donner 3912: 27 km west of Vokes Corner, 17.VII.1972 (AD).- N.N.Donner 3918: 60 km west of Vokes Corner, 17.VII.1972 (AD).- N.Forde 490: 46 miles E. of Emu Junction, 4.IX.1956 (CANB,MEL,NSW,PERTH).- N.Forde 622: 2 miles S. of Maralinga, 10.X.1956 (AD,CANB,MEL).- N.Forde 1508: 9 miles E.S.E. of Coffin Hill, 20.X.1960 (CANB).- N.Forde 1512: 37 miles E.N.E. of Coffin Hill, 20.X.1960 (CANB holotype).- D.W.Goode s.n.,ADW4913: Malbooma Station, 3.XII.1942 (ADW).-R.Helms s.n.,AD97113045: Birksgate Range, Eld.Expl.Exped.Camp 20 and 21, 14.VII.1891 (AD).- F.L.Hill 721: Maralinga, -X.1956 (F,G,K,PERTH).- C.E.Hubbard 8326: Barton, 23.IX.1931 (K).- E.H.Ising 2276: Barton, 17.IX.1926 (AD).- T.R.N.Lothian 2696: Tallaringa Well, ca. 140 km W. of Coober Pedy. 3.V.1964 (AD).- T.R.N.Lothian 2722: ca. 10 km east of Tallaringa, 4.V.1964 (AD).- T.R.N.Lothian 2764: ca. 74 km west of Tallaringa Well, 6.V.1964 (AD).- T.R.N.Lothian 3776: ca. 96 km W. of Mabel Creek Homestead, 27.V.1967 (AD,M),-T.R.N.Lothian 3780: ca. 8 km W. of Tallaringa Well, 27.V.1967 (AD,G 2-spec.,H, G;NCU - n.v.).- T.R.N.Lothian 3890: ca. 8 km W. of Emu,31.V.1967, (AD,E,W).- T.R.N.Lothian 5527: ca. 22 km north of Watson on Maralinga Road, 14.VII.1972 (AD).- C.P.Mountford & L.E.Sheard s.n., AD966080978: Mann Range, -IX.1940 (AD).- W.S.Reid s.n.,ADW33632 & ADW36814: Perimeter Road, 25.VI.1967 (ADW).- W.S.Reid s.n., ADW33631: Serpentine Lake Road, 28.VI.1967 (ADW).- D.E.Symon 3421: ± 9 m. S. of Mt.Christie on Commonwealth Hill Stn.,21.II.1965 (ADW,CANB,K,NSW).- Tietkens s.n.,AD97113312: Ooldea, -1879 (AD).- N.B.Tindale s.n.,AD97113310: loc. cit.,5.X.1934 (AD).- J.A.White s.n.,MEL40810: loc.cit.,-I.1917 (MEL).- S.A.White s.n.,AD9720517 & AD97205199: Ooldea, -I.1917 (AD).

WESTERN AUSTRALIA:- A.S.George 8297: ± 6 miles S. of Walter James Range, 4.X.1966 (PERTH).- A.S.George 8345: ± 3 miles N.E. of Walter James Range, 5.X.1966 (PERTH).- A.S.George 8890: 14 miles N. of Walter James Range, 24.VII.1967 (PERTH).

Distribution: (Map 7).

This variety is known to occur in the far eastern part of Western Australia, south-west of Alice Springs in Northern Territory, and in the north-western part of South Australia. Distribution in Western Australia is near Walter James Range and in Northern Territory it occurs to the south and south-east of Lake Amadeus. In South Australia, the majority of the collections come from the north-eastern and south-eastern parts of the Great Victoria Desert. The north-eastern localities are within Birksgate Range and Mann Ranges, while the south-eastern ones are to the north of the Trans-continental Railway around Maralinga, Ooldea, Barton and Malbooma.

Ecology:

In its ecological requirements var. lanata is much like var. beveridgei, being common in the arid sandy parts of South Australia and Northern Territory. Chippendale 6400 (AD,NT), from S. of Lake Amadeus, is noted growing "in deep red sand, associated with Triodia pungens". Forde 490 (CANB,MEL,NSW,PERTH), from E. of Emu Junction is reported "rare on the crest of a sand dune with Acacia linophylla and Eremophila latrobei". The plant is said to be "a woody herb 48 cm high. Bark hairy white. Flowers golden yellow". In his second collection of this taxon, Forde 622 (AD,CANB,MEL), from S. of Maralinga, is noted as "shrub 1 metre tall with golden yellow flowers and whitish bark". The habitat is recorded as "common on a sand ridge characterized by Callitris and Eucalyptus pyriformis" Learmouth s.n.,MEL40948 (MEL), from Ayers Rock,is collected from "Red sandhill". Symon 3421 (ADW,CANB,NSW), from S. of Mt.Christie on Commonwealth Hill Stn. was growing on "sand dune crest".Black (1917) remarks this taxon as "a most attractive plant with its panicles of golden flowers; the bushes attained the height of 3 feet, and in some instances grew in masses very closely together, forming a blaze of golden colour; many insects are attracted by the flowers". According to Johnston & Cleland (1942), this plant is "used in ceremonials by natives of Ooldea region, S.Australia".

Flowering and fruiting specimens have been collected chiefly during October - February with scattered flowering collections during September, and very rare at other times in a year.

Comments:

In the Northern Territory collections, the tomentum on stem and leaves is comparatively short, inflorescence lax and floral-clusters much more woolly and distinct. Among these, the leaves in Learmouth's Collection (no.MEL40948), from Ayers Rock, are larger

(up to 4.5by 0.7 cm), narrowly elliptic or elliptic - lanceolate and their margins not quite recurved in the adult stage. Moreover, the corolla-lobes in this specimen are not distinctly crenate. The number of calyx - lobes and corolla - lobes and stamens in a flower are normally five each, but like many other species of this genus, sometimes these are four or six each in a flower. Among the few flowers examined from F.Hill's collection no.721 (PERTH), many are hexamerous.

Relationship:

The var. lanata is closely related to the type variety. For distinctive characters see key to the subspecific taxa of D.beveridgei.

D.beveridgei F.v.M. ssp. revoluta Munir, ssp. nov.

Subspecies a typo ob folia anguste elliptica vel elliptico - oblonga margine valde revoluta distinguitur.

T y p u s: J.R.Maconochie 825: 25 miles N. of Sandy Blight - Docker River Road Junction, Western Australia, 23.IX.1969 (AD holotype; NT,PERTH).

This taxon differs from the type subspecies by its leaves being broader, elliptic - oblong (1 - 2.3 by 0.4 - 0.8 cm), with margins deeply revolute.

Specimens examined:

WESTERN AUSTRALIA:- J.R.Maconochie 825:25 miles north of Sandy Blight - Docker Road Junction, 23.IX.1969 (AD holotype; NT,PERTH-isotypes).- N.N.Donner 4472: 10 km south-east of Mt. Fanny, 28.VIII.1973 (AD).- A.A.Munir 5188: 35 km south of the turn - off of Giles Meteorological Station and Warburton Mission, 27.VIII.1973 (AD).- A.A.Munir 5198: 10 km south-east of Mt.Fanny, 28.VIII.1973 (AD).

NORTHERN TERRITORY:- A.A.Munir 5161: 3 km west of Armstrong Creek, 25.VIII.1973 (AD).

Distribution: (Map 7).

The ssp. revoluta is known from the Petermann Ranges in Northern Territory and to the north-east of Warburton Mission in Western Australia. The major distribution is in the far south-west border region of Northern Territory and adjacent regions of Western Australia.

E c o l o g y:

Much of what is true of the type subspecies seems also true of ssp. revoluta, The known distribution is restricted to dry eremean parts of Central and Western Australia where the average annual rainfall is very low. The plant is generally 30 to 45 cm high spreading chiefly by stolons over an area of three to four times its height. In the Northern Territory, the present writer (no.5161 -AD) has found it growing in sandy soil, associated with D.gilesii, Acacia, Eremophila, Eucalyptus and Grevillea species. Over the state border in Western Australia (Munir nos.5188 & 5198 - AD),it grows in spinifex sandy country mainly with Acacia, Eremophila, D.gilesii, Grevillea, Loudonia, Newcastelia spodiotricha, Solanum, Triodia and Thryptomene species. Moreover, Maconochie 825 (AD,NT,PERTH), from 25 miles north of the Sandy Blight - Docker River Road Junction is annotated as "growing in Desert Oak - spinifex community between dunes". The plant is noted as a yellow - flowered shrub of ± 30 cm high.

The flowering and fruiting seem to take place chiefly during October - December.

C o m m e n t s:

In many respects the leaves and flowers of ssp. revoluta are somewhat similar to D.doranii F.v.Mueller; the leaves of both are narrowly elliptic to elliptic - oblong with margins revolute throughout or often nearly so towards the base. Moreover, the mode of drying in the old leaves is also identical because they start drying gradually from apex towards the base. This character has not been observed in any other known species of this genus. In spite of these similarities, the shape of the inflorescence and golden - yellow colour of flowers and young shoots agrees more with D.beveridgei than D.doranii. The inflorescence in the latter is a pyramidal panicle, clothed with whitish - grey tomentum, but in the sub - species revoluta,the flowers are in golden -yellow spike - like panicles having few or no branches (lateral peduncles) near the base.

In view of the above facts, it is suspected that this taxon may perhaps be a hybrid between D.doranii and D.beveridgei. This hypothesis is supported by the fact that the distribution of these species overlaps in the region where subspecies revoluta now occurs. However, since the general shape of its inflorescence and golden - yellow colour of flowers and young shoots and density of leaf indumentum is more like D.beveridgei, it has been considered conspecific with the latter but as a distinct subspecies.

Relationship:

Like the type subspecies beveridgei, the subsp. revoluta is also related to D.costelloi in the shape of its inflorescence and flower character, but the shape of leaves and their mode of drying (when old) is somewhat similar to D.doranii. However, the recurved margins of the leaf, together with the golden - yellow inflorescence and young shoots readily distinguish it from the other two.

Sectio 5. Pyramidatae Munir, sect.nov.

Cymae in paniculas pyramidales dispositae, folia sessilia vel breviter petiolata decussata plus minusve elliptico - lanceolata vel ovato - lanceolata margine raro recurva.

T y p u s: Dicrastylis exsuccosa (F.v.Mueller.) Druce, Rep.Bot. Exch.Cl.Brit.Is. 1916 (1917) 619.

Cymes arranged in a ± pyramidal panicle; leaves shortly petiolate or sessile, decussate, ± elliptic - lanceolate, elliptic - oblong or ovate -lanceolate, margins seldom recurved.

Dicrastylis doranii F.v.Mueller, Fragm.8 (1874) 230; F.v.Mueller, Cens.Aust.Pl.1.(1882) 103; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; E.Giles, Aust.Twice Trav.2 (1889) 355; L.Diels & E.Pritzel, Bot.Jahrb.Syst.35 (1904) 499, pro parte- (quoad spec. H.Kempe 372 -BM,MEL); C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208,278; G.Chippendale, Trans.R.Soc. S.Aust.86 (1963) 8; J.S.Beard, West Aust.Pl.ed.2,(1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 (1971) 345, 475; G.Chippendale, Proc.Linn,Soc.N.S.W. 96 (1972) 256.

T y p u s: E.Giles s.n.,MEL40815: Rawlinson Range, Western Australia, -(MEL holotype).

D.carnegiei W.B.Hemsley, Hook.Ic.Pl.IV,6 (1899) no.2582; L.Diels & E.Pritzel, Bot.Jahrb.Syst.35 (1904) 498,499; A.J.Ewart & O.B. Davies, Fl.N.T. (1917) 237; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208,278;H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 345,475.....syn. nov.

T y p u s: H.D.Carnegie s.n.: in about 126° longitude and 22° 30' latitude, - 1896 (K, holotype).

Description: (Fig.22).

Greyish tomentose shrub, 40 - 90 cm high, spreading over an area of about 2 metres in diameter. Stem erect, branched from near the base, cylindrical, woody, cinerascent tomentose, Leaves sessile or very shortly petiolate, decussate, narrowly elliptic - lanceolate or elliptic - oblong, cuneate towards the base, densely clothed with cinerascent short tomentum, 1.5 - 3.5 cm long, 0.3 - 0.8(-1) cm broad; margins flat or sometimes slightly recurved in the lower halves. Inflorescence terminal, cymose; cymes forming head - like flower - clusters, arranged in ± pyramidal panicle; peduncles longer and spreading towards the base, greyish tomentose, the basal ones up to 4 cm long; heads (flower - clusters) normally 3 - 7 - or 9 - flowered, bracteate, 4 - 8 mm in diameter, the young spical heads sessile. Flowers 5 -merous, rarely 4 -merous, sessile, bracteate, ± 4.5 mm long, each subtended by one bract and two bracteoles; bracts elliptic - ovate, 1.3 - 1.5(-2.5) mm long, 0.8 - 1 mm broad, densely tomentose outside, glabrous inside; bracteoles minute, elliptic - lanceolate, 0.5 - 1.5(-2) mm long, 0.3 - 0.5(-0.8) mm broad, densely toemtnose outside, glabrous inside. Calyx 5 -lobed in the upper half, rarely 4 -lobed, 3 - 3.5 mm long, densely short tomentose outside, glabrous inside; lobes short, deltoid, obtuse, almost equalling the tube, ± 1.5 mm

long; tube somewhat cylindrical, 1.5 - 2 mm long. Corolla white, tubular, 5 -lobed towards the apex, rarely 4 -lobed, ± 4 mm long; lobes oblong, obtuse, distinctly crenate at the apex, glandular and densely short tomentose outside, glabrous inside, 1 - 1.5 mm long, ± 1 mm broad; tube cylindrical, ± 3 mm long, glabrous outside, densely villous inside the throat. Stamens 5, rarely 4, somewhat included or scarcely exserted, inserted in the corolla-throat; filaments filiform, glabrous, shorter than the corolla - lobes, 0.8 - 1 mm long; anthers 2 -lobed, dorsifixed, 0.5 - 0.6 mm long, yellowish - brown; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary elliptic - obovoid, densely white tomentose, ± 1 mm in diameter, 4 -locular, with one ovule in each cell; style deeply 2 -branched, somewhat included or scarcely exserted, up to 2.5 mm long (including lobes), the lower undivided part densely covered with branched tomentum, ± 1.5 mm long; lobes glabrous, ± 1 mm long, stigmatic at the tip. Fruit dry, indehiscent, obovoid, shortly toemtnose, 3 - 3.5 mm long, 2.5 - 2.7 mm in diameter, 1 - 2 - seeded.

Specimens examined:

NORTHERN TERRITORY:- G.Chippendale 3350: about 70 miles west-north-west of Mt.Singleton, 17.XII.1959 (AD,CANB,MEL,NSW,NT,PERTH).-

WESTERN AUSTRALIA:- E.M.Bennett 2902: Cunderdin, 23.I.1969 (PERTH).-H.D.Carnegie s.n.: in about 126° longitude and 22° 30' latitude - 1896 (K holotype of D.carnegiei Hemsl.).- A.Fairall 2103:Lake Carnegie, 29.VII.1966 (PERTH).- A.S.George 2961: 19 miles west of Warburton Mission, 30.VIII.1961 (PERTH).- A.S.George 3907: ± 36 miles east of Warburton Mission, 22.VIII.1962 (PERTH).- A.S. George 5366: 11 miles east of Natabilis Hill, Gunbarrel Hwy., Gibson Desert, 24.VII.1963 (PERTH).- A.S.George 5462: 14 miles west of Mt. William Lambert, Gunbarrel Hwy., Gibson Desert,26.VII. 1963 (PERTH).- A.S.George 8139(a) & 8139(b): near Wahlgu Rockhole, Laverton - Warburton Road, 29.IX.1966 (PERTH).- A.S.George 8210: ± 8 miles east of Natabilis Hill, Gunbarrel Hwy., Gibson Desert, 2.X.1966 (PERTH).- A.S.George 9013: ± 7 miles west Dovers Hills, north Gibson Desert, ± 128° 35' E, 23° 05' S, 27.VII.1967 (PERTH).- A.S.George 9096: 24 miles east of Gary Junction, northern Gibson Desert, ± 125° 42' E, 22° 36' S, 29.VII.1967 (PERTH).- E.Giles s.n., MEL40815: Rawlinson Range, -(MEL holotype).- H.A.Johnson 9752: about 200 miles south-south-west of Broome, 4.VIII.1962 (NT,PERTH).- A.J.Mahood 8704: Gregory Lake, 4.IV.1962 (NT).- A.A.Munir 5186 & 5187: 3 km and 35 km respectively from south of the junction of Giles Meteorological Station - Warburton Mission Road turnoff, 27.

VIII.1973(AD).- A.A.Munir 5207: ca. 75 km east of Warburton Mission 29.VIII.1973 (AD).- A.A.Munir 5214: 35 km south-west of Warburton Mission, 30.VIII.1973 (AD).- A.A.Munir 5218: 155 km south-west of Warburton Mission, 30.VIII 1973 (AD).- D.L.Serventy & A.R.Main s.n.: far S.E.corner near N. margin of Nullarbor Plain,- -VIII.1960 (PERTH).- Young s.n.,MEL40946: Queen Victoria Springs, -(MEL).

SOUTH AUSTRALIA:- R.Morland H2: Land and Survey Exped.Officer Basin, loc. incert., -VI.1963 (PERTH).

Distribution: (Map 7).

D.doranii F.v.M. is restricted chiefly to the dry eremean part of Western Australia. The only representation from South Australia is from some unknown locality in the Officer Basin, south of Musgrave Range. Similarly, the only known locality in the Northern Territory is to the west-north-west of Mt.Singleton near the Western Australian border. Distribution in Western Australia is mainly to the south-east and north-east of Gibson Desert towards the Northern Territory border. In this area, most of the localities are along Gunbarrel Highway and to the east and south-west of Warburton Mission. Its occurrence to the north-east of Gibson Desert is recorded from near Dovers Hills and east of Gary Junction. A few isolated localities are near Queen Victoria Springs, Cunderdin, Lake Gregory and to the south-south-west of Broome towards West coast.

E c o l o g y:

D.doranii is a greyish - tomentose shrub growing chiefly in dry sandy areas. According to Carnegie s.n.(K), from Gibson Desert, W.Aust., it "was found on the steep sides of sand - ridges". The plant is described as having "perfume resembling that of Lavender". Chippendale 3340 (AD,CANB,MEL,NT,PERTH), from west-north-west of Mt. Singleton.N.T., is annotated as "grey subshrub of 2 feet high with greyish inflorescnece". The plant is said to be "Common on side of sandridges". George 2961 (PERTH), 19 miles west of Warburton Mission, is described as a "shrub to 40 cm" with "flowers pale cream - white". It was growing "in red sand with Triodia,Grevillea eriostachya and Eucalyptus dichromophloia". In his subsequent collection (no.8210) of this species, from Gunbarrel Hwy., the collector has given exactly similar information. Johnson 9752 (NT, PERTH), ca. 200 miles south-south-west of Broome was collected from "near stony outcrops amongst firmer sandy loam soil". The present writer has seen it growing chiefly in sandy soil of spinifex country. Munir 5186 & 5187, (AD), 33 km and 35 km south of

Giles Meteorological Stn. respectively, were found growing along the sandy tracks and on the slope of a sand dune with Triodia, Convolvulus, Dicrastylis gilesii, Grevillea eriostachya, Halgania, Kennedya, Newcastelia spodiotricha, Solanum and Thryptomene species. Munir 5207 (AD), 75 miles east of Warburton Mission was also growing in sandy soil, chiefly associated with Acacia, Eucalyptus, Ptilotus and Newcastelia elliptica species. Munir 5214 (AD), from 35 km S.W. Warburton Mission was found in sandy ground with an association of Triodia, Dicrastylis exsuccosa, Cassia, Eucalyptus and Grevillea species. Yet another specimen was collected by the present writer from sandy soil . Munir 5218 (AD), from 155 km S.W. Warburton Mission occurs / along the roadside with Newcastelia hexarrhena, Triodia, Grevillea, Acacia, Cassia and Ptilotus species. The plant is a greyish - white tomentose shrub, branching from near the base and spreading over an area of about 2 metres in diameter,

Flowering and fruiting seem to take place chiefly from September to December.

C o m m e n t s:

After examing the holotype of D.carnegiei Hemsl., this taxon has been found conspecific with D.doranii FvM. and is therefore regarded by the writer as a synonym of the latter. In the original (protologue) plate of D.carnegiei [Hook.Ic.Pl.6 (1899) no.2582], the figs. 1- 6 seem correct illustrations of flowers and its various parts, but in the habit drawing the alternate arrangement of leaves and primary lateral vegetative branches (and peduncles) is contrary to the opposite [decussate] position of these organs. Moreover, in the protologue of D.carnegiei, the author considered Mr. Andrew's coll. no. 65 from Lake Eyre and "McDougal" Stuart's Coll. no.202 from the interior of Australia as also belonging to this taxon. After examining both these specimens, the former is found to belong to D.costelloi Bail. (s.str.) and the latter to its variety eriantha (FvM.)Munir.

Diels & Pritzel (1904) have cited two specimens under D.doranii FvM., one of them is the holotype, collected by E.Giles from Rawlinson Range, and the other H.Kempe's collection from Finke River. The latter was recorded by Mueller (1886) as a narrow - leaved variety [var. eriantha] of this species when he studied C.Winnecke's specimens from Central Australia. However, since H.Kempe's specimen has narrowly linear - lanceolate leaves with recurved margins and golden - yellow inflorescence, it has now been recognized as D.beveridgei FvM.

The number of flowers in a cluster (head) may be 9, 7 or 3 only; depending upon the number of cymes involved. In 9 -flowered clusters, there are two lateral and one terminal cyme, each bearing 3 flowers. The 7 - flowered cluster has a terminal flower with two lateral cymes of 3 flowers each. In 3 - flowered clusters, two of the three cymes (probably the lateral ones) seem suppressed. This information is based on the examination of both fresh and dried material without any anatomical studies. In a cyme, the terminal flower is apparently non - bracteate whreas each lateral flower is subtended by a small bract and two minute bracteoles. Actually, the main bract at the base of sessile cymes also subtends the terminal flowers. The reduced stalk of the cyme and sessile terminal flower are both in the same vertical line, and if the lateral flowers are removed the terminal flower appears bracteate.

Among all the specimens examined, Morland's collection (no. H2) from Officer Basin, South Australia, has comparatively smaller leaves and somewhat longer and looser calyx - tomentum. The specimen was collected flowering, but the collecting date is noted as June when this species usually does not flower. Flowering and fruiting mostly take place from September to December. Normally, the fresh leaves in this species are generally flat but in the dried specimens, the margins are sometimes recurved towards the base. Similarly, the cyme bears primary lateral peduncles which are normally decussately arranged, but in one of George's collections (no.8210 -PERTH) from Gibson Desert, the number of lateral branches in some inflorescences is three at a node.

The inflorescence is greyish tomentose, but in two of George's collections (nos.2916 & 3907 - PERTH) from around Warburton Mission it is yellowish - grey. There is no differance in the shape of their leaves and inflorescence nor in the size and density of their indumentum. In view of this, both these collections seem closer to D.doranii F.v.Mueller than to any other species. The colour variation in these specimens may possibly be the result of some natural cross between D.doranii F.v.Mueller and D.beveridgei F.v.Mueller var.revoluta Munir which overlap in distribution around the Warburton region.

Relationship:

D.doranii F.v.Mueller seems closely allied to D.costelloi Bailey and D.beveridgei F.v.Mueller in its flowers being sessile; calyx -lobes deltoid; corolla-lobes crenate at the top and stamens and style scarcely exserted. However, D.doranii may be easily

identified by its leaves being narrowly elliptic - lanceolate, flat or occasionally somewhat recurved towards the base when dry; mature inflorescence (with cymes) forming ± pyramidal panicle and tomentum on stem and leaves being short, cinerascent and close. The leaves in D.costelloi and D.beveridgei are linear or narrowly linear - lanceolate with always recurved or revolute margins and the inflorescence is a spike - like panicle with a few flower - bearing branches or short lateral peduncles near the base.

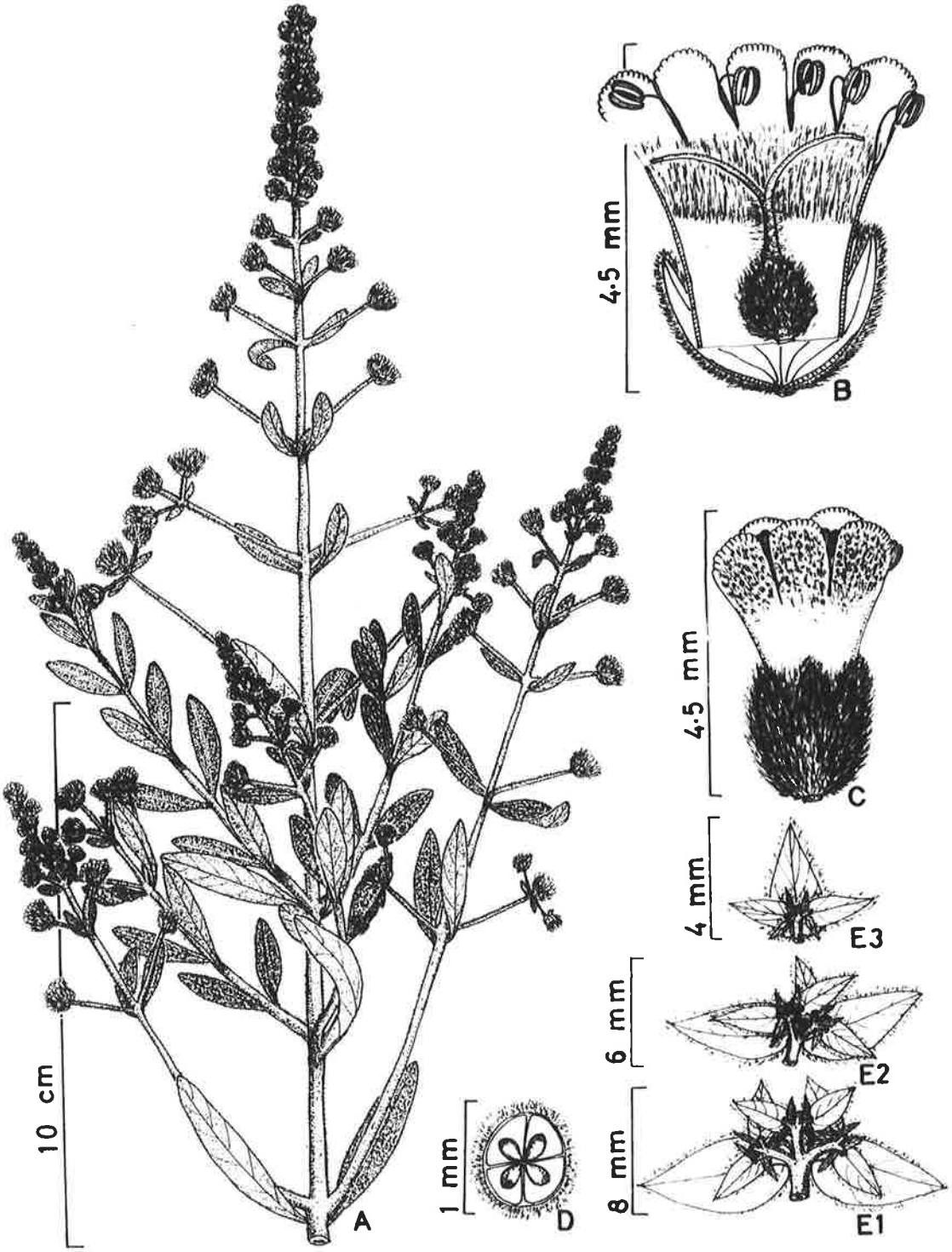


Fig. 22 — Dicrastylis doranii F.v.M. (E. Giles s.n., MEL 40815: MEL - holotype).

A, flowering branch; B, flower vertically cut open; C, flower; D, T.S. ovary; E1, E2 and E3, showing bracts and bracteoles of respectively 9, 7 and 3 flowered cymes, the flowers being removed.

Dicrastylis exsuccosa (F.v.M.) G.C.Druce, Rep.Bot.Exch.Cl.Brit. Isles. 4 (1917) 619 - ssp. exsuccosa var. exsuccosa; E.H.Ising, Trans.R.Soc.S.Aust. 61 (1937) 224; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 561,t.25; G.Chippendale, Trans.R.Soc.S.Aust. 82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208,278,335; R.E.Winkworth, Aust.J. Bot. 15 (1967) 122;J.S.Beard, W.Aust.Pl.ed.2,(1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1&2(1971) 345,475,476, 603; G.Chippendale, Proc.Linn.Soc.N.S.W. 96 (1972) 256.

Pityrodia exsuccosa [F.v.M.,Hook. J.Bot. & Kew Misc. 8 (1856) 326, nom nud.]; F.v.Mueller, Fragm.1 (1858) 60 - Basionym.

T y p u s : F.v.Mueller s.n.,MEL40891: " In locis petraeis deserti Australiae centralis, e.g. ad rivum Sturt Creek", 11.III.1856, Western Australia, - (MEL holotype; K).

D.ochrotricha F.v.Mueller, Fragm 4 (1864) 161; F.v.Mueller, Fragm. 6 (1868) 155; G.Bentham,Fl.Aust. 5 (1870) 42; R.Tate, Trans.R.Soc. S.Aust.3 (1880) 78; F.v.Mueller, Cens.Pl.Aust.1 (1882) 103; F.v.Mueller, Sec.Sens.Pl.Aust.1 (1889) 172; E.Giles,Australia Twice Trav. 2 (1889) 355; R.Tate, Trans.R.Soc.S.Aust.12 (1889)113; R.Tate, Fl.S.Aust. (1890) 155,254;J.Briquet in Engl. & Prantl. Pflanzenfam. IV,3a (1895) 164, in obs.;L.Diels & E.Pritzel, Bot. Jahrb.Syst. 35 (1904) 498,499 pro parte - (quoad spec.Mueller s.n. MEL40891 - MEL); A.J.Ewart & O.B.Davies, Fl.N.T. (1917) 237 pro parte - (quoad spec. Mueller s.n. ex Sturt's Creek); C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; S.Junnell, Symb.Bot.Upsal. 4(1934) 66, fig. 112; E.H.Ising, Trans.R.Soc.S.Aust.61 (1937) 224 pro syn.; E.Cheel, Rep.Aust.N.Z.Assoc.Advanc.Sc.(1937) 332;J.B.Cleland & T.H.Johnston, Trans.R.Soc.S.Aust. 63 (1939) 25;J.S.Beard,W.Aust. Pl. (1965) 92; J.S.Beard, W.Aust.Pl.ed.2, (1970) 113;.

T y p u s: D.ochrotricha F.v.M. and D.exsuccosa (F.v.M.) Druce are based on the same type.

Description: (Fig. 23).

An erect shrub, 30 - 90(-120) cm high, densely clothed with branched tomentum, often becoming golden - yellow. Leaves decussate, petiolate, often crowded towards the apex, lanceolate to ovate - lanceolate, obtuse, cuneate towards the base, thick, soft and densely woolly - tomentose on both sides when young, ±scabrous and rugose above when old, reticulate and tomentose underneath, (3-)4 - 8(-10) cm long, (0.7-)1.5 - 2(-2.5) cm broad; petiole

5 - 8 mm long. Inflorescence golden - yellow, cymose; cymes forming a pyramidal terminal panicle, opposite (decussate), pedunculate, sometimes with a few short umbel - like branches. Flowers 5 -merous, bracteate, pedicellate, 5 - 6 mm long, each subtended by a small bract and two minute bracteoles; bracts sessile, lanceolate, ± 1 mm long, 0.5 mm broad, densely covered with branched tomentum outside, glabrous inside; bracteoles ± 0.5 mm long. Calyx 5 - lobed, densely covered with golden - yellow branched tomentum outside, glabrous inside, 3 - 4 mm long; lobes oblong - lanceolate, obtuse, free to just below the middle, 2 - 3 mm long; tube short, 1 - 1.5 mm long. Corolla tubular, 5 -lobed towards the apex, 4.5 - 5 mm long, tomentose outside, very villous - tomentose in throat; lobes ± oblong, obtuse, 1 - 1.5 mm long, glandular and tomentose outisde, glabrous inside; tube ± cylindrical, 3.5 - 4 mm long. Stamens 5, somewhat included or scarcely exserted, inserted in the corolla- throat; filaments short, glabrous, 1 - 1.7 mm long; anthers 2 -lobed, dorsifixed, ± oblong, 0.8 - 0.9 mm long, pale - yellow, lobes free, divergent and narrowed in the lower halves, longitudinally dehiscent. Ovary subglobose, densely covered with yellow tomentum, 1.5 - 2 mm in diameter, 4 - locular, with one ovule in each cell; style deeply 2 - branched, somewhat included or scarcely exserted, 2 - 2.5 mm long (including lobes); the lower undivided part nearly as long as the lobes, densely clothed with branched tomentum; lobes unequal,glabrous, 1 - 1.3 mm long, stigmatic at the tip. Fruit dry, indehiscent, obovoid, short tomentose, 3 - 3.5 mm in diameter.

Specimens examined:

NORTHERN TERRITORY:- A.W.Banks 2434: Tanami area, -VII.1948 (NT).- S.T.Blake 17872: Rockhampton Downs, 19.V.1947 (CANB).- W.H.Butler 60: Ehrenberg Range, 60 miles east of Sandy Blight Junction,- V.1967 (PERTH).- W.H.Butler 106:Willis Rock Hole, ±30 miles east of Sandy Blight Junction, -V.1967 (PERTH).-N.Byrnes 1152: Hatches Creek Road, 25 miles from Highway, 22.XI.1968 (CBG, NT).- G.Chippendale 1523: 6 miles West of Frewena, Barkley Tableland, 14.VIII.1955 (AD,BRI,CANB,MEL,NSW,NT).- G.Chippendale 3382: 35 miles N.E. Lake Mackay, 16.VI.1957 (CANB,MEL,NSW,NT,PERTH).- G.Chippendale 3407: 17 miles N.E.Lake Mackay, 17.VI.1957 (AD,BRI, CANB,MEL,NSW,NT,PERTH).- G.Chippendale 3430:about 114 miles W. Mt. Singleton, 19.VI.1957 (CANB,NT,PERTH).- G.Chippendale3844: 6.7 miles W. of Frewena Road House, 2.X.1957 (CANB,NSW,NT,PERTH).- G.Chippendale 4262: 7⁄6miles S.E.Tanami, 3.V.1958 (AD,BRI,CANB, MEL,NSW,NT,PERTH).- G.Chippendale 4292:31.6 miles N.W. Mt.Patricia,

5.V.1958 (AD,CANB,MEL,NSW,NT,PERTH).- G.Chippendale 5636:25.8 miles N.E. Tanami, 11.IV.1959 (CANB,MEL,NSW,NT,PERTH).- G.Chippendale 5644:34.7 miles N.E.Tanami, 11.IV.1959 (MEL,NT).- L.Cockburn BPS72:Simpson Desert, -VII - VIII.1969 (BRI).- F.S.Colliver s.n., AD96231025: Tennant Creek,-VII.1938 (AD).-Dale s.n.,NSW106630: Standley Chasm, 30 miles W.Alice Springs, 7.VII.1939 (NSW).- H.V.Dam 54:Ca. 45 km north of Barrow Creek, 20.VI.1969 (AD).- N.G.Eddy 3783:50 miles N. Barrow Creek, 1.V.1957 (CANB,NT).- N.G.Eddy 5237:42 miles N.Barrow Creek, 3.IV.1958 (NT).- A.J.Ewart s.n.,MEL40899:5 - 8 miles N. Taylor Creek, -VI.1924 (MEL).- R.Hill & H.W.Caulfield s.n.,AD96208080: between Barrow Creek and Wauchope, -VII.1953 (AD).- P.K.Latz 486:30 miles S.Tennant Creek, Stuart Highway, 21.II.1969 (CBG,NT).- P.K.Latz 2099:Campbell Range, 22° 48' 130° 30', 17.I.1972 (AD,NT).-T.R.N.Lothian 422/54:Murray Downs Station, -1954 (AD).- J.R.Maconochie 432: 8 miles S.Wycliffe Well, 27.VII.1967 (AD,MEL,NT).- A.Nicholls 601:4 miles S.Wycliffe Well, Stuart Highway, 2.VII.1967 (AD,NT).- R.A.Perry 654: 55 miles W.N.W. of Frewena Station, 27.IV.1948 (BRI,CANB,NT).- R.S.Rogers s.n.,NSW166634: Tanami, -VIII to IX.1910 (NSW).- Rose 209:Tanami, -(CANB).- D.E.Symon 6902:8 miles N.W. of the Granite, 17.V.1971 (AD).- R.E.Winkworth 574: 33 miles S. of Tennant Creek, 16.IX.1954 (CANB,NT).- R.E.Winkworth 1582: 40 miles north of Wauchope, 1. VIII.1963 (NT).

WESTERN AUSTRALIA:- R.J.Chinnock 926:Ca. 18 km south-west of Glenayle Homestead, 9.IX.1973 (AD).- R.H.Kuchel 166: 250 miles north of Giles, S.W. of Lake Mackay, 2.VIII.1962 (AD,G-2 spec.,M) .- A.A.Munir 5223:190 km south-west of Warburton Mission, 31.VIII. 1973 (AD).- D.J.Nelson 1942: Pussycat Bore, Balweena Reserve, 30.VIII.1969 (AD,NT).-F.v.Mueller s.n.: Sturt Creek, near Mt. Wilford, 11.III.1856 (K - Isotype).- E.Oliver & T.Muir 3936: on track between Alexander Springs and Warburton Road, - VIII.1971 (AD).- M.Terry s.n.:near South Esk Tableland, -1925 (PERTH).

Distribution: (Map 8).

The type subspecies, variety and form of D.exsuccosa is known to occur chiefly in the Northern Territory and Western Australia. Most of the localities are recorded from Northern Territory where it is known to grow between 19 and 24 degrees south latitude and between 129 and 136 degrees east longitude. With the exception of a solitary collection from Simpson Desert (loc.incert.) almost all other collections have come from north and north-west of Alice Springs. To the north of Alice Springs, it is common between Barrow Creek and Tennant Creek along Stuart Highway; a few local-

ities are also known from Murray Downs and Hatches Creek to the north-east of Barrow Creek and around Frewena and Rockhampton Downs to the east-north-east of Tennant Creek. To the north-west of Alice Springs, the distribution is mainly around Tanami, The Granites and Archibald Soak. The other known localities are to the north-east of Lake Mackay, east of Sandy Blight Junction and north-west of Mt.Patricia.

In Western Australia, there are a few scattered localities restricted chiefly to the Eastern Division. Two of them are to the south-west of Warburton Mission, one south-west of Lake Mackay and all the rest from around Sturt Creek.

In South Australia, a few collections of its var. tomentosa f.lachnophylla are recorded from the far north-western area near the borders of Northern Territory and Western Australia.

E c o l o g y:

Like many other species, D.exsuccosa is also found mainly in sandy soil, associated with Acacia, Eucalyptus, Plectrachne, or Triodia communities. It is restricted to summer rainfall areas and is often collected from the disturbed soil along the roads. According to Blake 17872 (CANB), from Rockhampton Downs, it is "60 - 90 cm high shrub", growing in association with " low Eucalyptus - Acacia - Plectrachne scrubs on red sandy lateritic soil". The leaves are said to be hoary beneath, calyx yellow and corolla white. Byrnes 1152 (CBG,NT), from Hatches Creek, is noted to grow in "Red sand plain with Triodia". Plant size is described as "shrub to 3 ft. high". Chippendale 1523 (AD,BRI,CANB,MEL,NT), from Frewena; 3382 (CANB,MEL,NT,PERTH), from N.E. Lake Mackay, are recorded as "Infrequent, in deep red sand; inflorescences yellow green". His subsequent collections no. 3407 (AD,BRI,CANB, MEL,NT,PERTH), from N.E. Lake Mackay, and no. 3430 (CANB,NT,PERTH) from W. Mt.Singleton, are noted to be "rare on burnt area of deep red sand" and "common in small area in deep red sand at the base of sandstone ridge". The other Chippendale collections, show that it is "common on roadside in deep red sand but rare in loamy soil". Latz 486 (CBG,NT), from S. Tennant Creek is annotated; "Rare in red clayey soil on side of road in Acacia - Spinifex Community". Lothian 422/54 (AD), from Murray Downs is also collected from "amongst spinifex and Acacia spp." Maconochie 432 (AD, MEL,NT), from S. Wycliffe Well is noted as "prostrate shrub with clusters of yellow flowers". The habitat is reported "red sandy plain with Plectrachne and a few shrubs and trees". Nicholls 601 (AD,NT),loc.cit., is recorded as "Common on road side. Spinifex

plain with Plectrachne schinzii and occasional (with) E.terminalis" Nelson 1942 (AD,NT), from Pussycat Bore, Balweena Reserve, is noted as "subshrub, 2ft high, leaves discolorous. Rare in deep red sand. Grazed by Cattle". Munir 5223 (AD), from 190 km S.W. of Warburton Mission was growing in sandy soil, associated with Anthotroche, Dicrastylis doranii, Eremophila and Triodia species.

Flowering and fruiting seem to occur from July to October, but there are scattered occurrences at other times of the year.

C o m m e n t s:

The type of this species was collected by F.v.Mueller (during March, 1856) from Sturt's Creek, Western Australia. About two years later, he described it as Pityrodia exsuccosa, and in November, 1864, he recognized it as the genus Dicrastylis and re-named it D.ochrotricha FvM., reducing P.exsuccosa to a synonym under it. In both cases Mueller recorded his above-mentioned type from Sturt Creek as the only collection of this species. Thus the types of P.exsuccosa and D.ochrotricha are one and the same specimen, collected by the author.

In this species, great variation is observed in the shape, size and colour of its leaves and in the length, density and colour of its calyx tomentum. The majority of Dicrastylis collections with golden - yellow or greyish - yellow inflorescence or any mixture of these colours, have generally been identified or annotated as "D.ochrotricha","D.exsuccosa" or "D.gilesii". After studying numerous collections of this species, it has been found that D.exsuccosa now consists of several subspecific taxa, each with different shape and colour of leaf and fluffiness of calyx tomentum. The number of infra - specific taxa recognized comprise four sub-species, three varieties and three forms. Of these, three sub-species namely ssp. cinerea, ssp. elliptica and ssp. wilsonii are newly described. Two of the three varieties, var. lanceolata and var. tomentosa are also new. Both these varieties belong to the type sub-species exsuccosa. Under the var. tomentosa, three newly recognized forms are f. tomentosa, f. albo - lutea and f. lachnophylla.

The above-mentioned three new sub-species are distinguished from the type ssp. exsuccosa mainly by their long and very fluffy calyx - tomentum and difference in shape, size and colour of their leaves. The new variety tomentosa with both its forms, is separated from the type variety (exsuccosa) by its branches, leaves and calyx being more densely tomentose and inflorescence somewhat congested. Similarly, the new var. lanceolata differs from the

type variety and var. tomentosa by its leaves being narrowly lanceolate, somewhat thinner, dark - green and rugose above, grey -ish - yellow tomentose beneath; inflorescence lax with basal peduncles slender and hoary. (For more distinctive characters, see key to the infra - specific taxa of D.exsuccosa).

In the Flora of Northern Territory, Ewart & Davies (1917) have recorded under D.ochrotricha one of G.F.Hill's collections (n. 187) from Haast Bluff, and F.v.Mueller's (s.n.) from Sturt Creek. The former specimen, in all its characters and distribution belongs to another species D.gilesii FvM., while the latter is the type of D.exsuccosa (FvM.)Druce. Black (1926, 1957)has quoted under D.exsuccosa a plant from the MacDonnell Ranges, Central Australia, having the "calyxes covered with whitish or pinkish Hairs", but the name of its collector has not been indicated. In order to find out the collector and the exact identity of this palnt, the specimen has been traced as from among R.Tate's collection in Herb. AD, preserved under the number AD97113318.Actually, the herbarium sheet bearing this collection consists of seven small flowering branches, each with a few leaves towards the base. The collector's small notes tagged to three different branches indicate that these were collected from Ilpilla George Creek (a tributary of Finke River), Bagot Creek (in George Gills Range) and Mount Sonder (to the west of Alice Springs). The calyx - hairs in the Mount Sonder specimen are pinkish - white and in all the rest they are whitish. Keeping in view the above characters, and the distribution of these specimens, it is certain that they belong to D.gilesii FvM.. The calyx hairs in this species are pinkish and whitish and its distribution is mainly to the west-south-west of Alice Springs. The calyx - hairs, in D.exsuccosa are without any exception golden - yellow, light pinkish - yellow, yellow or any mixture of these colours. Moreover, the distribution of D.exsuccosa is restricted to the north and north-west of Alice Springs, and it is not known to grow anywhere close to Alice Springs, especially to its south, west or south-west.

Relationship:

D.exsuccosa is closely related to D.gilesii in its leaves being lanceolat; cymes arranged in a pyramidal panicle; corolla tomentose outside, villous - tomentose in throat and stamens and style scarcely exserted. However, it may be readily distinguished by its distinctly golden - yellow inflorescence and lax cymose flower - clusters.

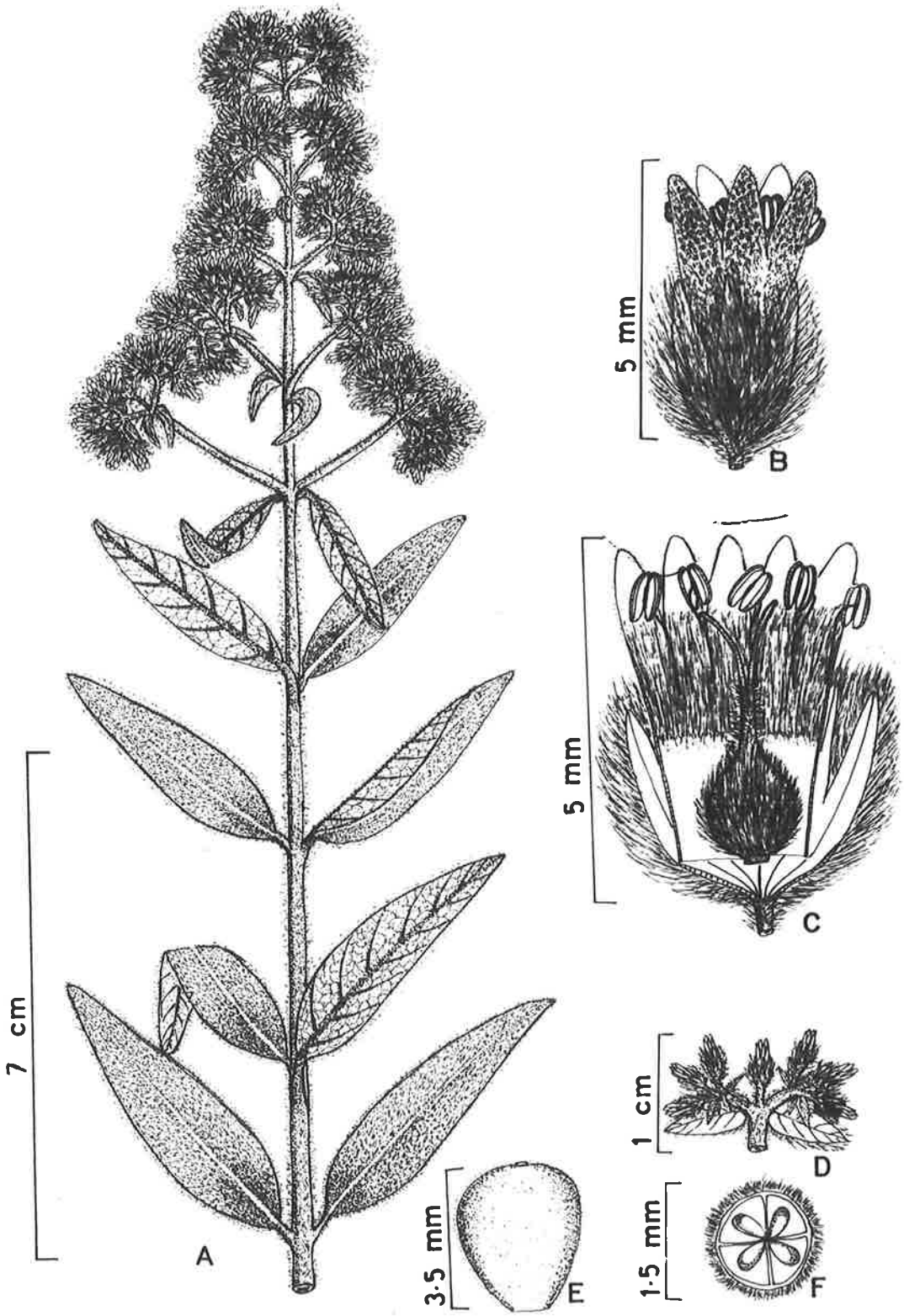


Fig. 23 — Dicrastylis exsuccosa (F.v.M.) Druce ssp. exsuccosa (A, R. Hill and H.W. Caulfield s.n., AD 96208080: AD; B-F, F.v.Mueller s.n., MEL 40891: MEL - holotype).
A, flowering twig; B, flower; C, flower vertically cut open; D, cyme; E, fruit; F, T.S. ovary.

D.exsuccosa (FvM.)Druce ssp. exsuccosa var. lanceolata Munir, var. nov.

Varietas ab aliis ob folia anguste lanceolata plus minusve tenuia supra atroviridia infra cinereo - lutea saepe versus apicem laxa inflorescentiam perlaxam et pedunculos incanos graciles ad basim usque ad 3(4) cm longos vix 1 mm diam. distinguitur.

T y p u s: M.Lazarides 5826: 34 miles north-north-east of Barrow Creek, Northern Territory, 24.VIII.1956 (CANB holotype; AD,BRI, MEL,NT,PERTH,US).

This taxon differs from the type variety by its leaves being narrowly lanceolate, thin, dark green on top, greyish - yellow beneath, often distant (not crowded) towards the apex; inflorescence lax, basal peduncles long, [up to 3(-4) cm], slender, hoary, less than 1 mm in diameter.

Specimens examined:

NORTHERN TERRITORY:- G.E.Black s.n.,AD97205193: Thomas Rockhole to Archibald Soak, -1936 (AD).- G.Chippendale 2223: 5 miles S.W. of Hooker's Creek, 11.VII.1956 (BRI,CANB,NT).-G.Chippendale 7350: 25 miles W.N.W. Frewena, 26.VI.1960(AD,CBG,NT).- C.Dunlop 2314:1 mile E. Camel W.H., Tanami Range, 12.IX.1971 (AD,NT).- C.Dunlop 2319:75 miles W.N.W. Tanami,12.IX.1971 (AD,NT).- C.Dunlop 2371:S.W. Yuendumu Res., 22° 34'S, 131° 33'E, 13.I.1972 (AD).- M.Lazarides 5826:34 miles N.N.E. of Barrow Creek, 24.VIII.1956 (CANB holotype;AD,BRI,MEL,NT,PERTH,US - isotypes).-J.R.Maconochie 1021: $\frac{1}{2}$ mile S.E.Tanami Gorge, Tanami Ranges, 25.V.1970 (AD,NT).- A.J.Mahood 8762: 80 - 90 miles W. The Granites, 9.IV.1962 (NT).- J.Must 167:40 miles N. Barrow Creek, Stuart Highway, 18.VII.1968 (AD,MEL,NT).- J.Z.Weber 1028:15 km N.Barrow Creek, 18.VII.1968(AD).

WESTERN AUSTRALIA:- A.S.George 9040:22 miles W. of Mt.Webb, northern Gibson Desert, ± 127° 50'E, 22° 55'S, 28.VII.1967(PERTH).- A.S.George 8913:N.E. of Sir Frederick Range, ± 128° 50'E, 23° 43' S, 25.VII.1967 (PERTH).- A.S.George 8968:13 miles W. of Mt.Tietkens Gibson Desert, 26.VII.1967 (PERTH).

Distribution: (Map 8).

This variety seems restricted mainly to the north and north-west of Alice Springs in Northern Territory, and along the eastern border of Gibson Desert in Western Australia. In the Northern Territory it overlaps the type variety near Barrow Creek, Murray Downs, Rockhampton, Taylor Creek and in the Tanami area.

One collection is recorded from Hooker Creek, to the north-east of Tanami and the other is reported from 80 - 90 miles west

of The granites. The known localities in Western Australia are to the west of Mt.Tietkens and Mt.Webb and to the north-east of Sir Frederick Range.

E c o l o g y:

Much of what is true of the type var. exsuccosa, is true also of this variety. According to information gathered from annotations, it commonly occurs in sandy - clayey soil associated with Acacia and Triodia species. Chippendale 2223 (BRI,CANB,NT), from 5 miles south-west Hooker Creek, is noted "subshrub 2', infl. yellowish. Infrequent, in deep red sand, associated with Triodia pungens". Lazarides 5826 (AD,BRI,CANB,MEL,NT,PERTH), from 34 miles N.N.E. of Barrow Creek, is "Common in coarse clayey sand with Acacia - Triodia basedowii woodland". Further, it is noted to be an "Erect subshrub to 2ft high. Leaves dark green above. Branchlets hoary. Flowers white to very pale mauve". Maconochie 102 (AD,NT), from $\frac{1}{2}$ mile S.E. of Tanami Gorge, is annotated as "shrub to 12 inches high with yellow calyces and white petals. Growing on floodout flats". Must 167 (AD,MEL,NT), from 40 miles north of Barrow Creek is reported as "shrub to 3 ft. high with yellow flower - heads. Growing on sandy spinifex plain". Dunlop 2314 (AD,NT), 1 mile east of Camel Well, Tanami Range, is found "growing in red sandy loam with Plectrachne pungens, Petalostylis and Didymotheca tepperi". The plant is "35 cm high, congregated into thickets covering areas of 10 sq. metres". George 9040 (PERTH), from 22 miles W. of Mt.Webb is annotated as "spreading shrub to 1 metre (high with) yellow wool". Plant is found in "red sand on spinifex steppe".

C o m m e n t s:

var. lanceolata should not be confused with var. tomentosa f. albo - lutea, because the leaves in both these taxa seem apparently similar. However, the latter may be easily identified by its stem and leaves being much more woolly, inflorescence congested (not lax) and the calyx-lobes completely hidden inside the long and much more woolly tomentum.

Relationship:

This variety is closely related to var. exsuccosa in its leaves being lanceolate; branchlets hoary; calyx - tomentum short, not fluffy and calyx- lobes distinct (not hidden by the tomentum). The var. lanceolata, however, can be distinguished by its leaves being often well spread (not crowded) towards the apex, dark -

green above, thin, narrowly lanceolate; inflorescence very lax; basal peduncles longer, hoary, and more slender (up to 1 mm in diameter).

D.exsuccosa (FvM.)Druce ssp. exsuccosa var. tomentosa Munir, var. nov.

D.ochrotricha F.v.Mueller: R.Tate, Horn Exped.Bot (1896) 174, pro parte -(quoad spec. R.Helms s.n.: Eld.Expl.Exped.Victoria Desert-AD,MEL,NSW,PERTH); L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 499, pro parte -(quoad spec. R.Helms s.n., loc.cit).

Varietas ab aliis ob ramulos foliaque plus dense tomentosus inflorescentiam plus minusve confertam et lobos calycis in tomentum densum perlanatum 1 - 2.5 cm longum absconditos distinguitur; etiam forma ab aliis ob folia ovata brunneo - lutea et tomentum calycis et apicum juvenilium aureo - luteum distinguitur.

T y p u s: R.H.Kuchel 286: 40 miles north-west of Giles, Rawlinson Range, Western Australia, 4.VIII.1962 (AD holotype; L,UC).

This taxon differs from the type variety and var. lanceolata by its branchlets and leaves being more densely tomentose; inflorescence ± congested; calyx - tomentum longer (1 - 2.5 mm), more dense, very woolly and calyx - lobes completely hidden inside the long woolly tomentum.

C o m m e n t s:

The var. tomentosa in addition to its type form tomentosa, has two new forms: f. lachnophylla and f. albo - lutea.

D.exsuccosa (FvM.)Druce ssp. exsuccosa var. tomentosa Munir f. tomentosa.

T y p e: (= The type of var. tomentosa).

From other forms of var. tomentosa, the type form can be readily separated by its leaves being ovate, brownish - yellow and young apical shoots and calyx - tomentum being golden - yellow.

Specimens examined:

WESTERN AUSTRALIA:- R.J.Chinnock 621: 22 km south-west of Warburton Mission, 29.VIII.1973 (AD).- N.N.Donner 4491: 20 km south-west of Warburton Mission, 30.VIII.1973 (AD).- N.Forde 1232: 56 miles west-south-west of Mt.Forrest, Rawlinson Range,6.X.1960 (CANB).- A.S.George 9071: 4 miles west of Jupiter Well, 22° 54'S,

126° 32'E, 29.VII.1967 (PERTH).- R.Helms s.n.,AD97113322,MEL40895, NSW106635,NSW106638: near Barrow Range, 17.VIII.1891 (AD,K,MEL, NSW,PERTH).- R.H.Kuchel 286: 40 miles north-west of Giles in Rawlinson Range, 4.VIII.1962 (AD holotype;L - n.v.,UC - isotypes).- R.Morland s.n.: from Officer Basin, -VI.1963 (PERTH).- A.A.Munir 5204: 8 km south-west of Warburton Mission, 29.VIII.1973 (AD).- A.A.Munir 5211:20 km south-west of Warburton Mission, 30.VIII.1973 (AD).- A.A.Munir 5216:70 km south-west of Warburton Mission, 30.VIII.1973 (AD).- N.B.Tindale s.n., AD966020604: Pt.Uhr, north-east of Laverton. 1.VIII.1935 (AD).- ? Anon. s.n.,AD97113317: loc. incert., North Australia, - (AD).

Distribution: (Map 8).

The form tomentosa is known from the Eastern Division of Western Australia. The recorded distribution is chiefly along the Gunbarrel Highway near Rawlinson Range and to the south-west of Warburton Mission towards Laverton. One locality is near Barrow Range and another is ± 120 miles to the west-south-west of Lake Mackay.

E c o l o g y:

In its ecological requirements, f. tomentosa seems very close to the type form exsuccosa, being commonly found in dry sandy soil. According to the present writer's own field observations, it occurs chiefly in the low rainfall areas of Triodia - Acacia country. Forde 1232 (CANB), from 56 miles west- south-west of Mt.Forrest, Rawlinson Range, was found growing in "Acacia brachystachya woodland". Munir 5204,5211 & 5216 (AD), from 8 km, 20 km and 70 km S.W. of Warburton Mission respectively were found in sandy soil. The other plants growing chiefly in association with it were Acacia Cassia, Eucalyptus pyriformis, Haloragis, Ptilotus and Triodia species.

C o m m e n t s:

A specimen of this form, preserved in Herb. AD under the no. AD97113317, bears no information regarding its collector and locality; however, it matches well with R.Helms' collection from Barrow Range, gathered (on 17.VIII.1891) during the Elder Exploring Expedition to Central and Western Australia. This is perhaps one of the few duplicates of this collection in Herb.AD, the others being at Herb. MEL,NSW and PERTH.

Relationship:

The form tomentosa is close to f. lachnophylla in its leaf-shape, but may be easily separated by the leaves being more prominently ovate, brownish-yellow-tomentose and the young apical shoots and calyx-tomentum distinctly golden - yellow.

D.exsuccosa (FvM.)Druce ssp. exsuccosa var. tomentosa Munir f. lachnophylla Munir f.nov.

Forma ab aliis ob folia late ovato - lanceolata dilute cinereo - lutea et tomentum calycis et apicum juvenilium purpureum vel purpureo - luteum vel pallido - luteum distinguitur.

T y p u s:J.B.Cleland s.n.,AD966042050: near Barrow Range,Western Australia, 25.VI.1958 (AD holotype;AD).

This form is distinct from the type form by its leaves being broadly ovate - lanceolate, pale greyish - yellow; young apical shoots and calyx- tomentum purplish, purplish - yellow or pale - yellow.

Specimens examined:

SOUTH AUSTRALIA:- R.Helms s.n.,AD97113391,AD97205196,MEL40897, NSW106636: Eld.Expl.Exped.Camp 15 & 16, Mt.Watson, Birksgate Range, 7.VII.1891 (AD,MEL,NSW).- W.S.Reid 52: 10 miles south of Mt.Davies 24.IX.1955 (ADW).

WESTERN AUSTRALIA:- A.M.Ashby 3480: Canning Stock Route between Weld Spring and Pierre Spring, Carnegie District, 2-14.VIII. 1970 (AD).- A.M.Ashby 3481:30 km W. of Lake Breaden, Carnegie District, 2 - 14.VIII.1970 (AD).- A.M.Ashby 3482: 480 km from Laverton on the Warburton road, 2 - 4.VIII.1970 (AD).- J.N.Casey s.n.: between Oakover River & Canning Stock Route, -1954 (PERTH).- J.B.Cleland s.n.,AD966071223 & AD966071051: ca. 50 km east of Warburton Range, 24.VI.1958 (AD).- J.B.Cleland s.n.,AD966042027: Giles Tank, near Cavenagh Range, 25.VI.1958 (AD).- J.B.Cleland s.n., AD966071224: Giles Tank, in Rawlinson Range, 26.VI.1960(AD) .-J.B.Cleland s.n.,AD966042095: near Barrow Range, 26.VI.1960(AD) .- A.S.George 3936: Elder Creek, 2 miles W. of Warburton, 23.VIII. 1962 (PERTH).-A.S.George 4080:Miss Gibson Hill, S.W. of Warburton 26.VIII.1962 (PERTH).-A.S.George 5325:42 miles N. of Warburton Mission, 24.VII.1963 (PERTH).- A.S.George 5373: 11 miles E. of Natabilis Hill, Gunbarrel Highway, 24.VII.1963 (PERTH).- A.S. George 8244: Western end of Rawlinson Range, 30.X.1966 (PERTH).- A.S.George 8397: 29 miles west of Neale Junction, 10.X.1966(PERTH)- A.S.George 8728:58 miles E. of Warburton Mission, 15.VII.1967

(PERTH).- A.S.George 9097: 24 miles E. of Gary Junction, ± 125° 42'E, 22° 36'S, 29.VII.1967 (PERTH).- A.S.George 9153: 10 miles W. of Swindells Field, Great Sandy Desert, 31.VII.1967 (PERTH).- A.S.George 10735: south of Rudall River, - 122° 06'E, 22° 45'S, 20.VII.1971 (PERTH).- E.Giles s.n.,MEL40947: between Alfred & Marie Range and Rawlinson Range, - 1876 (MEL).- H.A.Johnson 5096: near Mt.Charles, 18.X.1958 (NT,PERTH).- H.A.Johnson 5131: 40 miles W. Mt.Samuel, 20.V.1958 (CANB,NT,PERTH).- A.R.Main 189: 4 miles W. Mt.Samuel, 20.V.1958 (CANB,NT,PERTH).- A.R.Main 189: 4 miles W. of Boulyunu, 19.VIII.1960 (PERTH).-A.A.Munir 5225: 5 km south of Cosmo Newbery, 31.VIII.1973 (AD).- A.A.Munir 5227: 360 km south west of Warburton Mission, 31.VIII.1973 (AD).- N.B.Tindale s.n., AD96601936 & AD966050393: Sandhills near "Papakula (Babbagoola)", 26.VIII.1935 (AD).

Distribution: (Map 8).

The form lachnophylla is known from the Eremean Province of Western Australia and the far north-western corner of South Australia. In Western Australia, the main distribution is to the north-east of Laverton and around Warburton, Barrow, Cavanagh and Rawlinson Ranges. Two localities are known between Alfred & Marie Range and Rawlinson Range and between Pierre Spring and Weld Spring. A few collections are known from north of Gibson Desert and one from inside the Great Sandy Desert. The only two localities in South Australia are near Mt.Watson in Birksgate Range and the other to the south-west of Mann Ranges near Mt.Davies.

E c o l o g y:

In its ecological requirements form lachnophylla is much like f.tomentosa, being common in sandy soil in the arid parts of Western Australia. It is variously recorded as occurring "on interdune area", "lateritic soil" and "sandy soil". According to George 4080 (PERTH), from S.W. of Warburton, is noted as "shrub 70 - 100 cm fls. yellow". The habitat is said to be "lateritic soil at top of gorge". In his earlier collection no.3936 (PERTH), from Elder Creek, 2 miles west of Warburton Mission, he recorded it as "shrub 80 cm, fls. yellow, on interdune area - red sand". George 8244 (PERTH), from W. end of Rawlinson Range, is found growing "in red sand, in open Casuarina - Spinifex association". Plant is noted as 1 metre high shrub with creameus - grey flowers. Subsequent collection of George 8397 (PERTH), 29 miles W. of Neale Junction is annotated as "spreading shrub to 50 cm; wool yellow; corolla white; in red sand on open Triodia steppe". Munir 5225 &

5227 (AD), south of Cosmo Newbery, is found growing in sandy soil with Acacia, Eremophila, Eucalyptus pyriformis, Grevillea and Triodia spp.

Flowering and fruiting seem chiefly to occur from June to September but there are scattered occurrences in October, November and December.

C o m m e n t s:

The purplish colour of tomentum in some young apical shoots is somewhat similar to D.gilesii, but the golden - yellow calyx-tomentum easily distinguishes f. lachnophylla from the latter.

Tindale's collection (s.n.,AD96601936 & AD96050393) is noted to have come from a locality named "Papakula (Babbagoola)" in Western Australia. The name of such a locality is found recorded as Babbagoola Rock Hole which is about 55 km south-west of Warburton Mission. It appears to be an aboriginal name, adopted by the collector who has been much interested in aboriginal ethnology. According to his notes, the specimen was collected during August 1935. In one of his subsequent papers on the "Results of the Harvard - Adelaide Universities Anthropological Expedition 1938-1939" [Trans.R.Soc.S.Aust.40 (1946) 151], he has mentioned his visit to Warburton Range, Western Australia, with an Anthropological Expedition during 1935. Since this coincides with the date of collection and the known distribution of this taxon, it therefore seems that this specimen has come from Babbagoola Rock Hole which is the only known locality of this mame in that area.

Relationship:

Allied closely to f. tomentosa in its leaf - shape and denseness of tomentum, but can be distinguished by its leaf tomentum being pale greyish - yellow and the hairs of young apical shoots and calyx-tomentum purplish - yellow or pale - yellow.

D.exsuccosa(FvM.)Druce ssp.exsuccosa var. tomentosa Munir f. albolutea Munir f.nov.

D.ochrotricha FvM.:FvM. & R.Tate, Trans.R.Soc.S.Aust.13 (1890)105 -(quoad spec. Tietkens s.n.: Laura Vale - AD,MEL); R.Tate, Horn Exped.Bot. (1896) 174, pro parte -(quoad spec. Tietkens s.n.Loc. cit.).

Forma ab aliis ob folia plerumque anguste lanceolata supra atroviridia infra cinereo - lutea distinguitur.

T y p u s: P.K.Latz 710: 75 miles south-west of The Granites, Northern Territory, 1.VIII.1970 (AD holotype; NT).

Among all the forms of var. tomentosa, f. albo - lutea may be easily distinguished by its leaves being narrowly lanceolate, dark - green above, greyish - yellow beneath.

Specimens examined:

NORTHERN TERRITORY:- J.B.Cleland s.n.,AD97120311,AD97205198 & ADW6203: 20 miles S. of The Granites, 20.VIII.1936 (AD,ADW).- J.B.Cleland s.n.,AD97120312: The Granites, 14.VIII.1936 (AD).- J.B.Cleland s.n.,AD97120314: Archibald Soak, 12.VIII.1936 (AD).- P.K.Latz 710: 75 miles S.W. The Granites, 1.VIII.1970 (AD holotype, NT - isotype).- Tietkens s.n.,AD97113321 & MEL40898: Laura Vale, 23.V.1889 (AD,MEL).

WESTERN AUSTRALIA:- A.S.George 2866: 11 miles north-east of Cosmo Newbery, 24.VIII.1961 (PERTH).- F.V.McNamara s.n.: Balgo Hills Station via Derby, -V.1967 (PERTH).

Distribution: (Map 8).

The form albo - lutea is known from the Northern Territory and Western Australia. The recorded distribution in Northern Territory is to the south and south-west of The Granites. Another collection has come from Laura Vale, to the east of Lake Macdonald. In Western Australia, the known localities are to the north-west of Laverton in the Eastern Division and at Balgo Hills Station in the Kimberley Division.

E c o l o g y:

In its ecological requirements, this form seems close to other forms of this species, except the northern-most collection from Balgo Hill Station where the main rainfall takes place during summer. The plant is a medium sized under shrub of sandy soil, forming clones from the underground parts.

According to George 2866 (PERTH), from 11 miles N.E. of Cosmo Newbery, W.A., it is a "shrub to 50 cm. Fls. rusty - yellow". Latz 710 (AD,NT), from 75 miles S.W. The Granites is noted "Erect herb to 2ft. high; calyx with maroon tomentose hairs sparse on stems and peduncles; leaves dark- green above; part of clone. Not uncommon in deep red sand on slightly undulating spinifex plain".

The flowering and fruiting seem to occur mainly during May - August.

C o m m e n t s:

Among Tietkens' collections of f. albo - lutea, there are two specimens, one in Herb,AD (no.AD97113321) and the other in Herb. MEL (no. MEL40898). Thesespecimens seem duplicates of the same collection, but the latter (in Herb.MEL) is without any collecting date and locality. Both were collected during "1889",and are annotated to have come from "Central Australia". The collector's field note on the specimen in Herb. AD indicates, that it was collected on 23rd May, 1889, from Laura Vale. Since their year of collection is the same and they match exactly in all respects, it seems that they are probably duplicates of the same gathering. A subsequently typed label with the Herb.AD specimen indicates its locality as "Laura Vale within Western Australia". In fact, this place is located to the east of Lake Macdonald in Northern Territory.

Of the two collections from Western Australia, the one from Cosmo Newbery has the same general aspect as the type of this species, but the leaves and inflorescence are more densely tomentose. The other from Balgo Hill Station agrees with the type of this form, but its comparatively remote northern location in Kimberley Division seems unusual in the whole genus.

Relationship:

This taxon is close to other forms of var. tomentosa in its leaves and inflorescence being densely tomentose and calyx-lobes completely hidden within the woolly calyx-tomentum, but may be readily distinguished by its leaves being narrowly lanceolate, dark-green above and greyish- yellow beneath. The leaves of f. albo - lutea are apparently similar in appearance to var. lanceolata, but the leaves in the latter taxon are not densely tomentose, inflorescence not woolly, the calyx-lobes are distinct and calyx tomentum much shorter.

D.exsuccosa (FvM.)Druce ssp. cinerea Munir, ssp. nov.

Subspecies ab aliis ob folia parviora usque ad 3(4.5) cm longa crassa ovata supra coeruleo - cinerea vel cinereo - viridia infra cinerascentia et stylum saepe profunde lobatum distinguitur.

T y p u s: F.M.Bennett 157: Carnegie Station, Western Australia, - VII.1941 (PERTH holotype).

Diagnosis: (Fig. 24).

The ssp. cinerea differs from the type subspecies by its

leaves being smaller, up to 3(-4.5) cm long, thick, ± ovate, bluish - grey to grey - green tomentose above, greyish tomentose beneath; style more deeply 2 -branched.

Specimens examined:

WESTERN AUSTRALIA:- T.Muir in Stan Gratte's Party for A.M. Ashby 3552: ca. 80 km on the west side of the Warburton Range, 2 - 14.VIII.1970 (AD).- J.S.Beard 4850: Gary Highway from Gunbarrel Highway to Windy Corner, 24.VII.1967 (PERTH).- J. & A. Forrest s.n.,MEL40892: Alexander Spring,13.VII.1974 (MEL - pro parte, quoad spec.dextrorsum).- A.S.George 2897: 81 miles S.W. of Warburton Mission, 26.VIII.1961 (PERTH).- R.Morland s.n.: Officer Basin, Land and Survey Exped. C3, -VI.1963 (PERTH).- A.A.Munir 5220 & 5221: ca. 170 km south-west of Warburton Mission 31.VIII.1973 (AD).- A.S.George 9071: 4 miles W. of Jupiter Well, 126° 30'E, 22° 54'S, 29.VII.1967 (PERTH).- A.S.George 9099: Kidson No.1 Field, northern Gibson Desert, 30.VII.1967 (PERTH).

Distribution (Map 9).

The ssp. cinerea is recorded from the Eastern Division of Western Australia. The known distribution is to the west-south-west of Warburton Range and to the north of Carnegie Lake near Carnegie Station. One locality is to the north of Gunbarrel Highway along the Gary Highway, and two are known from north of Gibson Desert.

E c o l o g y:

The subspecies cinerea agrees well with the type subspecies in its ecological requirements. It grows in the dry eremean parts of Central Australia where the annual rainfall is scanty. It is a moderate - sized shrub found mostly in red sand. According to Beard 4850 (PERTH), from Gary Highway, north of Gunbarrel Highway, it is a soft tomentose shrub of 3 feet high, with flowers in yellow heads. George 2897 (PERTH), from 81 miles S.W. of Warburton Mission is noted as "70 cm tall shrub with yellow flowers". It was growing "in red sand with Triodia and scattered shrubs". George's subsequent collection no.9099 (PERTH), from Kidson No.1 is found "in gravelly soil on spinifex steppe". The plant is recorded as "70 cm shrub with yellow wool turning brown". Munir 5220 & 5221 (AD), ca. 170 km south-west of Warburton Mission, were collected from red sand along the roadside. The other plants growing in association with it are mainly Acacia, Newcastelia hexarrhena, Ptilotus and Triodia species.

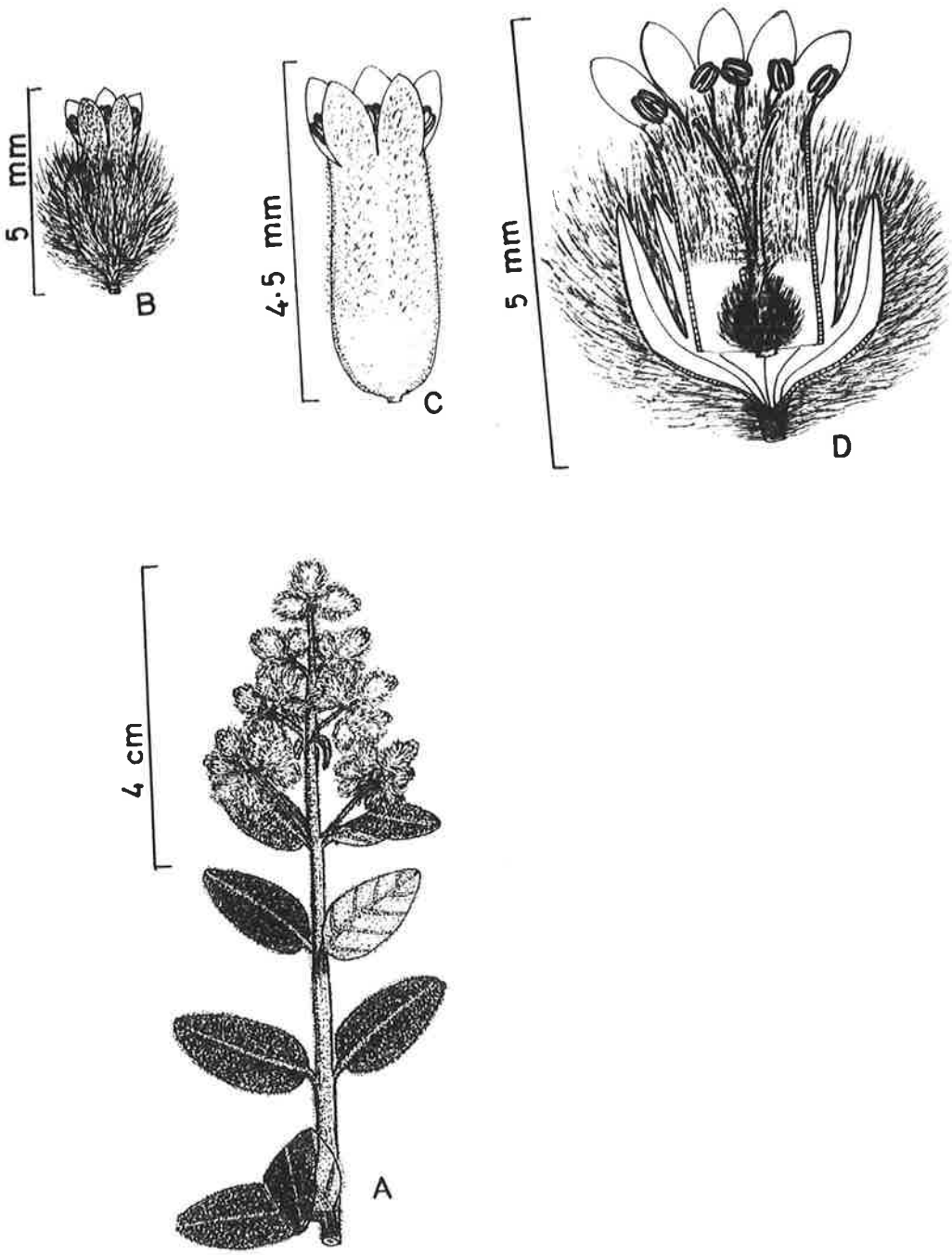


Fig. 24 — Dicrastylis exsuccosa (F.v.M.) Druce ssp. cinerea Munir (F.M. Bennett 157: PERTH - holotype).

A, flowering branch; B, flower; C, corolla-tube; D, flower vertically cut open.

Flowering and fruiting seem to take place mainly from August to November.

C o m m e n t s:

The collection of John & Alexander Forrest, in Herb.MEL (no. MEL40892), consists of two different taxa of D.exsuccosa. The one mounted on the right-hand side of the herbarium sheet belongs to the ssp.cinerea and the other comes under the ssp. elliptica. It seems, that probably one of them was collected by John Forrest and the other by his brother Alexander Forrest from different plants, but considering them one and the same taxon they are mounted together. According to annotations on the herbarium label, these were collected from "Alexander Spring" on 13th July, 1874, during John Forrest's third Exploring Expedition through the centre of Australia. The loaclity "Alexander Spring" was then named by John Forrest, after his brother Alexander Forrest,who discovered it. [see "Explorations in Australia" by J.Forrest (1875) 208].

Relationship:

Allied closely to the type form of ssp. exsuccosa var. tomentosa in having ± ovate leaves, similar inflorescence, and calyx-tomentum of the same colour and woolliness. However, ssp.cinerea may be easily distinguished by its leaves being smaller, up to 3(-4.5) cm long, somewhat thicker, prominently bluish - grey to grey - green tomentose above, greyish tomentose beneath and the style often more deeply 2 - branched.

D.exsuccosa (FvM.)Druce ssp.elliptica Munir, ssp.nov.

D.ochrotricha FvM.: E.Giles, Aust.Twice Trav.2 (1889) 355 - pro parte -(quoad spec. E.Giles s.n.,MEL40894: Mt.Olga and Barrow Range - MEL); FvM. & R.Tate, Trans R.Soc.S.Aust. 16 (1896) 333, 375 pro parte -(quoad spec. E.Giles s.n.,loc.cit.); R.Helms s.n., AD97113320 & MEL40896: Elder Exped.(1894) Camp 53, Victoria Desert (AD,MEL); R.Tate, Horn Exped.Bot. (1896) 174 - pro parte -(quoad spec.E.Giles s.n.,loc.cit.);L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 498,499 pro parte -(quoad spec.E.Giles s.n.,loc.cit.).

Subspecies ab aliis ob folia anguste elliptica cuneata parce tomentosa supra rugosissima infra reticulata et tomentum calycis atrocinereo - aurantiacum distinguitur.

T y p u s: N.H.Speck 1222: 99 miles east of Wiluna, Eremean Province, Western Australia, 17.VIII.1958 (CANB holotype;NSW,PERTH).

Diagnosis: (Fig. 25E).

ssp. elliptica differs from other subspecies of D.exsuccosa by its leaves being narrowly elliptic, cuneate towards the base, ± sparsely (short)tomentose, distinctly rugose above, reticulate beneath and calyx-tomentum deeply greyish-orange.

Specimens examined:

WESTERN AUSTRALIA:- J.S.Beard 4835: Gary Highway, N. of Gunbarrel Highway to Windy Corner, 23.VII.1967 (PERTH).- R.J.Chinnock 884: 25 km south of Carnegie Homestead, 8.IX.1973 (AD).-A.Fairall 1975: 3.6 miles from Carnegie Station towards Mt.Everard, 26.VII. 1966 (PERTH).- J.& A.Forrest s.n.,MEL40892: Alexander Spring, 13.VII.1874 (MEL- pro parte, quoad spec. sinistrorsum).-A.S.George 8121:11 miles S.W. of Beegull Rockhole, Laverton - Warburton Road, 29.IX.1966 (PERTH).- E.Giles s.n.,MEL40894: between Mount Olga and Barrow Range, -(MEL).- N.Harper 13: 20 to 60 miles N.E. of Laverton near White Cliffs Stn.,-X.1968 (PERTH).- R.Helms s.n.,AD97113320 & MEL40896: Elder Explor.Exped.Camp 53, Victoria Desert, 15.IX. 1891 (AD,MEL).- F.v.Mueller s.n.,MEL40893: Mount Moore, 28.VI.1874 MEL - pro parte, quoad spec.sinistrorsum).- A.A.Munir 5205 & 5212: 8 km & 20 km south-west of Warburton Mission respectively, 30.VIII. 1973 (AD).- N.H.Speck 1222: 99 miles E. of Wiluna, Eremean Province, 17.VIII.1958 (CANB holotype;PERTH,NSW - isotypes).- N.B.Tindale s.n., AD966050187: Virginia Range, north of Minnie Creek, 29.VIII.1935 (AD).- P.G.Wilson 7353:30 km N.E. of Bandya Homestead, ca. 100 km N. of Laverton (PERTH,BH-n.v.).

Distribution: (Map 9).

The ssp. elliptica is known from the Eastern Division of Western Australia. The localities recorded are mainly to the east -north-east of Laverton and Wiluna. In its distribution, it overlaps the ssp.cinerea at Carnegie Station, Alexander Spring and along the Gary Highway. The southern-most locality is in the Vistoria Desert (at Camp 53 of the Elder Exploring Expedition)and the eastern-most is to the east of Barrow Range.

E c o l o g y:

Much of what is true of ssp. cinerea is true also of this subspecies. According to information gathered from annotations it commonly occurs on sand plains. The plant is up to 90 cm high with greyish-orange flowers. Beard 4835 (PERTH), from Gary Highway is noted as soft shrub of about 2 feet high with flowers in yellow heads. The habitat is said to be "Mulga Parkland". Fairall 1975

(PERTH), 3.6 miles from Carnegie to Mt.Everard is described as 2 feet high shrub with golden calyx. Speck 1222 (CANB,NSW), from 99 miles east of Wiluna is annotated as "Perennial, to 2 ft. high" growing in "sand plain margin to pan depression".According to the present writer's field observations, it is a branched shrub up to 90 cm high, spreading chiefly from near the base. The leaves are ±elliptic and flowers deeply greyish-orange. It commonly occurs in red sandy soil with Acacia, Eucalyptus pyriformis, Halgania, Haloragis, Ptilotus and Triodia species.

Flowering and fruiting seem to take place mainly from August to December.

C o m m e n t s:

The locality of E.Gile's collection in Herb.MEL (no.MEL40894) is noted "Between Mount Olga and Barrow Range", without indicating the exact place of its collection. Geographically, Mount Olga is to the south of Lake Amadeus in the Northern Territory and Barrow Range is west of it about 100 miles inside Western Australia. The two places are separated by some 200 miles or more, and further precision in locality seems impossible. The main distribution of this taxon is to the west of Barrow Range, but it may occur somewhere to the east as well.

Mueller's collection in Herb.MEL (no.MEL40893) consists of two different taxa. The one mounted in the upper right hand side of the herbarium sheet belongs to the ssp. wilsonii and the other comes under the ssp. elliptica. The locality of this collection is recorded "Mount Moore", without reference to any state or territory. During the present investigation, one locality named "Mount Moore" is found near the Gulf of Carpentaria in the Northern Territory and three others are in Western Australia. So far, ssp. elliptica is not known to occur in the Northern Territory; and no taxon of Dicrastylis is recorded from as far north as the Mount Moore there.Of the Mounts Moore in Western Australia, one is located near Lake Brown where D.exsuccosa is not known to occur. A second is to the south-east of Cavanagh Range and the third to the north of Lake Carnegie. Although the last two localities are within the distribution limits of this sub-species, F.v.Mueller's above-mentioned collection (s.n.,MEL40893) has probably come from the (Mount Moore to the) north of Lake Carnegie, where ssp. elliptica occurs more commonly.

The remarks on John & Alexander Forrest's collection, no. MEL40892, and the notes on its locality are recorded above under the "Comments" upon ssp.cinerea.

The calyx-lobes in Mueller's specimen no.MEL40893 are sparsely hairy inside the upper part a character found only in the ssp. wilsonii. In all other characters it matches with the ssp.elliptica. The tendency towards hairiness on the inner side of its calyx -lobes seems to show a close relationship between the two subspecies.

Relationship:

Among all the subspecies of D.exsuccosa, ssp.elliptica seems closest to ssp. wilsonii in its leaves being distinctly rugose above, prominently reticulate beneath and calyx - tomentum longer and more fluffy (woolly). However, ssp. elliptica may be easily identified by its leaves being narrowly elliptic, cuneate towards the base; calyx-lobes glabrous inside and the calyx-tomentum often greyish - orange.

D.exsuccosa (F.v.M.)Druce ssp. wilsonii Munir, ssp.nov.

Subspecies ab aliis ob folia late elliptico - ovata vel sub - rotundata usque ad 3 cm longa tomentosa supra manifeste rugosa infra manifeste reticulata et lobos calycis intra in dimidio superiore tomentosos distinguitur.

T y p u s: H.M.Wilson 21: 10 miles south of no. 8 Well, Canning Stock Route, Western Australia, 21.IX.1942 (PERTH holotype).

Diagnosis: (Fig. 25 A - D).

Among all the subspecies of D.exsuccosa, the ssp. wilsonii can be easily distinguished by its leaves being broadly elliptic-ovate to sub - rotund, up to 3 cm long, shortly tomentose, distinctly rugose above, prominently reticulate beneath and calyx-lobes distinctly hairy inside the upper half.

Specimens examined:

WESTERN AUSTRALIA:- F.Mueller s.n.,MEL40893: Mount Moore, 28.VI.1874 (MEL pro parte quoad spec. dextrorsum).- H.M.Wilson 21: 10 miles south of no. 8 Well, Canning Stock Route, 21.IX.1942 (PERTH holotype).

Distribution:(Map 9).

The ssp. wilsonii is recorded from the central eremean part of Western Australia. One of the two known localities is south of no.8 Well on Canning Stock Route and the other to the north of Lake Carnegie near Mount Moore.

