A CRITICAL REVISION OF SOME ENDEMIC AUSTRALIAN GENERA OF CRUCIFERAE

BY

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SUMMARY

A taxonomic revision has been made of the Australian species of *Cruciferae* which were included by O.E.Schulz in the genera *Arabidella*, *Blennodia*, *Drabastrum*, *Geococcus*, *Harmsiodoxa*, *Lemphoria*, *Microsystria*, *Pachymitus*, *Pseudarabidella* and *Scambopus*. Recent Australian authors, following Bentham, have treated these species as belonging to *Blennodia* and *Geococcus*.

In the present revision the species included by Schulz in *Arabidella*, *Lemphoria*, *Microsystria* and *Pseudarabidella* are now placed in the genus *Arabidella*.

Two new species, *Arabidella glaucescens* Shaw and *Harmsiodoxa puberula* Shaw, and a new variety, *Harmsiodoxa brevipes* var. *major* Shaw, are here described.

Harmsiodoxa cunninghamii (Benth.)Schulz has been shown to be a synonym of *H. blennodioides* (FvM.)Schulz, *Pachymitus lucae* (FvM.)Schulz is treated as a synonym of *P. cardaminoides* (FvM.)Schulz, and *Scambopus richardsii* (FvM.)Schulz has been shown to be synonymous with *Phlegmatospermum cochlearinum* (FvM.)Schulz.

The use of these new combinations and new names in this thesis does not constitute valid publication.

This thesis contains no material which has been accepted for the award of a degree or diploma in any University. To the best of my knowledge it contains no material previously published or written by another person except where due reference is made in the text.

Elizabeth A. Shaw

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INTRODUCTION

Plants which belong to the family Cruciferae can be easily recognized as such, provided that they bear flowers or fruits. Within this family it is, however, difficult to satisfactorily determine generic and, to a lesser extent, specific limits. Treatments during this century range from that of E. H.L.Krause (1902) who recognized only one genus, Crucifera, to that of O.E. Schulz (1936) who, in his revision of the family for the second edition of Die natürlichen Pflanzenfamilien, recognized 351 genera including about 2500 species.

From the second edition of J.M.Black's Flora of South Australia (1948) it ca n be estimated that there are in Australia about 50 endemic species of Cruciferae, most of them being included in the genera Blennodia, Lepidium, Stenopetalum, Cardamine and Menkea, the remainder in Cuphonotus, Hymenolobus, Phlegmatospermum, Capsella or Geococcus. In this present work only those species which have at any time been placed in or associated with Blennodia or Geococcus have been considered.

Black lists eleven species of Blennodia which occur in South Australia and mentions that, in all, this genus includes about fifteen species. The first to be described was Blennodia canescens R.Br.(1849); of the others eleven species were described by Ferdinand Mueller, most of them before 1860 and usually in Erysimum or Sisymbrium. One was described by George Bentham (1863) as a Blennodia, one by Ralph Tate (1885) as a Sisymbrium, and one by Black (1917) as a variety of B. canescens.

In 1855 Mueller transferred to Sisymbrium three species which he himself had originally described in Erysimum, and by the time of the publication of his Systematic Census of Australian Plants (1882) Mueller had made at least one intergeneric transfer of each species described by himself, as well as transferring Blennodia canescens first to Sisymbrium (1869) and then to Erysimum (1877). In some cases he introduced new epithets for species already described and these superfluous names figured in new combinations, further confusing matters.

The broad concept of Blennodia, which was the one adopted by Black, originated with Bentham who in the first volume of his Flora Australiensis (1863) included all the species of this group then described (ten) in Blennodia, as well as there describing a new species, B. cunninghamii. This view was never accepted by Mueller; in his first major work, Plants indigenous to the Colony of Victoria (1860-1862), Mueller placed four of these species in Sisymbrium, four in Blennodia, and one, originally described as a Blennodia by Mueller himself, in Capsella. The tenth species does not occur in Victoria.

In The Native Plants of Victoria (1879) Mueller referred three of the species previously (1860-1862) treated as Blennodia to Erysimum, this being the genus in which they were originally described. The treatment in his later works is essentially the same as in this one.

In the first comprehensive flora of South Australia Ralph Tate (1890) followed Mueller closely, placing all the species under consideration in either Erysimum or Sisymbrium. However, in a paper published eight years later in the Transactions of the Royal Society of South Australia, Tate rebelled against the dictates of Mueller and stated that he thought all these species to belong in Blennodia. This view was accepted by Black in the first edition of his Flora of South Australia (1924).

Also in 1924 appeared O.E.Schulz's monogra ph of the tribe Sisymbrieae for Das Pflanzenreich and here he sharply departed from the treatments of Mueller, Bentham and Tate.

Schulz retained the genus Blennodia but included in it only B. canescens R.Br., distributing the other thirteen species known to him among eight new genera; i.e., Arabidella (FvM.)Schulz, Pseudarabidella Schulz, Drabastrum Schulz, Scambopus Schulz, Harmsiodoxa Schulz, Pachymitus Schulz, Lemphoria Schulz and Microsystria Schulz. All of these genera he included in the subtribe Arabidopsidinae except for Arabidella which he placed in the subtribe Sisymbriinae. It should be noted that in Schulz's system the only essential difference between these subtribes is that plants belonging to the former have seeds which exude mucus when moistened; those in the latter do not.

Schulz in his later treatment of the entire family done for the second edition of Die natürlichen Pflanzenfamilien (1936) followed the same system except that he removed Blennodia from the tribe Sisymbrieae to the Hesperideae.

Although Black accepted Cuphonotus and Phlegmatospermum, two other Australian genera described by Schulz (1933), he considered the eight new genera within the "Blennodia group" to be ill-founded. In 1937 Black criticized them as having "been divided ••• on very slight characters", a remark which is, perhaps, misleading for it is these "slight characters" which must often be used in delimiting genera in this family. In the second edition of his flora (1948) Black made no mention of Schulz's work, not even listing his new combinations as synonyms.

Geococcus was described by Harvey in 1855 from specimens and notes sent to him from Western Australia by James Drummond. It has generally been accepted as a distinct genus, although in the Flora Australiensis Bentham, after describing the only species, *G. pusillus* Drumm. ex Harv., remarked that it is perhaps only a form of *Blennodia cardaminoides* Benth., a view later adopted by Mueller and by Tate.

In 1939 was described *G. fiedleri* Scheuermann, based on plants found growing in a garden in Leipsig where Australian wool waste had been dumped. This species was at one time thought by Black to be that to which all the South Australian colledtions belong, but he later considered *G. fiedleri* to be only a taxonomic synonym of *G. pusillus*.

It was as a consequence of these varied ideas about the circumscription of *Blennodia* and *Geococcus* that the present work was undertaken. There is available in the Australian herbaria much more material than any previous worker had been able to see, and the relevant collections at Kew, Berlin and Vienna were borrowed. In 1963 a visit was made to the British Museum (Natural History) where some critical material, including the holotype of *Blennodia canescens*, is housed. During the course of the study the writer made several trips in South Australia for making collections and field observations. Efforts were made to expand the scope of the collections of these plants and the writer is grateful to all those people who took particular pains to collect endemic *Cruciferae*.

In this revision two new species and one new variety have been described, in three cases formerly accepted names have been shown to be synonyms of previously published names, and three of Schulz's genera have been combined into one.

On the following page the taxomomic groups recognized by Schulz are compared with those recognized in the present revision.

Schulz (1924)	Present revision
Blennodia canescens R.Br.	Blennodia canescens R.Br.
	B. pterosperma (Black)Black
Arabidella trisecta (FvM.)Schulz	Arabidella trisecta (FvM.)Schulz
A. trisecta var. brachycarpa (Benth.)Schulz	A. glaucescens Shaw (sp. nov.)
A. trisecta var. hybophora Schulz	A. trisecta (FvM.)Schulz
Pseudarabidella filifolia (FvM.) Schulz	A. filifolia (FvM.)Shaw (comb. nov.)
	A. glaucescens Shaw (sp. nov.)
Micromystria nasturtium (FvM.) Schulz	A. nasturtium (FvM.)Shaw (comb. nov.)
M. nasturtium var. pinnatifida (Benth.)Schulz	A. procumbens (Tate)Shaw (comb. nov.)
M. eremigena (FvM.)Schulz	A. eremigena (FvM.)Shaw (comb. nov.)
Lemphoria procumbens (Tate)Schulz	A. procumbens (Tate)Shaw (comb. nov.)
Harmsiodoxa blennodioides (FvM.) Schulz	Harmsiodoxa blennodioides (FvM.) Schulz
	H. puberula Shaw (sp. nov.)
H. cunninghamii (Benth.)Schulz	H. blennodioides (FvM.)Schulz
H. brevipes (FvM.)Schulz	H. brevipes var. brevipes
	H. brevipes var. major Shaw
Scambopus curvipes (FvM.)Schulz	Scambopus curvipes (FvM.)Schulz
S. richardsii (FvM.)Schulz	Phlegmatospermum cochlearinum (FvM.)Schulz
Pachymitus cardaminoides (FvM.) Schulz	Pachymitus cardaminoides (FvM.) Schulz
P. cardaminoides var. dasycarpus Schulz	P. cardaminoides (FvM.)Schulz
P. lucae (FvM.)Schulz	P. cardaminoides (FvM.)Schulz

<u>Schulz (1924)</u>	<u>Present revision</u>
Drabastrum alpestre (FvM.)Schulz	*Drabastrum alpestre* (FvM.) Schulz
Geococcus pusillus Drumm. ex Harv.	*Geococcus pusillus* Drumm. ex Harv.

SURVEY OF THE NOMENCLATURAL HISTORY OF THESE SPECIES

In 1849 Robert Brown in his discussion of the plants collected by Charles Sturt's expedition of 1844-1846 described the genus *Blennodia* and one species, *B. canescens*. In his generic description, Brown wrote, "Cruciferarum genus, prope Matthiolam. Char. gen. - Calyx clausus .... Stigma bilobum, dilatatum. ... Semina aptera pube fibroso-mucosa tecta! Cotyledones incumbentes." After describing *Blennodia canescens* he continued,

"This plant has entirely the habit, and in many important points the structure of Matthiola, near which in a strictly natural method it must be placed, differing, however, in having incumbent cotyledons, and in the mucus covering of its seeds. The mucus proceeds from short tubes covering the whole surface of the testa, each containing a spiral fibre, which seems to be distinct from the membrane of the tube. A structure essentially similar is known to occur generally in several families: to what extent or in what genera of Cruciferae it may exist I have not ascertained; it is not found, however, in those species of Matthiola which I have examined."

It is to this production of mucus that the name Blennodia refers, being derived from the Greek βλεννώδης meaning "slimey" or "mucose". On the holotype sheet of *B. canescens* in the herbarium of the British Museum is a note in Brown's hand, "Blennosperma vel Blennodia". The name *Blennosperma*, however, had been used earlier by Lessing (1832) for an American genus of *Compositae*.

Although the name *Blennodia canescens* was accepted by Ferdinand Mueller in his reports on the plants collected by Gregory and by Babbage on their expeditions into the interior of South Australia (both published in 1859), and by Bentham in the Flora Australiensis (1863). Mueller in 1869 transferred this species to _Sisymbrium_ as _S. blennodia_, the epithet _canescens_ being preoccupied in this genus by _Sisymbrium canescens_ Nutt.(1818), a North American plant. Mueller mentioned that the seeds of _S. blennodia_ are mucose and irregularly biseriate in the fruit, but added that these facts did not prevent its inclusion in _Sisymbrium_.

In 1877 Mueller transferred this species to another genus, this time to _Erysimum_ as _E. blennodia_, retaining this epithet because of the publication of _E. canescens_ Moench (1794). This combination was generally used until 1898 when Tate used the original combination in his paper on dimorphism in some Australian _Cruciferae_. Since then _Blennodia Canescens_ has been generally accepted. It was used by Black in both editions of his Flora of South Australia and by Schulz in Das Pflanzenreich (1924) and in the second edition of Die natürlichen Pflanzenfamilien(1936).

Black (1917), in discussing the plants collected on the South Australian Museum's expedition to the Strzelecki and Cooper's Creeks, mentioned a form of _B. canescens_ collected at Lake Blanche, saying, "The specimens agree well with other northern ones except that the seeds are bordered by a rather broad wing, while those of the type are, as usual in the genus, quite wingless. I therefore propose calling this variety _pterosperma_." In the first edition of his flora (1924) Black treated it as a distinct species _B. pterosperma_, and the next year published a Latin description, adding that it is "a stouter plant than B. canescens, with a less prominent style and flat winged seeds."

In Das Pflanzenreich (1924) Schulz did not mention this variety. In

Die natürlichen Pflanzenfamilien (1936) he did mention "B. pterosperma J.M.Black", although he said that Blennodia R.Br. includes only one species and that is B. canescens. Schulz remarked, "B. pterosperma J.M. Black ••• soll nach dem Autor nicht verschleimende Samen haben."

It is true that Black originally described the seeds as "haud mucosa", but he later (1937) noted that examination of ripe seeds had proved them to be mucose. It is presumably because Schulz thought the seeds to be non-mucose that he did not commit himself to any decision about the existence of B. pterosperma as a distinct species.

Ferdinand Mueller's stay in South Australia was a quite short one, from December of 1847 to August of 1852, but he made several short collecting trips around Adelaide and to the Murre y River, as well as making during October and November, 1851, a rather longer one which took him into the southern part of the Flinders Ranges. In volume 25 of Linnaea, published in February, 1853, Mueller described six new species of Erysimum, all based on material which he himself had collected in South Australia.

The first two described here are E. brevipes and E. blennodioides. The name Erysimum brevipes was generally accepted throughout the rest of the nineteenth century, being used by Mueller in his Native Plants of Victoria (1879) and in both parts of the Key to the System of Victorian Plants (1887-1888 and 1885), as well as by Ralph Tate in his Flora of Extratropical South Australia (1890). In 1885 Mueller had referred this species to Blennodia but did not make the necessary combination; this he did do in Plants indigenous to the Colony of Victoria (1860-1862) and it was accepted by Bentham and later by Black in both editions of his flora.

Turczaninow in 1855 published Alyssopsis drummondii, basing the description on Drummond, series 4, no.128 from "Swan River". Turczaninow was rather reluctant to include this species in Alyssopsis but did so for want of a better place. He remarked that although this plant differed in some respects from his concept of Alyssopsis, the differences were not great enough to warrant creation of a new genus for it.

Twenty-two years later Mueller mentioned A. drummondii Turcz. as a synonym of his Sisymbrium brevipes, this latter an illegitimate combination based on E. brevipes, illegitimate because of the earlier publication of Sisymbrium brevipes Kar. et Kir.(1842). Gardner in 1930 made the combination Blennodia drummondii; he here made no direct reference to Turczaninow's publication, but cited Sisymbrium brachypodum as a synonym. S. brachypodum FvM.(1869) is a legitimate combination, being the correct one if the taxon under consideration be treated as a Sisymbrium. Mueller twice (1877 and 1878) does mention Alyssopsis drummondii as synonymous with S. brachypodum and it was for this reason that Gardner cited it with his new combination in Blennodia.

Schulz in his treatment of the Sisymbrieae for Das Pflanzenreich (1924) created a new genus Harmsiodoxa in which he placed E. brevipes together with Erysimum blennodioides FvM.(1853) and Blennodia cunninghamii Benth.(1863); he retained Harmsiodoxa with these three species in the second edition of Die natürlichen Pflanzenfamilien (1936).

Erysimum blennodioides was published in 1853, but two years later Mueller used the combination Erysimum blennodes to refer to this species. Erysimum blennodes is in this place (Trans. Phil. Soc. Vict. 1(1855)100) a nomen nudum and although Mueller used it at least twice more was apparently never associated with a description.

In his Plants indigenous to the Colony of Victoria (1860-1862) Mueller described and figured Blennodia lasiocarpa, citing as a synonym "Erysimum blennodes, F.M. in Linnaea, 1852, 367". As it stands this citation is wrong for the combination Erysimum blennodes was first used only in 1855; it is, however, possible that "Erysimum blennodioides" was intended for the reference is to the place of publication of the latter combination. It seems that Mueller used the new epithet "lasiocarpa" because he feared that the combination Blennodia blennodioides would have been tautological. The combination Blennodia lasiocarpa was accepted by Bentham and later by Black in the first edition of his flora.

In 1869 Mueller transferred this species to Sisymbrium as S. lasiocarpum and in 1879 to Erysimum as E. lasiocarpum and this latter combination was generally used until the beginning of the twentieth century, notably by Tate in his South Austra lian flora. Druce in 1917 finally made the combination Blennodia blennodioides and this has been used in Australia since then.

The third species which Schulz included in the genus Harmsiodoxa, H. cunninghamii (Benth.)Schulz, was described as Blennodia cunninghamii by Bentham in 1863. In his first census of Australian plants (1882) Mueller transferred this species to Erysimum; beyond this, there seems to be no mention of it in the literature.

In addition to E. brevipes and E. blennodioides Mueller described in Linnaea in 1853 four more species of Erysimum, all based on plants collected during his trip into the Flinders Ranges in 1851. These are E. filifolium, E. trisectum, E. nasturtium and E. curvipes; the first three may be conveniently discussed together.

Of _Erysimum filifolium_ Mueller wrote,

"... suffruticosum, glabrum, erectum, foliis lineari-filiformibus plerumque fasciculatis, pedicellis crassiuculis patentibus siliquae aequilongis, valvis subconvexis uninerviis , stylo brevi, stigmate minuto depresso vix emarginato. ... Habitu convenit cum Erysimo (Arabidella) trisecto; in ultimo stylus defecit, stigma crassius est et profundius emarginatum, pedicelli tenuiores sunt et minus patentes, fere erecti siliqua manifeste breviores, siliquae duplo longiores, folia varie partita et semina minora. Flores desunt.

Arabidella est Erysimi subgenus, praesertim calyce petalo discernendum."

In 1855 he transferred this species to _Sisymbrium_, making an illegitimate combination which is antedated by _S. filifolium_ Willd.(1800). It was, however, used by Mueller in his first and second censuses and by Tate in his flora. Bentham of course considered this species to be a _Blennodia_, as he did _E. trisectum_; this was eventually accepted by Tate and later by Black.

As mentioned before, _Erysimum trisectum_ was published together with _E. filifolium_ a nd the similarities between the two were repeatedly stressed by Mueller. In 1855 he redescribed the former species as _Sisymbrium trisectum_ and this was the name generally used during the nineteenth century, Bentham's combination _Blennodia trisecta_ being ignored until used by Tate (1898) and later by Black in both editions of his flora.

In 1863 Bentham described _B. trisecta_ var. _brachycarpa_, basing it on a collection made on McDouall Stuart's expedition. He wrote, "These specimens, ..., are in fruit only; the habit and foliage are precisely those of the common form gathered with them, but the pods are shortly oblong and very turgid, about two lines long; they may be possibly accidentally abnormal." Schulz (1924) accepted this variety, repeating Bentham's comments. At the same time Schulz described _Arabidella trisecta_ var. _hybophora_, characterizing it as "Caulis inferne cum petiolis papillis minutis tuberculiformibus obsessus", and remarking that it is found with the typical variety. Neither of these varieties was mentioned by Black.