E c o l o g y:

Little is known of the ecology of this subspecies, but it seems to occur in sandy - soil of low rainfall areas. According to the collector's annotation on the holotype, it is "50 - 70 cm high shrub and nearly as much in diameter". The habitat is noted "sand close to sandridges".

Flowering and fruiting seem to occur chiefly from June to September.

C o m m e n t s:

Among all the taxa of this species, ssp. wilsonii is distinct in the shape of its leaves and presence of hairiness on the inner side of its calyx-lobes. The yellow calyx-tomentum is longer and more fluffy than in other related taxa of D.exsuccosa. Similarly, the white tomentum outside the corolla - lobes seems more dense.

The remarks on Mueller's collection no. MEL40893, and the notes on its locality (Mt.Moore) have been discussed under the "Comments" upon ssp. elliptica.

Relationship:

Of all the taxa of D.exsuccosa, the ssp. wilsonii seems more closely related to ssp. elliptica in its leaves being distinctly rugose above, prominently reticulate beneath, but may be readily identified by the leaf-shape being broadly elliptic - ovate to sub - rotund and calyx-lobes hairy in the upper halves inside.

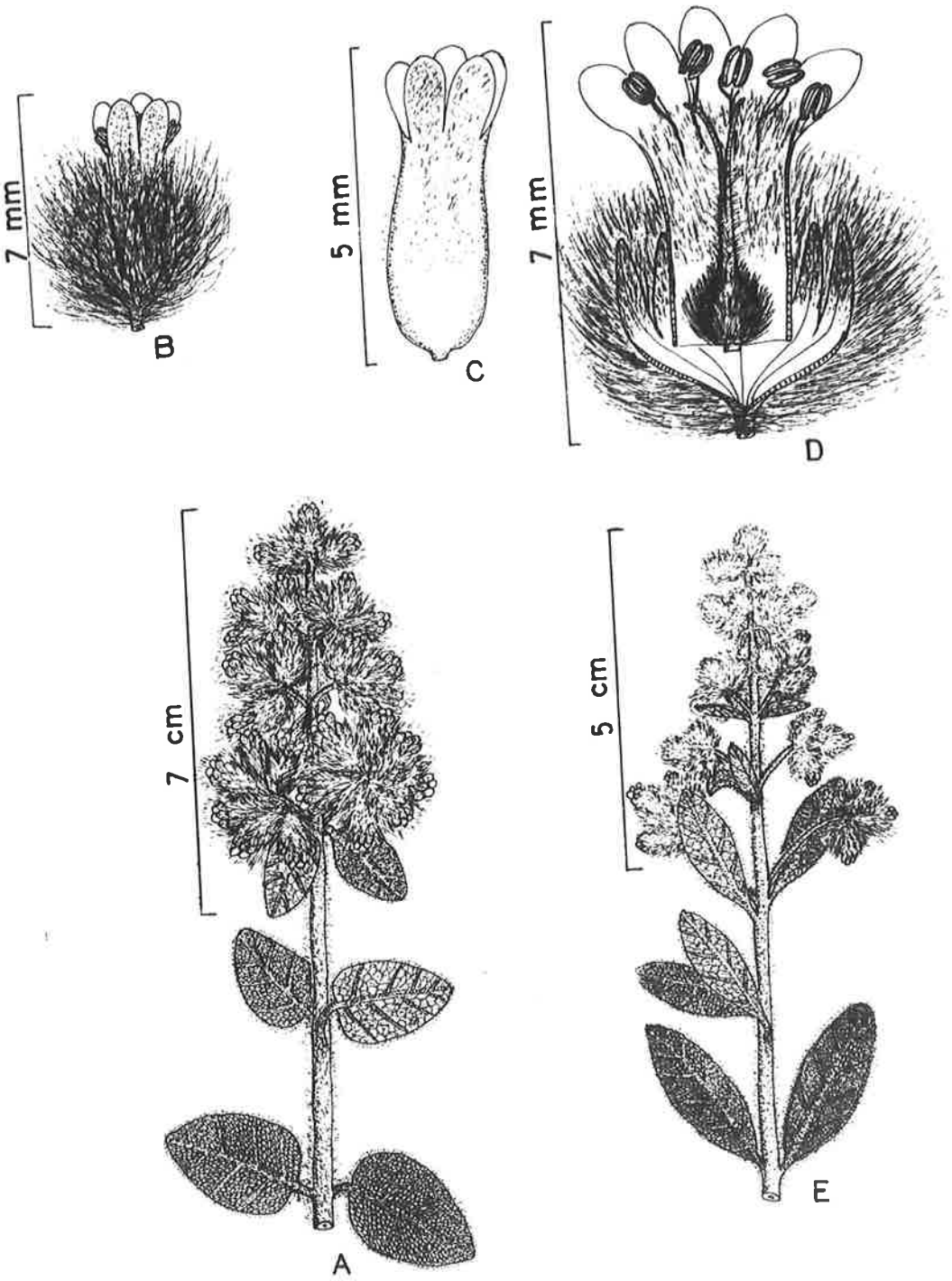


Fig. 25 — A - D, Dicrastylis exsuccosa (F.v.M.) Druce ssp. wilsonii Munir (H.M. Wilson 21: PERTH - holotype); E, Dicrastylis exsuccosa (F.v.M.) Druce ssp. elliptica Munir (N.H. Speck 1222: CANB - holotype).
A and E, flowering twigs; B, flower; C, corolla-tube; D, flower vertically cut open showing calyx-lobes hairy on the inner face.

Dicrastylis brunnea Munir, sp. nov.

Frutex 30 - 75 cm altus tomento ferrugineo caule ramoso cylindrico dense tomentoso; folia decussata sessilia vel breviter petiolata elliptico - oblonga supra rugosa dense tomentoso pilis ramosis; inflorescentia cymosa plus minusve pyramidalis; cymae subglobosae purpureo - flavae superae sessiles inferae pedunculis crassis brevibus usque ad 2.5(3) cm longis; flores sessiles bracteati in fasciculos lanatos conferti plerumque pentameri raro tetrameri; calyx extra tomento purpureo - flavo intra glaber quinquelobus raro quadrilobus tubo brevissimo lobis lineari - lanceolatis base tenus fere discretis; corolla extra glandulosa tomentosa intra ad faucem dense villosa quinqueloba raro quadriloba tubo cylindrico lobos plus minusve ter longiore; stamina 5 raro 4 vix exserta ad faucem corollae inserta filamentis lobes corollae brevioribus lobis antherae oblongis; ovarium ovoideum dense albo - tomentosum plus minusve 1 mm diam. stylus vix exsertus dense tomentosus profunde bilobatus lobis glabris; fructus globosus tomentosus 2 - 3 mm diam.

T y p u s: A.M.Ashby 2619: at Anketell, east of Mt.Magnet, on road to Sandstone, Irwin District, Western Australia, 13.IX.1968 (AD holotype; PERTH).

Description: (Fig. 26).

Shrub 30 to 75 cm tall. Stem erect, branched, cylindrical, woody, densely clothed with rusty - brown tomentum of branched hairs. Leaves decussate, sessile or very shortly petiole, 1.5 - 4 cm long, 0.5 - 1 cm broad, ± elliptic - oblong, obtuse, entire, cuneate towards the base, densely covered with brownish - yellow tomentum concealing the green rugose dorsal surface, often greenish - grey - tomentose beneath with a prominent line of rusty-brown tomentum over the midrib; petiole (when present) 2 - 4 mm long, densely tomentose. Inflorescence cymose, ± pyramidal in outline; cymes always purplish - yellow or purplish - grey - tomentose, upper sessile, the lower with thick short peduncles up to 2.5 (-3) cm long. Flowers usually 5 -merous, sometimes 4 -merous, sessile, bracteate, 6 - 8.5 mm long, densely clothed with branched woolly tomentum, crowded into sub-globose cymose heads. Calyx generally 5 -lobed, sometimes 4 -lobed, 4 - 5 mm long, densely clothed with purplish - yellow tomentum on outside, glabrous inside; lobes linear - lanceolate, 3 - 4 mm long, 0.5 - 0.7 mm broad, almost free to the base, glabrous but glandular on the inner face; tube very short, 0.5 - 1 mm long, non-glandular inside. Corolla

usually 5 -lobed, sometimes 4 -lobed, 5 - 8 mm long, densely tomentose outisde with interspersed white glands on the lobes and on the upper three quarters of the tube, villous - tomentose in the throat; lobes small, ± oblong, 1.5 - 2 mm long, glabrous and non-glandular on the inner face; tube 4 - 6 mm long, cylindrical, about three times longer than the lobes, glabrous only near the base. Stamens usually 5, sometimes 4, scarcely exserted, inserted in the corolla-throat; filaments glabrous, shorter than the corolla-lobes; anthers 2 -lobed, dorsifixed, ± orbicular in outline; lobes oblong,narrowed towards the base, free and divergent in the lower halves, longitudinally dehiscent. Ovary ovoid, about 1 mm in diameter, densely white -tomentose, 4 -locular, with one ovule in each cell; style 4 - 6 mm long, scarcely exserted, densely clothed with branched tomentum, deeply 2 -branched above; branches glabrous, stigmatic at the apex. Fruit dry, indehiscent, globular, tomentose, 2 - 3 mm in diameter.

Specimens examined:

WESTERN AUSTRALIA: A.M.Ashby 2619:at Anketell, east of Mt. Magnet, on road to Sandstone, Irwin District, 13.IX.1968 (AD holotype;PERTH isotype).- R.Aitkin & Hutchinson HA34: 79 miles from Sandstone, 9.VIII.2964 (PERTH).- E.M.Bennett 2901: Cunderdin, 23.I.1969 (PERTH).- W.E.Blackall 447: at base of Black Range Hill, 45 miles E. of Sandstone, 14.VIII.1931 (PERTH).- G.E.Brockway s.n.: North of Jumpup, Kathleen Valley Station, 12.X.1947 (PERTH,CANB).- W.D.Campbell s.n.:at Boulder, -1899 - 1900 (BM,PERTH).- R.Filson 8783: Mt. Magnet to Sandstone Road, 80 miles east of Mt.Magnet, 12.IX.1966 (MEL).- C.A.Gardner 2151:near Lake Darlot, 15.IX.1927 (PERTH).- C.A.Gardner 7928: 2 miles north of Barr Smith Range, 17.X.1945 (PERTH).- C.A.Gardner 13444: towards east of Sandstone, 5.IX.1961 (MEL).- C.A.Gardner & W.E.Blackall 447: 45 miles E. of Sandstone, foot of Black Range Hills, 14.VIII.1931 (PERTH).- C.A.Gardner & W.E.Blackall s.n.: Lake Darlot, N. of Malcolm, S.E. of Wiluna, 9.IX.1927 (PERTH).- A.S.George 5852: Queen Victoria Springs, 21.IX.1963 (PERTH).- A.S.George 7983: 19 miles west of Sandstone, 12.IX.1966 (PERTH).- M.C.George s.n.:40 miles south of Cundeelee Mission, 13.X.1963 (PERTH).- R.Helms s.n.: Barrow Range, 9.IX.1891 (PERTH).- R.Helms s.n.:Elder Expl.Exped. Victoria Desert, Camp 58, 21.IX.1891 (AD,BM,MEL,PERTH).- N.Kniep 153: Sandstone, 9.VII.1934 (PERTH).- R.D.Royce 5528: 5 miles south of Queen Victoria Springs, 2.X.1954 (PERTH).- N.H.Speck 830: 30 miles N. of Wiluna, 15.IX.1957 (CANB).- F.L.Whitlock s.n.: Bore Well, 110 miles E. of Mannine, E. Murchison Distt.,25.XI.1909 (K).- P.G.Wilson

8912: 24 km E. of Depot Spring Homestead, 80 km E. of Sandstone, 27.VIII.1970 (PERTH).- Young s.n.:Victoria Springs, 24.IX.1875 (MEL).

Distribution: (Map 9).

D.brunnea is recorded from the dry eremean parts of Western Australia. The known distribution is mainly to the east of Mt. Magnet near Sandstone, Kathleen Valley and Melrose Homestead. To the north-north-east of Mt.Magnet it is recorded from near Meekatharra and Wiluna, and far eastwards it occurs around the Barrow Range. The southern localities are near Cunderdin, Cundeelee Mission and around Queen Victoria Springs in the Great Victoria Desert.

E c o l o g y:

According to information gathered from collectors' annotations, this species is a shrub 1 - 2 feet high growing chiefly on red sand in association with Triodia. Gardner 2481 & 7928 (PERTH), from East of Sandstone and North of Barr Smith Range respectively are annotated as having grown on "red sand desert with Triodia". The plant is described as "shrub 9 - 12 inches tall; calyx purple; corolla white". Aitkin & Hutchinson HA34 (PERTH), 79 miles from Sandstone is noted as growing in "yellow - sand plain". Gardner & Blackall 447 (PERTH), from 45 miles east of Sandstone is desc-ibed as "erect, branching shrub, 30 cm tall; flowers white with indumentum yellow or purple, in spinifex mud patch". Gardner 2151 (PERTH), from near Lake Darlot is annotated as "12 - 18 inches tall; corolla white". The habitat is noted as "red sand". Helms s.n. (AD,PERTH) collected at Camp 58, Elder Explor. Exped. is from "Victoria Desert". George 7983 (PERTH), 19 miles west of Sandstone is noted to grow "in sand with Eucalyptus gongylocarpa-Triodia" species.

The most usual months for flowering and fruiting are July to November.

C o m m e n t s:

The flowers of this species are among the largest in the genus. reaching up to 8.5 mm in length. The majority of them are pentamerous but a few tetramerous flowers have also been found in the same inflorescence. The thick white glands outside the corolla -lobes and on the outer upper half of its tube are larger and more sparsely distributed than the glands on the inner face of the calyx - lobes.

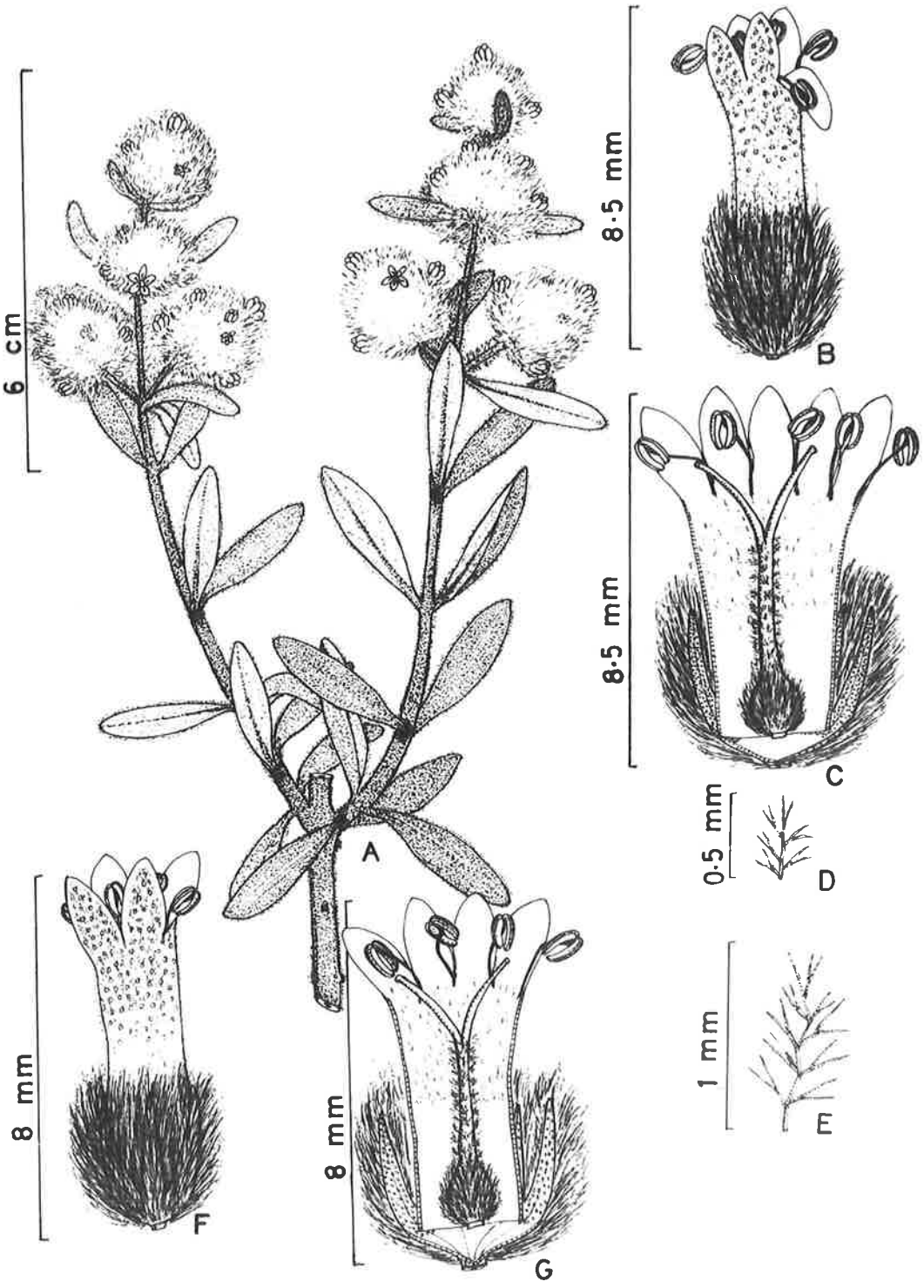


Fig. 26 — Dicrastylis brunnea Munir var. brunnea (A.M. Ashby 2619: AD-holotype).

A, flowering branch; B, flower; C, flower longitudinally cut open; D, tomentum outside corolla-tube; E, calyx tomentum; F, 4-merous flower; G, 4-merous flower vertically cut open.

The information on the herbarium labels of Gardner & Blackall 's collections seems to show confusion regarding the name of their collector. One of the two specimens from PERTH is shown to have been collected by "W.E.Blackall" and the other by "Gardner & Blackall". Both specimens were collected from the same locality, on the same date and bear the same collection number "447". The ecological remarks on both the herbarium sheets are also the same. One of the (original) herbarium sheets is annotated in pencil as "C.N = Gardner & Blackall". This information is apparently put by Blackall himself and seems to be correct. Comparison of the closely similar specimens and the original writingin pencil, supports the view that both specimens have come from the same collection, because Gardner & Blackall had many joint plant collecting expeditions in Western Australia.

Another similar case is with Gardner's coll.no.2151 and Gardner & Blackall's s.n., both collected during September, 1927, near Lake Darlot. The discrepancy over the collector's name apparently occurred subsequently when one of the specimens was remounted on a new herbarium sheet and the original information in pencil was not copied faithfully on the new herbarium label.

Relationship:

This species is related to D.gilesii and D.exsuccosa in having its cymes arranged in a pyramidal panicle; flowers apparently similar in appearance;stamens and style scarcely exserted. However, D.brunnea can be readily distinguished by its stem being rusty - brown - tomentose; leaves elliptic - oblong, sessile; cymes purplish - yellow - tomentose, ± globular in outline; calyx and corolla glandular on their inner and outer surfaces respectively.

Dicrastylis brunnea Munir var. pedunculata Munir, var. nov.

Varietas a typo ob inflorescentiam laxam et cymas pedunculis gracilioribus longioribus usque ad 5.5(-6.5) cm longis distinguitur.

T y p u s: N.H.Speck 1385: 12 miles north-east of Millrose,Eremean Province, Western Australia, 8.IX.1958 (AD holotype; CANB,NSW, PERTH).

Diagnosis: (Fig 27).

This taxon differs from the type variety in having ± lax inflorescence and flower - clusters (cymes) on slender and longer peduncles [of up to 5.5 (-6.5) cm long].

Specimens examined:

WESTERN AUSTRALIA:- T.E.H.Aplin 2397: 62 miles North of Agnew, on road to Wiluna, 19.VIII.1963 (PERTH).- R.J.Chinnock 970: 20 km north-west of Albion Downs Homestead, 12.IX.1973 (AD).-C.A.Gardner 7902: 10 miles west of Wiluna, 16.X.1945 (PERTH).- N.H.Speck 1385: 12 miles N.E. of Millrose, Eremean Province, 8.IX.1958 (AD holotype;¢ANB,NSW,PERTH- isotypes).- N.H.Speck 1198:12 miles S. of Cunyu, Eremean Province, 12.VIII.1958 (CANB,PERTH).

Distribution: (Map 9).

The var. pedunculata is recorded from the Eremean Province of Western Australia. The known distribution is chiefly around Wiluna with a few localities to the north of Agnew.

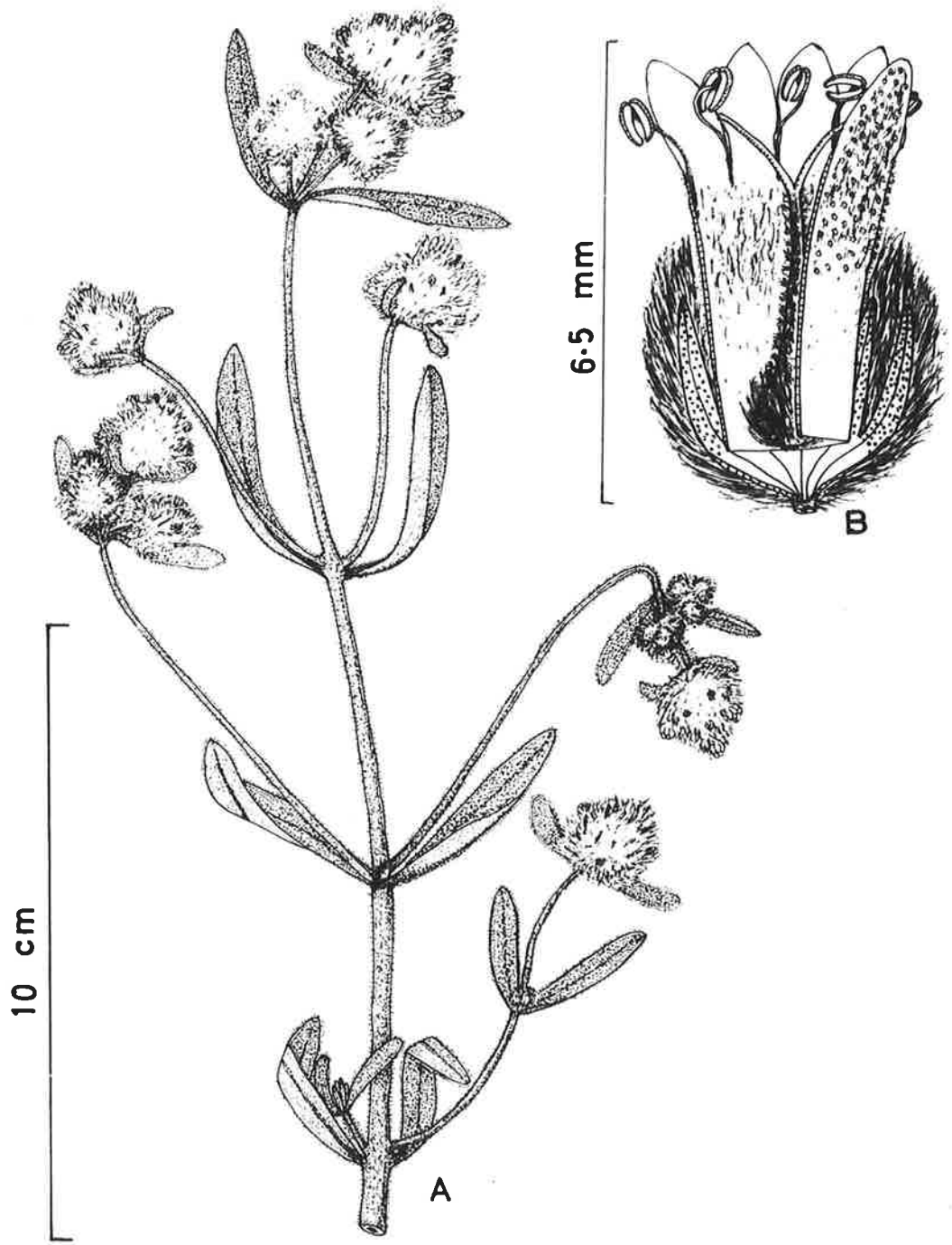
E c o l o g y:

In its ecological requirements, var. pedunculata seems to agree well with the type variety. According to Speck 1385 (AD, CANB,NSW,PERTH), from 12 miles north-east of Millrose, the plant is a "herbaceous shrub of up to 2 ft. high with white flowers". The habitat is noted as "sand plain". Gardner 7920 (PERTH), from 10 miles west of Wiluna is described as growing in "red sand". Aplin 2397 (PERTH), from 62 miles North of Agnew is recorded from "red sand, hummock grassland".

Flowering and fruiting appear to occur mainly from August to November.

Relationship:

var. pedunculata is closely related to the type variety. For the distinctive characters see the above diagnosis.



27 — Dicrastylis brunnea Munir var. pedunculata Munir (N.H. Speck 1385: AD-holotype).

lowering branch; B, flower vertically cut open.

Dicrastylis petermannensis Munir, sp. nov.

Frutex usque ad 120 cm altus tomento ramulorum cremeo - cinereo; folia decussata petiolata lanceolata vel ovato - lanceolata 2.5 - 6 cm longa 0.5 - 1.5 cm lata margine plana tomento omnino vestita supra cinereo - viridia infra cinereo - alba; inflorescentia plus minusve pyramidalis cinereo - viridis vel cremea; cymae sessiles in fasciculos axillares terminalesque dispositae fasciculis per rhachim crebre dispositis pari infimo raro axillari; flores in fasciculos cymosos dispositi paniculam elongatam spiciformem formantes; calyx extra dense lanatus lobis glabris intra glandulosis; corolla tubo extra intraque tomentoso lobis integris; stamina vix exserta filamentis lobos corollae subaequantibus; ovarium dense tomentosum; stylus vix exsertus dense tomentosus profunde bilobatus lobis glabris infimum indivisum styli subaequantibus; fructus non visus.

Inter species cymis sessilibus decussatis in fasciculos terminalos interruptos dispositis, ob folia lanceolata magna usque ad 6 cm longa 1.5 cm lata et inflorescentiam aliquantum cremeam facile distinguitur; etiam quoad folia lanceolata cinereo - viridia ad D.gilesii et D.exsuccosam var. lanceolatam accedit, sed ob cymas sessiles et fasciculos confertos distinguitur.

T y p u s: J.R.Maconochie 800: 1 mile west of Docker River Settlement, Petermann Ranges, Northern Territory, Australia, 20.IX.1969 (AD holotype; NT,PERTH).

Description: (Fig. 28).

A tomentose shrub of up to 1.5 metres high. Stem erect, branched, cylindrical, woody, densely clothed with creamy - grey tomentum. Leaves decussate, lanceolate to ovate - lanceolate, petiolate, greenish - grey tomentose above, whitish - grey tomentose beneath, 2.5 - 6 cm long, 0.5 - 1.5 cm broad, entire, sub-acute, shortly cuneate towards the base, the midrib and main lateral veins prominent only on the under-surface; petiole 3 - 8 mm long, whitish - grey tomentose. Inflorescence cymose, terminal, greenish - grey or creamy or with a faint tinge of yellow tomentum, 15 - 25 cm long; cymes decussate, sessile, sometimes shortly pedunculate towards the base of inflorescence, arranged in pairs forming regularly interrupted sub-globose flower-clusters; clusters congested, closely borne along the main central axis, each 1 - 2.5 cm in diameter, the lowest in the axil of leafy - bracts. Flowers 5 -merous, sessile or subsessile, bracteate, 5 - 6 mm long; pedicels 1 - 2 mm long. Calyx 5-lobed, 2 - 4 mm long, densely creamy - grey tomentose out-

side, glabrous inside; lobes lanceolate, free more than halfway down, glandular on the inner face; tube shallow, scarcely half the langth of the lobes. Corolla whitish, 5-lobed towards the apex, tubular below, 3 - 4 mm long; lobes ± ovate, nearly 1 mm long, densely covered with short creamy - white tomentum outside, sparsely hairy inside; tube ± cylindrical, 2 - 3 mm long, densely covered with short creamy - white tomentum outside and inside. Stamens 5, scarcely exserted, inserted in the corolla-throat; filaments short, glabrous, almost equalling the corolla-lobes; anthers 2 - lobed, dorsifixed; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, densely tomentose, 4 -locular, with one ovule in each cell; style scarcely exserted, deeply 2 - branched, densely tomentose, branches glabrous in the upper half, stigmatic at the tip. Fruit not seen.

Specimens examined:

NORTHERN TERRITORY:- J.R.Maconochie 800: 1 mile west of Docker River Settlement, Petermann Ranges, 20.IX.1969 (AD holotype;NT, PERTH - isotypes).

Distribution: (Map 9).

This species is recorded from the far south-western part of Northern Territory. The only known locality is to the west of Docker River Settlement in the Petermann Ranges.

E c o l o g y:

Not much is known about the ecology of this species, but it seems to agree much with D.gilesii which commonly occurs in the Petermann Ranges. According to collector's field notes, it is a "white flowered shrub to 4 feet high; leaves grey - green". It is found "growing in spinifex scrub on deep red sand".

The flowering and fruiting seem to take place from August to October.

Relationship:

D.petermannensis is closely related to D.gilesii in its inflorescence being ± pyramidal in outline; leaves lanceolate, petiolate; stamens and style scarcely exserted. However, it may be easily distinguished by its inflorescence being creamy - grey tomentose; cymes sessile, congested into subglobose interrupted clusters along the main central axis. It is also related to D.cordifolia, D.georgei, D.flexuosa and D.microphylla in having sessile cymes arranged thus. From these D.petermannensis can be easily distin-

-guished by its larger lanceolate leaves (up to 6 cm long) and creamy - grey tomentose inflorescence.

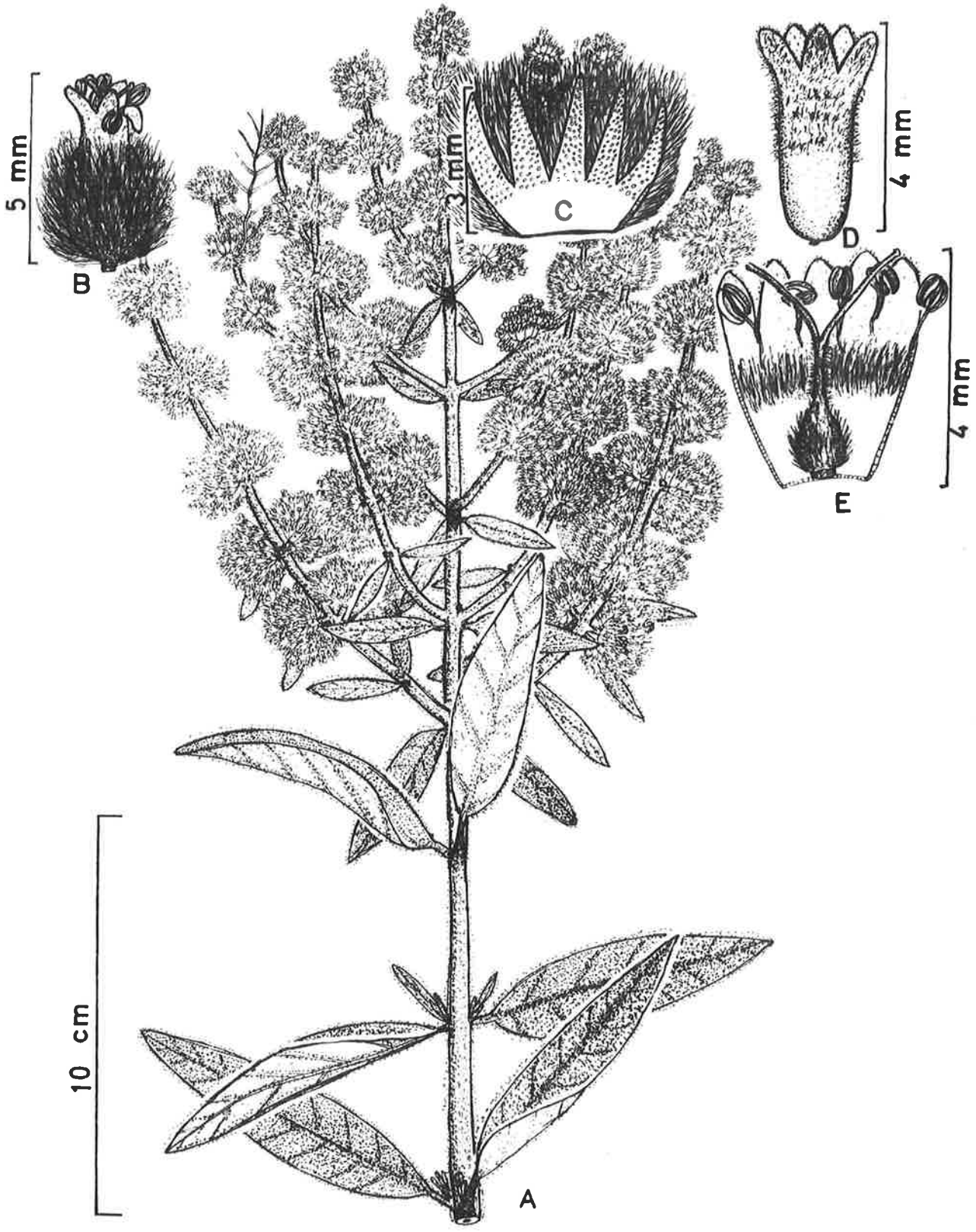


Fig. 28 — Dicrastylis petermannensis Munir (J.R. Maconochie 800: AD - holotype).

A, flowering twig; B, flower; C, calyx spread open; D, corolla-tube; E, corolla-tube vertically cut open showing stamens and pistil.

Dicrastylis sessilifolia Munir, sp. nov.

Frutex tomentosus usque ad 1 m altus caule ramoso cylindrico lignoso tomentoso ramulis plus minusve ascendentibus; folia decussata vel saepe 4 - 5 verticillata vel interdum dispersa sessilia anguste lanceolata 1.5 - 3 cm longa 3 - 7 mm lata; inflorescentia cymosa plus minusve pyramidalis; cymae in fasciculos subglobosos tomento viridi - cinereo dispositae pedunculis longis gracilibus parce tomentosis tomento rubri - purpureo; flores sessiles bracteati pentameri 5 - 6 mm longi in fasciculos sub - globosos cymosos conferti; calyx glandulosus extra dense tomentosus pilis longis intra glaber 2 - 2.5 mm longus quinquelobus tubo 0.5 - 1 mm longo lobis lanceolatis 1 - 1.5 mm longis; corolla alba extra glandulosa/intra ad faucem dense villosa tomentosa quinqueloba tubo plus minusve cylindrico prope basim glabro lobis oblongis apice crenatis; stamina 5 vix exserta ad faucem corollae inserta filamentis filiformibus glabris lobis antherae oblongis in dimidio inferiore discretis divergentibus; ovarium plus minusve globosum 0.5 - 0.7 mm diam. dense tomentosum; stylus vix exsertus tomentosus ad apicem profunde bilobatus lobis glabris; fructus non visus.

T y p u s: G.E.Brockway 32: sand - plain near Youanmi, Western Australia, 9.X.1939 (PERTH holotype).

Description: (Fig. 29).

A tomentose shrub, 45 cm to 1 metre high. Stem erect, branched, cylindrical, woody, densely clothed with branched woolly tomentum. Leaves sessile, decussate or both decussate and verticillate (i.e. in whorls of 4 or 5), sometimes ± scattered, lanceolate, entire, acute, rugose above, densely tomentose all over, 1.5 - 3 cm long, 0.3 - 0.7 cm broad. Inflorescence cymose; cymes subglobose, with long peduncles arranged to form a pyramid - shaped inflorescence; peduncles slender, reddish - purple, sparsely tomentose, the primary lateral peduncles often in whorls of three or four at a node. Flowers 5 -merous, sessile, bracteate, crowded into sub - globose cymose clusters, 5 - 6 mm long, densely covered with greenish - grey tomentum. Calyx 5-lobed, 2 - 2.5 mm long, glandular and densely tomentose outside, glabrous inside; lobes lanceolate, acute, 1 - 1.5 mm long, free to more than half way down; tube short, 0.5 - 1 mm long. Corolla white, 5 -lobed towards the apex, 4 - 5 mm long, glandular and short - tomentose outside, densely tomentose in the throat; lobes oblong, 1 - 1.5 mm long, distinctly crenate at the top, glabrous towards the apex; tube ± cylindrical, 3 - 3.5 mm long, glabrous near the base.

Stamens 5, scarcely exserted, inserted in the corolla-throat; filaments nearly as long as the corolla-lobes, filiform, glabrous; anthers 2-lobed, dorsifixed; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, densely tomentose, 0.5 - 0.7(-1) mm in diameter, 4 -locular, with one ovule in each cell; style deeply 2 -branched, scarcely exserted, densely tomentose in the lower half; lobes (branches) glabrous, stigmatic at the apex. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- G.E.Brockway 32: sand - plain near Youanmi, 9.X.1939 (PERTH holotype).- C.A.Gardner 13437: 150 km east of Sandstone, 5.IX.1961 (PERTH, 2 spec.).- C.A.Gardner s.n.: 120 km from Sandstone towards Wiluna, 25.X.1963 (PERTH, 2 spec.).- C.A.Gardner s.n.: 150 km east of Sandstone, 26.X.1963 (PERTH).- C.A.Gardner s.n.: 48 km east of Sandstone, 26.X.1963 (PERTH).

Distribution: (Map 9).

D.sessilifolia is recorded from the south-western part of Western Australia. The known distribution is chiefly between Sandstone and Wiluna. Most of the localities are to the south of Wiluna and east-south-east of Sandstone.

E c o l o g y:

Little is known about the ecology of this species. The information gathered from collectors' field notes show that it generally grows in sandy places. According to Brockway 32 (PERTH), from Youanmi, it grows in "sand plains". Gardner s.n. (PERTH), 120 km from Sandstone towards Wiluna is annotated as "frutex 40 - 50 cm alt, ramis erectis; corolla alba". The plant is growing "in arenosis rufulosis". A subsequent collection of Gardner s.n. (PERTH), from 150 km east of Sandstone is noted as "frutex 60 - 100 cm alt.; ramis ascendens; corolla? coerulea". The habitat is recorded as "arenosis apertis cum Triodia".

Flowering and fruiting seem to occur chiefly from September to December.

C o m m e n t s:

This species exhibits a combination of characters which are not found together in any other species of Dicrastylis. The shape, arrangement and non - recurved margins of decussate leaves, ± pyramid - shaped inflorescence, crenate - topped corolla - lobes and scarcely exserted stamens and style are similar to those of

D.doranii. Also the verticillate (or scattered) arrangement of leaves in some parts of the branches is somewhat like the leaves in D.lewellinii, D.morrisonii or D.verticillata, but the shape of leaves and flower characters, do not agree with any one of these species. The pyramidal outline of the inflorescence, the sub - globose cymose flower - clusters with long peduncles and large flowers seem somewhat similar to D.gilesii, but the much smaller leaves and very slender peduncles of D.sessilifolia at once distinguish it from that.

Most of the hairs on stem and leaves are not branched in the lower part. The unbranched stalk is septate and longer than the upper branched portion of the hair (see fig. 29).

Relationship:

D.sessilifolia is closely related to D.doranii in the characters just discussed under "Comments". However, it can be easily distinguished by its leaves and peduncles being (quite often) verticillate; stem and leaf tomentum denser, longer and each hair mostly unbrached in the lower part; peduncles reddish - purple; flower bigger (5 - 6 mm long); calyx and corolla with glands mixed in the outside tomentum.

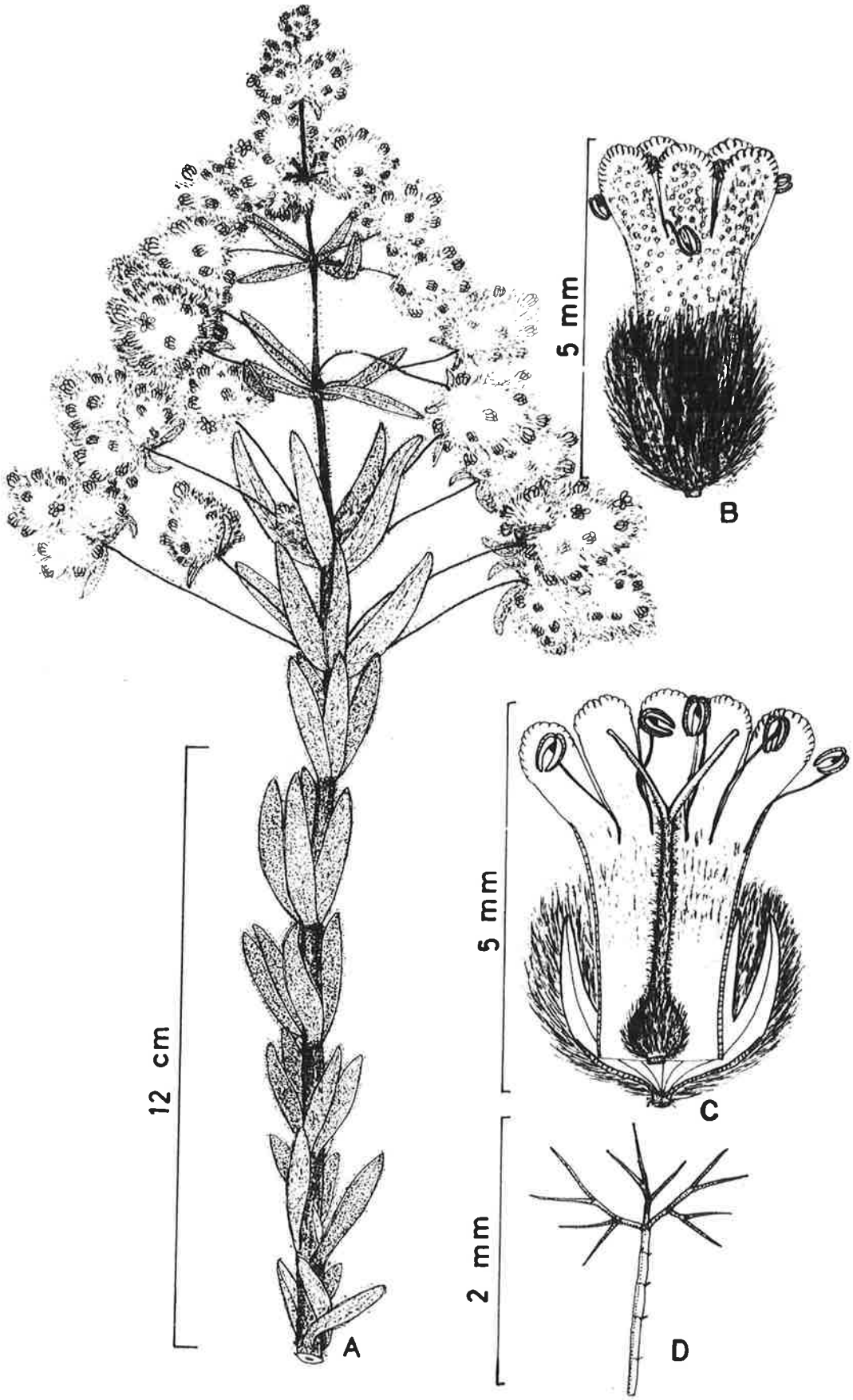


Fig. 29 — Dicrastylis sessilifolia Munir (G.E. Brockway 32: PERTH - holotype).

A, flowering branch; B, flower; C, flower vertically cut open; D, tomentum from peduncle.

Dicrastylis gilesii F.v.Mueller, Fragm.8 (1874) 229, var.gilesii; F.v.Mueller, Fragm. 9(1875) 4; F.v.Mueller, Fragm.10 (1876) 15; R.Tate, Trans.R.Soc.S.Aust. 3 (1880) 78;F.v.Mueller, Cens.Aust. Pl.1 (1882) 103; R.Tate, Trans.R.Soc.S.Aust.12 (1889)113; F.v. Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; E.Giles, Aust.Twice Trav. 2 (1889) 356; R.Tate, Fl.Extra - tropic.S.Aust. (1890) 155,254; F.v.Mueller & R.Tate, Trans.R.Soc.S.Aust.13 (1890) 105; R.Tate, Horn Exped.Bot.(1896) 174; L.Diels & E.Pritzel, Bot.Jahrb.Syst.35 (1904) 498; J.M.Black, Fl.S.Aust.ed.1, (1926) 696;C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; J.M.Black, Trans.R.Soc.S.Aust. 59 (1935) 261; J.M.Black, Fl.S.Aust.ed.2, (1957) 723; J.B.Cleland & N.B.Tindale, Trans.R.Soc.S.Aust. 82 (1959) 137; G.Chippendale, Trans.R.Soc.S.Aust. 82 (1959) 334; G.Chippendale, Vict.Nat. 75 (1959) 198; H.N.Moldenke, Résumé Verbenac.etc. (1959) 208,278; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W. Aust.Wildfls.3 (1965) 561; A.Moriya, List Pl.Spec.Aust. (1969) 13, MS.; A.Moriya, List Colour Slides Aust.Wildfls. (1969) 14,MS.; J.S.Beard, W.Aust.Pl.ed.2,(1970) 113; T.E.H.Aplin & Cannon, Economic Bot. 25 (4) (1971) 379; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 345,475; G.Chippendale, Proc.Linn.Soc.NSW 96 (1972) 256.

T y p u s: E.Giles s.n.,MEL40878: between the Alberga River and Mt.Olga, Northern Territory, - (MEL holotype; B,NSW).

Description: (Fig. 30).

A tomentose shrub 1 - 1.5(-2) metres high. Stem erect and spreading, branched chiefly towards the base, almost cylindrical, woody, densely covered with branched greyish - tomentum, the young top-most branchlets with purplish - grey or greenish - grey tomentum. Leaves petiolate, decussate, elliptic - ovate, ovate - lanceolate or broadly lanceolate, entire, obtuse, 4.5 - 8.5 cm long, 1.5 - 3 cm broad, up to 1.5 mm thick, densely clothed with a thick layer of soft branched tomentum, young apical leaves often purplish - grey tomentose, midrib prominent below; petiole 0.5 - 1 cm long, channelled above, densely tomentose. Inflorescence cymose;- cymes (flower-clusters) forming ± pyramidal panicle, pedunculate, purplish - creamy to purplish - grey tomentose, sometimes greenish - grey tomentose, each cyme generally up to 15 - flowered, sometimes more, often subtended by a pair of leafy bracts; peduncles 1 - 2.5(-3.5) cm long, purplish - grey tomentose. Flowers 5 -merous, rarely more, bracteate, pedicellate, 7 - 8 mm long, each subtended by a bract and two bracteoles; pedicels 2 -3

(-4) mm long, densely woolly - tomentose; bracts small, sessile, linear - lanceolate, 2 - 2.5 mm long, 0.2 - 0.4 mm broad, woolly - tomentose outside, glabrous inside; bracteoles linear, minute, 1 - 1.5 mm long, woolly - tomentose outside, glabrous inside. Calyx 5 -lobed, 3.5 - 4.5 mm long, sparsely glandular and densely clothed with long branched tomentum outside, glabrous inside with many minute glands on the lobes, outer tomentum up to 3.8 mm long; lobes linear - lanceolate, almost free to the base, 2.5 - 3.5(-3.8) mm long, 0.5 - 1 mm broad; tube short, 0.5 - 1 mm long. Corolla purplish, tubular, 5 -lobed towards the apex, 6.5 - 7 mm long, densely covered with minute glands and branched tomentum outside, densely tomentose inside; lobes ± elliptic - oblong, rounded at the apex, 1.5 - 2 mm long, 1 - 1.5 mm broad, sparsely hairy on the inner face; tube cylindrical, ± 5 mm long. Stamens5, sometimes 4, scarcely exserted, inserted in the corolla-throat; filaments somewhat thick, short, 2- 2.5 mm long, glabrous,completely attached to the corolla tube below, free above, the free part 0.8 - 1 mm long; anthers 2 -lobed, dorsifixed, brownish - yellow, 1 - 1.1 mm long, 0.7 - 0.8 mm broad; lobes free and divergent in the lower halves, longitudinally dehiscent. Ovary globular, very densely covered with long silky tomentum, 2 - 2.5(-3) mm in diameter, 4 -locular, with one ovule in each cell; style long, scarcely exserted, deeply 2 -branched, densely tomentose, 3.5 - 5.5mm long (including lobes), the lower undivided part 2 - 2.5 mm long; lobes filiform, 1.8 - 2.5 mm long, tomentose in the lower half, glabrous above,stigmatic at the tip. Fruit ± globose, indehiscent, silky hairy, 2.5 - 3 mm in diameter.

Specimens examined:

NORTHERN TERRITORY:- H.Basedow 77: between Ayers Rock and Musgrave Ranges, -VI.1926 (K).- H.Basedow 121: Bloods Range, 30. VI.1926 (K).- G.Chippendale 3592: Bagot Creek, George Gills Range, 13.VIII.1957 (AD,BRI,CANB,MEL,NSW,PERTH).- N.N.Donner 4348:50 km north-east of Mulga Park Homestead, 21.VIII.1973 (AD).- E.Giles s.n.,NSW106694: between the Alberga and Mt.Olga, (MEL holotype; BM,NSW -isotypes).- E.N.S.Jackson 132: west side of Mt.Olga area, 18.VIII.1959 (AD).- A.A.Munir 5090: 50 km north-east of Mulga Park Homestead, 21.VIII.1973 (AD).- A.A.Munir 5091: 50 km north-east of Mulga Park Homestead, 21.VIII.1973 (AD).- A.A.Munir 5167: near Armstrong Creek, ca. 55 km west-north-west of Mt.Olga, 25. VIII. 1973 (AD).- F.C.Vasek 680919 - 17: 15 miles south of Curtin Springs, 19.IX.1968 (CANB).

WESTERN AUSTRALIA:- D.E.Symon 2392:3 miles north of the end

of the Walter James Range, 2.VIII.1962 (AD,ADW,K, n.v.).- A.S. George 4817: Blackstone Mining Centre, 8.VII.1963 (PERTH).

Distribution: (Map 10).

D.gilesii var. gilesii is known chiefly from the far south-western part of the Northern Territory and from the Eastern Division of Western Australia. The known distribution in the Northern Territory is to the south-west of Alice Springs around Petermann Ranges, Ayers Rock and Lake Amadeus. In Western Australia, it has been recorded from near Walter James Range and from Blackstone Mining Centre in Blackstone Range.

E c o l o g y:

In its ecological requirements, D.gilesii seems to favour chiefly dry sandy or gravelly soil. The plant is a spreading shrub of up to 1.5(-2) metres high, branching mostly at ground level. Leaves are somewhat thick, densely clothed with branched hairs and the tomentum covering the young apical shoots and inflorescence is distinctly greyish - purple. According to Beard (1965, 1970), it is a 1 - 5 feet high shrub with "white flowers". The habitat is recorded as "spinifex country". Chippendale 3592 (AD, BRI,CANB,MEL,NSW,NT,PERTH), from Bagot Creek, George Gill Range, is annotated as "grey shrub up to four feet high, infrequent in sand on the sides of gorges". Munir 5090,5091 (AD), ca. 50 km north-east of Mulga Park Homestead, are growing in sandy - stony or somewhat gravelly soil, chiefly in association with Acacia, Eremophila, Solanus and Triodia species. The average plant is 1 - 2 metres tall with young shoots and leaf petioles clothed with purplish- grey tomentum and flowers somewhat yellowish. Munir 5167 (AD), near Armstrong Creek, was collected from a depression between the sand dunes. Other associated plants were chiefly Acacia, Casuarina, Eremophila and Triodia species.

Flowering and fruiting occur mainly from August to December.

C o m m e n t s:

The type locality indicated on the label of the holotype, written in F.v.Mueller's handwriting, is noted "between the Alberga and Mt.Olga". But in the protologue, the type locality is recorded "Inter flumen Albergae et Montem Olgae". Neither the collector nor the author of this species has pointed out the exact type locality. To find it out, the geographical position of Mt.Olga, the Alberga township and the Alberga River should be considered. Mt.Olga is in the far south-west of the Northern

Territory and both the Alberga town and the Alberga River are located across the border in the far north of South Australia. The Alberga River and Mt.Olga are approximately 200 miles apart, whilst the township and Mt.Olga are even more distant. In this region, the known dsitribution of D.gilesii is mainly to the south-west of Alice Springs towards the borders of South Australia and Western Australia. Most of the collections came from near Mt.Olga and adjacent areas, and none from near Alberga or the Alberga River. According to personal field observations, D.gilesii is not known to occur further than Mulga Park Homestead in the south-easterly direction from Mt.Olga. The region to the south-east of Mt.Olga, towards the Alberga River, was visited by E.Giles during his "Second Exploring Expedition into Central South Australia and into a portion of Central Western Australia", in the year 1873 [E.Giles (1889) 143 - 187, map 2]. It is thus probably that Giles collected the type of this species near the south-eastern part of Mt.Olga where this taxon grows commonly.

Subsequent to the publication of D.gilesii, many new subspecific taxa have been gathered, but most of them are either considered identical with the type form or were identified as "D.exsuccosa (FvM.) Druce" or "D.ochrotricha FvM." In the present treatment, D.gilesii is clearly distinguished from all the other species on the basis of its inflorescence and tomentum colour. Two new varieities var. bagotensis and var. laxa are described. In addition, the type variety gilesii is found to have a new form densa and the var. bagotensis has two new forms namely f. irregularis and f.brevipila.

Blackall & Grieve (1965) have recorded the distribution of this species within Diels' (1906) Botanical Districts "Avon" and "Coolgardie", while Beard (1965,1970) has noted its occurrence in Gardner & Bennett's (1956) Botanical Districts and Provinces "Fortescue District, Northern Province" and Austin District, Eremean Province". As is shown under the distribution of this species, D.gilesii does not extend so far to the west and north into Western Australia as is shown by the above authors. Since no specimen is cited with their records, it is not posiible to check the exact taxon or taxa to which they have referred as D.gilesii. However, it appears that like many others, they have probably mistaken for D.gilesii some sollections of D.exsuccosa, D.brunnea etc. or some undescribed species of this genus.

There are some minute glands on the inner glabrous face of the calyx-lobes and on the outside of calyx and corolla tube. The outside glands are concealed by the long branched hairs and can

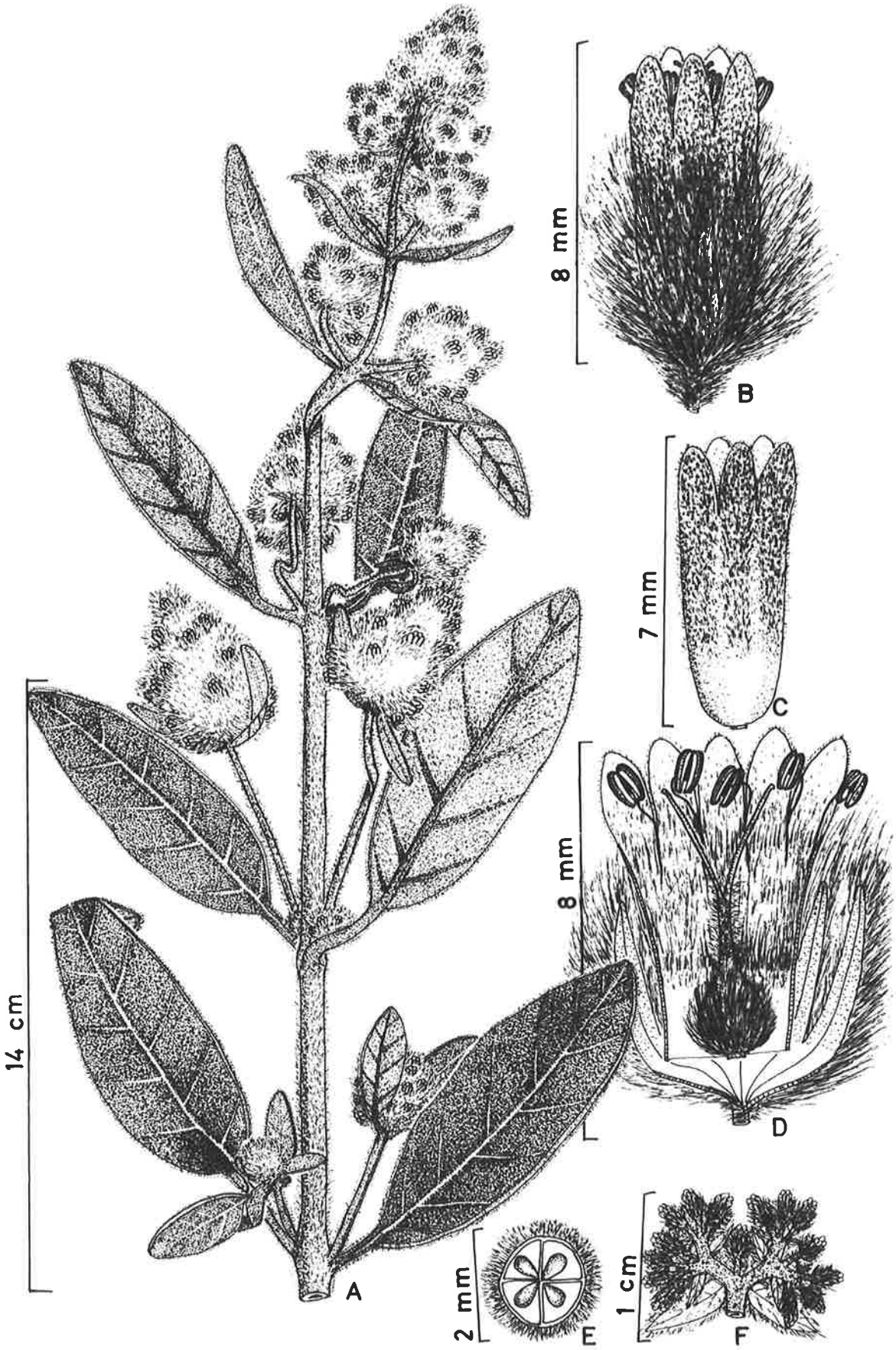


Fig. 30 — Dicrastylis gilesii F.v.M. (F.C. Vasek 680919-17; CANB). A, flowering twig; B, flower; C, corolla-tube; D, flower longitudinally cut open; E, T.S. ovary; F, cyme.

hardly be seen without carefully removing them. These glands are not visible when dry but can be seen either after boiling the material or in fresh flowers.

Relationship:

Allied closely to D.exsuccosa in its cymes being arranged in ± pyramidal panicle; corolla densely tomentose outside, villous - tomentose in throat, lobes entire and stamens and style scarcely exserted. However, D.gilesii may be readily distinguished by its young apical branchlets, leaves and inflorescence being purplish - grey or sometimes greenish - grey tomentose and flowers often in pedunculate or subsessile (head - like) woolly clusters.

Dicrastylis gilesii F.v.Mueller var. gilesii forma densa Munir, f.nov.

Forma a typo ob cymas perconfertas ramulos juvenes et pedunculos et folia apicalia tomento viridi - cinereo folia lanceolata vel anguste ovato - lanceolata et par infimum pedunculorum lateralium 1(-1.5) cm longum distinguitur.

T y p u s:P.K.Latz 835: 50 miles east of Docker River Settlement, Northern Territory, 26.X.1970 (AD holotype; NT).

This taxon differs from the type form by its cymes (floral - clusters) being very congested to make inflorescence quite dense, young branchlets, peduncles and apical leaves greenish - grey tomentose, leaves lanceolate or narrowly ovate - lanceolate, the basal pair of lateral peduncles 1(-1.5) cm long and the proximal pair of flower - clusters (cymes) congested with the upper ones.

Specimens examined:

NORTHERN TERRITORY:- G.Chippendale 2479: Waterhouse Range, 30 miles S.W. of Alice Springs, 6.VIII.1956 (AD,BRI,CANB,MEL,NT, PERTH).- H.Kempe 427:Finke River, -(MEL).- P.K.Latz 835: 50 miles E.Docker River Settlement, 26.X.1970 (AD holotype; NT - isotype).

Distribution: (Map 10).

The form densa is recorded only from the Northern Territory. The known localities are near Waterhouse Range and the Finke River to the south-west of Alice Springs and about 50 miles east of Docker River Settlement in the Petermann Ranges.

E c o l o g y:

In its ecological requirements, f.densa seems quite close to

the type form gilesii, being common in the arid parts of Northern Territory. According to Chippendale 2479 (AD,BRI,CANB,MEL,NT, PERTH), from Waterhouse Range, it is noted as "shrub 3 $\frac{1}{2}$' ,grey, in florescnece greenish. Common on rocky hillside". Latz 835 (AD,NT), from 50 miles east of Docker River Settlement is annotated as "spreading compact bush to 3 ft. high; flowers creamy forming globular heads. Infrequent, in deep red sand in Eucalyptus gamophylla - Triodia basedowii" association.

Flowering and fruiting generally occur from August to October.

C o m m e n t s:

H.Kempe's collection (no.427) in Herb.MEL is noted to have come from "Finke River" with no further details. In view of the present known distribution of this form, Kempe's collection probably comes from the Waterhouse Range along the northern part of the Finke River.

Among all the taxa of D.gilesii, the cymes (flower - clusters) of form densa are more congested than in any oth@r form of this species.

Relationship:

This taxon is closely related to the type form. For the distinctive characters see its diagnosis and key to the subspecific taxa of D.gilesii.

D.gilesii F.v.Mueller var.bagotensis Munir, var.nov.

D.ochrotricha FvM.: R.Tate, Horn Exped.Bot. (1896) 174, pro parte -(quoadspec. R.Tate s.n.,AD9711318 ex Ilpilla Gorge, Bagot Creek and Mt.Sonder - AD); A.J.Ewart & O.B.Davies, Fl.N.T. (1917) 237 -(quoad spec.G.F.Hill 187 -MEL); J.M.Black, Fl.S.Aust.ed.1, (1926) 480, pro parte -(quoad spec.R.Tate s.n.,AD97113318: from Macdonnell Ranges - AD);

D.exsuccosa (FvM.)Druce; J.M.Black, Fl.S.Aust.ed.2, (1957) 723 - pro parte -(quoad spec. R.Tate s.n. ibid. -AD).

Varietas ab aliis ob pedunculos cymarum perlongos 2 - 4.5 (5.5) cm et cymas terminales saepe in axillis bractearum non foliatarum distinguitur.

T y p u s:G.Chippendale 3616: from Bagot Creek, George Gill Range, Northern Territory, 13.VIII.1957 (NT holotype;MEL),

Diagnosis: (Fig. 31A).

This taxon differs from the type variety by its flower - clusters (heads) having very long peduncles, [2 - 4.5(-5.5) cm] and the terminal clusters (heads) often in the axil of non-leafy bracts.

Specimens examined:

NORTHERN TERRITORY:- R. & R.Belcher 75:Mt.Olga, 20.IX.1967 (MEL,BM,MICH,NSW).- R.J.Chinnock 488: 8.6 km west of Armstrong Creek along Docker River - Mt.Olga road, 25.VIII.1973 (AD).- G.Chippendale 3616: Bagot Creek, George Gill Range, 13.VIII.1957 (NT holotype;MEL isotype).-J.B.Cleland s.n.,AD97120310: Hann Range 9.VIII.1931 (AD).- J.B.Cleland 66:loc.cit. -VIII.1931 (NSW).- J.B.Cleland s.n.,ADW18373:Ulambara Springs, Haasts Bluff Reserve, 16.VIII.1956 (ADW).- J.B.Cleland s.n.,AD97120338: loc.cit., 19. VIII.1956 (AD).- N.N.Donner 4359:17 km east of Ayers Rock, 22.VIII. 1973 (AD).- N.N.Donner 4390: 5 km east of Ayers Rock, 23.VIII.1973 (AD).- H.Finlayson s.n.,AD97205194: west of James Range, -I.1935 (AD).- H.Finlayson s.n.,AD97205195: Blood Range, -I.1935 (AD).- C.H.Gittins 2110:Mt.Olga, -IX.1969 (BRI).- H.A.Johnson 57: Mt. Undoolya, 14.X.1956 (AD).- H.Kempe 7, MEL40877: Finke River,-1891 (MEL).- H.Kempe 361: loc.cit., -1880 (MEL).- H.Kempe 543:loc.cit., -(MEL).- P.K.Latz 772: Docker River Settlement Aerodrome, Petermann Ranges, 18.VIII.1970 (AD,NT).- N.F.Learmouth s.n., MEL40865: Palm Valley, James Range, -X.1952 (MEL).- A.A.Munir 5111 & 5112: 17 km east of Ayers Rock, 22.VIII.1973 (AD).- A.A.Munir 5123 & 5124: 5 km east of Ayers Rock, 23.VIII.1973 (AD).- A.A.Munir 5158: 75 km west of Armstrong Creek near Petermann Ranges, 25.VIII.1973 (AD).- A.A.Munir 5162: 3 km west of Armstrong Creek near Petermann Ranges, 25.VIII.1973 (AD).- A.A.Munir 5176: west end of Blood Range, 26.VIII.1973 (AD).- D.J.Nelson 1533: Standley Chasm area, 8.VIII.1967 (AD,NT).- R.Tate s.n.,AD97113318: from Ilpilla Gorge (Creek), Macdonnell Ranges; Mt.Sonder and Bagot Creek in George Gill Range, -1894 (AD).- Strehlow s.n.,AD97113311: from Lambura, -1932 - 33 (AD).

WESTERN AUSTRALIA:- A.S.George 8289: Rawlinson Range, ± 24° 58'S, 128° 17'E, 4.X.1966 (PERTH).- A.A.Munir 5192: 53 km west of Docker River Settlement ca. 25 km west of Rebecca Creek, 27.VIII. 1973 (AD).- A.A.Munir 5193: 65 km south of the turnoff of Giles Met.Stn. and Warburton Mission, 27.VIII.1973 (AD).- D.E.Symon 2368: 14 miles south of the western end of Lake Hopkins, 2.VIII.1962(AD, ADW,PERTH).

Distribution: (Map 10).

The var. bagotensis is known chiefly from the southern and south-western part of the Northern Territory and near its border region in Western Australia. The main occurrence in the Northern Territory is to the west and south-west of Alice Springs near Finke River, Macdonnell Ranges and George Gill Range. To the east it occurs near Mt.Undoolya and towards the north it has been recorded from Hann Range. In its distribution it overlaps the type variety near Bagot Creek,Mt.Olga,Docker River and Blood Range. In Western Australia, var.bagotensis occurs freely between Rawlinson Range and Petermann Ranges. Within this area, it extends southwards to Arnold River (east of Blackstone Range), and northwards to the southern end of Lake Hopkins.

E c o l o g y:

Much of what is true of var. gilesii is true also of var. bagotensis. According to information gathered from collectors' annotations, it is a very spreading greyish - tomentose woody shrub of 1 - 2 metres high. It is known to grow commonly in sandy and gravelly habitats chiefly along the rain-water depressions and near the gorges and creeks. Belcher 75 (BM,MEL,MICH,NSW),from Mt.Olga, is noted as "canescent woody shrub, 2 feet high, spreading to 3 feet". Chippendale 3616 (MEL,NT), from Bagot Creek, George Gill Range, is annotated as "Grey shrub of up to 5 feet high; corolla-lobes white. Rare at the side of rocky gorge".Latz 772 (AD,NT), from Docker River Settlement, is recorded as "erect subshrub to 2 feet high; stem red above, pink below; leaves paler below; flowers white. Rare in red sandy soil in Mulga - Triodia basedowii community". Nelson 1533 (AD,NT), from Standley Chasm area, N.T., is noted as "herbaceous shrub to 3 $\frac{1}{2}$ ft. high with greyish furry leaves. Common on rocky hill crest". Munir 5111 & 5112 (AD), 17 km east of Ayers Rock are collected from sandy soil, growing chiefly in a community of Acacia, Cassia, Eremophila, Grevillea and Triodia species. The shrubs are nearly two metres high, tomentose and spreading from near the base. The young shoots and inflorescence are purplish - grey tomentose and the lower flower - clusters (heads) are generally distinctly pedunculate. Munir 5123 & 5124 (AD), from 5 km east of Ayers Rock, were found growing mainly along the roadside and beside the rain-water depressions in the sandy soil.Their chief association is with Cassia, Casuarina, Dampiera, Grevillea and Triodia species. Munir 5158,5162,5176,5192,5193, (AD), from either side of the border of Northern Territory and Western Australia, also have the same

ecological characteristics, but the numbers 5162 & 5176, from Northern Territory, are also associated with Eucalyptus gilesii and Ptilotus species.

Flowering and fruiting occur chiefly during August to December.

C o m m e n t s:

This taxon is distinguished from the type variety mainly on the basis of its longer peduncles and non-leafy bracts subtending the uppermost flower-heads. These characters are better developed in the mature inflorescence, at a younger stage the peduncles are generally shorter and bracts are somewhat leafy. During field observations, the present writer has seen many populations with mature inflorescence having long - peduncled flower - heads and non-leafy bracts towards the summit. It is possible, that due to close resemblances in the two varieties at a younger stage, one might interpret var. bagotensis as a mature form of the type variety, but at present, neither the herbarium material nor the field observations are in favour of this view. There are plants seen in the field as well as in the available herbarium collections [e.g. Munir 5090 -(AD); Vasek 680919 - 17 (CANB)] which have short peduncles and leafy bracts when mature and agree in all important characters with the type of this species. In view of this, all the specimens having long - peduncled flower - heads and non - leafy bracts near the top are here regarded as a new variety bagotensis

Three of Kempe's collections are annotated as gathered from "Finke River", but there is no indication of their precise locality. As mentioned under the "Comments" of forma densa of the type var. gilesii, Kempe's var. bagotensis gatherings also seem to have come from the northern part of the Finke River. From the main distribution pattern of this variety, these collections probably came from the south-west of Alice Springs where this variety is known to occur commonly.

R.Tate's collection (no.AD97113318) in Herb.AD consists of seven small inflorescence - bearing brnaches, all mounted on the same herbarium sheet. The locality on the original herbarium label is written "McDonald Ranges, C.Australia", but there are three small notes tagged to three different branches, (apparently collector's field notes) each bearing different locality. One of them is noted to have come from Ilpilla Gorge, a tributary of Finke River, and the other two from Mt.Sonder and Bagot Creek respectively, all in and around the Macdonnell Ranges in the Northern Territory. The locality "McDonald Ranges", written on the original

herbarium label seems to be an orthographical error for Macdonnell Ranges which have maximum representation of this taxon in that region. This area was visited by R.Tate with the Horn Expedition during 1894.

The collections of this expedition were subsequently published by Tate during 1896. The "McDonald Range" is located to the north-west of Kimberley Division in western Australia. This area does not contain any species of Dicrastylis, neither was it visited by R.Tate during 1894.

Relationship:

This variety bagotensis is close to var.gilesii in its flowers being crowded into densely woolly - tomentose clusters (heads), peduncles generally simple or divided only near the top and the hairs of calyx - tomentum long, woolly, up to 3.5 mm long (tomentum is short in form brevipila). However, it can be easily distinguished by its mature peduncles being very long, [up to 4.5 (-5.5)cm]and the apical floral - clusters often in the axil of non - leafy bracts.

D.gilesii FvM. var. bagotensis Munir f. bagotensis

T y p u s:The type of var. bagotensis is also the type for this form.

The type form of var. bagotensis differs from f. brevipila by its long and more woolly calyx - tomentum (up to 2.5 mm),and from f. irregularis it differs by its mostly regular (pentamerous) flowers.

D.gilesii FvM. var. bagotensis Munir f. irregularis Munir, f.nov.

Forma ab aliis ob flores irregulares calycem corollam staminaque 5 - 9 partibus stylum 2 - 5 lobis et ovarium interdum duplex distinguitur.

T y p u s:P.G.Wilson 2405: "Warrapi" (Warrabi) Gorge, on south-west side of Rawlinson Range, ca. 15 km north-west of Giles, Western Australia, 3.VIII.1962 (AD holotype; B,E).

Diagnosis: (Fig. 31 B - E).

This form differs from all other taxa of D.gilesii in many of its flowers not being constant ("irregular") in the number of perianth - lobes, stamens and style branches. The perianth - lobes and stamens vary from 5 to 9 each within the flowers of the same inflorescence. Similarly, the style - brnaches may be 2 to 5 and

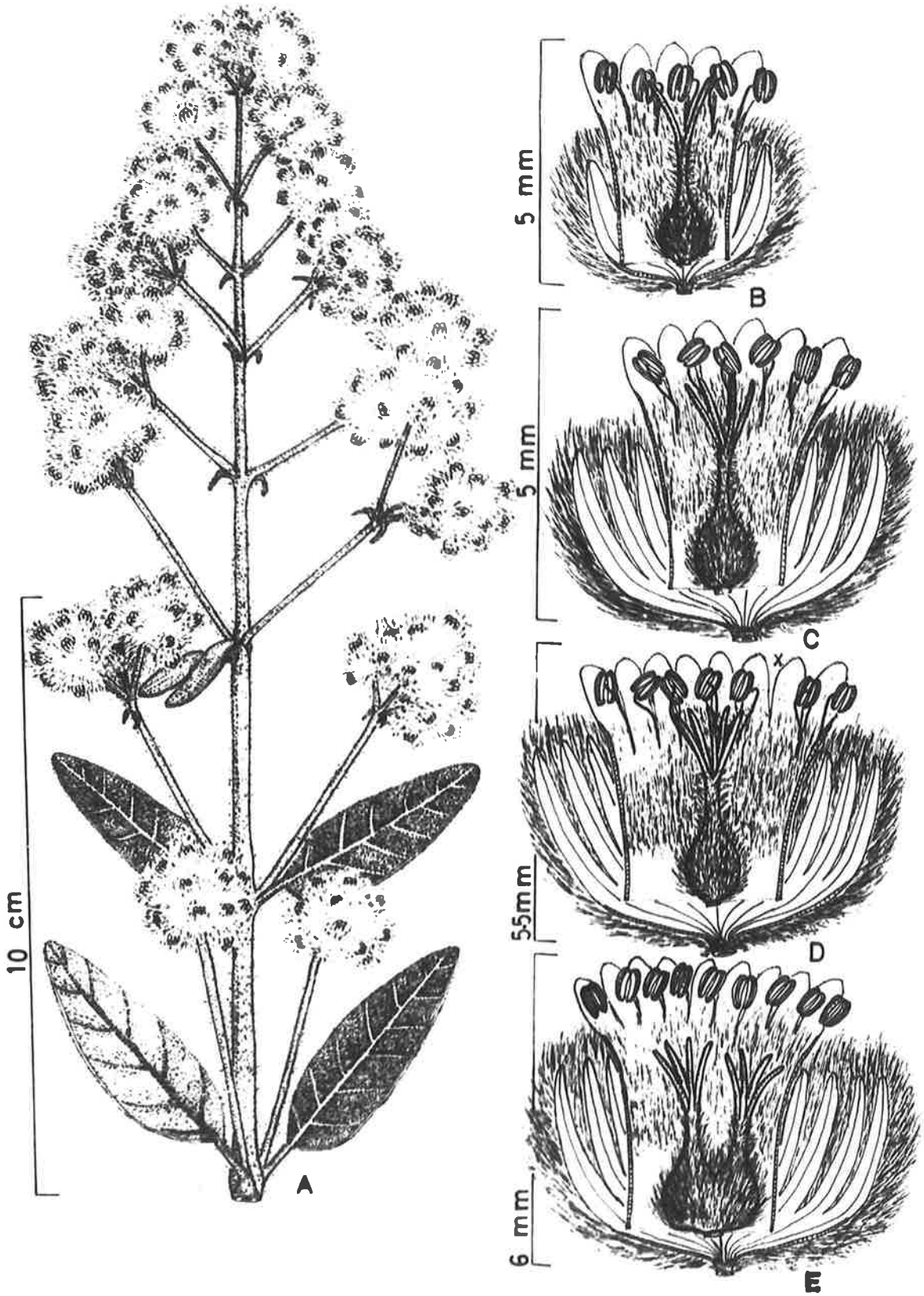


Fig. 31 A - Dicrastylis gilesii F.v.M. var. bagotensis Munir f. bagotensis (G. Chippendale 3616: NT - holotype); B-E - D. gilesii F.v.M. var. bagotensis Munir f. irregularis Munir (P.G. Wilson 2405: AD - holotype). A, flowering branch with long peduncled cymes; B, normal flower vertically cut open; C, abnormal flower cut open showing 8 sepals, 6 petals, 6 stamens and 4 lobed styles; D, abnormal flower cut open showing 8 sepals, 8 petals, 7 stamens and 5 lobed styles; E, abnormal flower cut open showing 9 sepals, 9 petals, 9 stamens, 2 fused ovaries each with 4-lobed styles.

the number of ovaries sometimes two in a flower (see fig. 31, B - E).

Specimens examined:

WESTERN AUSTRALIA:- P.G.Wilson 2405:"Warrapi" (Warrabi) gorge, on south-west side of Rawlinson Range, ca. 15 km north-west of Giles, 3.VIII.1962 (AD holotype; B,E -isotypes).

Distribution: (Map 10).

This taxon is recorded from the far eastern section of Western Australia. The only known locality is to the south-west side of the Rawlinson Ranges, about 15 km north-west of Giles.

E c o l o g y:

The solitary collectionrepresenting this form does not give any information about its ecology. However, its locality is in the dry eremean part of Central Australia. Like other taxa of D.gilesii, this one is densely covered with branched tomentum. Similarly, the young branchlets, peduncles and the tomentum outside the calyx and corolla are purplish - yellow to purplish - grey.

Flowering and fruiting occur mainly during August to October.

C o m m e n t s:

Apparently, the type form irregularis seems normal, but the abnormalities in its flower parts can be seen only after dissecting different flowers under the microscope. The selection of flowers should be made by observing the inflorescence under low power lens.

Relationship:

Akin to the type form of var. bagotensis. For the distinctive characters see its diagnosis and key to the subspecific taxa of D.gilesii.

D.gilesii FvM. var. bagotensis Munir f. brevipila Munir, f.nov.

D.ochrotricha FvM.: A.J.Ewart & O.B.Davies, Fl.N.T. (1917) 137 -(quoad spec. G.F.Hill 187 -MEL).

Forma ab aliis ob tomentum calycis non lanatum breve usque ad 1.3 mm longum distinguitur.

T y p u s:R.Hill & T.R.N.Lothian 921: Blackstone Mining Camp, ca. 630 km south-west of Alice Springs, ± 30 miles north-east of Cavanagh Range, Western Australia, 11.VII.1958 (AD holotype;K,NT).

This taxon differs from other forms of var. bagotensis by its calyx - tomentum being short, non - woolly and only up to 1.3 mm long.

Specimens examined:

NORTHERN TERRITORY:- G.F.Hill 187:at Haasts Bluff, 17.V.1911 (MEL).- R.F.Thornton s.n.,MEL40872: Tempe Downs, -1891 (MEL).

WESTERN AUSTRALIA:- R.Hill & T.R.N.Lothian 921: Blackstone Mining Camp, ca. 630 km S.W. of Alice Springs & ± 30 miles N.E. of Cavanagh Range, 11.VII.1958 (AD holotype; K,NT -isotypes).

Distribution: (Map 10).

The form brevipila is known to occur to the south-west of Alice Springs in the Northern Territory and about 30 miles to the north-east of Cavanagh Range in Western Australia.

E c o l o g y:

Little is known of the ecology of this form, because none of the three available collections bear collectors' notes of it. However, on the basis of its morphological characters and distribution, it seems that much of what is true of other taxa of D.gilesii applies also to this one.

C o m m e n t s:

The three collections of this form have been annotated as "D.exsuccosa", "D.ochrotricha" or"D.gilesii". The type and other specimens of f. brevipila agree in all major characters with D.gilesii var.bagotensis, but the calyx - tomentum is much shorter in this form.

Relationship:

This taxon is closely related to form bagotensis in having long - peduncled flower - clusters (heads) and non - leafy bracts towards the apex of the inflorescnece, but may be readily distinguished by its shorter calyx - tomentum (not exceeding 1.3 mm in length).

D.gilesii F.v.Mueller var.laxa Munir, var.nov.

Varietas ab aliis ob inflorescentiam laxam subviridem flores

paulo confertos in fasciculas subglobosas dispositos pedunculos in dimidio superiore ramosos et calycem tomento usque ad 1.3 mm longo distinguitur.

T y p u s: M.Lazarides 5999: 25 miles south-west of Napperby Station, Northern Territory, 16.IX.1956 (AD holotype; BRI,CANB,MEL, NSW,NT,PERTH,US).

This variety differs from other taxa of this species by its inflorescence being lax, greenish - grey tomentose; flowers not much crowded to form a definite cluster (head); peduncles generally branched above the middle and calyx - tomentum short, up to 1.3 mm long.

Specimens examined:

NORTHERN TERRITORY:- W.H.Butler s.n.: from Mount Olga, -III. 1967 (PERTH).- G.Chippendale 1840: Quartzite Hill behind Central Mt.Wedge H.S., 11.XI.1955 (AD,CANB,MEL,NSW,NT).- M.Lazarides 5999: 25 miles S.W. of Napperby Station, 16.IX.1956 (AD holotype;BRI, CANB,MEL,NSW,NT,PERTH,US- isotypes).- N.Matthews s.n.,MEL40866: from Stuart, -VI.1930 (MEL).- A.O.Nicholls 892: Pulka Currinya, Mt.Wedge Station, 22.VI.1968 (AD,MEL,NT,PERTH).- R.E.Winkworth 432: Vaughan Springs, 4.VII.1954 (NT).

WESTERN AUSTRALIA:- A.S.George 8816: Rawlinson Range, 128° 08'E, 24° 58'S, 20.VII.1967 (PERTH).

Distribution: (Map10).

This variety is recorded from the southern part of Northern Territory and from far eastern part of Western Australia. The main distribution is in the Northern Territory to the north-west of Alice Springs where it is found near Central Mt.Wedge, Napperby Homestead, Stuart Bluff Range and Vaughan Springs. Towards the south-west, it overlaps the varieties gilesii and bagotensis near Mt.Olga. The only record of its occurrence in Western Australia is from Rawlinson Ranges, near the border of Northern Territory.

E c o l o g y:

In its ecological requirements var.laxa is much like other taxa of this species, being common along the gorges and stony creeks. According to information gathered from annotations it is an erect, grey, hoary shrub of up to 4 feet high. Chippendale 1840 (AD,CANB,MEL,NSW,NT), from Quartzite Hill behind Central Mt. Wedge H.S. is noted as "shrub 4', stems and leaves grey. Infl. creamy - grey. Infrequent, in small area." Lazarides 5999 (AD,BRI,

CANB,MEL,NSW,NT,PERTH), from south-west of Napperby Station is annotated as "erect, grey, hoary shrub, up to 3 ft. high and as wide. Flowers white". The habitat is recorded as "occasional on rocky slopes of hill with numerous herbs, shrubs and Acacia aneura". Nicholls 892 (AD,MEL,NT,PERTH), from Pulka Currinya near Mt.Wedge Station, is noted as "open bush to 4 ft. high with soft pubescent leaves, some stems with a reddish - green pubescence, otherwise pale, almost white pubescence on stem and petioles". The plant is found "growing in stony creek bed between rocky hills". Winkworth 432 (NT), from Vaughan Springs is reported as "erect soft shrub, up to 2 feet tall, rare on steep rocky hillside".

The main flowering and fruiting season lasts from July to October.

C o m m e n t s:

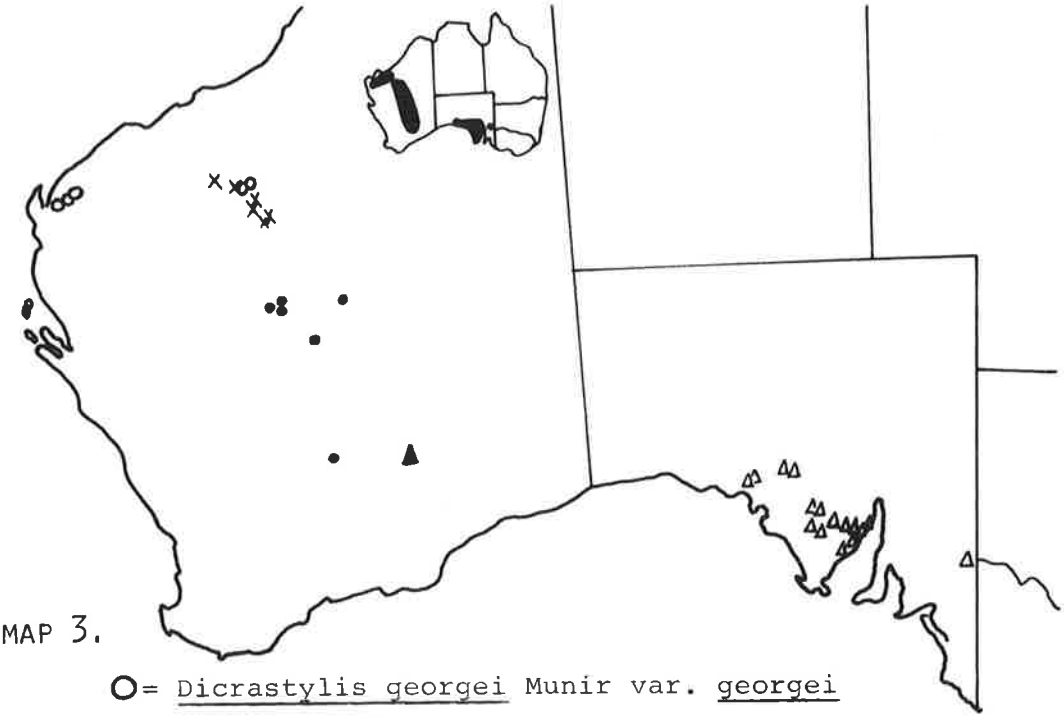
Among the three varieties of this species, var.laxa is the northern-most in its distribution, The greenish - grey lax inflorescence with generally branched peduncles and short calyx - tomentum easily distinguish it from other subspecific taxa of D.gilesii.

Relationship:

Like the type var.gilesii, var.laxa is also closely related to D.exsuccosa in having somewhat similar shaped leaves and inflorescence; corolla - lobes entire and stamens and style scarcely exserted, but may be easily distinguished by its inflorescence being lax and tomentose. It is also related to D.sessilifolia in having greenish - grey inflorescnnce of ± pyramid - shaped; flower - clusters loose on long peduncles and stamens and style scarcely exserted, but can be readily distinguished by its leaves being decussate, elliptic - lanceolate, petiolate, much larger, (4.5 - 8.5 by 1.5 - 3 cm); peduncles greenish - grey tomentum, decussate; calyx and corolla non-glandular outside, and corolla-lobes entire, not crenate at the top.

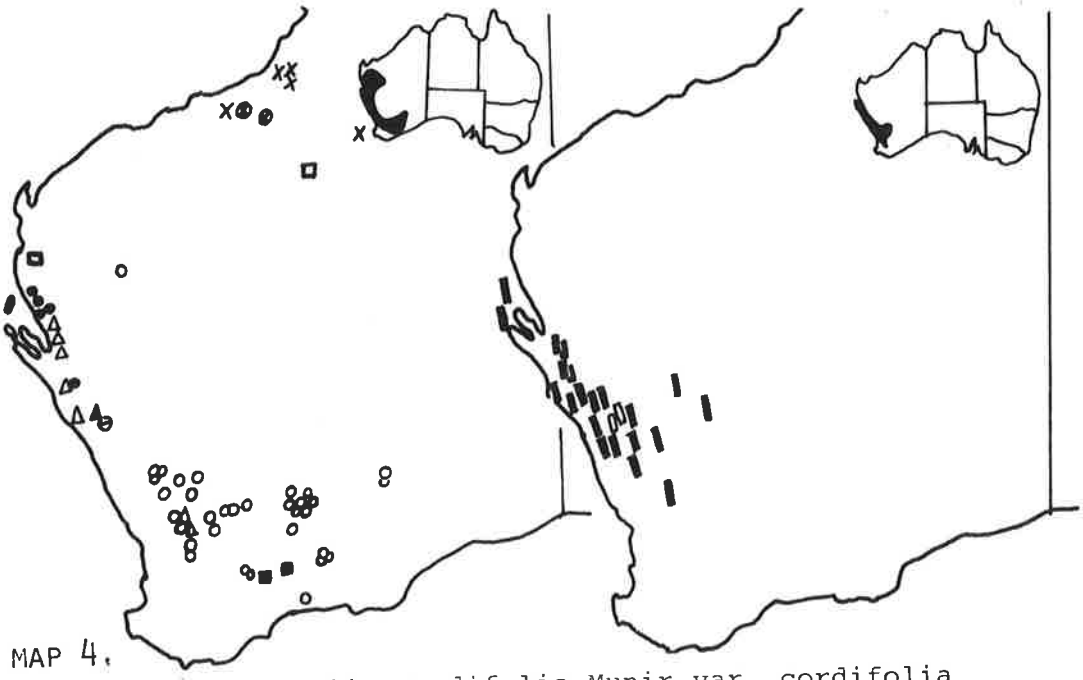
DISTRIBUTION MAPS OF DICRASTYLIS TAXA

(3 - 10)



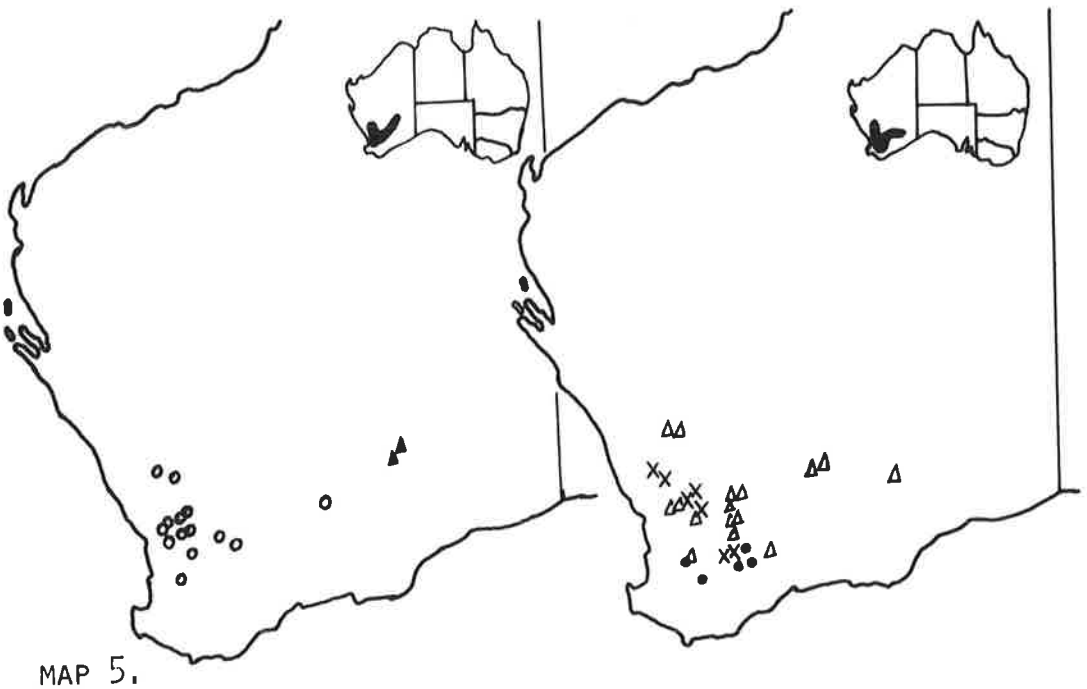
MAP 3.

○ = Dicrastylis georgei Munir var. georgei
× = D. georgei Munir var. cuneata Munir
▲ = D. microphylla Munir
● = D. flexuosa (Price) Gard.
Δ = D. verticillata Black



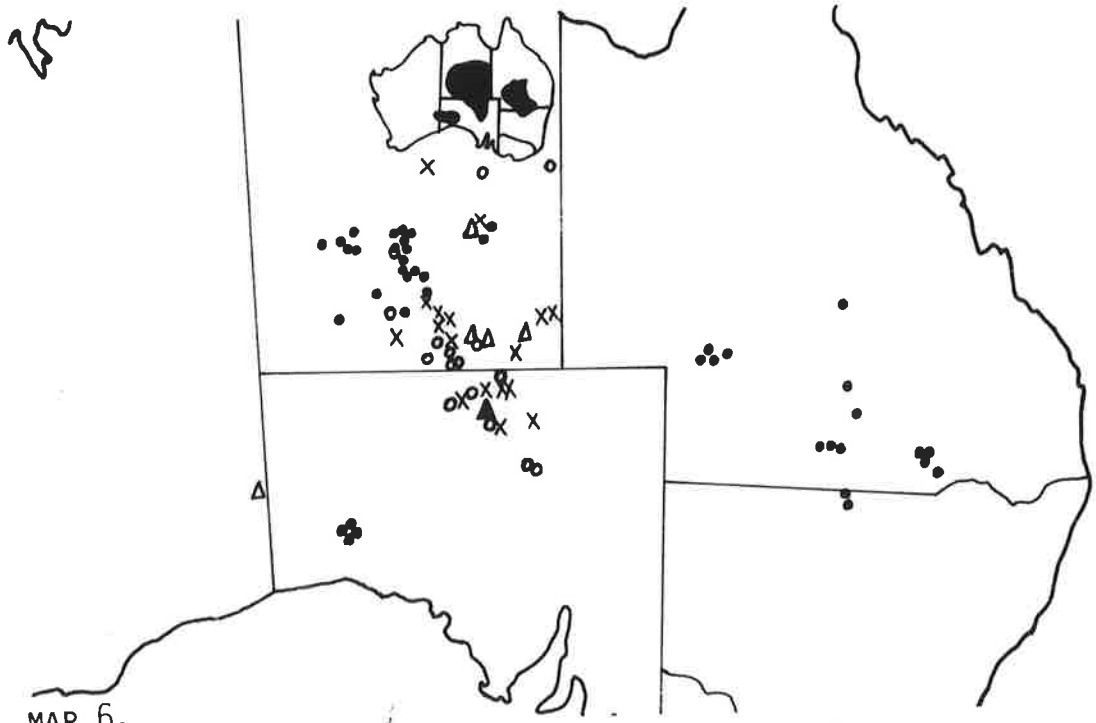
MAP 4.

× = Dicrastylis cordifolia Munir var. cordifolia
□ = D. cordifolia Munir var. barnettii Munir
⊗ = D. cordifolia Munir var. purpurea Munir
▮ = D. fulva Drumm. ex Harv. f. fulva
▯ = D. fulva Drumm. ex Harv. f. angustifolia Munir
■ = D. obovata Munir
Δ = D. micrantha Munir
○ = D. parvifolia F.v.M.
Θ = D. incana Munir
● = D. linearifolia Munir
▲ = D. morrisonii Munir



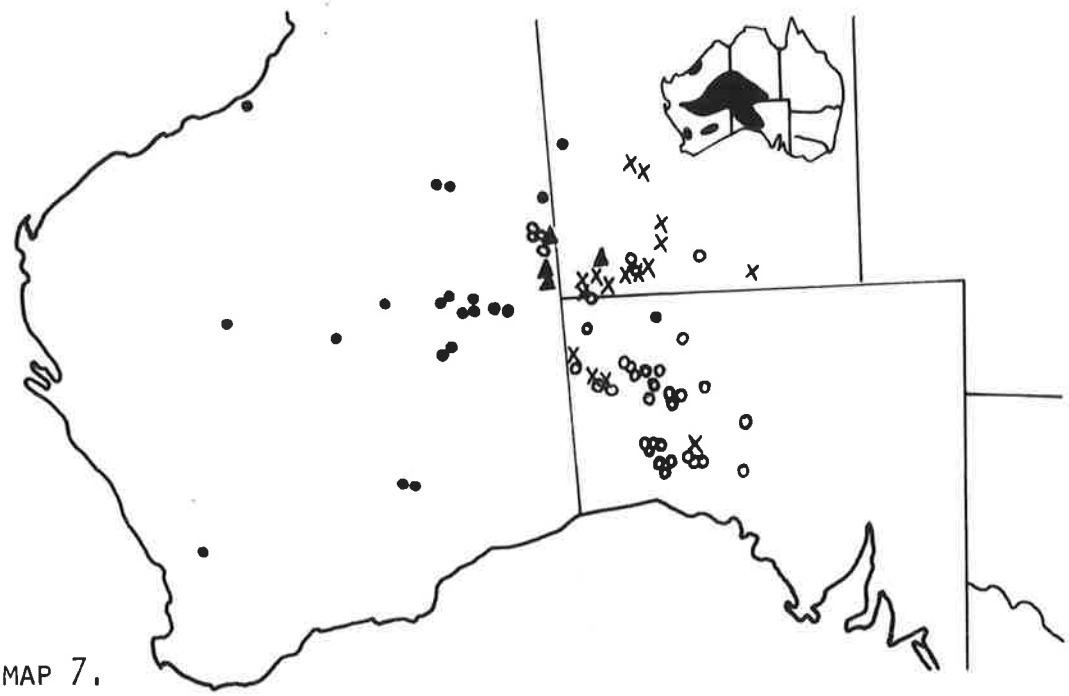
MAP 5.

▲ = Dicrastylis nicholasii F.v.M.
O = D. reticulata Drumm. ex Harv.
Δ = D. corymbosa (Endl.) Munir
● = D. glauca Munir
X = D. velunina Munir



MAP 6.

● = Dicrastylis lewellinii (F.v.M.) F.v.M.
O = D. costelloi Bailey var. costelloi
Δ = D. costelloi Bailey var. eriantha (F.v.M.) Munir
▲ = D. costelloi Bailey var. globulifera Munir
X = D. costelloi Bailey var. violacea Munir



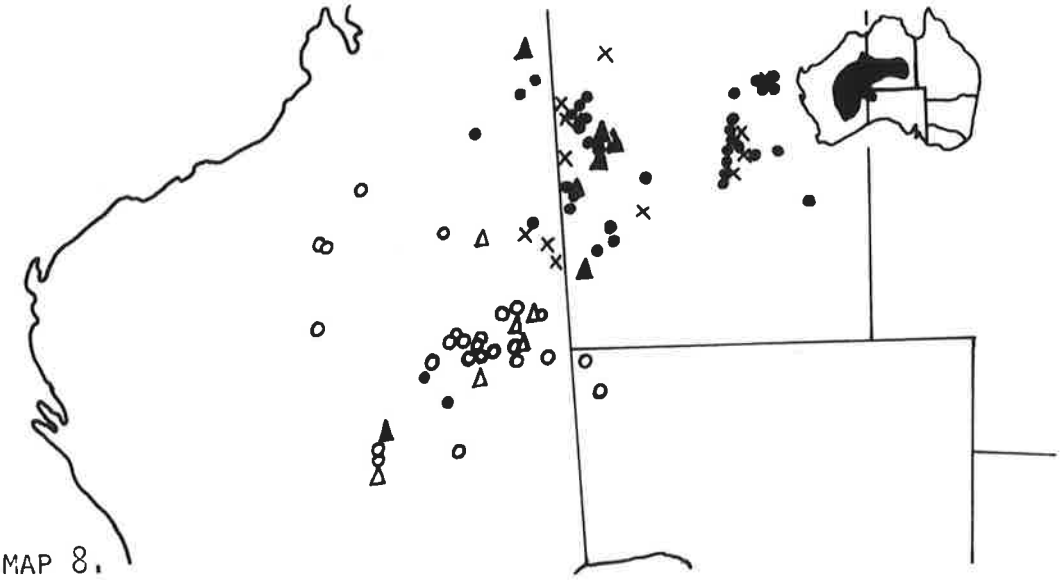
MAP 7.

X = Dicrastylis beveridgei F.v.M. ssp. beveridgei var. beveridgei

O = D. beveridgei F.v.M. ssp. beveridgei var. lanata Munir

▲ = D. beveridgei F.v.M. ssp. revoluta Munir

● = D. doranii F.v.M.



MAP 8.

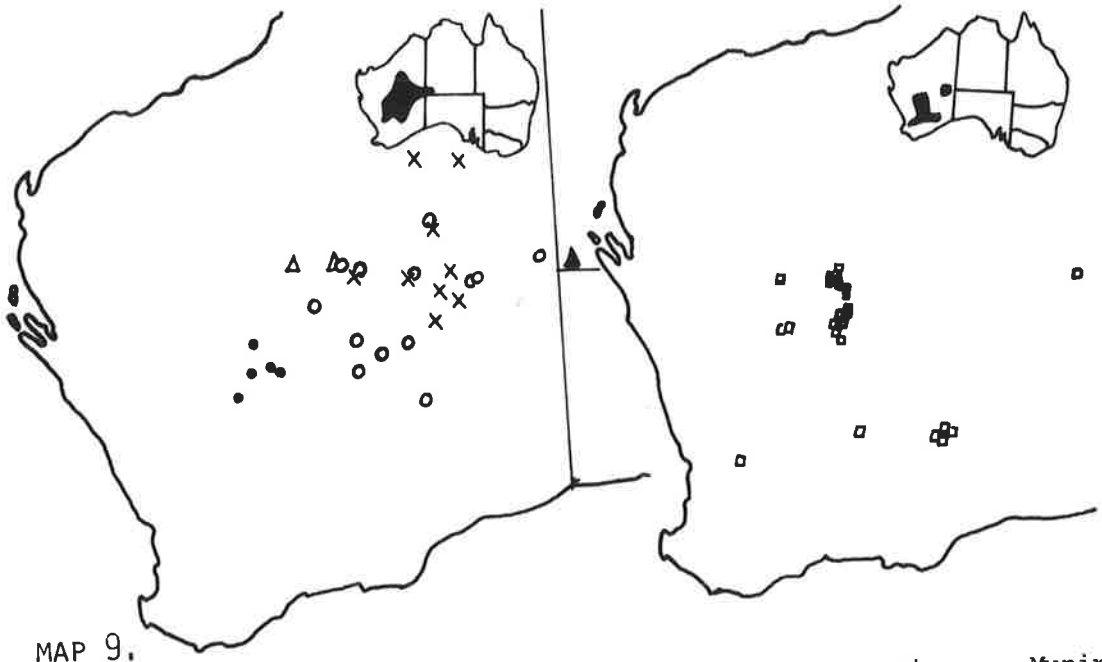
● = Dicrastylis exsuccosa (F.v.M.) Druce ssp. exsuccosa var. exsuccosa

X = D. exsuccosa (F.v.M.) Druce ssp. exsuccosa var. lanceolata Munir

Δ = D. exsuccosa (F.v.M.) Druce ssp. exsuccosa var. tomentosa Munir f. tomentosa

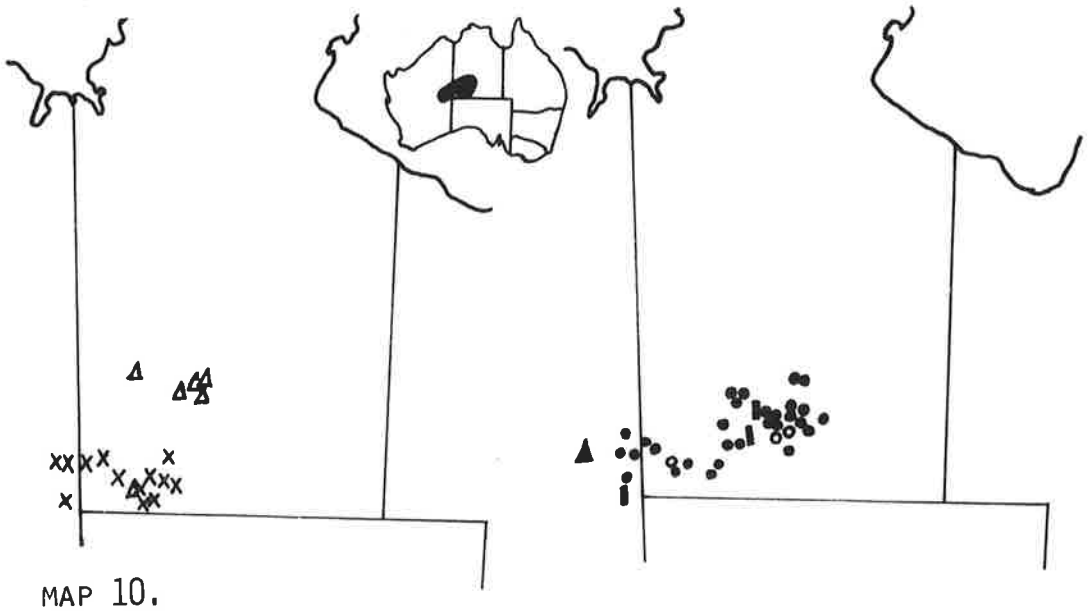
O = D. exsuccosa (F.v.M.) Druce ssp. exsuccosa var. tomentosa Munir f. lachnophylla Munir

▲ = D. exsuccosa (F.v.M.) Druce ssp. exsuccosa var. tomentosa Munir f. albo-lutea Munir



MAP 9.

X = Dicrastylis exsuccosa (F.v.M.) Druce ssp. cinerea Munir
O = D. exsuccosa (F.v.M.) Druce ssp. elliptica Munir
Δ = D. exsuccosa (F.v.M.) Druce ssp. wilsonii Munir
▲ = D. petermannensis Munir
● = D. sessilifolia Munir
▫ = D. brunnea Munir var. brunnea
▮ = D. brunnea Munir var. pedunculata Munir



MAP 10.

X = Dicrastylis gilesii F.v.M. var. gilesii f. gilesii
O = D. gilesii F.v.M. var. gilesii f. densa Munir
Δ = D. gilesii F.v.M. var. laxa Munir
● = D. gilesii F.v.M. var. bagotensis Munir f. bagotensis
▮ = D. gilesii F.v.M. var. bagotensis Munir f. brevipila Munir
▲ = D. gilesii F.v.M. var. bagotensis Munir f. irregularis Munir

M A L L O P H O R A S.L.Endlicher

MALLOPHORA Endlicher

Mallophora S.L.Endlicher, Ann. Wien. Mus.2 (1838)206; S.L.Endlicher & E.Fenz l, Nov. Stirp. Aust. no.8 (1839)68; S.L.Endlicher, Gen. Pl. Suppl.1 (1841) 1401,no.3694/1; C.F.Meisner, Gen. Pl.1 (1840) 291; ibid. 2(1840) 199; D.N.F. Dietrich, Synop. Pl.3 (1843) 371, 612; W.G.Walpers, Repert. Bot. Syst. 4 (1845) 72; J.C.Schauer in DC, Prod. 11 (1847) 529,530; F.v.Mueller in Hook.,J. Bot.Kew Misc. 9 (1857) 22,in obs; H.Bocquillon, Rev. Verbénac. (1863)102; F.v.Mueller, Fragm. 4(1864) 162, in obs;F.v.Mueller, Fragm.6(1868) 154, in obs; G.Bentham, Fl.Aust. 5(1870) 41; L.Pfeiffer,Nomencl. Bot.2 (1)(1874) 212; G.Bentham & J.D.Hooker, Gen. Pl.2(1876)1132, 1139; F.v.Mueller, Cens. Gen.Pl.Indig.Aust. (1882) 41;F.v.Mueller, Cens.Aust. Pl.1.(1882) 103; Th.Durand, Gen. Phan. (1888) 319; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; J.Briquet in Engl. & Prantl, Pflanzenfam. IV, 3a (1895)163;J.Briquet, Mém.Soc.Physiq. et Hist.Natur.Geneve, 32(2) (1896) 34; L.Diels & E.Pritzel, Bot. Jahrb.Syst. 35 (1904) 495,500; T.V.Post & O.Kuntze, Lexic. Gen. Phan. (1904) 348,688; C.G.D'Alla Torre & H.Harms, Gen.Siph. (1904) 432,no. 7171; E.H.Pelloe, Wildfls.W.Aust. (1921) 100; L.Diels, Pflanzenwelt W.Aust. (1906) 278, in obs; C.A.Gardner, Enum. Pl. Aust. Occ. 3(1931) 111; S.Junell, Sym.Bot.Upsal. 4(1934) 63; E.Cheel, Aust.-N.Z. Assoc.Advanc.Sc.23 (1937) 332; C.A.Gardner in Hook., Ic.Pl.V, 4 (1939)t.3383, in obs; A.Lemée, Dict.Descript. Syn.Gen.Pl.Phan. 8b (1943) 654; J.C.Willis, Dict.Fl.Pl. and Ferns, ed.6, (1957) 405; C.A.Gardner, Wildfls. W.Aust. (1959)127, in obs; J.Hutchinson, Fam.Fl.Pl.1,ed.2, (1959) 397; H.N.Moldenke, Résumé Verbenac. etc. (1959) 302,404; N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 187; J.S.Beard,W.Aust.Pl. (1965) 92; W.E.Blackall& B.J.Grieve, W.Aust.Wildfls. 3 (1965) 563; H.K.A. Shaw in J.C. Willis', Dict.Fl.Pl. and Ferns, ed.7, (1966) 689; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; A.R.Fairall, W.Aust,Nat. Pl.Cult. (1970) 186; H.N.Moldenke, Fifth Summary Verbenac. etc. 2 (1971) 534,751; C.A.Gardner, Wildfls.W.Aust.ed.11, (1973) 118, in obs.

Lectotypus: M.globiflora S.L.Endlicher,Ann.Wien.Mus.2 (1838) 206.

Lachnocephalus N.Turczaninow, Bull.Soc.Nat.Mosc. 22(2) (1849) 36; W.G.Walpers, Ann.Bot.Syst. 3 (1852) 237; H.Bocquillon, Rev. Verbénac. (1863) 138; F.v.Mueller, Fragm. 4 (1864) 162, in obs; F.v.Mueller, Fragm. 6 (1868) 154, pro syn; G.Bentham, Fl.Aust.5 (1870) 41,pro syn; N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 167, 187,pro syn; H.K.A.Shaw in J.C.Willis',Dict.Fl.Pl. and Ferns, ed. 7, (1966) 611,pro syn; H.N.Moldenke,Résumé Verbenac,etc,

(1959) 302, pro syn; H.N.Moldenke, Fifth Summary Verbenac.etc. 2 (1971) 534, pro syn.]

Typus: L.lepidotus Turcz.,Bull.Soc.Nat.Mosc. 22 (2) (1849) 36.

Typification:

The genus Mallophora was established by S.L.Endlicher on two syntype species, M.corymbosa and M.globiflora. M.corymbosa does not agree with the original description ("Calyx quadripartitus.... Corolla....limbi quadrifidi....Stmina 4...."). Therefore,M.globiflora has been chosen here as the lectotype. This choice results in the acceptance of the generic name Mallophora in its customary usage. The alternative choice would upset nomenclature as M.corymbosa is congeneric with Dicrastylis (having a very deeply 2-branched style and 5-merous flowers). The species now known as Dicrastylis would have to be transferred to Mallophora as this name has priority over Dicrastylis.

Excluded species: M.corymbosa Endl. [=Dicrastylis corymbosa (Endl) Munir].

Number of species: 2.

Excluded species: 1.

Description:

Woolly-tomentose shrubs. Stem erect, branched, cylindrical, solid, woody. Leaves cauline and ramal, decussate, exstipulate, sessile, simple. Inflorescence corymbosely arranged subglobose woolly heads or both woolly heads and elongated woolly spikes. Flowers tetramerous,bracteate, regular, hermaphrodite,hypogynous. Calyx gamosepalous, divided into 4-lobes, densely clothed with branched woolly tomentum outside, glabrous inside. Corolla gamopetalous, deeply 4-lobed at the top; lobes almost equal, spreading; tube short, cylindrical. Androecium: 4 stamens, epipetalous, scarcely exserted; filaments short, filiform,glabrous; anthers dorsified, 2-lobed, glabrous;lobes ± oblong, free and divergent in the lower halves, longitudinally dehiscent. Gynoecium: bicarpellary, syncarpous, tetralocular with axile placentation; ovules 4, one in each cell, attached above the middle of locule; style filiform, shortly 2-lobed at the top.Fruit dry, indehiscent, 4-celled, with usually one seed;seed albuminous.

Distribution:(Maps 1 and 2).

The genus Mallophora is endemic in Western Australia. The only two known species are restricted to the south-western part between

Distribution cont:-
28 and 34 degrees south latitude and between 115 and 122 degrees east longitude. They overlap each other chiefly in the Avon and Darling Districts of the South Western Province. Of the two species, M.globiflora extends as far south as Esperance and M.rugosifolia is known from as far north as Geraldton-Mullewa Road. However, neither is the latter known to occur south near Esperance nor the former north near Geraldton or Mullewa. In the west, both species are bounded by the west coast and they are not known to occur beyond Kalgoorlie, to the east.

Comments:

In the generic description of Mallophora Endl., Bentham & Hooker (1876) have erroneously recorded "Calyx alte 5 fidus" and "ovarium 2-loculare". This error was partly retained by Briquet (1895) who has also described "Kelch tief 5-Spältig". Actually, the calyx-lobes in Mallophora are never more than 4, and the ovary is always 4-locular.

Relationship:

Mallophora is very closely allied to Physopsis Turcz. in having 4-merous flowers [and a tendency in M.rugosifolia Munir towards spike-like elongation of the flower clusters]. However, it may be easily distinguished by its flowers being mostly congested into subglobose woolly heads; heads often corymbosely arranged at the end of the branches; calyx-lobes free for more than halfway to the base; corolla-tube hairy all over [inside and out]; stamens and style sub-exserted; filaments dinstinct and free from corolla below the anthers; style rather shortly 2-lobed towards the apex. Mallophora is also related to Dicrastylis Drumm. ex Harv., Lachnostachys Hook. and Newcastelia FvM. in having actinomorphic flowers [except D.verticillata Black and a few other species], but all these genera differ from Mallophora in their flowers being 5 to 8-merous. Moreover, the style in Dicrastylis is much more deeply 2-lobed and in Lachnostachys and Newcastelia it is practically undivided.

Note:-
The Botanical Provinces and Districts of Gardner and Bennetts (1956) are used to record the distribution of Western Australian taxa.

KEY TO THE SPECIES OF MALLOPHORA Endl.

1 a. Leaves flat or very lightly recurved along the margins, densely pubescent to tomentose and not rugose above; flowers 5 - 7 mm long, in corymbosely arranged subglobose woolly heads; stamens and style exserted; filaments 1 - 1.5 mm long; style distinctly 2-lobed near the apex, lobes 0.5 - 0.8 (-1.2)mm long.....M.globiflora.

b. Leaves closely revolute along the margins, glabrous and distinctly rugose above; flowers 3.5 - 4.5 mm long, in corymbosely arranged elongated woolly spikes, sometimes with additional subglobose woolly heads; stamens and style scarcely exserted; filaments 0.3 - 0.5 mm long; style minutely 2-lobed near the apex, lobes 0.1 - 0.3 (-0.5)mm long.....M.rugosifolia.

Mallophora globiflora S.L.Endlicher, Ann.Wien.Mus.2 (1838) 206; S.L.Endlicher & E.Fenzl, Nov.Stirp. no.8 (1839) 64; D.N.F. Dietrich, Synop.Pl.3 (1843) 612; W.G.Walpers, Repert,Bot.Syst. 4 (1845) 72; J.C.Schauer in DC., Prod. 11 (1847) 530; F.v.Mueller, Fragm.6 (1868) 154; G.Bentham, Fl.Aust. 5 (1870)41 exclud. Drummond's no. 72; F.v.Mueller, Cens.Aust.Pl.1(1882)103; F.v.Mueller, Sec.Cens.Aust.Pl. 1 (1889) 172; J.Briquet in Engl. & Prantl, Pflanzenfam.IV,3a (1895) 163; L.Diels & E.Pritzel,Bot. Jahrb.Syst. 35 (1904) 501 p.p., fig.55D-E,exclud.spec.young s.n.: Mt.Churchman -MEL; L.Diels, Pflanzenwelt W.Aust. (1906) 279, fig. 65 D-E; E.H.Pelloe, Wildfls.W.Aust. (1921) 77,100; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; S.Junell, Sym.Bot. Upsal. 4 (1934) 63; G.Erdtman, Pollen Morph. and Pl.Taxon. (1952) 448; C.A.Gardner, Wildfls.W.Aust. (1959) 132,in obs.; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,302,319; J.S.Beard, W.Aust.Pl.,ed. 1, (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls. 3 (1965) 563; J.S.Beard, W.Aust.Pl.,ed. 2, (1970) 113; A.R.Fairall, W.Aust.Nat.Pl.Cult. (1970) 186; H.N.Moldenke, Fifth Summary Verbenac. etc. 1&2 (1971) 347,534,570; C.A.Gardner, Wildfls.W.Aust.,ed.11, (1973) 120.

Holotypus:J.S. Róé s.n.: "Novae Hollandiae austro-occidentalis interioribus",-(W).

Lachnocephalus lepidotus N.Turczaninow, Bull.Soc.Nat.Mosc. 22 (2) (1849) 36; W.G.Walpers, Ann.Bot.Syst. 3 (1852) 237; H.Bocquillon Rev.Verbénac. (1863) 139, t.3, fig. 1 - 7; [F.v.Mueller,Fragm. 6 (1868) 154, pro syn.]; J.Briquet in Engl. & Prantl,Pflanzenfam. IV, 3a (1897) 163, fig. 61 - A & B; [H.N.Moldenke, Résumé Verbenac, etc. (1959) 302, pro syn.; H.N.Moldenke, Fifth Summary Verbenac. etc. (1971) 534, pro syn.].

Typus: J.Drummond, 4th Coll. no.235: Swan River,W.A.,- 1848. (BM,BRI,CGE,G,K,KW,L,LE,MEL,P,W,syntypes); Gilb 6: loc. incert. -(?KW,syntype).

Description: (Fig. 32).

A woody shrub of 30 - 45 cm tall. Stem erect, branched, (often many branches ascending from a woody base), cylindrical, rather slender, densely covered with a greyish - rusty powdery mass and short branched spreading tomentum. Leaves decussate, sessile,often crowded towards the apex, oblong or linear - oblong, obtuse,entire, somewhat cuneate towards base, thick, flat or slightly recurved allng the margins, 4 - 11(-15)mm long, 1 - 3(-4)mm broad, greyish-pubescent - tomentose all over, glabrescent and rugulose above when old. Inflorescence cymose; cymes solitary, terminal or often

corymbosely arranged into subglobose flower heads; heads densely woolly - tomentose, white, often suffused with purple when young, 1.5 - 3 cm across. Flowers 4-merous, bracteate, subsessile, 5 - 6 (-7)mm long, normally three flowers in a cyme forming a dense subglobose woolly head; pedicels tomentose, short, ± 0.5mm long; bracts sessile, oblong to oblong - lanceolate, densely woolly - tomentose on outside, glabrous inside, often suffused with purple, 4 - 6mm long, 1.3 - 1.8mm broad; bracteoles lanceolate, densely woolly - tomentose on outside, glabrous inside, 1.5 - 2mm long, 0.3 - 0.5 mm broad. Calyx deeply 4-lobed, very densely clothed with branched woolly tomentum on outside, glabrous inside; lobes narrow oblong, obtuse, almost free to the base, 2.5 - 3(-3.2)mm long, 0.5 - 0.7mm broad; tube shallow, ± 0.5mm deep; tomentum much branched, ± stalked, upto 1.5mm long. Corolla white, tubular, 4-lobed at the apex, (4.5-)5 - 6(-6.5)mm long; tube ± cylindrical, often longer than the calyx, 4 - 4.5mm long, sparsely glandular and densely covered with short branched tomentum outside,sparsely villous inside; lobes almost orbicular or somewhat elliptic - oblong, obtuse, 1.3 - 1.5(-2)mm long, 1 - 1.3mm braod, sparsely glandular and densely covered with short branched tomentum on outside, glabrous within, one lobe often somewhat larger than the others. Androecium: stamens 4, sub-exserted, inserted in the corolla-tube; filaments filiform,glabrous, 1 - 1.5mm long; anthers dorsifixed, 2-lobed, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent, ± 0.6mm long.Gynoecium: ovary globose, densely glandular and tomentose all over, 1 - 1.2mm in diameter, 4-locular, with one ovule in each cell; style long, exserted, shortly 2-lobed at the apex, filiform, densely tomentose in the lower half, glabrous above, (2.5-)3.5 - 4.5mm long; lobes unequal, somewhat porrect, stigmatic at the apex,0.5 - 1mm long, [much shorter than in Dicrastylis]. Fruit dry, indehiscent, ± globose, pubescent all over and sparsely glandular, ± 2mm in diameter, 4-celled, often with a single seed.

Specimens examined:

Western Australia.- A.M.Ashby 378:Wongan Hills on road to Ballidu, 11.IX.1963(AD).- A.M.Ashby 1352:Wongan Hills, 18.XI.1964 (AD).- A.M.Ashby 4243:near Kulja, 27.VIII.1971(AD).- J.W.Audas s.n. F 719625,UC299727 &UC882522: from Tammin, 2.IX.1926 (F,GH,UC-2 spec).- E.T.Bailey 968: Muntadgin,- X.1947 (PERTH).- W.E.Blackall s.n. near Yelbeni, -X.1937 (PERTH).- C.A.Gardner & W.E.Blackall 817: between Wongan Hills & Koorda, 28.IX.1931 (PERTH).- I.Common 0344: Wongan Hills, 125 miles N.E. of PERTH, 20.IX.1951 (CANB).-

J.B.Cleland s.n.,AD 966100620: Tammin on Great Eastern Highway, ca. 160km north-east of PERTH, 31.VIII.1926 (AD).- J.Drummond 11: Swan River,-(E).- J.Drummond 73:"Nova Hollandia", -?1847(G).- J.Drummond 4th Coll. no.235: Swan River, -1848 (BM,BRI,CGE,G,K,KW n.v.,L, LE,MEL - 3spec.,P,W - Syntypes of Lachnocephalus lepidotus Turcz.).- J.Drummond [probably 3rd coll.] no.555: loc.cit.,?-"1843"(K-2 spec., MEL 2-spec.,P-2 spec.,W-2 spec.) .- J.Drummond 1st coll. s.n.: loc. cit., -1839(BM).- J.Drummond s.n.: loc.cit.,-(K).-J.Drummond s.n.: loc.incert.,-(CANB 209500,FL,M,MEL40973,MEL40975,MEL41233,US147533).- A.Eaton s.n.,MEL40967: near York,-1888(MEL).- A.Eaton s.n.MEL40944: sources of the Swan River,-1889(MEL).- C.A.Gardner 684:near Wyalkatchem, 22.VIII.1920 (PERTH -2spec.).- C.A.Gardner 2736: east of Cadoux Siding, 24.IX.1936 (PERTH).- Gilb 6: loc.incert.,-(KW n.v.,syntype of L.lepidotus Turcz.).- J.W.Green 576: 5 miles south of Calingiri, 3.XI.1956 (PERTH).- J.H.Gregory s.n.: Northam, -1900(E).- J.H.Gregory s.n.: loc.cit., -1901 (E,PERTH).-B.J.Grieve UWA986: Tammin.-1959(UWA).- B.J.Grieve UWA988: Tammin-Kellerberrin, 25.X.1959(UWA).- W.R.Guilfoyle s.n.,MEL40965:loc.incert.,-(MEL).- E.H.Ising s.n.,AD97417062: Dowerin,1.IX.1926 (AD).- M.Koch 1250: Cowcowing [Lakes],-X.[IX].1904 (E,K,MEL,PERTH).-A.E.Lankester s.n.: Kellerberrin, 4.IX.1897 (PERTH).- R.B.Leak s.n.: Kellerberrin, -IX.1897 (BM,K,PERTH).- F.Lullfitz 3063: 127 mile post on Wyalkatchem Road, 5.XII.1963 (PERTH;K & P n.v.).- J.H.Maiden s.n.: Esperance,-XI.1909 (C). J.H.Maiden s.n.: Goongarrie,-IX.1909(G).- J.H.Maiden s.n., NSW106660: Tammin. -IX.1909(NSW).- J.H.Maiden s.n. NSW106657:Perth,-X.1909(NSW).- J.H.Maiden s.n.,Albany,-X.1909(L).- J.H.Maiden s.n.:Dist. Murray,-IX.1909(G).- C.Mangles s.n.:Swan River,-(CGE).- J.Mauritzon s.n.: loc.incert.,-IX.1936(S).- A.Morrison s.n.: Perth flower show,-1898(BRI).- F.v.Mueller s.n.: loc.incert.,-(C,GH,L,US248079).- K.Newbey 1556: 2 miles east of Wyalkatchem, 20.X.1964 (PERTH).- K.Newbey 1955: 2 miles south of Tammin, 22.VIII.1965 (PERTH).- M.E.Phillips CBG020808: Wongan Hills Research Station, 3.X.1962(CBG).- M.E.Phillips CBG035617.: 2 miles north of Wongan Hills,Research Station area, 13.IX.1968(AD).- E.Pritzel 756: District Avon, in apertis arenosis,-X,1901 (BR,E - 2 spec.,F,G-2 spec.,GH,HBG,K-2 spec.,M,MO,NSW106659,P,PR,S,US,W).- G.Sewell s.n.,MEL40972: Mt. Caroline,-1889(MEL).- Shell Oil Co.s.n. Esperance Bay,-(US1756514).- J.Staer s.n.: Kellerberrin,-XI.1905(E).- C.S.Sutton 2134: loc.incert.,-(K).- C.Walter s.n.: loc.incert.,- (NSW106658).- E.H.Wilson 19: Cunderdin, 21.X.1920(UC347583, US1430275).- P.G.Wilson 6380: ca.1 km east of Meckering & about 140 km east of Perth in Mortlock River bed, 23.XI.1967(PERTH).-? Leg. s.n.,F954693: S.W.Australia,-X.1935(F).?Leg.s.n.,NSW106656:

loc.incert.,-(NSW).?Leg.s.n.,UWA981: Trayming,-X.1918(UWA).

Distribution: (Map 11).

M.globiflora Endl. is endemic to the south-western part of Western Australia. According to known localties of its occurrence, the main distribution is between 30 and 34 degrees south latitude and between 116 and 121 degrees east longitude. Most of the localties are to the east and north-east of Perth. The easterly distribution is mainly between Northam and Kellerberrin along Great Eastern Highway, with other known localties near York and Muntadgin The north-easterly distribution lies about the Swan River as far as its northern portion near Calingeri, also in the vicinity of the Wongan Hills and Wyalkatchem, and along the road to Koorda near Cowcowing Lake. The far south-eastern Collections come from near Esperance and the eastern-most,from Goongarrie,north of Kalgoorlie.

Ecology:

According to the known pattern of its distribution, M.globiflora seems to grow mainly in winter-rainfall-summer-drought areas in Western Australia. The information gathered from collectors' field notes show that it grows chiefly in sandy and gravelly soils, quite often near or in the dried river beds. The plant is a small erect woody shrub,branching chiefly at the base. According to Gardner 684(PERTH),from near Wyalkatchem, it grows in "gravelly soil". The plant is said to be "a small and dense shrub with numerous spreading branches about 12 inches in height. Leaves opposite, glaucous and rusty. Flowers white in woolly globular heads, suffused with purple." Gardner's subsequent collection of this species, no.2736(PERTH), east of Cadoux Siding, is annotated as "Shrub 9-11",fls.white." The habitat is given "gravelly sand heath". Green 576(PERTH),from 5 miles S. of Calingiri is noted as "shrub about 40 cm high; fls. white,woolly. Sand. Low heath with Melaleuca cordata". Lullfitz 3063(PERTH),127 m.p. on Wyalkatchem Road is annotated as "Thick 15"x15" bush". Newbey 1556(PERTH), 2 miles east of Wyalkatchem is recorded as "15 inches high in sandy loam". Pritzel 756 (BR,E,F,G,GH,HBG,K,M,MO,P,S,US & W), from Avon district, was growing "in apertis arenosis".Wilson 6380(PERTH), 140 km E. of Perth in Mortlock River bed, is annotated as "Plant 0.3m high, compact and rounded, Inflorescence and petals white. Sandy rise above saline area."

Flowering and fruiting seem to occur chiefly from September through November.

Comments:

M.globiflora Endl. is the syntype species of this genus, based (in 1838) on one of Róé's collection from the "interior" of Western Australia. Subsequent to its establishment, two further conspecific collections, one each by Drummond (4th coll. no.235) and Gilb. (no.6), were described by Turczaninow (1849) as his new genus Lachnocephalus; the species being named L.lepidotus Turcz. F.v.Mueller (1868) found Lachnocephalus Turcz. as congeneric with Mallophora and thus recorded L.lepidotus Turcz. as a synonym under Mallophora globiflora Endl.

One of the corolla-lobes in M.globiflora is often slightly larger than the remaining three, but such a tendency has not been noticed in any other flower part. Bentham (1870) describes the corolla-tube as "scarcely as long as the calyx", but in all the specimens examined here the corolla- tube is always longer than the calyx.

Drummond's collection no.555 is not referred to any of his six collecting expeditions in Western Australia. It appears from the year of collection, noted with some of its duplicates, that it most likely belongs to Drummond's 1st collection, gatheres before or during 1842. According to Erickson (1969), part of the 1st collection came from Swan River and Wongan Hills where this species is now known to occur commonly. The year of collection with one of its duplicate in Herb.P is printed "1843", while the same information on the duplicate sheet in Herb.W is "C.1844". Actually, neither of the two can be accepted as the year of collection, because the last part of 1st collection was sent to Hooker in January, 1843 (Erickson, 1969). Therfore, the collection must have been made and prepared for despatch sometime during 1842 or earlier. The years recorded on the herbarium sheets are probably referred to their year of communication to that particular herbarium where thay are now preserved.

The date and place of collection noted with three duplicates of Max Koch's collection (no.1250) in Herbs. E,K and PERTH is "Cowcowing, X.1904", while the same information noted with its duplicate in Herb. MEL is "Cowcowing Lake, IX.1904". The former record seems correct because a field note on the duplicate in Herb. PERTH agrees with that information. However, due to proximity in both localities and collecting dates(months), it seems possible that this species may occur in both the places during September-October.

The leaves in the following specimens are somewhat intermediate between this species and M.rugosifolia, because they are

slightly more recurved along the margins and appear ± rugulose on the dorsal surface.

Collector	No.	Locality
A.M.Ashby	0378 (AD)	Wongan Hills
A.M.Ashby	1352 (AD)	Wongan Hills
A.M.Ashby	4243 (AD)	Near Kulja
I.Common	0344 (CANB)	Wongan Hills
J.W.Green	0576 (PERTH)	S.of Calingeri
M.E.Phillips	20808 (CBG)	Wongan Hills

In all other characters, these specimens are identical with the type material. Therefore, they have been included under this species (M.globiflora Endl.) withiut any distinction.

Relationship:

M.globiflora is closely related to M.rugosifolia. For the distinctive characters see key to the species, above.

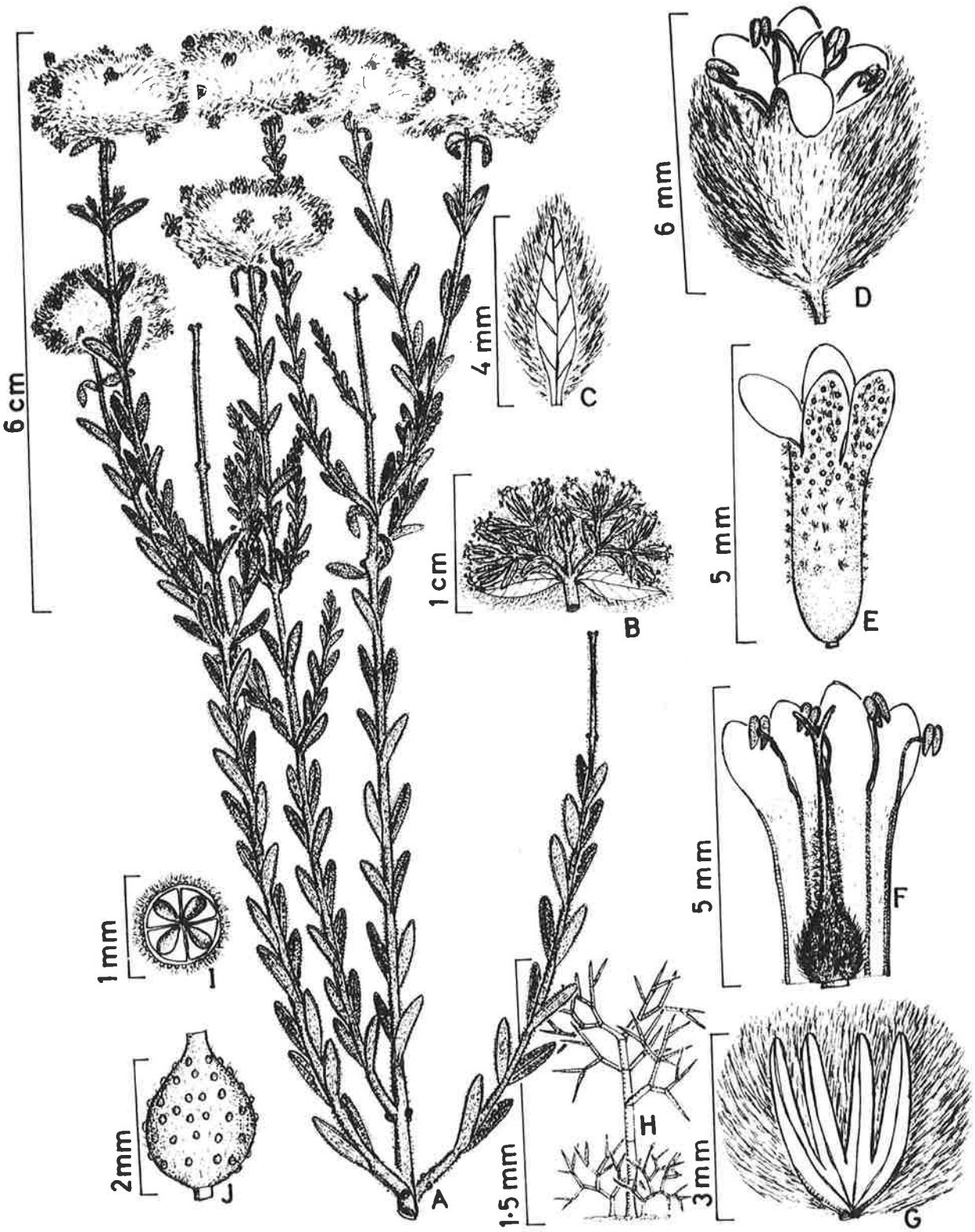


Fig. 32 — Mallophora globiflora Endl. (J.S. Roë s.n.: W - holotype). A, flowering branch; B, cyme; C, bract viewed from inside; D, flower; E, corolla-tube; F, corolla-tube vertically cut open showing stamens and pistil; G, calyx vertically cut open; H, calyx tomentum; I, T.S. ovary; J, fruit.

Mallophora rugosifolia Munir, sp. nov.
M.globiflora auct. non Endl.: FvM., Fragm. 10(1876)15 (quoad spec. Young s.n.: Mt.Churchman -MEL); L.Diels & E.Pritzel, Bot. Jahrb.Syst. 35 (1904) 501 proparte (quoad spec. Young s.n.: loc. cit.).

Species a M.globifloram accedit sed ob folia margine arcte revoluta supra glabra manifeste rugosa flores parvos 3.5 - 4.5mm longos in spicas lanatas subglobosas saepe elongatas corymbose dispositas confertos calycem ca. 2mm longum lobis ca. 1.5mm longis 0.5 - 1 mm latis corollam 2.5 - 3.5 mm longam stamina cum stylo vix exserta filamenta 0.3 - 0.5 mm longa antheras ca. 0.4 mm longas et stylum 0.8 - 1.5(2)mm longum breve bilobatum lobis 0.1 - 0.3(0.5)mm longis distinguitur.

Typus:A.M.Ashby 2034: Wongan Hills, Western Australia, 6.XI.1966 (AD holotype; isotypes still to be distributed).

Differs from M.globiflora Endl. in its leaves being closely revolute along the margins, glabrous and distinctly rugose above; flowers smaller, 3.5 - 4.5 mm long, crowded into corymbosely arranged elongated woolly spikes or partly forming subglobose woolly heads;calyx ± 2mm long, lobes ± 1.5mm long, 0.5 - 1 mm broad; corolla 2.5 - 3.5 mm long; stamens and style scarcely exserted; filaments 0.3 - 0.5 mm long, anthers ± 0.4 mm long; style 0.8 - 1.5(-2)mm long, more minutely2-lobed near the apex, lobes 0.1 - 0.3(-0.5)mm long.

Description: (Fig. 33)

A short dense shrub of upto 45 cm tall. Stem erect, much branched. cylindrical, woody, rather slender, densely clothed with a thick greyish powdery mass mixed with very dense,short and branched tomentum. Leaves decussate, sessile, oblong to narrow linear - oblong, obtuse, very closely revolute along the margins, glabrous and distinctly rugose above, somewhat crowded, (3-)4 - 8 (-11)mm long, 1 - 2(-2.5)mm broad. Inflorescence corymbosely arranged elongated woolly spikes, or sometimes partly in sub-globose woolly heads. Flowers 4-merous, bracteate, subsessile, three or sometimes one in the axil of each bract, 3.5 - 4.5 mm long; bracts sessile, sub-opposite or alternate, oblong - ovate to ovate - lanceolate, densely woolly - tomentose outside,glabrous inside 3 - 5 mm long, 1.5 - 2(-2.5)mm broad, tomentum much branched, lightly suffused with purple when young. Calyx deeply

4-lobed, very densely clothed with branched, woolly tomentum outside, glabrous within, ± 2mm long; lobes oblong, obtuse, almost free to the base, ± 1.5mm long, 0.5 - 1 mm broad; tube shallow, ± 0.5mm deep; tomentum greyish-white, much branched towards the apex, 0.5 - 1.5 mm long. Corolla white, tubular, 4-lobed at the apex, 2.5 - 3.5 mm long; tube cylindrical, 1.5 - 2.5mm long, sparsely glandular and densely tomentose outside, sparsely hairy within; outer tomentum short and much branched; lobes elliptic - oblong or almost orbicular, obtuse, 1 - 1.3mm long, ± 1mm broad, sparsely glandular and densely tomentose on outside, glabrous within, one lobe sometimes slightly larger than the others. Androecium : stamens 4, scarcely exserted, inserted in the corolla-tube; filaments short, filiform, glabrous, 0.3 - 0.5 mm long, anthers 2-lobed, dorsifixed, ± 0.4mm long, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Gynoecium : ovary globose, densely glandular all over and tomentose, ± 1 mm in diameter, 4-locular with one ovule in each cell; style scarcely exserted, filiform, 0.8 - 1.5(-2)mm long, densely tomentose in the lower half, glabrous above, minutely 2-lobed at the apex; lobes stigmatic at the end, 0.1 - 0.3(-0.5)mm long. Fruit dry, indehiscent, ± globose, pubescent all over and sparsely glandular, 1.5 - 2 mm across, 4-celled, usually with only one seed.

Specimens examined:

WESTERN AUSTRALIA .- T.E.H.Albin 514: Nalkain, 30.VI.1959 (PERTH).- A.M.Ashby 790 : near Kellerberrin, 21.XI.1963 (AD).- A.M.Ashby 1325: near Norpa, ca. 20km south-south-east of Merredin, 22.XI.1964 (AD).- A.M.Ashby 4232: near but south of Maya, ca. 215 km south-east of Geraldton, 29.VIII.1971 (AD).- A.M.Baird s.n.: near Kalgoorlie,-1932(UPS).- J.S.Beard 2502: Pithara, 19.XII.1962 (PERTH).- W.E.Blackall 2855: between Perenjori & Dalwallinu, 25.IX.1932(PERTH).- W.E.Blackall 3204: between Lake Grace and Hyden, 1.X.1933 (PERTH).- W.E.Blackall 3516: Rabbit Proof Fence near Kalannie, 17.X.1937(PERTH).- W.E.Blackall 3516: between Kulja and Koorda, 13.X.1937(PERTH).- W.E.Blackall 3774: between Wubin and Jibberding, 4.IX.1938(PERTH).- W.H.Butler s.n.: Wubin, 2.X.1959(PERTH).- W.M.Carne s.n.: Marchagee, -XI.1927(PERTH).- S.Dela Hunty s.n.: Wubin, 5.IX.1959(PERTH).- C.A.Gardner 1125: Tammin, 29.XI.1920(PERTH).- C.A.Gardner 12103: Rabbit Proof Fence, S.E. from Perenjori, 23.XI.1953 (PERTH).- J.W.Green 776: 12 miles W. of Ballidu, 3.XI.1956(UWA).- B.J.Grieve UWA985: Midland line to Geraldton,-X.1950(UWA).- M.Koch 1243: Cowcowing, -IX.1904(HBG, MEL,NSW,PERTH,W).- M.Koch 1302: Lake Monger,-X.1905(E,K,MEL,NSW,

PERTH).-K.F.Kenneally UWA980: 11.8 miles west of Ballidu, 27.IX.1969(UWA).- R.H.Kuchel 2090: south-west of Collgar, ca.10km S.E. of Merredin, 22.IX.1964(AD).- F.Lullfitz 1648: n orth of Wongan Hills, 30.X,1962 (PERTH).- F.Lullfitz 2027:186 mile peg Morawa road, 21.XII.1962(PERTH).- P.Luff & P.Birrel 47: 53 miles from Geraldton on Geraldton - Mullewa Road, 6.X.1965(AD).- A.Morrison 13180: south-west from Wongan Hills, 13.X.1903(BM,K).- K.Newbey 2057: 10 miles N.E. of Wubin,24.VIII.1965(PERTH).- Mrs.E.H.Pelloe B.1466: Tammin,-XI.1919(PERTH).- M.E.Phillips CBG016491: 2 miles S.of Wubin on Highway, 2.X.1962(CBG).- S.B.Rosier 42: north of Cleary, -VII.1959(PERTH).- F.W.& C.W.Went A-193: between Wubin and Wongan Hills, 10.IX.1962(GH,MO,PERTH).- Young s.n.,MEL40976: near Mt.Churchman, -(MEL).?Leg. UWA979: loc. incert.spec.from Wildfls. Shows,-IX.1956(UWA).?Leg. UWA982: Bruce Rock,- (UWA).

Distribution: (Map 11).

M.rugosifolia is endemic in the south-western part of Western Australia. Its main distribution is ± similar to M.globiflora,but it exceeds the known distribution limits of the latter species towards the north. Its southern-most locality is known between Hyden and Lake Grace and the northern-most between Geraldton and Mullewa. The majority of the localities are in the east and north-east of Perth between 29 and 33 degrees south latitude and between 116 and 119 degrees east longitude. Within this region, there are many records between Wongan Hills in the south and Perenjori and Lake Monger in the north. It is also recorded from between Lake Cowcowing and Lake Moore. Other known localities are near Tammin and south of Merredin near Collgar and Norpa.

Ecology:

In its ecological requirements, M.rugosifolia is much like M.globiflora,being common in sandy and gravelly soil. Moreover, it agrees with the latter in being restricted chiefly to the winter-rainfall-summer-drought areas in Western Australia. According to Beard 2502(PERTH), from Pithara, it is "very low 6 - 9 inches shrub, flowers woolly, white". The plant was found growing "in gravel heath". Blackall 2855 (PERTH), collected between Perenjori and Dalwallinu, is annotated as " small dense shrub 1/2'[tall], flower -heads white". Lullfitz 1648 (PERTH),from north of Wongan Hills, is recorded as "white woolly flowered shrub, 9"x18",heavily flowered". The habitat is given "sandplain". Newbey 2057 (PERTH), 10 miles N.E. of Wubin, is noted as "12 inches high in loam".

Phillips CBG016491(CBG), 2 miles S. of Wubin, is annotated as "small shrub ca. 20cm high. Flowers white". The inflorescence is described as "cross shaped". Went 193 (PERTH), from Wubin - Wongan Hills Road, is recorded to have "Fls. embedded in white woolly head. Leaves rolled under, 1cm long. Plant 30cm high. Among shrubs".

Flowering and fruiting seem to occur chiefly from October through December.

Comments:

This taxon was identified by F.v.Mueller as "M.globiflora var.rugosifolia", but the varietal name remained only an annotation on the herbarium label of Young's collection from Mt.Churchman, and is not known to have ever been published. However, since the proposed varietal name reflects true foliage characters, it has been adopted here as a specific epiphet for this species.

W.E.Blackall's collection number 3516, is found written on two herbarium sheets in PERTH, both bearing different localities and collecting dates. One of them is noted to have been gathered on "13 Oct.,1937", from "between Kulja and Koorda", and the other was collected on "17 Oct.,1937", from "Rabbit Proof Fence near Kalannie". It appears, therefore, that each probably belongs to a different collection erroneously bearing the same collection number. Similarly, some discrepancy in the date and place of collection is observed in the duplicate sheets of Max Koch's Coll. nos.1243 and 1302, preserved in Herb.PERTH. Among these, the collecting month noted with the duplicate of no.1243 (in Herb. PERTH) is "October", while the collecting month on all its duplicates is "September". Likewise, the locality on the duplicate sheet of no.1302 (in Herb.PERTH) is written "Watheroo", but on all other duplicate sheets of this number it is "Lake Monger". The locality on one of its duplicates (coll.no.1302) in Herb.NSW is written "Jibberding", which place is on the south-eastern corner of Lake Monger. Further, it has been observed that with the exception of PERTH duplicates of the above two collections, the labels of all the other duplicates seem to have been written in the same handwriting and ink, and probably by the collector himself. Therefore, it appears that the error in collecting month and locality has probably been caused by some one who subsequently wrote herbarium labels of the PERTH duplicates.

The style in W.M.Carne's collection (s.n.,PERTH) from Marchagee is as long and as deeply lobed as the style in M.globiflora, but the leaves and all other flower characters do not agree with latter species.

In the following specimens, the arrangement of flowers into elongated woolly spikes is more prominent, though spikes are also present in all the other specimens examined.

Collector	Collection no.	Herbarium where deposited.	Locality
A.M.Ashby	2034	(AD, holotype)	Wongan Hills
A.M.Baird	s.n.	(UPS)	near Kalgoorlie
W.E.Blackall	3516	(PERTH)	between Kulja and Koorda
Mrs.Dela Hunty	s.n.	(PERTH)	Wubin
C.A.Gardner	1125	(PERTH)	Tammin
C.A.Gardner	12103	(PERTH)	Rabbit Proof Fence,S.E. Perenjori
F.Lullfitz	2027	(PERTH)	186 miles Peg Morowa Road
Mrs.E.H.Pelloe	B.1466	(PERTH)	Tammin

It has been observed, that the elongation in the flowering peduncle is often conspicuous at anthesis and later, rather than at an earlier stage.

Relationship:

M.rugosifolia is closely allied to M.globiflora. For the distinctive and identical characters see key to the species.

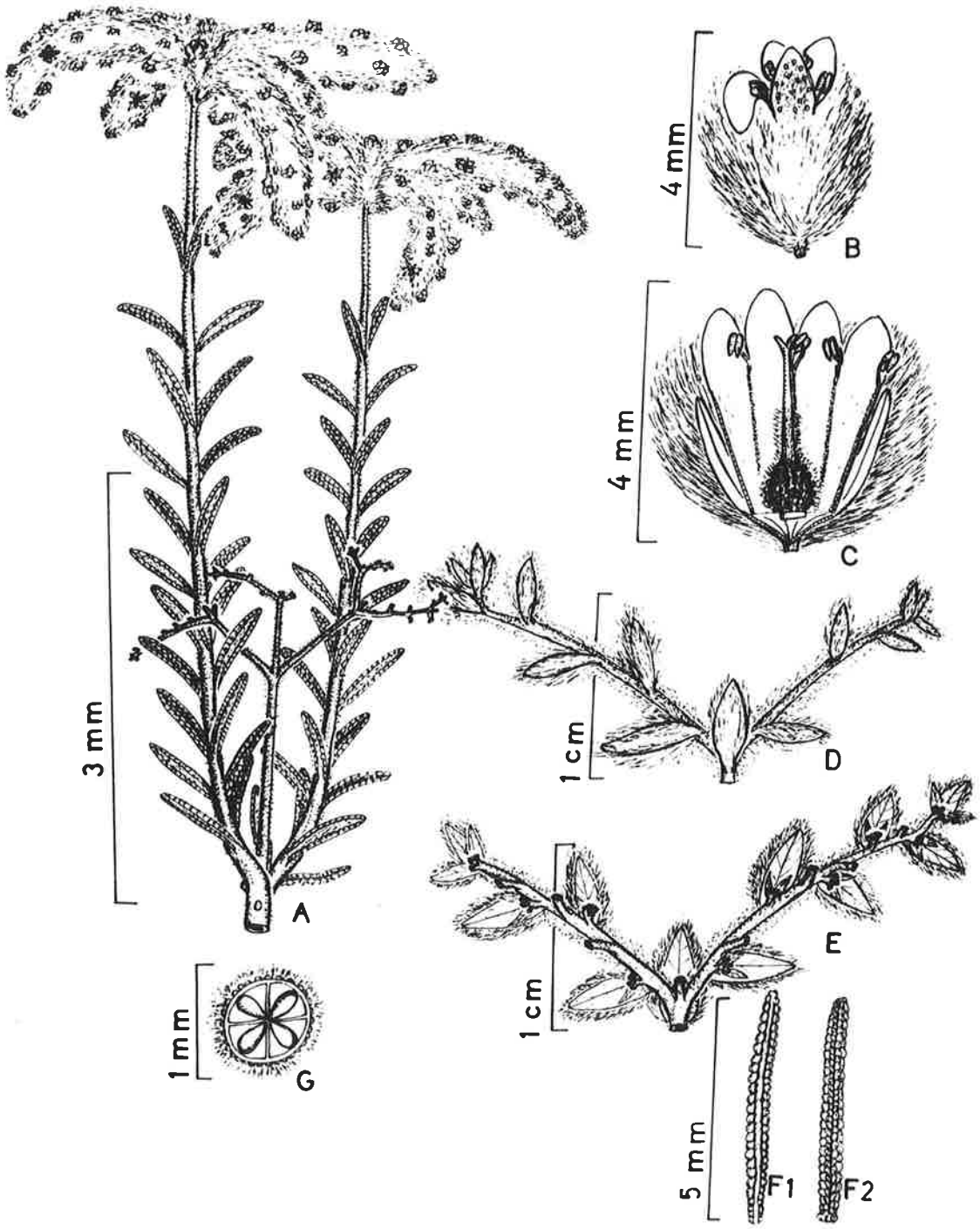


Fig. 33 — Mallophora rugosifolia Munir (A.M. Ashby 2034: AD - holotype). A, habit sketch of flowering twig; B, flower; C, flower vertically cut open; D, peduncles showing back view of the arrangement of bracts, the flowers being removed; E, peduncles showing front view of the arrangement of bracts, the flowers being removed; F_1, ventral view of a leaf showing deeply recurved margins; F_2, dorsal view of a glabrous and rugose leaf; G, T.S. ovary.

P H Y S O P S I S N.Turczaninow

PHYSOPSIS Turczaninow

Physopsis N.turczaninow, Bull.Soc.Nat.Mosc. 22(2) (1849) 34; W.G.Walpers,Ann.Bot Syst. 3 (1852) 231; H.Bocquillon, Rev.Verbénac. (1863) 102; F.v.Mueller, Fragm. 4 (1864) 162, in obs.;F.v.Mueller, Fragm. 6 (1868) 154, in obs.; G.Bentham, Fl.Aust. 5 (1870) 40; L.Pfeiffer, Nomencl.Bot. 2 (1874) 705; G.Bentham & J.D.Hooker,Gen. Pl. 2 (1876) 1132,1139; F.v.Mueller, Cens.Gen.Pl.Indig.Aust.(1882) 41; F.v.Mueller, Cens.Aust.Pl. 1 (1882) 103; Th.Durand, Gen.Phan. (1888) 319; F.v.Mueller, Sec.Cens.Aust.Pl. 1 (1889) 172;J.Briquet in Engl. & Prantl, Pflanzenfam. IV, 3a (1895) 163;J.Briquet, Mém. Soc.Physiq. et Hist.Natur.Geneve, 32(2) (1895) 59; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 495,501; T.V.Post & O.Kuntze, Lexic.Gen.Phan. (1904) 437,688;CG.Dalla-Torre & H.Harms, Gen.Siph. (1904) 432, no.7172; E.H.Pelloe, Wildfls.W.Aust. (1921) 100,in obs; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; A.Lemée, Dict.Descript. Syn.Gen.Pl.Phan. 5 (1934) 299; S.Junell, Sym.Bot,Upsal. 4 (1934)67; E.Cheel, Aust.-N.Z. Assoc.Advanc.Sc. 23 (1937) 332;C.A.Gardner in Hook., Ic.Pl.V, 4 (1939)t.3383, in obs.; A.Lemée, Dict.Descript. Syn.Gen.Pl.Phan. 8b (1943) 654; A.P.Rendle, Class.Fl.Pl. 2 (1952) 501, in obs.; J.C.Willis, Dict.Fl.Pl. and Ferns,ed.6, (1957) 509; G.H.M.Lawrence, Taxon.Vasc.Pl. (1958) 686, in obs.; C.A.Gardner, Wildfls.W.Aust. (1959) 127,in obs.; J.Hutchinson, Fam.Fl.Pl.1, ed.2, (1959) 397; H.N.Moldenke, Résumé Verbenac. etc. (1959) 404; N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 231; H.Melchior in Engl. Syllab.Pflanzenfam., ed.2, 2 (1964) 436; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls. 3 (1965)563; H.K.A.Shaw in J.C.Willis's, Dict.Fl.Pl.and Ferns, ed.7, (1966) 873; J.S.Beard, W.Aust.Pl., ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac. etc. 2 (1971) 751; C.A.Gardner, W.Aust.Wildfls. B (1972) 156, in obs.; C.A.Gardner, Wildfls.W.Aust., ed.11, (1973) 118, in obs

Typus : P.spicata N.Turczaninow, Bull.Soc.Nat.Mosc. 22(2) (1849)35.

Description:

Woolly-tomentose spreading shrubs. Stem erect, branched, cylindrical, solid and woody. Leaves cauline and ramal,exstipulate, simple, sessile, decussate, entire, often with recurved margins. Inflorescence elongated dense woolly spikes. Flowers bracteate, sessile or shortly pedicellate, solitary or three in the axil of each bract, complete, actinmorphic, hermaphrodite, hypogynous. Calyx gamosepalous, tubular, 4-lobed at the apex, densely woolly-tomentose outside, glabrous inside; tomentum interlocking, much branched. Corolla gamopetalous, tubular, 4-lobed in the upper half;

lobes equal, spreading, glabrous; tube short, almost cylindrical, glabrous outside, somewhat shortly hairy near the base within. Androecium: 4 stamens, epipetalous, included in the tube; filaments very short or almost absent; anthers 2-lobed, without appendages, lobes free in the lower halves, longitudinally dehiscent. Gynoecium: bicarpellary, syncarpous, 4-locular, with axile placentation; ovules 4, one in each cell, attached on the central axis above the middle, usually only one perfect; style short, included, slender, entire or very shortly notched at the apex. Fruit dry, indehiscent, often enclosed in the calyx, usually reduced to a single cell and seed. Seeds albuminous.

Distribution: (Maps 1 and 2).

This genus is endemic in Western Australia. The only two known species are restricted to the South Western Province between 29 and 34 degrees south latitude and between 115 and 119 degrees east longitude. Of these two species, P.spicata occurs chiefly in the Darling and Erwin Districts and P.lachnostachya is restricted to the Stirling District. The former is distributed mainly along Geraldton Highway and the latter is known chiefly from between Dumbleyung and Lake Grace and also near Newdegate and Lake Biddy. So far, the two species are not known to grow together in any of the above mentioned localities.

Relationship:

The genus Physopsis Turcz. is closely related to Mallophora Endl. in having 4-merous flowers, each with 4-sepals, 4-petals, 4-stamens and 2-carpelled 4-locular ovary with one ovule in each cell. Most striking differences between these two taxa are the shape of the inflorescence, the length of calyx-lobes, presence or absence of tomentum on the corolla-tube, length of filaments and style and presence or absence of stigma lobes. In Mallophora, the inflorescence consists of corymbosely arranged cymose (flower) heads, or both heads and somewhat spicately elongated flower clusters. Moreover, the calyx-lobes are free more than half-way down, corolla-tube hairy all over, stamens and style subexserted or scarcely included and stigma rather shortly 2-lobed [but the lobes are more distinct and longer than in Physopsis]. On the other hand, the flowers in Physopsis are spicately clustered at the ends of branches, calyx-lobes are short and ± deltoid,

Note:- The Botanical Provinces and Districts of Gardner and Bennetts (1956) are used to record the distribution of Western Australian taxa.

corolla-tube glabrous all over, excepting a narrow villous band near the base within, stamens and style included and stigma entire or minutely notched.

According to Bentham (1870), "the genus [Physopsis]consists of a single species endemic in Australia, differing from Mallophora chiefly in inflorescence." Therefore, the inflorescence type of these two taxa seems the main character used by Bentham in keeping them in separate genera. If that is so, then other genera of **Chloanthaceae** like Dicrastylis and Newcastelia would need splitting into more groups of the same rank, because many of their species differ from each other in their inflorescence types. In support of this argument, selected examples from these two genera may help to clarify this point.

The genus Dicrastylis has corymbose, pyramidal, spicate, verticillate or sessile decussate types of inflorescence. Within the corymbose type, the flowers may be in lax panicled cymes. [e.g. D.fulva Drumm. ex Harv., D.linearifolia Munir, D.obovata Munir and D.parvifolia FvM. etc.]or crowded into compact subglobose woolly-heads [e.g. D.corymbosa (Endl.)Munir, D.glauca Munir, D.reticulata Drumm. ex Harv. and D.velutina Munir, etc.]. Similar variations in the arrangement of flower clusters have also been observed in the species having pyramidal, spicate and verticillate types of inflorescence. Likewise, the inflorescence in Newcastelia may consist of subglobose flower clusters [e.g. N.cephalantha FvM. and N.insignis E.Pritz.] or of elongated spikes [e.g. N.hexarrhena FvM.,N.elliptica Munir, N.spodiotricha and N.viscida E.Pritz.,etc.]. Both inclusion and exsertion of stamens and style are found within the genera Dicrastylis and Newcastelia.

Therefore, the reason for the segregation of Mallophora and Physopsis only on their inflorescence type seems insufficient. During present investigations, some common characters have been observed in the inflorescence of Mallophora rugosifolia Munir and Physopsis Turcz. In M.rugosifolia Munir, the shape of the whole inflorescence is ± corymbose like the inflorescence of M.globiflora Endl., but instead of having subglobose flower-heads, the flowers are arranged into elongated ± spicate clusters, a character found in P.spicata Turcz. and ih the one other Physopsis species recognized. Moreover, M.rugosifolia Munir has both single as well as triple flowers in the axil of its (flower)bracts. The solitary flower in the axil of some of its bracts agrees with P.spicata Turcz. and three flowers in the axil of some of its bracts resemble those in P.lachnostachya Gard. and M.globiflora Endl.Further, filaments and style in M.rugosifolia Munir are

shorter than in M.globiflora Endl., nor is the stigma in the former as deeply lobed as in the latter (see fig. 33).

On the basis of the above observation, it seems that M.rugosifolia Munir is probably a connecting link between Mallophora and Physopsis. In the present revision, the two genera are treated as very closely related. However, the present author supports the view that they are sufficiently distinct to be regarded as separate genera. For the distinctive characters see key to the genera (P.39).

KEY TO THE SPECIES OF PHYSOPSIS Turcz.

1 a. Leaves subcoriaceous, slightly recurved along the margins, scabrid on the upper side, white cottony-woolly underneath; flowers solitary in the axil of each bract; bracts linear-lanceolate; anther 0.7 - 1 (-1.3)mm long, lobes ± parallel in the lower free halves, sessile; style 2.2 - 3.5(-3.8) mm long, hairy and glandular in the lower, glabrous in the upper half, eccentric on the maturing ovary .....P.spicata.

b. Leaves very coriaceous, deeply revolute along the margins, glutinous on the upper side, fulvescent-tomentose underneath; flowers 3 in the axil of each bract; bracts ovate or broadly elliptical to orbicular; anthers 0.5 - 0.7 mm long, lobes widely divergent in the lower free halves, with short (to 0.5mm) filaments; style 1 - 1.2(-1.5)mm long, glabrous and non-glandular, central (terminal) on the maturing ovary.....P.lachnostachya.

Physopsis spicata N.Turczaninow, Bull.Soc.Nat.Mosc.22 (2) (1849) 35; W.G.Walpers, Ann.Bot.Syst. 3 (1852) 231; H.Bocquillon, Rev. Verbénac. (1863) 103,t.3, fig.8-14; F.v.Mueller, Fragm. 6 (1868) 154; G.Bentham, Fl. Aust. 5 (1870) 41; F.v.Mueller, Cens.Aust.Pl. 1 (1882) 103; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172;J.Briquet, in Engl. & Prantl, Pflanzenfam. IV, 3a (1895) 163;fig.61 - C , D; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 501, fig.55A - C; L.Diels, Pflanzenwelt W.Aust. (1906) 279, fig. 65A - C;C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; S.Junell, Sym.Bot.Upsal. 4 (1934) 67; C.A.Gardner in Hook., Ic.Pl.V, 4 (1939)t.3383; C.A.Gardner, Wildfls.W.Aust. (1959) 127, in obs.; H.N.Moldenke, Résumé Verbenac. etc. (1959) 210; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 563, t.22 p.p.; A.Moriya, List. of Pl.Spec.Coll.Aust. (1969) 30,MS.;J.S.Beard, W.Aust.Pl.,ed. 2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 347; C.A.Gardner, W.Aust.Wildfls. B(1972) 156,157t; R.Erickson et al.,Fl.Pl.W.Aust.(1973) 108,187,t.322; C.A.Gardner, Wildfls.W.Aust., ed.11, (1973) 120.

Typus: J.Drummond 4th Coll. no.234: Swan River,Western Australia, 1846 or 1847 (KW holotype; CGE,K,LE,MEL,P,W.).

Description: (Fig. 34).

Erect spreading shrub of upto 75cm high. Stem branched, cylindrical, rather stout, woody, densely clothed with branched woolly tomentum. Leaves decussate, very rarely verticillate or sub-opposite, sessile, oblong or ovate - oblong, obtuse, with slightly recurved margins, sub-coriaceous, (0.8-)1.5 - 2.5(-3.3)cm long, (0.2-)0.5 - 0.8(-1.3) cm broad, glabrous or slightly scabrid above, densely white cottony-woolly underneath, nerves obscure on the upperside. Inflorescence spicate; spikes dense, solitary terminal or clustered at the end of branches, (2.5-)3.5 - 8(-14) cm long, 1.2 - 1.8(2.3)cm in diameter, white-woolly, cylindrical, sessile or very shortly pedunculate; rachis [central axis]tomentose. Flower 4-merous, bracteate, solitary in the axil of each (opposite) bract, shortly pedicellate, (6-)7 - 9(-11)mm long; pedicels cylindrical, short, 1 - 1.5mm long; bracts opposite (decussate), sessile, lanceolate or linear-lanceolate, deciduous, (6-)8 - 12 (-14)mm long, (0.7-)1 - 1.5(-2)mm broad at the middle, somewhat concave, woolly-tomentose outside, glabrous *inside*. Calyx tubular, shortly 4-lobed at the apex, 4 - 6(-7.5)mm long [excluding tomentum], glandular and very densely woolly-tomentose outside, glabrous within, glands mostly covered by tomentum; tomentum greyish-white,

much branched, 2.5 - 3.5mm long; lobes short, triangular to deltoid, obtuse, often sparsely tomentose on the inner side, 0.5 - 0.7(-1) mm long, 1 - 1.2mm broad at the base; tube ± cylindrical, 3.5 - 5.5(-6.5)mm long, somewhat narrowed towards the base. Corolla ochraceus-yellow, tubular, 4-lobed at the apex, 6 - 9.5mm long, glabrous allover excepting a few villous hairs inside near the base of the tube; lobes oblong to elliptic-oblong, obtuse,spreading, 1.5 - 2.5mm long, 1 - 1.5(-1.8)mm broad; tube ±cylindrical, brownish and slightly thickened in the throat, scarcely exceeding the calyx, (3.5-)4 - 6(-7.5)mm long. Androecium: stamens 4,included, inserted in the upper half of corolla-tube; filaments very much reduced or nearly absent; anthers sessile, 2-lobed, dorsifixed, 0.7 - 1(-1.3)mm long, 0.3 - 0.5 mm broad; lobes ± oblong, free in the lower halves, longitudinally dehiscent. Gynoecium: ovary subglobose, 0.4 - 0.8(-1)mm long, 0.4 - 0.6(-0.8)mm in diameter, glandular at the top, tomentose in the upper half, glabrous below, 4-locular, with one ovule in each cell; style included, slender, filiform, glabrous in the upper half, glandular and tomentose below, 2.2 - 3.5(-3.8)mm long, often almost half the length of corolla-tube, terminal on young ovary, but becomes eccentric when old; stigma minutely notched. Fruit dry, indehiscent, obovoid-globose, sparsely hairy in the upper half, 1 - 1.5mm long, 0.8 - 1.2mm across, often 1-seeded; seeds albuminous.

Specimens examined:

Western Australia.- T.E.H.Alpin 1304:west of Moora, 30.XI.1961 (PERTH).- A.M.Ashby 1328:near Dinner Hill Watheroo Road, ca. 185 km north of Perth, 14.XI.1964(AD).- A.M.Ashby 2041:east of Badgingarra,ca. 170 km north-west of Perth, 4.XI.1966(AD-2 spec.).- A.C.Burns 83:147 mile post on Eneabba Road, 1.X.1968(PERTH).- C.Chapman s.n.: 38 miles west of Coorow, on Green-Head road, 15.1.1967(PERTH).- H.Demarz 752:ca. 30 km south of Eneabba on road, 19.XI.1968(PERTH).- J.Drummond 4th Coll. no.234:Swan River, -1846 or 1847 (KW,holotype;CGE,K,LE,MEL40979,MEL40983,MEL40984, P,W,-isotypes).- J.Drummond s.n., MEL40980 & MEL40982:loc.cit.,- (MEL).- J.Drummond "235":"Nova Hollandia",-(KW).- C.A.Gardner 2357a: Hill River, 15.1.1931(PERTH- 2 spec.).- A.S.George 9797:± 150miles north of Perth on road to Eneabba, 17.X.1969(PERTH).- A.S.George s.n.:Hill River,-(PERTH).- F.Lullfitz 1955:Dinner Hill [?"or Mullewa"],-X.1959(PERTH).- F.Lullfitz 5635:13.7 miles from Jurien Bay turn-off on road to Watheroo westwards, 16.X.1966(PERTH).- F.v.Mueller s.n.:loc.incert.,- (GH,MEL41234).- M.W.Parratt 1643: 47 miles south of Dongara, 29.X.1965(UC).- D.H.Perry s.n.:Sand

Springs, Dale Road, 6.7.1953(PERTH).- O.H.Sargent 1427:Sand Springs near York, 25.1.1924 (MEL,PERTH).- N.H.Speck s.n.:Hill River district,-1953(PERTH).

Distribution: (Map 12).

This species is endemic in the south-western part of Western Australia. The known distribution is chiefly to the north of Perth, between Perth and Dongara. The majority of the localities are around the eastern half of Hill River and south of Arrowsmith River near Eneabba. Other known localities are around Swan River in the north-west of Moora and west of Coorow along Green-Head Road. The only other place of its occurrence is east of Perth where it is known to grow along Dale Road, south of York.

E c o l o g y:

Much of what is true of Mallophora species is true also of this taxon. It is known to grow in sandy soil and is restricted in its distribution chiefly to the winter-rainfall summer-drought areas. According to Demarz 752(PERTH), from ca. 30 km S. of Eneabba, it is a "straggling shrub" of about "2 feet" high with "yellow flowers", growing in "sand-heath". Drummond's 4th coll. no.234 is noted by F.v.Mueller as having the "Habit of Lachnostachys". Gardner 2357a(PERTH), from Hill River, is annotated as "Erect shrub, 2 ft. high; calyx white; corolla yellow.Sand heath." George 9797(PERTH), ± 150 miles N. of Perth on road to Eneabba,is recorded as "Spreading shrub to 40cm, corolla yellow, brown in the centre". The habitat is given "sand-heath". Lullfitz 5635(PERTH), 13.7 miles from Jurien Bay turn-off on road from Watheroo westwards, is described as "shrub 8"x8", leaves white below, white spikes". Parratt 1643(UC), from 47 miles S. Dongara, is also found growing in "sand heath; with Anigozanthos pulcherrima and Tetratheca confertifolia". Perry s.n.(PERTH), from Sand Springs, Dale Road, is annotated as a "shrub 12 inches tall; corolla ochre-yellow". The plant is noted to grow "in sand over laterite". Sargent 1427(PERTH), from Sand Springs, near York, is recorded as "shrublet with ascending branches; leaves deep green above;corolla yellow (ochreous)".The habitat given is "sand bordering ironstone".

Flowering and fruiting seem to occur chiefly from October through January.

C o m m e n t s:

This taxon is the type species of the genus Physopsis, based on J.Drummond's 4th collection no.234, from Swan River,Western

Australia. The year noted on the type duplicates in Herb K and MEL [MEL40984] is "1848", which has been erroneously accepted by Gardner (1939) as its year of collection. Previous to this also, Gardner made a similar annotation with one of his collections [no.2357a -PERTH] of this species, gathered during January, 1931. Actually, Drummond collected his 4th collection during late 1846 or early 1847, and according to Erickson (1969) "the 4th collection of plants was made ready [by Drummond] for his subscribers by July, 1847". Moreover, she has also given the following details of this collection: "July 1847, 14 sets of 400 sp. 4th coll., to Hooker and subscribers, from K.G.S., Stirling Ra., Porongorups, Mt.Many-peaks, Cape Riche and West Mt. Barren, and from N.andE. of Moore River" [Drumm. Hawthorn. (1969) 117 and 168]. The above mentioned last locality is the area where this species is now found growing commonly. However, it appears from the above record that the year "1848" noted on the type duplicates in Herb K. and MEL [MEL40984] is not the year of its collection but is the year when these specimens were communicated to these herbaria. This view is supported by the annotation on one of its duplicates in Herb.P, where it is clearly written on its label: "J.Drummond, received July, 1848".

According to Diels & Pritzel (1904), this species is distributed in Diels' Botanical districts Avon and Eyre in Western Australia. So far it is **not** known to occur as far south as the Eyre district. Similarly, Moldenke (1959,1971) has recorded this species both from South Australia and Western Australia, but like Lachnostachys Hook. and Mallophora Endl., Physopsis Turcz. too is endemic in Western Australia.

Among all the known taxa of Physopsis and its related genera, P.spicata is the only known species having always solitary flower in the axil of each bract. The white-woolly spicate inflorescence resembles in appearance the inflorescence of Lachnostachys, and is likewise popularly called by some "lamb's tail".

As indicated with the type citation, the holotype (J.Drummond 's 4th Coll. no.234) is expected to be at Kiew (KW) where the author's (N.Turczaninow) herbarium is located (Lanjouw & Stafleu, 1964). The holding of **Chloanthaceae** specimens at Herb.KW is not available for examination, but photographs of 15 different specimens [of **Chloanthaceae**] have been received from that herbarium. One of these photographs belongs to J.Drummond's 4th Collection [most likely no.234], apparently used by Turczaninow in describing his new genus Physopsis.In this photograph, the collector's number is written "235", the full annotation on its

herbarium label reads as follow:

"Physopsis spicata m Nova Hollandia Drum:N n.235"

Undoubtedly, the name written on the herbarium label is the one given to this taxon by Turczaninow, but the collector's number seems to have been wrongly entered. It has been found during present studies, that Turczaninow described simultaneously, Physopsis and Lachnocephalus, as two new genera in the same place (Bull.Soc.Imp.Nat.Mosc.22(2) (1849) 34-36).The type of the genus Physopsis is P.spicata Turcz., based on Drummond's 4th Coll. no. 234, and type of Lachnocephalus is L.lepidotus Turcz.,based on Drummond's 4th Coll. no.235. The author has not mentioned in the protologue the whereabouts of these types, but it seems most likely that they could be at Herb.KW where the author was working at the time of desribing these new taxa. In the original description, Drummond's 4th Coll, no.234 is recorded with the protologue of P.spicata Turcz. and his 4th Coll. no.235 with the protologue of L.lepidotus Turcz. Isotypes of P.spicata Turcz. (Drummond's 4th Coll. no.234) are now preserved in CGE,K,KW,LE,MEL- 3 spec., P and W, while the type duplicates of L.lepidotus Turcz.(Drummond's 4th Coll. no.235)are at the present housed in Herb.BM,BRI,CGE,G, K,L,LE,MEL - 3 spec., P and W. The photograph of the P.spicata Turcz. specimen received from KW, bearing Drummond's Coll. no"235" on its label, has no other duplicate. This appears not in accordance with Drummond's collecting practice who always had at least a few duplicates of each of his collection numbers.

It seems, therefore, that during subsequent handling of Drummond's collections at KW, the collection numbers of both the above-mentioned of Turczaninow's types may have been erroneously interchanged, although the name P.spicata Turcz. is correctly recorded on its herbarium label. In the present revision, therefore, the photograph P.spicata Turcz., received from herb.KW, is being accepted here as that of the (type) specimen used by the author in describing this taxon.

Relationship:

P.spicata is closely allied to P.lachnostachya. For the distinctive characters see key to the species above.