The species originally described as _E. nasturtium_ was in 1855, together with _E. filifolium_ and _E. trisectum_, transferred by Mueller to _Sisymbrium_ as _S. nasturtioides_, this new epithet being necessary because of the earlier publication of _S. nasturtium_ Thunb. (1794). This was the combination used by Mueller in the rest of his works and by Tate in his flora.

When Bentham in 1863 transferred this species to _Blennodia_ he unfortunately retained the epithet _nasturtioides_, making an illegitimate combination for the epithet _nasturtium_ was not preoccupied in _Blennodia_. Black apperently did not realize this and used _B. nasturtioides_ in both editions of his flora, although the combination _Blennodia nasturtium_ (FvM.)Druce had been made in 1917.

In the Flora Australiensis Bentham described _B. nasturtioides_ var. _pinnatifida_, basing it on a single collection made by Burkitt in New South Wales "between [the] Darling and Lachlan rivers". Burkitt's plants were small fruiting specimens with most of the leaves withered; Bentham described them as having "leaves small, on long pedicels, with few short lateral lobes and a larger terminal one", thus differing from the typical variety with "leaves usually pinnately divided into a few linear rather thick segments". This variety was retained by Schulz (1924) but there seems to be no other mention of it.

Mueller always thought E. trisectum and E. nasturtium to be quite closely related, at least belonging in the same subgenus, Arabidella, of Erysimum. Although he seems to have never published anything to this effect, there is in the National Herbarium of Victoria a specimen, probably collected in South Australia, which is labelled in Mueller's hand "Erysimum (Arabidella) nasturtium".

When Schulz revised the tribe Sisymbrieae for Das Pflanzenreich he raised Mueller's subgenus Arabidella to generic rank, but made it monotypic, including only A. trisecta (FvM.)Schulz. For E. filifolium he created a new genus Pseudarabidella and for E. nasturtium and one other species, the genus Micromystria.

The second species included by Schulz in Micromystria is M. eremigena (FvM.)Schulz, described by Mueller in 1861 from collections made by Sir Thomas Mitchell on the Balonne River in Queensland and by Hermann Beckler near the base camp of the Victorian Exploring Expedition at Pamamaroo near Menindie, New South Wales. Mueller noted that, "A Sisymbrio nasturtioide ... videtur specifice distinctum." Bentham transferred this species to Blennodia, misspelling the epithet as "eremigera", and this combination (with the correct spelling) was used by Black in both editions of his flora.

The genus Arabidella Schulz placed in the subtribe Sisymbriinae of the Sisymbrieae, Psedarabidella and Micromystria into the Sisymbrieae-

Ara bidopsidinae. In Schulz's treatment the only essential difference between these subtribes is that the Sisymbriinae are said to have seeds "humida haud mucilaginosa" while seeds of the Arabidopsidinae are mucose. He said of Pseudarabidella "... semina humida mucilaginosa (sec. Bentham); igitur ab Arabidella differt.". Schulz never saw material of P. filifolia, basing his description on those of Mueller and Bentham and on a drawing sent him from Kew. In the second edition of Die natürlichen Pflanzenfamilien this arrangement was not altered.

An important figure in the history of South Australian botany is Ralph Tate who came from England to Adelaide in 1875 and during the next twenty years collected extensively throughout South Australia. In September of 1883 Tate collected at Termination Hill, in the northern part of the Lake Torrens basin, a crucifer which he sent to Mueller with a note in which he referred to it as "a Sisymbrium which I cannot attach to any described Australian species."

Tate himself described this in 1885 as Sisymbrium procumbens. In the protologue he remarked, "Among Austra lian congeners, S. procumbens approaches to S. nasturtioides, from which it differs in habit, form of leaves, in the spreading not erect fruiting pedicels, stouter pods, etc."

Tate used this combination in his flora as did Max Koch (1898) in his report on plants collected at Mount Lyndhurst in the northern Flinders Ranges. However in the same number of the Transactions of the Royal Society of South Australia as Koch's report, Tate put an end to the inclusion of these Australian Cruciferae in Erysimum or Sisymbrium.

In his paper "Dimorphism in two South Australian Cruciferous Plants", Tate wrote, "The majority of Australian botanists influenced by their compeer [Mueller] have accepted his dictum that *Blennodia* is made up of species of the genera *Sisymbrium* and *Erysimum*. A critical examination of the 10 species of the Australian flora, collectively included under these two generic names, satisfies me that the venation of the capsule is not that proper to *Sisymbrium*; as in all the species, there is only a midrib, without a lateral vein on each side. ... There is no justification for the employment of *Sisymbrium* for some of our crucifers, and I take, therefore, this opportunity to refer my *S. procumbens* to *Blennodia* as *B. procumbens*, Tate, 1898."

This combination was used by Black in both editions of his flora.

Schulz (1924) created for this species a new genus *Lemphoria* placed in the *Sisymbrieae-Arabidopsidinae*.

The last of the species described in Linnaea was *Erysimum curvipes*, based on a collection made at Crystal Brook in South Australia. This combination was generally used by Mueller and by Tate, although in the report (1859) on the collections made by the Babbage expedition Mueller used the combination *Blennodia curvipes*, also used by Bentham and later by Black. As one might expect Mueller (1869) transferred this species to *Sisymbrium*, a move accepted by no one.

Schulz in 1924 published the genus *Scambopus* in which he included *S. curvipes* and the erstwhile *Erysimum richardsii* FvM. He apparently saw no material of either species for his generic description says, in part, "Plantae mihi tantum delineatae ex herbario Kewensi visae ...", and his specific descriptions were adapted from those of Mueller and Bentham.

Erysimum richardsii FvM. is described in the tenth volume of Fragmenta Phytographiae Austra liae (1877), the description being based on a collection made at Eucla in Western Australia by Mrs. Richards, wife of the police officer stationed there. In the protologue Mueller wrote, "Erysimum Richardsii (Sect. Blennodia)" and this seems to be the only published indication that Mueller considered there to be a section Blennodia in Erysimum. After describing the plant and commenting that he had seen no mature fruit, Mueller concluded, "Species ab E. eremigeno et E. nasturtioide petalis majoribus et praecipue stylo bene evoluto diagnoscenda."

The combination Blennodia richardsii was used by Tate in 1879 and 1898, but both times as a nomen nudum. It was validly made only in the first edition of Black's flora (1924). Black wrote, "B. Richardsii, F.v.M. (Erysimum Richardsii F.v.M. Sisymbrium Richardsii, F.v.M.) [this latter a combination made by Mueller in the first Census and used by Tate in his flora] was described by Mueller from flowering specimens collected in 1877 between Fowler's Bay and Eucla, but the specimen preserved in the Tate Herbarium appears to belong to the South Australian form of Hutchinsia Drummondii."

Schulz missed this comment made by Black for in the second edition of Die natürlichen Pflanzenfamilien (1936) he retained Scambopus richardsii. The last word on the matter was had by Black who in 1937 wrote, "It seems impossible to decide the generic position of Erysimum richardsii, F.v.M. ...until we have ripe fruits and seeds. ... From the notched, laterally compressed ovary [of the type] it appears to be a Phlegmatospermum rather than a Blennodia and is perhaps only a form of Ph. cochearinum. Helms' specimen from Arkaringa Creek, identified as

Sisymbrium Richardsii by Mueller and Tate is certainly Ph. cochlearinum".

In 1855 Mueller published a description of Sisymbrium cardaminoides based on collections made near the mouth of the Murray River. He was not sure of the individuality of this species, writing in Plants indigenous to the Colony of Victoria, "As a doubtful plant the Sisymbrium cardaminoides ... is likewise excluded, its diversity from S. Thalianum (Gaudin, Flora Helvet. iv 438) having not yet been convincingly proved".

In the Flora Australiensis Bentham described Blennodia cardaminoides citing "B. cardaminoides F. Muell. Herb. (as a Sisymbrium)". This suggests that he may not have known of Mueller's valid publication of S. cardaminoides; thus Bentham's B. cardaminoides cannot necessarily be interpreted as if based on Mueller's type although Bentham's citation of specimens makes it probable that he had seen it. The combination B. cardaminoides has been generally accepted and was used by Black.

Erysimum lucae FvM. was described in 1877 from a collection made by T.P.Lucas near the junction of the Murray and Darling Rivers. Mueller remarked that it stood closest to E. cardaminoides but seemed specifically distinct because of its larger size.

Schulz (1924) included both of these species in his genus Pachymitus. He also described P. cardaminoides var. dasycarpus, differing from the typical variety which, according to Schulz, has glabrous fruits, in having "siliquae pilis bifurcatis brevibus parce vestitae".

He had seen no specimen of P. lucae, only a drawing sent him from Kew, and borrowed his description from Mueller.

In the first part of Key to the System of Victorian Plants Mueller, commenting on Sisymbrium cardaminoides, wrote, "... fruits cylindrical-filiform, about twice as long as their stalklets, or in a stemless state of this plant very short, rather thick and turgid, singly forming on their stalks and during maturation burying themselves in the ground; the flowers of this state very minute."

This "state" refers to what is usually considered to be Geococcus pusillus Drumm. ex Harv., described in 1855 from a collection made by Drummond in Western Australia . This doubt about the individuality of G. pusillus seems to have arisen with Bentham (1863) who wrote, "... it may very likely be a Blennodia, of some species of which it has the radical leaves." The problem was taken up by Tate (1898) who, after discussing the comparatively few specimens of "so-called Geococcus pusillus" available to him, concluded that these plants really represented one of "the two very dissimilar states of Blennodia cardaminoides, which have in common virtually only leaf form."

A second species of Geococcus, G. fiedleri Scheuermann (1937), was described from a plant adventitious in a garden in Leipsig where it had been introduced with Australian wool waste. This species was discussed by Black (1940) who then accepted it as including all the South Australian collections available to him, but later considered G. fiedleri to be only a synonym of G. pusillus.

Somewhat remote geographically from those species so far discussed is Blennodia alpestris FvM. (1855) which is known only from the mountainous areas in south-eastern New South Wales and the adjacent parts of Victoria. Although described as a Blennodia by Mueller, he was uncertain of its correct generic position for he wrote, "... as the cotyledons are at times slightly bent inwards, I am uncertain whether the genus ought not to be united with *Diplotaxis* or *Moricandia*". In Plants indigenous to the Colony of Victoria Mueller transferred this species to *Capsella* as *C. blennodina*, considering it to form a link betw een that genus and *Blennodia*. Bentham retained it in *Blennodia* although admitting it to have certain affinities with *Capsella*.

Mueller in 1869 transferred it to *Sisymbrium* as *S. alpestre*, but ten years later moved it to *Erysimum* as *E. capsellinum*, a name retained in later works. It underwent a further name change to *E. blennodinum*, by Otto Kuntze (1891), before being placed by Schulz as the only species in his new genus *Drabastrum* based on a manuscript name used by Mueller.

These, then, are the main points of the nomenclatural history of these species at the time that this study was begun.

On the following page are shown in tabular form some of the name changes and intergeneric transfers made by Mueller himself. The species listed are those accepted in the present work which had been published up to the time of appearance of Mueller's Second Census (1889), with the exception of *Arabidella procumbens* which is not listed in the Second Census, a lthough published as *Sisymbrium procumbens* Tate in 1885. Mueller's publication of 1879 here listed is The Native Plants of Victoria.

Species	Genus in which described	Mueller (1860-1862)	Mueller (1879)	Mueller (1889)
Blennodia canescens R.Br.	Blennodia (1849)	————	Sisymbrium	Erysimum
Arabidella trisecta (FvM.) Schulz	Erysimum (1853)	Sisymbrium	Sisymbrium	Sisymbrium
A. filifolia (FvM.)Shaw	Erysimum (1853)	Sisymbrium	————	Sisymbrium
A. nasturtium (FvM.)Shaw	Erysimum (1853)	Sisymbrium	Sisymbrium	Sisymbrium
A. eremigena (FvM.)Shaw	Sisymbrium (1861)	————	————	Sisymbrium
Harmsiodoxa blennodioides (FvM.)Schulz	Erysimum (1853)	Blennodia lasiocarpa	Erysimum lasiocarpum	Erysimum blennodioides
H. brevipes (FvM.)Schulz	Erysimum (1853)	Blennodia	Erysimum	Erysimum
Scambopus curvipes (FvM.) Schulz	Erysimum (1853)	Blennodia	Erysimum	Erysimum
Drabastrum alpestre (FvM.) Schulz	Blennodia (1855)	Capsella blennodina	Erysimum capsellinum	Erysimum capsellinum
Pachymitus cardaminoides (FvM.) Schulz	Sisymbrium (1855)	Sisymbrium	Sisymbrium	Sisymbrium
Geococcus pusillus Drumm. ex Harv.	Geococcus (1855)	Geococcus	Geococcus	Geococcus

MORPHOLOGY

Techniques:

Although the flowers of all Cruciferae are much alike in basic pattern, there are minor differences among them; therefore, for many specimens floral dissections were made, not so much for the purpose of determination as for making measurements and observing the arrangement of the nectaries.

The dried flowers were soaked in a dilute solution of a proprietary brand of detergent for periods of up to twenty-four hours although one hour was usually long enough for the organs to become turgid. The detergent solution was then blotted off and a mixture of water and glycerine (about 4:1 by volume) added; in this the floral organs remained turgid and flexible indefinitely.

In making measurements the excess water-glycerine mixture was blotted off and the organs spread out into as natural a position as possible, care being taken not to stretch or otherwise distort them. After this treatment they were very near their size in life and the measurements taken from them are the ones used in the descriptions.

To preserve the dissections the organs were arranged in the desired position on a glass slide and thoroughly blotted. A white card was prepared by being spread with a thin layer of paste which was allowed to become nearly dry. The card was placed face down on the slide and firmly pressed. The flower parts came off onto the slide in about the required position although some minor rearrangements were usually necessary. The card could then be labelled, placed into a cellophane envelope and affixed to the sheet from which the flower was taken.

All other plant parts were measured when dry and the measurements given may in some cases be very slightly smaller than would have been obtained had living material been used; in some species a comparatively few measurements taken from living material have been incorporated. Seed measurements were taken from dried material although many were soaked in water to observe the exudation of mucus. The details of this were most easily seen by chipping off a small piece of the testa from an unsoaked seed and placing this into water; the sort of mucus exuded was more readily determined in transmitted than in reflected light. The soaked seeds were also dissected for study of the embryo.

For some species an attempt was made to obtain chromosome counts using stages of microsporogenesis. Although it could be seen that the basic chromosome number, at least in Arabidella trisecta and A. nasturtium, is probably seven or eight, this work was not continued. The chromosomes are small and difficult to work with and it was thought that it would be better, under the circumstances, to devote the available time to making as thorough as possible a morphological study of these plants.

Cytotaxonomic work in this group would be very valuable and there are a number of interesting problems to be persued. Among these is the matter of petal colour which, particularly in both species of Blennodia and in Harmsiodoxa blennodioides, varies from white to lavender within a population; there is also the rpoblem of the two colour forms of Arabidella trisecta which at the present time seem to be geographically distinct.

General characters of the flowers and embryo in the family:

The cruciferous flower is distinctive and not readily confused with that found in any other family. It is made up of two calyx whorls, each whorl of two sepals, a corolla whorl of four parts, these placed diagonally to the sepals, two androecial whorls, one of two stamens and one of four, and a bicarpellary ovary. Below the ovary and encircling the bases of the stamens is a ring of nectariferous tissue which is an outgrowth of the receptacle.

The ovary is almost always bilocular, divided by a membranous septum connecting the parietal placentas which lie in the median plane of the flower. The ovules vary in number from one to perhaps three hundred in a locule and are attached to the placentas which form a framework, the replum, by slender funicles; usually they are biseriate, but in ovaries compressed at right angles to the plane of the septum may appear uniseriate. The ovary is sessile on the receptacle or raised above it on a short gynophore or stipe. Usually the style is slender and more or less linear, but it is sometimes entirely absent; the stigmas are capitate and slightly depressed or bilobed.

In this work the two calyx whorls are referred to by their position in relation to the ovary; i.e., median and lateral. The median sepals are those in line with the replum; the lateral sepals, those in a plane at right angles to that of the replum and septum.

Very often one finds mention of "outer" and "inner" calyx whorls; this can be confusing for here the interpretation varies. According to the classical concept of Eichler the median sepals, which in the bud overlap the edges of the transverse (lateral) sepals, are the outer and lower ones. This view is opposed by the work of Arber (1931) and Eggers (1935), both of whom investigated the course of the vascular bundles in the flower and concluded that the lateral sepals are the outer for they are inserted below the median ones. It is for this reason that the terms "median" and "lateral" are used as being the less ambiguous.

As mentioned before the stamens are usually six in number, in two whorls, an outer whorl of two stamens, one on each side of the ovary and subtended by a lateral sepal, and an inner whorl of four stamens, these arranged in pairs, one pair on the dorsal side and the other on the ventral side of the ovary, each of these pairs subtended by a median sepal. The outer whorl is inserted lower on the receptacle than is the inner one and these outer stamens are usually the shorter, although, especially in smaller flowers, the stamens may be of about the same length. The outer stamens are here referred to as "lateral", the inner ones as "diagonal" for they do not stand exactly on the median line of the flower.

When the ovary has matured it either remains closed or is dehiscent by the two deciduous valves which fall away, leaving behind the septum surrounded by the replum. The fruit is usually referred to as a "siliqua" or "silicula"; the difference between these two is not well-defined and is a matter of relative dimensions. If the ratio of length to width is 3-4:1 or more, the fruit is a siliqua; if less, a silicula.

The fruit may be terete or compressed in one of two ways. If it is flattened in a plane parallel to the septum, that is, dorsoventrally, the greater width of a transverse section is parallel to the septum and the fruit is latisept; if it is flattened in a plane at right angles to that of the septum, that is, laterally, the lesser width is parallel to the septum and the fruit is angustisept; the valves are then very convex or keeled.

The embryo entirely fills the seed and its parts may be folded or rolled in various ways. Three basic patterns may be recognized. The first is the notorrhizal embryo in which the radicle lies against the backs of the cotyledons (the cotyledons then said to be incumbent). The a rra ngement of the cotyledons is often shown by symbols representing a seed cut transversely; that for the notorrhizal embryo is O||. In the pleurorrhizal embryo the radicle lies against the edges of the cotyledons (the cotyledons then accumbent); this state is symbolized by O=. The third sort is the orthoploceous embryo which resembles the notorrhizal, but has the cotyledons longitudinally folded and enclosing the radicle. This type is exclusively associated with the tribe *Brassiceae*. The cotyledons are said to be conduplicate and the appropriate symbol is O>>. In variants of these types the cotyledons are spirally rolled or twice folded. In the genera here discussed the embryos are notorrhizal, usually exactly so, although by pressure within the fruit, the radicle is sometimes pushed to one side and is not exactly centered.

Characters of the genera here discussed:

Calyx: The number of sepals is usually four although monstrous flowers may have fewer or more. The calyx can be described as "open" or "closed". If open the sepals are more or less spreading and this is the more common in this group; indeed, in some species, for example, *Arabidella trisecta*, the sepals are at full anthesis horizontal or even further bent back.

The closed calyx is seen only in *Blennodia canescens* and *B. pterosperma* in which species the sepals are usually erect and the margins overlapping; this is not an absolutely constant character for occasionally fully-opened flowers are seen which have slightly spreading sepals, spreading at least to the extent that the margins do not quite touch. However for practical purposes the calyx in these two species can be described as closed for the sepals are either parallel to the ovary or at only a slight angle from it.

Size varies quite considerably from plant to plant of a particular species, but is fairly constant among the fully opened flowers on an individual plant. In shape the sepals vary from oblong or ovate to deltate or, rarely, suborbicular. The lateral sepals are usually wider than the median and are more often ovate or deltate than oblong. Usually they are subacute to acute and are often saccate at the base; this latter characteristic is constantly seen in both species of Blennodia, but only sporadically or not at all in the other species. The median sepals are most commonly oblong or almost so and are usually rounded; not uncommonly the blunt tip is bent over and the sepals are cucullate. The median sepals are almost never saccate at the base.

Usually the sepals are green although they are occasionally lavender or partly so. They are bordered, almost to the base, by a narrow hyaline margin which is colourless or lavender. In pubescent species there are usually a few hairs, especially near the tip. The sepals are generally caducous, but sometimes remain until the fruit is quite well developed.

Corolla: Most of the Cruciferae have flowers with four petals, a trait which is constant throughout this group although some Australian species of Lepidium have none. The petals are usually longer than the sepals although in Geococcus pusillus they may be of the same length. Size is quite constant among flowers of a particular plant a lthough it may vary surprisingly much within a species.

The petals are generally white or yellow, although plants from predominantly white-flowered species may have many flowers with pink or lavender petals; this seems to be not the case in yellow-flowered species. The venation varies to the extent that a petal can be described as "finely" or "coarsely" veined.

Usually the petals taper into an obvious claw and this is probably the primitive condition in the family. The blades are generally oblong to (ob-)ovate to suborbicular and are rounded or truncate. If the latter they are often retuse or emarginate. The claw is usually more or less linear and is sometimes winged. In some species, for example, Arabidella trisecta, the blade is at right angles to the claw when the petal is fully expa nded.

Especially in some of the smaller-flowered species it is not uncommon to find petals with no obvious distinction between blade and claw or with only a very short claw. These petals are usually spathulate or obovate to deltate and are usually smaller than the distinctly clawed ones. This characteristic is not necessarily constant within a species; a good example is Arabidella nasturtium in which both clawed petals with suborbicular blades and clawless obovate petals, as well as all the transitional forms between the two, may be seen.

Androecium: Within this group the flowers have constantly six stamens although these sometimes do not all fully develop; this seems to be particularly true of the lateral ones.

The filaments are linear or conspicuously widened at the base, this latter condition more common in small-flowered species. Quite often the filaments of the lateral stamens are unequally widened, this being probably a consequence of compression within the flower, the greater width being on the lateral side of the vein. Usually they are white or pale green, sometimes pink or lavender.

The anthers are dorsifixed and the connective is barely visible. They are usually oblong to square, although sometimes ones which are sagittate at the base are seen, and are rounded or truncate. They are always yellow.

Nectaries: These glands are outgrowths of the receptacle and stand at the level of the bases of the stamens. They follow a quite constant pattern, the differences among the species being mainly the result of varying degrees of development, these in turn being influenced by the space available within the developing bud. When fully developed the glands form an extrastaminal ring which completely surrounds the bases of the stamens. In this group they are usually seen only partly developed.

In the common arrangement one can distinguish between lateral and median glands. The lateral glands are rings of tissue, each surrounding the base of a lateral stamen and usually open on the inner side, less often open or emarginate on the outer side. They may be circular or triangular, square to pentagonal or hexagonal or, alternatively, vee- or horseshoe-shaped. Differences within either of these two groups seem to be of minor importance although it is apparently of some taxonomic significance that a species falls within one rather than the other of these two groups.

From this basic circular or vee-shaped gland is produced, one on each side, a "lateral appendage" which curves around the base of the adjacent diagonal stamen. It is easy to call it this for descriptive purposes; it is part of the entire extrastaminal ring. The tips of the appendages from opposite glands approach each other and may sometimes touch, but apparently are never fused.

If the lateral glands are less well developed, each may appear as four lobes of tissue, one at each angle of a hypothetical square gland, or as semi-circular pieces of tissue, each one subtended by a petal, the pieces actually being the arms of the lateral appendages. These poorly developed glands are seen in the herbaceous species of Arabidella.

The median glands, if present, are more or less conical pieces of tissue, one between the bases of the members of each pair of diagonal stamens. Unfortunately presence or absence of the median glands is not a constant character; it is an expression of the degree of development of the glandular system and can vary from plant to plant of a particular species. This is especially noticeable in Arabidella eremigena.

Gynoecium: The ovary is usually sessile although in a few species, for example, Arabidella glaucescens, it is on a short gynophore. It is linear to fusiform to ampulliform and is usually terete. Occasionally the ovary is compressed, but any compression is usually more obvious after ripening has begun. In most species the ovary is glabrous, even though the fruit is pubescent, but in both species of Blennodia the ovary is densely tomentose.

The style is slender and linear or, in *Blennodia canescens*, very short and widened, eventually becoming almost spherical. The stigmas are usually depressed-capitate, but are sometimes two-lobed. The bilobed stigmas either have the lobes extended over the placentas or over the valves, in the latter case appearing tectiform if seen from the dorsal aspect. This is best seen in *Blennodia canescens*.

The flowering pedicels are slender and usually erect to slightly spreading, even in those species in which the fruiting pedicels are horizontal or recurved; in section they are terete or quadrangular.

Fruit: Within this group the fruits are quite variable in size but otherwise do not vary among themselves a great deal. They are usually siliquas, in a few cases, siliculas, terete or compressed. If the fruit is terete, the valves are convex and nearly semicircular in section and this is the most common condition; in a somewhat modified form the fruits are quadrangular and the valves almost right-angled in section. This is seen especially in *Scambopus curvipes* and *Drabastrum alpestre*.

When the fruit is compressed dorsoventrally and is thus latisept, the valves are almost flat and this is commonly seen in *Blennodia*; in such fruits the valves are often somewhat constricted between the seeds. The laterally compressed fruit is less commonly found within this group, although fruits of *Arabidella eremigena* and *A. procumbens* are often angustisept; the valves are then very convex or keeled. It may be noted that although terete and latisept fruits may occur in one species, as well as terete and angustisept together, latisept and angustisept seem not to occur in the same species.

The valves are usually rounded or truncate at the proximal end and rounded to subacute at the distal. There is a more or less distinct vein and when the fruit is fully ripe there is often visible a reticulum of secondary veins making the valve appear striated. Arabidella trisecta sometimes has three parallel veins, the lateral ones being rather indistinct, but this is not a constant characteristic. Although the usual colour is brown, one often sees red or magenta pigmentation, especially along the vein and at the edges of the replum. The valves usually fit smoothly against the replum, but in Scambopus curvipes and Pachymitus cardaminoides they are reflexed and flared at the proximal end.

The fruits are sessile or shortly stipitate, the stipe elongating very little during maturation. Usually there is present a style which is linear a nd slender or obconical although in Blennodia canescens and B. pterosperma it is often much widened and almost spherical. In most cases the s tigma is depressed-capitate and as wide as or slightly wider than the style, although in B. canescens it is tectiform. Very often the stigma shows at least a trace of purple pigmentation.

The funicles are short and slender, usually linear to deltate, straight or curved and almost always pendulous. The septum is quite variable; in this group it is thin and fragile and is sometimes fenestrate by a longitudinal slit. Usually it is white, less often colourless, and is opaque or hyaline; it is smooth or rugulose, then being wr wrinkled especially between the seeds and along the margins.

The fruiting racemes are always quite loose and may reach a considerable length, as much as 30cm in Arabidella glaucescens. The pedicels are generally quite slender, although those of Harmsiodoxa brevipes are stout (often 1mm in diameter) and very short, and in Pachymitus cardaminoides the pedicels, although slender proximally, become quite thickened just below the calyx. Usually the pedicels are somewhat spreading, but they may be horizontal and quite rigid or even recurved as in Blennodia pterosperma and Scambopus curvipes.

Seeds: The seeds are usually oblong to (ob-)ovate and quite plump, although those of B. pterosperma are quite flattened. Seeds of B. pterosperma are always surrounded by a membranous wing, a feature seen less often in Blennodia canescens and Arabidella filifolia.

The testa varies in colour from yellow through red-brown to brown and usually is slightly darker at the hilum. Usually it is finely papillose, although the testa of seeds of Dra bastrum alpestre is coa rsely reticulate.

The outstanding feature of the testa is its ability to exude mucus when moistened. In the outer layer are "slime cells" which very rapidly take up water. The contents of these cells are quickly exuded and rupture the cuticle which can then be seen as fragments on the surface of the sheath of mucus. The mucus seems to be generally produced from all parts of the testa although in some species there is found a small area near the hilum which seems to be not mucose. As mentioned before the testa is usually finely papillose and each papilla seems to extrude a strand of mucus. The result is a coat of mucus enveloping the entire seed.

In some genera, especially Harmsiodoxa, Blennodia and Scambopus, the mucus is exuded as distinct oblongs, one from each papilla, each oblong containing what appears to be a grey spirally coiled thread; to the naked eye this mucus is grey and under low magnification seems to be distinctly radiate. In _Arabidella_, however, the mucus is exuded as cubes, hemispheres, or cones, again one from each papilla, but not containing the thread. This mucus is colourless and, as the others, appears more or less radiate under low magnification; under higher magnification it is seen that this apparent radiate quality is caused by the overlapping rows of cubes or hemispheres, the optical properties of the mucus being such that the edges of each individual exudate seem accentuated.

Under low magnification (about 80 times) the testa appears to be three-layered. The inner of these layers is of light colour and is probably the endosperm, the two outer layers being the testa proper and they themselves covered by a cuticle. The outer layer is the thicker and pieces of it can easily be chipped off; it is quite light in colour and bears the papillae or reticulations. It is this layer which produces the mucus; it is made up of vertically placed oblong cells which are somewhat conical at the top and it is these cones which give the testa its papillose appearance. From each of these cells is produced a discrete mucose mass.

The seed is entirely filled by the embryo which in these plants is notorrhizal. The radicle is usually straight although in _Arabidella filifolia_ it is generally curved to one side, making the seed appear skew. The cotyledons are usually oblong or elliptic and about the same length as the radicle.

Mueller in the original description of *Blennodia alpestris* remarked that "as the cotyledons are at times slightly bent inwards, I am uncertain whether the genus ought not to be united with *Diplotaxis* or *Moricandia*." Several collections of this species, including those from which Mueller drew up his description, have been examined, but there is no indication in any of the cotyledons being curved.

On germination the radicle first elongates and ruptures the testa; as it lengthens the cotyledons unfold and push off the testa. In the very young seedling the shape of the cotyledons does not differ noticeably from species to species; the first true leaves are similar to the cotyledons, being oblong and usually entire, and it seems to be only the second-formed leaves which show any of the specific characters, although in pubescent species the first leaves do bear a few ha irs.

Not all species could be grown from seed, but the following did reach a stage at which the first few leaves could be seen: *Arabidella trisecta*, *A. nasturtium*, *A. glaucescens*, *Blennodia canescens*, *Harmsiodoxa blennodioides* and *H. brevipes*. At the early stages about all that is possible is to separate the entire- or trisect-leaved species from those with pinnatisect leaves.

Pubescence: The hairs found on members of the *Cruciferae* are almost entirely of the unicellular type; these are simple or, quite often, bifurcate or many-armed and complexly branched. There also occur, but rarely, capitate hairs which are either unicellular or divided by horizontal walls.

Within this group only four species of *Arabidella*, *A. glaucescens*, *A. filifolia*, *A. nasturtium* a nd *A. procumbens*, are quite glabrous. *A. eremigena* is covered, including the sepals and, in most cases, the fruit valves, with simple hairs; A. trisecta is usually described as glabrous, but almost all the plants seen have had on the lower parts of the stems and proximal parts of the leaves more or less numerous oblong to hemispherical papillae.

In the other genera the hairs are predominantly of the branched sort and occur on all parts of the plant except the stamens. In both species of Blennodia they are usually shortly stipitate and irregularly branched; in Scambopus, Pachymitus, Harmsiodoxa and Geococcus the hairs are shortly stipitate or sessile and are often twice bifurcate. Usually there are no constant differences among the hairs found on various parts of a particular plant, but in two species of Harmsiodoxa and in Scambopus the hairs at the distal end of the fruit valves are often simple or bifurcate with one arm very short, while those on the other parts of the plant are more branched.

Vegetative characters: Of the species discussed here four are perennial and suffruticose; the others are normally ephemerals, completing their life cycle within a few months. The suffruticose species are usually ma ny-stemmed, the stems arising either at ground level or from a short main stem when the plant is fully developed. These stems are equal and usually each is terminated by an inflorescence.

Very often the primary stems are themselves branched, the secondary stems arising from axillary buds; those branches bear inflorescences, but are sometimes much reduced, the inflorescences then seeming to arise directly from the leaf axils. Drabastrum alpestre may have several stem systems, those arising from a woody rhizomatous part.

The herbaceous species are also many-stemmed, the stems arising from ground level; very often these stems are unequal, the main central stem being leafless and shorter than the lateral stems. Occasionally or often, in _Arabidella procumbens_, the central stem does not develop and its terminal inflorescence appears to arise from the base of the plant. The lateral stems are erect or decumbent or prostrate; the latter state is seen only in _Arabidella procumbens_ and in a growth form of _Harmsiodoxa brevipes_. Usually the leafy lateral stems bear tertiary bra nches in the axils; as in the suffruticose species the axillary stems sometimes do not develop, so that there occur axillary inflorescences.

Geococcus pusillus is quite prostrate, consisting initially of only a rosette of leaves; older plants are quite complex in structure, the result of the intertwining at ground level of short secondary stems, leaf petioles and fruiting pedicels.

The root is usually slender and short, bearing a few laterals. In the perennial species it often becomes very woody and thick, the upper lateral roots as well becoming woody. _Drabastrum alpestre_ forms an underground rhizomatous part made up of the woody root and the basal parts of the aerial stem systems.

The stems are terete or finely fluted or quadrangular. When the plant is mature they are brown or reddish-purple in the herbaceous species and in the suffruticose species, brown to cream. These latter usually have a thick excoriating bark, at least at the base of the plant.

The basal leaves are usually crowded and form a rosette. They are always petiolate and rather variable in shape of the blade which can be oblong or (ob-)ovate or elliptic to suborbicular. They are sometimes entire or finely dentate, but most commonly are lyrate-pinnatifid so that the terminal lobe is the largest, the lateral segments gradually decreasing in size towards the leaf base. Usually the basal leaves are less than 10cm in length, but plants growing under favourable conditions may have leaves as long as 20cm.

The cauline leaves are always smaller than the basal ones although the lowermost cauline leaves may be much like the basal ones in shape. Those toward the top of the stem are gradually smaller and shortly petiolate or even sessile. These upper leaves are usually (ob-)ovate or elliptic in outline and are generally entire or dentate although those of Arabidella eremigena and A. procumbens may be quite deeply divided.

Four species of Arabidella have leaves which are narrow and entire or bi- or tri-sect or even more intricately divided. Three of these species are suffruticose and never have basal leaves, at least not clustered in a rosette. The leaves in these species are usually rather fleshy and are often glaucous.

The cauline leaves are solitary or fasciculate; they appear to be randomly scattered but the usual phyllotaxis is 5/8. In no species are the leaves amplexicaul or sagittate.

The flowers are borne on ebracteate racemes which are terminal on the stems. Initially the inflorescence appears corymbose but after anthesis begins the axis elongates and the infructescence is always racemose. The inflorescences vary in number of flowers, but there are rarely more than sixty.

Arabidella trisecta often has a few buds below the lowermost fruits but this is rarely seen in any of the other species. Very often one sees inflorescences which appear to be basal or axillary as a result of stems failing to develop. The fruits which develop from the basal inflorescences are usually borne on pedicels somewhat longer than those of the upper racemes.

An unusual case is that of Geococcus pusillus which is essentially stemless and has basal inflorescences of very small but perfect flowers. After flowering the fruit stalk elongates and turns downward, burying the fruit if the soil is soft enough. This species is usually found in sandy soil but when growing in harder soil the fruits are often only partly buried and are misshapen.

GENERAL ECOLOGY AND BIOLOGY

According to King et al (1960) Australia can be divided into six main topographic divisions. In the east the East Coastlands area extends from Cape York in the north to Victoria and "is made up of a series of river basins separated from each other by ridges projecting from the Eastern Highlands to the coast." This area has an adequate rainfall and places in northern Queensland receive more than 100 inches annually.

Behind these coastal lowlands are the Eastern Highlands extending from Cape York Peninsula to central Victoria. The highest parts are in southern Queensland, where there are elevations of more than 5000 feet, and in south-eastern New South Wales and adjacent parts of Victoria where there are several peaks of more than 6000 feet. The Eastern Highlands also receive an adequate rainfall.

From the Eastern Highlands the land to the westward falls away gradually to the Central Lowlands which are level and made up of three large basins. The northern-most of these is the Gulf of Carpentaria basin which, for the most part, lies in an area of heavy summer rains. To the south is the Lake Eyre basin which is extremely arid; the lakes are usually dry and salt-encrusted for the rivers feeding them run only rarely. Lying to the south and the south-east of the Lake Eyre basin is the Murra y-Darling basin in New South Wales. This is a great, almost treeless area extending from the western slopes of the Eastern Highlands into the arid interior of the continent.

The hottest and driest parts of Australia are on the Great Western Plateau which covers most of the western part of the continent. The plateau lies about 1000 to 2000 feet above sea-level and is quite level although there are some higher blocks and, in central Australia, some ranges of low mountains. In the southern part much of it is deset covered by parallel sandhills. West of the plateau is the plain which lies along the coast of Western Australia. In the north this is arid and barren, receiving an erratic rainfall.

King's last division includes the horsts and rifts of the southern part of South Australia. Spencer's and St. Vincent's Gulfs are rift valleys and to the east and north-east are the uplifts of the Mt. Lofty and Flinders Ranges. The western scarp of the Mt. Lofty Range is steep and receives adequate rainfall - about 21 inches annually in the city of Adelaide. On the east it gradually slopes into the Murray-Darling basin and has a much lower rainfall. Further north the Flinders Ranges are also in a lower rainfall area a nd show certain characteristics of a desert.

The Australian continent may be divided into three climatic zones, referred to as the Tropical, Temperate and Eremaean Zones (Burbidge, 1960).

The Tropical Zone is a crescent-shaped area covering north-western Western Australia, the northern part of the Northern Territory and the coastal parts of Queensland, extending into north-eastern New South Wales.

The Temperate Zone includes south-western Western Australia, the southern parts of South Australia which receive more than ten inches of rain annually, all of Victoria except the arid north-western corner, and New South Wales, including the Dividing Range and the area toward the coast.

The Eremaean Zone covers all of arid Australia, that is, most of

Western Australia, the central and southern parts of the Northern Territory, most of South Australia, south-western Queensland, western New South Wales a nd the north-western corner of Victoria. Between the Eremaean Zone and the areas of higher rainfall there are interzones; one lies in south-western South Australia, one in central New South Wales and one in central Queensland extending in to the Barkly Tableland in the eastern part of the Northern Territory.