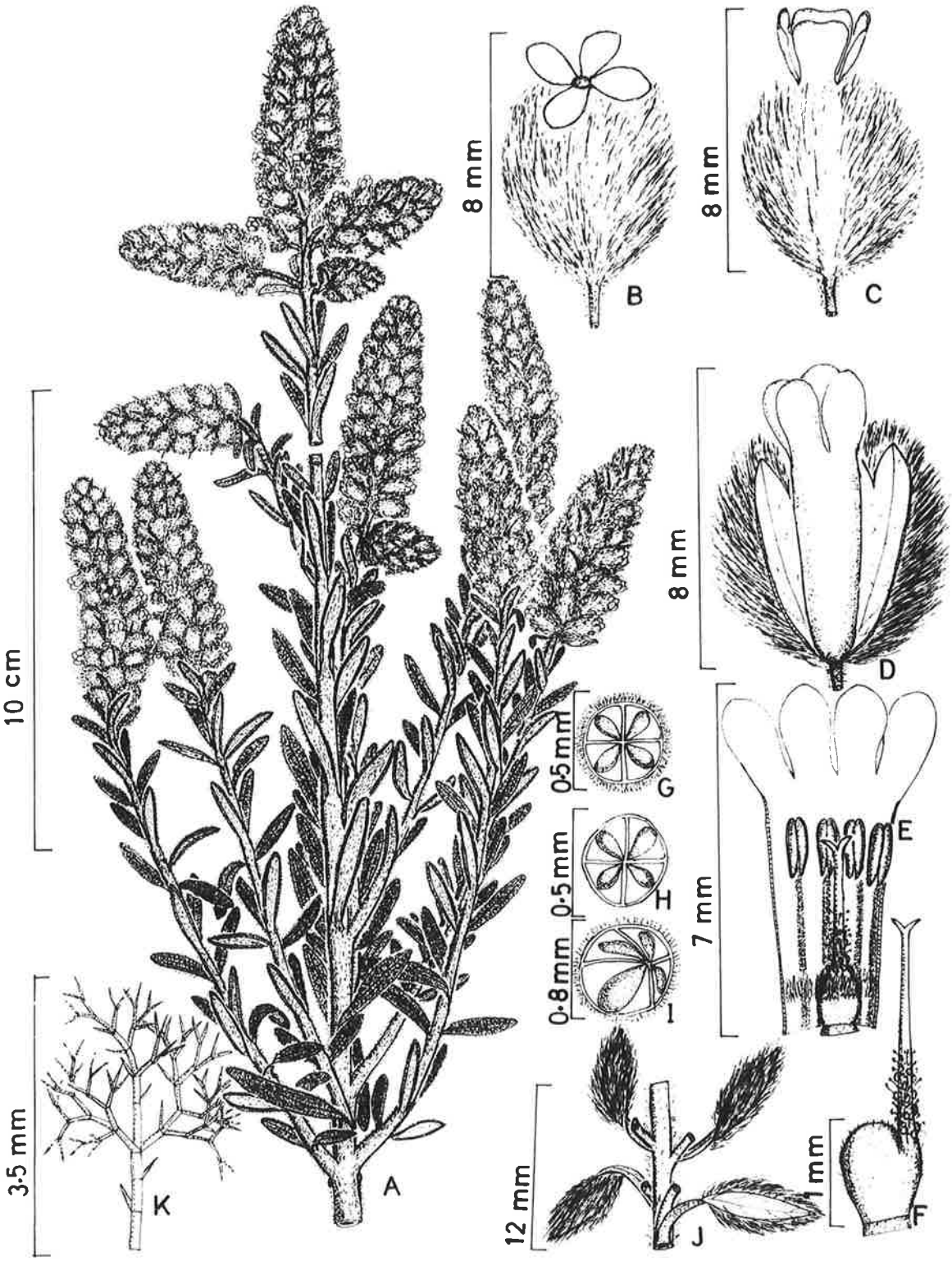


Fig. 34 — Physopsis spicata Turcz. (A.M. Ashby 2041: AD).
A, flowering branches; B and C, flowers; D, calyx vertically cut open showing glabrous corolla-tube; E, corolla-tube vertically cut open showing stamens and pistil; F, gynoecium with eccentric style; G and H, T.S. ovary from upper half and lower half respectively; J, T.S. mature ovary; J, bracts arrangement with a solitary flower in each axil, the flowers being removed; K, calyx-tomentum.

Physopsis lachnostachya C.A.Gardner in Hook., Ic.Pl.V, 4 (1939) t.3384; H.N.Moldenke, Résumé Verbenac.etc. (1959) 210;A.M.Ashby, S.Aust.Mus.Ser. (1965)t.69; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 563; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac. etc. 1 (1971) 347.

T y p u s:C.A.Gardner s.n.: gravelly hills between Dumbleyung and Kukerin, in sandy lateritic soil, Stirling District, Western Australia, 9.XI.1935 (PERTH holotype;B,K).

Description: (Fig. 35).

A spreading shrub of 60 - 120cm high. Stem branched, ± straggling,cylindrical, densely greyish-fulvescent tomentose when young, almost glabrous or somewhat sparsely greyish-hairy when old, solid, woody. Leaves decussate, sessile, ovate- lanceolate or ovate - oblong, often overlapping the next above, (5-) 10 - 18mm long, (2-) 3 - 5 (-6) mm broad, obtuse, deeply revolute along the margins, very coriaceous, with nerves almost obscure, glabrous and ± glutinous on the upper side,fulvescent- tomentose underneath. Inflorescence spicate; spikes solitary terminal or in groups of threes at the end of branches, sessile, cylindrical, very densely greyish - white tomentose; peduncle (central axis) densely fulvescent - tomentose. Flowers bracteate, sessile, compactly borne in groups of threes in the axil of each bract, 4 - 6.5 mm long [excluding tomentum]; bracts deciduous, opposite [decussate], shortly petiolate, broadly ovate, ovate - orbicular or elliptic - orbicular, (3-)3.5 - 5.5(-8.5)mm long, (2.5-)3.5 - 5(-6)mm broad, woolly - tomentose outside and along the margins, glabrous inside; petiole glabrous, 1 - 1.5mm long. Calyx tubular, ± obovoid in outline, 4-lobed at the apex, 3 - 4(-4.5)mm long, densely covered outside with branched woolly tomentum, glabrous within; lobes deltoid or somewhat triangular - ovate, acute, 1 - 1.5 mm long, nearly as broad at the base: tube ± obovoid, 2 - 3 mm long; tomentum dense, greyish - white, much branched, 1.8 - 3mm long. Corolla yellow, tubular, shortly 4-lobed at the apex, (3-)3.5 - 5 mm long, glabrous without, villous within near the base of tube only; lobes sub-orbicular or broadly elliptic - oblong, obtuse, 1 - 1.5(-2)mm long, 1 - 1.3(-2)mm broad; tube almost as long as the calyx, ± cylindrical, but somewhat broader towards the apex, 2.5 - 3.5(-4)mm long. Stamens 4, included, inserted just above the middle of the corolla-tube; filaments short, filiform, glabrous, 0.3 - 0.5 mm long; anthers 2-lobed, dorsifixed, 0.5 - 0.7mm long, ± 0.4mm broad, lobes oblong, free and divergent in the lower

halves, longitudinally dehiscent. Ovary ± globose, glandular and hairy at the top, glabrous below, 4-locular, with one ovule in each cell, 0.5 - 1.1 mm long, 0.6 - 1.5 mm in diamete; ovules attached to axile placentas above the middle of the ovary, generally only one matures to form a seed; style short, filiform, glabrous, 1 - 1.2(-1.5)mm long; stigma minutely 2-fid. Fruit dry, indehiscent, obovoid, ± 2.5mm long, 1.8 - 2mm in diamete, sparsely glandular and shortly hairy at the top, glabrous below, 4-celled, mostly single seeded; seeds albuminous.

Specimens examined:

Western Australia.- K.M. Allan 158: 28 miles east of Lake Biddy, 5.XI.1969 (PERTH).- T.E.H.Alpin 2834: 20 miles west of Lake Grace, 8.XI.1964 (PERTH).- A.M.Ashby 18: Kulin, IX.1946(AD,PERTH).- A.M.Ashby 594: Tarin Rock, ca.16 km west of Lake Grace, 6.X.1963 (AD).- J.S.Beard 2138:5 miles east of Kukerin, 29.X.1962 (PERTH).- E.M.Bennett 2949:198 3/4 miles south-east of Perth near Lake Grace, 29.IX.1969 (PERTH).- W.E.Blackall 1310:12 miles west of Lake Grace, 11.XI.1931 (PERTH).- H.F.Broadbent 113:Tarin Rock, 18.X.1952(BM).- A.J.Cough 42:Kukerin, 10.X.1962 (PERTH).- C.A.Gardner 1904:near Lake Grace, 26.IX.1925 (PERTH).- C.A.Gardner s.n.:between Dumbleyung and Kukerin, Stirling District, 9.XI.1935(PERTH holotype;B,K,- isotypes).- C.A.Gardner & W.E.Blackall s.n.: Tarin Rock, between Wagin & Lake Grace, -IX.1925 (PERTH).- A.S.George 276: ± 197 mile peg, Dumbleyung - Lake Grace, 12.IX.1959 (MO,PERTH).- F.W.Humphreys s.n.: ± 15 miles from Hyden to Newdegate, 10.X.1965 (PERTH).- F.W.Humphreys s.n.: 11 miles from Newdegate on Hyden road, 21.X.1966 (PERTH).- R.H.Kuchel 2014:ca. 15 miles north-east of Kukerin, 20.IX.1964 (AD).- F.Lullfitz L1744:2 miles north of Jitarning, 20.XI.1962 (PERTH).- V.F.McDougall 034:Tarin Rock East, 27.IX.1956 (PERTH).- K.Newbey 1482:5 miles west of Tarin Rock, 27.IX.1964 (PERTH).- K.Newbey 1483: 2 miles west of Tarin Rock, 27.IX.1964 (PERTH).- S.Paust 894:10 miles west of Kulin towards Wickepin, 15.IX.1971 (PERTH).- M.E.Phillips s.n.,CBG007519: 5 miles east of Kukerin, 29.X.1962 (CBG).- J.S.Roe s.n.: loc.incert., "interior of S.W.Australia",-(K).- J.W.Wrigley s.n.,CBG036544: 2 miles west of Tarin Rock towards Kukerin, 9.XI.1968 (AD).

Distribution:(Map 12).

This species is endemic in the extreme south-western part of Western Australia. The known localities are confined to Stirling District in the South Western Province where, so far, it seems restricted between 32 and 34 degrees south latitude and between

117 and 119 degrees east longitude. Most of the collections have come from between Dumbleyung and Lake Grace, where they are commonly found around Kukerin and Tarin Rock. Two localities in the north of Newdegate are near Lake Biddy and Hyden respectively. The only other place of its occurrence is near Kulin along Kulin - Wickepin road.

E c o l o g y:

In ite ecological requirements P.lachnostachya is much like P.spicata and Mallophora Endl. species, being restricted to the winter rainfall area in the south-western part of Western Australia. According to information gathered from collectors' annotations, it grows commonly in gravelly soil and sand heaths. The plant is a much-branched straggling shrub having white - woolly spicate inflorescences with the aspect of Lachnostachys bracteosa Gard.Allan 158 (PERTH),from 28 miles E. of Lake Biddy is noted as "Spreading shrub to 1 m., growing in sand". Aplin 2834 (PERTH), from 20 miles west of Lake Grace is found growing in "mallee-shrub association". Beard 2138 (PERTH), from 5 miles E.of Kukerin is annotated as "Straggling shrub, 3 - 4 feet. Inflorescence white. In gravel heath". Bennett 2949 (PERTH), from near Lake Grace is recorded as "4 feet bushlet; white flowers. Golden under pubescence to leaves". Blackall 1310 (PERTH), 12 miles W. of Lake Grace, is reported as an "erect straggling shrub 2'-4'. Fls. head white. Corolla yellow". Gardner s.n. (B,K,PERTH), from Dumbleyung and Kukerin is noted as having grown "in sandy lateritic soil" in "gravelly hills". The plant is "2 - 3 ft. high shrub. Corolla-yellow". Gardner & Blackall s.n.(PERTH),from Tarin Rock is annotated as "Spreading shrub 2' - 3 1/2'. Fls. dirty white". The habitat is noted as "sand heath". Lullfitz L1744 (PERTH), from 2 miles N. of Jitaring is recorded as "3 ft. high, open, spreading [shrub]. On gravel rise". Paust 894 (PERTH), from 10 miles W. of Kulin towards Wickepin is described as "shrub 3 ft. tall. compact and rounded. Flowers cream - grey in colour".

Flowering and fruiting seem to occur chiefly during September-November, but there are scattered occurrences in August and December as well.

C o m m e n t s:

This taxon is the second known species of Physopsis Turcz., described 90 years after the establishment of the genus. In appearance, its spicate inflorescence looks very much like the one in Lachnostachys bracteosa,but the tetramerous flowers with

very distinctly developed large corolla-lobes at once distinguish it. The specific epiphet of this species, however, must have been derived from Lachnostachys, because of its outward resemblance to the latter. The year of collection noted on the label of an isotype sheet in Herb. K is "1933", whereas the year on the holotype sheet in Herb. PERTH and With the isotype in Herb. B is "1935". Since all other information regarding habit, habitat, locality, day and month of collection are the same for all the three type duplicates, therefore, the year "1933" written in different ink [on the isotype sheet at Kew] may be an error.

F.W.Humphrey's collections [s.n.-PERTH] from Newdegate - Hyden Road have much smaller leaves but there is no difference in the flowers. The reduction in leaf size is probably due to some ecological reason, therefore, these collections are not separated from the type form.

The collection by K.M. Allan (158-PERTH), E.B.Bennett (2949-PERTH) and R.H.Kuchel (2014-AD) have each a few duplicates which are still to be distributed.

Among the regular flowered taxa of Dicrastylidaceae, P.lachnostachya is one of the few known species having very coriaceous leaves.

Relationship:

P.lachnostachya is closely related to P.spicata. For the distinctive characters, see the key above.

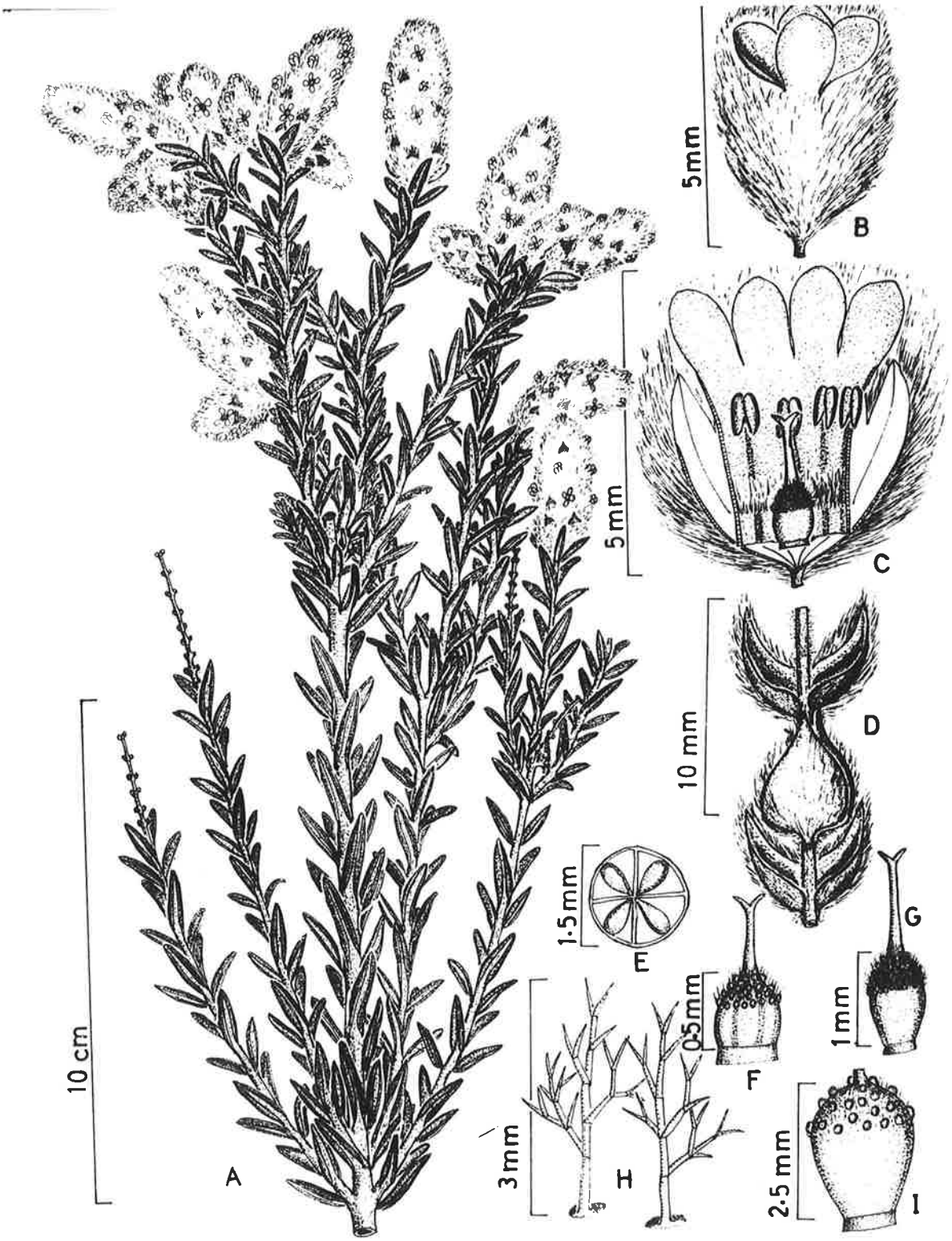


Fig. 35 — Physopsis lachnostachya Gardner (C.A. Gardner s.n.; PERTH - holotype).

A, flowering branches; B, flower; C, flower longitudinally cut open; D, bracts arrangement and shape; E, T.S. ovary; F, young ovary; G, fully developed ovary; H, calyx tomentum; I, fruit.

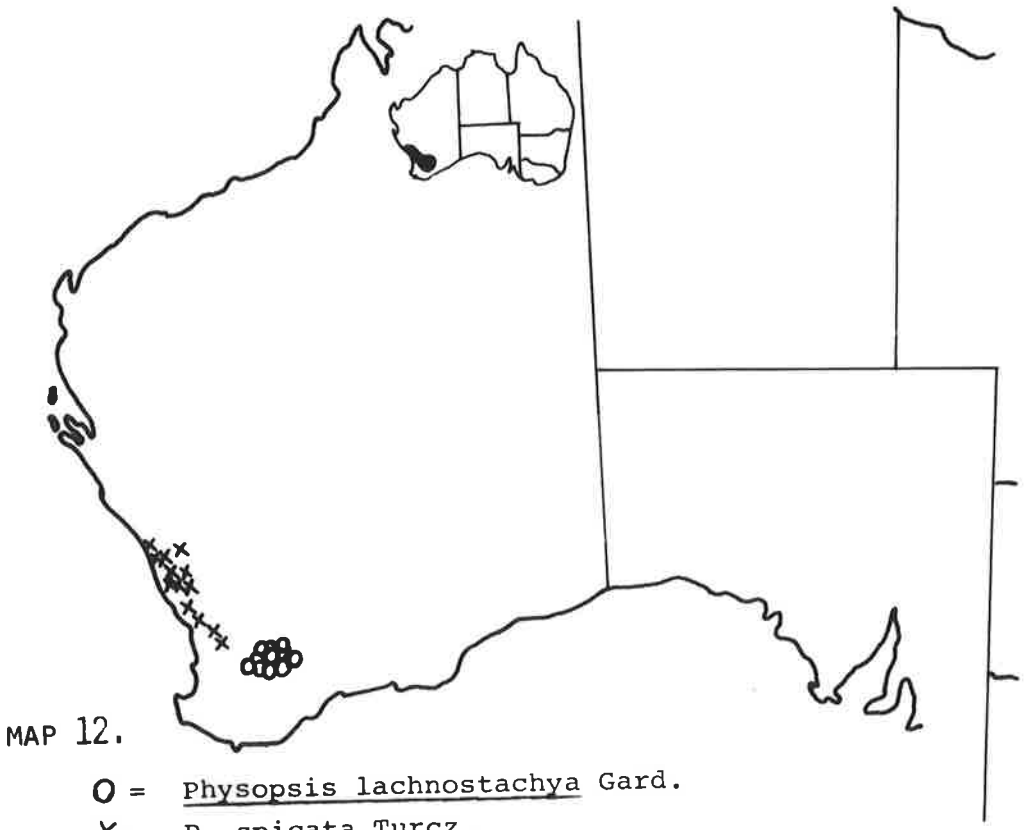
DISTRIBUTION MAPS OF MALLOPHORA AND PHYSOPSIS TAXA

(11 - 12)

MAP 11.

O = Mallophora globiflora Endl.

X = M. rugosifolia Munir



MAP 12.

O = Physopsis lachnostachya Gard.

X = P. spicata Turcz.

N E W C A S T E L I A F.v.Mueller

N E W C A S T E L I A Mueller

Newcastelia F.v.Mueller in Hook., J.Bot.Kew Misc.[8 (1856) 326, nom.nud.]9 (1857) 22;F.v.Mueller, Fragm.1 (1859) 184; F.v.Mueller, Fragm.4 (1864) 162 "Newcastlia", in obs; F.v.Mueller,Fragm.6(1868) 154 "Newcastlia", in obs.; G.Bentham, Fl.Aust.5 (1870) 39 "Newcastlia"; J.Lindley & T.Moore, Treasur.Bot.2 (1870) 787; G.Bentham & J.D.Hooker, Gen.Pl.2 (1876) 1132,1139 "Newcastlia"; F.v.Mueller, Cens.Aust.Pl.1 (1882) 102 "Newcastlia"; F.v.Mueller, Cens.Gen.Pl.Indig.Aust. (1882) 41 "Newcastlia"; Th.Durand, Gen. Phan. (1888) 319 "Newcastlia"; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172 "Newcastlia"; R.Tate, Trans.R.Soc.S.Aust. 12 (1889) 113 "Newcastlia"; F.M.Bailey, Cat.Indig.Natur.Pl.Qld. (1890) 110 "Newcastlia"; R.Tate, Fl.S.Aust. (1890) 155,254 "Newcastlia"; J.Briquet in Engl. & Prantl Pflanzenfam.IV, 3a (1895) 163 "Neurastlia", 164 "Newcastlia"; F.M.Bailey, Qld.Fl.4 (1901) 1165 "Newcastlia"; C.G.Dalla-Toore & H.Harms,Gen.Siph. (1904) 432, no.7174"Newcastlia"; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 495, 501"Newcastlia"; T.V.Post & O.Kuntze, Lexic.Gen.Phan.(1904) 389,688 "Newcastlea"; F.M.Bailey, Cat.Qld.Pl. (1913) 381 "Newcastlia";A.J.Ewart & O.B. Davies, Fl.North.Territory (1917) 235,237 "Newcastlia";E.H.Pelloe, Wildfls.W.Aust. (1921) 100 "Newcastlia", in obs.; J.M.Black, Fl. S.Aust.ed.1, (1926) 479 "Newcastlia"; K.Domin, Bibl.Bot. 85 + 89 (1929) 1107 "Newcastlia"; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111 "Newcastlia"; S.Junell, Sym.Bot.Upsal.4 (1934) 62,64"Newcastlia"; C.A.Gardner,Hook.Ic.Pl.V,4 (1939)t.3383 "Newcastlia"; P.A.Lemée, Dict.Descrip.Syn.Gen.Pl.Phan. 8b (1943) 654 "Newcastlia"; C.A. Gardner, J.R.Soc.W.Aust. 28 (1944) L,LVII "Newcastlia";J.M.Black, Fl.S.Aust.ed.2,(1957) 721 "Newcastlia"; J.C.Willis, Dict.Fl.Pl. and Ferns,ed.6,(1957) 449 "Newcastlia"; C.A.Gardner, Wildfls.W. Aust. (1959) 127 "Newcastlia"; J.Hutchinson, Fam.Fl.Pl.ed.2,(1959) 397 "Newcastlia"; H.N.Moldenke, Résumé Verbenac.etc.(1959) 321, 404;N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 208; Hj.Eichler,Suppl. Fl.S.Aust.ed.2, (1965)266; J.S.Beard, W.Aust.Pl. (1965) 92 "Newcastlia"; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 563; H.K.A.Shaw in J.C.Willis', Dict.Fl.Pl. and Ferns ed.7, (1966) 351,774; M.Morcombe, Aust.Wildfls.(1970) 94; J.S.Beard, W.Aust. Pl.ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac.etc. (1971) 573,751; G.M.Chippendale, Proc.Linn.Soc. NSW.96 (1972) 211 "Newcastlia"; H.T.Clifford & G.Ludlow,Key to Fam. & Gen.Qld.Fl.Pl. (1972) 124;C.A.Gardner, W.Aust.Wildfls.B(1972)156,in obs.; R. Erickson et al.,Fl.Pl.W.Aust.(1973) 187,200;C.A.Gardner, Wildfls. W.Aust.ed.11,(1973) 119.

Type species: N.cladotricha F.v.Mueller,Hook.J.Bot.Kew Misc. 9 (1857) 22.

Number of species: 12.

Excluded species: 1

Description:

Small perennial shrubs, densely covered with woolly or cottony tomentum of branched hairs. Stem erect, decussately brnached, cylindrical, solid, woody, tomentose. Leaves cauline and ramal, decussate or verticillate, (in whorls of 3), simple, exstipulate, sessile, entire, reticulate, unicostate, often recurved along the margins, herbaceous, tomentose. Inflorescence dense elongated spikes or ± subglobose heads, terminal on branches, woolly - tomentose. Flowers 5 - 6 -merous, rarely more, bracteate,solitary or three in the axil of each bract, sessile or subsessile, complete, regular, hermaphrodite, hypogynous; bracts opposite (decussate), deciduous. Calyx gamosepalous, 5 - 6 -lobed, rarely more, densely covered with distinctly branched tomentum outside, glabrousinside. Corolla gamopetalous, ± campanulate, usually 5 - 6 - lobed at the apex, rarely more lobes, glabrous outside,villous-tomentose inside. Androecium: stamens 5 - 6, rarely more, epipet-alous, exserted or included, alternating with the corolla-lobes; filaments glabrous, filiform; anthers dorsifixed, 2 -lobed; lobes ± oblong, free and divergent in the lower halves, longitudinally dehiscent, non - appendiculate. Gynoecium: bicarpellary,syncarpous, tetralocular, with axile placentation; ovules solitary in each cell, semianatropous, attached at or above the middle of central axis, only one or two maturing to form seeds; style exserted or included, glabrous, filiform, stigma minutely notched or almost entire. Fruit dry, indehiscent, 1 - 2 - seeded; seeds albuminous.

Distribution: (Maps 1 and 2).

The genus Newcastelia FvM. is endemic in Australia. It is known to occur in South Australia, Western Australia, Northern Territory and Queensland, but so far it has not been recorded from Victoria or New South Wales. According to known distribution, it seems to have more representatives in Western Australia and Northern Territory than in any other states. Among the 12 accept-ed species of this genus (Including 3 new), N.cephalantha and N.spodiotricha are the most widely distributed, being found in all the above-mentioned four states where this genus occurs. Of the remaining 10 species, N.bracteosa is found in the border

regions where South Australia meets Western Australia and Northern Territory. N.cladotricha is restricted chiefly to the Eremean Province in Western Australia, with also a few localities in the Dampier District of the Northern Province and even across the western border of Northern Territory. Of the remaining species, N.elliptica is found on either side of the border of Western Australia and Northern Territory near Petermann Ranges. Two of the other 7 species, namely N.interrupta and N.velutina, are notable in being endemic to distant south-eastern Queensland. The remaining five are known only from Western Australia. No species of this genus are recorded as endemic in South Australia or Northern Territory. The species endemic in Western Australia are N.chrysophylla, N.chrysotricha, N.hexarrhena, N.insignis and N.viscida,all of which are distributed chiefly in the south-western districts of the Eremean Province. Unlike the genera Lachnostachys, Mallophora and Physopsis, the genus is not known to occur in the South Western Province of Western Australia.

In general, the distribution in South Australia is along the far north and north-western borders. In the Northern Territory, it is chiefly in the adjacent southern half, with only a few loca--lities extending as far north as 14 degrees south latitude; there is only one species known to extend so far north, namely N.spodiotricha FvM.

The extreme easterly extension of the genus is represented by the two species mentioned above, N.interrupta and N.velutina, both endemic in Queensland. The limit of this extension is about 152 degrees east longitude.

The following table shows the number of Newcastelia species at present known in various states(or territories) of mainland Australia; the subspecific taxa are also given but they are not included in the totals for each region.

N o t e: The Botanical Provinces and Districts of Gardner and Bennetts (1956) are used to record the distribution of Western Australian species.

Name of taxon	S.A.	W.A.	N.T.	Qld.	Vic.	NSW.
N.bracteosa FvM.	X	X	X	-	-	-
N.cephalantha FvM. var.cephalantha	X	X	X	X	-	-
N.cephalantha FvM. var.oblonga Munir	-	X	X	X	-	-
N.cephalantha FvM. var.tephropepla Munir	X	X	X	-	-	-
N.chrysophylla Gard.	-	X	-	-	-	-
N.chrysotricha FvM.	-	X	-	-	-	-
N.cladotricha FvM.	-	X	X	-	-	-
N.elliptica Munir	-	X	X	-	-	-
N.hexarrhena FvM.	-	X	-	-	-	-
N.insignis Pritz.	-	X	-	-	-	-
N.interrupta Munir	-	-	-	X	-	-
N.spodiotricha FvM.	X	X	X	X	-	-
N.velutina Munir	-	-	-	X	-	-
N.viscida Pritz.	-	X	-	-	-	-
Number of species (only) recorded for each state or territory.	3	10	5	4	Nil	Nil

[X = Present; - = Absent]

In view of the above distribution pattern, it seems likely that the centre of diversity of this genus has been in Western Australia or else in the border region of Western Australia and Northern Territory.

C o m m e n t s:

The name of this genus was proposed in honour of Henry Pelham Clinton,5th Duke of Newcastle, 1811 - 64, who was Secretary of State for the Colonies, 1852 - 54, and supplied funds for the North-Western Australian Government Expedition of 1855. In this respect, Mueller wrote in his observations on the North Australian Botany as follows, " and a fine new genus from Central Australia, which I beg to name Newcastelia, to evince my gratitude for the exertions of his Grace the Duke of Newcastle on behalf of the North Australian Expedition". [Hook.J.Bot.Kew Misc.8 (1856)326;

ibid. 9 (1857) 22]. This Expedition was commended by the Government Surveyor, Augustus Gregory, who was accompanied by Frederick Mueller, the botanist. [ibid. 8 (1856) 321].

In 1862, Mueller changed the original generic name from Newcastelia to "Newcastlia"which he maintained in all his subsequent treatments of this genus. Following Mueller, in the majority of the later records of this genus, the generic name has mostly appeared with non - original spelling.

Post & Kuntze (1904) seem to have followed Bentham & Hooker's classification in retaining this genus under the tribe Chloantheae but at two different places in their record the genus is spelled as " Newcastlea".

Relationship:

Allied closely to Lachnostachys Hook. in its inflorescence being generally spicate, flowers 5 - 6 -merous and style minutely notched or almost undivided. However, it may be easily distinguished by the corolla being clearly lobed and stamens inserted towards the base [when included] or middle of corolla-tube [when extending between the lobes]. It is also closely related to Dicrastylis Drumm. ex Harv. in having well developed corolla - lobes and isomerous stamens, but differs from the latter in its undivided style. The other genera having some affinities with Newcastelia are Mallophora Endl. and Physopsis Turcz. Both of these have regular flowers with isomerous stamens, but can be readily distinguished by their strictly 4 -merous flowers.

NEWCASTELIA FvM.

Stamens & style exserted

N. bracteosa FvM. N. elliptica Munir
N. cephalantha FvM. N. hexarrhena FvM.
N. insignis E.Pritzel N. spodiotricha FvM.

Inflorescence golden-yellow

N. insignis E,Pritzel

Inflorescence greyish (cottony or woolly)

N. bracteosa FvM. N. cephalantha FvM
N. elliptica Munir N. hexarrhena FvM
N. spodiotricha FvM.

Flowers in globose or sub-globose heads

N. cephalantha FvM.

Flowers in elongated spikes

N. bracteosa FvM. N. elliptica Munir
N. hexarrhena FvM. N.spodiotricha FvM

Ovary all over tomentose; (plant with the aspect of Lachnostachys verbascifolia FvM.)

N. hexarrhena FvM.

Ovary non tomentose, wholly or partly glandular,

N. bracteosa FvM.
N. elliptica Munir
N. spodiotricha FvM.

Ovary all over glandular; leaves broadly ovate, 3-5(-6.5)by 1.2-2.5(-3)cm

N. spodiotricha FvM.

Ovary glandular in the upper half; leaves oblong or elliptic-oblong,less than 4 by 1 cm

N. bracteosa FvM.
N. elliptica Munir

####### Leaf margins recurved, rugae & reticulation concealed by dense woolly tomentum

N. bracteosa FvM.

####### Leaf margins flat (non recurved),rugae (above) & reticulation (beneath)distinct

N. elliptica Munir

Stamens & style included

N. cladotricha FvM. N. chrysophylla Gard.
N. chrysotricha FvM. N. interrupta Munir
N. velutina Munir N. viscida E.Pritzel

Inflorescence golden-yellow

N. chrysophylla Gard.
N. chrysotricha FvM.

Ovary all over tomentose; leaves obovate,opposite.

N. chrysophylla Gard.

Ovary glabrous below, glandular-hairy in the upper half; leaves narrow linear,in whorls of 3

N. chrysotricha FvM.

Ovary glabrous in the lower half, tomentose above;flowers 3 in the axil of each bract

N. interrupta Munir
N. velutina Munir

Plant velutinous; leaves braodly lanceolate, always opposite;inflorescence non-interrupted.

N. velutina Munir

Plant ± woolly tomentose; leaves oblong-lanceolate opposite or sometimes in whorls of 3 ; inflorescence interrupted.

N. interrupta Munir

Inflorescence greyish (cottony or woolly)

N. cladotricha FvM. N. interrupta Munir
N. velutina Munir N. viscida E. Pritzel

Leaves elliptic-oblong or oblong-lanceolate,all over tomentose

N. cladotricha FvM.
N. interrupta Munir
N. velutina Munir

Leaves narrow-linear,in whorls of 3 ,glutinous -viscid above

N. viscida E. Pritzel

Ovary all over glandular,glabrous; flower solitary in the axil of each bract.

N. cladotricha FvM.

N E W C A S T E L I A FvM.

Flowers in elongated spikes

N. bracteosa FvM. N. chrysophylla Gard.
N. chrysotricha FvM. N. cladotricha FvM.
N. elliptica Munir N. hexarrhena FvM.
N. interrupta Munir N. spodiotricha FvM.
N. velutina Munir N. viscida E. Pritzel

Spikes golden-yellow tomentose

N. chrysophylla Gard.
N. chrysotricha FvM.

Leaves obovate, opposite

N. chrysophylla Gard.

Leaves narrow-linear, in whorls of 3

N. chrysotricha FvM.

Spikes greyish, (woolly or cottony tomentose)

N. bracteosa FvM. N. cladotricha FvM.
N. elliptica Munir N. hexarrhena FvM.
N. interrupta Munir N. spodiotricha FvM.
N. velutina Munir N. viscida E.Pritzel

Stamens & style included

N. cladotricha FvM. N. interrupta Munir
N. velutina Munir N. viscida E.Pritzel

Mature spikes non-interrupted

N. velutina Munir
N. viscida E. Pritzel

Leaves broadly lanceolate, opposite; corolla-lobes narrow acuminate

N. velutina Munir

Leaves narrow-linear, in whorls of 3 ; corolla-lobes rounded at the top.

N. viscida E. Pritzel

Mature spikes interrupted

N. cladotricha FvM.
N. interrupta Munir

Flowers 3 in the axil of each bract

N. interrupta Munir

Flowers solitary in the axil of each bract

N. cladotricha FvM.

Stamens & style exserted

N. bracteosa FvM. N. elliptica Munir
N. hexarrhena FvM. N. spodiotricha FvM

Ovary non tomentose

N. bracteosa FvM.
N. elliptica Munir

Leaf margins non recurved; rugae & reticulation distinct

N. elliptica Munir

Leaf margins recurved; rugae & reticulation concealed by dense woolly tomentum.

N. bracteosa FvM.

Ovary tomentose

N. hexarrhena FvM.

Flowers in globose or subglobose heads

N. cephalantha FvM.
N. insignis E. Pritzel

Heads greyish

N. cephalantha FvM.

Heads golden-yellow

N. insignis E. Pritzel

KEY TO THE SPECIES AND INFRASPECIFIC TAXA OF NEWCASTELIA

F.v.Mueller

1 a. Leaves narrow - linear, mostly in whorls of 3, glabrous but glutinous - viscous on the dorsal surface.....11.

b. Leaves variously shaped, not narrow - linear, mostly decussate (sometimes in whorls of 3 in N.interrupta), hairy, not glutinous - viscous on the dorsal surface.....2.

2 a. Flowers in ± subglobular - ovoid terminal head.....10.

b. Flowers in an elongated spike.....3.

3 a. Stamens and style included.....7.

b. Stamens and style exserted.....4.

4 a. Leaves thin, broadly ovate or elliptic - oblong to elliptic-lanceolate, margins almost flat or broadly revolute, the midrib and primary lateral veins distinct on the under surface; floral - bracts sessile; calyx - tomentum thin, greyish - woolly; ovary non - tomentose.....6.

b. Leaves thick, oblong or oblong - lanceolate, margins recurved, the midrib and primary lateral veins hidden under the dense woolly tomentum; floral - bracts petiolate; calyx - tomentum thick, white - woolly; ovary tomentose or glabrous. .....5.

5 a. Leaves 1.5 - 2.5 cm long, 0.3 - 0.5(-0.7) cm broad; spikes slender, woolly, up to 8 cm long, 5 - 7 mm in diameter; ovary glabrous, densely glandular at the apex.....N.bracteosa.

b. Leaves 3 - 7 cm long, 0.8 - 1.5(-1.8) cm broad; spikes quite thick, very woolly, up to 13 cm long, 1 - 1.5 cm in diameter; ovary tomentose all over, with concealed glands at the apex. .....N.hexarrhena.

6 a. Leaves 3 - 5(-6.5) cm long, 1.2 - 2.5(-3) cm broad, broadly ovate, with a distinct short petiole; calyx tomentum very thin; hairs ± 1 mm long; ovary glandular all over..... .....N.spodiotricha.

b. Leaves 1.5 - 3.5(-4) cm long, 0.3 - 0.6(-0.8) cm broad, narrow elliptic - oblong to elliptic - lanceolate, sessile; calyx - tomentum thick; hairs ± 1.5 mm long; ovary glandular at the apex only.....N.elliptica.

7 a. Inflorescence distinctly golden - yellow tomentose; leaves obovate, olive - green above, golden - yellow tomentose beneath; corolla sparsely villous inside at the base of its lobes only; ovary tomentose all over, style with a few glandular hairs in the lower half;.....N.chrysophylla.

b. Inflorescence greyish - tomentose, purplish - grey tomentose or purplish - woolly; leaves ovate, oblong or ovate - oblong to oblong - lanceolate, greyish tomentose all over; corolla densely villous inside the tube; ovary glandular all over, glabrous or tomentose in the upper half, style glabrous...8.

8 a. Leaves oblong to ovate - oblong, distinctly rugose above, reticulate beneath; calyx - tomentum purplish - grey, ±fluffy; ovary glabrous, glandular all over.....N.cladotricha.

b. Leaves broadly lanceolate or ± oblong - lanceolate, rugae and reticulation often hidden under the dense tomentum; calyx - tomentum white, cottony - woolly; ovary tomentose in the upper half.....9.

9 a. Stem, leaves and peduncle velutinous, white cottony - woolly; leaves always decussate; spikes not interrupted; corolla - tube villous all over within; ovary glandular and tomentose in the upper half.....N.velutina.

b. Stem and leaves densely greyish - tomentose (not velutinous); peduncle purple or purplish - grey tomentose; leaves decussate or sometimes in whorls of 3; mature spikes interrupted; corolla - tube with a dense villous band within near the base; ovary not glandular but tomentose in the upper half... .....N.interrupta.

10a. Flower - heads distinctly golden - yellow tomentose; peduncles not leafy; bracts inconspicuous, linear - lanceolate; flowers usually 6 -merous (or more); ovary densely tomentose .....N.insignis.

b. Flower - heads greyish - woolly; peduncles leafy; bracts quite prominent, ± elliptic - orbicular; flowers usually 5 - merous (rarely 4 - or 6 -merous); ovary glabrous..... .....N.cephalantha.

A1. Stem and leaves brownish - grey tomentose; hairs 0.3 - 0.8(-1) mm long; leaves not crowded (lax), (1-)1.5 - 2.5(-3.8) cm by (0.3-)0.5 - 0.8(-1) cm, recurved mostly along the margins; flower - heads woolly, usually not fluffy.....B.

B1. Flower - heads ± subglobose.....var.cephalantha.

B2. Flower - heads ± oblong.....var.oblonga.

A2. Stem and leaves whitish - grey tomentose; hairs 0.2 - 0.3 mm long; leaves often crowded, 0.6 - 1(-1.5) cm by (0.2-)0.3 - 0.5(-0.6) cm, recurved mostly up to the midrib; flower - heads greyish - woolly, often very fluffly (± subglobose).....var.tephropepla.

11a. Spikes golden - yellow tomentose, elongated, slender, interrupted, usually stalked.....N.chrysotricha.

b. Spikes whitish - grey tomentose, not elongated, thick, continuous, usually sessile.....N.viscida.

Newcastelia bracteosa F.v.Mueller, Fragm. 8 (1873) 49, 230, in obs.; F.v.Mueller,Fragm. 9 (1875) 4; F.v.Mueller, Fragm. 10 (1876) 16, in obs.; R.Tate, Trans.R.Soc.S.Aust. 3 (1880) 78; F.v.Mueller, Cens.Austral.Pl.1 (1882) 102; E.Giles, Aust.Twice Trav. 2 (1889) 355; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; R.Tate, Trans.R. Soc.S.Aust.12 (1889) 113; R.Tate, Fl.Extra-Tropic.S.Aust.(1890) 155,254; F.v.Mueller & R.Tate, Trans.R.Soc.S.Aust.16 (1896) 375; R.Tate, Horn Exped.Bot. (1896) 174; L.Diels & E.Pritzel, Bot. Jahrb.Syst. 35 (1904) 502,503,505; J.M.Black, Fl.S.Aust.ed.1, (1926) 480; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; J.M.Black, Fl.S.Aust.ed.2, (1957) 722; G.Chippendale, Trans.R.Soc.S.Aust. 82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,321; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3(1965) 564;H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347,573; G.Chippendale, Proc.Linn.Soc.N.S.W. 96 (1972) 256.

T y p u s; E.Giles s.n.,MEL40990: MacDonnell Ranges, Northern Territory, -1872 (MEL holotype).

N.hexarrhena auct. non F.v.M.: Diels & Pritzel, Bot.Jahrb.Syst.35 (1904) 505, p.p. (quoad spec.Young s.n.,MEL40988:Victoria Spring-MEL).

Lachnostachys bracteosa F.v.Mueller,Fragm.8 (1873) 49, pro syn.

Description: (Fig. 36).

A low spreading shrub, 30-- 85(-90) cm high, densely covered with branched tomentum. Stem erect, branched, cylindrical, woody, clothed with ± fulvescent tomentum. Leaves decussate, sessile, oblong to oblong - lanceolate, with recurved margins, 1.5 - 2.5 cm long, 0.3 - 0.5(-0.7)cm broad, very densely fulvescent - grey tomentose, the midrib and lateral veins concealed by dense woolly tomentum. Inflorescence terminal, spicate; spikes cylindrical, dense, somewhat slender, purplish - grey tomentose,4 - 5(-8)cm long, 0.5 - 0.7 cm in diameter. Flowers usually 6 -merous, sometimes 5 -merous, bracteate, sessile, 3.5 - 4.5mm long, compactly arranged in spikes, often in a cluster of three in the axil of each bract; bracts decussate, ± imbricate (in young spikes), stalked, caducous, ovate - cordate, acuminate, brownish tomentose outside, glabrous inside, 5.5 - 6.5 mm long, 4 - 5 mm broad, distinctly reticulate; stalk 0.5 - 1 mm long, glabrous. Calyx usually 6 - lobed, sometimes 5 -lobed, tubular in the lower half, 1.8 - 2.2 mm long, glandular and densely woolly - tomentose out-

side, glabrous within; lobes deltoid, acute, 0.6 - 1mm long, ± as broad at the base; tube 1 - 1.5 mm long, broader towards the apex. Corolla purple - violet, campanulate, often with 6 short lobes at the apex, sometimes 5 -lobed, glabrous outside, densely tomentose within, ± 2.5 mm long; lobes narrow linear, acuminate, shorter than the tube, 0.8 - 1 mm long, ±0.2 mm broad, glabrous; tube campanulate, 1.8 - 2.2mm long. Stamens 6, sometimes 5, much exserted, inserted at the rim (margin) of corolla-tube; filaments long, filiform, glabrous, 1.5 - 2.5 mm long; anthers 2 -lobed, dorsifixed, ± orbicular in outline, 0.5 - 0.6 mm long, nearly as broad, yellowish - brown; lobes oblong, free in the lower halves, longitudinally dehiscent. Ovary ± globose, glabrous, glandular at the top, 0.5 - 0.6 mm long, about the same in diameter, 4- locular, with one pendulous ovule in each cell; style exserted, glabrous, filiform, 3 - 4 mm long; stigma almost entire or very minutely notched.

Specimens examined:

NORTHERN TERRITORY:- G.Chippendale 617: 1m. S.Olunga Well, Angas Downs, 24.XI.1954 (BRI,CANB,NSW,NT,PERTH).- G.Chippendale 3992: 36.6mm N. of Angas Downs H.S., 15.X.1957(AD,BRI,CANB,MEL, NT,PERTH).- G.Chippendale 7393: 26 m N. Angas Downs Homestead, 19.X.1960 (AD,CBG,NT).- C.Dunlop 1919: W. Chirnside Creek, Petermann Ranges, 129° 36', 25° 04', 29.IX.1970(NT).- P.K.Latz 829: 70m W.Ayers Rock, 25.X.1970(AD,NT).- R.T.Thornton s.n., MEL41022: Tempe Downs, near Charlotte Waters,-XII.1887(MEL).

SOUTH AUSTRALIA:- W.S.Reid 53: 10 miles south of Mount Davies, far N.W.,24.IX.1955 (ADW).- N.N.Donner 3910 & 3911: 27 Km west of Vokes Corner, 17.VII.1972 (AD).- N.N.Donner 3934: 130 Km west of Vokes Corner, 17.VII.1972 (AD).

WESTERN AUSTRALIA:- A.S.George 8365: 27miles E. of Winburn Rocks. E. of Warburton Mission, 6.X.1966 (PERTH).- A.S.George 8368: 52 miles E. of Warburton Mission, 7.X.1966 (PERTH).- A.S.George 8371: 21 miles W. of Warburton Mission, 9.X.1966(PERTH).- A.S. George 8445: 52 miles E. of Neale Junction, Great Victoria Desert, 11.X.1966 (PERTH).- E.Giles s.n.,MEL40989: From Mt.Olga to Barrow Range, -(MEL).- R.Helms s.n., AD96323051,AD97113043,AD97205176, MEL40987,NSW106649,NSW106650,NSW106651: Victoria Desert, Elder Explor.Exped.Camp 54,16.IX.1891 (AD,K,MEL,NSW).- H.A.Johnson 5108: near Lightning Rocks, 30.IX.1958(NT,PERTH).- H.A.Johnson 5113: 12 m N. Blackstone Mining Camp, 23.IX.1958(NT,PERTH).-R.T.Rowlands s.n.,MEL40986: ca 40 miles N. of Warburton Mission Station,-1966 (MEL).- J.Young s.n.,MEL40988: Victoria Springs,- (MEL).

Distribution: (Map)13).

N.bracteosa is restricted to South Australia, Northern Territory and Western Australia. The distribution in South Australia is mainly in the north-west where it is recorded from between Serpentine Lake and Vokes Corner and farther north-west near Mt. Davies. In Northern Territory, it is known to occur south-west of Alice Springs between MacDonnell Ranges and Petermann Ranges. Distribution in Western Australia is chiefly between Blackstone Range and Warbuton Range. These ranges are south-west of Petermann Ranges and more or less west of (Mt.Davies) Tomkinson Range. Three localities in Great Victoria Desert are also recorded. One of them is north-east of Kalgoorlie near Queen Victoria Springs, and the other two at Camp 54 of Elder's Exploring Expedition, and west of Neale Junction towards Yeo Hills.

E c o l o g y:

N.bracteosa is a dwarf eremean shrub with blue flowers and cylindrical spike-like inflorescence. It is known to grow chiefly along the creeks and in the dry sandy habitat of spinifex country. According to Chippendale 617 (BRI,CANB,NSW,NT,PERTH), from 1 mile south of Olunga Well, Angas Downs, it is a shrub 2 - 3 feet high with blue flowers, growing commonly on sand ridges. His subsequent collection no. 3992 (AD,BRI,CANB,MEL,NT,PERTH), from 36.6 miles north of Angas Downs H.S. is annotated "Perennial herb or shrub of 1 foot height; inflorescence pale blue. Rare, in deep red sand". Dunlop 1919 (NT), from W. of Chirnside Creek is noted as a "low spreading shrub with upright branches, flowers light mauve". It is reported to grow "on sand dune". Latz 829 (AD,NT), from 70 m. W.Ayers Rock, is recorded as "compact spreading shrub to 18" high, flowers purple, spikes cylindrical. Rare, in deep red sand with Triodia basedowii". George 8365 (PERTH), from 27 miles east of Winburn Rocks is recorded as "many - stemmed shrub to 70 cm tall with purple flowers". It is noted to grow in "red sand with Acacia salicina and Spinifex".

In most of the specimens examined, the flowers are 6 -merous, sometimes 5 -merpus and very rarely 7 -merous. The flowering and fruiting seems to occur chiefly from September through December.

C o m m e n t s:

E.Giles made two collections of this species, the first (MEL40990) during 1872 from "MacDonnell Ranges" which is the type and the second (MEL40989)[without any date] "from Mount Olga to Barrow Range". No definite locality is given for either of the

two collections; the place noted with each spreads over hundreds of miles. In respect of the second collection, the known localities between Mt.Olga and Barrow Range are near Tomkinson Range, Blackstone Range and around Lightning Rock between Cavanagh and Barrow Ranges. These places were visited by E.Giles from 30th September to 8th October, 1873, during his "Second Exploring Expedition in Central South Australia and into a portion of Central Western Australia" [E.Giles, Aust.Twice Trav.1 (1889) 201, -211, map 2]. It seems, therefore, that he collected this specimen (MEL40989) during that particular visit to the area, but the exact date and place of this collection is still uncertain. Similarly, Giles first collection of this species (MEL40990), the type, from MacDonnell Ranges is also without date and definite locality. It appears to have been collected during his "First Exploring Expedition into the Northern Territory Division of Central South Australia". During this expedition, Giles visited from 6th to 9th September, 1872, the western fringes of the MacDonnell Ranges around The Finke River, Rudall's Creek, Gosse's Range and Carmichael's Creek [E.Giles, ibid. p.p. 34 - 39, map 1]. Since then, a few more collections of this species have been recorded from south and south-west of Rudall's Creek and Gosse's Range. Therefore, Giles may have collected it from one of these localities when he visited that area in early September, 1872.

Young's two collections no.,MEL40998 and MEL41024 were gathered respectively from "Victoria Springs" and "from between Victoria Springs and Malaring". The former belongs to N.bracteosa FvM. and the latter to N.hexarrhena FvM..While dealing with these collections, Diels & Pritzel (1904) recorded the former collection [MEL40988 from Victoria Springs"] under N.hexarrhena,without any mention of the latter.

The locality of R.T.Thornton's collection no.MEL41022 is recorded as "Tempe Downs near Charlotte Waters", which are two different places separated from each other by over 200 miles. In fact, many collections of this species have been recorded from near Tempe Downs but its occurrence anywhere around Charlotte Waters is not known. In view of its frequency around Tempe Downs, Thornton's collecion may have come from this area and not from Charlotte Waters; the combination of these two localities is confusing.

Relationship:

Allied closely to N.hexarrhena in its leaves being oblong - lanceolate, thick, with recurved margins; floral bracts stalked,

caducous; inflorescence cylindrical, spicate; calyx tomentum long, white woolly; stamens and style exserted. However, N.bracteosa may be easily identified by its leaves being smaller, [measuring 1.5 - 2.5 cm by 0.3 - 0.5(-0.7) cm]; spikes less woolly, more slender, shorter, [upto 5 cm long, 0.7 cm across] and ovary glabrous but glandular at the top.

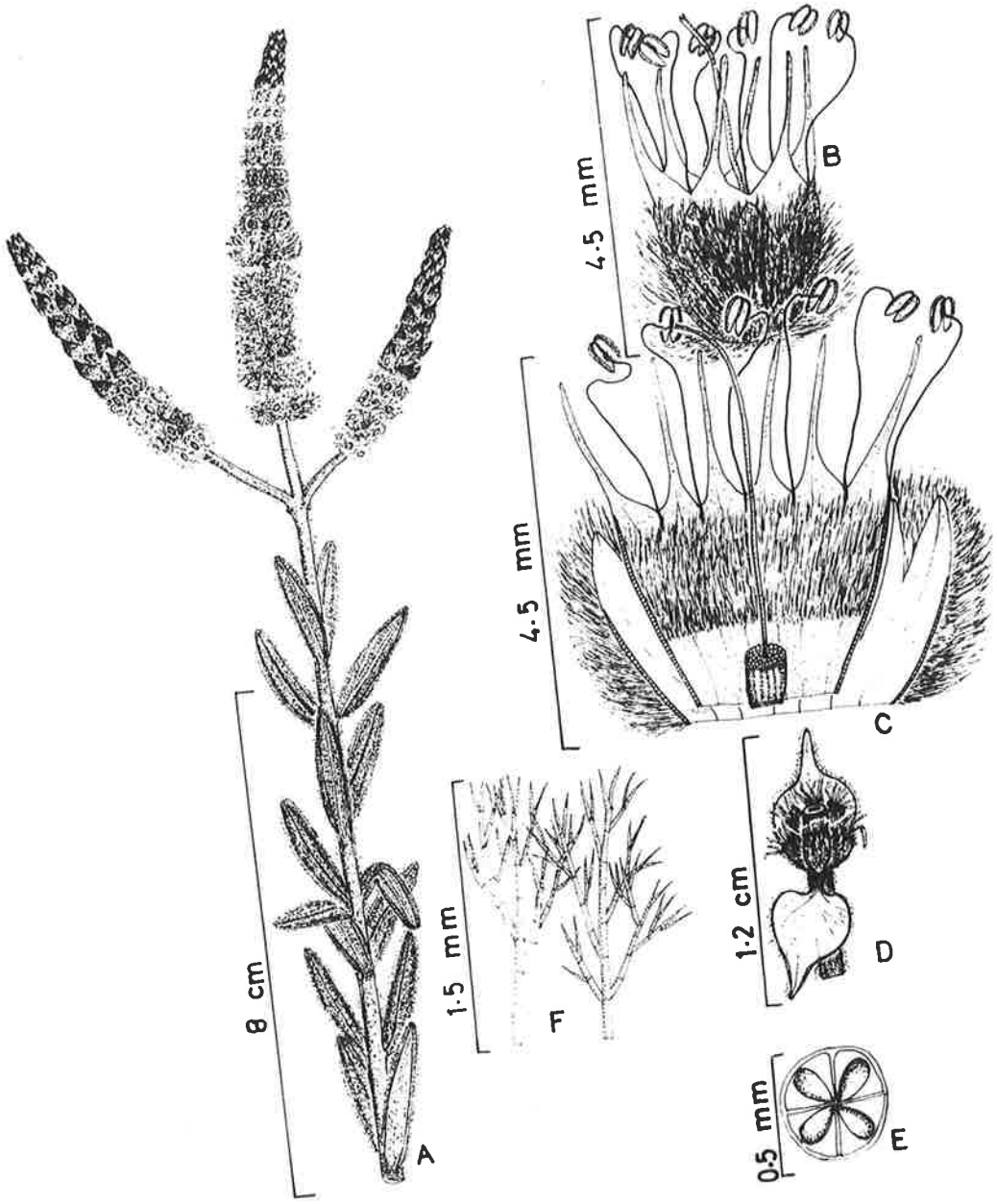


Fig. 36 — Newcastelia bracteosa F.v.M. (R.J. Rowlands s.n., MEL. 40986: MEL).

A, flowering twig; B, flower; C, flower vertically cut open; D, bracts showing 3 flowers in each axil; E, T.S. ovary; F, calyx tomentum.

Newcastelia hexarrhena F.v.Mueller, Fragm. 10 (1876) 16; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172.; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 502,503,505 pro parte; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,321; C.A.Gardner, Wildfls.W.Aust. (1959) 127,129; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 565; J.S.Beard, W.Aust.Pl.ed. 2, (1970) 114; M.Morcombe, Aust.Wildfls.(1970) 52; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,574; C.A.Gardner, Wildfls.W.Aust.ed.11, (1973) 118,119.

T y p u s:J.Young s.n.,MEL41024: between Victoria Spring and Ularing, Western Australia, - (MEL holotype).

Lachnostachys verbascifolia auct. non FvM.: C.A.Gardner, W.Aust. Wildfls.ed.4, (1943) 107; C.A.Gardner, W.Aust.Wildfls.ed.8,(1951) 107.

Description: (Fig. 37).

A woolly tomentose shrub, 0.30 - 1(-1.21) metres high, with the aspect of Lachnostachys verbascifolia FvM. Stem erect,branched, cylindrical, woody, densely clothed with greyish - woolly tomentum. Leaves decussate,sessile, lanceolate or oblong - lanceolate, with recurved margins, densely covered with greyish - woolly tomentum, 3 - 6 (-7) cm long, 0.8 - 1.5(-1.8) cm broad, ± 2 mm thick. Inflorescence terminal, spicate; spikes elongated, cylindrical, thick, very densely white woolly - tomentose, up to 14 cm long, 1 - 1.5 cm in diameter. Flowers 6 -merous, rarely 5 - or 7 -merous, bracteate, sessile, usually 3 in the axil of each bract, each 5 - 7(-7.5) mm long; bracts opposite, imbricate, caducous, ovate, distinctly stalked, 0.7 - 1 cm long (excluding stalk), 4 - 7 mm broad, distinctly reticulate, unicostate, densely tomentose outside, glabrous inside; stalk 2 - 3 mm long, glabrous. Calyx tubular, 6 -lobed towards the apex, concealed by the long white woolly tomentum on its outside, glabrous inside, 3.5 - 4.5(-5) mm long; hairs of tomentum much branched in the upper part, almost unbranched towards the base, up tc 6 mm long; lobes deltoid to ovate - acuminate, 1.5 - 2 mm long, 1 - 1.5 mm broad at the base; tube ± cylindrical, gradually broadening towards the apex, 2 - 2.5(-3.5) mm long. Corolla purple - lilac, ± campanulate, 6 -lobed towards the apex, glabrous outside, densely tomentose inside the tube, 6 - 6.5 mm long; lobes deltoid - ovate, acuminose, 1.5 - 2 mm long, 1 - 1.2 mm broad at the base; tube ± campanulate, much broader at the apex, 3 - 4(-4.5) mm long. Stamens 6, much exserted, inserted

in the corolla throat, emerging between the corolla - lobes; filaments filiform, glabrous, (1.8-)2- 2.5(-3) mm long; anthers dorsifixed, 2 - lobed; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, densely tomentose, glandular at the top, 4 -locular containing one ovule in each cell, ± 1 mm across: style much exserted, filiform. glabrous, (3.5-)4 - 6(-7) mm long; stigma minutely notched. Fruit globular, ± 2.5 mm across.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 4196: ca. 450 km north-north-east of Meekatharra, 6.VIII.1971 (AD).- R.Aitken & D.Hutchinson for W.H.Butler HA29:76 miles (east) from Sandstone, -VIII.1964 (PERTH).- J.S.Beard 2789: between Mundiwindi & Roy Hill, 14.VIII. 1963 (PERTH).- G.E.Brockway s.n.,CANB26644: north-east of Wiluna, 4.X.1947 (CANB,PERTH).- W.H.Butler s.n., Muggun Rock Hole, south-west of Warburton Mission, 4.XI.1965(PERTH).- W.H.Butler s.n.: Mt.Eveline, 50 miles east of Warburton Mission, 14.XI.1965 (PERTH).- R.J.Chinnock 664: 89.6 km east-north- east of Cosmo Newbery, 31. VIII.1973 (AD).- C.A.Gardner 2484: 43 miles east of Sandstone, 16.VIII.1931 (PERTH).- C.A.Gardner & Blackall 446: Black Range Hills, 45 miles east of Sandstone, 14.VIII.1931 (PERTH).-C.A.Gardner 13435: about 90 km east of Sandstone, 4.IX.1961 (PERTH-2 spec.) .- C.A.Gardner 14464: 120 km north of Sandstone, 23.X.1963 (PERTH) .- C.A.Gardner 19063: 65 km east of Wiluna, 21.X.1966 (PERTH).- C.A.Gardner s.n.: 48 km east of Sandstone, 25.X.1963 (PERTH-3spec).- C.A.Gardner s.n.: east of Murramunda, -(PERTH).- A.S.George 1000: 47 miles north of Mundiwindi, 23.VIII.1960 (PERTH).- A.S.George 5635: 32 miles south of Wiluna, 2.VII.1963 (PERTH).- A.S.George 8011: 19 miles east of Sandstone, 13.IX.1966 (PERTH).- A.S.George 8109: 24 miles east of Cosmo Newbery Mission on Warburton Road, 28.IX.1966 (PERTH).- A.S.George 8691: 39 miles east of Cosmo Newbery on Warburton Rd., 13.VII.1967 (PERTH).- G.F.Melville 34: Rabbit Proof Fence, south of Wiluna, -VII.1937 (K,PERTH).- T.Muir for A.M.Ashby 3553: ca. 50 km east of Carnegie Homestead, 2 - 14. VIII.1970 (AD).- A.A.Munir 5219: 155 km south-west of Warburton Mission, 31.VIII.1973 (AD).- A.A.Munir 5226: 400 km south-west of Warburton Mission, 31.VIII.1973(AD).- N.H.Speck 825: 31 miles north of Wiluna, 15.IX.1957 (CANB).- N.H.Speck 831: 30 miles north of Wiluna, 15.IX.1957 (CANB,MO,PERTH).- N.H.Speck 1202: 12 miles south of Cunyu, 12.VIII.1958 (AD,BRI,CANB,MEL,MO,NSW,PERTH;US-" Dicrastylis flexuosa (Price) Gardner, varified by H.N.Moldenke and cited by him in his Monograph of the genus, April, 1966".).-

J.Young s.n.,MEL41024: between Victoria Spring and Ularing,- (MEL holotype).

Distribution: (Map 13).

This species is recorded from the dry eremaean parts of Western Australia. The known distribution is mainly in the Eastern Division where it has been recorde chiefly from east of Sandstone, north of Wiluna and Mundiwindi. One locality is to the north-east of Kalgoorlie between Queen Victoria Springs and Ularing and one each to the east of Carnegie Homestead and Warburton Mission. The writer has collected it from north-east of Laverton along Cosmo Newbery - Warburton road.

E c o l o g y:

As is true of other species of Newcastelia, N.hexarrhena seems to occur chiefly in dry sandy soil of spinifex country. The plant is a much branched woolly shrub with densely tomentose thick leaves and white - woolly cylindrical spikes, popularly known "Lambs' Tails". Corolla is violet - mauve and often concealed within the long woolly calyx - tomentum. According to Gardner 2484 (PERTH), from 43 miles east of Sandstone, it grows in "red sandy soil" and has " lilac corolla". George 1000 (PERTH), 47 m. N. of Mundiwindi is annotated as "Shrub ± 70 cm. Fls. purple". The ahbitat is noted "red sand with Triodia sp." One of his subsequent collections no.8109 (PERTH), from 24 miles east of Cosmo Newbery is recorded as "shrub 1 metre.Fls.purple, sweetly scented", growing "in sand with spinifex - mallee steppe".Melville s.n. (PERTH), from south of Wiluna is noted to occur in "Spinifex Plain". Speck 1202: (AD,BRI,CANB,MEL,MO,NSW,PERTH,US), from 12 miles south of Cunyu is recorded to grow in "spinifex sandplain (after a burn)".

The present author has also found it growing in sandy soil along Cosmo Newbery Warburton road. Its association at two different localities was mainly with Acacia, Cassia, Dicrastylis doranii, Eremophila, Grevillea, Hakea, Ptilotus and Triodia species. The average size of plants is up to one metre tall, but very rarely they exceed this height.

Flowering and fruiting seem to take place generally from July to October.

C o m m e n t s:

N.hexarrhena has apparently so close a resemblance to Lachnostachys verbascifolia FvM. that without examining the flowers

one can be easily mistaken for the latter. A coloured plate of N.hexarrhena was erroneously identified by Gardner (1951) as L.verbascifolia FvM.; subsequently, however, the same plate was reproduced in 1959, and was correctly labelled and identified by him as N.hexarrhena FvM.

Diels & Pritzel (1904) recorded Young's collection from Victoria Springs under this species, which in fact belongs to the closely related N.bracteosa FvM.. Young's collection of N.hexarrhena (no.MEL41024) is the holotype of this species, and was gathered before 1876 from between Victoria Springs and Ularing. This seems to be the first collection of this species and since then it has not been recorded from the type locality.

Among all the known species of Newcastelia, the tomentum hairs of the calyx in N.hexarrhena are the largest of all, measuring upto 6 cm in length. These hairs are very dense and fluffy, with a long simple (unbranched) basal part and a much - branched upper half.

Relationship:

N.hexarrhena is closely related to N.bracteosa in having woolly - tomentose thick leaves with recurved margins, elongated terminal spikes, usually 6 -merous flowers, purple - violet corolla, exserted stamens and style and ± stalked flower - bracts. However, N.hexarrhena may be easily identified by its leaves being much thicker and larger than other closely related species of Newcastelia (measuring 3 - 7 by 0.8 - 1.5 cm); spikes longer, thicker and more woolly, measuring upto 13 cm by 1 - 1.5 cm; corolla - lobes deltoid - ovate, acuminose; ovary tomentose all over with glands at the top.

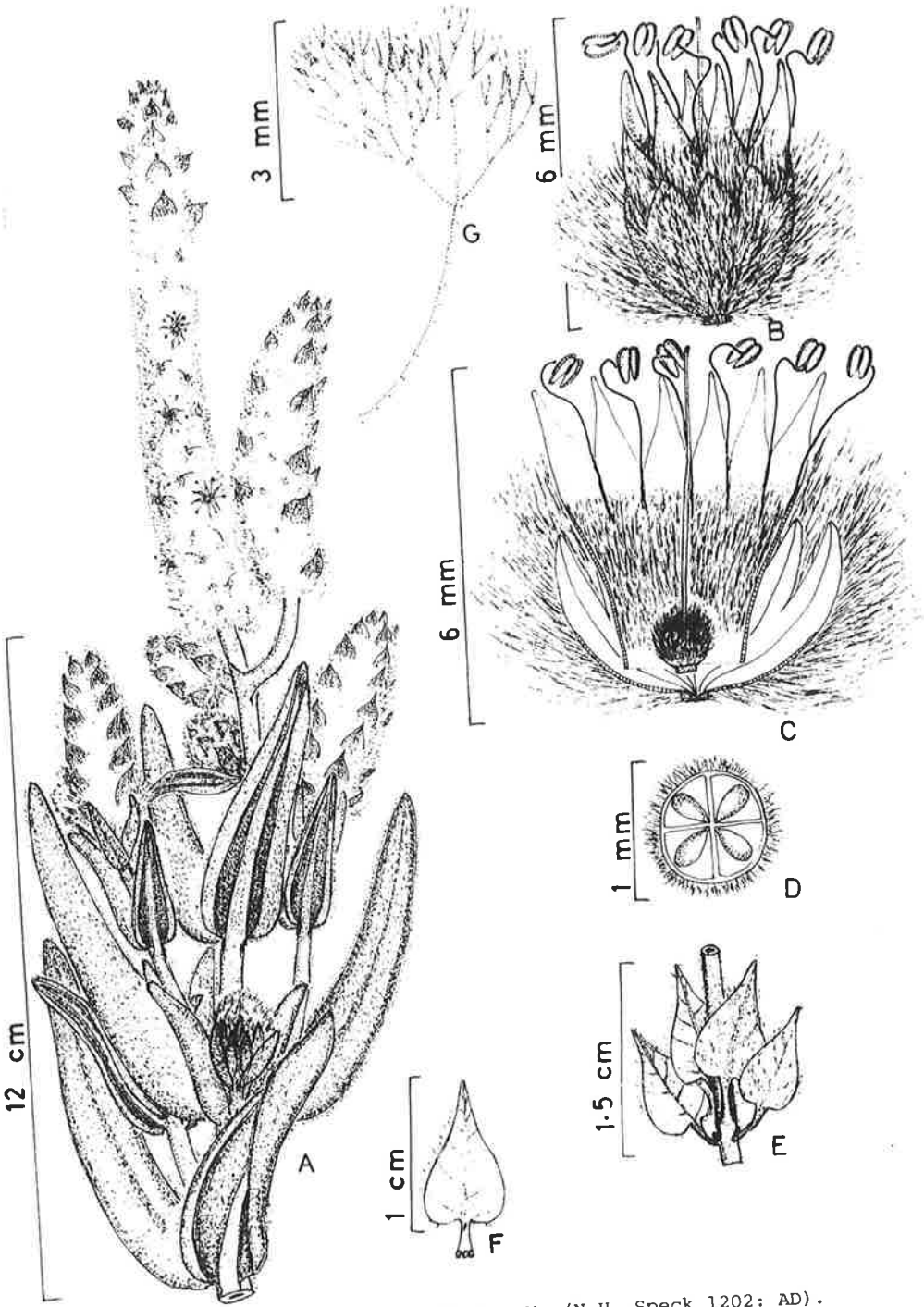


Fig. 37 — Newcastelia hexarrhena F.v.M. (N.H. Speck 1202: AD). A, flowering branch; B, flower; C, flower vertically cut open; D, T.S. ovary; E, bracts arrangement; F, bract viewed from inside showing 3 scars near the base left by the removed flowers; G, calyx-tomentum.

Newcastelia spodiotricha F.v.Mueller, Fragm.3 (1862) 21,t.21; G.Bentham,Fl.Aust.5 (1870) 40; F.v.Mueller, Fragm.8 (1873) 230; F.v.Mueller,Fragm.9 (1875) 4; R.Tate, Trans.R.Soc.S.Aust.3 (1880) 78; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; H.Kempe, Trans.R.Soc. S.Aust.5 (1882) 22; C.Winnecke,Trans.R.Soc.S.Aust.8(1886) 13; F.v.Mueller & R.Tate, Trans.R.Soc.S.Aust.10 (1888) 81; R.Tate, Trans.R.Soc.S.Aust.11 (1889) 98;R.Tate, Trans.R.Soc.S.Aust.12 (1889) 113; F.v.Mueller, Se.Cens.Aust.Pl.1 (1889) 172; E.Giles, Aust.Twice Trav.2 (1889) 355; R.Tate, Fl.Extra-Tropic.S.Aust.(1890) 155,254; F.v.Mueller & R.Tate, Trans.R.Soc.S.Aust.16 (1896) 375; R.Tate, Horn Exped.Bot. (1896) 174; J.Briquet, Engl. & Prantl. Pflanzenfam.IV,3a (1895) 164, in obs.;L.Diels & E.Pritzel,Bot. Jahrb.Syst.35 (1904) 503,506; J.M.Black, Trans.R.Soc.S.Aust. 38 (1914)468; A.J.Ewart & O.B.Davies, Fl.N.T. (1917) 237; J.M.Bl ack, Fl.S.Aust.ed.1, (1926) 480; C.A.Gardner, Enum.Pl.Aust.Occ.3(1931) 111; C.M.Eardley, Trans.R.Soc.S.Aust.70 (1946) 169; J.M.Black, Fl.S.Aust.ed.2,(1957) 722,fig.1032; G.Chippendale, Trans.R.Soc.S. Aust.82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc.(1959) 209, 321; J.S.Beard, W.Aust.Pl.(1965) 92; D.E.Symon,Trans.R.Soc.S.Aust. 93 (1969) 33; J.S.Beard, W.Aust.Pl.ed.2,(1970) 114; H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347,366,574; G.Chippendale, Proc.Linn.Soc.NSW. 96 (1972) 256.

T y p u s: J.McDouall Stuart s.n.,MEL41041: between Victoria River and Gulf of Carpentaria, latitude 17.30 to 18.30 degrees,Northern Territory, probably 1860 or 1861 (MEL holotype;K).

Dicrastylis doranii auct. non FvM.:R.Tate, Horn Exped.Bot. (1896) 174, p.p.- (quoad spec.Tate s.n.,AD97113061: Eagle Plains -AD).

Description: (Fig. 38).

Erect grey shrub, 1 - 2 metres high, clothed with a rather short and dense branched tomentum. Stem branched, cylindrical, woody, densely grey - tomentose. Leaves decussate, sessile or very shortly petiolate, broadly ovate or somewhat oblong - ovate,entire, obtuse, 3 - 5(-6.5) cm long, 1.2 - 2.5(-3) cm broad, densely clothed with whitish - grey short tomentum, conspicuously reticulate underneath; margins often very broadly revolute; petiole short,2 - 4 mm long, densely tomentose. Inflorescence terminal, spicate, with 1 to 3 lateral pairs of spikes towards the base; spikes ± cylindrical, greyish - tomentose, 3 - 6(-8.5) cm long, 1 - 1.5 cm in diameter. Flowers 5 -merous, greyish - blue, bracteate, sessile or sometimes very shortly pedicellate, 6 - 8 mm long, often three in the axil of each deciduous bract and two minute

(deciduous) lateral bracteoles; pedicels short, 1 - 2 mm long; bracts decussate, very early caducous, shortly stalked, broadly elliptic - orbicular, 5 - 5.5 mm long, nearly as broad, distinctly reticulate and glabrous inside, densely tomentose outside, with often interspersed minute white glands and distinct brown spots concealed by the tomentum. Calyx tubular, 5 -lobed at the apex, 3.5 - 4.5 mm long, glandular and densely short tomentose outside, glabrous inside; lobes ± deltoid, obtuse, 1 - 1.5(-2) mm long, ± 1 mm broad at the base; tube ± cylindrical, 2.5 - 3 mm long. Corolla blue, tubular, 5 -lobed at the apex, glabrous outside, very densely (long) tomentose in the throat, 6 - 7(-8) mm long; lobes glabrous, narrow acuminate, about as long as the tube, (2.5-)3 - 3.5(-4) mm long; tube ± cylindrical below, gradually broader towards the apex, 3.3 - 3.5(-4) mm long. Stamens 5, much exserted, inserted at the summit of the corolla -tube between the lobes; filaments filiform, glabrous, 2.5 - 3 mm long; anthers dorsifixed, oblong, 2 -lobed, 0.6 - 1 mm long, pale - brown; lobes free in the lower halves, longitudinally dehiscent. Ovary ±globose, glabrous, densely glandular, 0.8 - 1(-1.5) mm across, 4 -locular with one pendulous ovule in each cell; style much exserted, filiform, 5 - 6.5(-7) mm long, glabrous; stigma very shortly notched or almost entire. Fruit obovoid - globose, glabrous, sparsely glandular, 2.5 - 3 mm across, often 1 - seeded.

Specimens examined;

QUEENSLAND:- Kayser 17: Eyre's Creek,-(MEL).- L.Cockburn BPS13: N.E. section of Simpson Desert, -VII.to VIII. 1969 (BRI).

SOUTH AUSTRALIA:- G.C.Cornwall 231: S.W. corner of Everard Park Stn., 5.VI.1972(AD).- G.C.Cornwall 240: ca.10 km east-north-east of Purni Bore, Simpson Desert, 11.VI.1972 (AD).- R.Helms s.n., MEL41030: Elder Expl.Exped.C.22, near Pernamo Hill, N.W. Birksgate Range, 16.VII.1891 (MEL).- W.S.Reid s.n.,ADW33957: N. of Emu, Spanners Hwy, 250 km N.Watson, 26.VI.1967 (ADW).- R.Schomburgk 242: Centre of S.Australia, loc.incert., -V.1874 (K).

NORTHERN TERRITORY:- G.H.Allen 678: S. of Renner Springs, 22.VII.1922 (K-2 spec.,NSW).- A.W.Banks 2436: Tanami area, -VII. 1948 (NT).- A.C.Beauglehole 10230: between Curtin Springs and Ayer's Rock, 30.VI.1965 (NT).- A.C.Beauglehole 10610: 15 m. S. of Barrow Creek, Stuart's Highway, 15.VII.1965 (NT).-A.C.Beauglehole 27852:Simpson Desert, 57 m. N.N.W. Old Andado Homestead,27.VII. 1968 (NT).- W.H.Butler 102:Willis Rock, ± 30 m. east Sandy Blight Junction, -V.1967 (PERTH).- W.H.Butler s.n.: Mt.Olga,-III.1967 (PERTH).-NByrnes 1156: 10m. nth Wauchope, 23.XI.1968 (NT).-

N.Byrnes 1159: 10 m. south Elliott, 24.XI.1968 (NT).- Carter & Botemon 35:AD97116000 & AD97116001: 40 m. N.E. of Ayer's Rock, 15.V.1951 (AD).- C.M.Chalmers 2: MacDonald Downs Stn., 150 m. N.E. Alice Springs, -XII.1968 (AD).- G.Chippendale 134: 15 m. S.W. Santa Teresa Mission, 4.VIII.1954 (AD,CANB,NSW,NT).-G.Chippendale 491:33 m. S.W. Alice Springs, 11.XI.1954 (BRI,CANB,MEL,NSW,NT, PERTH).- G.Chippendale 608: 5 m. N.Clunga Well, Angas Downs, 24. XI.1954 (CANB,MEL,NSW,NT).- G.Chippendale 2300: 81 m. S. Hooker's Creek Settlement, 13.VII.1956 (NT).- G.Chippendale 3354: about 70 m. W.N.W. Mt.Singleton, 13.VI.1957 (AD,NSW,NT,PERTH).- G.Chippendale NT3756: 8.5 m. S. of Elliott, 11.IX.1957 (AD,BRI, CANB,MEL,NSW,NT,PERTH).- G.Chippendale 4641: 7 $\frac{1}{2}$ m. W.Shaw River, Petermann Ranges area, 24.VI.1958 (NSW,NT).- G.Chippendale 5341: 5 m. S. Central Mt.Wedge HS., 7.11.1955 (CANB,NT).-G.Chippendale 6358:13 m. N. Lake Amadeus, 28.VI.1959 (AD,NT).- J.B.Cleland s.n., AD966071163: between Petermann Ranges and Mt.Olga, 29.VI.1958(AD). J.B.Cleland s.n.,AD95811072: between Middleton Ponds and Liddle's S.W. Alice Springs, 7.VI.1935 (AD,NT).- J.B.Cleland s.n., AD97205184: loc.cit. 7.VI.1935 - pro parte (AD).- J.B.Cleland s.n.,AD95920075: Mary Vale, on main Adelaide - Alice Springs railway, 8.1.1927 (AD).- L.Cockburn BPS13: Lilla Creek and Tanami -VII. to VIII.1969 (BRI).- L.Crocker s.n.,AD97113046: Simpson Desert Exped. loc.incert., -1939 (AD).- Culvenor 351: 50 m. N. Renner Springs, 9.V.1963 (NT).- Dittrich s.n.,AD97113062: between Eva Downs and Ashburton Range, -VII.1886 (AD).- C.Dunlop 2313: 1 m. E. Camel W.H., Tanami Range, 12.IX.1971 (AD,NT)*.- A.J.Ewart s.n.,MEL40823: between Horse Shoe Bend & Wycliffe, -VI.1924 (MEL). H.Finlayson s.n.,AD97205185: Hills 7 miles N. of Meteorite, near Henbury, Finke River, -XII.1934 (AD).-,N.Forde 696: 4 miles N. Wauchope, 8.XI.1956 (CANB,MEL,NT).- N.Forde 697: loc.cit., 8.XI. 1956 (NSW,NT).- C.A.Gardner 11595: near no. 3 bore, Dashwood Creek, Narwietooma, 10.111.1953 (MEL,NT,PERTH).- E.Giles s.n., MEL41034: W.Aust.Exped.Camp.12 to 14, W. of MacDonnell Ranges, N.E. of Gardiner Range, -1872 (MEL).- Hill 433: N.T. Survey, lat. 19°, 4.VII.1911 (MEL).- Holtze s.n.: Powell Creek, -1895 (P).- Holtze 1380:MEL41032: Powell Creek, -1897 (MEL).- H.A.Johnson 4043: Wycliffe Well, about 230 m. N. Alice Springs, 3.VI.1957 (NSW,NT).- H.A.Johnson 11766: about 107 m. W. of Muckety HS., long. 132.29° Lat. 18.30° , 2.VI.1965 (NT).- H.Kempe s.n.,MEL41033,MEL41038: Finke River, -1880 (MEL).- H.Kempe 341,MEL40821: Finke River, -(MEL).- A.A.Munir 5089: 25 km N.E. Mulga Park Homestead,21.VIII. 1973 (AD).- T.R.N.Lothian 684: 20 m. E. Deep Well, 75 km S. Alice Springs, -1954(AD).- T.R.N.Lothian 4531: Chambers Pillar, ca.130

km S. of Alice Springs, 23.VII.1968 (AD).- J.R.Maconochie 416: 26 m. S.Tennant Creek,27.VII.1967 (AD,MEL,NT).- J.R.Maconochie 497: 15 m. N.Andado, 15.XI.1967 (AD,NT).- J.R.Maconochie 733: 15 m. S. Elliott, 30.VII.1969 (NT).- J.R.Maconochie 926: 1 m. W. False Mt.Russell, 2.VIII.1970 (AD,NT).- J.McDouall Stuart s.n.: between Victoria River and Gulf of Carpentaria, lat.17.30 to 18.30 degrees (MEL holotype;K isotype).- J.Must 254: 30m. S. Tennant Creek, Stuart Highway, 20.VII.1968 (AD,NT).- D.J.Nelson 1799: Deep Well Road, 19 m. S. Alice Springs, 6.XII.1968 (AD,MEL,NT).- D.J.Nelson & R.Swinbourne NT11795: 13 m. N.W. Numagalong HS., 26.VIII.1965 (AD,MEL,NSW,NT).- Officer 78: S. of Tanami, 24.VII. 1928 (MEL).- R.A.Perry 294: 6.5 m. S. of Elliott, 19.VII.1947 (CANB).- R.A.Perry 1897: 20 miles N. of Helen Springs Stn., 15. VIII.1948 (CANB,MEL,NSW,NT,PERTH,US).- Pink 64: between Newcastle Waters and Daly Waters, 25.IX.1930 (AD).- Rose s.n., BRI113967: about 2 m. N. Taylors Well, 15.111.1948 (BRI).- W.Rose 192:Tanami, -(CANB).- D.E.Symon 72: 6 mile post River Palmer on road to Ayer's Rock from Henbury, 10.VI.1953 (ADW).- D.E.Symon 4393: Amerada Petroleum Corporation, No.1 Hale River, Lat. 25.15° , Long. 136.43° ,2.XI.1966 (ADW).- R.Tate s.n., AD97113061: Wild Eagle Plains near Palmer River, - 1894 (AD).- R.Tate s.n., AD97205184: loc.cit. - 1894 - proparte (AD).- R.F.Thornton s.n.,MEL41035: Temple Downs, - 1888 (MEL).- R.F.Thornton s.n.,MEL41039: loc.cit. - XII.1889 (MEL).-Trapnell 138: 5 m. S. of Elliott, 19.VII.1958 (BRI).- H. & E.Walter s.n.,BRI085113A: 19°. 40' S., 134°. 12' E; Tennant Creek, 28.X.1958 (BRI).- H.& E.Walter 3385: 10 - 15 miles south-east of Alice Springs, 26.X.1958 (B).- J.Z.Weber 1053: ca. 50 km S. of Tennant Creek, Stuart Highway, 20.VII.1968 (AD).- S.A.White s.n., AD97205177: Depot Sandhill, near Finke River, 26.IX.1913 (AD).- R.E.Winkworth 51: 12 m. S. of Tempe Downs HS., 1.III.1954 (BRI,CANB,NT,PERTH).- R.E.Winkworth 746: 27 m. S.W. of Alice Springs, 23.XI.1954 (NT).- R.E.Winkworth 844: 14 m. W.N.W. of Narwietooma HS., 7.II.1955 (BRI,CANB,NT,PERTH).- C.Winnecke s.n.,MEL41025: loc.incert., - 1883 (MEL).- C.Winnecke 7,MEL41036: loc.incert, Central Aust., -1883 (MEL).

WESTERN AUSTRALIA:- J.S.Beard 5562: between Billiluna and Balgo, 20.VI.1968 (PERTH).- Fitzroy s.n.: desert of Fitzroy River, -IX.1906 (NSW).- A.S.George 8215: ± 22 miles N. of T-junction on Gunbarrel Hwy., N. of Warburton, 2.X.1966 (PERTH).- A.S.George 8372: 21 miles W. of Warburton Mission, 9.X.1966 (PERTH).- A.S. George 8877: South of Walter James Range, - 128° 46' E, 24° 43' S, 23.VII.1967 (PERTH).- A.S.George 9155: 19 miles W. of Swindells Field, Great Sandy Desert, 31.VII.1967 (PERTH).- E.Giles s.n.,

MEL41028: Rawlinson Range, - (MEL).- E.Giles s.n.,MEL41029: between the Alfred - Marie Range and Rawlinson Range,-(MEL).- E.Giles s.n.,MEL41026: near Mt.Everard, - 1882 (MEL).- J.N. Hutchinson 19: on road between Hall Creek and Balgo Hill Stn., 11.VI.1968 (PERTH).- M.Lazarides 6539: 21 miles S.W. of Luluigul Station, Kimberleys, 15.IX.1959 (CANB,MEL,NSW,PERTH,US).- R.Morland s.n., Land and Survey Exped. C.5: from Officer Basin, -VI.1963 (PERTH).- R.Morland s.n.,Land and Survey Exped. H 15: loc.cit., -VI.1963 (PERTH).- A.A.Munir 5189:35 km south of the turnoff of Giles Met.Stn. & Warburton Mission, 27.VIII.1973 (AD).- J.Staer s.n.: Fitzroy River, -IX.1905 (E).- M.Terry s.n.: near South Esk Tablelands, -1925 (PERTH).- E.H.Wilson 20: Well 15, Canning Stock Route, 20.IX.1940 (PERTH).- E.H.Wilson 22: between no. 6 & 7 Wells, Canning Stock Route, 21.IX.1942 (PERTH).- *C.Dunlop 2370: Yuendumu Reserve, 22° 34' S,131° 33' E,13.I.1972 (AD,NT).

Distribution:(Map 14).