The Tropical Zone receives most of its rain in the summer while the Temperate Zone is predominantly one of winter rainfall. The boundary between the areas of summer and winter rains runs approximately from Onslow on the north-western coast of Western Australia diagonally across the continent to a point on the east coast between Sydney and Brisbane. This line almost bisects the Eremaean Zone, but the rainfall in this Zone is erratic and differs very much from year to year. One of the driest parts is the Lake Eyre basin in north-eastern South Australia where the average annual rainfall is between four and six inches annually; there are many years in which less than an inch of rain falls.

The endemic genera of Cruciferae which are here discussed occur predominantly in the Eremaean Zone, south of the latitude of Alice Springs, and, to a lesser extent, in the temperate and interzonal areas immediately bordering the Eremaean Zone. This means that they occur in all of the topographic divisions of King et al except the western and eastern coastal plains.

Several species occur on both sides of the boundary between the areas of maximum summer and maximum winter rains, but in central Australia this boundary has little meaning. Rains here are erratic and may fall at any season. When rains do come one of the most impressive results is the sudden appearance of ephemerals, many of these species among them, which quickly flower, fruit and set seed.

According to Prescott (1944) and to the soils map in the Atlas of Australian Resources (1953) the soils in the Eremaean Zone are predominantly sandy or, at least, light in texture. In the arid central part of the continent the soils are almost entirely desert sands or desert loams (a term including a variety of brown or reddish soils), a large part of the sandy area being covered with surface stones. The stony plains occur chiefly in south-western Queensland and north-central South Australia.

The second largest area is that of the mallee soils which, in Western Australia, occur in the Kalgoorlie-Norseman area, in South Australia, on the Erye Peninsula extending north to Ooldea, on the Yorke Peninsula and in the Murray basin, in New South Wales in the south-western and central parts, and in Victoria in the north-western corner.

The mallee soils are solonized brown soils which contain a high percentage of salt and bear a vegetation of small species of Eucalyptus (mallees). Usually lime is found not far below the surface. In South Australia and Victoria these soils may lie in parallel sandridges, from east to west, or simply as sandhills with no particular orientation.

Another soil type of interest includes the heavy grey and black soils which are chiefly associated with former and existing river systems in northern and eastern Australia. These are fine-textured alluvial deposits, usually with lime in the lower horizon, although it ma y be present as flecks or concretions from the surface downward. They occur along the

Diamantina River and the Cooper's Creek in north-eastern South Australia and south-western Queensland, in a large area of north-central Queensland, along the Darling River and in north-central and south-central New South Wales.

In south-central Queensland, extending southward into New South Wales, is an area of brown soils of light texture. These are usually found bordering desert areas and are commonly red-brown and sandy; on the surface they are slightly acid, but in semi-arid parts of Queensland and New South Wales they have calcareous subsoils.

To the east and south-east of these soils and extending into north-central Victoria, as well as occurring north of Adelaide in South Australia, are areas of red-brown earths and terra rossas. They are usually loamy on the surface with a clay subsoil and some lime deeper. The terra rossas in South Australia are shallow soils formed on limestone.

In a small area south of Canberra and extending into Victoria are high moors. These soils are black and peaty and often water-logged.

The last soil type which must be considered includes the rendzinas and black earths of east-central Queensland. The black earths are deep clays usually derived from basalt or limestone; the rendzinas are shallow black earths on limestone or marl.

Some of these species are found predominantly on one soil type; for example, Blennodia canescens and B. pterosperma are associated with deep sand. Others, which are more widely spread, occur on a variety of soils; Arabidella eremigena grows on sand to the east of Lake Eyre, but in Queensland it is found on black earths in the Roma and Balonne River districts.

The non-woody species are generally considered to be annuals a nd usually the life cycle is completed in a few months. It seems that after fruits have begun to develop many of the leaves are dropped; this is perhaps a modification to reduce water loss. There is, however, evidence that some species may live for a longer time. Very often they germinate after one good rain and complete their reproductive cycle with the aid of one or two lighter rains. If there are other heavy rains, even after ma ny of the leaves have been shed, the plants send out new shoots which also flower and bear fruit. With an extremely fortunate series of rains it would probably be possible that a plant could live for more than a year, putting out new shoots after each rain.

The woody species, especially _Arabidella trisecta_, _A. filifolia_ and _A. glaucescens_, probably live for many years. In periods of drought they die back, sometimes to such an extent that only a few inches appear above ground. These may look like young plants but they have a very heavy woody root.

After rains they quickly produce flowering shoots and set fruit. Older plants sometimes have a very well developed basal part, from only part of which the current season's shoots come. If the plants are grazed by stock, this seems also to stimulate production of new shoots which sometimes give the plant a most misshapen appearance.

The herbaceous species often have a leafless central stem and a varying number of leafy laterals which are often decumbent. Sometimes the central stem does not develop and its terminal inflorescence then seems to be basal. This is often seen in _Pachymitus cardaminoides_ and _Arabidella procumbens_, the latter a species which is a lways prostrate.

Schulz (1924) remarked that in this species the central fruits develop before those on the lateral stems and suggests that this ensures seed production before the plant becomes large enough to attract grazing stock. However, the areas when A. procumbens is found have been stocked for fewer than one hundred years; the chief native animals which are herbivorous are kangaroos and emus and it is unlikely that these would ever have endangered the continued existence of this species. More probably the early development of the central fruits is a protection against the loss of the fruits on the lateral stems through heat and drought.

The number of seeds produced varies considerably from species to species. In one fruit of Scambopus curvipes there may be only three or four seeds; in a fruit of Arabidella trisecta, sixty or seventy. The order of maturation seems to be from the proximal end of the fruit to the distal and the dehiscence of the valves begins from the proximal end.

The seeds are light in weight and, especially those which are winged, can probably be carried considerable distances by the wind, although many must germinate where they fell beneath the parent plant. The thick patches of Arabidella nasturtium which one sees by road sides must certainly have come from seed produced by plants previously abundant at the same places.

Probably the seeds require a period of after-ripening which may be of some length. With several species the writer has had no success in a ttempting to make germinate seeds one and two years old. According to

Turner (1933) the Cruciferae are of the macrobiotic type and the seeds retain their power to germinate for fifteen or more years. However Ewart (1908) tested seeds of Arabidella trisecta, A. nasturtium and Harmsiodoxa blennodioides which had been collected from 12 to 57 years before and was unable to make them germinate.

It is certain that seeds of these species remain moist and unshriveled for many years. If seeds from plants collected more than one hundred years ago are pricked with a needle drops of moisture are immediately exuded. They also retain the ability to exude mucus when moistened for a surprisingly long time and this may be connected with the ability to germinate. After even the lightest rain a considerable amount of moisture would be trapped by the layer of mucus.

These plants seem to be rarely attacked by insects or fungi. The exceptions are Arabidella trisecta and A. filifolia which in the Flinders Ranges often have galled inflorescences. Unfortunately it is not known which insect is responsible for these.

The flowers are often sweetly scented, this being especially noticeable in A. filifolia and A. glaucescens, and the plants attract numerous insects. Probably it is easy for hybrids to be produced and crossing may occur between such species as Arabidella trisecta and A. nasturtium.

The problem of the origin of these species is difficult. Burbidge (1960) points out that although one can imagine relationships between the floras of the Temperate and Tropical Zones, and those of the Malaysian region and other parts of the Southern Hemisphere, it is not so easy to expla in the origin of certain Eremaean species in this way. Also it does not seem possible that they are derived from elements in the Temperate and Tropical Zones.

According to Schulz (1924) the Australian endemic Cruciferae in the Sisymbrieae - Arabidopsidinae are most closely related to genera of western America and western and central Asia.

Burbidge further suggests that the Eremaean flora may have developed "from the littoral and sand dune flora of the more extensive coasts of the Cretaceous." During the Creta ceous period much of Australia was covered by the sea and the coast lines would have then been much increased. It might have been possible that at that time there was some connection between Australia and the Mediterranean region.

However she points out that there are many difficulties associated with assuming a Cretaceous arrival for this flora, the chief one being that one would have expected during the intervening time a greater development of endemic forms, and a further dispersal of them into the Temperate and Tropical Zones, than has occurred.

Between the Cretaceous and the late Pleistocene or early Recent there is little that can be guessed about the Eremaean flora. Crocker and Wood (1947) visualized during the Recent, about 4000 to 6000 years ago, a great period of aridity during which much of the native flora was destroyed. However parts of the flora survived in more favoured sites; among the most important of these in central and southern Australia were the Musgrave Ranges in far-northern South Australia, the Flinders- Mt. Lofty chain, the Gawler Ranges across the top of the Eyre Peninsula, the Barrier Range in New South Wales, and the Grampians in Victoria.

These refuges were the centers from which recolonization proceeded after the climate improved. It could have proceeded in all directions from these areas and probably followed regions of similar soil types. Crocker and Wood suggested that the three main types were the sand dune system, the gibber downs and the mallee-desert loam complex.

In the case of most of the species one can make no guesses about the time of development, whether it was before or after the arid period or periods, or about ancestral types. With others the picture seems to be clearer and this especially true of the species of *Arabidella* which are discussed under their individual headings.

SURVEY OF SYSTEMATIC TREATMENTS OF THE CRUCIFERAE WITH DISCUSSION OF THE CHARACTERS USED IN CIRCUMSCRIBING TAXA OF INFRAFAMILIAL RANK

A.P. de Candolle (1821) - O.E. Schulz (1924, 1936):

The first to produce a more or less modern system for the Cruciferae was de Candolle in his Systema Naturale (1821). He here recognized 95 genera which are distributed among 21 tribes in 5 subordines (subfamilies). His chief criterion for distinguishing the subfamilies was the arra ngement of the cotyledons in relation to the radicle, a character still considered to be of great value in delimiting groups of infrafamilial rank.

The subfamilies recognized were the following:

(i) Pleurorhizeae with the cotyledons accumbent and flat

(ii) Notorhizeae with cotyledons incumbent and flat

(iii) Orthoploceae with the cotyledons incumbent, but longitudinally folded, the radicle lying in the sinus thus formed

(iv) Spirolobeae with the cotyledons incumbent but spirally rolled upon themselves

(v) Diplecolobeae with cotyledons incumbent and twice folded transversely

Within each subfamily the main criterion for delimiting tribes is the nature of the fruit; that is, whether it is a nucumentum (a short indehiscent fruit), a lomentum (a fruit separating transversely into one-seeded articles), or an ordinary siliqua or silicula, and also whether the fruit is latisept or angustisept. For exa mple, in subfamily Pleurorhizeae the tribes are (a) Pleurorhizeae Siliquosae (Arabideae), (b)

P. Latiseptae (Alyssineae), (c) P. Angustiseptae (Thlaspideae), (d) P. Nucamentaceae (Euclideae), (e) P. Septulateae (Anastaticeae), a group with dehiscent fruits in which the valves bear transverse processes on the inner side, and (f) P. Lomentaceae (Cakilineae). In describing the tribes de Candolle also mentioned certain features of the seeds, but these do not affect the arrangement dictated by the nature of the fruit.

For the circumscription of genera the characters are firstly those of the fruit; that is, whether it is terete or angled or compressed, whether it is linear or not and whether it is sessile or stipit ate. Also used are the characters of the valves; that is, if they are convex or flattened, if they are nerved or nerveless; the seeds, if they are compressed or plump, biseriate or uniseriate; the calyx, if it is opened or closed and if the sepals are basally saccate or not. Occasionally mentioned are features of the petals and filaments.

de Candolle realized the artificiality of previous systems and hoped that he had produced a natural one. His system, however, was also purely artificial, mainly because of his reliance on only a few characters. Still, as Hayek (1911) pointed out, this was one of the best systems produced up to his time, its strength lying in the fact that characters derived from the seed were used before those from the fruit. This system was the basis for many which followed, incorporating various modifications.

The first major work of Ferdinand Mueller was Plants indigenous to the Colony of Victoria (1960-1962) in which he used no characters not used by de Candolle in his treatment of the Cruciferae. Mueller here discussed only three genera relevant to the present work; that is, Sisymbrium, including S. nasturtioides and S. trisectum, Blennodia, with B. lasiocarpa, B. brevipes and B. curvipes, and Capsella (C. blennodina). The main distinguishing features in the descriptions are drawn from the calyx (erect or spreading, saccate or not), the fruit (cylindrical or ellipsoid) and the seeds (numerous or few, uniseriate or irregularly biseriate).

His prime criterion for separating Sisymbrium from Blennodia was that the latter has mucose seeds; this is somewhat difficult to understand for Mueller must surely have known that both his S. nasturtioides and S. trisectum have mucose seeds. He noted that Sisymbrium is most distingu guished from Erysimum by having fruits more cylindrical than quadrangular, while Blennodia is to be distinguished from Erysimum by its mucilaginous testa. Capsella is set apart from all the rest by the fruits having a rather low ratio of length to width.

After de Ca ndolle the first to treat the entire family were Bentham and Hooker (1862) who, by using fruit and seed characters, divided it into five series. The series were divided into ten tribes, these being separated by characters of the embryo and fruit and by arrangement of the seeds. Characters used for circumscribing genera were, among others, sepals erect or spreading, basally saccate or equal, fruit terete or compressed, septum smooth or wrinkled, and characters and arrangement of the seeds.

Blennodia, with six species, was included in the tribe Camelineae under Series A, the plants in this series being described as having "Siliqua elongata v. brevis, per totam longitudinem dehiscens. Valvae intus continuae, rarius septiferae, planae v. concavae, nec septo contrarie compressae, septo cum valvis aequilato." The _Camelineae_ were characterized by "Siliqua brevis v. elongata, oblonga, oviodea, v. globosa. Semina biseriata. Cotyledones incumbentes. Excepta: Semina interdum 1-seriata in _Blennodia_ et _Braya_." Among other genera placed in this tribe are _Stenopetalum_, _Geococcus_ and _Menkea_.

After the generic description of _Blennodia_ Bentham and Hooker remarked, "Genus vix a _Capsella_ distinguendum." This is rather surprising for _Capsella_ is placed in the tribe _Lepidineae_ under Series B, this series described as having "Siliqua brevis, pertotem longitudinem dehiscens. Valvae intus continuae, valde concavae, septo contrarie compressa, septum saepe angustissimum." In a note they mentioned that "Siliquae valvae septo contrarie occurrunt etiam in ... _Blennodia_ ... inter _Camelineas_." This suggests that Bentham and Hooker took note of the diversity of the species included in _Blennodia_ and one wonders that they did not split the genus.

Bentham and Hooker used no characters not used by de Candolle with the possible exception of the production of mucus by the testa. The system was criticized by Hayek who pointed out that Bentham and Hooker knew a great many more genera than did de Candolle, but were unable to produce a system which could be regarded as an improvement over his. He felt that their use of fruit characters before those of the embryo was particularly unfortunate for it split some natural groups.

In Bentham's Flora Australiensis (1863) the system followed is presumably that of Bentham and Hooker although there is no division into supra-generic groups. Bentham included in _Blennodia_ all the species then described (eleven). The generic characters used are those used in the Genera Plantarum - in fact, the descriptions are essentially those of the earlier work.

Of Blennodia Bentham remarked that it is "differing from Sisymbrium, to which some species have been referred, by the seeds never so completely overlapping each other as to form a single row, and generally in the copious mucus of the seeds, which is however not constant in all the species. From Capsella it differs in the longer pod, and in the dissepiment broader in proportion to the transverse diameter of the pod."

Bentham's inclusion of these eleven species in Blennodia cannot be considered as an advance over Mueller's distribution of them among Erysimum, Sisymbrium and Blennodia. They differ from Sisymbrium (in its modern delimitation) in that Sisymbrium species apparently never have mucose seeds, while all these do. Erysimum has a closed calyx and lateral glands which completely encircle the shorter stamens; the first feature is seen also in Blennodia canescens and B. pterosperma, both of which have, however, lateral glands open on the interior.

However these eleven species differ so much among themselves that it is difficult to imagine that Bentham who saw quite good material of these plants could have felt them to all belong to one genus.

After Bentham and Hooker the next major treatment of the family as a whole was that done by Prantl for the first edition of Die natürlichen Pflanzenfamilien (1891).

In 1862 appeared a paper by Fournier in which, by using characters of the embryo, he divided the family into three subfamilies, these including twenty-three tribes. Hayek praised this system highly but pointed out that Fournier gave diagnoses for neither the tribes nor the genera included in them.

During the interval between the work of Bentham and Hooker and that of Prantl there appeared only a few general discussions of the Cruciferae, such as those of Baillon (1872) and Pomel (1883), and treatments of various regional floras, but none of these modified the treatment of the Australian genera or, with a few exceptions, used any characters not used by de Candolle and Bentham and Hooker.

One of the exceptions was the work of Velenovsky (1883) who put forth a system for the family in which he essentially ignored the long-used embryo characters, but introduced the nature of the nectaries as a character of importance. These glands had long been recognized as being of some systematic importance, but Velenovsky was the first to use them in delimiting major divisions of the family. Unfortunately he investigated only a comparatively few genera, none of these being Australian.

After Velenovsky Prantl was the first to breakaway entirely from de Candolle's system - not, however, with always happy results. In his introduction Prantl pointed out that use of de Candolle's characters of fruit and embryo produces an artificial system, for genera much alike in all other respects stand far apart in different tribes and also the position of the cotyledons may vary within a genus.

He also complained that use of fruit characters tended to separate related genera, noting that "siliqua" and "silicula" are variable concepts and useful only within certain limits; he also criticized the concept of "angustisept" and "latisept" as used by de Candolle. Prantl meant that these characters can be misleading if used in making major divisions of the family; they are certainly e ssential in circumscribing groups of lower rank.

Prantl admitted that although it was easy to criticize de Candolle's system, it was equally difficult to construct a new one. He wrote that he considered it his duty to find new characters and thought that he had been successful in doing so in the stigma, that is, in whether it is capitate or bilobed. Other characters that he considered very useful were arrangement of the nectaries, the branching of the hairs and the disposition of the epidermal cells of the septum. These he used to characterize individual "Verwandtschaftkreise" or tribes.

To arrange the tribes into a natural system he used some further characters; the biseriate arrangement of the seeds he considered to be the most primitive, also treating the dehiscent, two-valved, many-seeded fruit as more primitive than the indehiscent, few- or one-seeded fruit. Prantl complained that he found this construction of a system difficult especially because he lacked material from tropical areas and from temperate regions in the Southern Hemisphere, areas where he supposed the most primitive of the forms to occur.

In spite of this Prantl thought that he had constructed rather natural subtribes, but admitted to having difficulty in expressing the relationships among them; he did however present a table in which various phylogenetic lines are tentatively shown. Certainly one cannot quarrel with Prantl's conclusion that the dehiscent, many-seeded fruit with biseriate seeds represents the primitive condition within the family, but his use of this fact did not produce a particularly fortunate result.

Hayek criticized sharply Prantl's system, especially objecting to his use of characters of pubescence in delimiting major groups (tribes). As Hayek pointed out, the absence or presence of hairs, and the branching of them or the lack of it, are useful characters at the specific or generic limits, but not above these. The division of all the known genera of Cruciferae into two groups on the basis of the occurrence of simple or branched hairs tends to widely separate some closely related genera. Furthermore Prantl placed too little reliance on characters of fruit and seed; this led to unlikely groupings such as the inclusion of Sisymbrium and Cakile in the subtribe Sisymbriinae. Prantl's table showing probably phylogenetic lines Hayek dismissed as fantasy. His series Lepidiinae - Sisymbriinae - Vellinae is said to be "ein phylogenetisches Unding".