N.spodiotricha is known to occur in South Australia, Western Australia, Northern Territory and adjacent dry eremean parts of Queensland. In South Australia, it has been collected from the far north-west around Birksgate Range, Everard Range and near Emu Junction. From the remote north-north-east it is recorded near Purni Bore in the Simpson Desert. In Queensland, it is known to grow near Eyre's Creek along the eastern border of Simpson Desert. The distribution in Western Australia is somewhat sparse and is chiefly in the Eastern Division and Kimberley Division. Collections from the Eastern Division have been made from south of Alfred and Marie Ranges, around Rawlinson Ranges and to the south of Hall Creek between Billiluna and Balgo Mission. It occurs along the Canning Stock Route from near the Well numbers 6,7 and 15. One locality in the Great Sandy Desert is west of Swindells Field; two in Kimberley are recorded from near the Fitzroy River and Luluigul Station. The present author has collected it from ± 35 km north of Mt.Fanny along the Gunbarrel Highway.

Northern Territory localities are mainly in the southerm half and along Stuart Highway towards the north. Only a few localties are known on the eastern side of Adelaide - Alice Springs Railway line and Stuart's Highway, and none from inside the Tanami Desert. In the south, it is chiefly in and around MacDonnell Ranges and towards their southern and south-western areas. Along Stuart's Highway, it is commonly found between Alice Springs and Daly Waters. The southern localities extend eastwards to Andado and Hale River along the western fringe of the Simpson Desert and

south-westwards they spread to the Petermann Ranges. Collections from the north-west of Alice Springs are mostly from around Narwietooma, Central Mt.Wedge, N. of Mt.Singleton, near Tanami, south of Hooker's Creek and west of Muckety Homestead.

E c o l o g y:

This species occurs chiefly in sandy or sandy – stony dry plains mostly along the roads or in somewhat disturbed soil. The plant body is a medium sized brnached shrub covered all over with branched grey tomentum. Leaves are large and soft with revolute margins and inflorescence is of terminal cylindrical spikes with blue flowers. According to collector's field notes, it often grows in spinifex country with other shrubs. Chippendale 134 (AD,CANB, NSW,NT), from 15 miles S.W. Santa Teresa Mission is annotated as " Grey shrub, 5' - 6' high, on Sand knoll". His subsequent collections, nos.: 419 (BRI,CANB,MEL,NSW,NT,PERTH), 33 m. S.W. Alice Springs; 608 (CANB,MEL,NSW,NT), from N.Olunga Well; 2300 (NT), from Hook.Ck.Settlement;3354(AD,NSW,NT,PERTH), W.N.W. Mt. Singleton; NT3756 (AD,BRI,CANB,MEL,NSW,NT,PERTH), S. of Elliott; 4641 (NSW,NT), from Petermann Ranges; 534 (CANB,NT), from S. of Central Mt.Wedge and 6358 (AD,NT), from 13 miles N. Lake Amadeus, are invariably recorded as grey or glaucous shrub of 2 to 5 feet high with grey leaves and blue flowers. The habitat is noted as red sand dunes or ridges, on roadside in gravelly sand or sometimes in a slight hollow between low ridges. Ford 696 (CANB,MEL, NT), from 4 m. N. Wauchope are noted as "shrub 1.3 m. tall with pale blue flowers. On a stony rise with Plectrachne and Acacia shrubs". Lothian 684 (AD), from 20 miles east of Deep Well is reported as "White tomentose shrub 4' - 6'. Leaves linear - lanceolate 2" - 4". Red sand dune". Maconochie 416 (AD,MEL,NT), from 26 miles south of Tennant Creek is noted as "shrub to 6' high with blue flowers clustered on cylindrical spikes, leaves with recurved margin. Growing on stony - sandy plain with spinifex shrubs". His subsequent collections 497 (AD,NT), N. of Andado is annotated "growing on W. slope of sand dune, generally absent on E.slope; Large - leaved shrub, perennial, to 3 ft high"; 733 (NT), 15 m. S. Elliott is recorded as "blue flowered, greyish - white leaved shrub to 3 ft high. Growing in Eucalyptus - Acacia scrub on skeletal soils." Yet another collection of his 926 (AD,NT), from 1 mile west False Mt.Russell is recorded to grow "on spinifex sand plain". Must 254 (AD,NT), S. of Tennant Creek, is also noted as "shrub to 3 ft high, blue flowers, woolly grey - green leaves. Growing on sandy spinifex plain". Nelson 1799 (AD,MEL,NT), from

Deep Well, S.Alice Springs is annotated as "Herbaceous shrub, 6' high, leaves soft, grey, furry, flowers pale blue. Scattered on red sand hill with Triodia spp." Perry 1897 (CANB,MEL,NSW,NT,PERTH), 20 miles north of Helen Springs Stn. is noted as "Spreading grey shrub 2 ft. high. Flowers light blue." The plant is recorded as growing"with Eucalyptus terminalis on deep red sandy soil". Winkwath 51 (BRI,CANB,NT,PERTH), from 21 miles S. of Temple Downs Homestead is recorded to grow " on sand dunes with Casuarina decaisneana and Triodia spp." According to Lazarides 6539 (CANB, MEL,NSW,PERTH), from 21 miles S.W. of Luluigul Station, Kimberleys, it is a "Robust undershrub to 2 ft high with thick leaves, white buds and mauve flowers. Leaves sweetly aromatic when crushed". Regarding the habitat, it is reported to be "Common in recently burnt area, on deep, red, loamy fine sand on dune with Eucalyptus zygophylla, Acacia stipuligera and Triodia pungens". According to the writer's field observations, it is a densely grey - tomentose shrub of up to 2 metres tall with branches spreading from the base, and leaves almost always revolute along the margins. The habitat is sandy soil where it is found associated with Acacia, Dicrastylis doranii,D.gilesii, Grevillea, Triodia amd Thryptomene species.

Flowering and fruiting seem to take place chiefly during October - December, but there are scattered occurrences in March, May and June.

C o m m e n t s:

Among all the known species of this genus, N.spodiotricha has the largest leaves of all, measuring 3 - 5(-6.5) by 1.2 - 2.5 (-3) cm. The only other species with large leaves is N.hexarrhena where the leaves are nearly as long as this species, but their average breadth is smaller, 0.8 - 1.5 cm only. In the original description of this species, the specific epithet is spodiotricha but the plate accompanying the protologue is spelled as "spodotricha". The latter seems to be the typographic error,because in all subsequent records of this species, the author F.v.Mueller maintained the spelling that he used in the original description.

The holotype was collected by John McDouall Stuart from between Victoria River and the Gulf of Carpentaria latitude 17.30 to 18.30 degrees south, the exact type locality is not recorded. McDouall Stuart, the famous explorer, was in this region in both 1860 and 1861 making his first two unsuccessful attempts to cross Australia from south to north, (success came only at the third attempt in 1862). It seems probable that the type locality is in the zone between Tennant Creek and Newcastle Waters. The existing

records of the distribution of this species " between Victoria River and the Gulf of Carpentaria" are known only along the Stuart Highway between Powell Creek and Daly Waters. It is possible, therefore, that the type locality maybe somewhere along this part of the Highway, (perhaps near Elliott).

Gile's collection no.MEL41026(MEL) was gathered in 1882 from "Mt. Everard" but a locality by the name of Mt.Everard is found in Northern Territory, South Australia and in Western Australia. To which of these mountains Gile's collection belongs is not known. In Northern Territory, the above named mountain is located to the north of Alice Springs within MacDonnell Ranges and in South Australia it is in Musgrave Ranges. The West Australian "Mt.Everard" is to the south of Alfred and Marie Ranges which is west of Rawlinson Range. According to known distribution, so far this species has not been recorded from Musgrave Ranges in South Australia, but is common in MacDonnell Ranges in Northern Territory and has also been collected from the south of Alfred and Marie Ranges in Western Australia. From these records, it appears that this specimen may have come either from MacDonnell Ranges in Northern Territory or from south of Alfred and Marie Ranges in Western Australia. Since this collection was made much after Gile's (last) Expedition in 1876, therfore, it is possible that either it was collected (by Giles) from south of Alfred and Marie Ranges on a private collecting trip when latterly he lived at Coolgardie in Western Australia, or that the year "1882" on the herbarium sheet was erroneously written by F.v.Mueller instead of some earlier date. In the latter case, the collection may have come from the Mt.Everard in MacDonnell Ranges, Northern Territory.

Winnecke collected this species from "Central Australia" in the year 1883, it is now preserved in Herb.MEL under the numbers MEL41025 & MEL41036. The exact locality of these occurrences is also not given with the specimens, but in Winnecke's paper [in Trans.R.Soc.S.Aust.8 (1886) 13], these specimens along with the others are reported to have been collected from between latitude 22° 30' and 28° S, and longitude 136 30' and 139 30' E. This covers the whole of Simpson Desert, and some adjacent parts of Northern Territory, Queensland and South Australia. Within this area, N.spodiotricha is known to grow only around Andado Homestead and Hale River in Northern Territory and Eyre's Creek in Queensland. These localities are situated along the western and eastern borders of Simpson Desert. This distribution indicates, that Winnecke's collections within the above specified area may have come from any of these localities.

Chippendale's collection no.464(NT) is noted to have come from " 7 $\frac{1}{2}$m. W. of Shaw River, Petermann's Ranges, N.T.", but in Petermann Ranges there is a Shaw Creek and not Shaw River. It appears , that the collector has by mistake named Shaw Creek as Shaw River; the latter is in the north-western part of Western Australia where this species is not known to occur.

Relationship:

Among the taxa having an elongated spike like inflorescence, this species is very close to N.elliptica in its stamens and style being exserted; ovary not tomentose; flower - bracts sessile and very early caducous and the primary lateral veins and midrib quite distinct on the undersurface of leaves. However, N.spodiotricha may be easily distinguished by its leaves being much larger [measuring 3 - 5(-6.5) by 1.2 - 2.5(-3) cm], shortly petiolate; calyx - tomentum very short and ovary glandular all over. The ovary in N.elliptica is glandular at the top only.

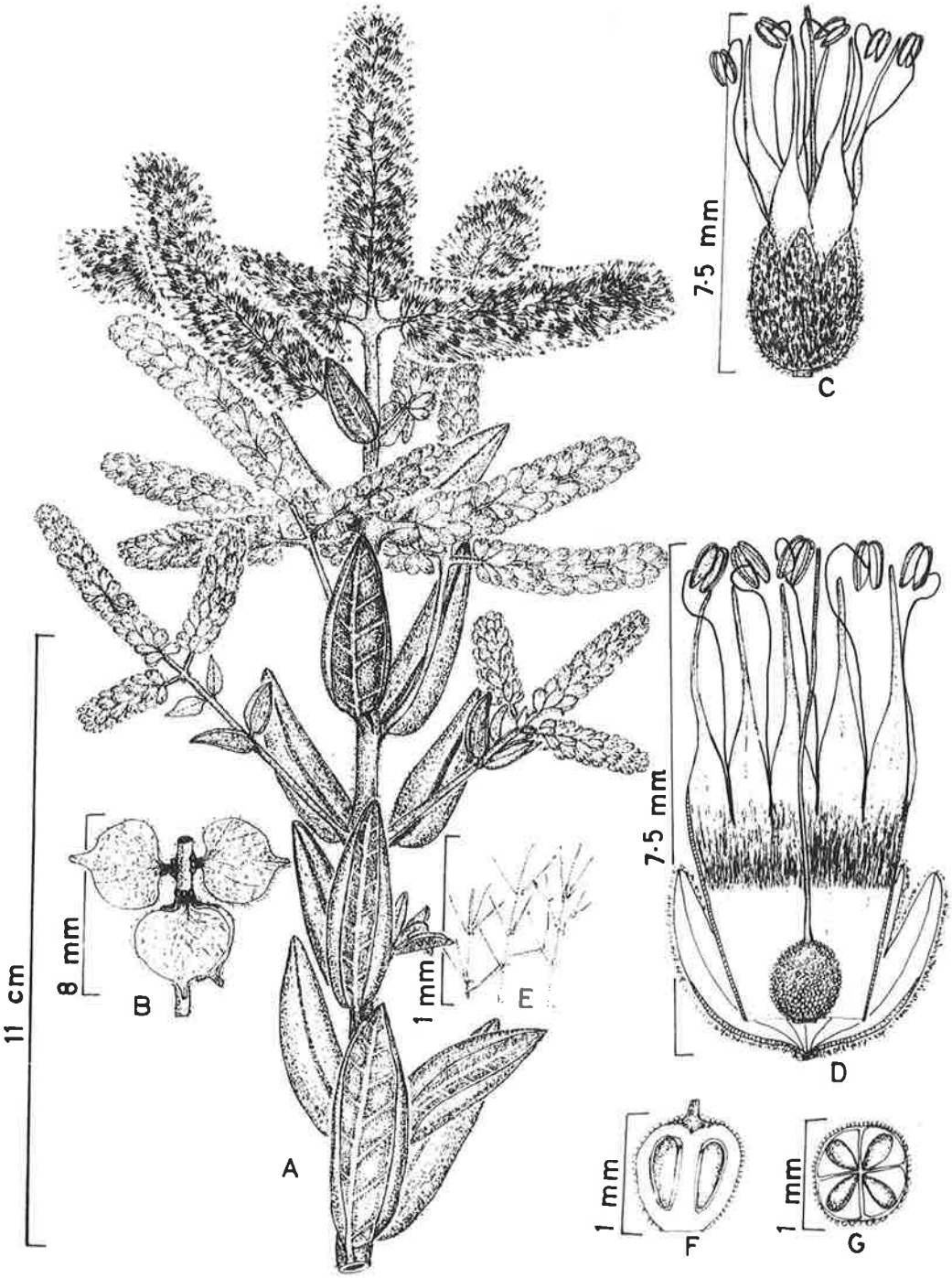


Fig. 38 — Newcastelia spodiotricha F.v.M. (A and C - G, D.J. Nelson 1799: AD; B, J.R. Maconochie 926: AD).
A, flowering branch; B, bracts showing 3 scars in each axil left by the removed flowers; C, flower; D, flower longitudinally cut open; E, tomentum from corolla-throat; F, L.S. ovary; G, T.S. ovary.

Newcastelia elliptica Munir, sp. nov.

Frutex tomentosus; folia decussata sessilia elliptico - oblonga vel elliptico - lanceolata fere plana margine haud vel leviter recurva/tomento cinereo omnino vestita; flores conferti spicam elongatam formantes; bracteae sessiles caducae; stamina cum stylo exserta; ovarium glabrum non nisi ad spicem glandulosum.

Quoad spicam elongatam et stamina cum stylo exserta ad N. bracteosam et N. hexarrhenam accedit sed ob folia tenuia tomento brevi bracteas sessiles et calycem pilosum facile distinguitur; etiam ad N. spodiotricham accedit sed ob folia sessilia parviora spicam gracilem et ovarium ad spicem glandulosum distinguitur.

T y p u s: J.R.Maconochie 654: 50 miles west of Ayers Rock, Northern Territory, Australia, 18.1.1969 (AD holotype; CBG,MEL,NT).

Description: (Fig. 39).

A branched shrub of up to 120 cm high. Stem erect, cylindrical woody, densely covered with whitish - grey branched tomentum. Leaves decussate, sessile, narrowly elliptic or elliptic - oblong to elliptic - lanceolate, 1.5 - 3.5(-4) cm long, 0.3 - 0.6(-0.8) cm broad, almost flat with slightly recurved margins, ± acute, comewhat crenate - dentate along the margins when old, rugose above, with a distinct midrib on the under - surface, whitish - grey tomentose all over. Inflorescence terminal, spicate; spikes elongated, un - interrupted, cylindrical, often in opposite pairs, solitary at the apex, densely whitish - grey tomentose, (2.5-)4 - 7(-8.5) cm long, 0.5 - 0.8 cm in diameter; peduncles cylindrical, 1 - 2.5(-3) cm long, densely tomentose. Flowers 6 -merous, sometimes 7 - 8 -merous, bracteate, sessile, 3 in the axil of each bract, ± campanulate, 4 - 5.5 mm long (including stamens and style); bracts subsessile or shortly stalked, decussate, early caducous, ovate, acute, glabrous inside, glandular and tomentose outside, up to 3.5 mm by 2 mm, rarely more. Calyx often 6 -lobed at the apex, sometimes 7 - 8 -lobed, glandular and densely tomentose outside, glabrous inside, 2.5 - 3 mm long; tomentum branched, whitish - grey, ± 1.5 mm long; lobes deltoid, acute, ± 1 mm long, nearly as broad at the base; tube narrow at the base, gradually broader towards the apex, ± 2 mm long. Corolla campanulate, often 6 -lobed at the apex, sometimes 7 - 8 -lobed, glabrous outside, very densely villous - tomentose inside the tube, 3 - 4 mm long; lobes abruptly narrow - linear towards the apex, somewhat broader at the base, glabrous, 1 - 1.5 mm long, ± 0.5 mm broad at the base; tube ± cylindrical in the lower half, gradually widening towards

the apex, 2 - 2.3 mm long. Stamens 6, sometimes 7 - 8, exserted, inserted at the summit of corolla-tube between the lobes; filaments long, filiform, glabrous, 2 - 2.5 mm long; anthers 2 -lobed, dorsifixed, ± orbicular in outline, pale - yellow; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent, ± 0.5 mm long. Ovary elliptic - globose, glabrous, densely glandular at the top, 0.8 - 1 mm long, 0.7 - 0.8 mm in diameter, 4 - locular, with a single ovule in each cell; style exserted, filiform, glabrous, ± 4 mm long; stigma minutely notched or almost entire. Fruit obovoid, glabrous, often sparsely glandular at the the top, 2 - 2.3 mm long, 1.9 - 2.1 mm in diameter; seeds not seen.

Specimens examined:

NORTHERN TERRITORY:- J.R.Maconochie 654: 50 miles west of Ayers Rock. 18.1.1969 (AD holotype;CBG,MEL,NT isotypes).- A.Robinson 66: between Irving & Churnside Creeks, Petermann Ranges, 16.1.1969 (NT).

WESTERN AUSTRALIA:- A.A.Munir 5195: 10 km south-east of Mt. Fanny, 28.VIII.1973 (AD).- A.A.Munir 5196: 12 km south-east of Mt.Fanny, 28.VIII.1973 (AD).- A.A.Munir 5206: 75 km east of Warburton Mission, 29.VIII.1973 (AD).

Distribution: (Map 15).

This species is endemic to the far south-western part of the Northern Territory and across the border into Western Australia. The distribution in Northern Territory is in the Petermann Ranges, west of Ayers Rock, while in Western Australia it has been collected from south-east of Mt.Fanny and east of Warburton Mission near the Barrow Range.

E c o l o g y:

This taxon is known to occur in the dry eremean parts of Northern Territory and Western Australia. It grows chiefly in the open sandy soil of spinifex country. According to Maconochie 654 (AD,CBG,MEL,NT), from 50 miles west of Ayers Rock, it is found " growing on red sand dune in sovate (sic) slopes". The plant is noted as "shrub to 15 inches high with white woolly erect spikes". Robinson 66 (NT), from between Irving and Churnside Creeks in Petermann Ranges is annotated as "upright bush to 3 ft. high growing on red sand hill with spinifex". In Western Australia, the author has found it growing on roadside in sandy soil with Triodia Grevillea, Thryptomene, Eremophila, Dicrastylis gilesii,D.doranii, Ptilotus, Eucalyptus, Acacia and Solanum species. Normally, it is

a shrub one metre tall branching from near the base and spreading over an area of one to two metres in diameter.

Flowering and fruiting seem to take place chiefly from October to December.

C o m m e n t s:

In N.elliptica, the arrangement and shape of leaves, inflorescence and the flower parts seem to have some resemblance to N.bracteosa FvM., but the leaves in the former species are thin, not congested, shortly tomentose, somewhat crenate - dentate along the margins when old and with midrib and lateral veins distinct on the under surface. Moreover, the spikes of N.elliptica are generally longer (up to 8.5 cm long) than the spikes in N.bracteosa.

The holotype is noted to grow on red sand dune in "sovate" slopes. It seems, that perhaps the word "sovate" is a typing error for south-west, unless the collector has used the word to convey some special ecological conditions of its habitat.

Relationship:

N.elliptica is closely allied to N.bracteosa in its leaves being elliptic - oblong to elliptic - lanceolate; flowers in elongate cylindrical spikes; each bract with 3 axillary flowers; corolla-lobes narrow linear; stamens and style exserted; ovary glabrous, glandular at the top. However, N.elliptica may be readily distinguished by its leaves being thinner and by their other characters discussed under "Comments". The spikes of N.elliptica also are longer.

Th e relationship of N.elliptica with N.spodiotricha may be established by the leaves of both species being shortly tomentose, thin, midrib and primary lateral veins prominent underneath; stamens and style exserted. However, the leaves in N.spodiotricha are much larger [measuring 3 - 5(-6.5) by 1.2 - 2.5(-3) cm], broadly ovate, often revolute along the margins, distinctly (short) petiolate; spikes 1 - 1.5 cm in diameter and ovary glandular all over.

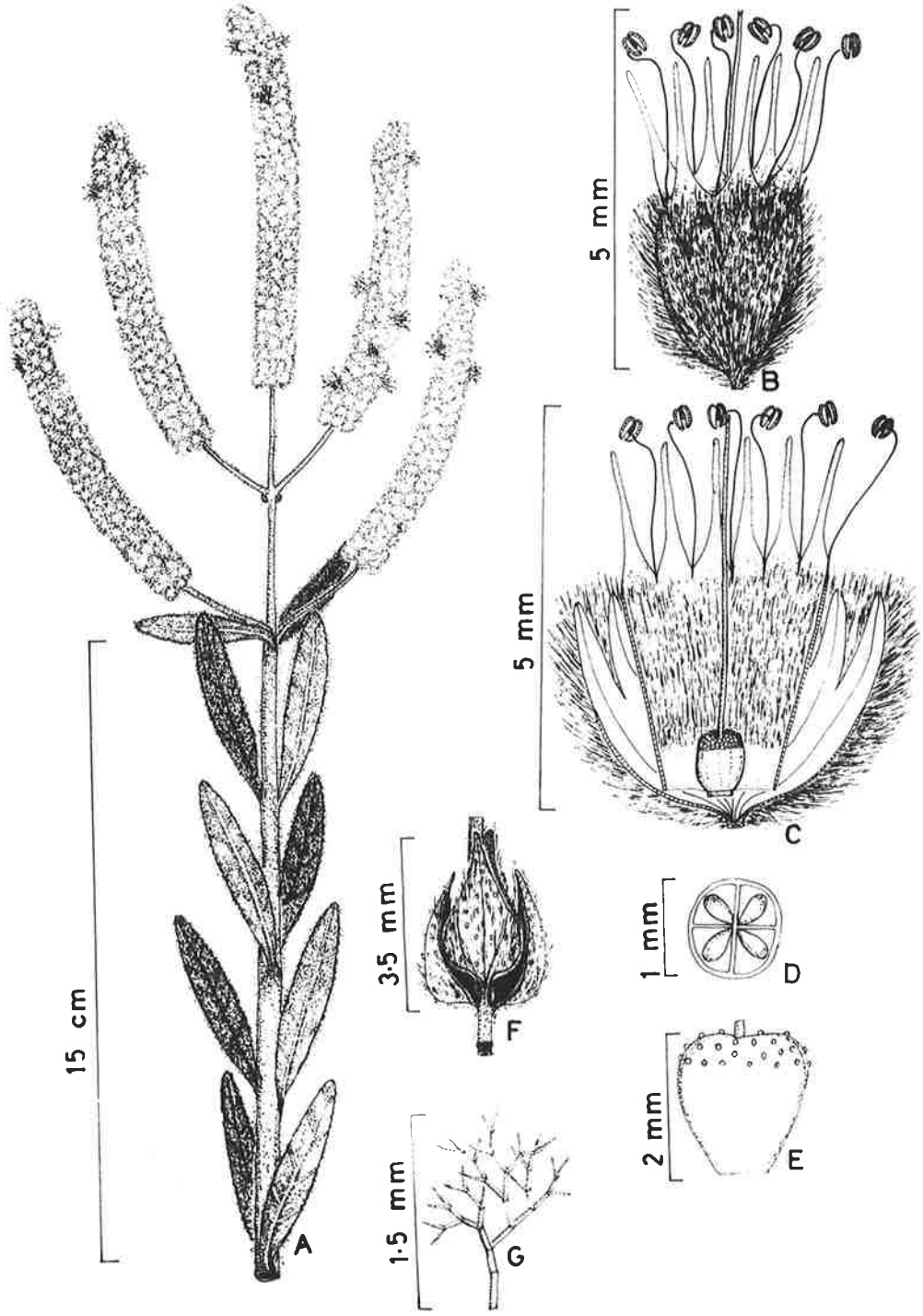


Fig. 39 — Newcastelia elliptica Munir (J.R. Maconochie 654: AD - holotype).

A, flowering twig; B, flower; C, flower vertically cut open; D, T.S. ovary; E, fruit; F, bracts arrangement; G, calyx tomentum.

Newcastelia chrysophylla C.A.Gardner, J.R.Soc.W.Aust. 47 (1964) 62; J.S.Beard, W.Aust.Pl.(1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 564; A.Moriya, List Pl.Spec.Coll.Aust. (1969) 28 -MS.; A.Moriya, List Colour Slides Aust.Wildfls. (1969) 31 - MS.; J.S.Beard, W.Aust.Pl.ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,574; C.A.Gardner, W.Aust.Wildfls.B (1972) 154,155; R.Erickson et al., Fl.Pl.W.Aust. (1973) 188.

T y p u s: C.A.Gardner 12054: Along roadside near Carnarvon, about 45 km north of Murchison River, 3.1.1959 (PERTH holotype;AD,PERTH)

Description: (Fig. 40).

A tall shrub or small tree, 2 - 4 metres high; stem erect, branched cylindrical, woody, up to 7 cm in diameter, densely clothed with brownish - yellow branched tomentum. Leaves decussate, subsessile or very shortly petiolate, obovate, shortly recurved along the margins, often sinuate - dentate in the upper halves, cuneate towards the base, (1.3-)1.5 - 2.8(-3.7) cm long, (0.5-) 0.7 - 1(-1.5) cm broad, olivaceous and somewhat scaberulous above, densely covered with golden - yellow tomentum beneath. Inflorescence terminal on branches, spicate, bright golden - yellow;spikes elongated, cylindrical, shortly pedunculate, uninterrupted, 3 - 5.5 cm long, 0.5 - 0.8 cm in diameter; peduncle below the flowers cylindrical, densely tomentose, 0.5 - 1(-1.5) cm long. Flowers 5 -merous, rarely 4 -merous, bracteate, sessile, solitary in the axil of each (decussately arranged) bract, 4 - 4.5 mm long; bracts early caducous, broadly elliptic - ovate, sessile, obtuse, glabrous on both surfaces, tomentose along the margins, 4 - 4.5 mm long, 2.5 - 3.2 mm broad. Calyx 5 -lobed, rarely 4 -lobed, densely tomentose outside, glabrous inside, 2.5 - 2.8 mm long; lobes deltoid, acute, 0.7 - 1 cm long, 0.8 - 1.1 mm broad at the base; tube shallow, ±1.5 mm deep; tomentum golden - yellow,branched, 2 - 2.5 mm long. Corolla 5 -lobed, rarely 4 -lobed, glabrous outside, sparsely villous inside at the base of corolla - lobes, 3 - 3.5 mm long; lobes narrow elliptic - oblong, obtuse, 1 - 1.5 mm long, 0.8 - 0.9 mm broad; tube cylindrical, ± 2 mm long. Stamens 5, rarely 4, included, inserted well inside the corolla-tube; filaments minute, glabrous; anthers dorsifixed, 2 -lobed, oblong, 0.5 - 0.6 mm long; lobes free and deflected in the lower halves, longitudinally dehiscent. Ovary ± globose, densely covered with short white tomentum, 1 - 1.5 mm long and across, 4 -locular, with one ovule in each cell; style short, included, with a few glandular hairs on the lower half, 1 - 1.2 mm long; stigma shortly

notched. Fruit somewhat globose, pubescent, ± 2 mm across, 4 - locular, with normally 1 - 2 seeds only.

Specimens examined;

WESTERN AUSTRALIA:- S.Davies s.n.: between Hamelin Pool and Tamala, 13.X.1960 (PERTH).- C.A.Gardner 12054: along roadside near Carnarvon, about 45 km north of Murchison River, 3.1.1959 (PERTH holotype; AD,PERTH 3 spec.-isotypes).-ELullfitz 1968: 416 mile peg Northern Highway, No.1 Tank (? Ger. - Car.Hway),19.XII. 1962 (A,K,P,PERTH).- N.H.Speck 878: ? Shark Bay, ± 3/4 miles N. of no. 7 Tank, - (PERTH).

Distribution: (Map 14).

This species is endemic to the north-western part of Western Australia. The known distribution is restricted between Geraldton and Carnarvon along the North Western Coastal Highway. All the recorded localities are to the north of Murchison River towards south and east of Shark Bay. One collection comes from between Hamelin Pool and Tamala, and all the rest are gathered along the (N.W.Coastal) Highway, south of Carnarvon.

E c o l o g y:

Due to limited collections of this species, little is known about its ecology, but it probably occurs commonly in sandy soils. Apparently, this remarkable shrub is rare but seems quite attractive due to dense golden - yellow tomentum on the under surface of its leaves and all over the inflorescence. The contrasting dark olivaceous upper surface of the leaves is also of particular attraction. According to the author's remarks; " the stem is often 7 cm in diameter, and it is by far the largest species of this genus". Unlike other species of Newcastelia, N.chrysophylla has so far not been recorded from the dry eremean interior of Australia. Gardner 12054 (AD,PERTH), from 45 km N. of Murchison River is annotated as " Frutex usque 4 met. alt.; fl.flavis. in arenosis lutosis in fruticetis". Davies s.n. (PERTH), from between Hamelin Pool and Tamala is recorded as "yellow - flowered shrub of ± 12 feet". Lullfitz 1968 (A,PERTH), 416 mile peg N.W.Coastal Highway is noted as "8 ft. high erect small tree, with attractive foliage and yellow heads".

Flowering and fruiting seem to occur mainly during October - December.

C o m m e n t s:

N.chrysophylla is by far the tallest species of this genus, measuring up to 4 metres in height, and having a stem of up to 7 cm in diameter. Some other distinctive characters are its obovate leaves, glabrous flower - bracts having tomentum only along the margins, villous corolla - throat with a sparse narrow band of hairs restricted to the base of its lobes and glandular short hairs on the lower half of the style.

In the original description, the leaves are recorded as " Folia alterna, sparsa vel rare opposita" and ovary " 2 - locul- atum". After examining the type and other specimens recorded here, it has been found that the leaves in this species are always opposite (decussate) and ovary 4 -locular. The latter appear 2 - locular only when mature, because out of 4 - ovules only 1 or two develop into seeds and the remainder abort with ultimate obliteration of two loculi.

Under the protologue, the author has vaguely pointed out the affinities between this taxon, N.dixonii FvM. et Tate and N.chrysotricha FvM., but has not recorded any character showing their relationship. The only known characters showing affinities between N.chrysophylla and N.chrysotricha FvM. are the golden - yellow spicate inflorescence and included stamens and style. However, the relationship with N.dixonii FvM. & Tate is very doubtful, because the latter has been excluded from Newcastelia as it belongs to the genus Anthotroche in Solanaceae [Hj.Eichler (1965) 266].

Relationship:

N.chrysophylla is closely related to N.cladotricha FvM. in its inflorescence being spicate; spikes elongate, cylindrical; flowers solitary in the axil of each bract; stamens and style included. However, it may be easily distinguished by its inflor- escence being golden - yellow; leaves obovate, olive - green and somewhat scaberulous above, golden - yellow tomentose beneath; corolla sparsely villous inside at the base of its lobes only; lobes oblong, rounded at the top; ovary tomentose all over and style with a few glandular hairs on the lower half.

Among the species having golden - yellow inflorescences, N.chrysophylla can be readily identified by its obovate leaves and elliptic - ovate flower bracts with a solitary flower in each axil.

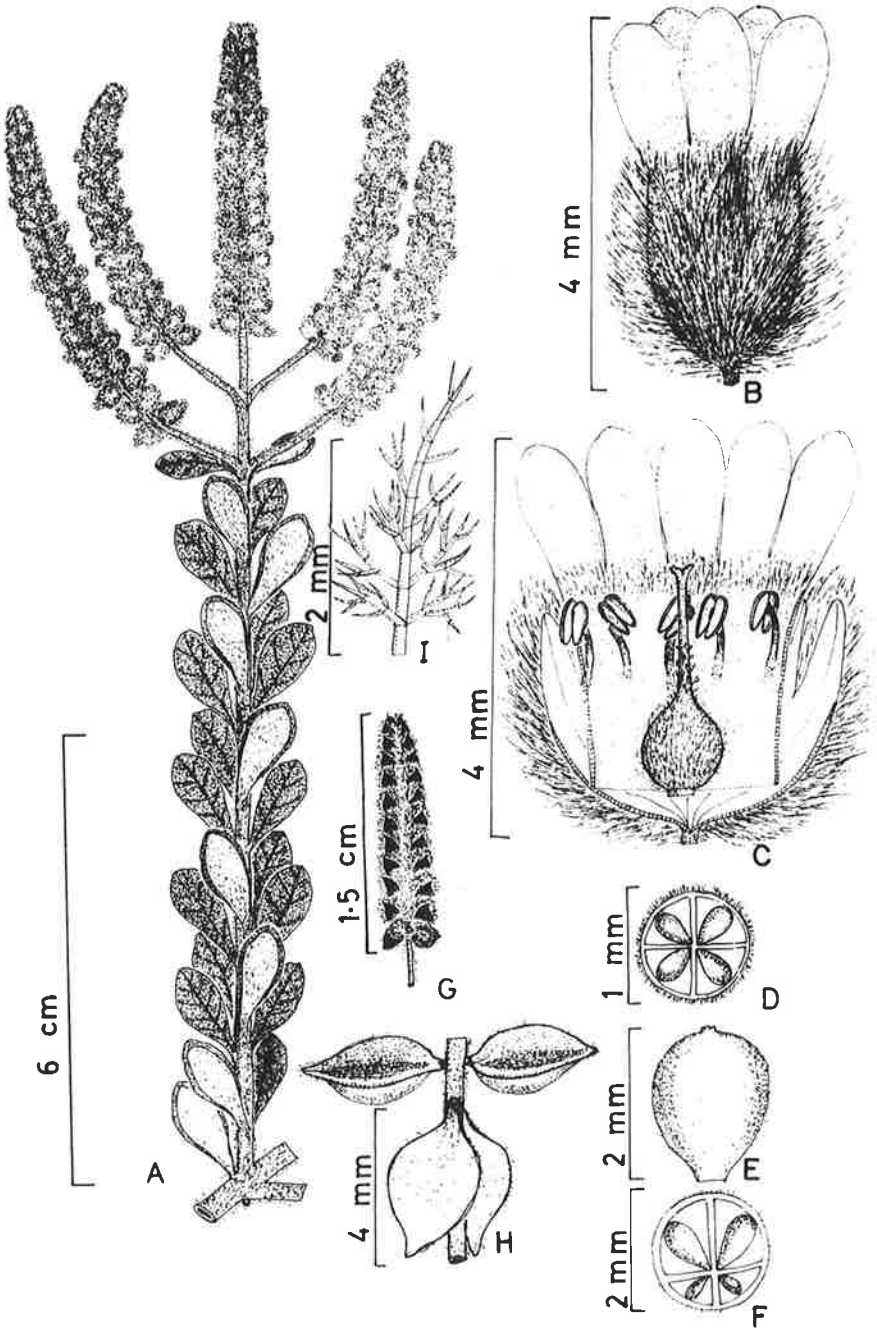


Fig. 40 — Newcastelia chrysophylla Gard. (A - G, C.A. Gardner 12054: PERTH - holotype; H - I, N.H. Speck 878: PERTH).
A, flowering twig; B, flower; C, flower vertically cut open; D, T.S. ovary; E, fruit; F, T.S. fruit; G, young inflorescence with bracts; H, bracts arrangement each with an axillary scar near the base left by the removed solitary flower; I, calyx-tomentum.

Newcastelia cladotricha F.v.Mueller in Hook., J.Bot.Kew Misc. 9 (1857) 22; F.v.Mueller,Fragm.1 (1859) 184 t.1,245; F.v.Mueller, Fragm.3 (1862) 21; F.v.Mueller,Fragm.6 (1868) 155; G.Bentham, Fl. Aust. 5 (1870) 40; F.v.Mueller,Fragm.8 (1873) 50,230;F.v.Mueller, Cens.Aust.Pl.1 (1882) 102; R.Tate, Trans.R.Soc.S.Aust. 12 (1889) 113; F.v.Mueller,Sec.Cens.Aust.Pl.1 (1889) 172; R.Tate, Fl.Extra-Tropic.S.Aust. (1890) 155,254;J.Briquet in Engl. & Prantl Pflanzenfam.IV,3a (1895) 164, in obs.; F.M.Bailey, Qld.Fl. 4 (1901)1165, p.p.(quoad spec.Jos.Wedd 645-BRI); Diels & Pritzel,Bot.Jahrb.Syst. 35 (1904) 502,503,505; F.M.Bailey, Cat.Qld.Pl. (1913) 381,p.p.; A.J.Ewart & O.B.Davies, Fl.N.T. (1917) 237; C.A.Gardner, Enum.Pl. Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,321; J.S.Beard, W.Aust.Pl. (1965) 92;J.S.Beard, W.Aust.Pl.ed. 2,(1970) 114; J.R.Maconochie & N.Byrnes, Muelleria 2 (1971) 135; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,574; M.Hodgson & R.Paine, Field Guide Aust.Wildfls. (1971) 234,t.93,p.p.

T y p u s: F.v.Mueller s.n.,MEL41017: Sturt's Creek, towards Mount Mueller,Western Australia, -III.1856 (MEL holotype; K).

Description: (Fig. 41).

Shrub 30 - 90 cm high. Stem erect, branched, ± cylindrical, woody, densely covered with greyish - rusty branched tomentum. Leaves sessile, decussate, oblong to ovate - oblong, entire,obtuse, rounded at the base, slightly recurved along the margins, (1-) 1.5 - 2.5 (-3) cm long, (0.3-)0.5 - 1(-1.5) cm broad, rugose above, distinctly reticulate beneath, sparsely tomentose all over. Inflorescence terminal, spicate, purplish - grey tomentose; spikes short and dense when young, later elongated, lax, cylindrical, interrupted, up to 12 cm long; peduncle purplish - grey tomentose. Flowers 5 -merous, sessile, bracteate, solitary in the axil of each bract, 4.5 - 5(-6) mm long, mauve or purplish - grey; bracts sessile, elliptic - ovate to ovate - lanceolate, ± imbricate when young, caducous, 0.5 - 1(-1.3) cm long, 3.5 - 5 mm broad, glabrous and distinctly reticulate inside, tomentose outside. Calyx 5 -lobed in the upper half, tubular below, 3 - 3.5(-4.5) mm long, densely covered outside with purplish - grey branched tomentum, glabrous inside; lobes deltoid - ovate, almost equalling the tube or somewhat shorter,1.5 - 1.7(-2) mm long; tube 1.5 - 2(-2.5) mm long. Corolla purple - violet,tubular, 5 -lobed in the upper half, glabrous outside, densely villous inside the tube, (3.5-)4.5 - 5(-6) mm long; lobes ± ovate, abruptly acuminate towards the apex, glabrous, 1.5 - 2 mm long, nearly as broad at the base; tube

± broadertowards the summit, 2.5 - 3(-4) mm long. Stamens 5, included, inserted in the corolla-throat; filaments short, attached to the corolla-tube, the upper free part ± 1.5 mm long; anthers dorsifixed, 2 -lobed, oblong, 0.6 - 0.7(-0.9) mm long, often glandular on the back above the filament attachment; lobes free in the lower halves, longitudinally dehiscent. Ovary ± globular, glabrous but densely glandular, 1 - 1.5 mm in diameter, 4 - celled with one ovule in each cell; ovules attached near the top of central axis; style included, simple, glabrous, 1.5 - 2.5 mm long; stigma, minutely notched. Fruit ± globular, glabrous, glandular, 2 - 3 mm in diameter; seeds albuminous.

Specimens examined:

NORTHERN TERRITORY:- C.Dunlop 2339: 71 m. W.N.W. Tanami, 13.IX.1971 (AD,NT).- J.R.Maconochie 930: 1 mile N. of False Mt. Russell,2.VIII.1970 (NT,PERTH).- J.R.Maconochie 1785: ca. 72 miles west of Tanami, 21.VII.1973 (AD,B,BRI,CBG,CANB,DNA,K,MO,NT,PERTH).

WESTERN AUSTRALIA:- R.J.Anketell s.n.: Rabbit Proof Fence, N. end, -1905 (PERTH).- G.F.Barnett s.n.: between Broome and La Grange Bay, -V.1936 (PERTH).- J.S.Beard 4039: Telegraph Line, N. of Radi Hill, Pindar, 8.V.1965 (PERTH, S).- J.S.Beard 4875: between Windy Corner and Gary Junction, Gunbarrel Hwy., 24.VII.1967(PERTH).- J.S.Beard 5561: between Billiluna and Balgo, 100 m. S. of Hall's Creek, 20.VII.1968 (PERTH).- A.C.Beauglehole 11281: 40 miles S. of Broome, 8.VIII.1965 (PERTH).- N.T.Burbidge 1413: Anna Plains, 10.VII.1941 (PERTH).- N.T.Burbidge 1502: Wallal Downs, 20.VII.1941 (PERTH).- Burean 10: Canning Stock Route, 29.VI.1956 (PERTH).- W.H.Butler s.n.: Badur sandhills, -VIII.1963 (PERTH).- J.B.Cleland s.n.,AD966071211: On road West of Rawlinson Ranges, 25.VI.1960(AD).- N.Forde 1223: 26 miles W.S.W. of Mt. Forrest, Rawlinson Ranges, 5.X.1960 (CANB).- A.S.George 8236: near Van Der Linden Lakes, ± 97 miles W. of Giles Meteorological Stn., 3.X.1966 (PERTH).- A.S.George 9044: Pollock Hills, northern Gibson Desert, ± 127° 37' E, 22° 50' S, 28.VII.1967 (PERTH).- A.S.George 9102: 11 miles N.W. of Kidson no.1 Well, northern Gibson Desert, 30.VII.1967 (PERTH).- A.S.George 9151: ± 2 miles S.E. of Swindells Field, Great Sandy Desert, 31.VII.1967(PERTH).- A.S.George 10734: South of Rudall River, - 122° 05' E, 22° 45' S, 20.V.1971 (PERTH).- E.Gile s.n.,MEL41016: West of Alfred & Marie Ranges.-(MEL).- C.H.Gittens 1453: Towards Pt. Hedland, 52 miles from Broome, -VIII.1967 (PERTH).- M.Degraaf 191: between Hall's Creek and Wiluna, no.13 Well, on Canning Stock Route, 15.V.1968 (PERTH).-J.N.Hutchinson 18: between Hall's Creek and Balgo Mission road, 11.VI.1968

(PERTH).- H.A.Johnson 9750: about 150 miles S.Broome, 1.VIII.1962 (NT,PERTH).- M.Lazarides 6542: 21 miles S.W. of Luluigui Station, Kimberleys, 15.IX.1959 (AD,BRI,CANB,MEL,NSW,NT,PERTH,US).-Martin 67: Roebuck Bay, loc.incert., -(MEL).- A.A.McTavish 13: 90 - 120 miles N.E. of Callawa Stn. on road across Great Sandy Desert, 15 - 25.VII.1963 (PERTH).- A.A.McTavish 17: 290 miles from Callawa Stn., S.E. wards on road across Great Sandy Desert, 15 - 25.VII. 1963 (PERTH).- F.v.Mueller s.n., Sturt's Creek, towards Mount Mueller, -III.1856 (MEL holotype; K).- A.M.Phee s.n.,MEL41053: N.W., loc.incert., - 1890 (MEL).- R.D.Royce 1594: 5 miles N. of Jiggalong Mission, Rabbit Proof Fence, 13.V.1947(PERTH).-R.D.Royce 1832: 15 miles N. Lookout Rock, 20.V.1947(PERTH).- H.T.Wells 8: Stansmore Range, -IX.1957 (PERTH).

Distribution:(Map 14).

This species is restricted to Western Australia and Northern Territory. The main distribution is in the Eremean and Northern Provinces in Western Australia and their borderlands in Northern Territory. Distribution in the Northern Province is chiefly along the Great Northern Highway between Port Hedland and Broome, but the localities in the Eremean Province are widespread inside and outside the Gibson Desert and Great Sandy Desert. Within these provinces, it is known to occur along the Canning Stock Route where it has been recorded from west of Lake Disappointment and between Billiluna and Balgo Mission (near Sturt's Creek). A few localities close to Rabbit Proof Fence are found near Jiggalong Mission, Mt.Goldworthy Mine and N. of Lookout Rock. The other occurrences are between Windy Corner and Gary Junction (west of Alfred and Marie Ranges), and near Mt. Forrest to the west of Rawlinson Ranges.

In the Northern Territory it is recorded from west-north-west of Tanami and south-west of The Granites along the Western Australian border.

E c o l o g y:

Characteristically, N.cladotricha is an eremean shrub growing chiefly in sandy soil and along the creeks. According to its known localities, this species grows under the influence of summer rainfall with a long interval of dry winter. The plant is a dense spreading shrub with dark green (tomentose) leaves and violet - mauve flowers. Like many other species of Newcastelia, it is reported to grow generally in association with the spinifex - mallee community. According to Barnett s.n. (PERTH), from between

Broome and La Grange Bay, it is a "shrub, 4 - 5 ft. high,with fls. white". Beard 4039 (PERTH), from N. of Radi Hills is noted as "shrub 2 ft., leaf tomentose, fls. violet - white, woolly".Another collection by Beard 5875 (PERTH),from Gunbarrel Highway, is reported as "soft tomentose shrub, fls. purple in white balls". Burbidge 1502 (PERTH), from Wallal Downs Stn. is annotated as an "undershrub 2 ft. high, flowers blue to mauve". Forde 1223 (CANB), from 26 miles W.S.W. of Mt. Forrest, Rawlinson Ranges, is noted to grow " in sand dunes". Johnson 9750 (PERTH,NT), from ± 150 miles S. of Broome is noted to occur " on sandridges and flats". Lazarides 6542 (AD,BRI,CANB,MEL,NSW,NT,PERTH), from 21 miles S.W. of Luluigui Station, Kimberleys, is annotated as "spreading, dense undershrub,18 in. - 2 ft. high with dark-green hairy leaves and mauve flowers". The habitat is described as "fine red sand between dunes in recently burnt area". Maconochie 930 (PERTH,NT), 1 mile north of False Mt. Russell, is recorded as a "small shrub to 2 ft. high, blue flowers enclosed in white woolly globular heads long spike. Growing in spinifex - mallee community on sand plain". Royce 1594 (PERTH), 5 miles N.Jiggalong Mission, near Rabbit Proof Fence, is described as "open branched shrub, 2 - 3 ft. tall, fls. blue in interrupted spikes". Habitat is reported "sandy soil in Triodia - Acacia Pindan association".

Flowering and fruiting seem to occur chiefly during May to October.

C o m m e n t s:

N.cladotricha is the type species of the genus Newcastelia F.v.M.; the type specimen of which was collected by the author himself from Sturt's Creek, towards Mt.Mueller, in Western Australia. In the protologue, the seeds of this species have been erroneously recorded as exalbuminous, a character generally attributed to all groups of Verbenaceae (s.str.). The seeds of Newcastelia and other genera of Chloanthaceae are albuminous and this is one of the chief characters uses in segregating the latter family from Verbenaceae. Leaves in the original description are recorded as "lanceolatis", but in the holotype and all other specimens examined, they are generally oblong to ovate - oblong. It seems that the author has probably used the term "lanceolate" in a very broad sense.

The pattern of distribution of this species is around the periphery of the Great Sandy Desert and Gibson Desert, but so far only a few collections have been made from their interior, where

the flora probably has not been fully explored. The distribution seems more or less restricted to the north-north-east of Western Australia with only three collections across the border from Northern Territory. However, Bailey (1901) has described one of Jos.Wedd's collections (no.645,BRI 113964) from St. George, Queensland, as "N.cladotricha". and Tate (1890) has recorded it from South Australia. These records seem unusual for this species, because, as described above, it does not extend much towards south or east. It has been found during the present investigation, that Bailey's record from St.George,Queensland, is in fact a mis-identification of an undescribed taxon now described here as a new species N.interrupta Munir. The plant identified by Tate (1890) as N.cladotricha cannot be traced because he has not cited any collection in his Flora.

There are three available collections by Jos.Wedd from St. George, Queensland. Two of these belong to the genus Dicrastylis (and are discussed there), and one to Newcastelia. This third collection (no.645,BRI 113964), gathered during August, 1894, was erroneously recorded by Bailey as "Newcastelia cladotricha", because in some characters it is close to the latter species. However, as noted above, this collection was then really an undescribed taxon and is now recorded as a new species N.interrupta Munir. In short, there is no proof at hand to confirm the presence of N.cladotricha FvM. in Queensland, nor Tate's record of this species from South Australia.

Beard (1965,1970) has recorded the distribution of this species in Gardner and Bennetts' Botanical Districts, Dampier and Fitzroy of the Northern Province, Western Australia. This may be supplemented by including herewith the Carnegie district of the Eremean Province as well.

Relationship:

N.cladotricha is closely related to N.velutina and N.interrupta in its flowers being in elongated spikes, stamens and style included, corolla-tube densely villous inside and lobes ± ovate. However, it may be easily distinguished by its leaves being oblong to ovate - oblong, with distinct rugae and reticulation on the dorsal and ventral surfaces respectively; calyx tomentum much longer and fluffy, purplish - grey and ovary glabrous but glandular.

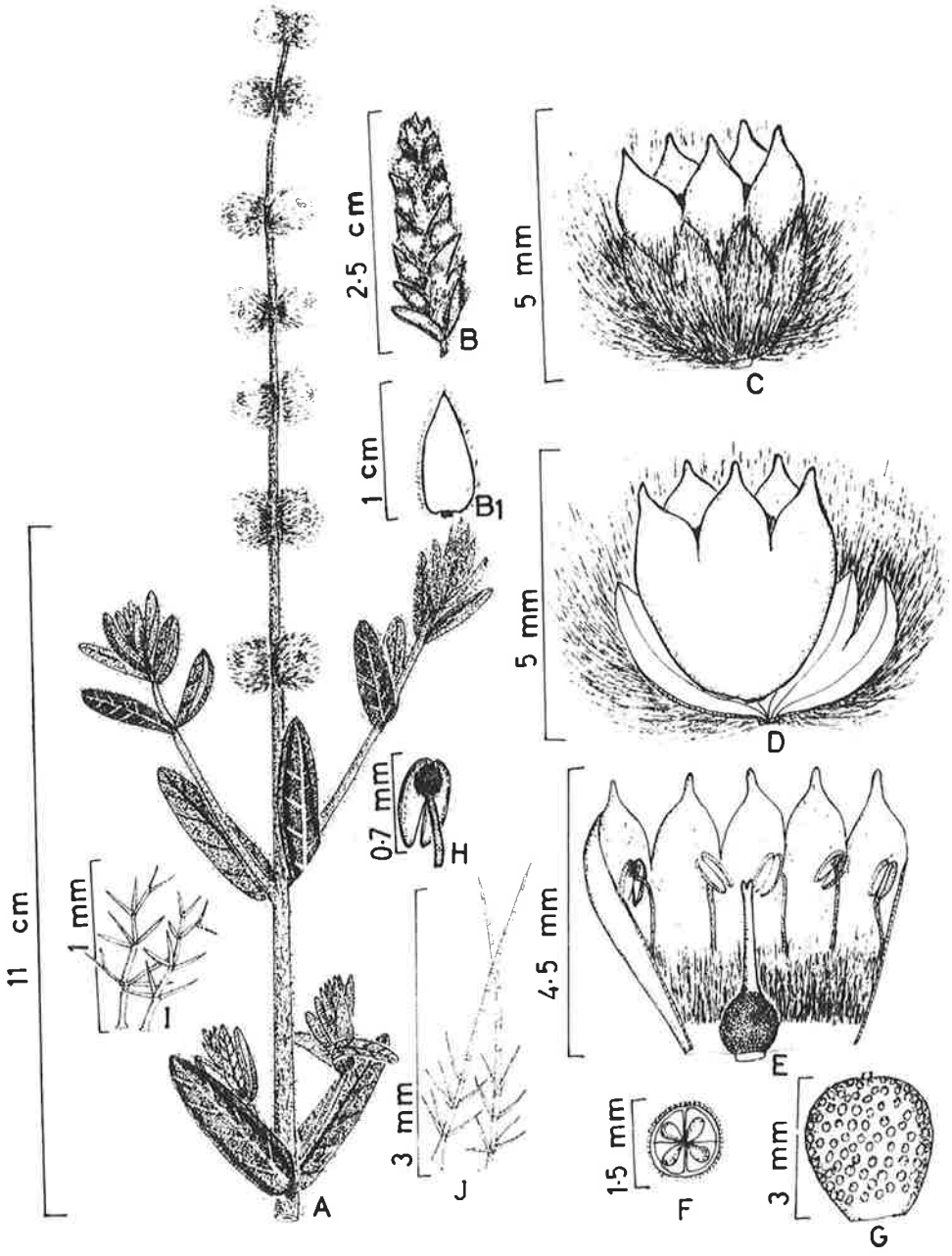


Fig. 41 — Newcastelia cladotricha F.v.M. (A and C - J, R.D. Royce 1594: PERTH; B and B_1, M. de Graaf 191: PERTH).
A, flowering twig; B, young spike with bracts; B_1, single bract viewed from inside; C, flower; D, calyx cut open vertically to show corolla-tube; E, corolla-tube cut open vertically showing stamens and pistil; F, T.S. ovary; G, fruit; H, anther's back view showing granular mass; I, stem and leaves tomentum; J, calyx-tomentum.

Newcastelia velutina Munir, sp. nov.

Frutex velutinus ramis ternatis tomento albo - lanato dense vestitus; folia decussata late lanceolata tomento cinereo - lanato denso; flores spicam elongatam continuam gracilem formantes tomento pedunculorum albo - lanato denso; calyx tomento albo - gossypino-lanato; corolla tubo intra omnino villoso lobis anguste elongatis acutis; stamina cum stylo inclusa; ovarium glandulosum in dimidio superiore/inferiore glabrum; stylus glaber; stigma subcapitata.

Quoad folia non - linearia spicas elongatas et stamina cum stylo inclusa ad N.interruptam proxime accedit sed ob folia semper decussata late lanceolata spicas continuas pedunculum tomento - albo - lanato corollam tubo intra omnino villoso lobis anguste elongatis acutis et ovarium glandulosum facile distinguitur.

T y p u s: L.Cockburn s.n., BRI099903: 40 miles north of Durong, in Mrs.Mearn's paddock, latitude 25° 50' s, longitude 151° 25' E, Queensland, Australia, -1969 (BRI holotype).

Description: (Fig. 42).

Stem erect, branched, cylindrical, woody, densely clothed with branched woolly tomentum. Leaves decussate, sessile, broadly lanceolate, up to 4 cm by 1.2 cm, recurved along the margin, densely greyish woolly tomentose all over, midrib prominent on the under - surface, the lateral veins and reticulation concealed by the dense branched tomentum. Spikes terminal on branches, elongated, cylindrical, densely woolly - tomentose, 6 - 17 cm long; peduncles (i.e.flower-less basal part of the axis of the spike) upto 3.5 cm long, cylindrical, densely greyish - woolly tomentose. Flowers (buds only) 5 -merous, bracteate,sessile, 3 in the axil of each bract, ±4 mm long; bract early caducous (not seen). Calyx tubular, 5 -lobed towards the apex, glandular and densely cottony - woolly outside, glabrous inside. Corolla ± campanulate, 5 -lobed at the apex, glabrous outside, densely villous - tomentose inside the tube; lobes abruptly narrow linear towards the apex, somewhat broader at the base, glabrous; tube ± cylindrical in the lower half, gradually widening towards the apex. Stamens 5, included, inserted in the corolla - throat; filaments very short; anthers dorsifixed, 2 -lobed, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, glandular and hairy in the upper part, glabrous below, 4 -locular with one ovule in each cell, ± 1 mm in diameter; style short, included, filiform,glabrous; stigma minutely notched, somewhat capitate or ± knobby.Fruit not seen.

Specimens examined:

The holotype is the only available collection for examination.

Distribution: (Map 16).

Endemic in Queensland, Australia. The only known locality of this species is [latitude 25° 50' S, longitude 151° 25' E.]. 40 miles north of Durong in Mrs. Mearn's paddock, sotuh-eastern Queensland.

E c o l o g y:

Nothing is known about its ecological requirements because the only available collection is without any collector's remarks regarding the habit, habitat or association with other plants. The area of its occurrence however, appears to be very arid but the exact ecological condition of that locality cannot be ascertained without examining the plant in its natural habitat. In its morphological features, however, it does not differ markedly from closely related taxa of this genus. Like many other species of Newcastelia, this taxon seems quite shrubby and densely covered with branched woolly greyish tomentum. The leaves have recurved margins and the deciduous flowers are borne in elongated cylindrical spikes.

C o m m e n t s:

This taxon is based on a solitary collection from Queensland which was taken in an early stage of flower buds. There are not many mature flower buds or open flowers that could indicate the exact mature size of its flower parts but the few young buds examined have shown the exact shape and number of its flower parts as well as the distinct characters whereby it can be easily distinguished from its closely allied species. The type material is poor and perhaps insufficient for future investigations. Therefore, it is strongly suggested that more material of this new species be collected from the type locality and its environs.

The soft velvety greyish surface of the leaves (and stems) which suggested the specific epithet, velutina, is a conspicuous vegetative character and distinctive even among species of Newcastelia.

Relationship:

Akin to N.cladotricha FvM. in having elongated spikes and included stamens and style, but can be easily distinguished by its spikes being uninterrupted, cottony - woolly, not fluffy;

flowers 3 in the axil of each bract; calyx glandular and greyish cottony - woolly outside; corolla - lobes (abruptly) narrow linear and ovary glandular and hairy in the upper half, glabrous and non glandular below.

N.velutina is also related to N.interrupta Munir in having leaves with recurved margins, reticulation concealed by the dense woolly tomentum; flowers 3 in the axil of each bract; calyx - tomentum cottony - woolly; stamens and style included and ovary hairy at the top. However, the leaves in N.interrupta are often three in a whorl below the inflorescence; stem and leaves are non- velutinous; peduncles purplish - grey tomentose; spikes interrupted; corolla - lobes narrowly ovate, tube with a dense villous band near the base inside, and ovary hairy but not glandular in the upper half. Thus N.velutina is clearly distinct from N.interrupta also.

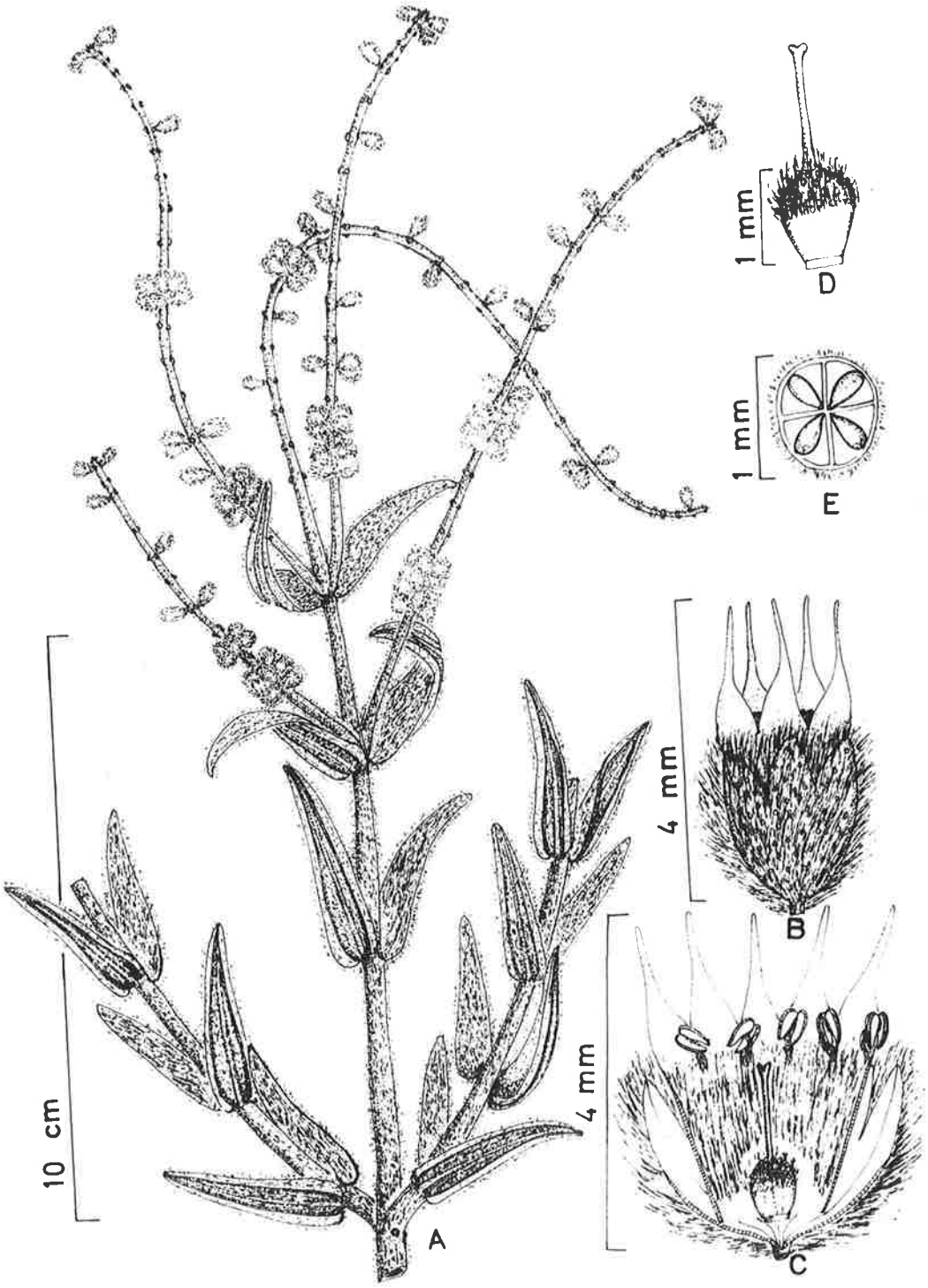


Fig. 42 — Newcastelia velutina Munir (L. Cockburn s.n., BRI 099903: BRI - holotype).

A, flowering branch; B, flower; C, flower longitudinally cut open; D, pistil; E, T.S. ovary.

Newcastelia interrupta Munir, sp. nov.

N.cladotricha auct. non FvM.: Bailey,Qld.Fl.4 (1901) 1165 -(quoad spec.Jos.Weld 645: from St.Goerge - BRI); Bailey, Cat.Qld.Pl. (1913) 281.

Frutex effusus tomento cinereo brevique dense vestitus; folia oblongo - lanceolata decussata vel in caule principali interdum ternata supra eglutinosa; flores spicam elongatam gracilem ubi maturam interruptam formantes tomento pedunculorum purpureo vel cinereo - purpureo; calyx tomento gossypino - lanato; corolla tubo intra prope basim villoso lobis anguste ovatis obtusis; stamina cum stylo inclusa; ovarium eglandulosum in dimidio superiore tomentosum inferiore glabrum; stylus glaber; stigma plus minusve claviformis.

Inter species foliis non - linearibus spicis elongatis et staminibus cum stylo inclusis ob folia oblongo - lanceolata decussata in caule principali ternata spicas maturas interruptas pedunculum tomento purpureo vel cinereo - purpureo corollam tubo intra prope basim villoso et ovarium eglandulosum in dimidio superiore tomentosum facile distinguitur.

T y p u s: N.T.Burbidge 5472: 124 miles south-west of Dalby, on Moonie Highway, S.Queensland, Australia, 4.IX.1956 (CANB holotype; AD,BRI,MEL).

Description: (Fig. 43).

Perennial spreading shrub of up to 90 cm high. Stem erect, branched, cylindrical, woody, densely covered with short greyish tomentum. Leaves sessile, decussate or sometimes in whorls of three on the main stem, oblong - lanceolate, entire, ± acute, deeply recurved all along the margins, (1-)2 - 3(-3.5) cm long, (0.3-)0.4 - 0.5(-0.6) cm broad, densely covered with short greyish tomentum, the rugae and reticulation often concealed by the dense hairs. Inflorescence terminal on branches, spicate; spikes short when young, later elongated, cylindrical, regularly interrupted when mature, cottony - woolly, (4-)6 - 12(-18.5) cm long, 0.6 - 0.8 cm in diameter; peduncle purple to purple - grey tomentose, generally 1 - 2(-3.5) cm long. Flowers 5 -merous, rarely 6 -merous, bracteate, sessile, mostly three together in the axil of each bract, each 4 - 4.5 mm long; bracts decussate, subsessile, caducous, ovate to elliptic - ovate, entire, acute, 3 - 5(-7) mm long, 2.5 - 4 mm broad at the widest in lower halves, brownish - black, (? purple when fresh), tomentose outside, glabrous inside. Calyx 5 -lobed towards the apex, rarely 6 -lobed, densely clothed

with cottony - woolly (branched) tomentum outside, glabrous inside, 1.9 - 2 mm long; lobes deltoid, acute, 0.9 - 1 mm long, nearly as braod at the base; tube ± 1 mm deep, gradually broader towards the apex. Corolla purple - violet, 5 -lobed at the apex, rarely 6 -lobed, glabrous outside, villous - tomentose inside near the base of tube, 3.5 - 4 mm long; lobes narrowly ovate, attenuate towards the apex, obtuse, 1.7 - 2 mm long, 1 - 1.2 mm broad at the base; tube 1.9 - 2 mm long, ± cylindrical, gradually widening towards the apex. Stamens 5, rarely 6, included, inserted in the corolla-tube; filaments very short, glabrous; anthers dorsifixed, 2 -lobed, pale - brownish, 0.5 - 0.6 mm long, 0.3 - 0.4 mm across; lobes ± oblong free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, hairy in the upper half, glabrous below, 0.6 - 0.7 mm long, ± 0.8 mm in diameter, 4-locular with a single ovule in each cell; style included, glabrous, 0.7-0.9 mm long; stigma knobby - capitate, minutely notched. Fruit ± obovoid, very sparsely hairy in the upper part, glabrous below, 1 - 1.5 mm across; seeds not seen.

Specimens examined:

QUEENSLAND:- N.T.Burbidge 5472: 124 miles S.W. of Dalby on Moonie Highway, 4.IX.1956 (CANB holotype; AD,BRI,MEL isotypes).- N.Carstairs s.n., BRI113971: Captain Mountain, via Millmerran, - X.1947 (BRI).- S.L.Everist 5827: about 35 miles N.E. of St. George, Moonie Highway, 27.VIII.1956 (BRI,L,).- S.L.Everist 6092: 80 miles E.N.E. of St. Goerge, Moonie Highway, 11.IX.1959 (BRI, L).- D.M.Gordon 822: between St. George and Dalby, Moonie Highway, 13.XII.1953 (BRI).- R.Jones 220:ca. 45 miles from St.George, Moonie Highway, 11.IX.1961 (BRI).- A.May s.n., BRI113966: about 117 miles from Dalby, down the Moonie Highway, -II.1955 (BRI).- R.Roe 1: Foxborough Stn., Maranoa district, 3.1.1938 (BRI).- R.Roe 1013: 30 miles from St.George on Moonie Highway, -1961N(BRI). D.Shoobridge s.n., CBG014297: 13 miles from Westmar, Moonie Highway, 10.IX.1964 (CBG).- H.& E.Walters s.n.,BRI013320: 19 miles from Westmar Junction, 29.XI.1958 (BRI).- Jos.Wedd 645, BRI113964: St.George, -VIII.1894 (BRI).- K.Williams 42: Moonie Highway - Bungunya Road Junction, 27° 58' S, 149° 23' E, 47 miles E. of St.George, 21.IX.1968 (BRI).

Distribution: (Map 16).

This species is endemic to southern Queensland. The known distribution is mainly along Moonie Highway between St.George and Dalby. Elsewhere, its occurrence is recorded from Captain Mtn.

near Millmerran and Foxborough Stn. in Maranoa district.

E c o l o g y:

According to collector's field notes, this species is reported to grow mainly in sandy soil with Triodia - Casuarina Community. A collection by Burbidge 5472 (AD,BRI,CANB,MEL), from 124 m. S.-W. Dalby, Moonie Hway. is noted as "spreading shrub to 3 feet high with woolly spikes and purple corollas." It was growing in "red sand with Triodia michellii, Callitris and Casuarina". Everist 5827 (BRI), 35 miles N.E. of St.George, is annotated as "shrub, loosely branched, to 3 feet. Leaves grey - green; calyx white - blue tomentose;corolla pale blue. Abundant". It is noted to grow "in loose red sand with Triodia".Everist's subsequent collection no.6092 (BRI), from 80 miles E.N.E. of St.George is recorded to grow in "deep red sand with Eucalyptus exserta and Triodia". The plant is described as "shrub with slender branches above two feet; leaves dull yellow green; calyx cottony - white; corolla purple". Jones 220 (BRI), 45 miles from St.George, is reported as "Perrenial with straggling erect stems to about 2 feet. Leaves grey green; calyx cottony white; corolla blue". Habitat is "deep yellow brown sand". Roe 1013 (NSW), 30 miles from St. George along Moonie Hway., is noted to grow in "sandy soil carrying spinifex". The plant is described as "soft shrub up to 18 inches high, flowers white and purple".

Flowering and fruiting seem to occur chiefly during September - December, sometimes this period may be prolonged to February.

C o m m e n t s:

Jos.Wedd's collection no.645 (BRI113964) from St.George, Queensland, is the earliest record of this species(N.interrupta), gathered during August, 1894. It was identified by Bailey (1901, 1913) as "N.cladotricha FvM." and included in his Flora and Catalogue of Queensland Plants as first record of the latter species from that region. His publications were subsequently used by others to identify Newcastelia species from Queensland. As a result, most of the later collections of this species (N.interrupta) are found annotated as N.cladotricha FvM". Bailey's description of"N.cladotricha" agrees well with the actual species described by F.v.Mueller, but Jos.Wedd's specimen (no.645) and all other collections belonging to N.interrupta differ from this description in the following characters:

In N.cladotricha FvM. the leaves are opposite throughout, oblong to oblong - ovate, slightly recurved along the margins,

distinctly reticulate benaath, rugose above; flowers solitary in the axil of each bract; calyx - tomentum purplish - grey, unbranched towards the apex, upto 3 mm long; corolla - lobes ovate, abruptly acuminate towards the apex; ovary glandular all over (glabrous), not hairy; stigma cylindrical, neither capitate nor knobby.

On the contrary, the leaves of N.interrupta Munir are,opposite or sometimes in whorls of three on the main stem, oblong - lanceolate, deeply recurved along the margins, reticulation and rugae often concealed by the dense woolly tomentum; flowers three in the axil of each bract; calyx - tomentum white cottony - woolly, branched at the apex, up to 1.6 mm long; corolla - lobes narrowly ovate, long attenuate towards the apex; ovary densely hairy in the upper half, glabrous below; stigma distinctly capitate or knobby.

The above information indicates that Bailey did not pay much attention to the flower characters of Jos.Wedd's collection when identifyling it with N.cladotricha FvM., and seems to have been fascinated by some superficial characters in the plant. As pointed out before, most of the subsequent collections of N.interrupta identified with the help of Bailey's Flora have been invariably annotated as "N.cladotricha FvM.". In this way, the identity of N.interrupta remained confused (and suppressed) till the present revision of this genus. Geographically, N.cladotricha FvM. is restricted mainly to Northern and Eremean provinces in Western Australia and does not occur in Queensland. On the other hand, N.interrupta is found only in southern Queensland and is not known to grow in any other area.

Leaves on the main stem ar sometimes in whorls of three at a node, but on the lateral branches they are mostly decussate. The tomentum on the outside of flower - bracts look brownish - black which seems to have changed in colour from purple - violet after drying. Actual colour of this tomentum can only be ascertained by studying fresh specimens or examining the bracts in the living plant. In the upper half of the ovary, there seem to be a few very small glands interspersed with the tomentum; however, because of their microscopic size they are difficult to detect.

Relationship:

Allied closely to N.cladotricha FvM. in having elongated interrupted spikes when mature and included stamens and style, but may be readily distinguished by its leaves being oblong, deeply recurved along the margins, very densely tomentose, not

conspicuously rugose or reticulate, sometimes in whorls of three on the main stem; flowers 3 in the axil of each (caducous) bract; calyx - tomentum very short, white cottony - woolly, branched at the apex, up to 1.6 mm long; corolla narrowly ovate, long attenuate towards the apex; ovary densely hairy in the upper half, glabrous and non - glandular below and stigma distinctly capitate or knobby.

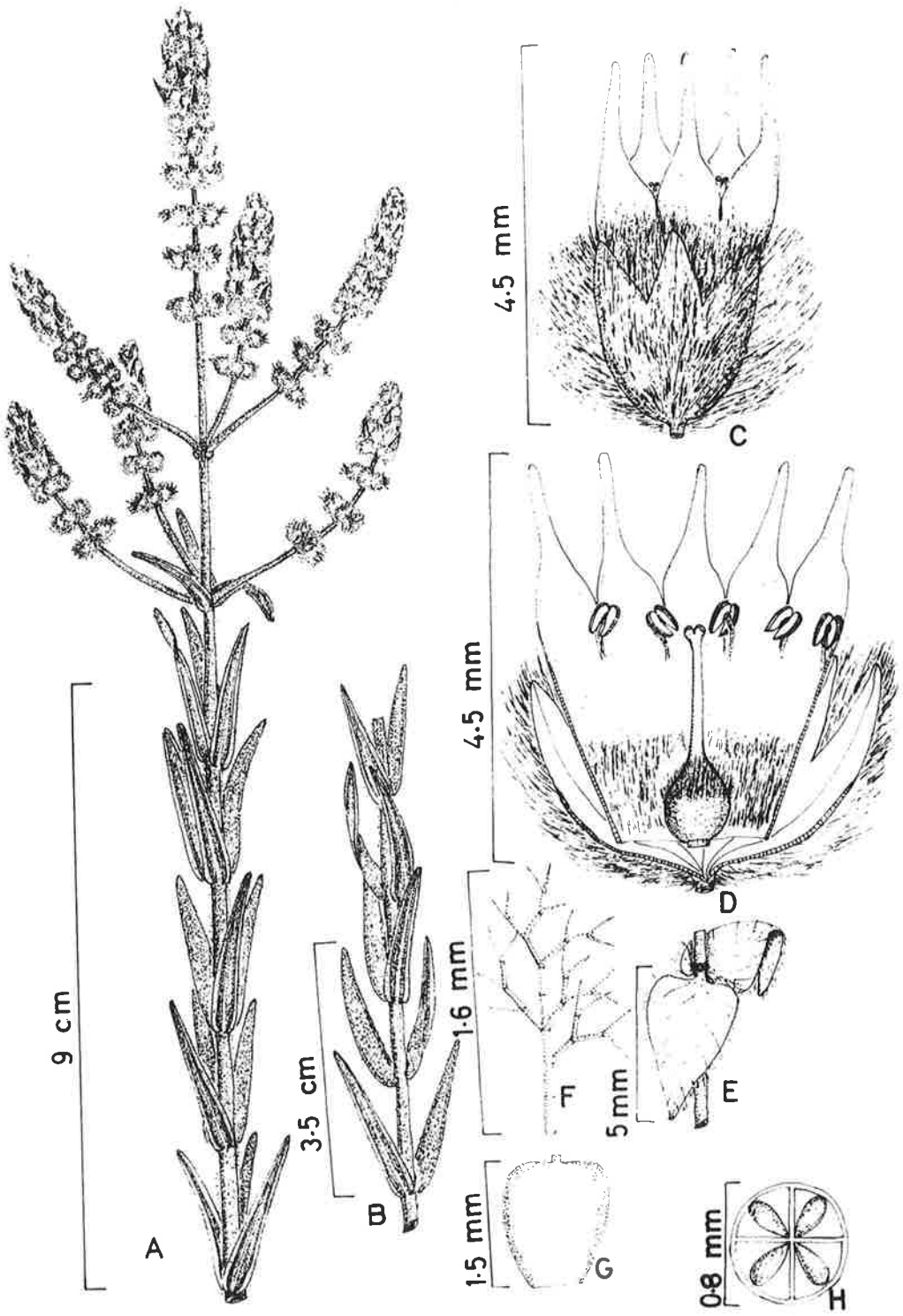


Fig. 43 — Newcastelia interrupta Munir (N.T. Burbidge 5472: CANB - holotype).

A, flowering branch with 3 leaves at each node; B, branch with decussate leaves; C, flower; D, flower vertically cut open; E, bracts showing 3 axillary scars left by the removed flowers; F, calyx-tomentum; G, fruit; H, T.S. ovary.

Newcastelia insignis E.Pritzel, Bot.Jahrb,Syst. 35 (1904) 506, fig. 56 E - G; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931) 111;S.Junell, Sym.Bot.Upsal.4 (1934) 64, fig.109,110; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve,W.Aust.Wildfls.3 (1965) 565; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,302,321; C.A.Gardner, Wildfls.W.Aust. (1959) 127,128; J.S.Beard, W.Aust.Pl.ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347, 534,574; C.A.Gardner, Wildfls.W.Aust.ed.11, (1973) 119.

T y p u s: E.Pritzel 849, AD97221080: Coolgardie Goldfields, in apertis arenosis, Western Australia, -X.1901 (AD lectotype; A,BM, BR,E,HBG,G,K,L,M,MO,NSW,NY,P,PERTH,PR,S,US,W isolectotypes).

Lachnostachys insignis E.Pritzel, Bot.Jahrb Syst. 35 (1904) 506, nom. nud., pro syn.

Typification:

N.insignis E.Pritzel was described on two collections namely Diel's no. 3144 and E.Pritzel's no.849. The author did not select any specimen (of the above syntypes) as a type of this species. It is necessary, therefore, to choose a lectotype from amongst the syntypes. The above-mentioned collection of Diel's no.3144 is not available for study (probably untraceable or not extant), but some twenty two specimens (syntypes) of E.Pritzel's no.849 have been obtained for examination from different herbaria. Among these the one preserved in Herb. AD (AD97221080) seems a good representative of this species and is selected here as the lectotype.

Description: (Fig. 44).

a much - branched shrub, 30 - 90 cm high, densely clothed with yellow branched tomentum. Stem erect, cylindrical, woody, greyish - yellow tomentose. Leaves decussate, sessile, pressed close together, linear - lanceolate, broader at the base, gradually tapering towards the apex, obtuse, with recurved margin, (3-)4 - 6(-7) cm long, 0.5 - 0.8(-1.2) cm broad, densely covered with greyish - yellow tomentum, the midrib and reticulation often conspicuous on the under - surface of old leaves. Inflorescence terminal, corymbose, of bright yellow - woolly spicate heads; heads sub - globose to ± sub - oblong, (1-)1.5 - 2(-3) cm long, 1 - 1.2(-1.4) cm in diameter; peduncles (2-)3 - 6(-7) cm long, leafless, covered with dense branched woolly tomentum. Flowers 6 - 8 -merous, very compactly borne in the heads, bracteate, subsessile, 6 - 7(-8) mm long (including stamens and style),mostly three in the axil of each bract; bracts very early caducous,

opposite, linear - lanceolate, sessile, 5 - 7 mm long, 0.5 - 0.7 mm broad, densely yellow tomentose outside, glabrous inside, often concealed by the long woolly calyx - tomentum. Calyx 6 - 8 -lobed towards the apex, tubular below, densely clothed with long, branched yellow - woolly tomentum outside, glabrous within, 3 - 4 mm long; tomentum up to 3.5 mm long; lobes ± ovate, acute, 1.2 - 1.5 mm long; 0.5 - 0.8 mm broad at the base; tube narrow at the base, gradually widening towards the apex, 2 - 2.5 mm long. Corolla yellow or whitish - yellow, ± campanulate, 6 - 8-lobed at the apex, glabrous outside, villous inside the tube, 4.5 - 5.5 mm long; lobes linear - lanceolate, obtuse, quite glabrous, (1.3-)1.5 - 1.7(-2) mm long, 0.5 - 0.6 mm broad at the base; tube narrow at the base, gradually widening towards the apex, 3 - 3.5(-4) mm long. Stamens 6 - 8, much exserted, inserted at the summit of corolla-tube between the lobes; filaments long, filiform, glabrous, ± 3 mm long; anthers dorsifixed, 2 -lobed, 0.6 - 0.8 mm long; lobes oblong, free and very divergent in the lower halves, longitudinally dehiscent. Ovary globose, somewhat glandular and densely hairy, (0.5-)0.8 -1 mm in diameter, 4 -locular, with one ovule in each cell; style long, much exserted, filiform, glabrous, 5 - 6(-6.3) mm long; stigma almost entire or very minutely notched. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- C.A.Gardner 2159: Comet Vale, Coolgardie district, 17.IX.1927 (PERTH-2 spec.).- C.A.Gardner 7959: loc.cit, 19.X.1945 (PERTH).- C.A.Gardner 11104: loc.cit.,3.XI.1953 (PERTH-5 spec.).- C.A.Gardner & W.E.Blackall s.n.; loc.cit., -IX.1927 (PERTH).- J.H.Maiden s.n.: Goongolah, -X.1909 (M).- E.Pritzel 849: Coolgardie Goldfields, -X.1901 (AD lectotype,A,BM,BR,E,HBG,G - 2 spec.,K - 2 spec,L,M,MO,NSW,NY,P,PERTH,PR,S,US650608 & US1373638, W isolectotypes).- J.Wood s.n.: Yilgarrie ("Yilgaru") Goldfields, -X.1909 (C).

Distribution: (Map 15).

N.insignis is endemic to the dry eremean parts in Western Australia. The only known distribution is around Coolgardie and Comet Vale. One collection from an "untrustworthy " locality "Yilgaru Goldfields" has been gathered by J.Wood.

E c o l o g y:

Little is known of the ecology of this species. It seems to occur in sandy places of low rainfall areas. The syntype, E.Pritzel 849 (A,AD,BM,BR,E,HBG,G,K,L,M,MO,NSW,NY,P,PERTH,PR,S,US,W), from Coolgardie Goldfields, is collected from "apertis arenosis".

Gardner 2159 (PERTH), from Comet Vale, is annotated " Erect shrub 2 ft. high; flowers sulphur - yellow". The habitat is noted " Red sand - dunes on edge of desert".

Flowering and fruiting apparently take place mainly from September to November.

C o m m e n t s:

The original description of this species was based on E.Pritzel's collection no.849 and Diel's collection no.3144, without selecting any type. Therefore, the specimens of both the above collections have the status of syntypes. Diel's collection is not available for study, (perhaps destroyed during Second World War), but the duplicates of E.Pritzel's no.849 are available from nineteen different herbaria. The syntypes of this collection in Herb. BR and US are erroneously annotated by Moldenke (during March, 1948 and March, 1966 respectively) as isotypes and a similar view is expressed by A.S.George on the syntype sheet in Herb. E.

Among the species having a golden - yellow inflorescence, N.insignis may be easily distinguished by its leaves being much larger, measuring (3-)4 - 6(-7) by 0.5 - 0.8(-1.2) cm; inflorescence of sub - globose corymbose heads; corolla-tubes linear - lanceolate and stamens and style much exserted.

Flower bracts in this species are very early caducous, small and generally hidden within the long woolly calyx - tomentum. In all the syntypes examined, the flower - bracts seem to have fallen off, and that may be the reason why E.Pritzel did not make any mention of bracts in the protologue. The small size and early caducous nature of bracts coupled with long woolly calyx tomentum may be the reason that Blackall & Grieve (1965) have regarded the bracts as " inconspicuous (or absent)".

Relationship:

N.insignis is closely related to N.cephalantha in having its flowers crowded into sub - globose (-ovoid) terminal heads and stamens and style exserted. However, it can be readily distinguished by its leaves being much longer (measuring (3-)4 - 6(-7) cm long); flower - heads bright golden - yellow tomentose; peduncles leafless; bracts inconspicuous, linear - lanceolate, early caducous; flowers usually 6 - 8 -merous; corolla-lobes gradually narrowing towards the apex and ovary densely covered with long villous hairs.

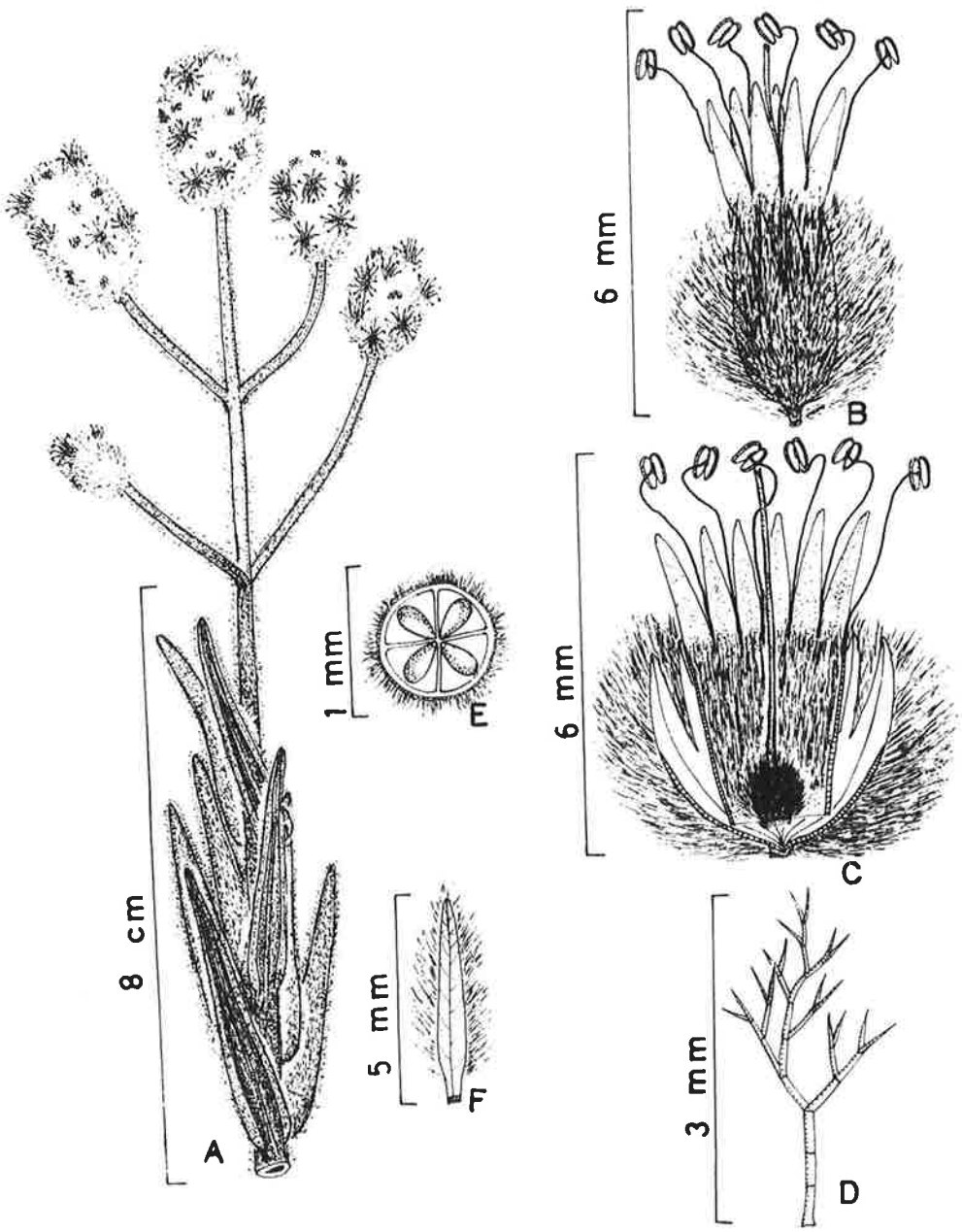


Fig. 44 — Newcastelia insignis E. Pritzel (E. Pritzel 849: AD - syntype, now lectotype).
A, flowering branch; B, flower; C, flower vertically cut open; D, calyx tomentum; E, T.S. ovary; F, bract viewed from inside.