In circums cribing genera Prantl used no new characters, relying on such things as presence or absence of the septum, nature of the calyx and the arrangement of the epidermal cells of the septum. There seems to have been no particular criticism of his generic concepts.

In Prantl's system Blennodia, said to include eleven species, and Geococcus are placed at the end with sixteen other genera of uncertain position. He mentioned B. trisecta Benth. as being glabrous, B. eremigena Benth. as having simple hairs, and B. lasiocarpa as having branched hairs, but said that he had been able to study only scanty material of the glabrous species.

Prantl commented that the stigma suggests that of the Thelypodieae which is described as "ringsum gleich entwickelt", but added that he could not decide if such diversity in pubescence could occur in a single genus. It should be noted that Prantl's tribe *Thelypodieae* includes such genera as *Pringlea*, *Streptanthus*, *Hexaptera* and *Chamira*, none of which show any real resemblance to pla nts of the *Blennodia* group.

Of *Geococcus* Prantl said only that it seemed to be related to *Blennodia*. In his description of the genus he mentioned a form with erect stems and the appearance of a *Cardamine*; this is probably based on a misunderstanding of Bentham's remark that *G. pusillus* could perhaps be a form of *Blennodia cardaminoides*.

There have been only a few attempts to construct for the *Cruciferae* a system which is based on anatomical characters. The most ambitious of these was that of Schweindler (1905) who used the orientation of the myrosin cells in the plant as a prime criterion. The first investigation of these had been made by Heinricher (1886) who recognized five groups according to the orientation of these cells in the leaves.

Schweindler investigated more genera and suggested three major groupings in the family; these are, Exo-Idioblastae, in which the myrosin cells are exclusively in the mesophyll and contain chlorophyll, Endo-Idioblastae, in which the myrosin tubes are free of chlorophyll and are closely associated with the vascular bundles, and Hetero-Idioblastae, which are plants with both sorts of myrosin cells. These three groups are equivalent to subfamilies; the last one includes only the tribe *Isatidinae*, but the Exo-Idioblastae are divided among eight tribes and the Endo-Idioblastae among five.

Schweindler's work is commented upon at some length by Hayek who stated that these groups certainly should not stand at the ra nk of subfamilies, but that the orientation of these cells seemed to be of some value in characterizing smaller groups. Hayek's main objection to Schweindler's use of this character was that it separated too widely groups which are closely related.

Hayek himself devised a method of investigating these cells in herbarium material, and in most of his descriptions of genera and of groups of higher rank, mentioned their position in the leaf, but they seem to have had no greattpart in influencing his delimitations of groups of any rank.

Hayek's own system (1911) was the first truely natural one and a marked improvement on that of Pra ntl. He knew 231 genera which were divided among ten tribes, most of which include several subtribes. The characters which Hayek used to delimit groups of supra-generic ra nk are chiefly drawn from the fruit, the nectaries, the myrosin cells, the s tigma and the epidermal cells of the septum.

He considerably reduced Prantl's list of genera of uncertain position, having only four such. One of these was _Geococcus_ which, he remarked, should perhaps be included in his tribe _Schizopetalae_; in Hayek's system this tribe includes five subtribes, one being _Stenopetalinae_, and stands near the beginning of the system, being placed in a direct evolutionary line from the _Thelypodieae_ which are the most primitive tribe.

Blennodia, apparently including the eleven species mentioned by Prantl, Hayek with some misgivings placed in his _Arabideae_ - _Sisymbriinae_, together with such genera as _Sisymbrium_, _Descurainia_, _Alyssopsis_ and _Chrysochamela_. He remarked that the genus was too little known for him to be certain of its place in the system, but that it very probably belonged here. Unfortunately Hayek was unable to see material of more than three species, these being B. trisecta, B. brevipes, and B. lasiocarpa (Harmsiodoxa blennodioides), but this was enough to convince him that the genus should be split. He was impressed by the diversity of trichome types in Blennodia (sensu Bentham) and twice noted that it was unlikely that they could be found in a single genus. He also commented on the difference in nectaries between B. trisecta, on the one hand, and B. brevipes and B. lasiocarpa on the other.

Hayek considered these species to be old, rather isolated types which stand closest to Sisymbrium, although he suggested that the capitate stigma indicated some relationship with the Thelypodieae. Still, he concluded that Blennodia included Australian representatives of the Sisymbriinae which are only rather distantly related to the other genera in this subtribe.

Hayek's system, by far the best produced to that time, was lightly dismissed by Schulz (1936) who repeated the criticism made by Thellung (1913) that Hayek's system was further removed from the practical requirements of determination than was that of Prantl. This criticism, which implies some defect inherent in the system, is not justified.

To support his criticism Thellung presented Hayek's conspectus, which gives the main features of tribes and subtribes and is not intended for purposes of determination, together with Prantl's dichotomous key to tribes and subtribes. The key is naturally better adapted to determinations than is the conspectus.

Hayek's system seems far more natural than does that of Prantl and it is only unfortunate that he did not construct a key; it should also be noted that Hayek's paper is of value because he presented a survey, with criticisms, of earlier treatments of the _Cruciferae_.

O.E.Schulz (1924, 1936):

Thirteen years after Hayek's publication the genus _Blennodia_ (sensu Bentham) was finally split. In 1924 O.E.Schulz published his revision of the tribe _Sisymbrieae_ for Das Pflanzenreich. Here the eleven species known to Bentham and Prantl are, with three subsequently described ones, distributed among nine genera.

These genera and the species included in them are listed in the following tabulation:

Blennodia R.Br.	_B. canescens_ R.Br.
Arabidella (FvM.)Schulz	_A. trisecta_ (FvM.)Schulz
Pseudarabidella Schulz	_P. filifolia_ (FvM.)Schulz
Drabastrum Schulz	_D. alpestre_ (FvM.)Schulz
Harmsiodoxa Schulz	_H. blennodioides_ (FvM.)Schulz
	H. brevipes (FvM.)Schulz
	H. cunninghamii (Benth.)Schulz
Micromystria Schulz	_M. nasturtium_ (FvM.)Schulz
	M. eremigena (FvM.)Schulz
Scambopus Schulz	_S. curvipes_ (FvM.)Schulz
	S. richardsii (FvM.)Schulz
Pachymitus Schulz	_P. cardaminoides_ (FvM.)Schulz
	P. lucae (FvM.)Schulz
Lemphoria Schulz	_L. procumbens_ (Tate)Schulz

Included with these genera is _Geococcus_ Drumm. ex Harv., with only one species, _G. pusillus_ Drumm. ex Harv.

Eight of these genera, including Blennodia itself, as well as Geococcus, are placed in the subtribe Arabidopsidinae Schulz which is chiefly to be distinguished from the other s ubtribes by the fact that its seeds are mucose. Arabidella (FvM.)Schulz is in the subtribe Sisymbriinae only because Schulz believed its seeds to be non-mucose.

This is not entirely understandable for, although there is no mention anywhere in the literature of the seeds of A. trisecta in regard to their production of mucus, specimens seen by Schulz have been investigated and their seeds are certainly mucose.

Schulz commented on the difficulties involved in determining generic limits when good distinctive characters are not known. However, he concluded that this tribe forms a very natural group which, by use of "oft subtile Charaktere", ca n be divided among six subtribes. In doing this characters such as the orientation of the nectaries, size of the seeds, nature of the testa, possession of glandular hairs and division of the leaves are useful. It may be noted that these last two characters, possession of glandular hairs and of bipinnatipartite leaves, serve to separate the subtribe Descurainiinae from the others.

Schulz continued to say that in delimiting genera he used all constant characters, especially those of the more important organs, and mentioned that among these are the number of ovules, size of the stigma, nature of the fruit, nervation of the septum and presence of a wing on the seed.

Other characters used by Schulz, as drawn from his generic descriptions, are position of the calyx (erect or spreading), presence or absence of a median nectary, details of the septum (smooth or rugulose), type of pubescence and dissection of the leaves. For separation of species within a genus, Schulz relied mainly on such features as details of the flowers and fruit as well as on differences in habit and details of pubescence and leaf dissection.

In Schulz's final work on the Cruciferae, the monograph of the family for the second edition of Die natürlichen Pflanzenfamilien (1936), his disposition of these genera is the same except that Blennodia is removed from the tribe Sisymbrieae to the Hesperideae. The essential differences between these tribes is that the Sisymbrieae have sepals almost always spreading and a stigma described as depressed-capitate or, sometimes, bilobed, while the Hesperideae have sepals erect a nd a stigma which is bilobed, the lobes sometimes being carpidial. These things being so, Blennodia certainly seems to fit more naturally into the latter tribe, for it is precisely by these characters that it differs most sharply from the other Australian genera.

In circumscribing these new genera Schulz made very astute use of a wide range of morphological characters - it may be noted that nowhere did he use the anatomical feature of the myrosin cells and, in fact, did not mention them in any of his descriptions.

Although Schulz saw only a very limited amount of material his treatment of the Australian Cruciferae is good. These genera can easily be recognized in a subjective, intuitive manner, but it is more difficult to express clearly the differences among them and to show why they should be separated. In this Schulz was remarkably successful.

Blennodia is well distinguished by its having a closed calyx and tectiform stigma, the other genera having an open calyx and a more or less depressed-capitate stigma. The other eight genera are distinguished one from the other by varying combinations of characters which are often subtle, although, according to Schulz, Arabidella is immediately set apart by having non-mucose seeds. Of the remaining genera, none can be said to have any one striking and distinctive feature.

Among the characters which seem, in Schulz's treatment, to be of most importance in this group are such as shape and colour of the petals, nature of the filaments - that is, if they are linear or basally expanded, presence or absence of the median glands, details of the structure of the lateral glands, number of ovules per ovary, shape of t the fruit - for example, linear or ellipsoid, habit and, to some extent, the nature of the fruiting pedicels.

Unfortunately Schulz's descriptions of Scambopus and Pseudarabidella are rather short because he saw only some drawings sent him from Kew and had to rely on these and on the descriptions of Mueller and of Bentham.

Schulz described no new species in this group, but did describe two new varieties, one in Arabidella trisecta and one in Pachymitus cardaminoides. Neither of these can be considered as "good"; both were published because Schulz had seen insufficient material to quite appreciate the range of variation within these species.

Apart from these minor points it must be emphasized that Schulz made a great move forward in splitting the genus Blennodia (sensu Bentham). There are certainly some inaccuracies in his descriptions, and, in some cases, the generic limits must be modified, but these are only the consequence of his having seen such a small amount of material.

In the present revision two new species and a new variety in another species are recognized but Schulz had probably seen no representatives of any of these newly-described taxa.

Schulz's system was criticised by Janchen (1942) who pointed out that Schulz paid little attention to the principles by which a phylogenetic system for this family should be constructed as they had been set out by Hayek. Janchen made some pointed criticisms of Schulz's work, but these are entirely at the levels of the supra-generic groupings. Janchen's own system is closer to that of Schulz than to that of Hayek, but differs from the former in several particulars. However the present work is concerned chiefly with generic circumscriptions and Janchen did not criticize Schulz's work in this respect. On the other hand the writer herself is not qualified to judge Schulz's delimitation of tribes and subtribes and must accept his major groups.

Present revision:

On the whole the criteria used in circumscribing the genera and the species are not different from those used by Schulz. It is often difficult to delimit groups of any rank in this family and subtle characters must be used. Characters drawn from any plant organ may be used, but this does not mean that they are all of equal value.

Most useful in circumscribing genera in the group here studied are such characters as shape of the fruit (linear or fusiform, terete or compressed), nature of the nectaries, position of the sepals (erect or spreading), nature of the stigma (tectiform or depressed-capitate), and the sort of mucus exuded by the testa, this last a character which to the writer's knowledge has not been used before.

For example, the fact that mucus exuded by seeds of species of *Arabidella* is clear helps to distinguish this genus from *Scambopus* and *Harmsiodoxa* in which each exudate of mucus appears to contain a spirally coiled thread.

In delimiting species such characters as details of fruit (sessile or stipitate) and of seed (plump or flattened, winged or wingless), habit (suffruticose or herbaceous, erect or prostrate), size and shape of the floral organs, details of pubescence (glabrous or pubescent, hairs erect or appressed, distribution pattern of differing sorts of hairs on the fruit valves), and details of the leaves (entire or trisect or pinnatisect) have been used.

With the exception of the type of mucus exuded by the testa these characters have been used before. However, although the characters used are not new, the results, in some respects, are.

One must agree with Schulz that *Blennodia* stands well a part from all the other Australian *Cruciferae* and it is now difficult to imagine that any other of these species could have been included in *Blennodia*. For the present Schulz's system must be accepted and this genus seems more likely to belong in the tribe *Hesperideae* than in the *Sisymbrieae*.

Of Schulz's new genera, *Drabastrum*, *Scambopus* and *Pachymitus* must stand almost as he circumscribed them, except that from the latter two genera one species each is removed. Each of these genera is monotypic and within this group stands somewhat isolated.

Harmsiodoxa still includes three species, but one is newly-described and *H. cunninghamii* has been shown to be a synonym of *H. blennodioides*. It must be admitted that *Scambopus* is closely related to *Harmsiodoxa* and some would probably join these two genera. However, *S. curvipes* differs from the three species of *Harmsiodoxa* in having median glands, the fruit quadrangular rather than terete or slightly latisept, and pedicels recurved rather than somewhat spreading. These differences seem enough to warrant retaining *Scambopus* as a distinct genus.

Drabastrum is like *Scambopus* in that it seems to have many features in common with *Harmsiodoxa*, but it too differs in having quadrangular fruit and also in the sort of mucus exuded by the testa. In all species of *Harmsiodoxa* the mucus is of the sort in which each individual exudate appears to contain a grey thread; in *Drabastrum* the mucus is clear. For these reasons, and because of the geographical and ecological isolation of *D. alpestre*, it seems more realistic to maintain it as a distinct genus.

Geococcus (*G. pusillus* only) is maintained. It may be related to *Pachymitus* and does resemble this genus in some ways, but it is certain that it is not to be considered a mere form of *P. cardaminoides*.

The largest of the genera is *Arabidella*, including six species. *Pseudarabidella filifolia* (Fv^M.)Schulz is so much like *A. trisecta* that it seems impossible to maintain them in distinct genera. The seeds of *A. trisecta* are mucose to the same degree as are those of *P. filifolia*; this knowledge removes the only difference between these genera in Schulz's treatment.

J.M.Black (1937) commented that most of the collections of *P. filifolia* had leaves trisect rather than entire, the "typical form" being rather rare. This form which has trisect leaves and also differs from the "typical form" in having fruits more often ellipsoid rather than linear, as well as in some other respects, has been separated as a distinct species, A. glaucescens.

The species included by Schulz in Micromystria and Lemphoria have, in the present revision, been also included in Arabidella. These species are herbaceous and differ considerably in habit from the suffruticose A. trisecta, A. filifolia and A. glaucescens, but the resemblances between these groups are strong enough to make it certain that they all belong in the genus Arabidella. The relationships within this genus are discussed with the general discussion of these species.

If Schulz's division of the family be accepted, Blennodia must remain in the tribe Hesperideae and the other genera, including Arabidella, in the Sisymbrieae - Arabidopsidinae. These genera are distinct, one from the other, but have enough characters in common to warrant their inclusion in thissubtribe.

TABLES

On page 70 is a table showing the distribution of thirteen characteristics among the species here discussed. These characters are not of equal value; in particular, characteristics of the testa and pedicels are of less importance than those of fruit and flowers. However, in the Cruciferae one must often use quite subtle differences in circumscribing genera and species and these have all proved useful in this study.

On page 71 is shown the number of these features which each of these species has in common with each of the others. The generic groupings stand out quite sharply by having 12 or 13 characters in common among the species of a given genus.

It should be noted that these figures do indicate the differences between Arabidella eremigena and A. procumbens on the one hand, and the remaining species of Arabidella on the other, but these differences are not sharp enough to warrant segregation of A. eremigena and A. procumbens into a separate genus. This is further discussed under the treatment of the individual species.

TABLE 1

Species / Character	sepals erect	sepals saccate	lateral glands circular	stigma capitate	ramose hairs	ovules 40	mucus with thread	suffruticose	testa reticulate	pedicels recurved	median gland present	fruit linear	fruit in section
B. canescens	×	×			×		×				×	×	T,L
B. pterosperma	×	×			×		×			×	×	×	L
S. curvipes			×	×	×	×	×			×	×		Q
D.alpestre			×	×	×	×		×	×				Q
P. cardaminoides			×	×	×	×					×	×	T,Q
G. pusillus				×	×	×						×	T,L
H. brevipes			×	×	×	×	×						T,L
H. blennodioides			×	×	×	×	×						T,L
H. puberula			×	×	×	×	×						T,L
A. eremigena			×	×								×	A
A. procumbens			×	×								×	A
A. trisecta			×	×				×			×	×	L
A. nasturtium			×	×							×	×	T,L
A. glaucescens			×	×				×			×	×	T,L
A. filifolia			×	×				×			×	×	L

N.B.: A = angustisept

L = latisept

Q = quadrangular

T = terete

TABLE 2

	B. canescens	B. pterosperma	S. curvipes	D. alpestre	P. cardaminoides	G. pusillus	H. brevipes	H. blennodioides	H. puberula	A. eremigena	A. procumbens	A. trisecta	A. nasturtium	A. glaucescens	A. filifolia
B. canescens	13														
B. pterosperma	12	13													
S. curvipes	5	6	13												
D. alpestre	2	1	7	13											
P. cardaminoides	6	5	10	8	13										
G. pusillus	7	6	7	8	10	13									
H. brevipes	6	5	10	8	9	10	13								
H. blennodioides	6	5	10	8	9	10	13	13							
H. puberula	6	5	10	8	9	10	13	13	13						
A. eremigena	5	4	6	6	9	9	8	8	8	13					
A. procumbens	5	4	6	6	9	11	8	8	8	13	13				
A. trisecta	6	5	6	6	9	7	7	7	7	10	10	13			
A. nasturtium	7	6	7	5	10	9	8	8	8	9	11	12	13		
A. glaucescens	6	5	6	6	9	8	7	7	7	9	10	13	12	13	
A. filifolia	6	5	6	6	9	8	7	7	7	9	10	13	12	12	13

SYSTEMATIC TREATMENT

KEY TO THE GENERA OF CRUCIFERAE WITH DEHISCENT FRUITS AND INCUMBENT COTYLEDONS WHICH AT THE PRESENT TIME MAY BE FOUND IN AUSTRALIA

A Fruit compressed dorso-ventrally or terete, valves flat or rounded, septum broad (also next page)

B Fruit usually 4-angled, valves with nerve prominent

C Fruit linear, leaves amplexicaul .... CONRINGIA *

C Fruit fusiform, leaves not amplexicaul

D Fruiting pedicels spreading .... DRABASTRUM

D Fruiting pedicels recurved .... SCAMBOPUS

B Fruit rounded or flattened, valves with nerve distinct to obsolete

E Seeds mucose (also next page)

F Fruit obovoid, cauline leaves sagittate ...... CAMELINA *

F Fruit linear to fusiform, cauline leaves not sagittate

G Petals drawn into slender point .... STENOPETALUM

G Petals obtuse

H Sepals erect, stigma 2-lobed or tectiform . BLENNODIA

H Sepals spreading, stigma capitate

I Plant prostrate, fruit buried .... GEOCOCCUS

I Plant erect, fruit aerial

J Plants glabrous, papillose or with simple hairs ..... ARABIDELLA

J Plants with branched hairs

K Fruit fusiform .... HARMSIODOXA

K Fruit linear .... PACHYMITUS

E Seeds not mucose

L Fruit linear, septum fully developed.......... SISYMBRIUM *

L Fruit spherical to obovoid, septum reduced to narrow rim......MENKEA

A Fruit compressed laterally, valves very convex or keeled, septum narrow

M Fruit linear.. ARABIDELLA

M Fruit orbicular to ovate or obcordate

N Fruit notched at summit

O Ovary with ca. 100-200 ovules................. CARINAVALVA

O Ovary with fewer than 100 ovules

P Ovary with 2 ovules....................... LEPIDIUM

P Ovary with ca. 10-30 ovules............... CAPSELLA

N Fruit entire at summit

Q Fruit valves rounded........................ CUPHONOTUS

Q Fruit valves keeled or winged

R Ovary with ca, 100-200 ovules............. CARINAVALVA

R Ovary with ca. 10-25 ovules............... HYMENOLOBUS

N.B.: The genera marked with an asterisk are those which are represented in Australia by introduced species only.

BLENNODIA R.BR.

(βλεννώδης = mucose; the seeds are mucose when moistened)

R. Brown in Sturt, Exped. 2(1849)67; FvM., Pl. Col. Vict. 1(1860-1862)40; Benth. & Hook., Gen. Pl. 1(1862)61,82; Benth., Fl. Austral. 1(1863)73; Prantl, Pflfam. 3(2)(1891)204; Hayek, Beih. Bot. Centralbl. 27(1911)167,186,325; Black, Fl. S. Austral.(1924)246; Schulz, Pflreich. 86(1936)265; Schulz, Pflfam.ed.2 17b(1936)571; Black, Fl. S. Austral. ed.2(1948)374.

Original description: "Blennodia. Cruciferarum genus, prope Matthiolam. Char. Gen. - Calyx clausus, foliolis lateralibus basi saccatis. Petala aequalis, laminis obovatis. Stamina : filamentis edentulis. Ovarium lineare. Stylus brevissimus. Stigma bilobum dilatatum. Siliqua linearis valvis convexiusculis, stigmate coronata, polysperma. Semina aptera pube fibroso-mucose tecta! Cotyledones incumbentes! Herba (v. Suffrutex) erecta, ramosa canescens, pube ramosa; foliis lato-linearibus remote dentatis; racemis terminalibus."

Description: Calyx closed; sepals erect or very slightly spreading, usually green, less often lavender, with a narrow pink or colourless hyaline margin, on abaxial side sparsely pubescent with shortly stipitate branched hairs; lateral sepals narrowly oblong, usually slightly wider than the median, basally saccate, distally tapering and acute to subacute; median sepals narrowly oblong to obovate, not basally saccate or, rarely, slightly so, distally tapering gently and rounded to truncate.

Petals about twice as long as the sepals, white to lavender, with distinct blade and claw; blades oblong to obovate, entire or sinuate, rounded or truncate, often retuse or emarginate, finely veined, tapering into a more or less linear claw about as long as or slightly longer than the blade.

Stamens 6, erect, filaments linear or dilated toward the base, sometimes distinctly winged, the filaments of the diagonal stamens often unequally widened, the greater width being on the lateral side of the vein, white or pink; anthers oblong, obtuse, yellow.

Lateral glands each surrounding the base of a lateral stamen, horseshoe- or vee-shaped, open on the interior; median glands small, triangular, one on either side of the median line or, if more fully developed, forming a thinly torose ridge at the base of the diagonal stamens.

Pistil sessile, cylindrical, densely tomentose with shortly stipitate irregularly branched hairs, rarely with a few simple hairs; ovules biseriate on slender pendulous funicles, ca. 20-40 per cell; style linear, stout, short or obsolete; stigma fleshy, depressed-capitate or, as seen from the median line, tectiform, broader than the style.

Fruit bilocular, bivalved, dehiscent, sessile, linear, elongate and straight, terete or slightly flattened dorso-ventrally, therefore, latisept; valves convex or flat, with a distinct midnerve and a fine network of more or less parallel anastomosing veins, often somewhat constricted between the seeds, brown or reddish-purple, sparsely to densely pubescent with sessile or shortly stipitate branched hairs, proximally rounded to truncate, distally rounded; style linear to broadly obconical, sometimes greatly thickened and almost spherical or obsolete; stigma capitate or tectiform, usually centrally depressed, usually purple, often not as wide as the style.

Septum white or colourless, opaque or translucent, sometimes fenestrate at the distal end, with median nerve, smooth or rugose; funicles short, triangular to linear, usually slightly curved, sometimes falcate.

Seeds subbiseriate, ca. 20-40 per cell, broadly elliptic, plump or flattened, wingless or surrounded by a membranous wing; testa light golden-brown to dark brown, finely papillose, when moistened, mucose, the mucus exuded as discrete spiral threads, thus appearing radiate; embryo exactly notorrhizal, the radicle slightly longer than the cotyledons.

Plant annual, herbaceous, usually many-stemmed, erect, canescent or tomentose with simple or irregularly branched ha irs; stems arising from a basal rosette of leaves, equal or with a leafless or almost so central stem and leafy decumbent lateral stems, those often branched, the secondary stems sometimes reduced to the terminal inflorescence.

Basal leaves rosulate, obovate to oblong, pinnatifid or, less often, entire, tapering into slender petioles.

Cauline leaves scattered, obovate to elliptic, entire or remotely dentate, rarely pinnatifid, usually sessile, occasionally on a short linear to cuneate petiole.

Root a slender taproot.

Inflorescences ebracteate, terminal on stems, dense, initially corymbose but after anthesis elongating and then racemose; buds just before anthesis oblong; flowering pedicels sometimes rather stout, erect or spreading or recurved; fruiting pedicels erect to spreading or recurved.

Two species in semi-arid parts of the Northern Territory, South Australia, Queensland and New South Wales.

Blennodia canescens R.Br. - TYPE SPECIES

Blennodia pterosperma (Black)Black

Key to the species of Blennodia:

A Fruiting pedicels erect, seeds plump .... B. canescens

A Fruiting pedicels recurved, seeds flattened ...... B. pterosperma

Relationships: The genus Blennodia is not closely related to any other Australian members of the family. In technical characters this genus seems to have most in common with some species of Hesperis L. and Blennodia certainly fits more naturally into the tribe Hesperideae than into the Sisymbrieae.

<u>BLENNODIA</u> <u>CANESCENS</u> R.BR.

(canescens = hoary; the dense pubescence gives the plant a hoary appearance)

R. Brown in Sturt, Exped. 2(1849)67; FvM., Enum. Pl. Gregory (1859) 4; FvM., Rep. Babb. Exped.(1859)7; Benth., Fl. Austral. 1(1863)76; Tate, TRSSA 22(1898)123; Black, TRSSA 39(1915)830; Ising, TRSSA 46 (1922)597; Black, Fl. S. Austral.(1924)248; Schulz, Pflrch.86(1924) 266; Murray, TRSSA 55(1933)105; Black, TRSSA 61(1937)243; Black, Fl. S. Austral. ed.2(1948)376; Jessup, TRSSA 74(1951)244,245,262; Chippendale, TRSSA 82(1959)329.

N.B.: Throughout this work the abbreviation "TRSSA" is used for Transactions of the Royal Society of South Australia.

<u>Sisymbrium</u> <u>blennodia</u> FvM., Fragm. 7(1869)20 [non <u>Sisymbrium</u> <u>canescens</u> Nutt., Gen. Am. 2(1818)68]

<u>Erysimum</u> <u>blennodia</u> (FvM.)FvM., Fragm. 10(1876)78 [non <u>Erysimum</u> <u>canescens</u> Moench, Meth. Suppl.(1802)86]; Tate, TRSSA 3(1880)51; FvM., Census 1(1882)5; Tate, TRSSA 6(1883)101; Winnecke, TRSSA 8(1886)10; FvM., TRSSA 9(1887)213; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1 (1889)9; Tate, Fl. S. Austral. (1890)16,206; FvM., TRSSA 13(1890)96; FvM. & Tate, TRSSA 16(1896)335; Koch, TRSSA 22(1898)102.

Both <u>Sisymbrium</u> <u>blennodia</u> FvM. and <u>Erysimum</u> <u>blennodia</u> (FvM.) FvM. are nomenclatural synonyms of <u>Blennodia</u> <u>canescens</u> R.Br., these names being based on the same type.

<u>Figures</u>: Schulz, Pflrch. 86(1924)fig.58; Schulz, Pflfam. ed.2 17b (1936)fig.347; Blake, Proc. Royl Soc. Qld. 49(1938)fig.23; Figure 1, 2A,B,E-L.

Original description: "Desc. Suffruticosa, sesquipedalis, caule ramisque teretibus. Folia vix pollicaria paucidentata. Racemi multiflori, erecti, ebracteati. Flores albicantes. Calyx incano-pubescens. Petalorum ungues calyce paulo longiores. Sta mina 6, tetradyname, filamentis linearibus membranaceis apice sensim angustato."

Description: Plant herbaceous annual canescent with sessile or shortly stipitate stellate or irregularly branched hairs; root a slender taproot; stems few to many, to about 50cm, erect, terete or, often, finely fluted, more or less leafy, often reddish-purple, arising from a basal rosette of leaves.

Basal leaves to 12cm in length, sinuate-pinnatifid with 2-5 lobes per side, the lobes more or less linear and obtuse to subacute; more rarely entire or with a few small teeth, these leaves usually linear to narrowly spathulate; leaves tapering into a long slender petiole.

Cauline leaves 3-5[-7]cm in length, broadly linear or spathulate, usually entire or with a few teenth per side, obtuse to subacute, sessile or on a cuneate base, or, more rarely, shortly petiolate.

Inflorescences usually 10-25-flowered, dense, then elongating after anthesis; flowering pedicels 3-10[-15]mm in length, rather stout, erect to slightly spreading; buds oblong-ovate, almost oblong just before anthesis.

Sepals oblong to obovate, green or, especially in northern material, lavender, usually with a narrow hyaline margin; lateral sepals [4.7-]5.2-6.0[-6.5]mm long, [1.2-]1.5-1.8[-2.0]mm wide, average ratio length to width 3.4:1, usually more or less oblong, acute to subacute, basally saccate; median sepals [4.4-]5.0-5.5[-5.8]mm long, [0.9-]1.2-1.7[-2.1] mm wide, average ratio length to width 3.8:1, usually more or less oblong, tapering distally and obtuse, not, or only very slightly, basally saccate.

Petals about twice as long as the sepals, ca. 9.5-13.0mm long, clawed; blades ca. 3.0-6.7x2.0-3.7mm, ratio length to width 1.3:1-2.5:1, average 1.7:1, oblong to broadly cuneate, apically rounded ,truncate or emarginate, tapering into a more or less linear claw, often winged, usually slightly longer than the blade, blade averaging 44 per cent of the total petal length; petals white, pink or lavender, the last seen especially on northern material, in sicco yellowish to dark brown.

Lateral stamens [4.7-]5.5-6.0[-6.5]mm long, filaments usually more or less linear, 0.4-1.0mm wide, green to pink; anthers 1.6-2.3mm long, average 2.0mm, rectangular, obtuse, yellow; diagonal stamens [6.5-] 7.0-8.0mm long, filaments 0.5-0.8mm wide, linear or widened toward the base, the widening being greater on the lateral side of the vein; anthers 1.2-2.0mm long, average 1.6mm, oblong, obtuse, yellow.

Pistil 4.0-6.5mm long, cylindrical, sessile or on a short linear stipe, densely tomentose with very short hairs; style obsolete or short and linear, crowned with a fleshy testiform or capitate stigma, this usually depressed; nectaries as in generic description, usually well-developed, bright green.

Fruiting pedicels [4-]8-13[-16]mm long, 0.4-0.7[-1.0]mm, averaging 0.6 mm in diameter, rather stout, spreading to erect;

Fruit [1.5-]2.5-4.0[-5.5]cm long, septum 1.4-2.3mm wide, usually less than 2.0mm; valves with distinct but not prominent nerve, usually not constricted between seeds, rather densely pubescent, proximally usually truncate, distally rounded to subacute; style [2.0-]2.5-4.0mm, linear or broadly obconical or so thickened as to be almost spherical; stigma tectiform or sometimes reduced and appearing depressed-capitate, usually purple; septum white, usually opaque and rugulose with median nerve, the epidermal cells being square to oblong, sometimes irregularly pentagonal, with straight or slightly curved walls; funicles to about 0.5mm in length, more or less linear to broadly triangular, usually slightly curved, pendulous.

Seeds ca. 1.1-1.5x0.7-1.0mm, subbiseriate, ca. 20-40 per cell, oval, plump, wingless or occasionally with a small obtusely triangular wing at the distal end; testa golden- to darkbrown, usually with a darker area at the hilum, when moistened, exuding a radiate mucus to ½mm wide, the mucus emerging as a distinct spiral thread from each papilla of the testa as soon as moistened; embryo with radicle same length or slightly longer than the cotyledons; average thickness of embryos from soaked seeds 0.44 mm.

Type locality: "Loc. In arenosis depressis"

Holotype: C. Sturt, No. 12 - BM!

Other specimens seen: (see Map 1 - page 99)

South Australia: - Cooper's Creek; 1883; J. Flierl 66 - MEL: Mulloorina Stn.;18.7.1955; R.Hill 134 - AD: Mulloorina Stn.; 18.7.1955; R.Hill 115: 16 miles S. of Moolawatana Stn.;22.8.1963; Kuchel 876 - AD: Mt. Lyndhurst; Aug.1899; M.Koch 329 - AD, NSW53725: Lake Torrens Plain; 11.6. 18883 R.Tate - AD: North of Lake Eyre; June,1887; Newland 75 - MEL: Lake Eyre; Sept.1903; Baldwin Spencer - NSW53713: 8km E. Macumba H.S.; 3.9.1931; Ising 2504 - AD: Pedirka; 26.8.1932; Ising - AD: Mt. Sarah,

; creek flat 1 mile S. homestead; 14.8.1963; Lothian 2112 - AD: 36 miles west Oodnadatta; 14.8.1963; Lothian 1998 - AD: Oodnadatta; 29.7.1952; Ising - AD: 1 mile S. Oodnadatta; 18.9.1963; Shaw 225 - AD: 2 miles S. Oodnadatta; 18.9.1963; Shaw 221 - AD: 21 miles N. of Warrina; 7.8. 1963; Lothian 1382 - AD: Warrina ;1890; Richards - MEL: Warrina; 1890; Richards - MEL: between Coward Springs and Edward Creek; 18.8.1930; Cleland - AD: Boortha na; 1954; Lothian L34/54 - AD: 20 miles N. William Creek; 6.8.1963; Kuchel 697 - AD: William Creek; 18.8.1930; Cleland - AD: William Creek; 10.9.1930: Cleland - AD: Irrapatana; 7.8.1931; Cleland-AD: Irrapatana; 21.8.1931; Ising 2502 - AD: Alberrie Creek; 19.8.1932; Ising - AD: Arcoona; Sept.-Oct. 1927; Murray 84 - AD: Mt. Gunson Mine; Aug.1915; Beckworth - AD: N.W. of Port Augusta; July,1915; per Mrs. Smedley - AD: near Spencer's Gulf; 1881; Latterf - MEL: Musgrave Ranges; Aug.1933; Cleland - AD: Ernabella; 13.7.1943; Young - MEL: halfway between Moorilyanna and Ernabella; 7.8.1933; Cleland - AD: Dg Rose Hill Stn.; 1954; Lothian 758 - AD: Everard Range; 3.7.1960; Cleland - AD: 30 miles E. Everard Park H.S.; 12.8.1963; Wilson 2579 - AD,UC,Z: Wantapella Bore; 29.7.1962; Kuchel 38 - AD: Arkaringa Creek; 16.5.1891; Helms - AD,MEL, NSW53722: 55 miles S.E. Coober Pedy on Mt. Eba road; 15.8.1962; Wilson 2604 - AD: 50 miles south Mt. Eba H.S.; 28.7.1962; Kuchel 32 - AD: Coondambo Siding; 2.8.1963; Kuchel 555 - AD: Tarcoola; 5.9.1920; Ising 1192 - AD: Tarcoola; 21.9.1920; Ising - AD: Tarcoola; 19.9.1920; anon. - AD: Tarcoola; June,1954; Deland - AD: Tarcoola; 21.9.1920; anon. - AD: Wynbring; 20.9.1920; Ising coll. - AD: Wynbring; 20.8.1926; Cleland - AD: Wynbring; 20.8.1926; Cleland - AD: between Ooldea and the Elizabeth River; June,1875; Young (Elder [Giles] Exped.) - AD: Wynbring; Sept. 1920; Ising 1393 - MEL, NSW53717;BRI: Elizabeth R.; 1858; Herrgott - MEL

New South Wales: - between the Darling and Lachlan; ?; Burkitt - MEL: Darling River; ?;? - NSW53721: Darling River; ?;? - MEL: Paroo River; 1923; Collins - SYD: Yandama Stn.; July, 1910; Collier - NSW53727.

Queensland: - Thylungra; 4.7.1942; Allen 237 - CANB(p.i.), NE: Mulligan River; Feb.,1904; Clarke - NSW53726: Barcoo;?;? - MEL: between Stokes Range and Cooper's Creek;?; Wheeler - MEL:

Northern Territory: - 18 miles S.S.E of Indiana Stn.; 11.9.1956; Lazarides 5965 - NT, PERTH, CANB(p.i.&l.r.r.s.), BRI, AD, NSW53731: Simpson Desert near Hale River; 8.9.1955; Perry 5418 - CANB(l.r.r.s.): 70 miles S.E. of Ringwood; 8.9.1955; Winkworth 1286 - NT, CANB(p.i.), MEL, NSW 53728: Charlotte Water; 1887; Byrne - MEL: west of Charlotte Waters; May, 1926; Basedow 3 (MacKay Exploring Exped.) - AD: 19 miles S.E. of Alice Springs Township; 17.8.1956; Lazarides 5721 - NT, PERTH, AD, NSW53732: Ooraminna Pass, 30 miles S. Alice Springs; 29.7.1956; Chippendale - AD, NT 2381: 13 miles N. Deep Well Siding; 3.9.1956; Chippendale - AD, NT 2714: 20 miles S. Alice Springs; 21.8.1962; Nelson 465 - AD,NT 9541: 5 miles S.W. of Deep Well Stn.; 19.8.1956; Lazarides 5747 - NT, AD, BRI, NSW53730, CANB(p.i.&l.r.r.s.), PERTH: Bundooma; 29.8.1955; Ryche - AD: Rumbalara; 4.9.1945; Gilbert - NE: Hermannsburg; 1906-1908; Strehlow 4 - B: vicinity Hermannsburg Mission; 23.9.1955; Burbidge & Gray 4251 - CANB(p.i.): near the Finke River; 1880; Warburton - NSW53719: between Horseshoe Bend and Hermannsburg; May-Sept., 1920; Basedow - AD: 5 miles E. Henbury H.S.; 21.7.1955; McKay - NT 273: 9 miles S. Henbury; 5.7.1955; Winkworth 1138 - NT: 1 mile W. Umbea ra Well; 7.7.1955; Chippendale - NT 1356, CANB(p.i.), BRI, NSW53718, AD: 6 miles S. Kulgera Stn.; 1954; Lothian 726 - AD: $17\frac{1}{2}$ miles E. New Crown H.S.; 5.9.1956; Chippendale - AD, NT 2802: 5 miles N. Mt. Cavanagh Stn.; 12.9.1955; Perry 5501 - AD, PERTH, NT, CANB(p.l.&l.r.r.s.):

<u>Northern Territory or South Australia</u>: - N. Musgrave Ranges, Border of Northern Territory and South Austra lia; July, 1926; Basedow 256 - NSW 53733, PERTH: Central Australia; 1883; Winnecke - MEL: Alice Springs-Marree; Aug.,1947; Ward - SYD:

<u>Western Austra lia</u>: Perth [Kalgoorlie?]; Sept.,1913; Ashby - BM

<u>Distribution</u>: In the Northern Territory <u>B</u>. <u>canescens</u> is known from the area between Alice Springs and the South Australian border, and from the Simpson Desert; it probably occurs also in the south-western part of the Northern Territory, but has not yet been collected there.