Newcastelia cephalantha F.v.Mueller,Fragm.9(1875) 4 - var. cephalantha; R.Tate, Trans.R.Soc.S.Aust.3 (1880) 78; F.v.Mueller, Cens.Aust.Pl.1 (1882) 103; R.Tate,Trans.R.Soc.S.Aust.12 (1889) 113; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; E.Giles, Aust.Twice Trav.2 (1889) 355; R.Tate, Fl.Extra-Trop.S.Aust. (1890) 155,254; F.M.Bailey, Cat.Indig.Natur.Pl.Qld. (1890) 110; F.v.Mueller & R. Tate, Trans.R.Soc.S.Aust.16 (1896) 375; F.M.Bailey, Qld.Fl.4 (1901) 1166; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 502,503,505, fig.56 H,J; F.M.Bailey, Cat.Qld.Pl. (1913) 381,fig. 359; A.J.Ewart, & O.B.Davies, Fl.N.T. (1917) 237, in obs.; J.M.Black, Fl.S.Aust. ed.1,(1926) 479; K.Domin, Bibl.Bot.89 (1929) 553; C.A.Gardner, Enum.Pl.Aust.Occ 3 (1931) 111; E.Cheel, Aust.N.Z.Assoc.Advanc.Sc. 23 (1937) 332; N.Tindale, S.Aust.Natur. 21(1) (1941) 12;C.M.Eardley, Trans.R.Soc.S.Aust. 70 (1946) 152,169; R.L.Crocker, Trans.R.Soc.S. Aust. 70 (1946) 251; J.M.Black, Fl.S.Aust.ed.2, (1957) 721, fig. 1031; G.Chippendale, Trans.R.Soc.S.Aust.82 (1959) 334; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,321; W.E.Blackall & B.J.Grieve, W. Aust.Wildfls.3 (1965) 564; J.S.Beard, W.Aust.Pl. (1965) 92; A. Morris, Pl.Life W.Darling (1966) 76; R.E.Winkworth, Aust.J.Bot.15 (1967) 122; D.E.Symon, Trans.R.Soc.S.Aust.93 (1969) 33; J.S.Beard, W.Aust.Pl.ed.2, (1970) 114; T.E.H.Alpin & J.R.Connon, Economic Bot. 25/4 (1971) 379; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,573; G.Chippendale, Proc.Linn.Soc.N.S.W. 96 (1972) 256.

T y p u s: E.Giles s.n.,MEL41005: between the Alberga River and Mount Olga, South Australia, - (MEL holotype).

N.cephalantha F.v.Mueller var. queenslandica Domin in Bibl.Bot.89 (1929) 553; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,321; H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347,573,574. - syn.nov.

T y p u s: W.Rose s.n.,PR530702: Windorah, Queensland,-1910 (PR holotype).

Description: (Fig. 45).

An erect shrub, 0.45 - 1(-1.21) metre high, densely covered with brownish - grey branched tomentum. Stem brnached, cylindrical, woody,[± fulvescent - grey tomentose]. Leaves decussate, sessile, ovate - lanceolate to oblong - lanceolate, with recurved margins, (0.8-)1 - 2(-2.3) cm long, (0.2-)0.4 - 0.6(-0.8) cm broad, densely covered with greyish tomentum, the midrib and lateral veins conspicuous on the under surface. Inflorescence of greyish - woolly spicate heads; spikes terminal on branches, ± subglobose, sessile,

each subtended by a pair of leaves, (0.8-)1 - 1.5(-1.8) cm by (0.8-)1 - 1.3(-1.8) cm. Flowers 5 -merous, rarely 4 -or 6 -merous, bracteate, sessile, 6 - 7.5 mm long (including stamens and style), compactly arranged in opposite clusters of three in the axil of each bract; bracts opposite, almost sessile, broadly elliptic - orbicular, densely covered with small (black) glands and short branched tomentum outside, glabrous inside, 4 - 5(-7) mm long, (3.5-)4 - 5(-8) mm broad, often concealing the young flowers. Calyx 5 -lobed, rarely 4 -lobed, 2.5 - 3 mm long, (up to 4.5 mm in the fruiting specimens), glandular and densely woolly -tomentose outside, glabrous inside; tomentum ± silky - woolly, much branched, upto 3 mm long; lobes small, deltoid, ± 1 mm long, nearly as broad at the base; tube 1.5 - 2 mm long, braoder towards the apex. Corolla purple - violet, ± campanulate, 5 -lobed towards the apex, rarely 4 -lobed, glabrous outside, densely tomentose within, 4.5-5 mm long; lobes ovate, acuminate, shorter than the tube, 1.5 -1.8 mm long, 0.8 - 1 mm broad at the base, glabrous all over; tube cylindrical, somewhat broader towards the summit, 3 - 3.5 mm long. Stamens 5, rarely 4, much exserted, inserted on the summit of corolla-tube; filaments long, filiform, glabrous, 3.5 - 4 mm long; anthers 2 -lobed, dorsifixed, 0.5 - 0.7 mm long, nearly as broad, pale - yellow; lobes oblong, free in the lower halves, longitudinally dehiscent. Ovary ± globose, glabrous, densely glandular all over, 0.8 - 1 mm across, 4 -locular, with one ovule in each cell; style much exserted, filiform, glabrous, 6 - 7 mm long; stigma almost entire or very minutely notched. Fruit ± globular, 1.8 - 2.8 mm across, glabrous, glandular.

Specimens examined:

QUEENSLAND:- R.L.Crocker s.n.,AD97113066: Camp 17, Simpson Desert Expedition, ca. 185 km north-north-west of Birdsville, 25.VI.1939(AD).-S.L.Everist 3892: about 52 miles west of Windorah 8.VI.1949 (BRI,CANB).- A.Henry s.n., MEL41007: Georgina River, -1889 (MEL).- R.S.Stranger s.n., BRI024841: 47 miles W. of Windorah on Windorah - Currawilla road at roadside, 20.VII.1960 (BRI).- W.Rose s.n., PR530702: Windorah, -1910 (PR type of var.queenslandica K.Domin).

SOUTH AUSTRALIA:- B.Alright 14: 10 m. W.Musgrave Ranges, between Musgrave and Mann Ranges, N.T.= S.A. border, -VIII.1967 (N T).- J.B.Cleland s.n.,AD966071226: between Tomkinson and Mann Ranges, 26.VIII.1954 (AD).- J.B.Cleland s.n.,AD966071129: between Mann and Musgrave Ranges, 27.VIII.1952 (AD).- J.B.Cleland s.n., AD966071139 & AD97205178: Cordillo Downs,-V.1924 (AD).- E.Giles

s.n., MEL41005: between the Alberga And Mt. Olga, -(MEL holotype).- R.Helms s.n., AD97113067,NSW106645: between camp 11 and 12 of Elder Expl. Exped., between Musgrave and Birksgate Ranges, 30.VI. 1891 (AD,NSW).- R.Helms s.n., AD97113065,MEL41006,NSW106642, NSW106643: Camp 12, Elder Expl.Exped.,30.VI.1891, (AD,K,MEL,NSW, PERTH).- R.H.Kuchel 333: Roadside, 12 m.S. of Cheeseman's Peak turnoff, 50 m. S. of Mt.Lindsey, Birksgate Range, 7.VIII.1962, (AD,B,E,UC).- McGillivray s.n.,Herb.Morris 907: Cordillo Downs Stn., -IX.1922 (AD,-2 spec.,ADW-2 spec.,NSW).- D.E.Symon 2156, ADW25599: 29 m. W.Musgrave Park Stn, Musgrave Ranges, ± 131° E, 26° 10' S, 30.VII.1962 (ADW,PERTH).- N.Tindale & Hackett s.n., AD97113068: Mt.Kintore, 12.II.1933 (AD).- N.Tindale & Hackett s.n., AD97205180: 4 m. N.W. of Camp 18, near Kunamata, 16.VII.1933 (AD).- N.Tindale & Hackett s.n., AD97205182: Mt.Kintore, 17.VII·1933 (AD).- N.Tindale & Hackett s.n.,AD97113083: between Musgrave and Mann Ranges, - 1933 (AD).

NORTHERN TERRITORY:- H.Basedow s.n., CANB50248: Finke River District, S.Aust.Medical Relief Exped.,-1919 (CANB,K,P,PERTH).- G.Chippendale 141: Hugh Stock Route, 10 m. E.Adelaide Road,5.VIII. 1954 (AD-2 spec.,BRI,MEL,NSW,NT).- G.Chippendale 157: about 40 m. S.W. Alice Springs, 6.VIII.1954 (AD,CANB,MEL,NSW,NT,PERTH).- G.Chippendale 4675: 4 m. N.Connor Well, 22.VII.1958 (AD,MEL,NT, PERTH).- J.B.Cleland s.n.,AD97120315: Sandstone Range near Junction of Fraser and Bundey Creeks, 31.VIII.1930 (AD).- M.Costello s.n., BRI113959,NSW106644: from Lake Nash,-(BRI,NSW).- A.S.George 5092: ± 46 m. S. of Alice Springs, 19.VII.1963 (PERTH).- R.Hill & H.W. Caulfield s.n.,AD96208088: 60 miles N. of Alice Springs, -VII.1953 (AD).- E.H.Ising s.n.,AD966080966: MacDonald Downs Station, 25.VII. 1936 (AD).- T.R.N.Lothian 366/54: about 60 miles N. of Alice Springs,-1954 (AD,B,E,PR,RSA-n.v.,NY,TI-n.v.,Z-n.v.).- T.R.N. Lothian 698: 35 m. W. Deep Well Railway Siding, -1954 (AD,B,BM,K, LE,L-n.v.,NT,NY).- J.Must 145: 62 m. N. Alice Springs, Stuart Highway,18.VII.1968 (AD,MEL,NT).- J.Must 303: 90 m. W. Stuart Hwy, Yuendumu Road, 22.VII.1968 (CBG,NT,PERTH).- D.E.Symon 2156: 29 m. W. of Musgrave Park Stn., Musgrave Ranges, - 131° E, 26° 10' S, 30.VII.1962 (AD).- J.Z.Weber 996: Stuart Highway, ca. 110 km north of Alice Springs, 18.VII.1968 (AD).- R.E.Winkworth 359: 18 m. N.N.E. Narwietooma Homestead, 11.VI.1954 (AD,MEL,NSW,NT).- R.E.Winkworth 495: 63 m. N.N.W. of Alice Springs, 27.VII.1954 (MEL, NT).- R.E.Winkworth 752: 44 m. S.W. of Alice Springs, 23.XI.1954 (CANB,NSW,NT-2 spec.).- R.E.Winkworth 1465: 62 m. N.N.W. of Alice Springs, 4.VI.1958(NT).

WESTERN AUSTRALIA:- A.M.Ashby 4211: ca. 280 km north of Meekatharra, 6.VIII.1971 (AD).-J.S.Beard 4830: Gary Highway between Gunbarrel Hwy. & Windy Corner, 23.VII.1967 (PERTH).- R.J. Chinnock 688: 32 km east-north-east of Cosmo Newbery, 1.IX.1973 (AD).-J.B.Cleland s.n.,AD966071196: ca. 65 km north-east of Warburton Ranges, 25.VI.1960 (AD).- J.B.Cleland s.n., AD966071212: on road west of Rawlinson Ranges, 26.VI.1960 (AD).- N.N.Donner 4479: 145 km S.W. of Mt. Fanny, 28.VIII.1973 (AD).- A.S.George 2911: 44 miles S.W. of Warburton Mission, 26.VIII.1961 (PERTH).- A.S.George 3753: 12 m. N.E. of Cosmo Newbery, 19.VIII.1962 (PERTH).- A.S.George 5369: 11 miles E. of Notabilis Hill, Gunbarrel Highway, Gibson Desert, 24.VII.1963 (PERTH).- A.S.George 5634: 32 miles S. of Wilunga, 29.VII'1963 (PERTH).- A.S.George 8689: 42 miles N.E. of Laverton, 12.VII.1967 (PERTH).- A.S.George 8732: 4 mile E. of Winburn Rocks, E. of Warburton 16.VII.1967 (PERTH).- A.S.George 9070: 4 miles W. of Jupiter Well, N. of Gibson Desert, - 126° 32' E, 22° 54' S. 29.VII.1967 (PERTH).- A.A.Munir 5197: 145 km south-west of Mt.Fanny, 28.VIII.1973 (AD).- A.A.Munir 5224: 5 km south of Cosmo - Newbery,31.VIII.1973 (AD).- E.Oliver 3957:on Warburton Rd. to Empress Springs, -VIII.1971 (AD).- E.Giles s.n.,MEL41009: between the Alfred - Marie's Ranges and the Rawlinson Ranges, - (MEL).- R.Helms s.n.,AD97113082,MEL41008,NSW106646,NSW106647 & NSW106648: near Barrow Range, 17.VIII.1891 (AD,BM,G,K,MEL,NSW- 3 spec.,PERTH).- R.H.Pulleine s.n.; Fraser River,31.VIII.1930 (K).- R.D.Royce 1988: Well 36, Rabbit Proof Fence, 9.VI.1947 (PERTH- 2 spec.).- N.H.Speck 1194: Camel Well, Eremean Province, 25.IX.1958 (AD,BRI,CANB,NSW,PERTH).- Herb.R.Tate s.n.,AD97113081: loc.incert., - (AD).

Distribution: (Map 16).

This species is known from the dry eremean parts of Australia. The main areas of its occurrence are in Queensland,South Australia, Northern Territory and Western Australia. In Queensland, this species is confined to the west-south-west towards the Northern Territory and SouthAustralian borders. The known localities are west of Windorah along the road to Currawilla towards the north and north-west of Birdsville near to the Georgina River and to the Northern Territory border respectively. South Australian localities are restricted to the far north-eastern corner near Cordillo Downs and also the far north-west around Birksgate, Mann, Musgrave and Tomkinson Ranges.

In Northern Territory, this species is known from the southern and eastern parts only. Localities in the east are near Lake Nash,

MacDonald Downs and close to the junction of Bundy and Fraser Creeks. The southern distribution is mainly north-north-west and south-south-west of Alice Springs. Some localities to north-north-west are near Hann Range, Conner's Well, Yuendumu Settlement and around Narwietooma Homestead. To the south, along the railway, it occurs near Finke and Deep Well. In the south-west, it is recorded from the neighbourhood of Hugh River and in the north-western portion of Musgrave Ranges near the South Australian border.

In Western Australia, its occurrence is mainly restricted to the far eastern section of the Eastern Division, In this area, the majority of collections have come from Gibson Desert and the vicinity of Barrow, Rawlinson and Warburton Ranges. Gibson Desert records are mainly from between Alfred - Marie and Rawlinson Ranges, and between Gunbarrel Highway and Windy Corner. Farther north, it is recorded from near Well 36 along Canning Stock Route and north-east of Broome near Fraser River. To the south-west of Gibson Desert and west of Great Victoria Desert, it occurs south of Wiluna, near Lake Way and north-east of Laverton near Cosmo Newbery Homestead.

E c o l o g y:

Much of what is true of N.spodiotricha is true also of this species. According to information gathered from collector's annotations, it commonly occurs in sandy spinifex plain, often in association with Eucalyptus and Acacia species. Tate (1880) has recorded this species with N.bracteosa and N.spodiotricha, in region "C" of his flora, which is characterized by the large proportion of Crucifers, Zygophylleae, Malvaceae, Sterculeaceae, Euphorbiaceae, Amaranthaceae, Chenopodiaceae, Portulacaceae, Ficoideae, Goodenovieae, Solanaceae, Myoporineae and Grasses etc". It seems likely that N.cephalantha may spread rather quickly; the long woolly tomentum on the calyx is probably helpful in transport of the fruit by wind. Everist 3892 (BRI,CANB), from ± 50 miles W. of Windorah, Qld., is recorded as"densely branched subshrub of about 2 feet high, with dull green leaves". The plant is noted to grow "in pinkish brown sandy soil with Eucalyptus papuana". Chippendale 141 (AD,BRI,MEL,NSW,NT), from Hugh Stock Route, 10 miles east of Adelaide Road, N.T., is annotated as "subshrub of 3 - 4 feet high with lilac to purple flowers, growing in Spinifex country". His subsequent collections nos. 157 (AD,CANB,MEL,NSW, NT,PERTH), from 4 miles S.W. Alice Springs, and 4675 (AD,MEL,NT, PERTH), from 4 miles north of Connor Well, are recorded as "2 - 3 feet shrub, growing on open plains in deep red sand". The inflor-

escence is noted as "purple - blue". George 5092 (PERTH), ± 46 miles south of Alice Springs is annotated as "shrub to 80 cm.Fls. white, stamens purple". The habitat is said to be "red sand, with Spinifex and scattered Acacia". Must 145 (AD,MEL,NT), 62 miles north Alice Springs and 303 (CBG,NT,PERTH), 90 miles W. Stuart Hwy, Yuendumu Rd., are noted as " Shrubby perennial to 2 ft. high, flowers purple in white woolly heads. Growing on sandy spinifex plain". Winkworth 495 (MEL,NT), from 63 miles N.N.W. Alice Springs is recorded as "grey shrub 2 ft high, blue flowers". The plant was growing "on red sand with Triodia basedowii". Winkworth's subsequent coll. no. 1465 (NT), loc.cit., is noted to grow in "sand plain, in Spinifex community, regenerating after fire". Speck 1194 (AD,BRI,CANB,NSW,PERTH), from Camel Well, Eremean Province, W.A., is annotated as "Bush to 2 ft. flowers blue, Spinifex sandplain after a burn". In Western Australia, the present author has found this species growing in sandy soil with Eucalyptus pyriformis, Grevillea, Ptilotus and Triodia species. The average plant is shrub 60 by 60 cm spreading from the base. Leaves are normally with recurved margins and flower - heads are woolly and somewhat fluffy when old.

Flowering and fruiting seem to occur chiefly from June to September.

C o m m e n t s:

In the protologue, the type is noted as collected by E.Giles from between the River Alberga and Mt.Olga, but the exact type locality is not given by the author nor is it recorded by the collector. The River Alberga and Mt.Olga are located respectively in South Australia and Northern Territory, and are nearly 300 miles apart. Between these two places, N.cephalantha is known to grow near the Musgrave Ranges in South Australia but its presence around Mt.Olga in the Northern Territory is not known. Moreover, F.v.Mueller, the author, in his First and Second Census of Australian Plants [(1882) 103 , (1889)172], has recorded this species from South Australia only. Therefore, the type locality is most probably in the vicinity of Musgrave Ranges in South Australia, which is indeed between the River Alberga and Mt.Olga. This area was visited by E.Giles in early September, 1873, during his Second Exploring Expedition into Central South Australia [E.Giles, Aust. Twice Trav. 1 (1889) 156-187, map 2]. Thus the type was apparently collected during that visit of E.Giles to Musgrave Ranges in early September, 1873, which date has neither been recorded on the herbarium label nor in the protologue of this species.

Tindale & Hackett's collection no.AD97205180 was gathered on 16th July, 1933, from " 4 miles north-west of camp 18", but the name of the exact locality is not given on the herbarium label. After going through Tindale's Expedition records, it has been found that this particular collection was made during their Anthropological Expedition to the Mann Ranges in May to July,1933; the location of "camp 18" is north of Kunamata, which is south of the eastern end of the Mann Ranges [S.Aust.Natur. 21/1 (1941)8-12].

Beard (1965,1970) has recorded the distribution of this species within Gardner & Bennett's Botanical district Austin of the Eremean Province, W.Australia. This record may now be supplemented by combining with it the Carnegie district, to include the currently known majority of the localities of this species.

The number of bracts in a flower-head are usually 3 - 5 pairs. Each mature bract normally subtends 3 flowers, one axillary and two somewhat lateral. In the uppermost pair, the number of flowers in the axil of a bract are often one or two only, and in the next lower pair, the number of flowers may be one, two or three. When the number of flowers is one per axil, the two laterals have apparently been suppressed. In cases of two, then one of the lateral flowers appears not to have developed. Such variation may also occur in other species where the number of axillary flowers is 3 per mature bract.

The corolla in the collections from Upper Arkaringa Valley, andEverard Range, is recorded by Mueller & Tate (1896) as being "larger and somewhat exceeded by the stamens". This is not peculiar to this species alone, because an almost exactly similar situation exists in Mueller's two earlier described species, N.spodiotricha and N.bracteosa.In the flowers with exserted stamens, the corolla length (tube + lobes) somewhat exceeds the free part of the filament, but the insertion of stamens at the summit of corolla-tube make them much protruded and longer than the corolla-lobes.

After examining the type specimen of N.cephalantha FvM. var. queenslandica Domin, it has been found that the characters attributed to this variety are found commonly in the type variety as well; there seems no unusual character which can really help to distinguish this taxon. Therefore, the var. queenslandica Domin is found convarietal with the type variety and is recorded here as a synonym.

Relationship:

This species is closely related to N.insignis in having ± globular - ovoid flower - heads and much exserted stamens and

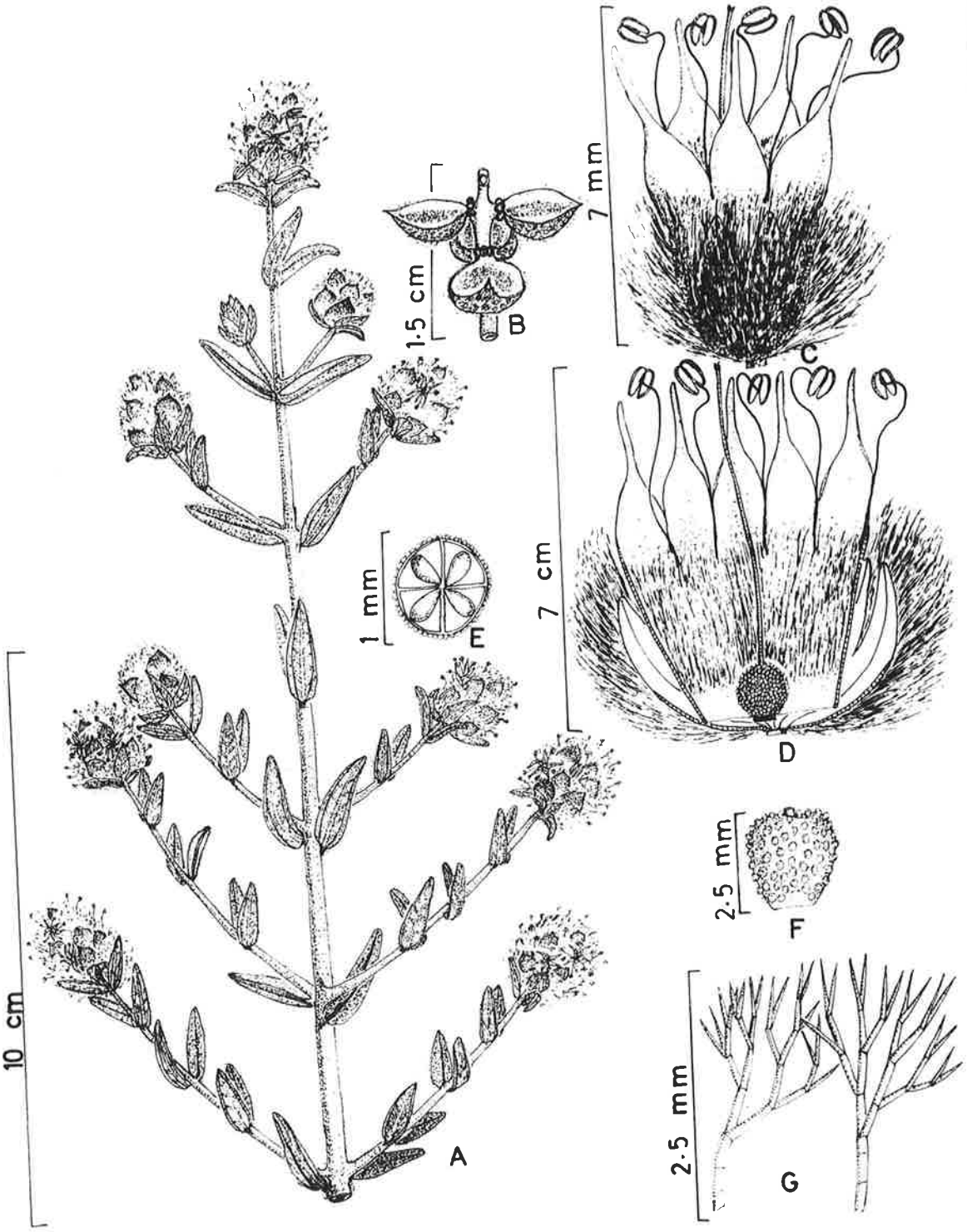


Fig. 45 — Newcastelia cephalantha F.v.M. var. cephalantha (T.R.N. Lothian 698: AD).

A, flowering twig; B, bracts each with 3 axillary scars left by the removed flowers; C, flower; D, flower vertically cut open; E, T.S. ovary; F, fruit; G, calyx tomentum.

style, but can be readily distinguished by its flower - heads being greyish - woolly; peduncle leafy; bracts large and quite prominent; flowers usually 5 -merous; corolla - lobes abruptly acuminate and ovary glabrous, (densely glandular).

Newcastelia cephalantha F.v.Mueller var. oblonga Munir, var. nov.

Varietas ab aliis ob spicas oblongas et folia majora (1-) 2 - 3.5 (-3.8) cm longa (0.4-)0.5 - 0.6(-0.8) cm lata distinguitur.

T y p u s: D.J.Nelson 372: Hann Range, 70 m. N. of Alice Springs, Northern Territory, 1.VI.1962 (AD holotype; BRI,CANB,MEL,NT,PERTH).

This taxon differs from the type variety by its oblong flower - heads.

Specimens examined:

QUEENSLAND:- D.E.Boyland 150: 20 miles S.E. of Windorah, 18.IX.1966 (BRI).- J.Little s.n.,BRI113961: south-west Queensland, -1910 (BRI).- C.L.Mackay 1: 50 miles S.W. of Windorah, 6.IX.1961 (BRI).

NORTHERN TERRITORY:- G.Chippendale 2709: Hamilton Downs,Desert Grazing Area, 29.VIII.1956 (AD,MEL,NT).- G.Chippendale 3797: 14.1 m. E.Ammaroo Homestead, 30.IX.1957 (AD,BRI,CANB,MEL,NT,NSW,PERTH).- E.H.Ising s.n., AD966080797: MacDonald Downs Station, 30.VIII.1933 (AD).- D.J.Nelson 372: Hann Range, 70 m. N. Alice Springs (AD holotype,BRI,CANB,MEL,NT,PERTH isotypes).

WESTERN AUSTRALIA:- T.E.H.Alpin 2411: Wiluna, 21.VIII.1963 (PERTH).- J.V.Blockley 453: roadside near Mundiwindi, 26.X.1966 (PERTH).- A.S.George 2857: 11 miles N.E. of Cosmo Newbery, 24. VIII.1961 (B,PERTH).- A.S.George 5618: 13 miles N.E. of Wiluna, 28.VIII.1961 (PERTH).- A.S.George 8379: 34 miles N. of Neale Junction, E. of Laverton, 9.IX.1966 (MEL,PERTH).- A.S.George 8396: 29 miles W. of Neale Junction, 10.IX.1966 (PERTH).- R.Helms s.n., AD9720922: Camp 53, Elder Expl.Exped., Victoria Desert, 15.IX.1891 (AD).

Distribution: (Map 16).

This variety is recorded from Queensland, Northern Territory and Western Australia. In Queensland, the distribution is in the south-west around Windorah, and in Northern Territory it occurs to the north-north-west and north-east of Alice Springs. North-east of Alice Springs it has been collected from MacDonald Downs and Ammaroo Homestead and to the north-west it grows near Hamilton Downs. The northern-most locality is along the Stuart Highway in

Hann Range. Distribution in Western Australia is confined mainly to the Eastern Division, where most of the collections come from Great Victoria Desert. The desert localities are to north and west of Neale Junction, south-east of Laverton , near Cosmo Newbery and at Camp 53 of the Elder Exploring Expedition. Other known localities are about Wiluna and along the Great Northern Highway near Mundiwindi.

E c o l o g y:

In its ecological requirements var.oblonga is much like the type variety, being common in the dry eremean parts of Australia. According to Chippendale 2709 (AD,MEL,NT), from Hamilton Downs,it is a " 9" high grey sub - shrub with blue flowers, growing in deep red sand". In his subsequent collection no.3797 (AD,BRI,CANB,MEL, NT,PERTH), from 14.1 miles east of Ammaroo Homestead, is noted as "Perennial herb 1', infl. grey - green. Rare, in deep red sand". Ising AD966080797 (AD), from MacDonald Downs, is annotated as "shrub of 2 ft. high and across, growing in sand hills". George 8379 (MEL,PERTH), 34 miles north of Neale Junction, east of Laverton, is noted "Much branched shrub to 50 cm. Flr. heads pale greenish". The habitat is recorded "red sand with Spinifex and Mallees". Blackley 453 (PERTH), from roadside near Mundiwindi is described as " 3' - 4' shrub with fluffy silver white head". Nelson 372 (AD,BRI,CANB,MEL,NT,PERTH), from Hann Range, 70 miles north of Alice Springs, is noted as "Herb to 1' high, flower heads mauve to whitish when old. Infrequent in deep red sand in Triodia and Mallee Community".

Flowering and fruiting seem to take place mainly during June - September.

C o m m e n t s:

This taxon overlaps the area of the type variety near Windorah in Queensland, MacDonald Downs and Hann Ranges in Northern Territory and at Cosmo Newbery in Western Australia. The leaves are comparatively larger than the type variety, measuring (1-)2 - 3.5(-3.8) cm by (0.4-)0.5 - 0.6(-0.8) cm

Relationship:

Allied closely to the type variety in its stem and leaves being brownish - grey tomentose; tomentum 0.3 - 0.8(-1) mm long; leaves not crowded (± lax), recurved mostly along the margins; flower - heads woolly, usually not fluffy. However, it may be easily identified by its oblong flower - heads and comparatively

larger leaves measuring (1-)2 - 3.5(-3.8) cm by (0.4-)0.5 - 0.6 (-0.8) cm.

Newcastelia cephalantha F.v.Mueller var. tephropepla Munir, var.nov.

Varietas ab aliis ob in caule foliisque tomentum albo - canum breve 0.2 - 0.3 mm longum folia saepe conferta brevia 0.6 - 1(1.5) cm longa (0.2)0.3 - 0.5(0.6) cm lata ad medium usque recurva et spicas subglobosas cano - lanatas saepe lanatissimas distinguitur.

T y p u s: Hj.Eichler 17310: ca. 46 km west of Musgrave Park Homestead, along track to Mt. Davies, western portion of Musgrave Ranges, South Australia, 6.IX.1963 (AD holotype; AAU.n.v.,B,E,L n.v.,M,NY,RSA n.v.,UC,US).

This variety differs from other taxa of this species by its stem and leaves being whitish - grey tomentose; tomentum short, 0.2 - 0.3 mm long; leaves often crowded, short, [0.6 - 1(-1.5) cm by (0.2-)0.3 - 0.5(-0.6) cm], recurved mostly up to the middle; flower - heads ± subglobose, greyish woolly, often very fluffy.

Specimens examined:

NORTHERN TERRITORY:- N.T.Burbidge & Grey 4319: Mt.Chappel Bore to Spinifex Bore, 25.IX.1955 (CANB,PERTH).- N.T.Burbidge & Grey 4338: Hamilton Downs Survey Camp, 26.IX.1955 (CANB).- G.Chippendale 3130: 30.2 m. E. Elkedra Homestead, 23.X.1956 (CANB, MEL,NSW,NT).- C.Dunlop 2022: 39 m. N.E. Mt. Davies Camp,1.XI.1970 (NT).- S.E.Firth F43: 65 m. W. Argadargada Homestead, on Ammaroo Road, 5.IX.1968 (NT).- H.A.Johnson 70: 63 miles N. of Alice Springs, 20.X.1956 (AD).- H.A.Johnson 26: about 10 miles N. of Renners Rock H.S.,27.IX.1956 (AD).- M.Lazarides 5989: 12 miles N.E. of Narwietooma Station,15.IX.1956 (AD,BRI,CANB81290 & CANB 81291,MEL,MO,NSW,NT,PERTH,US).- D.J.Nelson 1728: Stuart Highway, 62 m. N. Alice Springs, 13.VIII.1968 (AD,MEL,NT).- H.Walter 3339: 60 miles N. of Alice Springs, 24.X.1958 (B).

SOUTH AUSTRALIA:- N.Forde 1511: 3 miles E.S.E. of Coffin Hill, 20.X.1960 (CANB).- W.S.Reid s.n.,ADW19308: between Musgrave & Mann Ranges, 20.IX.1955 (ADW).- Hj.Eichler 17310: ca. 46 km west of Musgrave Park Homestead, along track to Mt.Davies, western portion of Musgrave Ranges, 6.IX.1963 (AD holotype;AAU n.v., B, E,L, n.v.,M,NY,RSA n.v.,UC,US isotypes).- D.J.E.Whibley 982:ca. 47 km west of Musgrave Park, 6.IX.1963 (AD,W).

WESTERN AUSTRALIA:- Stan Gratte's party for A.M.Ashby 3488: ca. 30 km west of Lake Breaden, approx. 160 km north-west of

Warburton, Carnegie district, 2 - 14.VIII.1970 (AD).- A.Fairall 2031: 126 miles from Carnegie Station to Mt.Everard Station, 27. VII.1966 (PERTH).- A.S.George 3982: 42 miles S.W. of Warburton, 24.VIII.1962 (PERTH).- A.A.Munir 5213: 35 km south-west Warburton Mission, 30.VIII.1973 (AD).- A.A.Munir 5222: 415 km south-west of Warburton Mission, 31.VIII.1973 (AD).- N.H.Speck 1470: 13 miles north-west of Albion Downs Woolshed, 14.IV.1959 (CANB,MEL,PERTH).

Distribution: (Map 16).

This variety is recorded mainly from southern and western parts of Northern Territory, far north-west of South Australia and from the Eastern Division of Western Australia. In general, the main distribution coincides to some extent with the type variety and var. oblonga, but in some places they grow a little apart from each other. Northern Territory localities are near Hann Range and Renners Rock along Stuart Highway and around Mann Ranges near South Australian border. To the north-east of Narwietooma Homestead it occurs between Mt.Chappel Bore and Spinifex Bore and near Hamilton Downs. Other localities in Northern Territory are around Elkedra and along roadside between Ammaroo and Argadargada Homesteads.

In South Australia, this variety is collected from south-east of Birksgate Range and between Mann and Musgrave Ranges. The Distribution in Western Australia is south of Wiluna, south-west of Warburton Range and west of Lake Breaden.

E c o l o g y:

Much of what is true of the type variety and var. oblonga applies also to this variety. According to information gathered from collectors' annotations, it commonly occurs in deep red sand chiefly of spinifex - mallee country. Chippendale 3130 (CANB,MEL, NSW,NT), from 30.2 m. E. Elkedra H.S., is noted "infrequent, in deep red sand, associated with Triodia pungens". The plant is said to be one foot high sub - shrub, having woolly - grey inflorescence. Dunlop 2022(NT), 39 miles north-east of Mt.Davies is recorded as growing "on red sandy loam plain with Triodia basedowii". Forde 1511 (CANB), 3 miles east-south-east of Coffin Hill, is annotated as "common in dune fields dominated by Acacia ramulosa". Lazarides 5989 (AD,BRI,CANB,MEL,NSW,NT,PERTH), 12 miles north-east of Narwietooma Station is noted as "Spreading, grey shrub of 12 ins. high, forming clumps 3 ft. wide. Flowers white, almost globular". The habitat is "occasional in fine clayey sand with Triodia basedowii and sparse Eucalyptus terminalis". Nelson 1728

(AD,MEL,NT), 62 m. N.Alice Springs, Stuart Highway, is reported "subshrub 18" high with dense, grey white inflorescence, leaves opposite, grey, green. Infrequent in red sandy soil with Triodia basedowii by road side". The present author has collected this variety fromsandy and gravelly soils in Western Australia. In sandy soil, it was associated chiefly with Acacia, Grevillea, Newcastelia hexarrhena and Triodia species, and in gravelly soil the main plants growing with it are Acacia, Cassia, Dicrastylis exsuccosa, Eucalyptus pyriformis, Hakea and Triodia species. In both soils the plant size is ± 60 by 90 cm.

Relationship:

var.tephropepla is closely related to the type variety. For distinctive characters, see under key to the species the sub - specific taxa of N.cephalantha.

Newcastelia chrysotricha F.v.Mueller, Fragm.10 (1876) 15; F.v. Mueller, Cens.Aust.Pl.1 (1882) 103; F.v.Mueller, Sec.Cens.Aust. Pl.1 (1889) 172; R.Tate, Trans.R.Soc.S.Aust.19 (1895) 82; F.v. Mueller & R.Tate, Trans.R.Soc.S.Aust.16 (1896) 375; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 502,503,505; J.M.Black, Fl. S.Aust.ed.1, (1926) 479; C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931)111; J.M.Black, Fl.S.Aust.ed.2,(1957) 721; H.N.Moldenke, Résumé Verbenac. etc. (1959) 209,321; C.A.Gardner, J.R.Soc.W.Aust. 47 (1964) 62, in obs.; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls.3 (1965) 564; J.S.Beard, W.Aust.Pl.ed.2, (1970)114; H.N.Moldenke, Fifth Summary Verbenac.etc. (1971) 347,574.

T y p u s: Jess. Young s.n.,MEL41013: Victoria Springs, Western Australia, - (MEL lectotype; k,MEL41012 isolectotypes).

Typification:

N.chrysotricha FvM. is based on Young's collection from Victoria Springs, Western Australia. The collection consists of three specimens, one at Kew and two in Herb.MEL preserved under the nos. MEL41012 and MEL41013. Both the specimens in Herb.MEL have been seen, annotated and used by the author while describing this species, but neither was selected as a type of this species. It is therefore necessary to choose a lectotype from among the syntypes. Of the two specimens in Herb.MEL, the one with no. MEL41013 seems to be the better representative of this species and is selected here as the lectotype.

Description: (Fig. 46).

A branching shrub; stem erect, generally decussately branched, cylindrical, woody, densely covered with yellowish - brown branched tomentum. Leaves mostly in whorls of three, sessile, narrowly linear with recurved margins, glutinous - glandular but glabrous above, golden - yellow tomentose beneath, (1-)1.8 - 2(-2.5) cm long, 1.5 - 3 mm broad. Inflorescence terminal, spicate; spikes golden - yellow, pedunculate, cylindrical, (5-)7 - 12(-14) cm long, 0.8 - 1 cm in diameter, often with lateral branches near the base, mostly interrupted, (at least in the lower part); peduncle golden - yellow tomentose. Flowers 5 -merous, rarely 4 -merous, sessile, bracteate, generally three in the axil of each bract, 4.5 - 5 mm long; bracts lanceolate, mostly in whorls of three,stalked, (4-)4.5 mm long, (1-)1.3 - 1.5 mm broad in the widest part, inside glabrous, outside covered with branched yellow tomentum, reticulate unicostate. Calyx tubular, 5 -lobed at the apex, sometimes 4 -lobed, ± 3 mm long, glandular and densely

woolly - tomentose outside, glabrous within; tomentum branched, golden - yellow; lobes deltoid, acute, smaller than the tube, 0.8 - 1 mm long, 1 - 1.5 mm broad near the base; tube ± 2 mm long, somewhat broader at the apex. Corolla tubular, 5 -lobed at the apex, sometimes 4 -lobed, glabrous outside, villous inside towards the base, 3.5 - 4 mm long; lobes ± elliptic or elliptic - ovate, obtuse, 0.8 - 1 mm long, 1 - 1.3(-1.5) mm broad; tube ± cylindrical, somewhat broader at the apex, ± equalling the calyx, 2.7 - 3 mm long. Stamens 5, rarely 4, included, inserted inside the corolla-tube; filaments minute, hardly 0.5 mm long; anther 2 -lobed, dorsifixed, ± oblong, 0.5 - 0.6 mm long, yellowish - brown; lobes free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, glandular and hairy at the top, glabrous below, ± 1 mm across, 4 -locular with a single pendulous ovule in each cell; style short, included, glabrous, filiform, 1 - 1.3 mm long; stigma notched. Fruit not seen.

Specimens examined:

WESTERN AUSTRALIA:- R.Helms s.n., AD96323036,AD97113059, AD97205183,MEL41011,NSW106653: Elder Expl.Exped.Camp 54, Victoria Desert, ca. 320 km N.-E. of Kalgoorlie, 16.IX.1891 (AD,G,K,MEL, NSW,PERTH).- J.Young s.n., MEL41012: Victoria Springs,- (MEL41013 lectotype; K,MEL41012 isolectotypes).

Distribution: (Map 15).

This taxon is recorded from the dry eremean part of Western Australia. The known distribution is towards north-east of Kalgoorlie in the south-western part of the Great Victoria Desert.

E c o l o g y:

Little is known about the ecology of this species. It seems to occur in sandy soil along the creeks. According to the author 's own remark in the protologue, the type was collected from near gushing / bubbling water viz. "prope scaturigines". Helms. s.n. (AD,K,MEL,NSW,PERTH), from Camp 54 of the Elder Exploring Exped-ition is collected from dry "yellow - sand spinifex" country with "poor bushes". The plant body is a low shrub with golden - yellow spicate inflorescence.

Flowering and fruiting seem to occur mainly during September-November.

C o m m e n t s:

Distribution of this species has been recorded by Mueller &

Tate (1896), and Diels & Pritzel (1904) from near Mt.Watson (N.T. or W.A.) and Birksgate Range (S.A.). The latter locality has been doubtfully recorded by Black (1926,1957) because the specimen examined by him is "in bud and doubtful". Almost all the above authors have based their records on one of Helm's collections which according to Diels & Pritzel (1904) is preserved in Herb. MEL. After having examined all the collections of this species in Herb. MEL and in many other herbaria, the present author has not found any collection of this species by Helms or any others which may represent its occurrence in either of the above-mentioned localities. There is no such record in Black's herbarium now preserved in Herb.AD. Geographically, the Birksgate Range is in the north-west of South Australia, while one Mt.Watson is in the far north-west of the Northern Territory and the other to the west of Kalgoorlie in Western Australia. So far, there is no collection to support the occurrence of this species in any part of Northern Territory or South Australia, nor is there any proof of its existence near Mt.Watson in Western Australia.Mueller (1882,1889), has restricted the distribution of this species to Western Australia, which is quite in accordance with its present known distribution. Prior to these records, Tate (1895) reported this species from Everard Range, and the plant which he has identified with this taxon is noted to belong to "Elder Exped". But this could not be confirmed by any of Helm's collections of the Elder Expl. Expedition (1891), nor by any subsequent record from that area.

The plant must be rare in Australia (W.A.), as it has not been rediscovered since 1891.

In their key to the species of Newcastelia, Blackall & Grieve (1965) have classified the flower of this species as "stalked". The flowers are undoubtedly sessile but the peduncle of the spike is often naked towards the base. It appears as if the authors have erroneously stated "fls. stalked" for the stalked spikes. This view seems reasonable, because the contrasting character used for N.viscida refers to spikes only.

The golden - yellow indumentum on stem, leaves and inflorescence is similar to that in N.insignis and N.chrysophylla, but the narrow linear leaves with revolute margins easily distinguish this species from the other two. The spicate inflorescence and included stamens and style in N.chrysophylla are identical with N.chrysotricha, but the leaves in the former are obovate, flower-bracts ovate, corolla villous inside at the base of its lobes only and ovary tomentose all over.

In Index Kewesnsis, the original publication of this species is erroneously referred to Fragm. "IX" which in fact is Fragm. X.

Relationship:

N.chrysotricha is closely allied to N.viscida in its leaves being narrowly linear, with revolute margins, often in whorls of three; flowers in long spikes; stamens and style included and ovary glandular and hairy at the top. However, it may be readily distinguished by its inflorescence being golden - yellow; spikes much elongated, slender, interrupted and often stalked.

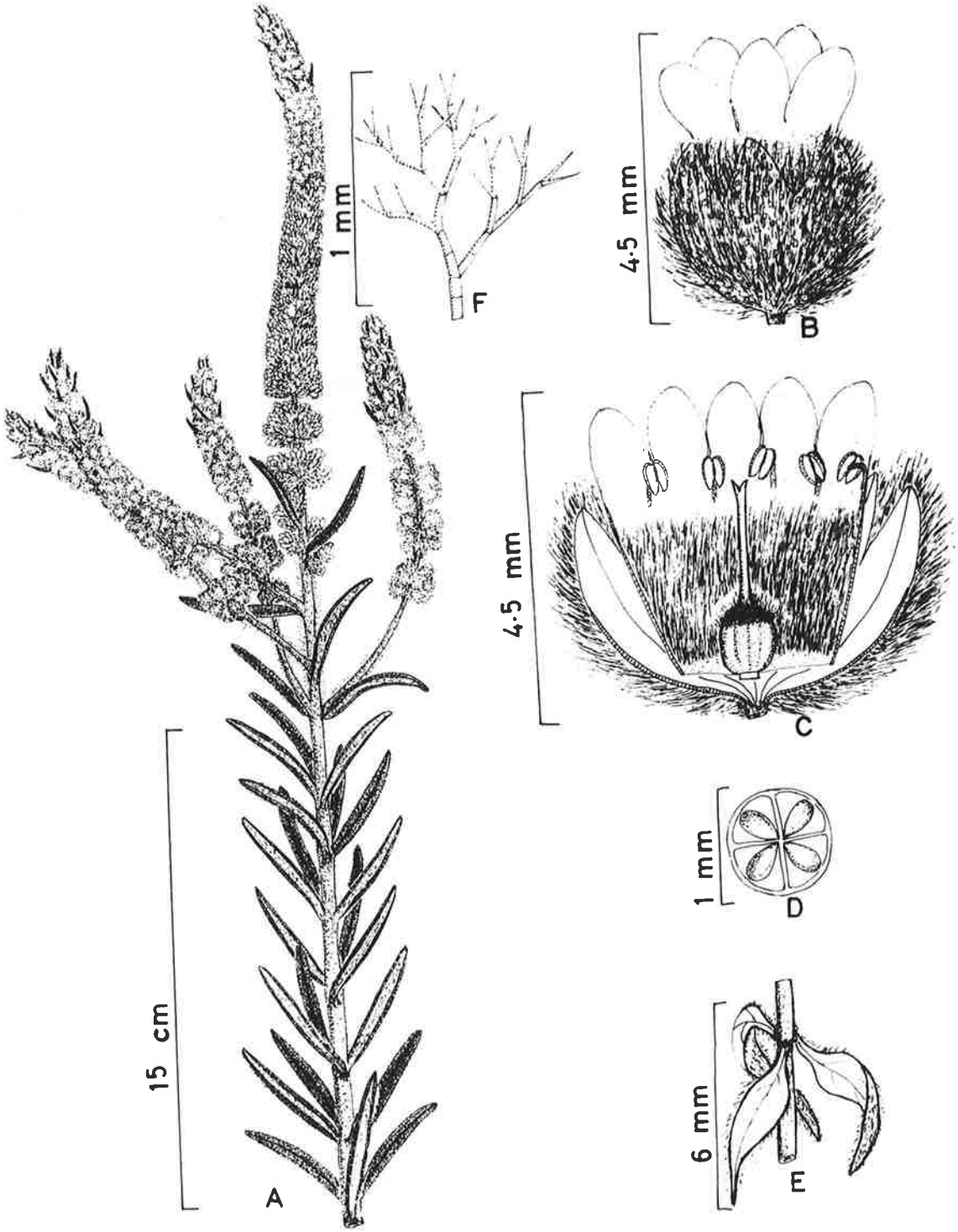


Fig. 46 — Newcastelia chrysotricha F.v.M. (R. Helms s.n., AD 97113059: AD).

A, flowering twig; B, flower; C, flower vertically cut open; D, T.S. ovary; E, 3 bracts at a node each with 3 axillary scars left by the removed flowers; F, calyx tomentum.

Newcastelia viscida E.Pritzel, Bot.Jahrb.Syst.35 (1904) 505, fig. 56 A - C; C.A.Gardner, EnumPl.Aust.Occ.3 (1931) 111; S.Junell, Sym.Bot.Upsal.4 (1934) 64, fig.111; C.A.Gardner, Wildfls.W.Aust. (1959) 127, 128; H.N.Moldenke, Résumé Verbenac.etc.(1959) 209,321; J.S.Beard, W.Aust.Pl.(1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls.3 (1965) 564; J.S.Beard, W.Aust.Pl.ed.2, (1970) 114; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,574; C.A.Gardner, Wildfls.W.Aust.ed.11, (1973) 119.

T y p u s: E.Pritzel 858: Coolgardie Goldfields, Western Australia, -X.1901 (AD lectotype; A,BM,BR,E,F,G,HBG,K,L,M,MO,NSW,P,PR,S,US, W - isolectotypes).

Typification:

N.viscida E.Pritzel was described on two collections, Diels' no.5143 and E.Pritzel's no.858. The author did not select any specimen (of the above syntypes) as a type of this species. Therefore, it is necessary to choose a lectotype from amongst the syntypes. Diel's above-mentioned collection (no.5143) is not available for the present study (probably untraceable or not extant), but some twenty specimens (syntypes) of E.Pritzel's no.858 have been obtained (for examination) from different herbaria. Among these, the one preserved in Herb, AD seems the best representative of this species and is selected here as the lectotype.

Description: (Fig. 47).

A much - branched spreading shrub of 1 to 2 metres high. Stem erect, branched, cylindrical, woody, densely clothed with short grey tomentum. Leaves verticillate, mostly in a whorl of three, sometimes four, sessile, narrow - linear, with recurved margins, glutinous - viscous (but glabrous) above, pubescent and distinctly reticulate beneath, (1-)1.5 - 3(-3.5) cm long, (1-)2 - 3(-4) mm broad. Inflorescence terminal, spicate; spikes whitish - grey tomentose, thick, cylindrical, un-interrupted, often sessile, (3-)4 - 8.5(-11.5) cm long, 1 - 1.4 cm in diameter. Flowers 5 - merous, bracteate, sessile, generally three in the axil of each bract, 4 - 5 mm long; bracts early caducous, verticillate, mostly three in a whorl, sometimes four, lanceolate, shortly stalked, ± 1 cm long, 2.5 - 2.8 mm broad at the base, densely tomentose outside, glabrous inside. Calyx tubular, 5 -lobed at the apex, 2.5 - 3.5 mm long, sparsely glandular and densely tomentose outside, glabrous inside; tomentum whitish - grey, much - brnached, 1.5 - 2 mm long; lobes deltoid, acute, 0.8 - 1 mm long, 0.8 - 1.3 mm broad at the base; tube ± cylindrical, somewhat broader towards

the apex, 1.8 - 2 mm long. Corolla ± campanulate, 5 -lobed at the apex, glabrous outside, villous inside the throat, 3.5 - 4 mm long; lobes ± elliptic - orbicular, obtuse, glabrous, 0.8 - 1 mm long, 1 - 1.5 mm broad; tube narrowed towards the base, ± equalling the calyx, 2.5 - 3.5 mm long. Stamens 5, included, inserted in the corolla - throat; filaments short, hardly as long as the anthers; anthers oblong - orbicular in outline, dorsifixed, 2 -lobed; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, glandular, sparsely pubescent at the top, glabrous otherwise, 1- 1.5 mm in diameter, 4 -locular, with a single ovule in each cell; style short, included, glabrous, filiform, 1.5 - 2 mm long; stigma shortly notched. Fruit ± obovoid sparsely glandular, slightly pubescent,at the top, elsewhere glabrous, 2 - 2.5 mm long, 2 - 2.2 mm across in the widest upper part.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 832: ca. 80 km north-north-west of Kalgoorlie, 25.XI.1963 (AD).- J.W.Audas s.n., AD97205179: loc. incert., interior of W.Australia, -(AD).- G.E.Brockway s.n.: Eastern Goldfields,-1952 (PERTH).- W.H.Butler s.n.: Menangina, N.E. of Kalgoorlie, 22.IX.1962 (B,PERTH).- W.D.Campbell s.n.: Boulder, -XI.1901 (K,PERTH).- F.Fitzgerald 343/22: between Kununoppin and Mt.Marshall, about long. 118° , lat. 31° and Lake Barlee, - long. 119° - 120° , lat. 29° - 30° , during Winter - Spring, 1919 (NSW).- C.A.Gardner 2158: Comet Vale, 17.IX.1931 (PERTH).- C.A.Gardner 7960: loc.cit.,19.X.1945 (PERTH).- C.A.Gardner 11119: loc.cit.;4.X.1953 (PERTH).- C.A.Gardner & W.E.Blackall s.n.: loc. cit.,-IX.1927(PERTH).- J.T.Jutson 107: loc.cit.,-XII.1916 (NSW).- J.T.Jutson 232: loc.cit.,-VIII.1971 (NSW).- A.E.Kitson s.n.: loc. cit. 11.1.1906 (BM).- C.R.James s.n.: Menzies,loc.incert.8.X.1910 (K).- Merrall s.n., MEL41054: loc.incert; interior of W.Australia., -1892 (MEL).- R.Morland 03:Officer Basin, -VI.1963 (PERTH).- A.A. Munir 5233 & 5234: 35 km south of Menzies, 31.IX.1973 (AD).- E. Pritzel 858: Coolgardie Goldfields, -X.1901 (AD lectotype;A,BM,BR, E,F,G-2 spec.,HBG,K-2 spec.,L,M,MO,NSW,P,PR,S.US,W isolectotypes).- R.D.Royce 4447: Comet Vale, 23.IX.1953 (PERTH).- P.G.Wilson 7547: 30 km N.N.E. of Gindelbie Homestead, ca. 90 km N.N.E. of Kalgoorlie, 31.VIII.1968 (PERTH).- P.G.Wilson 8837: 16 km N. of Diemal HS. near southern end of Lake Barlee, 25.VIII.1970 (PERTH).

Distribution: (Map 15).

N.viscida is endemic to the south-western part of Western

Australia. The known distribution is mainly around Coolgardie and Kalgoorlie Goldfields and northwards near Comet Vale. A few localities to the north-east of Kalgoorlie are found along the road near Gindalbie and Menangina, and one collection is known from south-west of Comet Vale. To the west of Kalgoorlie, it is found between Kununoppin and Mt.Marshall and north-west from there it grows near the southern end of Lake Barlee. The only other record of its occurrence is some unknown locality in the Officer Basin.

E c o l o g y:

In its ecological requirements, N.viscida is much like N.insignis being common in open sandy places and gravelly soil. According to Gardner 2158 (PERTH), from Comet Vale, it is " 1 - 2 feet erect shrub with white flowers" growing in "red sand on sand-dunes". Moreover, in his Wildflowers of Western Australia", Gardner (1959) has noted the habitat of this species as " stony soil". Wilson 7547 (PERTH), from 30 km north-north-east of Gindalbi is annotated as "shrub 1.6 m". E.Pritzel 858 (A,AD,BM,BR,E, F,G,HBG,K,L,M,MO,NSW,P,PR,S,US,W), from Coolgardie Goldfields, is noted occurring in "apertis arenosis".

The writer has collected this species from stony - gravelly soil along the roadside. Its main association in the field was with Acacia, Cassia, Dodonaea, Callistemon, Haloragis and Ptilotus species.

Flowering and fruiting seem to occur chiefly from September to November, but a collection by R.Morland from Officer Basin, gathered during the month of June, is with infructescence.

C o m m e n t s:

N.viscida is distributed in the same general area as N.insignis. The type of this species was collected by E.Pritzel along with the type of N.insignis and both were simultaneously described by him as new species. N.viscida agrees with many other species of this genus in having stamens and style included but it comes closer to N.chrysotricha than to any other taxon.

The leaves are generally in whorls of three in the lower parts of the stem, but in the upper parts they often seem to be in whorls of four. Similarly, the overlapping flower - bracts in young inflorescences also appear four in a whorl. This phyllotaxis may be due to much shortening of the internodes between decussate leaf or bract pairs. Like many other species of Newcastelia, the flower - bracts here are early caducous and fall off before the flowers mature.

Relationship:

N.viscida is closely related to N.chrysotricha in having narrow - linear leaves arranged mostly in whorls of three, glutinous - viscous on the dorsal surface; flowers in spicate inflorescence; stamens and style included and ovary glandular and hairy at the top. However, N.viscida, may be readily distinguished by its spikes being whitish - grey tomentose, thick, not slender, uninterrupted and more or less sessile. The spikes in N.chrysotr-icha are golden -yellow, somewhat slender, much elongated and interrupted (at least in the lower part).

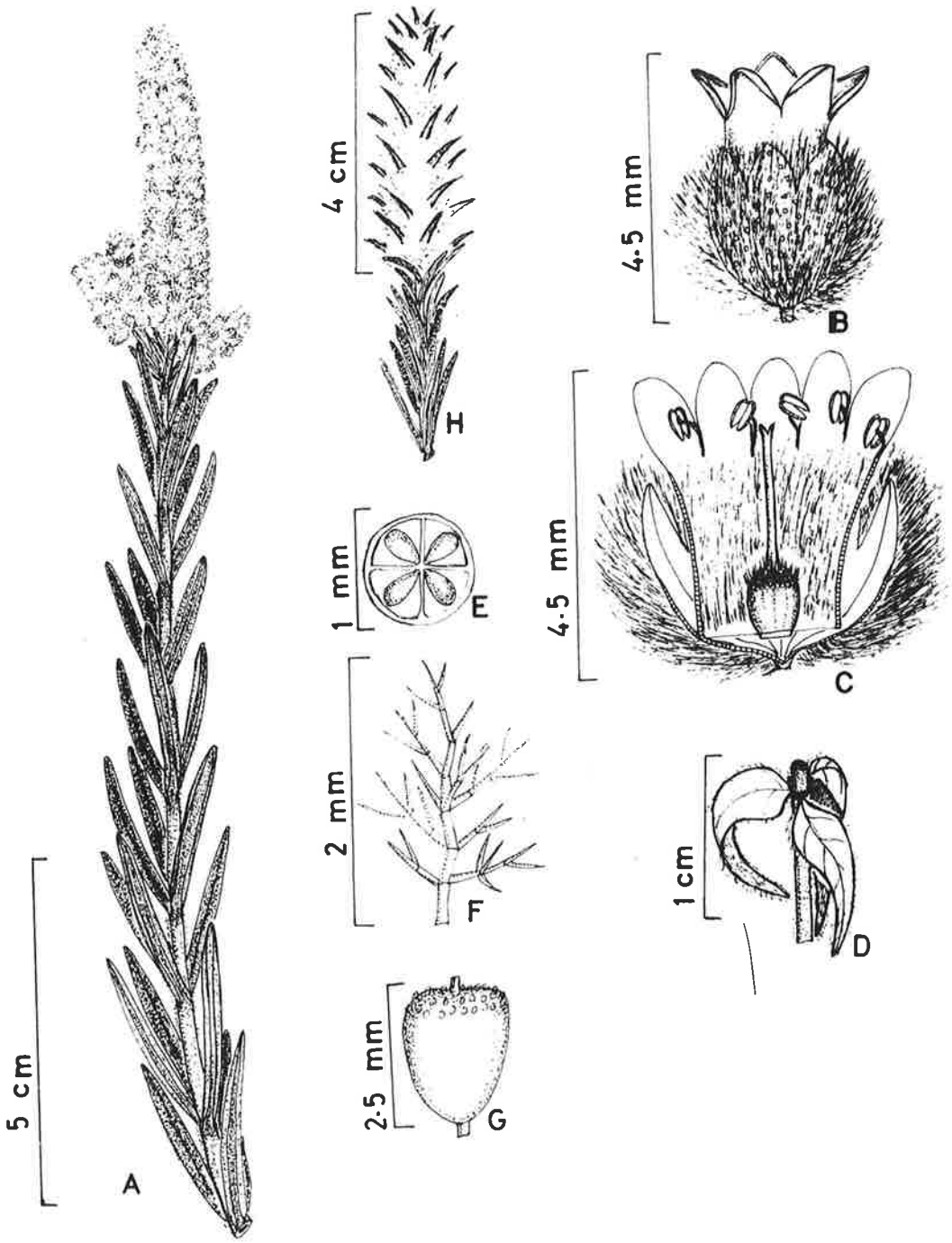
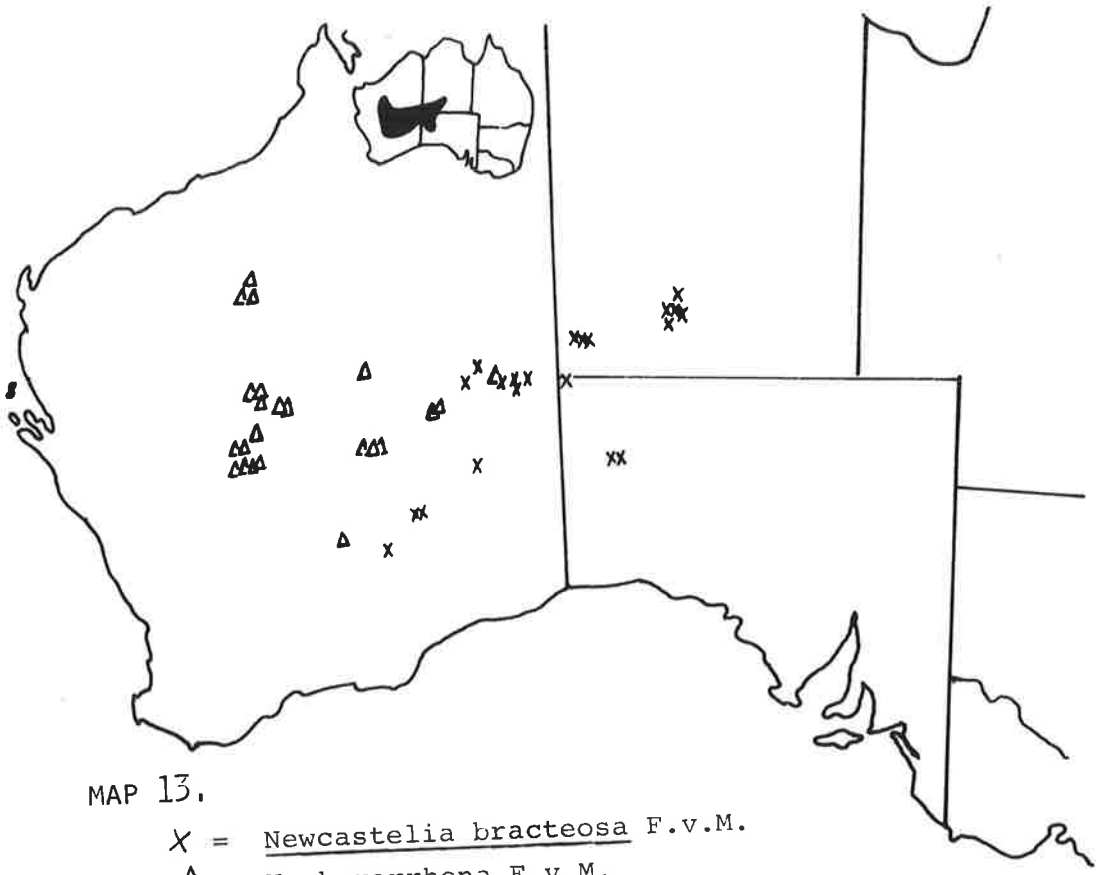


Fig. 47 — Newcastelia viscida E. Pritzel (A - G, E. Pritzel 858: AD - lectotype; H, P.G. Wilson 7547: PERTH).

A, flowering branch; B, flower; C, flower vertically cut open; D, 3 bracts at a node each showing 3 axillary scars left by the removed flowers; E, T.S. ovary; F, calyx-tomentum; G, fruit; H, young inflorescence with bracts.

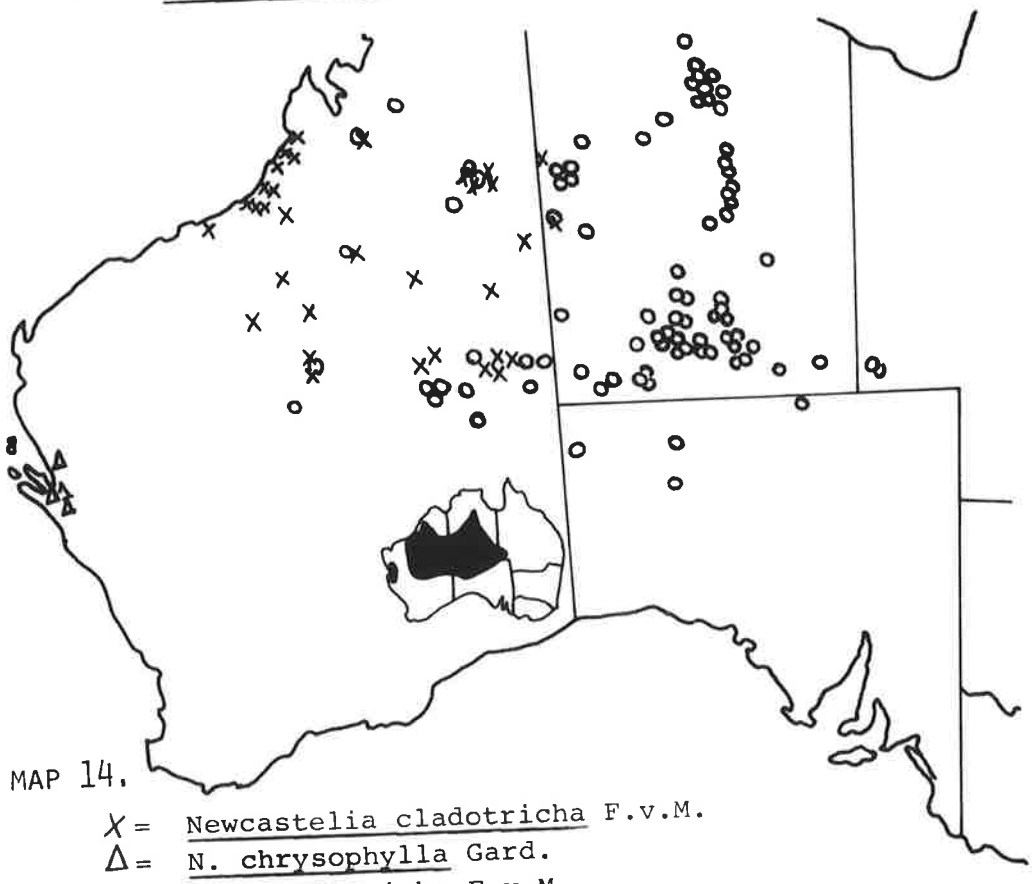
DISTRIBUTION MAPS OF NEWCASTELIA TAXA

(13 - 16)



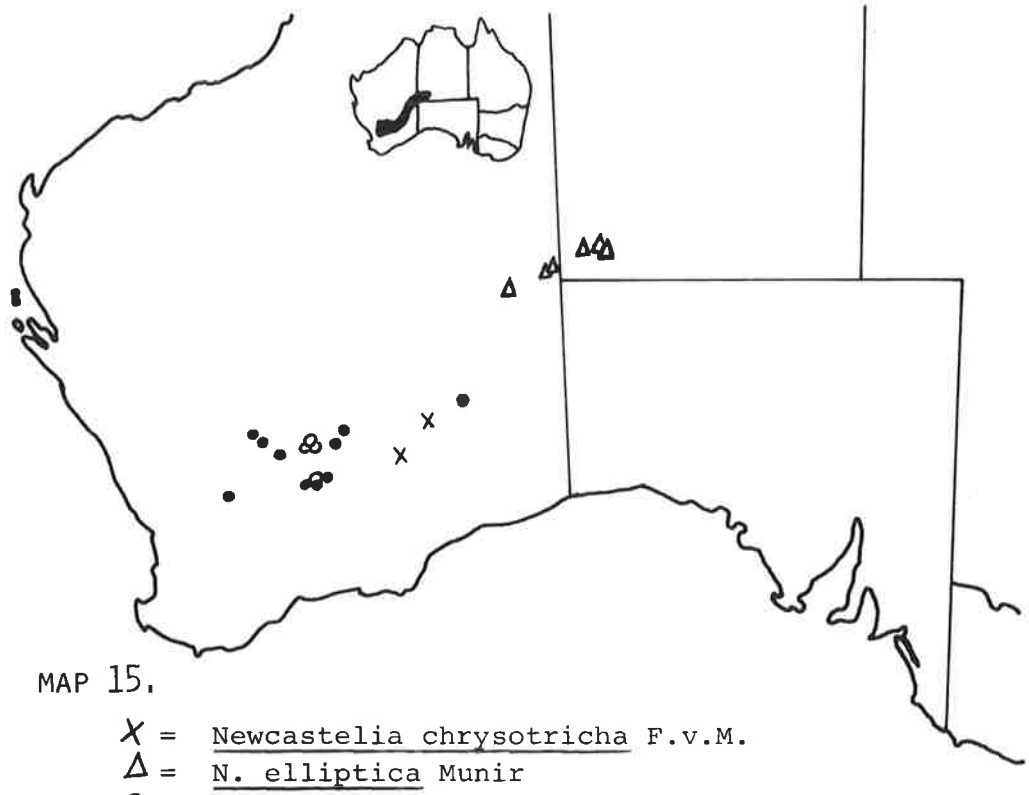
MAP 13.

X = Newcastelia bracteosa F.v.M.
Δ = N. hexarrhena F.v.M.



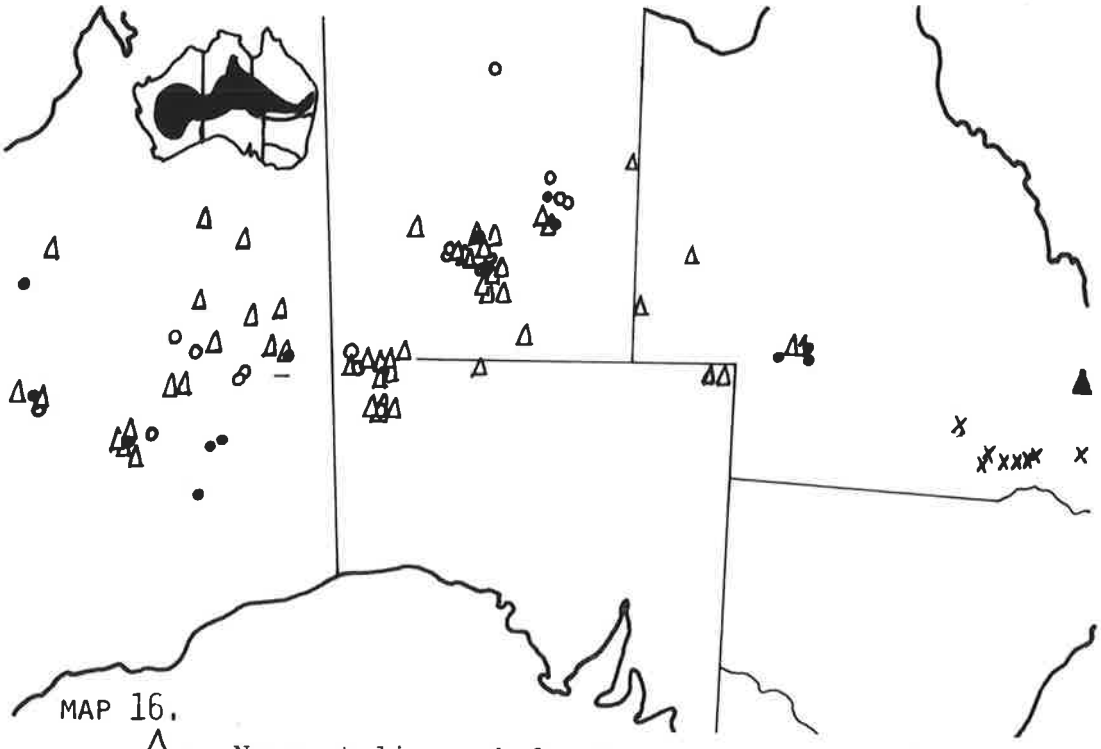
MAP 14.

X = Newcastelia cladotricha F.v.M.
Δ = N. chrysophylla Gard.
O = N. spodiotricha F.v.M.



MAP 15.

X = Newcastelia chrysotricha F.v.M.
Δ = N. elliptica Munir
O = N. insignis E. Pritzel
● = N. viscida E. Pritzel



MAP 16.

Δ = Newcastelia cephalantha F.v.M. var. cephalantha
● = N. cephalantha F.v.M. var. oblonga Munir
O = N. cephalantha F.v.M. var. tephropepla Munir
X = N. interrupta Munir
▲ = N. velutina Munir

L A C H N O S T A C H Y S W.J.Hooker

LACHNOSTACHYS Hooker

Lachnostachys W.J.Hooker, Ic.Pl.N.S.1 (1842) t.414,415;S.L.Endlicher Gen.Pl.Suppl. 3 (1843) 64, no.1964/2- "Lachanostachys"; V.E.Nees in Lehm.,Pl.Preiss. 1 (1845) 631- "Lachanostachys"; S.L.Endlicher, Gen.Pl.Suppl. 4 (1847) 43, no.1964/2- "Lachanostachys"; T.Moquin in DC.Prod. 13 (1849) 233,298; G.Bentham, Fl.Aust. 5 (1870) 37; J.Lindley & T.Moore, Treasur.Bot.2 (1870) 654; F.v.Mueller, Fragm. 8 (1873) 50, in obs.; L.Pfeiffer, Nomencl.Bot.2(1) (1874) 6; G.Bentham & J.D.Hooker, Gen.Pl.2 (1876) 1132,1139; F.v.Mueller, Cens.Aust.Pl.1 (1882) 102; F.v.Mueller, Cens.Gen.Pl.Indig.Aust. (1882) 41; Th.Durand, Gen.Phan. (1888) 319; F.v.Mueller, Sec.Cens. Aust.Pl.1. (1889) 171; J.Briquet in Engl. & Prantl, Pflanzenfam. IV,3a (1895) 163,164 - sphalm. "Lachnocephalus"; J.Briquet, Mém. Soc.Physiq.Hist.Natur.Genéve, 32(2), no.8 (1896) 34,50,65,67,71, in obs.; H.B.Hemsley in Hook., Ic.Pl.IV,8 (1902) t.2732, in obs.; C.G.Dalla-Torre & H.Harms, Gen.Siph. (1904) 432, no.7175;L.Diels & E.Pritzel, Bot.Jahrb.Syst.35 (1904) 506; T.V.Post & O.Kuntze, Lexicon Gen.Phan. (1904) 312,688; L.Diels, Pflanzenwelt W.Aust. (1906) 278, in obs.; E.H.Pelloe, Wildfls.W.Aust. (1921) 15,100; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; S.Junell, Sym.Bot. Upsal. 4 (1934) 62,64; C.A.Gardner in Hook.,Ic.Pl.V, 4 (1939) t.3383/ 1 and 2, in obs.; A.Lemée, Dict.Descript.Syn.Gen.Pl.Phan. 8b (1943) 654; C.A.Gardner, J.R.Soc.W.Aust. 28 (1944) XLVII,L, LVII, in obs.; J.C.Willis, Dict.Fl.Pl. and Ferns, ed.6, (1957)360; C.A.Gardner, Wildfls.W.Aust. (1959) 127; J.Hutchinson, Fam.Fl.Pl., ed.2, 1 (1959) 397; H.N.Moldenke, Résumé Verbenac. etc. (1959) 302,341,393,404; N.T.Burbidge, Dict.Aust.Pl.Gen. (1963) 167; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls. 3 (1965) 560,565; H.K.A.Shaw in J.C.Willis, Dict.Fl.Pl. and Ferns,ed.7, (1966) 611; A.R.Fairall, W.Aust.Native Pl.Cult. (1970) 177; M.Morcombe, Aust.Wildfls. (1970) 94,in obs.; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc. 2 (1971) 534,614,735,751; C.A.Gardner, W.Aust.Wildfls.B(1972) 156, in obs.; C.A.Gardner, Wildfls.W.Aust.,ed.11, (1973) 118,119; R.Erickson et al., Fl.Pl.W.Aust.(1973) 115,187.

T y p u s: L.ferruginea Hook., Ic.Pl.New.Ser. 1 (1842) t.415, lectotype.

Walcottia F.v.Mueller, Fragm. 1 (1859) 241: [H.N.Moldenke, Résumé Verbenac.etc. (1959) 393, pro syn.; H.N.Moldenke, Fifth Summary Verbenac. etc. 2 (1971) 735, pro syn.].

T y p u s: W.eriobotrya F.v.Mueller, Fragm.1 (1859) 241.

[≡ L.eriobotrya (F.v.Mueller)Druce].

Pycnolachne N.Turczaninow, Bull.Soc.Nat.Mosc.36(2) (1863) 214;

W.B.Hemsley in Hook., Ic.Pl.4th Ser., 8 (1902) t.2732, in obs.;
[H.N.Moldenke, Résumé Verbenac. etc. (1959) 341, pro syn.;
H.N.Moldenke, Fifth Summary Verbenac. etc.2 (1971) 614, pro syn.].
T y p u s: P.ledifolia Turcz.,Bull.Soc.Nat.Mosc. 36(2) (1863) 215.
[= L.eriobotrya (F.v.Mueller)Druce].

Typification:

Of the two syntypes, L.albicans and L.ferruginea, the latter species is more widely distributed and more characteristic of the features of the genus as a whole. Therefore, it has been designated here as the lectotype species of Lachnostachys Hook.

Number of species: 6.

Description:

Shrub clothed with a dense cottony-woolly tomentum. Stem erect, branched, cylindrical,woody, solid, clothed with a dense and thick covering of branched woolly tomentum. Leaves cauline and ramal, decussate, exstipulate, sessile, simple, entire, with recurved margins, rarely flat, reticulate, unicostate; midrib and veins mostly covered with soft and thick woolly tomentum, sometimes rugose and glabrescent above in old leaves, ± herbaceous to sub-coriaceous. Inflorescence axillary and terminal panicles with flowers either somewhat compactly arranged into elongated cylindrical spikes or forming ± lax corymbose or pyramidal panicles. Flowers 5 - 8(-9)-merous, bracteate, sessile or subsessile,complete, regular, hermaphrodite, hypogynous, normally in opposite (decussate) clusters of three in the axil of each bract, often concealed inside the woolly calyx tomentum. Calyx gamosepalous, ± campanulate, 5 - 8(-9) lobed in the upper half, densely woolly - tomentose outside, glabrous within; lobes lanceolate, ovate - lanceolate or ± deltoid; tomentum much branched. Corolla gamopetalous,± equalling the calyx, campanulate, almost truncate at the apex or very minutely lobed, glabrous outside, villous - tomentose inside; lobes (when present) very short, often 5 - 8, sometimes more.Androecium: 5 - 8 stamens, rarely more, exserted, inserted on the margin(rim) of corolla-tube; filaments long, filiform, glabrous, ± flattened near the base; anthers 2-lobed, dorsifixed, glabrous, glandular on the back; lobes oblong, non-appendiculate, free and divergent in the lower halves, longitudinally dehiscent. Gynoecium:bicarpellary, syncarpous, 2- or rarely 4-locular, with axile placentation; Ovules 4, two in each of the two cells attached "laterally" below the apex; style long, slender, exserted; stigma entire or

very minutely notched. Fruit dry, indehiscent, hard, enclosed in the calyx, usually unilocular with a single seed; seeds albuminous.

Distribution: (Maps 1 and 2).

The genus Lachnostachys is endemic in Western Australia. According to known distribution, it seems restricted to the South Western and the Eremean Provinces only. The known localities of its occurrences, however, are limited between 26 and 35 degrees south latitude and between 114 and 124 degrees east longitude. Of all the six accepted species of this genus, L.bracteosa is known only from [Avon and Eyre Districts of] the South Western Province and L.coolgardiensis only from [Austin and Coolgardie Districts of] the Eremean Province. But the other four species occur predominantly in the South Western Province, and also sparsely distributed in the Austin and Coolgardie Districts of the Eremean Province. Within the above named botanical Provinces, L.eriobotrya (F.v.M.)Druce and L.verbascifolia F.vM. are the most wide-spread, whereas L.albicans Hook. and L.bracteosa Gardner are known from very limited areas.

Relationship:

Lachnostachys is closely related to Newcastelia FvM. in its inflorescence being spicate, flowers 5 - 6(-8) merous and style practically undivided. However, it can be easily identified by its corolla being truncate or very minutely lobed and stamens inserted on the rim (margin) of corolla-tube. It is allied to Physopsis Turcz. in having spicate inflorescence, isomerous stamens, and undivided style, but the latter genus is at once distinguished by its strictly 4-merous flowers, lobed corolla-tube and included stamens and style. The genus Dicrastylis Drumm. ex Harv. is also related to Lachnostachys in having regular flowers with isomerous stamens, but the former may be easily separated by its lobed corolla, non-marginal stamens and very deeply 2-branched style.

N o t e :- The Botanical Provinces and Districts of Gardner and Bennetts (1956) are used to record the distribution of Western Australian taxa.

KEY TO THE SPECIES AND INFRASPECIFIC TAXA OF LACHNOSTACHYS

W.J.Hooker

1 a. Leaves narrow - linear with closely revolute margins, 1 - 3 (-4) mm broad; style hairy near the base.....5.

b. Leaves variously shaped, not narrow - linear, with recurved or almost flat margins, often many times more than 4 mm in breadth; style glabrous throughout.....2.

2 a. Spikes solitary at the end of branches, cylindrical, white silky - woolly with compactly arranged flowers; leaves ovate - lanceolate or oblong - lanceolate, the decussate pairs always overlapping the next upper ones; the external calyx - tomentum reaching a thickness of up to twice the length of the calyx; ovary not glandular but silky tomentose..... .....L.albicans.

b. Spikes usually more than one at the end of branches, sometimes arranged in loose panicles, greyish or brownish -woolly; leaves narrow elliptic - oblong, ovate, ovate - lanceolate or almost orbicular, the decussate pairs rarely overlapping the next upper ones; the external calyx - tomentum less than twice the length of the calyx in thickness; ovary glandular and tomentose.....3.

3 a. Leaves distinctly decurrent so that the stem appears 4 - angled; spikes 1 - 3(-4.5) cm long, 0.5 - 1 (-1.5) cm in diameter.....L.coolgardiensis.

A1. Leaves narrow oblong, 1.5 - 3 cm long, 0.5 - 0.8 cm broad, distinctly recurved along the margins; spikes slender, 1 - 3 cm long, 0.5 - 0.8 cm in diameter.....f.coolgardiensis.

A2. Leaves narrow elliptic or elliptic - oblong, 2 - 5(-6) cm long, 0.8 - 1.5 cm broad, often slightly recurved along the margins or nearly flat; spikes thick, (2-)3 - 4.5 cm long, 1 - 1.5 cm in diameter.....f.brevispicata.

b. Leaves not decurrent; stem cylindrical; spikes (2-)3 - 8.5 (-10) cm long, 1 - 1.6 cm in diameter.....4.

4 a. Leaves oblong to elliptic - oblong, oblong - lanceolate or almost orbicular; margins nearly flat, not recurved; tomentum rusty - grey, very dense, thin; hairs 1 - 1.5(-2) mm long; flower - bracts ± orbicular, purplish - brown tomentose, anthers with a prominent granular mass on the back..... .....L.ferruginea.

A1. Upper leaves or leafy - bracts subtending a simple spike.....var. ferruginea.

B1. Leaves oblong to elliptic - oblong or almost suborbicular, obtuse.....C.

C1. Leaves distinctly reticulate on the undersurface.....f. reticulata.

C2. Leaves with reticulation concealed by the dense woolly tomentum.....f. ferruginea.

B2. Leaves oblong - lanceolate, somewhat acute..... .....f. acutifolia.

A2. Upper leaves or leafy - bracts subtending panicles of spikes.....var. paniculata.

D1. Leaves oblong - lanceolate, somewhat acute.....f. paniculata.

D2. Leaves elliptic - oblong, obtuse....f. obtusifolia.

b. Leaves ovate - lanceolate, often ± cordate at base; margins recurved or revolute; tomentum grey or brownish - grey, dense thick; hairs 2 - 5(-8) mm long; flower - bracts narrow elliptic or lanceolate, ± greyish tomentose, anthers not prominently granular on the back.....L. verbascifolia.

5 a. Leaves distinctly decurrent; spikes solitary at the end of branches, cylindrical, with somewhat compactly arranged flowers; flower - bracts narrowly elliptic - lanceolate, petiolate, calyx - lobes abruptly acuminate; corolla - tube tomentose within throughout, tomentum exserted; ovary elliptic - oblong, pubescent all over, densely glandular at the apex only.....L. bracteosa.

b. Leaves not decurrent; spikes many, terminal and axillary in the distal parts of branches, arranged in ± corymbose or pyramidal panicles; flower - bracts linear or linear - lanceolate, ± sessile; calyx - lobes gradually acuminate; corolla tube tomentose within near the base only, tomentum included; ovary ± globose, pubescent and glandular all over..... .....L. eriobotrya.

Lachnostachys albicans W.J.Hooker, Ic.Pl.N.S. 1 (1842) t.414; V.E.Nees in Lehm's, Pl.Preiss. 1 (1845) 631; C.Moquin, DC.Prod. 13 (1849) 298; F.v.Mueller,Fragm. 2 (1861) 140, in obs.; F.v.Mueller, Fragm. 6 (1868) 159; G.Bentham, Fl.Aust. 5 (1870) 38; F.v.Mueller, Cens.Aust.Pl. 1 (1882) 102; F.v.Mueller, Sec.Cens.Aust.Pl.1. (1889) 171; J.Briquet in Engl. & Prantl, Pflanzenfam.IV, 3a (1895) 164; J.Briquet, Mém.Soc.Physiq.Hist.Natur.Geneve, 32 (2),no.8 (1896) 77; H.B.Hemsley,Hook.Ic.Pl.IV, 8 (1902) t.2732, in obs.; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 507 - 509,fig.57A,B; A.J.Ewart, Vict.Nat. 24(3) (1907) 58, in obs.; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac. etc. (1959) 209, 302; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls. 3 (1965) 565, t.26 p.p.; J.S.Beard, W.Aust.Pl.ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc.1 and 2 (1971) 346, 534.