In South Australia this species is found in the north-western and northern parts of the state, but apparently not in the Flinders Ranges and the Lake Frome Basin; its absence here is surprising for it has been collected in the adjacent parts of New South Wales.

From New South Wales and Queensland there are only scattered collections, but these are from the north-western and south-western parts of the respective states. Blake mentions it as being very common in the Channel Country in south-western Queensla nd.

In the herbarium of the British Museum is a collection made by Ashby in Western Australia a nd labelled "Perth"; however there is on the label a pencil note suggesting that it was probably collected near Kalgoorlie and this does seem much more likely. <u>B</u>. <u>canescens</u> probably occurs in the eastern part of Western Australia for in South Australia it has been collected as far west a s Ooldea and Wynbring.

<u>Observations</u>: Within this species there is comparatively little variation in growth form and size of the floral organs and fruit. The most

noticeable variation is in the size a nd shape of the style which can be linear or globose or any shape between these. In the flowering stage, the stigma is almost always tectiform with the lobes extending over the valves, but in the fruit this is often difficult to see for the stigma becomes distorted by growth of the style.

The petals are usually white, but pink or lavender petals are not uncommon. These coloured ones seem to occur at random for they have been reported on plants from Mt. Lyndhurst, Arcoona a nd De Rose Hill Stn., all in South Australia, and from Ooraminna Pass and Henbury Stn. in the Northern Territory. Unfortunately unless a note was made at the time of collection one cannot be sure of the colour for originally white petals sometimes take on a lavender tinge when dried. Sepals are sometimes pink or lavender, but this seems to be not correlated with petal colour for coloured sepals are found on flowers with either white or coloured petals.

The testa is finely papillose; when the seed is moistened mucus is rapidly exuded as a long and distinct spiral thread, one from each papilla. It should be noted that the seeds have usually been described as wingless; occasionally there are found seeds which have a small triangular wing at the distal end. One also sees seeds which a re apparently surrounded by a narrow wing, but this is a consequence of incomplete development of the embryo with the peripheral parts of the integuments being flattened around it.

To the unaided eye the entire plant looks hoary. All parts except the petals a nd stamens and root are covered with hairs which are usually shortly stipitate, although some few are sessile, are are irregularly branched or bifurcate. Many of the hairs, especially those on the leaves, are twice bifurcate; that is, each arm of a bifurcate hair is again forked. There sometimes are a few additional arms on these hairs, but the basic pattern is twice bifurcate.

Ecology and Biology: This species is not uncommon in semi-arid parts of South Australia and the adjacent parts of Queensland, New South Wales and the Northern Territory. Usually it grows in deep sand and under favourable conditions large sand hills may be covered with it. Allen s.n. (CANB, NE) from Thylungra, Queensland, is annotated as having grown on "red stony Gidgea and Boree flats" and Chippendale s.n. (AD, NT 2381) is described as "common in small area, on rocky ground", but these are probably less common occurrences.

Collections from Arcoona (Murray 84 - AD) are noted as occurring on "bluebush [Kochia] flat and sandhills" and Jessup (1951), in discussing the Acacia linophylla-A. ramulosa association which occurs on sandhills on Arcoona and neighboring stations west of Lake Torrens, mentions B. canescens as, a long with Calandrinia remota and Myriocephalus stuartii, being common after winter rains. He also remarked that it occurs rather rarely in mulga (Acacia aneura) swamps in the same area.

Lazarides 5965 (AD, BRI, CANB, NSW53731, NT, PERTH) from near Indiana Station in the Northern Territory is noted as being "common on creek-bank with Chloris acicularis and Lepidium spp."; Lazarides 5721 (AD, NT, PERTH, NSW53732), collected 19 miles south-east of Alice Springs, was "with Acacia estrophiolata and annuals on fine clayey sand". Also in clayey sand was Lazarides 5747 (AD, BRI, CANB, NSW53730, NT, PERTH) from Deep Well Station, annotated as occurring with Triodia basedowii and Casuarina decaisneana; Perry 5501 (AD, CANB, NT, PERTH), collected near Mt. Cavanagh Station, was "with sparse Acacia aneura and A. kempeana on deep red sand on granite".

Blennodia canescens cannot be said to belong to any particular vegetation community except that it is a member of the large group of ephemerals which appear after rain in the semi-arid country. Probably mature seeds will germinate at any season, but only those plants coming up in autumn to early spring would have a chance of fruiting and setting seed. It seems that the seed, when shed, is not fully mature, but requires an after-ripening period. They certainly retain their viability for several years.

The most usual months for flowering are July, August and September, depending, of course, on the available rain. A plant collected on the Mulligan River in south-western Queensland in February, 1904, bears flowers and fruit, but this is unusual.

Uses and Common Names: Koch 329 (AD, NSW53725) from Mt. Lyndhurst in South Australia is annotated as "good fodder" and this is probably the only use of this species. Generally it does not occur in large enough quantities in any area to be of much importance as a fodder plant, although Jessup (1951) mentions B. canescens as being "quite palatable" (to mature merino sheep) and "fairly common".

The plants have sweetly scented flowers and under favourable conditions can be large and showy, looking much like Matthiola. For this reason it is usually called "wild" or "native stock", a name which residents of the Oodnadatta area in South Australia and of north-western New South Wales have been heard to use. According to Blake (1938) it is called "heliotrope" in south-western Queensland.

It is possible that it is used for food by the aborigines; they do use some species of Lepidium and Stenopetalum, either for steaming on hot stones or for preparing a paste from the ground seeds.

Relationships: *Blennodia canescens* is very closely related to *B. pterosperma* and differs from it in only a few characters. The most obvious difference lies in the spreading pedicels of *B. canescens* which, although sometimes almost horizontal, are never recurved. Also *B. canescens* seems never to have hairs on the replum, a feature constantly seen in *B. pterosperma*. The two are compared in the following tabulation:

B. canescens	*B. pterosperma*
style apparently never obsolete	style sometimes obsolete
septum opaque, rugulose	septum translucent, smooth
seeds plump, almost always wingless	seeds flattened, surrounded by a wing
fruiting pedicels ca. 0.4-1.0mm in diameter	fruiting pedicels ca. 0.3-0.6mm in diameter
fruiting pedicels spreading to erect	fruiting pedicels almost always recurved

BLENNODIA PTEROSPERMA (BLACK)BLACK

(πτερόν = wing; σπέρμα = seed; the seed is surrounded by a membranous wing)

Black, Fl. S. Austral.(1924)248; Black, TRSSA 49(1925)272; Ising, TRSSA 51 (1933)186; Schulz, Pflfam. ed.2 17b(1936)571; Black, TRSSA 61(1937)243; Eardley, TRSSA 70(1946)162; Black, Fl. S. Austral. ed.2 (1948)376; Chippendale, TRSSA 82(1959)329.

Blennodia canescens var. pterosperma Black, TRSSA 41(1917)638 (basionym); Black, TRSSA 42(1918)173.

Figures: Black, TRSSA 41(1917)t.41,fig.1; - Figure 2 C,D,M.

Original description: Black (1917) - "B. canescens, R.Br. ... The linear cylindrical pods are sometimes 5 cm. long. The specimens agree with the other northern ones except that the seeds are bordered by a rather broad wing, while those of the type are, as usual in the genus, quite wingless. I therefore propose calling this variety pterosperma. Capt. White says the flowers resemble those of a garden stock and vary from pink to white."

Black (1925) - "Herba annua, stellato-pubescens, foliis praecipue radicalibus parce lobulatis vel dentatis superioribus saepe integres et lineari-lanceolatis, sepalis 5-7 mm. longis, petalis 10-15 mm. longis albis vel roseis longe unguiculatis, pedicellis fructiferis 5-8 mm. longis demum reflexis; siliquis compresso-linearibus 3-6 cm. longis 2-2½ mm. latis pubescentibus, stigmate fere sessile, vavlis uninervibus, seminibus numerosis ala angusta membranacea cinctis fere uniserialibus haud mucosa."

Description: Plant herbaceous annual, tomentose with sessile or shortly stipitate stellate or irregularly branched hairs, rarely, beset with a few simple hairs as well as the others; root a slender taproot; stems few to many, to about 50cm, erect, terete or finely fluted, rather sparsely leaved, brown-green or reddish-purple in colour, arising from a basal rosette of leaves.

Basal leaves to ca. 7cm long, sinuate-pinnatifid with 2-5 lobes per side, the lobes usually obtuse or, more often, linear to spathulate with margin entire or with a few small teeth, obtuse to subacute; leaves tapering into a slender petiole to 4cm long.

Cauline leaves to ca. 6cm long and 4cm wide, pinnatifid with 2-3 linear lobes per side, terminal lobe subacute or, less often, acute; or entire or with a few small teeth; tapering into a short narrow petiole or, often, sessile on a narrowly cuneate base.

Inflorescences averaging about 20-flowered, dense, elongating after anthesis; flowering pedicels 4-6mm long, erect to slightly spreading, later becoming recurved in most cases; buds oblong just before anthesis.

Sepals oblong to narrowly obovate, usually green, less often lavender, with a narrow hyaline margin; lateral sepals [4.3-]5.5-6.0[-6.5] x [1.2-]1.5-2.0[-2.3]mm. average ratio length to width 3.1:1, oblong, tapering distally and subacute to acute, basally saccate; median sepals [4.5-]5.0-5.5[-6.0]x[1.1-]1.4-1.6[-1.8]mm, average ratio length to width 3.9:1, oblong to narrowly obovate, rounded to truncate, not or, rarely, very slightly saccate.

Petals about twice as long as the sepals, ca. 9.5-13.0mm long, clawed; blades ca. 3.2-6.3x2.0-4.5mm, ratio lenght to width 1.2:1-2.0:1, average

1.6:1, oblong to ovate, apically rounded, truncate or, less often, emarginate, tapering into a linear claw, this usually expanded slightly distally or proximally, slightly longer than the blade, blade averaging 40 per cent of the total petal length; petals white, pink or lavender, the last seen more often in northern specimens, in sicco dark brown or yellowish.

Lateral stamens [4.0-]4.5-5.0[-5.5]mm long, filaments linear, average 0.5 mm wide, tapering slightly distally, green, pink or lavender; anthers 1.6-2.3mm, average 1.9mm, oblong, obtuse, yellow; diagonal stamens [5.8-] 6.1-6.7[-7.4]mm, filaments to 0.8mm, linear or broadened proximally, this often unequal, the greater width being on the lateral side of the vein, green, pink or lavender; anthers 1.5-2.1mm, average 1.7mm, oblong, obtuse, yellow.

Pistil 4.0-6.5mm long, cylindrical, sessile or on a short linear stipe, densely tomentose with very short hairs; style obsolete or short and linear; stigma fleshy, tectiform or depressed-capitate; nectaries as generic description, green, very often not well developed.

Fruiting pedicels to ca. 18mm long, 0.3-0.6mm, average 0.4mm in diameter, rather slender, spreading or, in most cases, recurved.

Fruit 4.5-7.0cm long, septum 1.2-2.5mm, usually less than 1.7mm , straight or slightly curved; valves with prominent nerve, usually slightly constricted between seeds, with rather scattered pubescence, proximally usually rounded, rarely, truncate, distally rounded or subacute; style 0.7-1.4mm, linear, or oboslete; stigma tectiform or depressed-capitate, usually purple; septum white or colourless, vitreous and smooth, with median nerve, often fenestrate at the distal end, the epidermal cells of the center usually more or less oblong with very sinuous margins, occasionally with almost straight or slightly curved margins, those cells toward the edge more nearly square, with straight margins, the peripheral area often somewhat rugulose; funicles usually more or less linear, straight or curved, pendulous; replum usually with a few scattered hairs.

Seeds ca. 1.3-1.6x0.9-1.1mm, subbiseriate, ca. 25-40 per cell, oval, flattened, surrounded by a membranous wing to 0.5mm in width at the chalazal end; testa light golden-brown, usually with a darker area at the hilum, when moistened exuding a narrow radiate mucus, especially on the wing, the mucus emerging from each papilla of the testa as a hyaline oblong, each containing a grey spiral thread; embryo exactly notorrhizal, the radicle slightly longer than the cotyledons; average thickness of embryos from soaked seeds 0.28mm.

Type locality: "Lake Blanche"

Holotype: Lake Blanche; 19.9.1916; S. A. White - AD 96446049!

Other specimens seen: (see Map 2 - page 99)

South Australia: - Marree-Birdsville; Aug.1936; Mrs. Andrewartha - ADW: Birdsville Track; Spt.1960; Browning - ADW: very common on sandhills a bout the Diamantina from Birdsville to Andrewilla; 14.7.1939; Crocker - AD: Diamantina River; Aug.1930; Morgan - AD: ½ mile E. homestead Pandie-Pandie; 26.8.1960; Lothian 436 - AD: 15 miles S. Pandie-Pandie; 26.8.1960; Lothian 432 - AD: between Nappamerrie and Innamincka; 13.8. 1962; Jackson 429 - AD: Caraweena, Lower Strzelecki Creek; May,1924; Cleland - NSW53714: Caraweena; 30.5.1924; Cleland - AD: Lower Strzelecki Creek; .9.5.1924; Cleland - AD: sandhills around Lake Wittakilla (S. of Lake Callabonna) - near junction of Boolkaree and Yandama Creeks; 11.8.1950; Béchervaise - MEL: east shore of Lake Frome; 28-31,8.1952;

Peake-Jones - AD: Mungeranie; 10.9.1956; Cleland - AD: approx. 5 miles N. Cooper's Creek; 24.8.1960; Lothian 269 - AD,UC,Z: Cooper's Creek crossing; 16.9.1956 Cleland - AD: Etudinna; 16.9.1956; Cleland - AD: Clayton River; 22.9.1956; Lothian L2008 - AD: Clayton River; 22.9. 1956; Lothian 2016 - AD: Clayton River bed (36 miles N. Marree); 23.8. 1960; Lothian 249 - AD: Mooloorina Stn.; 20.7.1955; Lothian 1106 - AD: Muloorina homestead; 19.7.1955; Hill 141 - AD: sand dunes by Level Post Bay - Lake Eyre; 24.7.1955; Lothian 1178 - AD: 6 miles N. Coward Springs; 7.8.1963; Kuchel 715 - AD: on sand dune about 1 miles S. Muloorina H.S.; 10.9.1963; Hill 1159 - AD: dunes about 30km N.W. Muloorina H.S.; 11.9.1963; Hill 1164 - AD: ridge of mesa 1 mile W. Lake Harry; 28.7.1955; Hill 268 - AD: 18km N. Andamooka Stn.; 25.9.1960; Filson 3216 - AD: Avondale H.S.; 21.8.1963; Kuchel 777 - AD: 16 miles N. Leigh Creek; 29.8.1963; Shaw 185 - AD: eastern shore of Lake Torrens, west of Parachilna; 7.9.1962; Sharrad 1353 - AD: Parachilna; 17.10.1917; Black - MEL, AD: Parachilna; 19.8.1921; Cleland - AD: Parachilna; 3.9. 1941; Cleland - AD: 1 mile N. Brachina railway crossing; 6.8.1963; Lothian 1270 - AD: ca. 8 miles E. Dalhousie Springs; 9.8.1963; Lothian 1479 - AD: 7 miles east along track, then 2 miles north along dune trough from base camp, this ca. 61km E. Dalhousie Springs; 12.8.1963; Lothian 1789 - AD: 22 miles east of base camp, camp ca. 61km east of Dalhousie Springs; 11.8.1963; Lothian 1734 - AD: 22 miles east of base camp; 11.8.1963; Lothian 1774 - AD: 30 miles east from base camp; 10.8. 1963; Lothian 1665 - AD: 38 miles east Dalhous ie Springs; 9.8.1963; Lothian 1419 - AD:

New South Wales: - Mootwingee; Aug.1962; Gardiner - AD: Tibbooburra District; Aug.1921; MacGillivray - ADW: Fort Grey; Aug.1921; MacGillivray

- K: Tilcha; Sept.1921; Collins - SYD: Milparinka; Sept.1941; Beadle - SYD: Milparinka; Oct.1939; Ashby - NSW53716: Milparinka; Sept.1940; Beadle - SYD:

Queensland: - near Nappamerrie Stn.;15.8.1962; Jackson 447 - AD: near the Mulligan River; 1885; Cornish - MEL:

Northern Territory: - camp 11, Simpson Desert Exped.; 19.6.1939; Crocker - AD: Simpson Desert, about 60-65 miles S.E. Ringwood Stn.; 8.9.1955; Chippendale - NSW53715, NT1610: 70 miles southeast of Ringwood; 6.10. 1954; Winkworth 634 - CANB(p.i.): 23½ miles S.E. Alice Well, about 102 miles S. Alice Springs; 4.9.1956; Chippendale - AD, NT2777: Horse Shoe Bend; 24.8.1931; Ising 2505 - AD: sandy watercourse, Charlotte Waters; 27.5.1939; Crocker - AD: between the Finke River and Charlotte Waters; 1888; Kempe - MEL:

Distribution: This species is known from South Australia, the Northern Territory, New South Wales and Queensland, but appears to be much less widely spread than is B. canescens. In South Australia the collections are chiefly from the north-eastern part of the state, with a few from the Flinders Ranges, the western part of the Simpson Desert, and a single collection from 18km north of Andamooka (Filson 3216 - AD) which is the only one from the area south-west of Lake Eyre.

The Northern Territory collections are from the Simpson Desert and the area between Alice Springs and Charlotte Waters. The seven collections made in New South Wales are all from the far north-western part of the state. Two collections from Queensland are from the south-western part.