T y p u s: J.Drummond s.n.: Swan River Colony, Western Australia, - 1839 (K holotype; G)

Description: (Fig. 48).

A spreading shrub of 30 - 90 cm high. Stem erect, branched, cylindrical, woody, leafy, densely clothed with short branched tomentum. Leaves decussate, sessile, closely borne on the stem, somewhat congested, the lower often overlapping the next upper ones, ovate - lanceolate or oblong - lanceolate, ± acute, erect, somewhat subcoriaceous, (1-)1.5 - 3.5(-4.2) cm long, (0.4-)0.6 - 1(-1.3) cm broad, densely covered with whitish - grey tomentum; margins recurved and slightly rugose - crenulate. Inflorescence spicate, terminal; spikes solitary at the end of branches, elongated, cylindrical, very densely white silky - woolly, (2.2-) 2.5 - 5.5(-7.5) cm long, 1 - 1.5(-2) cm in diameter. Flowers usually 5 -merous, sometimes 6 -merous, compactly arranged in spikes, bracteate, sessile,normally 3 in the axil of each bract, 7-9 mm long (including stamens and style); bracts opposite, sessile or nearly so, imbricate, cordate, somewhat orbicular in outline, acute, 7 - 9(-10)mm by 7 - 8.5 mm, reticulate unicostate, densely tomentose outside, glabrous inside, caducous. Calyx tubular, usually 5 - lobed at the apex, sometimes 6 or 7 lobed, 2.5 - 3.5 (-4) mm long, densely silky - woolly tomentose outside, glabrous within; tomentum long, branched, upto 4 mm long, collectively reaching a depth of about twice the length of whole calyx; lobes ovate or ± broadly triangular, acute, 1 - 1.5 mm long, 1 - 1.7mm broad at the base; tube ± cylindrical, somewhat broadening towards

the apex, (1.5-)2 - 2.5 mm long. Corolla purple or mauve, tubular, truncate, sometimes very minutely lobed, glabrous outside, the inside densely covered with branched exserted tomentum; lobes minute, hardly 0.5 mm long; tube ± infundibuliform, broadened towards the summit, 2.5 - 3.5(-4.5) mm long. Stamens 5, sometimes 6 or 7, exserted, inserted at the margin (rim) of corolla-tube; filaments long, filiform, glabrous, 3 - 3.5(-4) mm long; anthers 2 - lobed, dorsifixed, 0.7 - 0.9 mm long, ± 0.5 mm broad; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary ± globose, very densely clothed with long silky-woolly tomentum, 1 - 1.5 mm in diameter, young ovary 4 - locular with one ovule in each cell, but becomes 2-locular (sometimes unilocular) due to early breakdown of thin dissepiment from the walls of the cavity; style long, exserted, filiform, gradually thickened towards the base, glabrous, 5.5 - 7 mm long; stigma minutely notched. Fruit, dry, indehiscent, hard, enclosed in the calyx, globose, hairy, usually 1 - seeded.

Specimens examined:

WESTERN AUSTRALIA.- H.F.Broadbent 1[illegible]: from Tinkurrin, 17.VIII.1953 (BM).- M.Cronin s.n., MEL41135: sources of the Blackwood River, -I. 1890 (MEL).- M.Cronin s.n., MEL41136: Lake Deborah, - 1893 (MEL).- M.Cronin s.n., MEL41133: between Bunkin and Southern Cross, - 1893(MEL).- J.Drummond s.n.: Swan River Colony,- 1839 (K holotype; G isotype).- J.Drummond 13: loc.cit., -(E- probably paratype).- J.Drummond 439: loc.cit., - 1843 (BM, CGE - 2 spec.,G,GH,K,LE,MEL,P,W - 2 spec.).- J.Drummond 513: loc. cit., - (W).- C.A.Gardner 1021a: from Toolibin, -XI.1923(PERTH).- A.S.George 6855: near Collie, 15.X.1965(PERTH).- A.S.George 9350: 19 miles west of Kulin on road to Yealering, 29.V.1969(PERTH).- T.Muir s.n.,MEL41137: 100 miles north of Stirling Range,- 1879 (MEL).- T.Muir s.n.,MEL41132: towards the Tone River, - 1880(MEL).- S.Paust 901: 32 1/2 miles west of Kulin towards Wickepin, 15.IX. 1971 (PERTH).- A.L.Preiss 1376,1377: Wellington district, 5.XII. 1839 (LD,LE).- R.D.Royce 7499: 5 miles east of Goomalling, 18.VIII.1962 (PERTH).- C.Walter s.n.,NSW106663: Blackwood River, - (NSW).

Distribution: (Map 17).

This species is endemic in the far south-western part of Western Australia. According to known distribution, the main areas of its occurrence are to the south-east and north-east of Perth,

where it seems restricted between 30 and 35 degrees south latitude and between 115 and 120 degrees east longitude. South-east of Perth, it is known to occur near the sources of the Blackwood and Tone Rivers, and near Collie Township along the Collie River. Other localities in this region are west and south-west of Kulin and south-east of Wickepin. North-east of Perth it is recorded from near the Swan River, Lake Deborah and between "Bunkin" and Southern Cross.

E c o l o g y:

L.albicans is known to grow mainly in sandy places. In view of its present distribution, it seems restricted to the winter-rainfall areas. The plant is[a] small, spreading shrub covered with grey - cottony tomentum and much-crowded leaves. Inflorescence is of silky - woolly cylindrical spikes with purple, pink or mauve flowers. According to Broadbent 1214(BM), from Tinkurin, it is a "woody herb" with "grey leaves and pink flowers". It was found growing in "Silver sand - Black-humus" soil. Gardner 1021a (PERTH), from Toolibin, is annotated as "erectly branched shrub, 12 - 30 in. tall, Corolla lilac or white". The habitat is noted as "sand heaths". George 6855 (PERTH), near Collie, is recorded as "shrub to 50 cm; flowers mauve; in sand over laterite". His subsequent collection no.9350(PERTH), from 19 miles W. of Kulin, is noted as "spreading shrub to 50 cm, flowers purple". The plant was found growing "on sand heath". Paust 901(PERTH), from 32 1/2 miles west of Kulin, is annotated as "erect shrub, 1 1/2 ft. tall. Flowers white".

Flowering and fruiting seem to occur chiefly from August to January.

C o m m e n t s:

In the original description, the truncate corolla-tube with marginal stamens seem to have been mistaken by the author for a staminal cup. Similarly, the early breaking off of the thin dissepiment of the ovary from the walls of the cavity, and often the enlargement of only one ovule, gives on a hasty examination the impression of a 1 - celled uni-ovulate ovary. These two confusing characters seem to have induced the author to place this species under Amaranthaceae, as both these characters are present in some genera of this family.

The type of this species belongs to J.Drummond's 1 st collection, which now includes several lots sent to England between the years 1837 and 1842. According to available inform-

ation about Drummond's collections, L.albicans Hook. seems to have been collected from the Swan River during 1839, and it apparently belongs to Drummond's set of 1300 specimens which he sent to Hooker late in November, 1839 [Erickson (1969) 52,158]. Drummond's collections of this species, now available for study from different herbaria, have some specimens bearing both year and collection number, while the others bear either the year of collection or the collection number. All these collections have come from Swan River and without exception they look identical in their morphology. The holotype at Kew and its duplicate in Herb. G are without any collection number, but both have the same year of collection "1839". Two other specimens, one each in Herb. E and W are without any date but are respectively numbered "13" and "513". The only other collection bearing the number "439" on some sheets and the year of collection "1843" on the others is a collection of eleven duplicates. The collection number (439) on some sheets is found written on a field slip in Drummond's own handwriting while the other two numbers "13" and "513" are written (perhaps later) in different handwriting. Similarly, the year "1843" is not in Drummond's own handwriting amd could therefore be the year when these specimens were sent to those herbaria where they are now housed. In view of these discrepancies, the authenticity of collection numbers and the year of collection written on these herbarium sheets are somewhat doubtful except where this information is in Drummond's own handwriting; thus, the collection numbers 13, 513 and all other un-numbered specimens may probably belong to the same (? type)collection.

Collections of this taxon in Herb. CGE and GH are without collector's name and number, nor do they bear any date or place of collection. The one in Herb. CGE belonged initially to Lindley's herbarium, which according to its small printed label was purchased by the Cambridge Botanical Museum in 1866. Most likely, it was sent to Lindley by Drummond during 1838 when the latter despatched "10sets of over 500 sp. each (un-mounted), to Mangles and Lindley; collected from the Swan,Avon, Helena, Toodyay Valleys and the Guangan".[Erickson (1969) 168]. Both the specimens match well with Drummond's collections of this species and are therefore being regarded here as un-annotated duplicates of his coll. no.439, from the Swan River.

The holding of this species in Herb.LE is on a solitary herbarium sheet, consisting of three different collections mounted together. Two of them, the middle and the left hand side one belong to this taxon and were collected respectively by Preiss

(nos. 1376,1377) and Drummond (no.439). The extreme right hand side specimen, also collected by Drummond, does not belong to the family Chloanthaceae or Verbenaceae, (probably to Solonaceae)

Moquin (1849) and Bentham (1870) have recorded Drummond's coll. no. "434" which is not found among all the available collections examined here. It seems, that perhaps both of them have mistaken Drummond's no. 439 for the above number.

Among the species, recorded by Briquet (1895) under Lachnostachys, he seems to have mistakenly referred this taxon to F.Mueller's species.

Relationship:

L.albicans seems very close to L.bracteosa in having solitary cylindrical spikes at the end of branches but can be readily distinguished by its leaves being larger, much crowded (overlapping) ovate - lanceolate or oblong - lanceolate, coriaceous; flower-bracts cordate; flowers usually 5 -merous; calyx-lobes broadly ovate; ovary non-glandular, densely clothed with long silky - woolly tomentum.

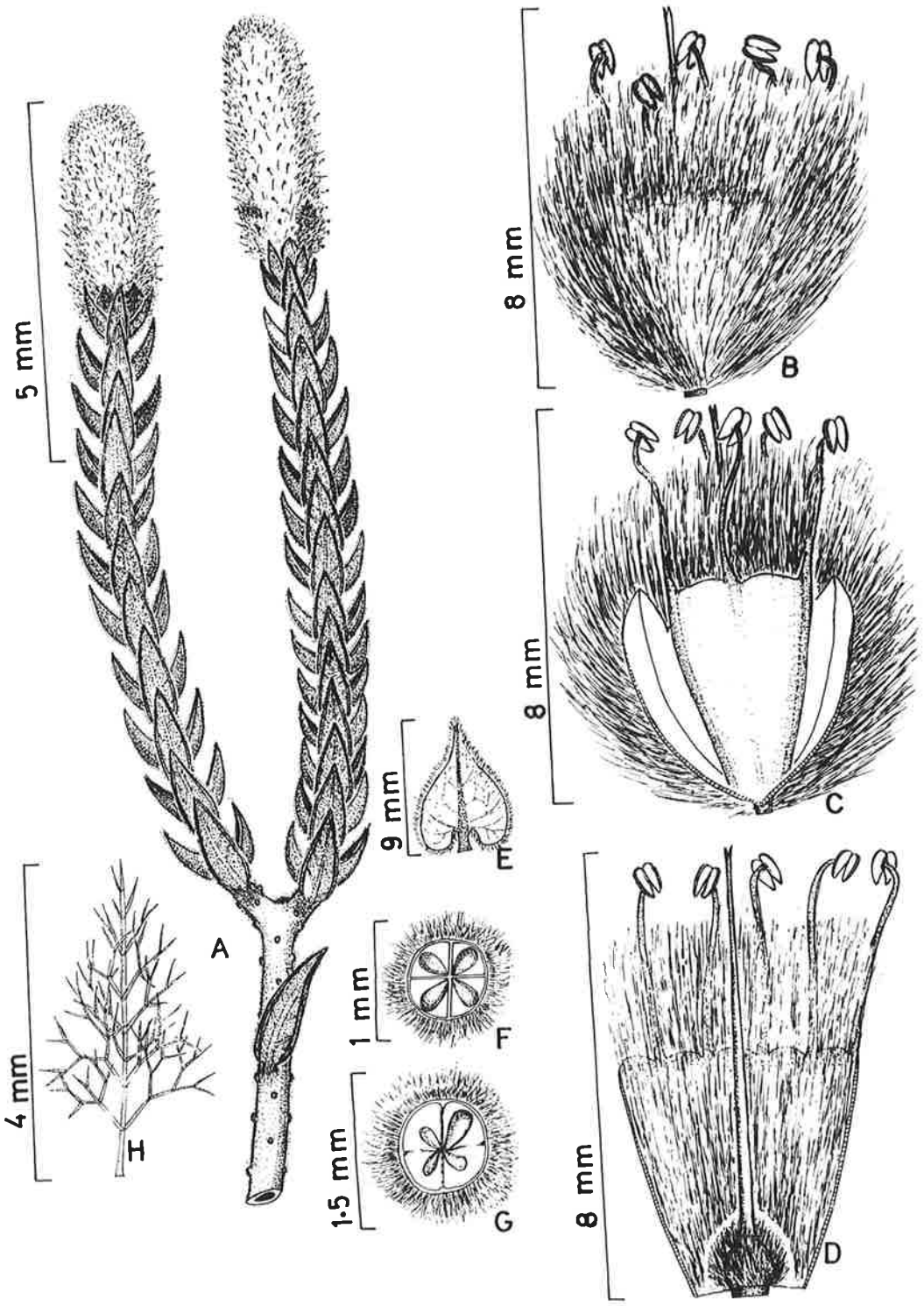


Fig. 48 — Lachnostachys albicans Hooker (J. Drummond 439: CGE - isotype).

A, flowering branch; B, flower; C, calyx vertically cut open to show corolla-tube and attachment of stamens; D, corolla-tube vertically cut open showing pistil and long exserted tomentum; E, bract viewed from inside; F, T.S. young ovary; G, T.S. mature ovary; H, calyx-tomentum.

Lachnostachys coolgardiensis S.Moore, J.Bot. 41 (1903) 100, f.coolgardiensis; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 509,511; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; E.Cheel, Rept.Aust.N.Z.Assoc.Advanc.Sc. 23 (1937) 332; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209; C.A.Gardner, J.R.Soc.W.Aust. 47 (2)(1964) 62,in obs.; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 566; J.S.Beard, W.Aust.Pl., ed. 2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc.1 & 2 (1971) 347,363; R.Erickson et al., Fl.Pl.W.Aust. (1973) 196.

T y p u s: L.C.Webster s.n.: Coolgardie district, Western Australia - 1900 (BM holotype;MEL,NSW).

L.cliftonii auct. non FvM.:FvM. & Tate, Trans.R.Soc.S.Aust. 16 (1896) 375 - (quoad spec. R.Helms s.n., 20miles N.W. from Lake Lefroy - AD,MEL).

Description: (Fig. 49)

A much branched woolly shrub, 30 - 90 cm high. Stem erect, branched, cylindrical but appears 4-angular due to decurrent leaves, woody, densely clothed with woolly tomentose. Leaves decussate, sessile, oblong to narrowly elliptic - oblong, obtuse, with recurved margins, ± spreading or somewhat deflexed, distinctly decurrent, (1.5-)2 - 4(-6) cm long, (0.5-)0.8 - 1(-1.5) cm broad, densely covered with branched woolly tomentum. Inflorescence spicate; spikes axillary and terminal in the distal part of branches, short, cylindrical, 1 - 3(-4.5)cm long, 0.5 - 1(-1.5)cm in diameter, very densely woolly. Flowers 5 - 6 merous, bracteate, ± sessile, normally in clusters of 3 in the axil of each bract, 4 - 5(-6)mm long (including stamens and style); bracts caducous, decussate, sessile or very shortly stalked, narrowly elliptic or lanceolate, 4- 5.5(-6)mm long, 1.3 - 2(-2.5)mm broad, densely woolly-tomentose outside, glabrous inside. Calyx tubular, 5 - 6 lobed towards the apex, rarely 7 - lobed, glandular and very densely woolly tomentose outside,glabrous within, 1.5 - 2.2 mm long (excluding tomentum); lobes ± deltoid, obtuse, 0.5 - 0.7 mm long, 0.4 - 0.7(-1)mm broad at the base; tube ± infundibuliform, 1 - 1.5 mm long; tomentum much branched, up to 3.5 mm long. Corolla "lilac," infundibuliform, truncate at the apex, not lobed, glabrous outside, densely tomentose within, 1.5 - 2(-2.5)mm long, 2 - 3 mm in diameter at the top, 1 - 1.5 mm in diameter near the base. Stamens 5 - 6, ± lilac when fresh , much exserted inserted at the rim (margin) of corolla-tube; filaments long, filiform, glabrous,

somewhat flattened towards the base, 1.5 - 2.5 mm long; anthers dorsifixed, 2 - lobed, with small glandular mass at the back, lobes oblong, free and divergent in the lower halves, longitudinally dehiscent, 0.4 - 0.6 mm long. Ovary globose, densely glandular and hairy all over, 0.5 - 1 mm across, 2-locular with 2 - ovules in each cell, but only one ovule maturing to form a seed; style long, exserted, filiform, glabrous, 1.5 - 3(-4)mm long; stigma minutely notched or almost entire. Fruit ± elliptic or elliptic - oblong, sparsely glandular and hairy all over, longitudinally striate, 2.5 - 2.8 mm long, 1.3 - 1.5 mm across, single seeded; seed white, ± oblong, 1.7 - 2 mm long, 0.8 - 1.2 mm across, albuminous.

The type form coolgardiensis differs from other taxa of this species by its leaves being narrowly oblong, small, 1.5 - 3 cm long, 0.5 - 0.8 cm broad, deeply recurved along the margins; spikes short, slender, 1 - 3 cm long, 0.5 - 0.8 cm in diameter.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 1799: Great Eastern Highway, ca. 545 km from Perth, 6.VII.1966 (AD).- H.F.M.Broadbent 1604A: Boondi, 8.IX.1953 (BM).- R.Carolin 3072: Ubini near Coolgardie, 14.VIII.1961 (SYD).- R.J.Chinnock 1089: 29 km South of Menzies, 16.IX.1973 (AD).- J.B.Cleland s.n., AD966030172: Kurrawang, -IX.1915 (AD).- C.A.Gardner 1745: Coolgardie, 29.IX.1927 (PERTH - 3 spec.).- A.S.George 4451: Comet Vale, near mine, 25.V.1963 (B,MO).- R.Helms s.n., AD97113019: 32 km north-north-west of Lake Lefroy, 10.XI.1891 (AD,MEL).- J.T.Jutson 87: Comet Vale,-XII.1916(NSW).- R.H.Kuchel 1759: ca. 15 km south-east of Londonderry siding, 14.IX.1964 (AD).- A.A.Munir 5237 ca. 12 km west of Coolgardie, 5.IX.1973 (AD).- M.E.Phillips s.n., CBG031073: 9 miles west of Coolgardie, 16.IX.1962 (CBG).- L.C.Webster s.n., MEL41146, NSW106693: Coolgardie,- 1900 (BM holotype; MEL, NSW-isotypes).- L.C.Webster 63: loc.cit.,- 1898 (B n.v., NSW-syntypes of L.brevispicata E.Pritzel).- P.G.Wilson 8541a: 18 km west of Sandstone, 3.VIII.1969(PERTH).- Young s.n., MEL41141: between Queen Victoria Springs and Ularring, 7-9.X.1875 (MEL).

Distribution: (Map 17).

L.coolgardiensis is endemic to the south-western part of Western Australia. The main distribution is recorded from around Coolgardie and between Comet Vale and Menzies. The only other known locality is between Mt.Magnet and Sandstone, north-west of Kallgoorlie.

E c o l o g y:

According to known distribution and collector's annotations, L.coolgardiensis grows in dry sandy places receiving occasional winter rainfall and little or no summer rain. The plant is a much branched woolly shrub with elongated white woolly spikes and lilac flowers. Broadbent 1640A(BM), from Boondi, is noted as "soft tomentose herbaceous" growing in "yellow sand". Carolin 3072(SYD) from Ubini near Coolgardie is annotated as "common in disturbed soil, ca. 50 cm tall, staminal-tube blue". The plant was found growing in "sandy soil ± lateritized," in "open dry sclerophyll woodland". George 4451(B,MO), from Comet Vale, near mine, is reported as "Perennial herb. to 70 cm. Flowers mauve, sickly scented". Habitat is given "Red sand". Gardner 1745(PERTH), from Coolgardie, is recorded as "densely branched compact shrub" of about "12" tall", growing chiefly "in red sand". Wilson 8541a (PERTH), 18 km W. of Sandstone, is annotated "plant to 0.6m., staminal ring mauve" growing in "sand plain".

The author has seen it growing in disturbed sandy soil along the Highway near Coolgardie. It is a woolly shrub upto 60cm high spreading over an area of ± 90 cm in diameter. The associated plants are chiefly Acacia, Callitris, Grevillea and Thryptomene species.

Flowering and fruiting seem to occur chiefly from May to September.

C o m m e n t s:

The type of L.coolgardiensis is not cited with the original description. During present investigations, therefore, it has been discovered that the type consists of 3 specimens, one each in Herb. BM,MEL and NSW. It was collected by L.C.Webster from Coolgardie during 1900, and received in Herb.BM and MEL during 1902. Out of these three specimens, the one in Herb.BM was actually used by the author in describing this species, and is therefore accepted here as the holotype; the remaining two being the isotypes.

One of R.Helms' collection of the Elder Exploring Expedition, gathered from 20 miles north-west of Lake Lefroy, is recorded by Mueller & Tate (1896) as a variety of L.cliftonii FvM. "with close vestiture and small leaves" but they did not specifically name it. This collection is now found conspecific with L.coolgardiensis and is therefore included under the latter in the present treatment.

Among Gardner's collections of this species, his nos. 1245 and 1745 seem to have come from one and the same collection. The

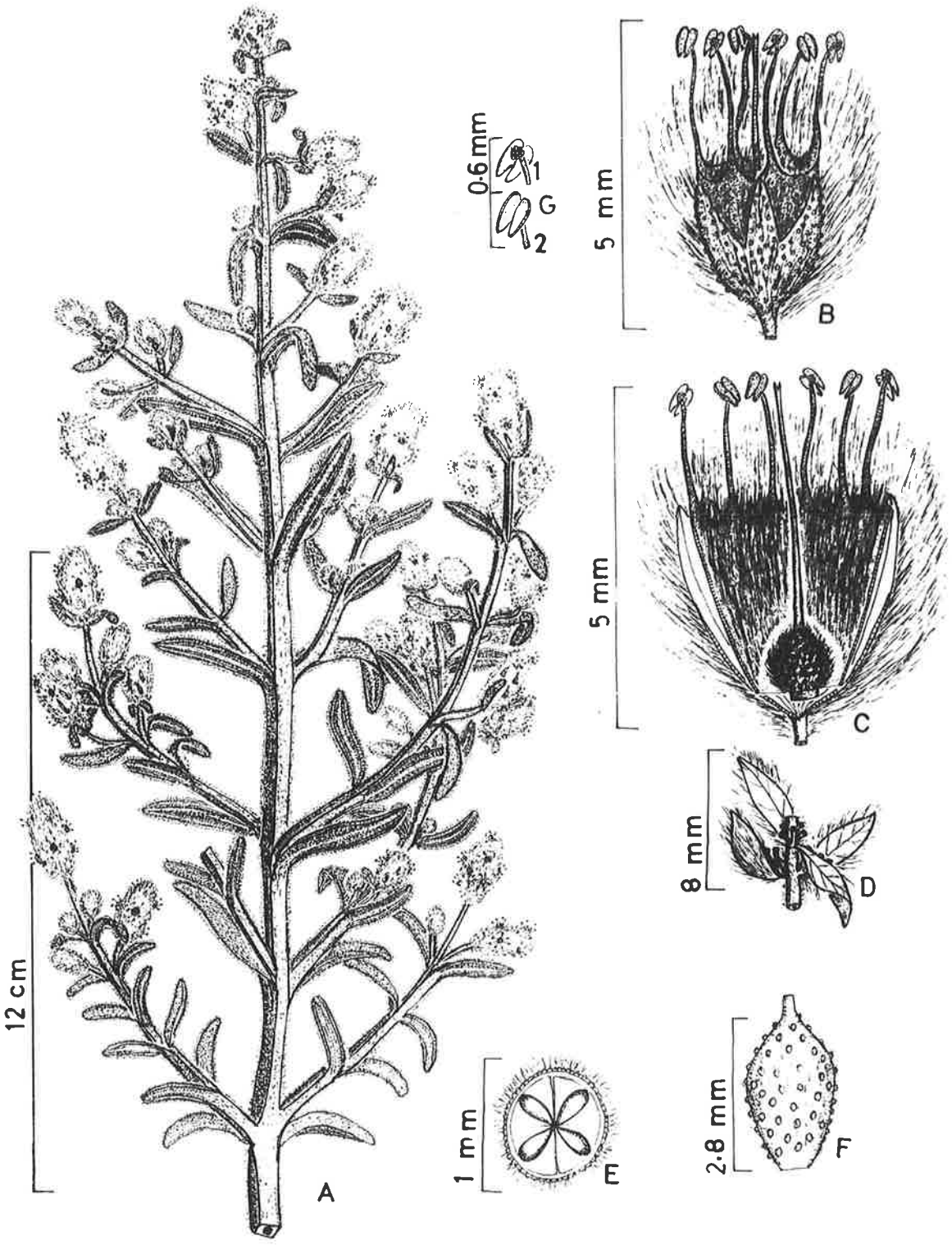


Fig. 49 — Lachnostachys coolgardiensis S. Moore (L.C. Webster s.n., NSW 106693: NSW - isotype).

A, flowering twig; B, flower; C, flower vertically cut open; D, bracts with remnant of 3 axillary pedicels, the flowers being removed; E, T.S. ovary; F, fruit; G, back and front views of anther.

former (no.1245) seems an error for the latter (no.1745) because all the information regarding habit, habitat, date and place of collection etc. are exactly the same for both the specimens. Moreover, the specimens look very much alike and collector's handwritten annotation on one of the three duplicates clearly refers it to his no.1745.

The type form differs from L.brevispicata (E.Pritzel)Munir in having smaller leaves and spikes, measuring 1.5 - 3 cm by 0.5-0.8 cm and 1.3 by 0.5 - 0.8 cm respectively.

Relationship:

Allied closely to L.ferruginea Hook. and L.verbascifolia FvM. in having spikes more than one at the end of branches; leaves with recurved margins, densely clothed with branched wooly tomentum, non-coriaceous and ovary glandular tomentose. However, L.coolgardiensis S.Moore may be easily distinguished by its leaves being smaller and distinctly decurrent so that the stem appears ± 4-angular; spikes smaller, measuring 1 - 3 (-4.5) by 0.5 -+(1.5) c.m. It is also related to L.bracteosa in having decurrent leaves.

L.coolgardiensis S.Moore f.brevispicata(E.Pritzel)Munir, Comb. et stat.nov.

L.brevispicata E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 511- Basionym; S.Moore J.Bot. 59 (1921) 247, in obs.; C.A.Gardner, Enum.Pl.Aust. Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac. etc. (1959) 209; C.A.Gardner, Wildfls.W.Aust. (1959) 127,128; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 566, t.26- p.p.; M.Morcombe, Aust.Wildfls. (1970) 116; J.S.Beard, W.Aust.Pl.ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc. 1 (1971) 346.

T y p u s: E.Pritzel 1018: from Menzies, Western Australia, - X.1901 (PERTH-lectotype; B,BM).

Typification:

This taxon is based on L.brevispicata, described by E.Pritzel on the following three different collections: Diel's 5142 and Pritzel's 1018, both from Menzies, and Webster's 63 from Coolgardie. The author, however, did not select any of these as a type for his species. Therefore, it is necessary to choose a lectotype for this name from amongst the syntypes. Of the above cited collections, Diels 5142 is not available for study (perhaps destroyed) and Webster's no.63 has been found identical with the type form coolgardiensis. The only other available syntype material is

is E.Pritzel's 1018, which consists of 3 specimens, one each in Herb.B,BM and PERTH. Apparently, all these specimens were named ,annotated and used by the author in preparing the original description. Among the three, the one preserved in Herb.PERTH seems the best representative of this taxon and is being designated here as the lectotype.

This taxon differs from the type form in its leaves being narrowly elliptic or elliptic - oblong, larger, 2 - 5(-6) by 0.8 - 1.5 cm, often slightly recurved along the margins; spikes longer and thicker, (2-)3 - 4.5 by 1 - 1.5 cm (thus its epitaet seems relatively inappropriate.)

Specimens examined:

WESTERN AUSTRALIA:- F.Weber for Mrs.Tarabini for A.M.Ashby 1773: near Menzies, 17.X.1965 (AD).- A.M.Ashby 3928: from Anketell, ca. 100 km east of Mt.Magnet, 3rd week. VIII.1971(AD).- Boulder s.n.: loc.incert.,-1900(C).- G.E.Brockway s.n., CANB26643: 22 miles north of Comet Vale, 4.X.1974 (CANB).- M.I.H.Brooker 1983: 2 miles south-west of Payne's Find, 11.VIII.1969(PERTH).- C.Brooks 790: Wallaroo near Kalgoorlie, -XII.1914(BM).- N.N.Donner 4545: 25 km south of Menzies, 3.IX.1973 (AD).- R.Filson 8788: 80 miles east of Mt.Magnet along Mt.Magnet to Sandstone road, 12.IX.1966(MEL).- C.A.Gardner 2083: Comet Vale near Menzies, 9.IX.1927 (PERTH - 2 - spec.).- C.A.Gardner 14374: 75 miles north-east of Payne's Find, 26.VIII.1963(PERTH).- C.A.Gardner 19012: 30 km north of Mt.Churchman, 18.X.1966(PERTH).- E.H.Ising s.n.AD966080987: ca. 70 miles north of Kalgoorlie, -IX.1930(AD).- H.H.Kretchmar s.n.: between Menzies and Leonora, -VIII.1963(PERTH).- F.Lullfitz 1540: 62 miles north of Kalgoorlie, 3.IX.1963(PERTH).- A.Morrison s.n.: Coolgardie District, -1899-1900(K).- A.A.Munir 5231: ca. 25 km south of Menzies, 3.IX.1973 (AD).-T.Oliver 3932:between Agnew and Sandstone, 18.VIII.1971(AD).- M.E.Phillips s.n., CBG029949: 14 miles from Menzies towards Kalgoorlie, 7.IX.1968(CBG).- E.Pritzel 1018;from Menzies, -X.1901(PERTH lectotype).- E.Pritzel s.n., [most likely the duplicates of no.1018]: north of Coolgardie Goldfield, 20 km south of Menzies, -X.1901 (B,BM probably isolectotypes;syntypes of L.brevispicata E.Pritzel).- R.D.Royce 4415 & 4480: Comet Vale, 23.IX.1953(PERTH).- R.A.Saffrey 850: 5 km W. of Payne's Find on Great Northern Highway,-(PERTH).- D.E.Symon 5463: ± 6 miles east of Anketell, 5.VII.1967(ADW).- ? Leg. s.n.: loc.incert., 10.X.1931(A).

Distribution: (Map 17).

Like the type form, f.brevispicata is also endemic in the south-western part of Western Australia. It overlaps the type form coolgardiensis near Coolgardie, Comet Vale and west of Sandstone. Elsewhere, the main localities of its occurrence are around Menzies, Paynes Find, east of Mt.Magnet and Sandstone, and south of Leonora. Three more localities, one each north of Mt. Churchman, north-west of Coolgardie and north-east of Paynes Find are also recorded.

E c o l o g y:

Much of what is true of the type form is true also of the form brevispicata.According to known distribution, this taxon grows under the same climatic conditions as the type form.Similarly, the information from collector's annotations shows, that this form also occurs commonly in sandy places. Brooks 1983 (PERTH), 2 miles S.W. of Paynes Find is noted as "rounded shrub, 0.6m tall". Filson 8788 (MEL), 80 miles east of Mt.Magnet is annotated:"small shrub only 25 cm high, the leaves are grey-green, tomentose, the flowers in densely woolly heads, ovary hairy". Gardner 2083(PERTH), fom Comet Vale, near Menzies, is recorded as "bushy shrub 2 - 3 ft. tall; corolla lilac; in red sand in open spaces". Gardner's subsequent collection no.14374(PERTH), from 75 miles north of Paynes Find is noted as "Frutex 30-45 cm alt., patens; corolla lilacina. In arenosis rufulis". Saffrey 850 (PERTH), from 5 km W. of Paynes Find on Great Northern Highway is reported "60 cm tall bush" with "violet flowers", growing in "brown sand". Symon 5463(ADW), from ± 6 miles east of Anketell is annotated "on dunes-wide low dunes of red sand, in Triodia and sparse woodland". The plant is said to be 1 metre high and strikingly white in appear-ance.

The author has collected it from sandy places of spinifex (Triodia) country where the vegetation has previously been burnt. Other plants growing in the asscoiation were chiefly Acacia, Eucalyptus, Euphorbia, Grevillea,Haloragis, Olearia, Solanum and Triodia species.

Like the type form, the flowering and fruiting generally take place from May to September.

C o m m e n t s:

E.Pritzel described this taxon as a new species L.brevispicata, but the characters on the basis of which he distinguished it from an earlier (now conspecific) taxon L.coolgardiensis are its

larger spikes, leaves and calyx. During present investigations, both the species are found almost identical except that L.brevispicata appears to be a slightly larger form both in leaves and inflorescence. After examining the types of both, the only difference that I can find is this one of size. In view of these facts, L.brevispicata has been placed under L.coolgardiensis as its new form brevispicata(E.Pritzel)Munir.

Among the available syntype collection, E.Pritzel's no.1018 consists of 3 duplicates, one each in Herb.B,BM and PERTH. All these have been annotated by the author (E.Pritzel), but the collection number on the specimens in Herb. B and BM is missing, apparently an oversight by the collector (who is also the author), because after writing the name of his species on the herbarium labels he has clearly written "nov.spec.". The three specimens agree with each other in all respects and there is no difference in their place and date of collection; the present author is convinced that all of them belong to E.Pritzel's no.1018.

Relationship:

f.brevispicata is closely allied to f.coolgardiensis.For distinctive characters see key to the species.

Lachnostachys ferruginea W.J.Hooker, Ic.Pl.N.S.1 (1842) t.415, var.ferruginea f.ferruginea; C.Moquin, DC.Prod.13 (1849) 298; F.v.Mueller,Fragm. 2 (1861) 140, in obs.; F.v.Mueller,Fragm. 6 (1868) 159; G.Bentham, Fl.Aust. 5 (1870) 39; F.v.Mueller, Cens. Aust.Pl.1 (1882) 102; F.v.Mueller, Sec.Cens.Aust.Pl.1 (1889) 172; J.Briquet in Engl. & Prantl, Pflanzenfam.IV,3a (1895) 164; * W.B.Hemsley, Hook.Ic.Pl.IV, 8 (1902) t.2732, in obs.;W.V.Fitzgerald, J.W.Aust.Natur.Hist.Soc. 2(1) (1904) 29, in obs.; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 507,508,509,512; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,302; J.S.Beard, W.Aust.Pl.(1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 567, t.27-p.p.; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc. 1 & 2 (1971) 347,534; R.Erickson et al.,Fl.Pl.W.Aust. (1973) 115, t.346. *J.Briquet, Mém.Soc.Physiq.Hist.Natur.Geneve,32(20,no.8 (1896) 77.

T y p u s: J.Drummond 14: Swan River Colony, Western Australia,- (K holotype; E).

Description: (Fig.50).

A branched woolly shrub of upto 75 cm high. Stem erect, branched, cylindrical, woody, covered with a soft dense woolly tomentum of somewhat rusty colour. Leaves decussate, sessile, elliptic - oblong or almost suborbicular, obtuse, (1.5-)2.5 - 3.5 (-6) cm long, (0.8-)1 - 1.5(-2)cm broad, densely clothed with a soft woolly tomentum, with nearly flat (non recurved) margins; tomentum ± ferruginous, short, branched, 1 - 1.5(-2) mm long. Inflorescence composed of simple spikes or panicles of spikes, terminal, ± pyramidal; spikes opposite (decussate), bracteate, cylindrical, very woolly, (2-)3 - 5.5(-6.5) cm long, 1 - 1.6 cm in diameter. Flowers mostly 7 - 9 -merous, sometimes 10 -merous, bracteate, sessile, normally 3 fls. in the axil of each bract, each fl. 6 - 9mm long (including stamens and style); bracts opposite, ± orbicular, sessile or very shortly stalked, imbricate in young spikes, late caducous, densely clothed with purplish - brown tomentum outside, glabrous within, 5 - 6.5(-7) mm by 4.5 - 6 (-6.5) mm; stalk 0.5 - 1 mm long, glabrous. Calyx 8 - 9(-10)-lobed in the upper half, tubular below, concealed by the long woolly tomentum on outside, glabrous within, 3.5 - 4 mm long; lobes ovate - lanceolate, acute, (0.8-)1 - 1.5 mm long, (0.6-)0.8 - 1 mm broad at the base; tube gradually broader towards the apex, (1.5-)2 - 2.5 mm long. Corolla purplish, tubular, ± campanulate, truncate at the apex,not lobed, glabrous without, densely tomentose within, 3 - 4(-4.5) mm long. Stamens purplish, 7 - 9, sometimes 10,exserted,

inserted at the rim (margin) of corolla-tube; filaments long, filiform, glabrous, somewhat flattened near the base, (2.5-) 3 - 3.5(-4) mm long; anthers 2 - lobed, dorsifixed, with a prominent granular mass on the back; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent, (0.6-)0.8 - 0.9 mm long. Ovary globose, densely glandular and tomentose, ± 1 mm in diameter, initially 4 - locular with a solitary ovule in each cell, but often appears 2 - locular (or sometimes unilocular) due to early breaking of the thin dissepiment from the walls of the cavity; style long, exserted, filiform, glabrous, gradually thickened towards the base, 4.5 - 5(-6.5) mm long; stigma minutely notched. Fruit dry, indehiscent, ovoid, glandular - pubescent when young, becoming glabrous and non - glandular when old, often longitudinally striate on drying, 1.5 - 2 mm long.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 94: near Moora, ca. 135 km north-east of Perth, 26.IX.1961(AD).- A.M.Ashby 153: Kulin to Lake Grace sand plain, 8.VIII.1963(AD).-A.M.Ashby 380: west of Elphin, ca. 6 km north-west of Wongan Hills, 11.IX.1963(AD).- Atkinson s.n.: from Mogumber, -(E).- J.Drummond 14: from the Swan River,-(K holotype; E isotype).- J.Drummond 202: loc.cit.,- (A,CGE, E,G,GH,LD,LE,MEL41181,MEL41182,P,W).- J.Drummond 438: loc.cit., -?1843(LE,MEL41180,MEL41184,P,W 2-spec.).- A.Eaton s.n.,MEL41196: loc.incert.,-(MEL).- Shell Oil Company s.n.: loc.incert.,-IX.1939 (A,F).- S.Smith 834∝: near Pingelly, -X.1922(PERTH).- T.B.Wolfe s.n.: loc.incert., -(K).

Distribution: (Map 17).

This taxon is endemic to the far south-western section in Western Australia. Like L.albicans, the main areas of its occurrence are to the south-east and north-north-east of Perth where it seems restricted between 30 and 35 degrees south latitude and between 115 and 120 degrees east longitude. The known localities north-north-east of Perth are along the Swan River, around Toodyay and (south of Moora) towards the sources of Moore River; one other locality is known in the north-west of Wongan Hills. Occurrences south-east of Perth are recorded from near Pingelly and between Kulin and Lake Grace.

E c o l o g y:

Information is scarce, but in its ecological requirements it seems much like L.albicans; being common in dry sandy places

towards the sources of rivers. Like the latter species, L. ferruginea is also restricted mainly to winter-rainfall summer - drought areas. The plant is a branched woolly shrub covered with dense, soft and somewhat ferruginous tomentum, and is popularly called by some "Flannel Plant". According to Beard (1965,1970), it is a "divaricate shrub" of 2 feet in height with "violet flowers". The habitat is noted "sandy soil". Ashby 94(AD), from near Moora, is annotated to have "purple stamens". Subsequent collection of Ashby 153(AD), from between Kulin and Lake Grace was gathered from "Gravel white sand plains". Ashby 380(AD), from West of Elphin, is noted to grow in "red gravel soil". Smith 834 (PERTH), from near Pingelly is recorded to have white woolly calyx and red - purple bracts.

Flowering and fruiting seem to occur chiefly from July to November.

C o m m e n t s:

In the protologue, the stamens are shown included with a short corolla-tube ("filaments - tube") and the ovary glandular all over but not tomentose. These characters are also recorded by Moquin (1849) who seems to have followed Hooker's description and drawing of this species. Bentham's diagnosis of this taxon agrees chiefly with the original records, but he has not made any mention of the inclusion or exsertion of stamens, neither about the presence or absence of glands or indumentum on the ovary. In fact, he has pointed out the resemblance of its young fruit to that of L. albicans, which in the latter species is non-glandular but very densely silky tomentose. The confusion regarding the exact nature of stamens and ovary seems to have occurred because of young flower-buds examined by the author, and probably by Moquin (1849) and Bentham (1870). According to their records, they all examined only Drummond's coll. nos. 14, 202 and 438, which all bear only very young flower or buds. During the present investigations, it has been observed that the stamens and style in young flowers or their buds are included and ovary densely glandular and non-tomentose; but in the fully developed flowers the stamens and style are always exserted and ovary glandular and tomentose. The absence of tomentum in the young (glandular)ovary is evidently due to earlier development of glands than tomentum.

The collection number of the type specimen is not recorded with the original description, but on the holotype sheet in Herb. K and on isotype in Herb.E, the collection number is written "Drummond No.14". The date of collection is not given but it

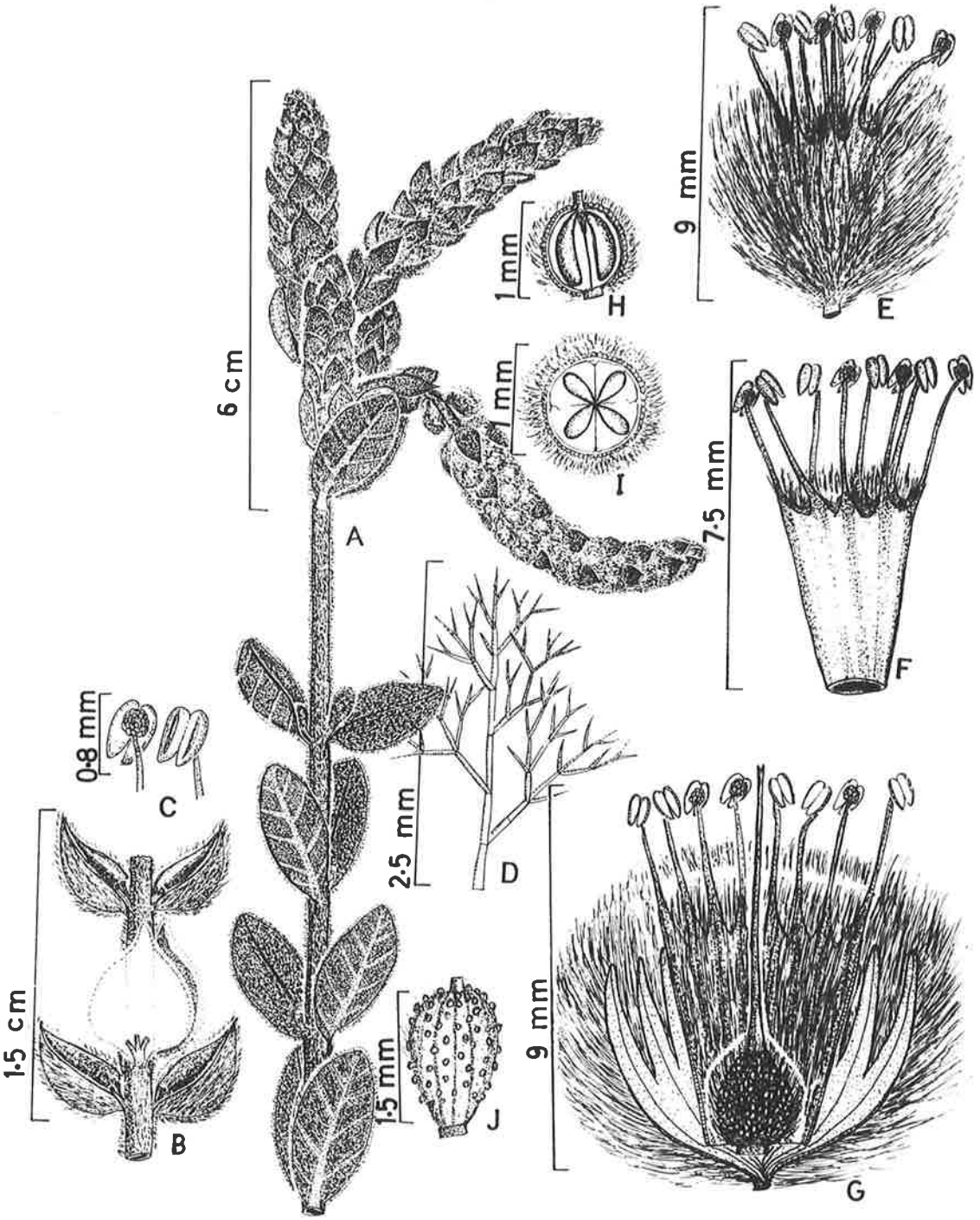


Fig. 50 — Lachnostachys ferruginea Hooker (A - D, J. Drummond 14: K - holotype; E - J, A.M. Ashby 94: AD).
A, flowering branch; B, bracts decussately arranged; C, back and front views of anthers; D, calyx-tomentum; E, flower; F, corolla-tube showing attachment of stamens; G, flower vertically cut open; H, L.S. ovary; I, T.S. ovary; J, fruit.

seems certain that it was collected before 1842, and belonged probably to one of Drummond's earlier collections which he sent to Hooker between the years 1837 and 1842. Drummond's other two collections of this species, nos.202 and 438, with respectively (at least) seven and four duplicates of each, have "1843","1843-4" and "1844" written or printed on some of their duplicates. This cannot be taken for the date or the year of their collection, because in some case two different years are found recorded on the duplicates of the same collection. In view of this, it seems that the year noted on some of the above duplicates may be the one when these specimens were acquired by those herbaria where they are now preserved.

Distribution of this species has been erroneously recorded by Moldenke (1959,1971) in South Australia. Actually, so far no Lachnostachys species is known to occur anywhere outside Western Australia.

The thick granular mass on the back of anthers, is more prominent in this species, than in any other known taxon of the genus.

Relationship:

L.ferruginea seems closely allied to L.verbascifolia FvM. in having very woolly and almost cylindrical stem, non -decurrent leaves, more than one (±panicled) large woolly spike at the end of branches, and mature spikes normally measuring 3 - 6.5 by 1 - 1.6 cm. However, it is easily distinguished by its leaves being oblong to elliptic - oblong or almost orbicular, with margins nearly flat; tomentum (on leaves) rusty - grey, very dense but short, 1 - 1.5(-2) mm long; flower- bracts ± orbicular, purplish - brown tomentose, (comparatively) late caducous and anthers with a very prominent granular mass on the back.

L.ferruginea Hook. var. ferruginea forma reticulata Munir, f.nov.

Forma ab aliis ob folia infra manifeste reticulata distinguitur.

T y p u s:A.M.Ashby 1279: from Tarin Rock, South-West Division, Western Australia, 26.X.1964 (AD holotype).

This taxon differs from the type form in having distinct reticulations on the under-surface of its leaves.

C o m m e n t s:

The holotype is the only known collection of this form, gathered from about 20 km west of Lake Grace, Western Australia.

There is no collector's note regarding its Ecology, but this probably agrees much with the type form. The leaves are comparatively thin and less densely hairy but the exact nature of its texture could be established only after studying more material of this form.

Relationship:

f.reticulata is closely allied to the type form. For distinctive characters see key to the species.

L.ferruginea Hook. var.ferruginea forma acutifolia Munir, f.nov.

Forma ab aliis ob folia semper oblongo-lanceolata aliquantum acuta distinguitur.

T y p u s:A.M.Ashby 16: from Kulin, South-West Division, Western Australia,- (AD holotype).

This taxon differs from the type form and f.reticulata in its leaves being always oblong - lanceolate and somewhat acute.

Specimens examined:

WESTERN AUSTRALIA:- C.A.Gardner 13625: loc.incert.,-(PERTH).- L.W.Greaves s.n., AD966080986: loc.incert.,-IX.1935(AD).- M.Koch 1723: "Karrijine",-X.1907 (E,MEL,NSW).- W.Lullf 1090: Talbot Brook near York, (?Kerrigan Rock) -X.1921(BM).?Leg. s.n., F954713: S.W. of W.Australia, -X.1936(F).

Distribution:

Like the type form and f.reticulata, this taxon is also endemic to south-western Division in Western Australia. According to known distribution, it occurs mainly east and south-east of Perth where it is recorded from south of York and Hyden respectively.

E c o l o g y:

In its ecological requirements, f.acutifolia seems much like the type form being common in dry sandy places of mainly winter-rainfall summer - drought areas. According to collectors' annotations, Koch 1723(E,MEL,NSW), from "Karr i jine" is noted as " a shrub 0.75 to 1.30m high". Lullf 1090(BM), from Talbot Brook near York is described as an "erect shrub to about 27" tall." According to Sargent, "calyx lobes and stamens vary from 7 - 10 even on the same spike. Spikes are usually simple; internodes always shorter than leaves".

Flowering and fruiting occurs mainly during August - November.

C o m m e n t s:

Among the six available collections of this taxon, only three have their localities. One of these was gathered [by Max Koch no.1723] from "Karrijine", a place not found recorded in any available map or atlas of Western Australia. A duplicate sheet of this collection in herb. NSW bears additional note namely "Darling Range". Since no locality by the name "Karrijine" is found near Darling Range in Western Australia, therefore, it seems that this may have been an error for Kerrigan (Rock) which is quite within the known distribution limits of this species.

Relationship:

f.acutifolia is related to the type form in having simple spikes in the axil of upper leaves or leafy bracts, but may be easily separated by its leaves being oblong - lanceolate and somewhat acute.

L.ferruginea Hook. var. paniculata (Ewart)Munir, comb nov.

L.verbascifolia F.v.Mueller var. paniculata Ewart,Vict.Natur. 24 (1907) 58.- Basionym.

T y p u s:A.Dempster s.n.,MEL41206: between Esperance Bay and Fraser's Range, Western Australia,-1884(MEL lectotype; MEL isolectotype).

L.dempsteri E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 512; A.J.Ewart, Vict.Natur. 24 (1907) 58, in obs.; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust. Wildfls. 3 (1965) 567; J.S.Beard,W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. (1971) 347; C.A.Gardner, W.Aust.Wildfls. B (1972) 158,159-p.p.

T y p u s:A.Dempster s.n., MEL41139,MEL41206,MEL41207: between Esperance Bay and Fraser's Range, West.Aust.-1874/76 and 1884 (MEL syntypes).

L.verbascifolia auct. non FvM.: F.v.Mueller & R.Tate, Trans.R.Soc. S.Aust. 16 (1896) 375-(quoad spec. Gwynne s.n.: from 85 miles north-east of Esperance Bay, W.Aust.; Eld.Expl.Exped. 1891- AD9711302 p.p.,K,MEL41208,NSW106689).

Typification:

L.ferruginea Hook. var. paniculata (Ewart)munir is based on L.verbascifolia FvM. var. paniculata Ewart. The latter was published as a new variety with two different collections cited under it. Since the author did not select any type for this variety, therefore, it is necessary to choose a lectotype. The two collections were made respectively by Dempster and Gwynne from N.E. of Esperance Bay, W.Australia. Dempster's collection consists of three specimens, all are preserved in Herb.MEL under the numbers MEL41139,MEL41206 and MEL41207, while Gwynne's collection is with four duplicates one each in Herb.AD,K,MEL, and NSW. Of these two collections, Dempster's specimens are the earlier known of this variety and have twice been recorded as syntypes of L.dempsteri E.Pritzel and L.verbascifolia FvM. var. paniculata Ewart respectively. It has fully developed paniculate inflorescences with many leaves, and seems the best representative of this variety. In view of this, one of Dempster's specimens in HerbMEL, preserved under the no.MEL41206, is being selected here as a lectotype for this variety.

Var.paniculata differs from the type variety of L.ferruginea in having a compound inflorescence (i.e. panicles of spikes) in the axils of upper leaves or leafy bracts.

C o m m e n t s:

Gwynne's collection (s.n.) from 85 miles north-east of Esperance Bay, Western Australia, gathered during the Elder Exploring Expedition in 1891, was originally identified (?probably by R.Helms) as Lachnostachys albicans Hook. However, due to thinner tomentum and more compound inflorescence, it was later described by F.v.Mueller and R.Tate (1896) as a variety of L.verbascifolia FvM. although they did not specifically name it. Subsequently, an earlier convarietal collection by A.Dempster (s.n.),gathered in 1884(and 1874/1876) from between Esperance Bay and Fraser's Range, Westersn Australia, was described by E.Pritzel as a new species L.dempsteri. According to E.Pritzel (1904) Dempster's collection along with the above-mentioned Gwynne's collection in Herb.MEL were confused by F.v.Mueller with L.verbascifolia FvM.

Ewart (1907) found Dempster's and Gwynne's specimens convarietal but distinct from the type variety of L.verbascifolia FvM. Therefore, on the basis of their compound (paniculate) inflorescence, shorter tomentum amd almost non-revolute leaf margins he ventured to constitue of them a new var. paniculata [under L.verbascifolia] and reduced L.dempsteri E.Pritzel to synonymy

under this new variety.

During the present revision of Lachnostachys, it has been observed that the shorter (or thinner) tomentum and almost non-revolute leaf margins are some of the distinct characters of L.ferruginea Hook. The same characters, coupled with the compound inflorescence formed the basis of L.verbascifolia FvM. var. paniculata Ewart. In the compound inflorescence and thinner tomentum, this variety seems close to L.eriobotrya(FvM.)Druce from which, however, the large non-revolute leaves at once distinguish it. On the whole, var. paniculata is much closer to L.ferruginea Hook. than to L.verbascifolia FvM. or any other known species of this genus. In view of this, it is being transferred here under L.ferruginea without change of rank.

In the protologue of this variety, the author (A.J.Ewart)has erroneously presumed (Gwynne's) Elder Exploring Expedition specimen as being regarded by some as "L.albicans". Actually, this collection was initially identified (?probably by R.Helms) as "L.albicans", a name found written on all the original herbarium labels of this collection. But it is a mere annotation on Gwynne's Elder Exploring Expedition collection, because the latter is not known to have ever been published under this name. In the published (original) records of this Expedition, however, the collection in question was recorded by F.v.Mueller & R.Tate (1896) as a variety of L.verbascifolia F.v.M., but as pointed out before, they did not give it any name.

Of the two specimens cited under the new variety, the one belonging to the Elder Exploring Expedition is shown to have been gathered during "1881". Since the above expedition took place in 1891, therefore, the error in the year of collection may be rectified accordingly.

L.ferruginea Hook. var. paniculata (Ewart)Munir f. paniculata

T y p u s: The type of var. paniculata is also the type for this form.

This taxon differs from the other form of this variety in its leaves being oblong - lanceolate and somewhat acute.

Specimens examined:

WESTERN AUSTRALIA:- J.D.Batt s.n.,MEL1188: between Dundas Hills and Lake Lefroy,-1893(MEL).- S.Brooks s.n.,MEL41194: N.W. base of Mt.Ragged,-1894(MEL).- A.Dempster s.n.,MEL41139: between Esperance Bay and Fraser's Range,-? 1876 or 1874(MEL).- A.Dempster s.n.,

MEL41206,MEL41207: loc.cit.,-1884 (MEL lectotype;MEL isolectotype).- P.A.Gwynne s.n.,AD97113020,MEL41208,NSW106689: Elder Exploring Exped. 85 miles north-east from Esperance Bay, 2.XI.1891 (AD,K,MEL, NSW - syntypes of L.verbascifolia FvM. var. paniculata Ewart).

Distribution:

Endemic to the south-western section in Western Australia. The known distribution of this taxon is mainly to the north and north-east of Esperance Bay in Western Australia.

C o m m e n t s:

In the original description of L.dempsteri E.Pritzel, the number of calyx-lobes and stamens in a flower are said to be 5 each. Actually, this is not always so in this taxon because the number of these flower parts are mostly 6 - 9 each in a flower, rarely 5 or more than 9.

The collector's name on one of Elder Exploring Expedition specimens (of this taxon) in Herb.NSW is written "R.Helms", while its three duplicates in Herb AD,K, and MEL are noted to have been gathered by P.A.Gwynne. The other information regarding the name, date and place of their collection is the same on all the four duplicates and is written in same handwriting. In the scientific records of this Expedition, this particular collection is referred to Gwynne under the name L.verbascifolia FvM. [Trans.R.Soc.S.Aust. 16(1896) 334,375]. The same collection was subsequently recorded by Ewart (1907) as a syntype of L.verbascifolia FvM. var.paniculata Ewart, but without collector's name. There is no doubt that R.Helms accompanied this expedition as Naturalist and P.A.Gwynne as a by-worker, and during this journey R.Helms made many plant-collections from Western Australia, but all the collections of this taxon between Fraser Range and Esperance Bay were made by P.A.Gwynne. (ibid. P.334). In view of this, all the specimens from above locality were collected by Gwynne, and R.Helm's name (as a collector) on the duplicate sheet in Herb.NSW seems an error.

The name of locality on Miss S.Brooks' collection (s.n.) MEL41194 is mis-spelled as "Mt.Rugged". This may be read as Mt. Ragged, because Mt. Rugged is near Tennant Creek in Northern Territory where this taxon is not known to grow.

Relationship:

Allied closely to f.ferruginea in its leaves being flat, not recurved along the margins; tomentum dense and short; flower bracts ± orbicular, purplish - brown tomentose, and anthers with a

prominent granular mass on the back. However, it can be readily distinguished by its compound (paniculate) inflorescence.

L.ferruginea Hook. var. paniculata (Ewart)Munir f.obtusifolia Munir,f.nov.

Forma a typo ob folia obtusa elliptico - oblonga distinguitur.

T y p u s:H.& E.Walter 719: 100 miles N. of Perth, between New Norcia and Moora, 15.IX.1958 (B holotype).

From its closely related form paniculata, this taxon differs in having elliptic - oblong obtuse leaves.

C o m m e n t s:

The holotype is the only known collection of this new form. In its ecological requirements, it is noted as sub-shrub growing in sandy places, and in the leaves it shows an approach to f.ferruginea, from which, the inflorescence at once distinguishes it.

Relationship:

f.obtusifolia is closely related to f.paniculata in having a compound inflorescence(i.e. Panicles of spikes), but the elliptic-oblong obtuse leaves at once distinguish it. The leaves are ± similar in f.ferruginea, from which it may be easily separated by its compound inflorescence.

Lachnostachys verbascifolia F.v.Mueller, Fragm. 6 (1868) 158; G.Bentham, Fl.Aust.5 (1870) 38; F.v.Mueller, Fragm. 9 (1875) 4; F.v.Mueller, Cens.Aust.Pl.1. (1882) 102; F.v.Mueller, Sec.Cens. Aust.Pl.1. (1889) 172; J.Briquet in Engl. & Prantl, Pflanzenfam. IV, 3a (1895) 164; W.B.Hemsley, Hook. Ic.Pl.IV, 8 (1902) t.2732; W.V.Fitzgerald, J.W.Aust.Natur.Hist.Soc. 2(1) (1904) 29, in obs.; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 508,510 - 512; A.J.Ewart, Vict.Natur. 24(3) (1907) 58, in obs.; A.Morrison, J.Natur.Hist.Sc.Soc.W.Aust. 3(1) (1910) 56, t.4, fig.1; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; B.J.Grieve, J.R.Soc.W.Aust. 39(2) (1955) 32; C.A.Gardner, Wildfls.W.Aust. (1959) 127,128, p.p.; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,302; J.S.Beard, W. Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 566, t.26, p.p.; A.Moriya, List Pl.Spec.Coll.Aust.; List Colour Slides Wildfls.Aust. (1969) 24 and 27 respectively - MS.; A.R.Fairall, W.Aust.Native Pl.Cult. (1970) t. on dust jacket; J.S.Beard, W.Aust.Pl., ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 347,534; R.Erickson et al., Fl.Pl.W. Aust. (1973) 196; H.N.Moldenke, Phytologia 26(5) (1973) 368; C.A.Gardner, Wildfls.W.Aust., ed.11, (1973) 8,119.

T y p u s: J.Drummond's 5th coll.no.237, MEL41202: from south-west of Western Australia, - 1848 (MEL lectotype; G,K,M,MEL,P,W).

L.cliftonii F.v.Mueller, Fragm. 9 (1875) 3; F.v.Mueller, Cens.Aust. Pl.1. (1882) 102; F.v.Mueller, Sec.Cens.Aust.Pl.1. (1889) 171; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 507 - 509,511,512; L.Diels, Pflanzenw.W.Aust. (1906) 279, in obs.; C.A.Gardner, Enum. Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc.(1959) 209; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 567, t.27, p.p.; J.S.Beard, W.Aust.Pl., ed. 2, (1970) 113; B.Everard & B.D.Morley, Wildfls. of the World (1970) t.132 - C; H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347,534.- syn.nov.

T y p u s: W.Clifton s.n., MEL41140, MEL41186: sources of the Arrowsmith River, - L (MEL syntypes).

L.cordifolia S.Moore, J.Bot. 59 (1921) 247; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209; H.N.Moldenke, Fifth Summary Verbenac. etc.1. (1971) 347; [C.A.Gardner, Enum.Pl.Aust.Occ.3 (1931)111, pro syn.].

T y p u s: G.Turvey s.n., Herb.O.H.Sargent 808: ± 15 miles south-east of York, -X.1914 (BM holotype).

Typification:

L.verbascifolia FvM. is based on J.Drummond's 5th collection, no.237, consisting of about half-a-dozen duplicates. Since the author did not choose any one of them as a type for this species, it is necessary to select a lectotype for this name. Of all the available syntypes, two are preserved in Herb.MEL under the nos. MEL41202 & MEL41192, and the rest in Herb.G,K,P and W. Among all these, the two (duplicates) in Herb.MEL have been annotated by the author and possibly used by him in preparing the original description of this species. One of them, preserved under the no.MEL41202, has both leaves and inflorescence and seems the best representative of this taxon. Therefore this specimen is being chosen here as the lectotype for this species.

Description: (Fig.51).

A tall stout woolly shrub of upto 1 metre high. Stem erect, branched, cylindrical, woody,very densely clothed with long silky - woolly tomentum. Leaves decussate, sessile, ovate or ovate - oblong, obtuse, often cordate at base, mostly with recurved margins, (2.5-)3 - 7.5(-10.5)cm long, 1 - 2.5(-3) cm broad, very densely covered with much-branched woolly tomentum; tomentum 2 - 5(-8)mm long, greyish - silky in fresh leaves, somewhat ferruginous on drying. Inflorescence of dense paniculate spikes; spikes opposite (decussate), both axillary and terminal towards the end of branches, cylindrical, (2-)3 - 8.5(-10)cm long, 1 - 1.6 cm in diameter, very woolly. Flowers mostly 6 - 7 -merous, rarely 5 -merous, bracteate, subsessile or shortly pedicellate, normally in clusters of three in the axil of each bract, 6 - 7.5 mm long, (including stamens and style); pedicel short, very woolly, (0.5-)1 - 2 mm long; bracts opposite (decussate), sessile, narrowly elliptic or lanceolate, early caducous, 6 - 10(-15) mm long, (1-)1.5 - 2.5(-3) mm broad, densely covered with branched woolly tomentum outside, glabrous within. Calyx tubular, 6 - 7 - lobed in the upper half, rarely 5 -lobed, very densely woolly - tomentose without, glabrous within, 2.5 - 2.8 mm long, lobes ± deltoid - lanceolate, acute, 0.7 - 1 mm long, 0.6 - 0.8 mm broad at the base; tube ± infundibuliform, (1-)1.5 - 1.8 mm deep; tomentum long, branched, upto 3.5(-4) mm long. Corolla purple - violet, infundibuliform,glabrous without, densely tomentose in the lower half within; tube truncate at the top, not lobed, 2 - 2.8 mm long. Stamens 6 - 7, rarely 5, purple - violet, much exserted, inserted at the rim (margin) of corolla-tube;filaments long, filiform, glabrous, 3 - 3.5(-4) mm long; anthers 2 -lobed, dorsifixed, with a small granular mass at

at the back, ± 0.7 mm long, 0.6 mm broad; lobes oblong, free and divergent in the lower halves, longitudinally dehiscent. Ovary globose, densely glandular all over and tomentose, 0.6 - 1 mm across, 2 - locular, with 2 - ovules in each cell; style long, exserted, filiform, glabrous, 4 - 5.5 mm long; stigma almost entire or minutely notched. Fruit elliptic to elliptic - oblong, sparsely glandular and hairy all over, with faint longitudinal ridges, 2.5 - 3 mm long, 1 - 1.7 mm across, one seeded; seeds 2 - 2.5 mm long, ± 1 mm across, albuminous.

Specimens examined:

WESTERN AUSTRALIA:- C.R.P.Andrew s.n.,NSW10668: Menzies, -(NSW).- Barlee s.n., MEL41187: Upper Irwin, -(MEL).- G.F.Berthond 8895/15,NSW106687:Wurarga, -XII.1915(NSW).-H.F.M.Broadbent 1847: loc.incert., spec. obtained from fl.show, 10.IX.1953(BM).-A.C.Burns s.n.: Cranbrook, 9.X.1969(E).- W.H.Butler s.n.: Wongan Hills, 30.X.1959(PERTH).- C.Carter s.n.: loc.incert., -(E).- J.Clark s.n.: near or at Mount Dale, Helena River, -XII.1922(PERTH).-,W.Clifton s.n.,MEL41140 & MEL41186: sources of the Arrowsmith River, -(MEL-syntypes of L.cliftonii FvM.).-Cobham s.n.,MEL41185: loc.incert., 5.X.1903(MEL).- M.Cronin s.nMEL41201: near King George's Sound,-1892(MEL).- M.Cronin s.n., MEL41193: between the upper Blackwood River & Lake Lefroy,-1893(MEL).- M.Cronin s.n., MEL41205: Interior of south-west Australia, -1894(MEL).- S.Daniell for A.M.Ashby 2028(a): near Cranbrook, 16.X.1966(AD).- Dare s.n.,MEL41195: Swan River, -1889(MEL).- E.Daw 1017: 97 miles N. from Ravensthorpe on no.1 Rabbit Proof Fence, -XI.1924(PERTH).- J.Drummond's 5th Coll. no.237: south-west, Western Australia, - 1848(MEL41202 lectotype; G,K,MEL,P,W-isolectotypes).- J.Drummond s.n.,MEL41190,MEL41191: loc.incert.,-(M,MEL- 2 spec.).- M.E.Forrest s.n.MEL41189: about 80 miles eastward of the Irwin River, 19.X.1893(MEL).- Fuller s.n. NSW106685: loc incert.,-(NSW).- C.A.Gardner 1750:Tarin Rock near Lake Grace, 13.IX.1925(PERTH).- C.A.Gardner 12475: near Lake Mongers, 9.VIII.1960(PERTH-2 spec.).- C.A.Gardner 16095: 46 km east of Hyden, 11.VIII.1965(PERTH- 2 spec.).- C.A.Gardner s.n.,MEL41143: Lake Austin, -1942(MEL).- C.A.Gardner s.n.: ±18miles eastwards from Pindar, 30.VIII.1945(PERTH - 2spec.).- C.A.Gardner s.n.: between Coorow and Wubin, -XI.1967(PERTH).- A.S.George 6851: near Muja Mine, Collie, 15.X.1965(PERTH).- A.Gillham for A.M.Ashby 2028(b): near Cranbrook, 17.X.1966(AD).- Ch.Gray s.n.,MEL41204, W741: loc.incert., -1880(MEL,W).- R.Helms s.n.,UC882459: loc.incert. -IX.1899(S,UC).- A.U.Henn ex Herb. J.C.Melville s.n.: 6 miles east from Cue,-1898(BM,K).- C.Holl~way 2: near Freemantle,-(BM).-

King & Lefroy s.n.,MEL41203: between Lake Moore & Lake Austin,-(MEL).- W.Luelf 1440a: near York, Talbot Distt., 24.XII.1923 (BM).- J.H.Maiden s.n., W18107: Albany, -X.1909(W).- J.H.Maiden s.n., AD97113018,F294459,MO822959,NSW7688,UC176553,UC249395,US654209, US568864,W5302: Pindar, -XI.1909 (AD,B,C,F,G - 2 spec.,L,MO,NSW, P,S,SYD,UC- 2 spec.,US- 2 spec.,W).- F.v.Mueller s.n., W7837: Lake Muir,-(W).- F.v.Mueller s.n.,MEL41197: Upper Irwins River,-(MEL).- F.v.Mueller s.n.,SING044209: Greenough River,- (BM-p.p.,C,SING).- T.Muir s.n.,MEL41145: Sources of the Tone River,-1880 (MEL).- A.A.Munir 5061: From Adelaide florist's shop bought by Mrs. Marie Luise Eichler, 18.VII.1972(AD).- C.H.Ostenfeld 1099: loc.incert., -X.1914(C).- Prinsep s.n.: Bindoon, 18.X.1898(BM).- O.H.Sargent 808: near York, 25.1.1924(BM).- O.H.Sargent 909a: near York, -IX-X.1924(PERTH).- O.H.Sargent 1444: York, -X.1924(MEL).- J.Sheath s.n., NSW106682 & NSW106683: Murchison Distt.,-IX.1902(NSW).- J.Sheath s.n., NSW106681:Perth,-XII.1910(NSW).- G.Turvey s.n., Herb. O.H.Sargent 808: about 15 miles south-east of York,-X.1914 (BM- holotype of L.cordifolia S.Moore).- Shell Oil Co. s.n., F1071293,UC1328205: loc.incert., -IX.1939(A-2spec.,F,Uc).-J.Staer s.n.: Mingenew,-XI.1905(E).- A.Steffanoni s.n.,ADW14608: Porongurups (from flower show),30.IX.1927(ADW).- R.T.Stubbs s.n., AD966080988: loc.incert., -X.1933(AD).- F.E.Victor s.n.,NSW106688: Cue, -VIII.1899 (A- drawing, NSW).- Waldeck s.n.,MEL41198: one hundred miles east of Greenough-flats near upper part of Irwin River,-(MEL).- Ch.Walter s.n.,NSW106688: loc.incert., -(NSW).- J.S.Wells s.n.,MEL41200: Boxvale, 50 miles east of York,-(MEL).- H.B.Williamson s.n.,F731881: Tammin, -VIII.1926(F).- J.G.Young 2100: Central Greenough (50 miles beyond),-IX.1910(MEL) ? Leg. s.n.,F954699: loc.incert., south-west, -X.1935(F).? Leg.s.n., BRI113972: loc.incert., -(BRI).

Distribution: (Map 18).

L.verbascifolia FvM. is endemic to the south-western part of Western Australia. The known distribution is mainly towards the south-south-east and north-north-east of Perth, between 25 and 35 degrees south latitude and between 115 and 122 degrees east longitude. It seems to extend far down south where no other taxon of this genus is known to occur. In the southern areas, it grows along the southern-most section of Albany Highway and around the sources of Blackwood and Tone Rivers. A few localities are near Lake Muir and Lake Grace and more are known in the vicinity of Collie, Hyden and York. Distribution north-wards extends to Murchison River, and north-east-wards this species is collected

from near Menzies and Cue. Majority of the localities in the north are located towards the sources of Swan, Arrowsmith, Irwin and Greenough Rivers. Discontinuous distribution is recorded mainly near Mingenew and Pindar in the north, and around Wingan Hills, Wubin, Lake Mongor and Lake Austin in the north-east.

E c o l o g y:

Little is known of the ecology of this species, but according to information gathered from collectors' annotations, it seems to grow commonly in sandy soil, often near lakes and towards the sources of rivers. According to known distribution, it seems to occur chiefly in the winter-rainfall summer drought areas. It is a very woolly "flannel-like" shrub with densely branched tomentum, generally longer tomentum than in any other known species of Lachnostachys. Gardner 1750 (PERTH), from Tarin Rock, near Lake Grace was found growing in "sand heath". The plant is reported as " 12 - 28 ins. tall" with "lilac corolla". Similar information is recorded with Gardner's 12475 (PERTH), from near Lake Monger and also with his no.16095 (PERTH), from 40 km east of Hyden. George 6851 (PERTH), near Muja Mine, Collie, is annotated as "shrub to 1.3 m. Fls. pale greenish - cream". The plant was found growing "in sand over laterite, in jarrah - Casuatina woodland". Sargent 909 (PERTH), from near York, is recorddd to have "woolly - white flowers; white perianth".

Flowering and fruiting seem to occur chiefly from August to November.

C o m m e n t s:

L.verbascifolia FvM. was originally described under the family Byttneriaceae ("Buettneriaceae") but was subsequently transferred by the author to Verbenaceae [Fragm 6 (1868) 158; Fragm. 9 (1875)4]. The apparent reason for placing it initially under Byttneriaceae [=Sterculiaceae] may probably be due to its very woolly - tomentose stem, leaves and inflorescence with the aspect of some Sterculeaceae.

Hemsley (1902) describes the flower of this species as "invariably pentamerous", but according to present investigations, it is mostly 6 - 7 -merous, rarely 5 -merous. Similarly, in the original description the ovary is described as unilocular with a single ovule, but during present studies the ovary is found certainly 2 -locular with 2 - ovules in each cell. On hasty examination, the amture ovary may appear one celled with a single ovule because out of four ovules only one enlarges to form a seed.

Unlike three earlier species of this genus, there is no clear indication in L.verbascifolia of early disruption of the ovary dissepiment.

The type of this species belongs to J.Drummond's 5th collection gathered in 1848 from "S.W.Australia". As it is usual with many other Drummond's collections, the locality on the type duplicates of L.verbascifolia is also noted "S.W.Australia", "W.Australia", "Swan River Nouvelle Hollande" etc., but there is no indication of the exact type locality. It seems very likely that the type of this species may have come from near the southern coast of Western Australia, which Drummond visited during 1848 and where this species is known to occur commonly. During his 5th plant collecting expedition to the south, Drummond did collect plants from Porongurups and Albany [Erickson (1969) 120 - 122,168],where L.verbascifolia is now known to grow. Since his 5th collection (exclud. Suppl.) comes exclusively from south, it is likely that the type of this species came from one of the above mentioned localities.

Under "geographic distribution", Moldenke (1959,1971) has recorded this species from South Australia. But as pointed out under the generic distribution, this genus is endemic only to Western Australia and its existence in any other state in Australia is not yet established.

Due to "thinner tomentum and compund inflorescence", Gwynne's collection from near Esperance Bay has been recognised by Mueller & Tate (1896) as a variety of L.verbascifolia FvM., although they did not specifically name it. The same plant (collection) was subsequently described and named by Ewart (1907) as var.paniculata under this species. Actually,this variety is now found conspecific with L.ferruginea Hook., by the present writer and has therefore been transferred to the latter with the same rank.

Gardner (1931) identified S.Moore's L.cordifolia as conspecific with L.verbascifolia FvM. and thus reduced the former to synonymy under the latter. This change was subsequently accepted by all except Moldenke (1959 & 1971) who has maintained L.cordifolia as a distinct species. The type of L.cordifolia S.Moore is Geo Turvey's specimen (Herb. Sargent no.808 in Herb. BM) with somewhat cordate leaves, but suchleaves ar e also found in the type material of L.verbascifolia FvM. Apparently the type of the latter species was not seen by the author (S.Moore).

Mueller (1875) based his L.cliftonii on Worsley Clifton's collection from the sources of Arrowsmith River, but all the characters that he recorded in its protologue are exactly the

ones found also in his earlier described species L.verbascifolia FvM. During present investigations, therefore, the type of L.cliftonii FvM. is found conspecific with L.verbascifolia FvM. and as a result the former(L.cliftonii FvM.) is reduced here as a synonym under the latter.

Usually, there are two leaves at each stem node, arranged in decussate manner. But in A.S.George's Coll. no.6851 (in Herb.PERTH), the number of leaves at a node is three in some of the branches subtending the inflorescence. This seems an unusual situation in this particular specimen.

Relationship:

Allied closely to L.ferruginea Hook. in having more than one spike at the end of branches, very densely woolly (flannel-like) non-coriaceous leaves and glandular tomentose ovary. However, L.verbascifolia FvM. may be readily distinguished by its leaves being ovate - lanceolate to (sometimes) cordate, with recurved margins; tomentum (on leaves) much longer, measuring 2 - 5(-8)mm in length; flower bracts narrowly elliptic or lanceolate, not orbicular, early caducous and anthers not prominently granular at their back. In many of the above characters, L.verbascifolia FvM. seems close to L.coolgardiensis S.Moore, but the leaves in the latter species are narrow - oblong, spreading or somewhat deflexed, very distinctly decurrent; spikes slender and shorter, measuring 1 - 3(-3.5) cm long.

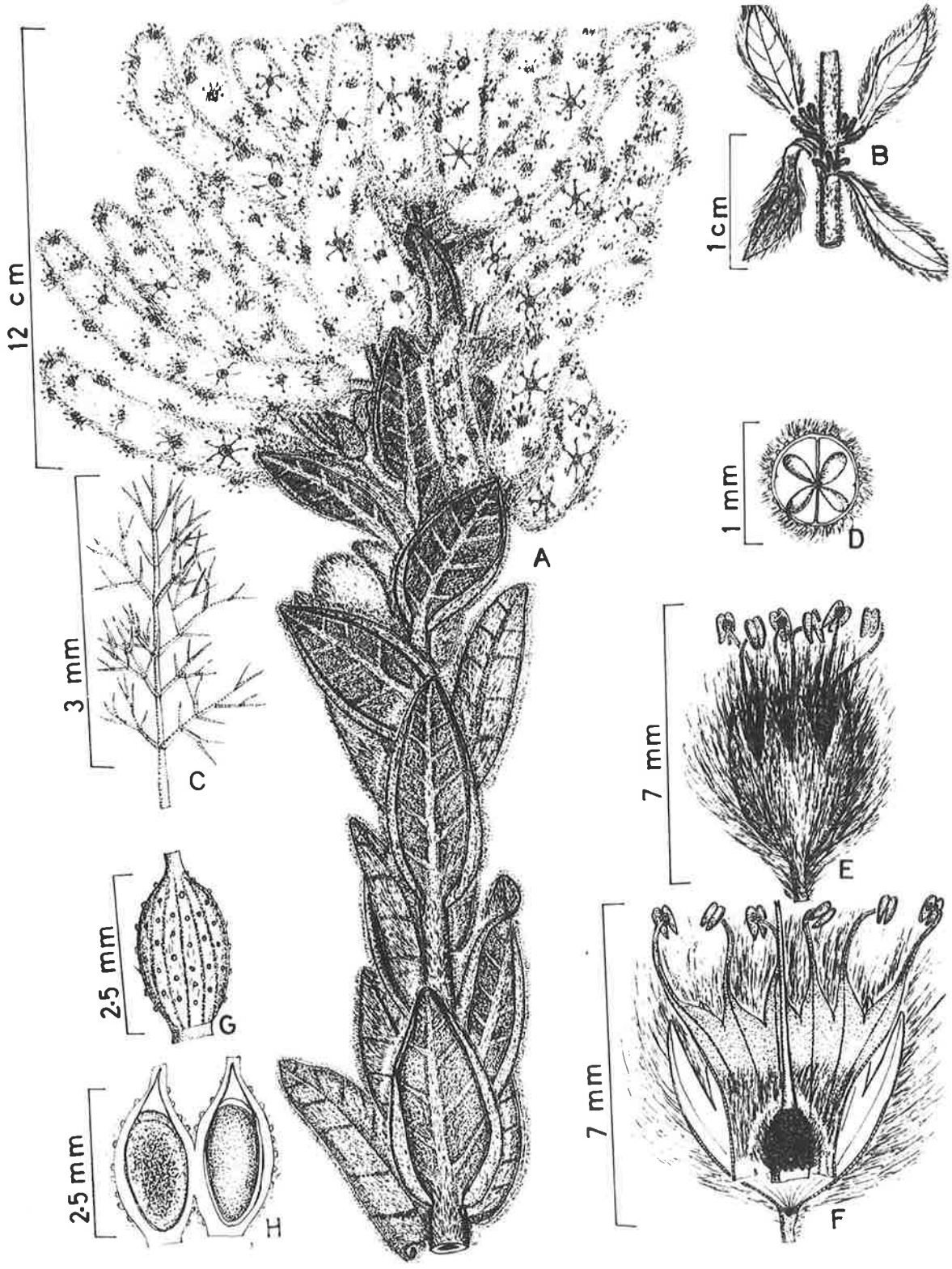


Fig. 51 — Lachnostachys verbascifolia F.v.M. (A - F, A.M. Ashby 2028(a); AD; G - H, R.T. Stubbs s.n., AD 966080988 : AD).

A, flowering twig; B, bracts with each showing remnant of 3 axillary pedicels; C, calyx-tomentum; D, T.S. ovary; E, flower; F, flower vertically cut open; G, fruit; H, fruit longitudinally cut open showing single seed.

Lachnostachys bracteosa C.A.Gardner, J.R.Soc.W.Aust. 47 (1964) 62; J.S.Beard, W.Aust. Pl.(1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 563; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac. etc.1 (1971) 346.

T y p u s: C.A.Gardner 13636: near Lake King, Eyre district, Western Australia, 20.X.1961 (PERTH lectotype; MEL,PERTH).

Typification:

L.bracteosa Gardner is based on the author's own collection no.13636, consisting of 5 syntypes. One of these is preserved in Herb. MEL and the remaining 4 are located in PERTH herbarium. Since the author did not select any one of these as a holotype, it has become necessary to designate one of the syntypes as lectotype. The syntypes in Herb. PERTH, [all without herbarium accession numbers] were used by the author in describing this species. One of these seems the best representative of L.bracteosa and is being chosen here as the lectotype.

Description: (Fig. 52).

A short woody shrub of up to 50 cm tall. Stem erect, branched, cylindrical, often with remnants of decurrent leaf bases, densely covered with short greyish tomentum. Leaves decussate, sessile, distinctly decurrent, narrow linear, obtuse, with closely revolute margins, (0.6-)1 - 1.5 cm long, (1-)2 - 3 mm broad, dark olive-green or somewhat blackish - grey, all over greyish - pubescent when young, rugose and glabrescent above when old. Inflorescence spicate, spikes solitary terminal, cylindrical, (1-) 2 - 5(-6)cm long, 1 - 1.5 cm in diameter, very densely white woolly - tomentose. Flowers 6 -7-merous, rarely 5 - or more than 7 -merous, bracteate, pedicellate, normally in opposite (decussate) clusters of three in the axil of each bract, whole flower 6 - 7 mm long; pedicels ± 1 mm long, glabrous; bracts caducous, opposite (decussate), stalked, lanceolate, 5 - 6(-7)mm long, (0.8-)1 - 1.5 mm broad, very densely covered with branched woolly - tomentum outside, glabrous inside. Calyx tubular below,usually 6 - 7 -lobed towards the apex, rarely 5 - or more than 7 - lobed, glandular and very densely woolly - tomentose outside, glabrous within, 2.5 - 3.5mm long (excluding tomentum); tomentum long, much branched, upto 2.5 mm long; lobes ± deltoid - lanceolate, abruptly acuminate at the apex, 1.2 - 1.5 mm long, 0.5-1 mm broad near the base; tube ± campanulate, 1.3 - 2(-2.5)mm long. Corolla "lilac",campanulate, truncate at the top, (not lobed), 2 - 3.5 mm long, 2 - 3 mm in diameter at the top, glabrous outside, densely tomentose within;

tomentum long and branched, somewhat exserted. Stamens "lilac", 6 - 7, rarely more, exserted, inserted at the rim (margin) of corolla-tube; filaments long, filiform, glabrous, 2 - 3 mm long; anthers 2-lobed, dorsifixed, lobes free and much divergent in the lower halves, longitudinally dehiscent, 0.5 - 0.6 mm long. Ovary ± subglobose, glandular and densely tomentose at the top, pubescent below, ± 1mm long, 0.8 - 1 mm in diameter, 2 - locular, with 2 - ovules in each cell, but only one ovule maturing to form a seed; style long, exserted, filiform, glabrous all over excepting the hairy base, 4 - 5(-6) mm long; stigma minutely notched or almost entire, not "capitate". Fruit elliptic - obovoid, longitudinally striate, (1.5-)2 - 2.5 mm long, 1 - 1.5 mm in diameter, glandular and tomentose at the top, sparsely pubescent below, mostly single seeded; seeds oblong, ± cylindrical, 1.3 - 2 mm long.

Specimens examined:

WESTERN AUSTRALIA.- C.A.Gardner 13636: near Lake King, Eyre district, 20.X.1961 (PERTH lectotype; MEL, PERTH - 3 spec. - isolectotypes).- C.A.Gardner 14018: [Pr.Mt.] Madden, 26.VIII.1962 (PERTH - 2 spec.).- C.A.Gardener 15040: between Forrestania and Lake Hope, 25.XI.1964 (PERTH).- C.A.Gardner 15921: towards north of Lake Cronin, 10.XII.1964(PERTH).- F.Lullfitz 5570: between Lake Grace and Lake King, ca. 434 km by road from Perth, 8.X.1966 (PERTH).

Distribution: (Map 17).

L.bracteosa is endemic in the far south-western section of Western Australia. According to known distribution, it is found restricted between 32 and 34 degrees south latitude and 119 and 121 degrees east longitude. The known localities of its occurrence are chiefly around Lake King and Lake Cronin.

E c o l o g y:

Little is known of the ecology of this species, but according to its known distribution it occurs mainly in the winter-rainfall summer - drought areas. The collector's field notes describe this taxon as "Shrubby" growing in sandy soil. Gardner 13636 (MEL, PERTH), from near Lake King, is annotated "Frutex 40 - 45 cm alt., ramis diffusis, corolla lilacina". The habitat is noted "argillaceis arenosis". Similar information is recorded with all the other available collections of this species.

Flowering and fruiting seem to occur chiefly from August to December.

C o m m e n t s:

In the protologue, Gardner seems to have mistaken the persistent flower-less short trifid peduncle of the cyme for the stalk ("petiole") of the flower bract. Therefore, he has recorded under his observations that "What appears to be a peculiarity in this species is to be seen in the cymbiform bracts which have a slender but rigid petiole. These are either single, or three-brnached, each bract having a flower in its axil. These persistent petioles, simple or trifid, persist after the flowers have fallen, giving to the inflorescence a distinctive appearance not seen in any other species of Lachnostachys".

During present investigations, however, the above-mentioned persistent trifid "petiole" is identified as the peduncle of the cyme, because the bract stalk ("petiole") is neither very slender nor rigid. The bracts, being caducous, fall early as a whole (including stalk) leaving a scar below the persistent trifid peduncle. These peduncles are short and rigid on the flowerless central axis and can hardly be mistaken for a bract stalk if examined carefully; earlier each bears 3 pedicellate flowers and is axillary to the bract. The trifid structure at the end of the pedumcle is of course the remnant of 3 flower pedicels. Solitary flowers are rarely found in this species. This type of arrangement also occurs in almost all other known species of Lachnostachys and Newcastelia, and cannot be regarded as a peculiarity in L.bracteosa.

Similarly, in the original description the stigma of L.bracteosa has been described as "capitate" but such a stigma is not seen in any taxon of the trib. Physopsideae. Actually, the stigma is hardly distinguishable from the upper portion of the style because the diameter of stigma is nearly the same or even smaller. It is either entire or very minutely notched, never capitate.

The leaves in L.bracteosa are decurrent as in L.coolgardiensis, but being narrow-linear with closely revolute margins and ± glabrescent and rugose above when old, they are at once distinguished from the latter species. L.bracteosa also differs from the latter species in its spikes being solitary, terminal and ovary glandular only in the upper half.

The present holdings of this species are preserved mainly in Herb. PERTH with only one type duplicate in MEL. It consists of altogether five different collections, of which four were gathered by the author himself. Because of limited material, it is being suggested here that more collecting expeditions be made to the type locality and its vicinty. This would add desirable material

of this species and might probably expand its present limited distribution.

Relationship:

L.bracteosa is closely related to L.eriobotrya in its leaves being narrow-linear, closely revolute along the margins, 1 - 3(-4) mm broad, dark olive - green or almost blackish - grey when young greyish pubescent all over when old, rugose and glabrescent above and style hairy near the base. However, it may be easily distinguished by its decurrent leaves, solitary terminal spikes, stalked flower-bracts, abruptly scuminate calyx - lobes, corolla-tube completely villous - tomentose inside with ± exserted tomentum, and ovary glandular only on the top.

L.bracteosa is also allied to L.coolgardiensis in having decurrent leaves, but the leaves in the latter species are oblong to narrowly elliptic - oblong, always more than 4 mm broad, very densely woolly - tomentose, never glabrescent or rugose above when old and spikes are both axillary and terminal, often more than one together. The ovary in L.coolgardiensis is glandular and hairy all over, but in L.bracteosa the glands are restricted to the top or the upper half of the ovary only.

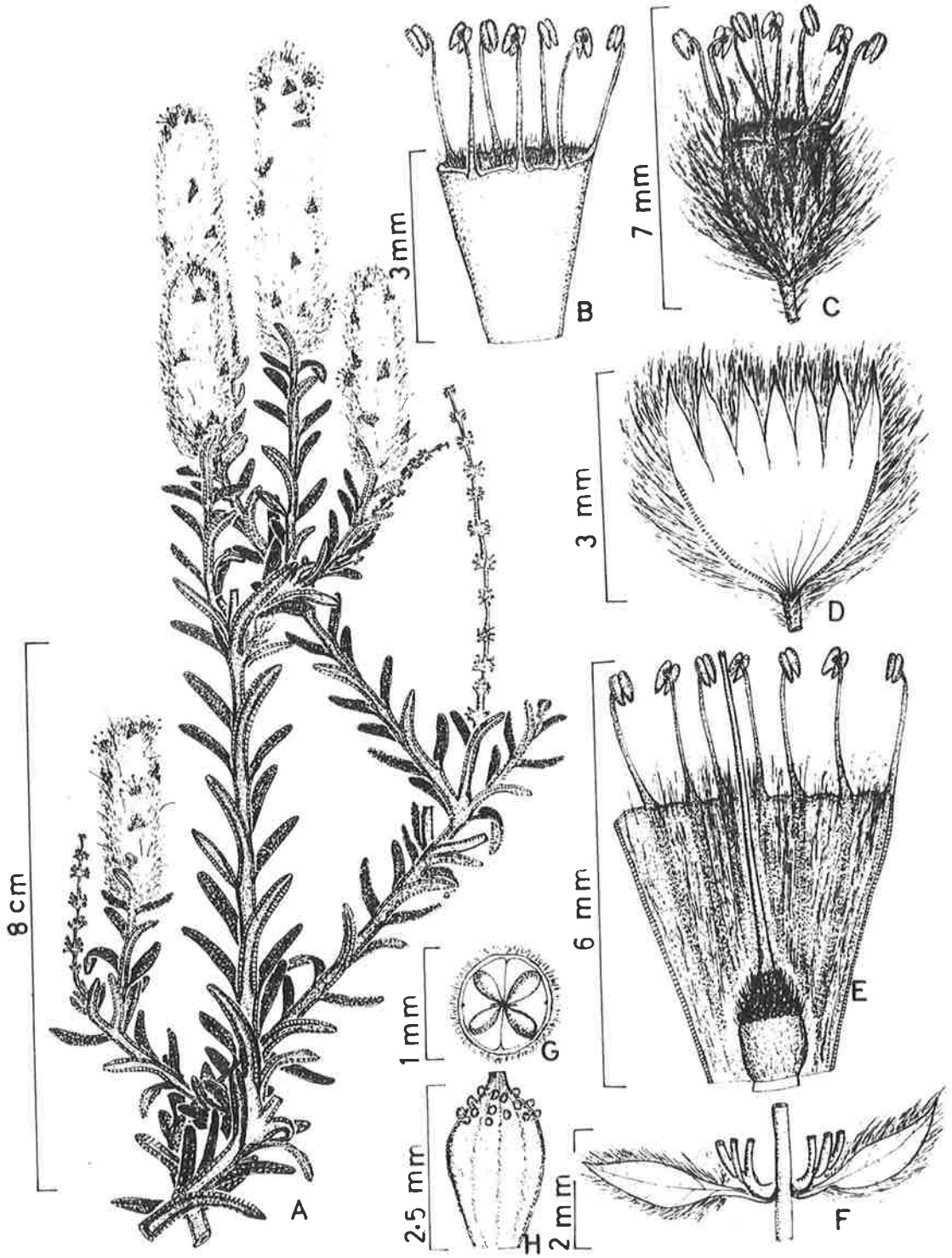


Fig. 52 — Lachnostachys bracteosa Gardner (C.A. Gardner 13636: PERTH lectotype).

A, flowering twig; B, corolla-tube with stamens; C, flower; D, calyx vertically cut open showing acuminate lobes' tips; E, corolla-tube vertically cut open showing pistil and tomentum; F, bracts with remnant of 3 axillary pedicels; G, T.S. ovary; H, fruit.

Lachnostachys eriobotrya(F.v.Mueller) G.C.Druce, Rep.Bot.Exch.Cl. Brit. Isles. 1916(1917) 630; C.A.Gardner, Enum.Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209,302,341, 393; J.S.Beard, W.Aust.Pl. (1965) 92; W.E.Blackall & B.J.Grieve, W.Aust.Wildfls. 3 (1965) 565, t.27 p.p.; A.Moriya, List Pl.Spec. Coll.Aust. and List Colour Slides Aust.Wildfls. (1969) 24 and 27 respectively,MS; A.R.Fairall, W.Aust.Native Pl.Cult. (1970) 178; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc.1 & 2 (1971) 347,534,614,735; R.Erickson et al., Fl. Pl.W.Aust. (1973) 187; H.N.Moldenke, Phytologia 26(5) (1973) 368; C.A.Gardner, Wildfls. W.Aust.,ed.11,(1973) 119.

T y p u s:P.Walcott s.n., MEL41166: Murchison River, Western Australia,- ? 1859 (MEL lectotype).

Walcottia eriobotrya F.v.Mueller, Fragm 1 (1859) 241 - Basionym; [F.v.Mueller, fragm. 2. (1861) 140, pro syn.; G.Bentham, Fl.Aust. 5 (1870) 39, pro syn.]; W.B.Hemsley, Hook.Ic.Pl.4th Ser. 8 (1902) t.2732, in obs.; [H.N.Moldenke, Résumé Verbenac.etc. (1959) 393, pro syn.; H.N.Moldenke, Fifth Summary Verbenac.etc. 2 (1971) 735, pro syn.].

T y p u s: P.Walcott et A.Oldfield s.n.: Murchison River, W.A.,- ? 1859 (G,K,MEL,W - syntypes).

L.walcottii F.v.Mueller, Fragm. 2 (1861) 140,[based on Walcottia eriobotrya F.v.M.]; F.v.Mueller, Fragm 6 (1868) 153, in obs.,159; F.v.Mueller, Fragm. 9 (1875) 4; G.Bentham, Fl.Aust. 5 (1870) 39; F.v.Mueller,Cens.Aust.Pl.1 (1882) 102; F.v.Mueller, Sec.Cens.Aust. Pl.1 (1889) 172; L.Diels & E.Pritzel, Bot.Jahrb.Syst. 35 (1904) 507,508,509 & fig. 57 C,D; A.J.Ewart, Vict.Natur. 24(3) (1907) 58, in obs.; J.H.Maiden, J.W.Aust.Natur.Hist.Soc. 2(6) (1909) 26; E.H.Pelloe, Wildfls.W.Aust. (1921) 47; S.Junell, Sym.Bot.Upsal. 4 (1934) 64; [H.N.Moldenke, Résumé Verbenac.etc. (1959) 302, pro syn.; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 & 2 (1971) 534, pro syn.].

T y p u s: P.Walcott et A.Oldfield s.n.: Murchison River, W.A., ? 1859 (G,K,MEL,W - syntypes).

Pycnolachne ledifolia N.Turczaninow, Bull.Soc.Imp.Nat.Mosc. 36(2) (1863) 215;[F.v.Mueller, Fragm.6 (1868) 153, in obs.,159, pro syn.]; W.B.Hemsley, Hook.Ic.Pl.IV, 8 (1902) t.2732, in obs.;[H.N.Moldenke, Résumé Verbenac.etc. (1959) 341, pro syn.; H.N.Moldenke, Fifth Summary Verbenac.etc.2 (1971) 614, pro syn.].

T y p u s: J.Drummond 6th Coll. no.220: between Moora and Murchison Rivers, W.A.,- 1852 (A,BM,CGE,E,G,K,?KW n.v.,LD,MEL,W- syntypes).

L.rodwayana W.V.Fitzg., J.W.Aust.Natur.Hist.Soc.2 (1904) 29;L.Diels & E.Pritzel, Bot.JahrbSyst. 35 (1904) 508,511; C.A.Gardner, Enum. Pl.Aust.Occ. 3 (1931) 111; H.N.Moldenke, Résumé Verbenac.etc. (1959) 209; J.S.Beard,W.Aust.Pl. (1965) 92; W.E.Blackall & B.J. Grieve, W.Aust.Wildfls. 3 (1965) 566; J.S.Beard, W.Aust.Pl.,ed.2, (1970) 113; H.N.Moldenke, Fifth Summary Verbenac.etc. 1 (1971) 347.- syn.nov.

T y p u s: W.V.Fitzgerald s.n.: from Arrino,-IX.1903 (E,NSW,SING- syntypes).

Typification:

L.eriobotrya (FvM.)Druce was originally described by F.v. Mueller (1859) under the name Walcottia eriobotrya as a type of his new genus Walcottia F.v.M. Soon after, Mueller (1861) found his Walcottia identical with Hooker's Lachnostachys and re-named the former as L.walcottii F.v.M., with Walcottia eriobotrya F.v.M. as a synonym under it. In both places, the author named his genus and species after Pemberton Walcott who collected the type material with Augustus Oldfield from Western Australia. In the original description, the type is noted to have been collected by "Walcott and Oldfield". According to present investigations, the type collection consists of 8 specimens, of which 7 are noted to have been collected by A.Oldfield and one by P.Walcott. Contrary to the original citation, there is no specimen bearing the name of both the collectors on a single sheet. In view of this; it seems that the type of this species consists of two different collections from the same locality although these are erroneously indicated in the protologue as one joint collection. Almost all the syntypes have been annotated (or seen) by the author, but none of them was selected as a type for this taxon. It is therefore necessary to choose a lectotype for this name. Of the 8 syntypes, the one collected by Pemberton Walcott, now preserved in Herb.MEL under the number MEL41166, seems the best representative of this species. It was annotated by the author and most likely used by him in preparing the original description. Moreover, since Mueller's original generic name (Walcottia) and the specific epiphet (L.walcottia) are in commemoration of Mr.P.Walcott, therefore, his numbered collection above in Herb.MEL is selected here as the lectotype for this species.

Description: (Fig.53).

A tall spreading shrub of 1 - 1 $\frac{1}{2}$ metre tall, covered all over with a close but soft woolly tomentum. Stem erect, branched, cylindrical,woody, closely invested with a short whitish tomentum. Leaves decussate, sessile, erect, sometimes spreading and incurved.,linear or oblong - linear, obtuse, thick and rather rigid, with closely revolute margins, (1-)2 - 3.5(-4.5) cm long, 1.5 - 3(-4)mm braod, dark olive - green or somewhat blackish - grey, greyish pubescent all over when young, rugose and glabrescent above when old. Inflorescence spicate, terminal and axillary in the distal parts of branches; spikes many - flowered, ± lax, 2.5 - 7 cm long, arranged in a pyramidal or corymbose panicle of 5 - 8(-12) by 5 - 12(-17) cm in outline. Flowers 8 - 9(-10)-merous, bracteate, pedicellate, normally 3 in the axil of each bract, 4 - 5 mm long (including stamens and style); pedicels short, filiform, densely covered with branched woolly tomentum, 1- 2 mm long; bracts decussate, sessile, linear or linear - lanceolate, early caducous, (3.5-)4 - 6.5(-8) mm long, 0.5 - 0.8 mm broad, densely woolly - tomentose outside, glabrous inside. Calyx 8 - 9 -lobed towards the apex, sometimes 10 or 11 - lobed, tubular below, densely covered with branched woolly tomentum outside, glabrous inside, 2.5 - 3(-4) mm long; lobes ± lanceolate, acuminate, 1 - 1.5 mm long, 0.3 - 0.7 mm broad at the base; tube ± cylindrical, somewhat expanded towards the apex, 1.5 - 2(-2.5) mm deep;tomentum woolly, branched, purplish - grey in young flowers, ultimately whitish - grey, 1 - 1.5(-1.7) mm long. Corolla purple - violet, infundibuliform, almost truncate at the top, with mostly 8 - 9 (sometimes 10 or 11) inconspicuous minute rounded lobes, glabrous without, sparingly villous near the base within, 1.8 - 2.5 mm long; tube up to 3mm in diameter at the top. Stamens purple - violet, exserted, often 8 - 9, sometimes 10 or 11, inserted at the rim (margin) of corolla-tube; filaments glabrous, filiform, 1.5 - 2= (-2.5) mm long; anthers 2 - lobes, dorsifixed, granular at the back; lobes oblong; free and divergent in the lower halves, longitudinally dehiscent, 0.5 - 0.6 mm long. Ovary ± globose, densely glandular and tomentose, 0.6 - 1 mm across, 4 - locular, with one ovule in each cell, but often becomes 2 - locular (or even 1 - locular) due to breaking down of its thin dissepiment from the walls of the cavity;style exserted, filiform, 2.5 - 3 (-3.5) mm long, glabrous in the upper half, hairy towards the base; stigma minutely notched. Fruit dry, indehiscent, oblong, or elliptic - oblong, sparsely glandular and hairy, 2 - 2.5 mm long, 1 - 1.3 mm across, 1 - seeded; seeds oblong, smooth, almost as

long as the fruit cavity.

Specimens examined:

WESTERN AUSTRALIA:- A.M.Ashby 773; from Moora to Dandaragan Road, 18.XI.1963(AD).- A.M.Baird s.n.: Yandanooka, -VIII.1932(UPS).- J.S.Beard & F.Lullfitz s.n.: Gunyidi, west of Geraldton Hwy., 29.XI.1961(B).- G.F.Berthoud "8489/12", NSW106678: near Watheroo on Midland Railway, -XI.1912(B,NSW).- S.T.Blake18133: 10 - 20 miles north of Northampton, 3.IX.1947 (BRI,CAMB).- B.G.Briggs s.n., NSW106674: 18m. S.E. Mullewa, 2.X.1960 (NSW).- H.F. & M. Broadbent 1273 & 1273a: Moora, 21.VIII.1953 (BM).- G.E.Brockway s.n., CANB26579 & CANB26581: 39 miles north of Ajana, -X.1947(CANB).- N.T.Burbidge 2176: 9 miles south of Ajana, N. of Northampton, 3.IX.1947 (AD,CANB,MEL).- A.C.Burns 73: 300 mile post on Mullewa-Morawa Road, N. of Perth, 22.IX.1968(MO).- W.H.Butler 1143: 48 miles above Murchison River, 4.IX.1959(PERTH).- W.D.Campbell s.n.: Northampton, -IX.1901(E).- W.D.Campbell 73: "Nagade" Minginew, 10.X.1907(BM,K).- S.Carey s.n.,MEL41167: between Northampton and Shark Bay, -1884 (BM,MEL).- R.C.Carolin 3377: Murchison House, 31.VIII.1961(SYD).- J.B.Cleland s.n.,AD97123220: north of Moora, 25.VIII.1948(AD).- E.Cronin s.n.,MEL41157: sources of the Blackwood River, - 1893(MEL).- S.Delahunty s.n.: Wubin. 5.VI.1959 & 5.IX.1959(PERTH).- J.Drummond 219, 6th coll.: between Moora and Murchison Rivers, -1852 (A,BM,CGE,E,G,LD,MEL,P,W).- J.Drummond 220,6th coll.: loc.cit.,-1852 (A,BM,CGE,E,G,K,?KWn.v.,LD 2 spec., MEL,W- syntypes of Pycnolachne ledifolia Turcz.).- J.Drummond s.n., MEL41147,SING044210,UC25100,W3998: loc.incert.,-(C,MEL,SING,UC,W).- Elliott s.n.,MEL41164: loc.incert.,-1889(MEL).- W.V.Fitzgerald s.n. NSW106669,SING044208: from Arrino,-IX.1903 (E,NSW,SING- syntypes of L.rodwayana Fitzg.).- W.V.Fitzgerald s.n.: Cottesloe,-IX.1908 (C).- Lady Forrest s.n.: near Champion Bay, 9.IX.1894(M).- Mrs. Forrest s.n.,MEL41173: near Champion Bay, -1889(MEL).- Conservator of Forest 17, NSW106673: loc.incert.,-1900(NSW).- Miss Fuller s.n. MEL41175: loc.incert., 15.VI.1922(MEL).- K.Goebel s.n.: loc.incert. -X.1899(M).- C.A.Gardner 1926: near Watheroo, 22.IX.1926 (PERTH).- C.A.Gardner 2055: near Ajana, 27.IX.1926(PERTH).- C.A.Gardner 12804: near Binnu,-IX.1960(PERTH).- C.A.Gardner s.n.: 60 km west of Coorow,-XI.1967(PERTH).- C.A.Gardner s.n.: from Yandanooka,-(PERTH).- G.H.Gittins 1569: on Highway,10 miles N.W. of Kalbarri, 27° 42' S, 114° 10' E,-VIII.1967 (BRI,MEL).- Ch.Gray s.n., MEL41160: Greenough Flats,-(MEL).- Guerin s.n., MEL41150:Champion Bay,-1871(MEL).- Guerin s.n., MEL41165: Upper Irwin,-(MEL).- R.Helms s.n.,NSW106675: Coorow, on Midland Railway,-X.1898(BM,NSW).-

R.Helms s.n.,NSW106668: on Midland Railways,-IX.1898(NSW).-R.Helms s.n.,NSW106676: Watheroo,-X.1898(NSW).- R.Helms s.n., NSW106667: Victoria Plains, 15.IX.1898(NSW).- R.Helms s.n.,NSW106671: Midland Railways,-X.1899(G,NSW,US).- Irvine s.n.: loc.incert.,-1889(M,MO).- A.W.Jessep s.n.,MEL41176: between Geraldton and Northampton, -IX.1947(MEL).- King s.n.,MEL41172: S.W. of Western Australia,loc. incert., 18.XI.1903(MEL).- M.Koch 1300: Jibberding,-X.1905 (AD,E, K,MEL,NSW).- Langley 74∝: Geralton District, -VIII.1919(PERTH).- P.Luff & P.Birrel 57: 36 miles from Geraldton on Geraldton - Mullewa Road, 7.X.1963(AD).- P.Luff & P.Birrel s.n.,AD96416174: 26 miles from Mullewa on Geraldton Road, 6.X.1963(AD).- J.H.Maiden s.n.: District Murray,-IX.1909(G).- A.Meebold 6595: Watheroo, -XII.1929(M).- A.Morrison s.n.: Bowes, 5.XI.1903 (BM,E).- A.Morrison s.n.: "Ebbano", 24.IX.1904(E).- A.Morrison s.n.: Watheroo, N. of Moora, 9.XI.1906(BM,K).- F.v.Mueller s.n.: Murchison River,-?1862(LE,M,P,W).- F.v.Mueller s.n.,MEL41152, MEL41153,MEL41155: loc.cit.,-X.1877(MEL).- F.v.Mueller s.n., MEL41151: Upper Irwin River,-XI.1877(MEL).- F.v.Mueller s.n., MEL41154: between the Arrowsmith and Irwin Rivers, "upper portion", -XI.1877(MEL).- F.v.Mueller s.n.: Champion Bay, -1896(G,W).- F.v.Mueller s.n.,MEL41148,MO118661,W7836: loc.incert.,-1889(MEL, MO,W).- A.Oldfield s.n.,MEL41158,MEL41159,MEL41168: Murchison River,-?1859(G 2 spec.,K,MEL 3 spec.,W- syntypes of Walcottia eriobotrya F.v.M. and L.walcottii F.v.M.).- M.E.Phillips s.n., CBG012549:12 miles east of Murchison River mouth, 27.IX.1962(CBG).- M.E.Phillips s.n.,CBG011340: 10 miles west of Coorow, 25.IX.1962 (CBG).- M.E.Phillips 1450,CBG025809 & AD96922070: 24 miles from Dongara towards Eneabba, 22.IX.1968(AD,CBG).- M.E.Phillips s.n., CBG027252,AD97001185 & MEL41178: 4 mile inland from Kalbarri on old road, 18.IX.1968(AD,CBG,MEL).- Prewett 555∝: "Northern District" loc.incert., -IX.1922(PERTH).- Pries s.n.,MEL41163: Champion Bay,-(MEL).- E.Pritzel 609: between Moore and Murchison Rivers,-IX.1901 (A,AD,B,BM,BR,E,F,G,HBG,K-2spec.,L,M,MO,NSW,P,PR-2 spec,S,US,W).- E.Pritzel 985: loc.cit.,-XI.1901 (A,AD,B,BM,E,F,G-2 spec.,GH,HBG, K 2 spec.,L,M,MEL,MO,NSW,P,PR 2 spec.,S,US,W).- E.Pritzel s.n.: Coolgardie,-XI.1901(L).- R.D.Royce 4930: 20 miles west of Moora, 3.XI.1954(PERTH).-J.Sewell s.n.,MEL41156: loc.incert.,-(MEL).- J.Sewell s.n.,MEL41162: between the rivers Murchison & Irwin,-(MEL).- Shell Oil Co. s.n.,F1071305,UC1328227: loc.incert., -IX.1939(A,F,UC).- M.A.H.Spalding s.n.,MEL41171: Northampton,-1884(MEL).- A.Steffanoni s.n., ADW14338: loc.incert,W.A.Fl.Show, 30.IX.1927(ADW).- R.F.Thorne 24358: 5 - 7 miles W. of Moora, 12.IX.1959(AD).- R.F.Thorne 24313: loc.cit.,12.IX.1959(K).-

F.E.Victor s.n.,BRI080319: "N.distr.", loc.incert.,-X.1898(BRI).- F.E.Victor s.n.: Northampton, -X.1898(E).- H.& E.Walter 801: between Watheroo and Geraldton, 16.IX.1958(B).- H. & E.Walter 906: between Geraldton and Great View Stn., 17.IX.1958(B).- H. & E. Walter 1024: Dinner Hill, west of Watheroo, 19.IX.1958(B).- F.W. & C.W.Went A-103: south of Mullewa, 9.IX.1962(MO).- F.W. & C.W.Went 148: west of Moora, 5.IX.1962(MO).?Coll. s.n.: near Kalgoorlie,-X.1931(G).?Coll. s.n.,NSW106677: Murchison River,-(NSW).?Coll. s.n.: loc.incert.,"W.A.", 6.X.1931(A).? Coll. s.n., MEL41169: loc.incert.,"W.A.",-(MEL).? Coll. s.n.: Perth,-(M). ? Coll. s.n.,CANB15768: loc.incert.,Wildfls.Show A.N.Z.A.A.S., -VIII.1947(CANB).? coll. s.n.,ADW2419: loc.incert.,W.A.Wildfls.Show -Spring,-1935(ADW).

Distribution: (Map 18).

L.eriobotrya (FvM.)Druce is endemic to the south-west Division in Western Australia. The main distribution is to the south-south-east of Shark Bay all along the Geraldton Highway, and along the southern portion of North-Western Coastal Highway. Most of the localities on Geraldton Highway are in the north of Moore River and along North-Western Coastal Highway they are found on either side of the Murchison River. A few localities are recorded from along the Geraldton - Mullewa road and Morawa - Mullewa road.

In the south, there are records from near the sources of Blackwood River; along the South-Western Highway near Murray River and from Cottesloe near Perth. The only known eremean localities are around Kalgoorlie,Jibberding and near the sources of Murchison River towards Great Northern Highway.

E c o l o g y:

L.eriobotrya is a low sclerophyll shrub growing chiefly in sandy plains of winter-rainfall summer - drought areas. According to information gathered from annotations, it is a hoary woody shrub of up to 5 feet in height with pinkish - white inflorescence and"violet - black" corolla-tube. Pelloe (1921) has recorded it as "very common in arid districts" among "open thickets in sand". The plant is said to be "a tall shrub covered with a close but soft cottony wool". Bear & Lullfitz s.n.(B), from Gunyidi, west of Geraldton Highway, is amnotated as "shrub 100 - 150 cm. fls. almost black". The habitat is "sandplain". Blake 18133(BRI,CANB), from 10 $\frac{1}{2}$ 20 miles N.of Northampton, is recorded as "hoary shrub of ca. 1 $\frac{1}{2}$ m. with woolly white inflorescence; corolla violet-black inside". Habitat is given "sandyheath". Broadbent 1273(BM),

from Moora, is annotated as "Silver sand. Woody plant" with "Pink -white soft inflorescence". Carolin 3377(SYD), from Murchison House, is noted as "shrub C. 1 metre tall. Perianth white outside, deep blue purple inside". He collected it from "Coastal heath on laterite and sand soils". Gardner 1926(PERTH), from Watheroo, was found growing in "yellow sand on open heath". The plant is described as "shrub 2 - 4 ft. tall, much branched; corolla violet". His subsequent collections no.2055 from Ajana, no.12804 from Binnu and s.n. from Coorow, all in Herb.PERTH, were found growing in sandy places, and have "corolla lilac purple or atropurpureous". Phillips CBG027252 (AD,CBG, MEL), 4 miles inland from Kalbarri, is noted as "1.5 m high, very showy". Thorne 24313 (K), from 5 - 7 miles W. of Moora, is recorded as shrub growing in "sandy heath" with "white - woolly" calyx and "purple" corolla. Similarly, Walter 801,906,1024 (B), respectively from between Watheroo and Geraldton, between Geraldton and Great View Stn. and near Dinner Hill west of Watheroo, are described as "shrub" growing " on sandy heath". Went 148(MO), from W. of Moora is annotated "low sclerophyll", growing in " sandy soil".

Flowering and fruiting seem to occur mostly from August to November.

C o m m e n t s:

L.eriobotrya (FvM.)Druce is based on F.v.Mueller's Walcottia eriobotrya which he described (as a type species) with his new genus Walcottia FvM. It was then placed under the family Byttneriaceae ("Buettneriaceae") with the remark: "plantam Verbenaceam quam Buettneriaceam mentiens", the type being "Walcott and Oldfield's" (s.n.) collection from the sandy plains near Murchison River [Fragm.1 (1859) 241]. Two years later, Mueller (1861) referred this species and the above collection to Amaranthaceae under the name Lachnostachys walcottii FvM.,with Walcottia eriobotrya FvM. as a synonym under it. Subsequent to this, a conspecific collection of Drummond's (no.220) from "between Moore and Murchison Rivers", was described by Turczaninow (1863) as Pycnolachne ledifolia, he referred it to the family Verbenaceae. A few years later, Mueller (1868) identified Drummond's collection nos. 219 and 220 as conspecific with his L.walcottii and placed Pycnolachne ledifolia Turcz. as a synonym under it. Moreover, he referred it and all the then known species of Lachnostachys to Byttneriaceae ("Buettneriaceae") [Fragm. 6 (1868)159]. In 1870, Bentham placed this species and other related taxa under Verbenaceae, a position subsequently accepted by F.v.Mueller and

others.

In the original description, the author has mistaken the corolla-tube for "tubus staminum" which may have induced him to refer this taxon twice to Byttneriaceae ("Buettneriaceae") and once to Amaranthaceae.

J.Drummond's collections nos. 219 and 220, from between Moore and Murchison Rivers, belong to his 6th and final collection from Western Australia. In Herb.LD, one duplicate of his no.219 and two duplicates of his no.220, have been erroneously referred to his 3rd collection. Similarly Drummond's no.220, which is also the type of Pycnolachne ledifolia Turcz. has been recorded by Turczaninow as "Ad.fl.Cygnorum, Drummond,VII.No.220". In fact, as indicated above, Drummond's last collection was his 6th collection. Moreover, no specimen of his 3rd coll. is known to represent any taxon of Lachnostachys. All specimens of Drummond's 3rd collection come mainly from north and east of Bolgart, from Stirling Range and its southern and south-eastern areas where L.eriobotrya is not known to exist [Erickson (1969) 89 - 94,140 - 146 & 168].

The year and place of collection noted on the duplicate sheets of Drummond's above two collections [nos.219 & 220] are not the same throughout, therefore, this discrepancy also needs clarification. Among the duplicates of no.219 in Herb.A,E,G and P, the apparent year of collection is written "1854". The locality noted for one of its duplicates in Herb.G is "Swan River", while all the others are without any place of collection. Similarly, most of the duplicates of no.220 are without any place, or date of collection excepting the two specimens in Herb. G and K. The former (in Herb. G) is annotated "Swan River, 1854" while the latter (in Herb. K) as "Between the Moore and Murchison Rivers, 1852". According to the known biography of Drummond, he made his last plant collections with his sixth (and final) collecting expedition from Murchison River and Champion Bay during 1852. [Erickson (1969) 168]. This information agrees with the annotations of the specimen in Herb. K, which was probably recorded by W.J.Hooker who had direct correspondence with Drummond, and who always received the first set of all Drummond's collections. In view of these facts, the year and locality of Drummond's 219 and 220 are the one written on the duplicate of no.220 in Kew (1852). The year "1854", noted on many duplicates of both the above collections is apparently the year when these specimens were sent to those herbaria by W.J. Hooker or other subscribers to Drummond's collections.

After examining the type of L.rodwayana Fitzg., preserved in Herb.E,NSW and SING, this taxon is found conspecific with

regarded
L.eriobotrya (FvM.)Druce and is therefore/here as a synonym of the latter. While describing L.rodwayana as a new species, the author (W.V.Fitzgerald) found it "different from L.verbascifolia FvM.and L.ferruginea Hook. in foliage, inflorescence and in the constantly 7 -merous flowers, and from all members of the genus in vestiture". It is obvious therefore, that the author neither compared it with the conspecific and earlier described L.walcottii FvM.[=Walcottia eriobotrya FvM.],nor did he match his collection with the types of Mueller's species mentioned above. Soon after the publication of L.rodwayana Fitzg., E.Pritzel (1904) described two new species under this genus; L.brevispicata E.Pritzel and L.dempsteri E.Pritzel. He also recorded all the then known species of this genus [including L.walcottii FvM. and L.rodwayana Fitzg. as two distinct species]. Under the key to species, the latter two are distinguished from each other by leaf vestiture and (lax or dense) inflorescence. Actually, these characters and those of flowers, are exactly the same in both these species. The young inflorescences in both mostly appear somewhat congested but become lax when fully mature. Similarly, the young leaves are always covered with dense short tomentum but the old ones are often glabrescent above. E.Pritzel (1904) compared L.rodwayana Fitzg. with L.verbascifolia FvM. and with his own new species L.brevispicata, showing the difference in their leaves, inflorescence, flower parts and woolly tomentum, but apparently no attempt was made to find out the many similarities between L.walcottii FvM. and L.rodwayana Fitzg. The above distinctions between these two species were later maintained by Gardner (1931), Moldenke (1959,1971), Beard (1965, 1970) and Blackall & Grieve (1965).

According to Pelloe (1921), this species is regarded as dangerous for cattle, because "when eaten by stock, often causes death from impaction, the indigestible hairs matting together in stomach of the animals. Cows and sheep are the worst sufferers, more so than horses and donkeys".

Relationship:

Akin to L.bracteosa Gard. in having narrow-linear leaves of 1 - 3(4) mm broad with closely revolute margins, but may be easily distinguished by its spikes being more than one together, terminal and axillary in the distal parts of branches, arranged in ± pyramidal or corymbose panicles; flower - bracts linear or linear - lanceolate, almost sessile; calyx - lobes gradually acuminate; corolla-tube hairy within near the base only, tomentum included and ovary glandular and hairy all over. Among the species

having their spikes arranged into axillary and terminal panicles, L.eriobotrya is at once distinguished by its marrow - linear leaves with closely revolute margins.

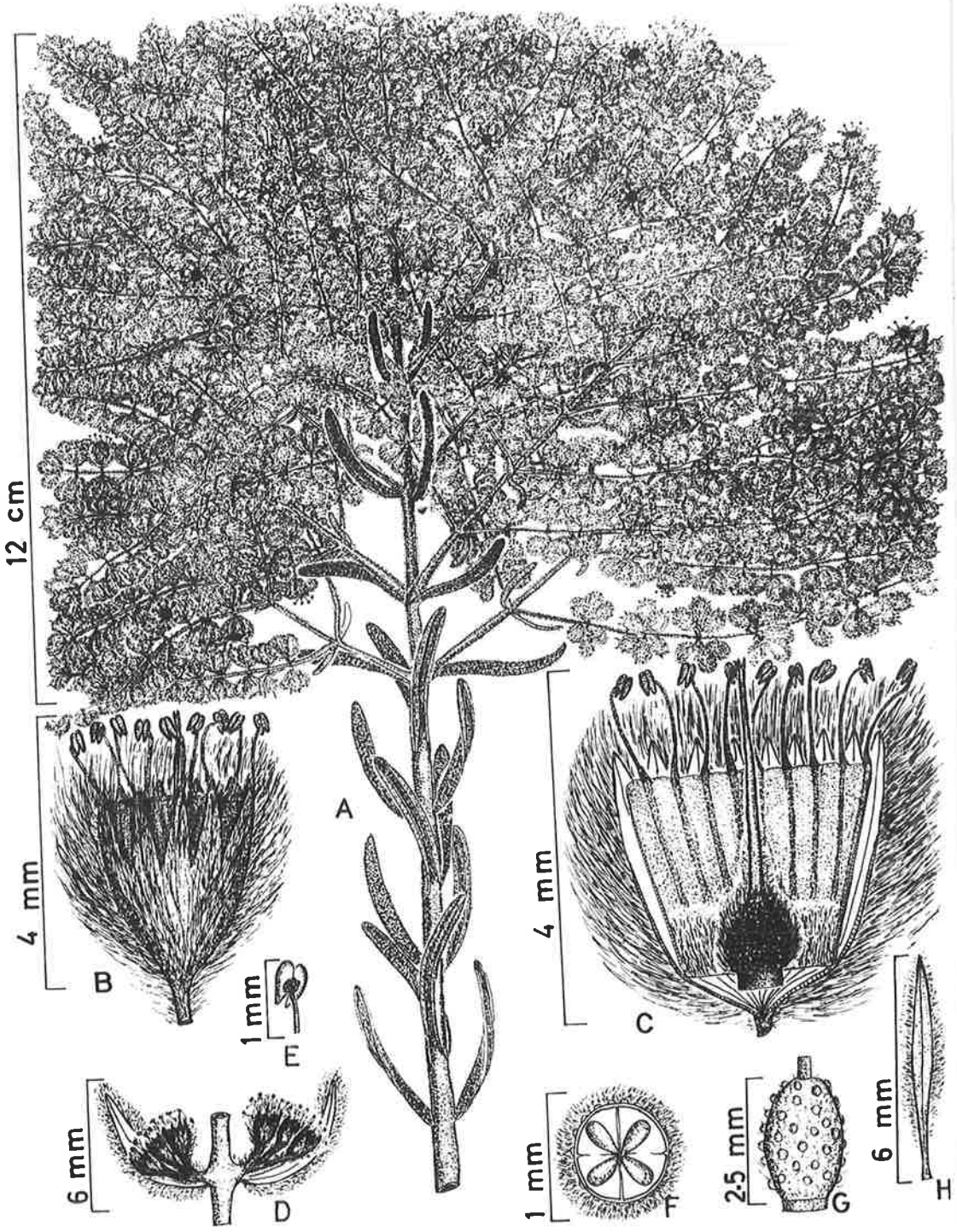


Fig. 53 — Lachnostachys eriobotrya (F.v.M.) Druce (P. Walcott s.n., MEL 41166: MEL - lectotype).

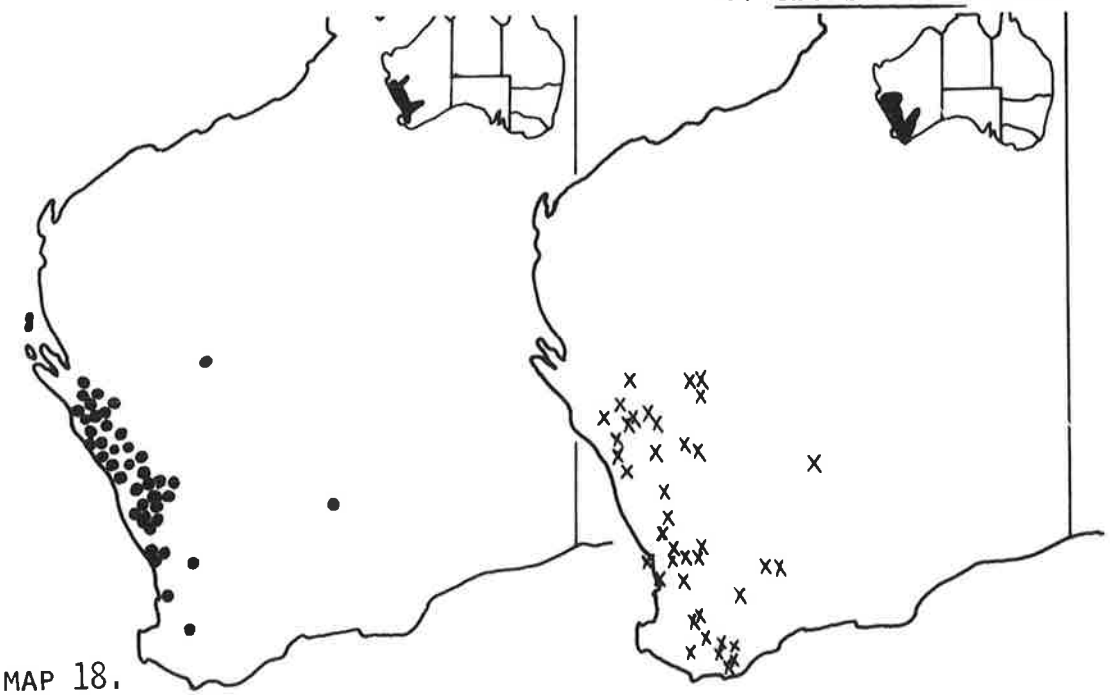
A, flowering branch; B, flower; C, flower vertically cut open; D, bracts with 3 axillary flowers each; E, anther back view; F, T.S. ovary; G, fruit; H, bract.

DISTRIBUTION MAPS OF LACHNOSTACHYS TAXA

(17 - 18)

MAP 17.

X = Lachnostachys albicans Hook. ● = L. bracteosa Gard.
○ = L. coolgardiensis Moore f. coolgardiensis
△ = L. coolgardiensis Moore f. brevispicata (E.Pritzel) Munir
▬ = L. ferruginea Hook. var. ferruginea f. ferruginea
⬭ = L. ferruginea Hook. var. ferruginea f. reticulata Munir
□ = L. ferruginea Hook. var. ferruginea f. acutifolia Munir
⊗ = L. ferruginea Hook. var. paniculata (Ewart) Munir f. paniculata
▲ = L. ferruginea Hook. var. paniculata (Ewart) Munir f. obtusifolia Munir



MAP 18.

● = Lachnostachys eriobotrya (F.v.M.) Druce
X = L. verbascifolia F.v.M.

LIST OF COLLECTORS' NUMBERS

The first number [in Roman numerals] is that of the genus, the second [in Arabic numerals] is that of the species and the following A,B or C respectively indicate the taxa of subspecific, varietal or forma rank. T represents holo - or lectotype of the taxon indicated.

DICRASTYLIS	Drumm. ex Harv.	: I
MALLOPHORA	Endl.	: II
PHYSOPSIS	Turcz.	: III
NEWCASTELIA	F.v.Mueller.	: IV
LACHNOSTACHYS	Hooker.	: V

Dicrastylis beveridgei F.v.M.	: I/1
ssp. beveridgei	: I/1
var. beveridgei	: I/1
var. lanata Munir	: I/1B
ssp. revoluta Munir	: I/1A
D. brunnea Munir	: I/2
var. brunnea	: I/2
var. pedunculata Munir	: I/2B
D. cordifolia Munir	: I/3
var. cordifolia	: I/3
var. barnettii Munir	: I/3B
var. purpurea Munir	: I/3B1
D. corymbosa (Endl.)Munir	: I/4
D. costelloi Bailey	: I/5
var. costelloi	: I/5
var. eriantha (F.v.M.)Munir	: I/5B
var. globulifera Munir	: I/5B1
var. violacea Munir	: I/5B2
D. doranii F.v.M.	: I/6
D. exsuccosa (F.v.M.)Druce	: I/7
ssp. exsuccosa	: I/7
var. exsuccosa	: I/7
var. lanceolata Munir	: I/7B
var. tomentosa Munir	: I/7B1
f. tomentosa	: I/7B1C
f. lachnophylla Munir	: I/7B1C1
f. albo-lutea Munir	: I/7B1C2
ssp. cinerea Munir	: I/7A
ssp. elliptica Munir	: I/7A1
ssp. wilsonii Munir	: I/7A2
D. flexuosa (Price)Gard.	: I/8

D. fulva Drumm. ex Harv. : I/9
f. fulva : I/9
f. angustifolia Munir : I/9C
D. georgei Munir : I/10
var. georgei : I/10
var. cuneata Munir : I/10B
D. gilesii F.v.M. : I/11
var. gilesii : I/11
f. densa Munir : I/11C
var. bagotensis Munir : I/11B
f. bagotensis : I/11BC
f. irregularis Munir : I/11BC1
f. brevipila Munir : I/11BC2
var. laxa Munir : I/11B1
D. glauca Munir : I/12
D. incana Munir : I/13
D. lewellinii (F.v.M.)F.v.M. : I/14
D. linearifolia Munir : I/15
D. micrantha Munir : I/16
D. microphylla Munir : I/17
D. morrisonii Munir : I/18
D. nicholasii F.v.M. : I/19
D. obovata Munir : I/20
D. parvifolia F.v.M. : I/21
D. petermannensis Munir : I/22
D. reticulata Drumm. ex Harv. : I/23
D. sessilifolia Munir : I/24
D. velutina Munir : I/25
D. verticillata Black : I/26
Mallophora globiflora Endl. : II/1
M. rugosifolia Munir : II/2
Physopsis lachnostachya Gard. : III/1
P. spicata Turcz. : III/2
Newcastelia bracteosa F.v.M. : IV/1
N. cephalantha F.v.M. : IV/2
var. cephalantha : IV/2
var. oblonga Munir : IV/2B
var. tephropepla Munir : IV/2B1
N. cladotricha F.v.M. : IV/3
N. chrysophylla Gard. : IV/4
N. chrysotricha F.v.M. : IV/5
N. elliptica Munir : IV/6
N. hexarrhena F.v.M. : IV/7

N. insignis E. Pritzel : IV/8
N. interrupta Munir : IV/9
N. spodiotricha F.v.M. : IV/10
N. velutina Munir : IV/11
N. viscida E. Pritzel : IV/12
Lachnostachys albicans Hooker : V/1
L. bracteosa Gard. : V/2
L. coolgardiensis S.Moore : V/3
f. coolgardiensis : V/3
f. brevispicata(E.Pritzel) Munir : V/3C
L. eriobotrya (F.v.M.)Druce : V/4
L. ferruginea Hooker : V/5
var. ferruginea : V/5
f. ferruginea : V/5
f. reticulata Munir : V/5C
f. acutifolia Munir : V/5C1
var. paniculata Munir : V/5B
f. paniculata : V/5B
f. obtusifolia Munir : V/5BC
L. verbascifolia F.v.M. : V/6

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Adams s.n., MEL40936:I/4.-Aitkinson & Hutchinson HA39:I/2.- Alcock s.n.,874,875:I/26.- Allan 158:III/1,.- Allen s.n.BRI.113977: I/14;678:IV/10.- Aplin 2397:I/2B;607:I/25;514:II/2;2834:III/1; 1304:III/2;2411:IV/2B.- Alright 19:I/1;14:IV/2.- Anders 66:I/21.- Andrew 65:I/5.- Andrews s.n., NSW10668:V/6.- Anketall s.n.:IV/3.- Ashby 3552:I/7A;3480,3481,3482:I/7B1C1;4037:I/10;2619:I/2T;4496: I/15T;1363:I/25T;783:I/25;780,1452:I/21;753:I/9;3454:I/8;378,1352, 4243:II/1;1325,4232:II/2;2034:II/2T;1328,2041:III/2;18,594:III/1; 4211:IV/2;3488:IV/2B1;4196,3553:IV/7;832:IV/12;1799:V/3;1773,3928: V/3C;773:V/4;94,153,380:V/5;1279:V/5CT;16:V/5C1T;2028(a&b):V/6.- Ashton s.n.,AD96218083:I/5B2.- Atkinson s.n.:V/5.- Audas s.n., F719625, UC299727, UC882522:II/1;AD97205179:IV/10.- Bailey 232: I/4; 1-9:I/9C;1-35:I/10B;557:I/21;968:II/1.- Baird s.n.:II/2;s.n. V/4;987:I/16.- Banks 2434:I/7;2436:IV/10.- Barlee s.n.,MEL41187: V/6.- Barlow 398:I/16.-Barnes 2435:I/14.- Barnett s.n.:I/3BT;s.n. IV/3.- Basedow 77,121:I/11;s.n.,CANB50248:IV/2.- Bate s.n., AD97205189:I/1B.- Batt s.n.,MEL40908:I/21; s.n.MEL41188:V/5B.- Beard 4850:I/7A;4835:I/7A1;3940:I/12;2304,2380:I/21;1990:I/9;2502: II/2;2138:III/1;4039,4875,5561:IV/3;4830:IV/2;2789:IV/7;5562:IV/10.-

Beard & Lullfitz 943:I/9; s.n.:V/4.- Beauglehole 20242:I/1B;27853: I/5B2;11281:IV/3;10230,10610,27852:IV/10.- Belcher 75:I/11B.- Bennett 157:I/7AT;2901:I/2;1477:I/16; s.n.,NSW130335:I/21;2902: I/6;2949:III/1.- Berthond 8895/15:V/6.- Berthoud 8489/12, NSW106678:V/4.- Black,G.E.s.n.AD97205193:I/7B.- Black,S.T.17872: I/7;8133:V/4.- Blackall 447:I/2;3204:I/12;860,3807:I/4;s.n.,3940: I/23;3345:I/21;4803:I/9;4233,4433, s.n.:I/8;s.n.:II/1;2855,3204, 3516,3774:II/2;1310:III/1.- Blockley 453:IV/2B.- Boulder s.n.:V/3C.- Bowen 141:I/1B;329:I/14.- Bowering s.n.:I/26T.- Boyland 150:IV/2B.- Briggs s.n.,NSW106674:V/4.- Broadbent 2010:I/10;743:I/10B;1767: I/9;113:III/1;1214:V/1;1640A:V/3;1273,1273a:V/4.- Brooker 1983: V/3C.- Brooks 776:I/21;790:V/3C;s.n.,MEL41194:V/5B.- Brockway s.n.:I/2;32:I/24T;33, s.n.,CANB21646,26647:I/9; s.n.,CANB26640: I/8;s.n.,CANB26644:IV/7; s.n.:IV/12; s.n.,CANB26643:V/3C; CANB265793,CANB26581:V/4.- Burbidge 4695:I/9;4340:I/14;2631:I/21; 1413,1502:IV/3;5472:IV/9T;2176:V/4.- Burbidge & Grey 4319,4338:IV/2B1.- Burean 10:IV/3.- Burns 69,117:I/9;74:I/9CT;83:III/2;73:V/4;s.n.: V/6.- Butler 60,106:I/7;s.n.:I/9; 1172:I/10B; s.n.:I/11B1; s.n.: II/2; s.n.:IV/3; HA29, s.n.:IV/7;102, s.n. IV/10; s.n.:IV/12;1143: V/4; s.n.:V/6.- Byrnes 1152:I/7;118:I/14;1159:IV/10.- Campbell s.n.:I/2;74:I/9; s.n.:IV/12; s.n.,73:V/4.- Canning s.n.,CBG029520: I/21.- Carey s.n.,MEL41167:V/4.- Carne s.n.:II/2.- Carnegie s.n.: I/6.- Carolin 7717:I/10BT;3072:V/3; 3377:V/4.- Carstairs s.n., BRI.113971: IV/9.- Carter s.n.:V/6.- Carter & Botemon 35:IV/10.- Casey s.n.: I/7B1C1; s.n.:I/3B1T.-Chalmers 3:IV/10.- Chalmers & Warnes 3:I/5B.- Chapman s.n.:III/2.- Chinnock 970:I/2B;926:I/7; 621:I/7B1C;884:I/7A1;488:I/11B;688:IV/2;664:IV/7;1089:V/3.- Chippendale 613:I/1;6400:I/1B;1730,3131,3911,3935,3955,6616:I/5; 2520,2758:I/5B2;3350:I/6;7350:I/7B;3592:I/11;2479:I/11C;3616: I/11BT;1840:I/11B1;1523,3382,3407,3430,3844,4262,4292,5636,5644: I/7;729,773,1706,4186,7439:I/14;617,3992,7393,:IV/1;141,157,4675: IV/2;2709,3797:IV/2B;3130:IV/2B1;134,491,608,2300,3354,3756,4641, 5341,6358:IV/10.- Clarke s.n.:I/26; s.n.:V/6.- Cleland 66, AD97120310, s.n., AD97120338, ADW18373:I/11B; s.n.,AD966042050:I/7B1C1T; s.n., AD966071223, AD966071224, AD966242027, AD966042095:I/7B1C1; s.n., AD97120311, AD97120312, AD97205198, AD9712014:I/7B1C2; s.n., AD966042052,AD9666042020, AD966042053, AD966042054, AD966042021: I/1B;65, s.n.,AD97120341:I/5B2; s.n., AD97120309, AD95811024:I/14; s.n.:I/26; s.n., AD966100620:II/1;s.n., AD966071211:IV/3; s.n., AD966071226, AD966071129, AD966071139, AD97205178:IV/2;s.n., AD97120315, AD966071196, AD966071212:IV/2; s.n.,AD96607113, AD95811072, AD97205184, AD95920075:IV/10;s.n.,AD966030172:V/3; s.n.,AD97123220:V/4.- Clemens s.n.,BRI.113980,F125278, s.n.:I/14.-

Cobham s.n., MEL41185:V/6.- Cockburn BPS72:I/7;BPS13, AD97113046: IV/10; s.n.:IV/11T;.- Colliver s.n., AD96231025:I/7.- Common 344: II/1.- Coppock 4614:I/14.- Corwall 234:I/1B; 239:I/5;238:I/5B2; 231,240:IV/10.- Costello s.n.,BRI.010407:I/5T;s.n.,BRI.113959, NSW106644:IV/2.- Cough 42:III/1.- Crocker s.n.,AD95833113, AD95836110, AD9583111:I/5B2; s.n.,AD97113066:IV/2.- Cronin s.n., MEL40970,MEL40928:I/4; s.n.,MEL40931:I/12;s.n.,MEL40909:I/21;s.n. MEL40921,MEL40971:I/23; s.n.,MEL41133,MEL41135,MEL41136:V/1;s.n., MEL41157:V/4;s.n.,MEL41201,MEL41193,MEL41205:V/6.- Crowford 69: I/4.- Culvenor 351:IV/10.- Dale s.n.,NSW106630:I/7.- Dam 54:I/7.- Dare s.n.,MEL41195:V/6.- Davies s.n.:IV/4.- Daw 1017∝ :V/6.- Dawkins s.n.:I/4.- Degraaf 191:IV/3.- Delahunty s.n.:II/2;s.n.:V/4.- Demarz 707:I/15;711:I/16;752:III/2.- Dempster s.n.,MEL41206:V/5BT; s.n.,MEL41139,MEL41207:V/5B.- Diels & Pritzel 502:I/9.- Dittrich s.n.,AD97113062:IV/10.- Donner 3918B:I/1;4472:I/1A;3886,3912,3918: I/1B;4491:I/7B1C;4348:I/11;4359,4390:I/11B;4563:I/21;4688:I/26; 3910,3911:IV/1;4545:V/3C.- Drummond 5th coll.suppl.no.95:I/4T; s.n.,MEL40929,MEL40933:I/4; 6th coll. s.n.:I/9T; s.n.,MEL40849, MEL40851,MEL40854,MEL40856,MEL41230,MEL40857:I/9;72,95,176,236: I/21;4th coll. no.94:I/23T;11,73,4th coll. no. 235, 3rd coll. no. 555,1st coll. s.n.,CANB209500,MEL40973,MEL40975,MEL41233,UC147533: II/1;4th coll. no. 234:III/2T;4th coll.no. 235,s.n.,MEL40980, MEL40982:III/2;13,439,513:V/1T;219,220,MEL41147,SING044210, UC25100,W3998:V/4;14:V/5T;202,438:V/5; 5th coll.no.237:V/6T;s.n., MEL41190,MEL41191:V/6.- Duncan 12:I/9.- Dunlop 1948,2019:I/1;2314, 2319,2371:I/7B;1919:IV/1;2339:IV/3;2022:IV/2B1;2313,2370:IV/10.- Eaton s.n.,MEL40928:I/4;s.n.,MEL40907:I/21;s.n.,MEL40944,MEL40967: II/1;s.n.,MEL41196:V/5;s.n.,MEL40923:I/23.- Ebersohn s.n., BRI.o33181:I/14.- Eddy 3783,5237:I/7.- Eichler 17310:IV/2B1T.- Elliott s.n.,MEL41164:V/4.- Everist s.n.:I/16;40,1941,4071:I/14; 3892:IV/2;5827,6092:IV/9.- Ewart s.n.,MEL40899:I/7.- Fairall 2103: I/6;1975:I/7A1;2031:IV/2B1.- Filson 8783:I/2;8788:V/3C.-Finlayson s.n.,AD97205194,AD97205195:I/11B;s.n.,AD97205185:IV/10.- Firth 43: IV/2B1.- Fitzgerald s.n.,NSW106627,NSW106628,SING 055212:I/4;s.n., NSW106624:I/21;s.n.,NSW106669,SING 044208:V/4.- Fitzroy s.n.: IV/10.- Forde 490,622,1508:I/1B;1521:I/1BT;1232:I/7B1C;1223:IV/3; 1511:IV/2B1;697:IV/10.- Forrest s.n.,MEL40937:I/4;s.n.,MEL40892: I/7A;s.n.,MEL40892p.p.:I/7A1;s.n.,MEL41173:V/4;s.n.,MEL41189:V/6.- Fuller s.n.,MEL41175:V/4;s.n.,NSW106685:V/6.- Gardner 2151,7928, 13444:I/2;7902:I/2B;14274:I/15;s.n.:I/25;s.n.:I/12T;s.n.,13437: I/24;s.n.,176,2769:I/4;7908:I/8;s.n.,2016,7780,12014:I/9;1086, 11139:I/21;8501,9483:I/23;684,2736:II/1;1125,12103:II/2;2357a: III/2;s.n.:III/1T;s.n.,1904:III/1;12054:IV/4T;s.n.,13435,14464,

19063:IV/7;2159,7959:IV/9;11595:IV/10;2158,7960,11119:IV/12;1021a:
V/1;13636:V/2;14018,15040,15921:V/2;1745:V/3;2083,14374,19012:V/3C;
1926,2055,1280, s.n.:V/4;13625:V/5C1;175,12475,16095,s.n.,MEL41143:
V/6.- Gardner & Blackall s.n.,447:I/2; s.n.:I/9;817:II/1;s.n.:
III/1;446:IV/7;s.n.:IV/8; s.n.:IV/12.- George s.n.:I/2;8297,8345,
8890:I/1B;5852,7983:I/2;9152:I/3;10818:I/3B;6063:I/4;2961,3907,
5366,5462,8132,8210,9013,9096:I/6;8446:I/5B;9040,8913,8968:I/7B;
9071:I/7B1C;3936,4080,5325,5373,8244,8397,8728,9097,9153,10735:
I/7B1C1;4817:I/11;8289:I/11B;8816:I/11B1;2897,9071,9099:I/7A;8121:
I/7A1;1007:I/10T;9169:I/10;10368:I/16;5804:I/17T;1999,4240,5956:
I/21;9197:I/23;276:III/1;9797,s.n.:III/2;8368,8371,8445:IV/1;8236,
9044,9102,9151,10734:IV/3;5092,2911,3753,5369,5634,8689,8732,9070:
IV/2;2857,5618,8396:IV/2B;3982:IV/2B1;1000,5635,8011,8109,8691:
IV/7;8215,8372,8877,9155,IV/10;6855,9350:V/1;4451:V/3;6851:V/6.-
Giles s.n.,MEL40805:I/1T; s.n.,MEL40813:I/1; s.n.,MEL40815:I/6T;
s.n.,MEL40947:I/7B1C1;s.n.,MEL40894:I/7A1;s.n.,MEL40878:I/11T;s.n.,
NSW106694:I/11; s.n.,MEL40879:I/14T; s.n.,MEL40989:IV/1; s.n.,MEL
40990:IV/1T; s.n.,MEL41005:IV/2T; s.n.,MEL41009:IV/2; s.n.,
MEL41016:IV/3; s.n.,MEL41026,MEL41028,MEL41034:IV/10.- Gittin 2110:
I/11B;1453:IV/3;1569:V/4.- Goebel s.n.:V/4.- Goode s.n.,ADW4913:
I/1B.- Gordon 122:I/14;822:IV/9.- Gray s.n.,MEL41160:V/4;s.n.,
MEL41204,W741:V/6.- Greave s.n.,AD966080986:V/5C1.- Green 576:
II/1;776:II/2;1336:I/21.- Gregory s.n.:I/23;s.n.:II/1.- Grieve
s.n.,UWA978:I/21;UWA986,UWA988:II/1;UWA985:II/2.- Guerin s.n.,
MEL41150,MEL41165:V/4.- Guilfoyle s.n.,MEL40965:II/1.- Gwynne s.n.,
AD97113020,MEL41208,NSW106689:V/5B.- Hall s.n.:I/26.- Harper 13:
I/7A1.- Heal s.n.,MEL40935:I/4.- Helms s.n.,AD97113045:I/1B;s.n.:
I/2;s.n.,AD91113320,MEL40893:I/7A1;s.n.,AD97113322:I/7B1C;
AD97113391:I/7B1C1;s.n.,NSW106618,NSW106619:I/9;s.n.,AD97205186:
I/19;s.n.,AD97113281,AD97113282:I/21;s.n.,AD96323051,AD97113043,
AD97205176,MEL40986,NSW106649,NSW106650,NSW106651:IV/1;s.n.,
AD97113067,AD97113065,MEL41006,NSW106645,NSW106642,NSW106643:IV/2;
s.n.,AD97113082,MEL41008,NSW106646,NSW106647,NSW106648:IV/2;s.n.,
AD9720922:IV/2B;s.n.,AD96323036,AD97113059,AD97205183,MEL41011,
NSW106653:IV/5;s.n.,AD97113019:V/3;s.n.,NSW106675,NSW106668,NSW
106676,NSW106667,NSW106671:V/4;s.n.,MEL41030:IV/10;s.n.,UC882459:
V/6.- Henry s.n.,MEL41007:IV/2.- Hicks 39,s.n.,MEL40939:I/26.-
Hill 433:IV/10;721:I/1B;835,842:I/14;1507:I/26.- Hill & Caulfield
s.n.,AD96208098:I/5B2;s.n.,AD96208080:I/7;s.n.,AD96208096,
AD96208103:I/14;s.n.,AD96208088:IV/2.- Hill & Lothian 921:I/11BC2T.
Hollway 2:V/6.- Holtz s.n., 1380:IV/10.- Hubbard 8326:I/1B.-
Humphreys s.n.:I/10;s.n.:I/15;s.n.:I/20;s.n.:I/25;s.n.:III/1.-
Hursthouse s.n.,NSW106620:I/9.- Hutchinson s.n.,I/16;18:IV/3;19:

IV/10.- Ince s.n.:I/8T.- Irvine s.n.:V/4.- Ising 2276:I/1B;s.n., AD966080965,AD96608967,AD966080968,AD966080984,AD97113308,AD966080970: I/5;s.n.,AD96612007,AD966080971:I/5B1;s.n.,AD966050523:I/5B1T;s.n. AD966080969:I/23;s.n.,AD97417062:II/1;s.n.,AD966080966:IV/2;s.n., AD966080797:IV/2B;s.n.,AD966080987:V/3C.-Jackson 132:I/11.- James s.n.:IV/12.- Jarvis s.n.,BRI.113982:I/14.- Jessep s.n.,MEL41176: V/4.- Johnson 57:I/11B;5096,5131:I/7B1C1;9758:I/3T;9749:I/3;71: I/14;9752:I/6;5108,5113:IV/1;9750:IV/3;26,70:IV/2B1;4043,11766: IV/10.- Jones 220:IV/9;s.n.,AD966032938:I/5B2.- Jutson 87:V/3;107: IV/12.- Kayser 17:IV/10.- Kempe 7,361,543:I/11B;162:I/14;372:I/1; 341,MEL41038:IV/10;427:I/11C.-Kenneally 12:I/9;UWA980:II/2.- King s.n.,MEL41172:V/4.- King & Lefray s.n.,MEL40906:I/21;s.n.,MEL41203: V/6.- Kitson s.n.:IV/12.- Kniep 153:I/2.- Knox 65x084:I/21.- Koch 1249,2912,2980:I/21;1250a,1301:I/9;1250b:II/1;1243,1302:II/2;1300: V/4;1723:V/5C1.- Kraehenbuehl 529:I/26.- Kretchmar s.n.:V/3C.- Kuchel 166:I/7;286:I/7B1T;2090:II/2;2014:III/1;333:IV/2;759:V/3.- Langley 74∞:V/4.- Lankester s.n.:II/1.- Latham 7:I/9;45:I/9C.- Latz 163:I/14;710:I/7B1C2T;772:I/11B;835:I/11CT;829:IV/1;486,2099: I/7.- Lay 73:I/1.- Lazarides 5742,5864:I/5B2;5999:I/11B1T;5826: I/7BT;6058,6070:I/1;6542:IV/3;5989:IV/2B1;6539:IV/10.- Leak s.n.: I/23;s.n.:II/1.-Learmouth s.n.,MEL40948:I/1B;s.n.,MEL40865:I/11B.- Lewis s.n.,MEL40822:I/5.- Little s.n.,BRI113961:IV/2B.- Lothian 422:I/7;366,698:IV/2;684,4531:IV/10;2696,2722,2764,2776,3780,3890, 5527:I/1B;1722:I/5B2T;1600,1700,1722,4870:I/5B2.- Luelf 144oa:V/6.- Luff & Birrel 47:II/2;57.s.n.,AD96416174:V/4;s.n.,AD96416182:I/9.- Lullf 1090:V/5C1.- Lullfitz 1962,4294:I/16;1954,2185,4553,5956: I/15;3835:I/4;1738:I/23;154,3153:I/21;1186,3165,4596:I/9;3063:II/1; 1648,2027:II/2;1955,5635:III/2;1744:III/1;1968:IV/4;5570:V/2;1540: V/3C.- Lyons s.n.:I/5B2.- Maconochie 432:I/7;1021:I/7B;800:I/17T; 825:I/1AT;473,477:I/14;496:I/5;930,1785:IV/3;654:IV/6T;416,497, 733,926:IV/10.- Mackay 1:IV/2B.- Mahood 8704:I/6; 8762:I/7B.- Maiden 8,NSW106629:I/4;v19,v20,s.n.,NSW106616,NSW106617:I/9;s.n. NSW106660,NSW106657:II/1;s.n.:IV/8;s.n.:V/4;s.n.,W18107,AD97113018, F294459,MO822959,NSW7688,UC176553,UC249395,US654209,US568864,W5302: V/6.- Main 189:I/7B1C1.- Mangles s.n.:II/1.- Martin 32:I/9;67:IV/3. Matthews s.n.,MEL40866:I/11B1.- Mauritzon s.n.:II/1.- Maxwell s.n., MEL40903:I/21;MEL40917:I/21T.- May s.n.,BRI113966:IV/9.- McDougall 034:III/1.- McGillivray Herb.Morris 907:IV/2.-McTavish 13,17:IV/3.- Meeb 18485:I/21.- Meebold 6595:V/4.- Melville 34:IV/7;s.n.:V/6.- Merral s.n.,MEL40904:I/21;s.n.,MEL41054:IV/12.- Millington s.n., NT12084,NT15484:I/5B.- Mitchells.n.,AD97[illegible]03361:I/5B2.- Morland s.n.:I/7B1C;s.n.:I/7A;H2:I/6;C5,H15:IV/10;03:IV/12.- Morrison s.n. I/9;s.n.:I/18;s.n.:II/1;13180:II/2;s.n.:V/3C;s.n.:V/4.- Mountford & Sheard s.n.,AD966080978:I/1B.- Mueller s.n.:I/4;s.n.,MEL40891:

I/7T;s.n.,MEL40893 p.p.:I/7A1;s.n.,MEL40893 p.p.:I/7A2;s.n., MEL40858,MEL44211,MEL41229:I/9;s.n.,MEL40859,MEL40860:I/16;s.n., MEL40913:I/21;s.n.,UC248079:II/1;s.n.,MEL41234:III/2;s.n.,MEL41017: IV/3T;s.n.,MEL41151,MEL41152,MEL41153,MEL41154,MEL41155,MEL41148, MEL41159,MEL41168,MO118661:V/4;s.n.,W7837,MEL41197,SING044209:V/6. Muir s.n.,MEL40938:I/12;s.n.,MEL41132,MEL41137:V/1;s.n.,MEL41145: V/6.- Munir 5116,5149:I/1;5161,5188,5198:I/1A;5254,5256:I/4;5223: I/7;5204,5211,5216:I/7B1C;5225,5227:I/7B1C1;5220,5221:I/7A;5205, 5212:I/7A1;5207,5214,5218:I/6;5111,5112,5123,5124,5158,5162,5176, 5192,5193:I/11B;5238:I/21;5197,5224:IV/2;5213,5222:IV/2B1;5195, 5196,5206:IV/6;5219,2226:IV/7;5089,5189:IV/10;5233,5234:IV/12; 5237:V/3;5231:V/3C;5061:V/6.- Must 167:I/7B;146:I/14;145,303:IV/2; 254:IV/10.- Nelson 372:IV/2BT;1533:I/11B;1728:IV/2B1;1799:IV/10; 1942:I/7.- Newbey 1025:I/25;1569:I/23;1123:I/21;1556,1955:II/1; 2057:II/2;1482,1483:III/1.- Nicholls 601:I/7;892:I/11B1.- Officer 78;IV/10.- Oldfield s.n.,MEL41235:I/9;s.n.,MEL41158,MEL41159, MEL41168:V/4.- Oliver 3932:V/3C.- Oliver & Muir 3936:I/7;3957:IV/2. Osterfeld 1099:V/6;1115:I/21.- Parratt 1637:I/9;1643:III/2.- Paust 894:III/1;901:V/1.- Pearce 6:I/21.- Pelloe B1466:II/2.- Perry s.n. III/2;654:I/7;4108:I.14;294,1897:IV/10.- Phee s.n.,MEL41053:IV/3.- Phillips s.n.,CBG027723:I/9;CBG020641:I/13T;CBG02852,CBG025853: I/16;CBG025095:I/21;CBG020808,CBG035617:II/1;CBG016491:II/2; CBG007519:III/1;CBG031073:V/3;CBG029949:V/3C:1450,CBG012549, CBG011340,CBG025809,CBG027252,AD96922070,AD97001185:V/4.- Preiss 1376,1377:V/1.- Pries s.n.,MEL41163:V/4.- Prewett 555:V/4.- Prinsep s.n.:V/6.- Pritzel 756:II/1;849:IV/8T;858:IV/12T;1018:V/3CT;609, 985,s.n.:V/4.- Pulleine s.n.:IV/2.- Reid 52:I/7B1C1;s.n.ADW33630, ADW36237:I/1;s.n.,ADW33631:I/1B;s.n.,ADW20820:I/5;s.n.:I/26;53:IV/1; s.n.,ADW19308:IV/2B1;s.n.,ADW33957:IV/10.- Roé s.n.:I/4;s.n.:I/4T; 18,7742:I/14;s.n.:II/1T;s.n.:III/1;1,1013:IV/9.- Robinson 66:IV/6; s.n.,NSW106632:I/14.- Rogers s.n.,NSW166634:I/7.- Rohrlach 91,148: I/26.- Rose 209:I/7;s.n.,PR530702:IV/2;192:IV/10.- Rosier 42:II/2; 385:I/16.- Rowlands s.n.,MEL40986:IV/1.- Royce 1595:I/10B;5528:I/2; 5344:I/16;1838:I/3B1;10231:I/20T;1594,1832:IV/3;1988:IV/2;4447:IV/12; 7499:V/1;4451,4480:V/3C;4930:V/4.- Ryko s.n.:I/5.- Saffrey 850:V/3C. Sanfood s.n.:I/9.- Sargent 808,909,1444:V/6;1427:III/2.-Schomburgk 17:I/14;242:IV/10.- Schwartz s.n.,MEL40819:I/5.- Serventy & Main s.n.:I/6.- Swell s.n.,MEL40905:I/21;s.n.,MEL40926:I/23;s.n., MEL40852:I/9;s.n.,MEL40972:II/1;s.n.,MEL41156,MEL41162:V/4.- Shaw 610:I/16T.- Shell Oil co. s.n.,F1071305,UC1328227:V/4;s.n.:V/5; s.n.,F1071293,UC1328205:V/6.- Sheath s.n.,NSW106681,NSW106682,NSW 106683:V/6.- Shoobridge s.n.,BRI014297:IV/9.- Smith 834:V/5.- Spalding s.n.,MEL41171:V/4.- Speck 825,831,1202:IV/7;830:I/2;878:

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Stuart 202:I/5B;s.n.,MEL41041:IV/10T.- Stubbs s.n.,AD966080988:V/6.-
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IV/10.- Taylor s.n.,MEL40901:I/21.- Tepper 4:I/4.- Terry s.n.:I/7;
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3339:IV/2B1;1053,3385;IV/10;801,906,1024:V/4;719:V/5BCT.- Warner
20102:I/14.- Webb s.n.,MEL40916:I/21.- Weber 996:IV/2;1028:I/7B;
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Wedd 740,s.n.,BRI113984:I/14;645:IV/9.- Wells 8:IV/3;s.n.,MEL41200:
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I/1B;s.n.,AD9720517,AD96205199:I/1B;s.n.,AD97205188:I/5;s.n.,
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A P P E N D I X

POLLEN GRAIN MORPHOLOGY CHARTS

(2 Charts)

TAXA	POLARITY			SYMMETRY		APERTURES		NO. OF AP.	POSITION OF APERTURES			NATURE OF APERTURES			AMB TYPE POLAR VIEW			SHAPE POLAR AXIS/EQUATORIAL AXIS i.e. [TOT. BREA P/E						SIZE LONGEST SPORE AXIS LENGTH				DIAMETER IN POLAR VIEW	SPORODERM [EXINE] STRATIFICATION		
D I C R A S T Y L I S	ISOPOLAR	SUB-ISOPOLAR	HETEROPOLAR	RADIOSYMMETRIC	BILATERAL	APERTURATE	NON-APERTURATE	NUMBER OF APERTURES IN ONE POLLENGRAIN	POLAR	GLOBAL	EQUATORIAL	COLPATE	PORATE	COLPORATE	ANGUL-APERTURATE	PLANAPERTURATE	SIN-APERTURATE	FOSS-APERTURATE	P R O L A T E 8/6-8/4			S U B - P R O L A T E 8/7-8/6			P R O L A T E	PROLATE-SPHEROIDAL 8/8-8/7	VERY SMALL <10µ	SMALL 10-25µ	MEDIUM 25-50µ	LARGE 50-100µ; very large 100-200µ		SEXINE THICKNESS	SEXINE PATTERNS or STRATIFICATION	
D.beveridgei FvM. ssp.beveridgei var.lanata Munir	x			x		x		3		x		x						x	(16.0-)19.2-22.4/12.8-16.6µ								(16.0-)19.2-22.4µ			12.8-16.0µ	± as thick as Nexine	very finely reticulate	
D.brunnea Munir	x			x		x		3		x		x						x			22.4/19.2-25.6/19.2µ						22.4-25.6µ			±22.4µ	"	"	
D.brunnea Munir var.pedunculata Munir	x			x		x		3		x		x						x			25.6/19.2-44.8/28.8µ							25.6-44.8µ		±25.6µ	"	"	
D.corymbosa(Endl.)Munir [=D.stoechas Drumm.ex Harv.]	x			x		x		3		x		x						x	usually 22.4/16.0-25.6/19.2 (28.8/19.2)µ			sometimes 22.4/19.2-25.6/22.4µ						usually 22.4-25.6µ	rarely 25.6-28.8µ		22.4-25.6(-28.8)µ	"	"	
D.costelloi Bailey	x			x		x		3		x		x						x	usually 22.4/16.0-25.6/19.2µ			sometimes 19.2/16.0-22.4/19.2 (-25.6/22.4)µ						(19.2-)22.4-25.6µ			(16.0-)19.2(-22.4)µ	"	"	
D.exsuccosa(FvM.)Druce ssp.exsuccosa var.exsuccosa	x			x		x		3		x		x						x	(22.4/16.0-)25.6/19.2 -28.8/22.4(-35.2/25.6µ			22.4/19.2-25.6/22.4µ						usually 22.4-25.6µ	sometimes 25.6-35.2 µ		(19.2-)22.4(-25.6) µ	"	"	
D.exsuccosa(FvM.)Druce ssp.exsuccosa var.lanceolata Munir	x			x		x		3		x		x						x	usually (22.4/16.0-)25.6/19.2 -28.8/22.4µ			sometimes ±25.6/22.4µ						22.4-25.6 µ	25.6-28.8 µ		19.2-22.4 µ	"	"	
D.exsuccosa(FvM.)Druce ssp.exsuccosa var.tomentosa Munir	x			x		x		3		x		x						x	usually 22.4/16.0-28.8/22.4 (-32.0/22.4)µ			sometimes (22.4/19.2-) 25.6/22.4-28.8/25.6µ						22.4-25.6 µ	25.6-28.8(-32.0) µ		(19.2-)22.4-25.6(-28.8) µ	"	"	
D.exsuccosa(FvM.)Druce ssp.cinerea Munir	x			x		x		3		x		x						x	usually 25.6/19.2(-28.8/22.4)µ			sometimes ±22.4/19.2µ						22.4-25.6 µ	25.6-28.8 µ		(19.2-)22.4 µ	"	"	
D.exsuccosa(FvM.)Druce ssp.elliptica Munir	x			x		x		3		x		x						x	usually (22.4/16.0-)25.6/19.2 (-28.8/19.2)µ			sometimes 22.4/19.2(-25.6/22.4)µ						22.4-25.6 µ	25.6-28.8 µ		19.2(-22.4) µ	"	"	
D.exsuccosa(FvM.)Druce ssp.wilsonii Munir	x			x		x		3		x		x						x	usually 25.6/16.0-25.6/19.2 (-28.8/19.2)µ			occasionally ±25.6/22.4µ							25.6-28.8 µ		(16.0-)19.2-22.4(-25.6)µ	"	"	
D.gilesii FvM. var.gilesii	x			x		x		3		x		x						x	usually (25.6/16.0-)25.6/19.2 -28.8/22.4(-32.0/22.4)µ			sometimes 22.4/19.2-25.6/22.4 (-28.8/25.6)µ						22.4-25.6 µ	25.6-28.8(-32.0)µ		19.2-22.4 µ	"	"	
D.gilesii FvM. var.bagotensis Munir	x			x		x		3		x		x						x	usually 25.6/19.2-28.8/22.4 (-32.0/22.4)µ			rarely ±28.8/25.6µ							25.6-28.8(-32.0)µ		22.4(-25.6) µ	"	"	
D.gilesii FvM. var.laxa Munir	x			x		x		3		x		x						x	usually (22.4/16.0-)25.6/19.2 -28.8/22.4µ			sometimes (19.2/16.0-)22.4/19.2 -25.6/22.4µ						(16.0-)19.2-25.6 µ	25.6-28.8 µ		19.2-22.4(-25.6) µ	"	"	
D.flexuosa(Price)Gard.	x			x		x		3		x		x						x				(25.6/22.4-)28.8/25.6 -32.0/25.6(-38.4/32.8)µ							(25.6-)28.8-35.2 (-38.4) µ		(22.4-)25.6-28.8 µ	"	"	
D.fulva Drumm.ex Harv.	x			x		x		3		x		x						x	22.4/16.0(-25.6/19.2)µ			19.2/16.0-22.4/19.2 (-25.6/22.4)µ						19.2-25.6 µ			16.0-19.2(-22.4) µ	"	"	
D.lewellinii (FvM.)FvM.	x			x		x		3		x		x						x	35.2/22.4-38.4/28.8 (-41.6/28.8)µ			(32.0/25.6-)35.2/28.8 -38.8/35.2(-41.6/35.2)µ							(32.0-)35.2-38.4 (-41.6) µ		28.8-35.2 µ	"	"	
D.petermannensis Munir	x			x		x		3		x		x						x	28.8/19.2-28.8/22.4µ			25.6/22.4-28.8/25.6µ							25.6 - 28.8 µ		22.4 - 25.6 µ	"	"	
D.parvifolia FvM.	x			x		x		3		x		x						x	usually 25.6/16.0-25.6-19.2µ			sometimes 22.4/16.0-22.4/19.2 (-28.8/22.4)µ						22.4 - 25.6 µ	sometimes 25.6-28.8 µ		19.2 - 22.4 µ	"	"	
D.reticulata Drumm.ex Harv.	x			x		x		3		x		x						x	usually (19.2/12.8-)22.4/16.0 -25.6/19.2µ			rarely 22.4/19.2µ						(19.2-)22.4-25.6µ			16.0(-19.2) µ	"	"	
D.velutina Munir	x			x		x		3		x		x						x	25.6/19.2-28.8/19.2 (-32.0/19.2)µ			(19.2/16.0-)22.4/19.2 -28.8/22.4µ						19.2 - 25.6 µ	25.6 - 32.0 µ		19.2 - 22.4 µ	"	"	
D.verticillata Black	x			x		x		3		x		x						x	usually 25.6/19.2-32.0/22.4			sometimes 25.6/22.4-32.0/25.6µ							25.6-32.0(-35.2)µ		22.4 µ	"	"	

TAXA	POLARITY			SYMMETRY		APERTURES		NO. of APERTURES	POSITION of APERTURES			NATURE of APERTURES					AMB TYPE POLAR VIEW					SHAPE P/E [total breadth]			SIZE LONGEST SPORE AXIS LENGTH			DIAMETER IN POLAR VIEW	SPORODERM [EXINE] STRATIFICATION		
	ISOPOLAR	SUB-ISOPOLAR	HETEROPOLAR	RADIOSYMMETRIC	BILATERAL	APERTURATE	NON-APERTURATE	NUMBER OF APERTURES IN ONE POLLENGRAIN	POLAR	EQUATORIAL	GLOBAL	COLPATE	PORATE	COLPORATE	ANGUL-APERTURATE	PLANAPERTURATE	SIN-APERTURATE	FOSS-APERTURATE	PROLATE 8/6-8/4	SUB-PROLATE 8/7-8/6	PEROBLATE 8/8-8/7	PROLATE-SPHEROIDAL 8/8-8/7	VERY-SMALL <10µ	SMALL 10-25µ	MEDIUM 25-50µ	LARGE 50-100µ VERY LARGE 100-200µ	DIAMETER IN POLAR VIEW	SEXINE THICKNESS	SEXINE PATTERNS or STRATIFICATION	
LACHNOSTACHYS																															
L.coolgardiensis S.Moore f.coolgardiensis	x			x		x		3			x	x							x	(22.4/16.0-)28.4/22.4 -35.2/25.6(-38.4/28.8)µ	usually (22.4/19.2-)28.8/25 -35.2/28.8µ				(19.2-)22.4µ	28.8-35.2(-38.4) µ		(19.2-)25.6-28.8µ	± as thick as Nexine	very finely reticulate	
L.coolgardiensis S.Moore f.brevispicata(E.Pritzel) Munir	x			x		x		3			x	x							x	usually 32.0/22.4-35.2/25.6 (-38.4/28.8)µ	(28.8/25.6-) 32.0/28.8-35.2/28.8					28.8-35.2(-38.4) µ		25.6(-28.8)µ	"	"	
L.eriobotrya (FvM.)Druce	x			x		x		3			x	x							x	22.4/16.0-25.6/19.2 (-38.4/25.6)µ	19.2/16.0-25.6/22.4 (-35.2/28.8)µ				19.2-25.6µ	25.6-32.0(-38.4) µ		(16.0-)19.2-22.4(-25.6)µ	"	"	
L.ferruginea Hook. var.ferruginea	x			x		x		3			x	x							x	32.0/22.4-35.2/25.6 (-38.4/25.6)µ	(25.6/22.4-) 28.8/25.6-32.0/28.8 (-38.4/32.0)µ					(25.6-)28.8-35.2 (-38.4)µ		22.4-28.8(-32.0) µ	"	"	
L.ferruginea var. paniculata (Ewart)Munir	x			x		x		3			x	x							x	usually 32.0/22.4-35.2/22.4 (-35.2/19.2)µ	rarely ±32.0/25.6µ					32.0(-35.2)µ		22.4-25.6µ	"	"	
L.verbascifolia FvM.	x			x		x		3			x	x							x	32.0/22.4-)35.2/19.2 -35.2/25.6(-38.4/25.6)µ	(28.8/22.4-) 32.0/25.6-38.4/3 (-41.6/32.0)µ					28.8-38.4(-41.6)µ		22.4-25.6(-28.8)µ	"	"	
MALLOPHORA																															
M.globiflora Endl.	x			x		x		3			x	x							x	19.2/12.8-25.6/19.2 (-28.8/19.2)µ	19.2/16.0-22.4/1 .2µ				19.2-25.6µ	rarely 25.6-28.8µ		16.0-19.2(-22.4)µ	"	"	
M.rugosifolia Munir	x			x		x		3			x	x							x	19.2/12.8-22.4/16.0µ	(16.0/12.8-)19.2 16.0 (-22.4/19.2)µ				(16.0-)19.2 -22.4µ			(12.8-)16.0-19.2µ	"	"	
NEWCASTELIA																															
N.bracteosa FvM.	x			x		x		3			x	x							x	(22.4/16.0-)25.6/16.0 -35.2/22.4(-38.4/25.6)µ	22.4/19.2-28.8/2 .6 (-32.0/25.6)µ				sometimes 22.4-25.6µ	usually 25.6-35.2(-38.4)µ		(16.0-)19.2-22.4µ	"	"	
N.cephalantha	x			x		x		3			x	x							x	(22.4/12.8-)22.4/16.0 -25.6/19.2(-28.8/22.4)µ	(19.2/16.0-) 22.4/19.2-25.6/2 .4µ				19.2-25.6µ	25.6-28.8µ		19.2-22.4µ	"	"	
N.chrysotricha FvM.	x			x		x		3			x	x							x	sometimes 19.2/12.8-22.4/16.0µ	usually (16.0/12.8-)19.2 16.0 (-22.4/19.2)u				rarely 16.0/16.0µ	(16.0-)19.2 -22.4µ		(12.8-)16.0(-19.2µ	"	"	
N.cladotricha FvM.	x			x		x		3			x	x							x	x	25.6/22.4-32.0/2 .6 (-28.8/22.4)µ				22.4/22.4-25.6/25.6 (-28.8/28.8)µ	22.4-25.6µ	25.6-32.0µ		(19.2-)22.4 (-25.6)µ	"	"	
N.elliptica Munir	x			x		x		3			x	x							x	22.4/16.0-25.6/16.0µ	22.4/19.2-28.8/2 .6µ				rarely 19.2/19.2µ	22.4-25.6µ	25.6-28.8µ	(19.2-)22.4-25.6µ	"	"	
N.hexarrhena FvM.	x			x		x		3			x	x							x	32.0/19.2-38.4/25.6 (-41.6/28.8)µ	(25.6/22.4-)28.8/25.6 -32.0/25.6(-35.2/28.8)µ					25.6-38.4(41.6)µ		22.4-25.6(-28.8)µ	"	"	
N.interrupta Munir	x			x		x		3			x	x							x	22.4/16.0(-25.6/19.2)µ	usually 19.2/16.0-22.4/1 .2µ				rarely 19.2/19.2µ	19.2-22.4 (-25.6)µ		16.0-19.2(-22.4)µ	"	"	
N.spodiotricha FvM.	x			x		x		3			x	x							x	22.4/16.0-25.6/19.2 (-28.8/19.2)µ	(19.2/16.0-)22.4/19.2 -25.6/22.4(-28.8/25.6)µ				rarely 22.4/22.4µ	19.2-25.6µ	sometimes 25.6-28.8µ	(16.0-)19.2-22.4 (-25.6)µ	"	"	
N.viscida E.Pritzel	x			x		x		3			x	x							x	rarely 19.2/12.8µ	usually 19.2/16.0µ					19.2µ		(12.8-)16.0µ	"	"	
PHYSOPSIS																															
P.lachnostachya Gardner	x			x		x		3			x	x							x	sometimes (16.0/9.6-)19.2/12.8 (-22.4/16.0)µ	usually 16.0/12.8-19.2/ .0 (-22.4/19.2)µ				rarely 16.0/16.0-19.2/19.2µ	(16.0-)19.2 (-22.4)µ		12.8-16.0(-19.2)µ	"	"	
P.spicata Turcz.	x			x		x		3			x	x							x	x	12.8/9.6-16.0/12.8 (-19.2/16.0)µ					12.8-16.0 (-19.2)µ		9.6-12.8µ	"	"	