Observations: B. pterosperma is even more constant in its characters than is B. canescens, the only real variation being in size of the style. Black (1925) said "stigmate fere sessile" but there is often a quite conspicuous style as much as 1½mm long. The most noticeable feature is the occurrence of recurved fruiting pedicels; when the plant is in flower the pedicels are usually only spreading, but with maturation of the ovary the pedicels gradually turn downwards. On any given plant there may be a few pedicels which remain spreading, but these are always few in number.

As in _B. canescens_, the petals may be white or lavender; coloured petals seem to occur at random in a population and to be correlated with no other feature. Collections which definitely had lavender petals have been made at Pandie-Pandie (_Lothian 436_ - AD), between Innamincka and Nappamerrie (_Jackson 429_ - AD) and several other places in the north-eastern part of South Australia, as well as at scattered localities in the Flinders Ranges and near Lakes Torrens and Frome. In this species too, the sepals may be pink or lavender, but this is again independent of petal colour.

A distinctive character of the septum is the transparent band running along either side of the vein. The epidermal cells are usually fusiform and quite acute or oblong, the edges being straight or wavy. This central band may take up half the total width of the septum and even to the unaided eye is conspicuous. The apparent difference is perhaps the result of some difference in the middle layer of the septum, for the epidermal cells themselves seem to be much the same across its width.

The seeds are more flattened than are those of _B. canescens_ and are surrounded by a membranous wing. When moistened, mucus is rapidly exuded as discrete oblong bodies, one appearing to come from each papilla, each of which contains a grey coiled thread; this can be seen especially well on the wing.

The pubescence is essentially the same as that of B. canescens, the plant usually having an over-all hoary appearance. The hairs are usually shortly stipitate and are irregularly branched, often being twice bifurcate. On the fruit valves the hairs seem to be generally not much more than ca. ½mm long with the arms usually flattened in a plane parallel to the valve. On the leaves they are much the same except that comparatively more are almost sessile and there is an admixture of trifurcate ones. The cauline hairs are the same, but slightly longer, a bout ½ - ¾mm long.

On casual inspection specimens of B. canescens and B. pterosperma look slightly different and this would seem to be due to some subtle difference in the pubescence. It has, however, proved impossible to find any constant difference between them and one cannot satisfactorily determine material which is purely vegetative or bearing flowers only. Fruits of B. pterosperma generally have scattered hairs on the replum, buttthese are not always present on the young ovary. It also seems generally true that the ovary of B. pterosperma is less stout than that of B. canescens, but this difference is neither great enough nor constant enough to be of value in making determinations.

Ecology and Biology: Much of what is true of Blennodia canescens is true also of this species. According to information gathered from annotations it commonly occurs on deep sand; the writer has seen it growing densely on sand hills north of Leigh Creek where it was with other ephemerals - Compositae, Zygophyllum, Euphorbia, Portulacca, etc.

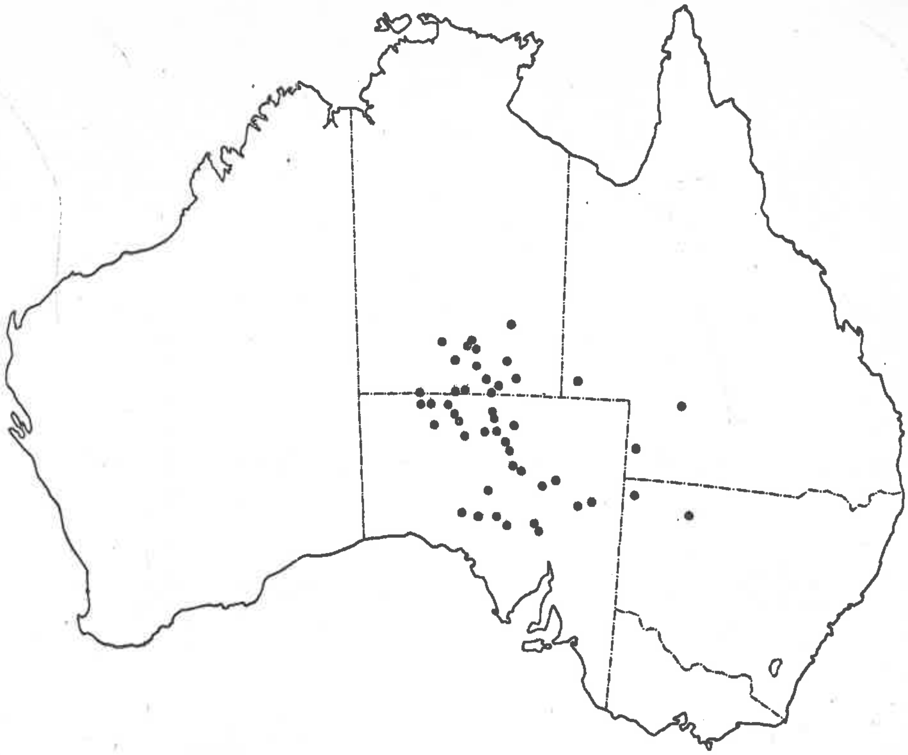
Other plants with which it has been found associated in south-western Queensland and north-eastern South Australia are species of Senecio, Myriocephalus, Zygochloa, Frankenia, Crotalaria and Scaevola.

It seems likely that B. pterosperma may spread rather quickly; the flat winged seeds are probably easily carried by the wind. The earliest collections available were made in 1885 (Mulligan River; Cornish - MEL) and in 1888 (between the Finke River and Charlotte Waters; Kempe - MEL); none were then made until 1916 (the holotype). During this time several collections of B. canescens were made in areas where B. pterosperma might now be expected and it seems possible that B. pterosperma is less common than is the other species. Yet, in favourable seasons it occurs in profusion in rather restricted areas.

Uses and Common Names: Apparently no uses for this species have been recorded. This species is known as "wild" or "native stock".

Relationships: It is somewhat surprising that Black originally described this species as agreeing with B. canescens except for the seeds being winged. Certainly the recurved pedicels of B. pterosperma are very distinctive and could not be confused with those of B. canescens. The writer agrees with Black's later conclusion that these two are distinct species.

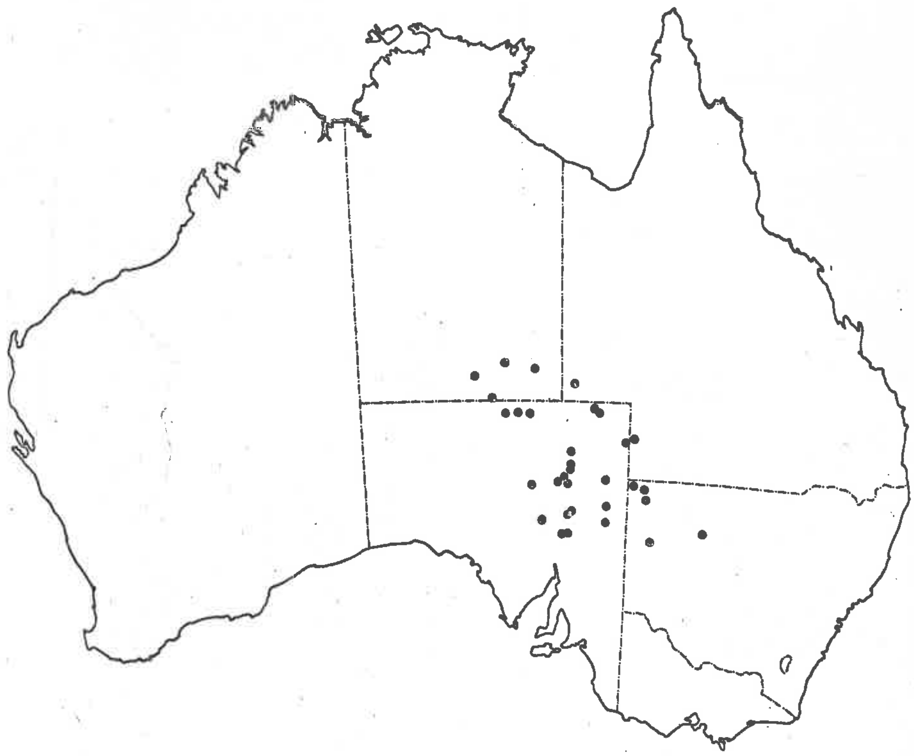
1



Map 1 - Blennodia canescens R.Br.

Map 2 - Blennodia pterosperma (Black)Black

2



ARABIDELLA (FvM.)SCHULZ

(Arabidella = diminutive of Arabis L., a genus in this family)

Schulz, Pflrch. 86(1924)177; Schulz, Pflfam. ed.2 17b(1936)612.

Erysimum subgenus Arabidella FvM., Linnaea 25(1853)368.

Pseudarabidella Schulz, Pflrch. 86(1924)257; Schulz, Pflfam. ed. 2 17b(1936)636. (ψευδής = false, Ara bidella = genus in this family)

Micromystria Schulz, Pflrch. 86(1924)263; Schulz, Pflfam. ed. 2 17b (1936)639. (μικρός = small,μυστρίον = spoon; the filaments of Arabidella nasturtium (FvM.)Shaw are basally dilated)

Lemphoria Schulz, Pflrch. 86(1924)267; Schulz, Pflfam. ed. 2 17b (1936)640. (λέμφος = mucus; the seeds are mucose)

Original description: Mueller (1853) - "Arabidella est subgenus Erysimi, praesertim calyce patulo discernendum."

Schulz (1924) - "Sepala patula, tandem deflexa, exteriora oblonga, obtusiuscula, interiora latiora, subacuta, basi aequalia. Petala alba, in sicco ochroleuca; lamina orbicularis, dense venosa, subito in unguiculum aequilongum linearem contracta. Stamina 6; filamentia tenuia; antherae oblongae, obtusae. Glandulae nectariferae manifestae, confluentes, laterales annuliformes, extrinsecus intusque emarginatae, medianae inter stamina lobulatae. Pistillum cylindricum, substipitatum; ovarium 64-ovulatum; stylus brevis, incrassatis; stigma capitatum. Siliquae breviusculae, linearis, stylo crassiusculo coronatae, biloculares, setigerae, bivalvis, dehiscentes, valvis parum convexis utrinque obtusiusculis nervo crasse carinatis caeterum nervis longitudinalibus tenuibus anastomosantibus praeditis; placentae tenues; septum tenerum, album, foveato-rugosum, obscure uninerve. Semina minutissima, biseriata, oblongoellipsoideae, funiculo brevi capillari pendula, dilute brunnea, ad hilum non maculata, laevia, humida haud mucosa, notorrhiza. Cotyledones lineares, radicula crassiuscula paulo breviores. - Planta primo anno florens, forsan perenna ns. Caulis ramosus, ad basin induratus, glaber vel rarius inferne papillis minutis tuberculiformibus diaphanis obsessus. Folia petiolata, trisecta segmentis linearibus. Racemis iam sub anthesi dissitiflorus, nudus. Pedicelli fructiferi tenues.

Species unica in planictibus Australiae obvia."

Arabidella trisecta (FvM.)Schulz

Description: Calyx open; sepals spreading or, less often, almost erect, basally not saccate, usually green or yellow-green, sometimes lavender, with a narrow colourless or lavender hyaline margin and bearing on the abaxial side a few hairs near the tip; lateral sepals usually oblong, sometimes obovate, usually absolutely and relatively wider than the median, distally gently tapering and subacute or, less often, rounded; median sepals oblong or obovate or elliptic (sometimes suborbicular), proximally usually gently tapering, distally rounded or, less commonly, subacute, sometimes slightly cucullate.

Petals at least as long as the sepals to about twice as long , white or yellow, very rarely lavender, obovate to cuneate, or with distinct blade and claw; if obviously clawed, claw usually more or less linear or slightly widened basally, as long as or shorter than the blade, blade usually suborbicular to obovate, rarely rhombic, margin entire or sinuate, apically rounded to truncate, then sometimes retuse or emarginate, finely or coarsely veined, often blade at right angle to the claw or further reflexed.

Stamens 6, erect or somewhat spreading, filaments linear and slightly widened at the base, or much expanded and filament spathulate, usually yellow to green, occasionally pink to lavender; anthers usually oblong, less often almost square or more or less sagittate, rounded or truncate, yellow.

Nectaries of a quite constant pattern, but showing varying degrees of development; lateral glands each surrounding the base of a lateral stamen, annuliform to hexagonal, usually open on the inner side, open or, often, only emarginate on the exterior, producing from each side of each gland a lateral appendage curving around the base of the adjacent diagonal stamen; lateral glands sometimes not fully developed and then usually appearing as semicircular or oblong lobes of tissue, each subtended by a petal; median glands, if present, single oblong or deltoid lobes of tissue lying between the bases of the diagonal stamens; at fullest development, lateral and median glands approximate, but not fused.

Pistil sessile or on a short linear stipe, linear or fusiform, terete or slightly flattened dorso-ventrally, therefore latisept, glabrous or sparsely pubescent (A. eremigena); ovules usually biseriate, oblong to oval, on slender pendulous funicles, ca. 16-45 per cell; style linear to broadly obconical, short, rarely obsolete; stigma fleshy, depressed-capitate or, sometimes, almost tectiform, as wide as or slightly wider than the style.

Fruit bilocular, bivalved, dehiscent, sessile or on a short stipe, linear, straight or slightly curved, terete or flattened dorso-ventrally or laterally; valves almost flat or slightly or very convex, with a distinct midnerve and, when mature, usually a reticulum of secondary veins, sometimes slightly constricted between seeds, brown, often with reddish or magenta pigmentation especially at the margins, glabrous or pubescent with simple hairs, proximally rounded to truncate, less often, subacute, distally rounded or tapering and subacute; style linear to broadly obconical or very short and stout or obsolete; stigma usually depressed-capitate, sometimes much depressed and cuplike or almost tectiform, as wide as or slightly wider than the style.

Septum white or colourless, opaque or translucent, sometimes fenestrate by a longitudinal slit, nerve obsolete or more or less distinct, smooth or rugulose, especially at the margins and between the seeds; funicles linear or slightly broadened proximally to almost deltoid, straight or curved, pendulous.

Seeds uniseriate to biseriate, oblong to oval, plump or slightly flattened, sometimes (A. filifolia) with a small wing at the distal end; testa yellow or yellow-brown to reddish-brown, slightly darker at the hilum, very finely papillose; when moistened, mucose, the mucus exuded as discrete oblongs or cones, one from each cell of the outer layer of the testa and thus appearing radiate; embryo exactly or obliquely notorrhizal, cotyledons usually oblong, slightly shorter than the radicle.

Plant perennial, suffruticose and many-stemmed, erect, or annual, herbaceous, erect or prostrate, glabrous or finely papillose or pubescent with simple hairs; stems arising from ground level or from a short main stem; if herbaceous, sometimes with a leafless central stem and leafy lateral stems arising from a basal rosette of leaves, the central stem sometimes reduced to an apparently basal inflorescence.

Basal leaves (present in herbaceous species only) rosulate, usually obovate to narrowly so in outline, entire or pinnatifid, petiolate.

Cauline leaves (in species with a basal rosette) usually few, scattered, pinnatifid with 1-7 lobes per side or, rarely, entire, shortly petiolate or sessile on cuneate bases; otherwise solitary or fasciculate, filiform to linear, entire or bi- or tri- sect, sometimes with regular dichotomous divisions of the second and third order, sessile.

Root a taproot, slender or short, stout and woody.

Inflorescences ebracteate, terminal on stems, initially corymbose but after anthesis elongating and racemose, sometimes stem reduced so inflorescence seems basal; buds immediately before anthesis oblong to ovoid or obovoid; flowering pedicels slender, ascending to slightly spreading; fruiting pedicels slender, almost erect or spreading to horizontal.

Six species in semi-arid parts of Western Australia, South Australia, the Northern Territory, Queensland, New South Wales and Victoria.

Arabidella eremigena (FvM.)Shaw

Arabidella filifolia (FvM.)Shaw

Arabidella glaucescens Shaw

Arabidella nasturtium (FvM.)Shaw

Arabidella procumbens (Tate)Shaw

Arabidella trisecta (FvM.)Schulz - TYPE SPECIES

Key to the species of Arabidella:

A Plants herbaceous

B Leaves mostly bisect or trisect.................. *A. nasturtium*

B Leaves pinnatisect or lyrate-pinnatifid

C Plants glabrous .... *A. procumbens*

C Plants pubescent............................. *A. eremigena*

A Plants suffruticose

D Plants straggling shrubs, leaves mostly entire .. *A. filifolia*

D Plants erect, leaves mostly bisect or trisect

E Fruit usually sessile, linear, plant usually papillose, leaves less than 0.5mm wide ... *A. trisecta*

E Fruit usually stipitate, linear-ellipsoid, plant glabrous, leaves ca. 0.5-1.5mm wide ... *A. glaucescens*

Relationships: These species form a quite natural group which seems not closely related to any other of the Australian Cruciferae. There are interesting relationships between the suffruticose group of species and the herbaceous group which are discussed with each species.

ARABIDELLA TRISECTA (FvM.)SCHULZ

(tres = three, secta = cut; the leaves are often divided into three segments)

Schulz, Pflrch. 86(1924)179; Black, TRSSA 61(1937)243.

Erysimum trisectum FvM., Linnaea 25(1853)368 in obs. (basionym).

Sisymbrium trisectum FvM., Trans. Vict. Inst. 1(1855)114; FvM., Hook. J. Bot. Kew Misc. 8(1856)4; FvM., Rep. Babb. Exped.(1859)7; FvM., Pl. Col. Vict.1(1860-1862)39; FvM., Fragm. 7(1869)20; FvM., Fragm. 11(1879)60; FvM., Nat. Pl. Vict. 1(1879)33; Tate, TRSSA 3 (1880)51; FvM., Census 1(1882)5; Tate, TRSSA 6(1883)101; FvM., Key Vict. Pl. 2(1885)7; FvM., Key Vict. Pl. 1(1887-1888)131; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral. (1890)16,206; FvM. et Tate, TRSSA 13(1890)96; 16(1896)335; Koch, TRSSA 22(1898)102.

Blennodia trisecta (FvM.)Benth., Fl. Austral. 1(1863)74; Turner, Forage Pl. Austral.(1891)2; Tate, TRSSA 22(1898)123; Black, TRSSA 39(1915)830; TRSSA 41(1917)45,638; Ising, TRSSA 46(1922)588,597; Black, Fl. S. Austral.(1924)247; Black, TRSSA 61(1937)243; Black, Fl. S. Austral. ed.2(1948)375; Jessup, TRSSA 74(1951)243,248,250.

Arabidella trisecta var. hybophora Schulz, Pflrch.86(1924)179.

The first three of the above names are nomenclatural synonyms of Arabidella trisecta, being based on the same type. The name Arabidella trisecta var. hybophora which is based on a different type is discussed below.

Excluded: Arabidella trisecta var. brachycarpa (Benth.)Schulz

(Blennodia trisecta var. brachycarpa Benth.) = Arabidella glaucescens Shaw.

Figures: Turner, Forage Pl. Austral.(1891)fig.2; Hayek, Beih. Bot. Centralbl. 27(1911)fig.8(11); Schulz, Pflrch. 86(1924)fig.33; Schulz, Pflfam. ed.2 17b(1936)fig. 382; - Figure 3A, 4G-N.

Original description: Mueller (1853) - "Habitu [Erysimum filifolium] convenit cum Erysimo (Arabidella) trisecto; in ultimo stylus defecit, stigma crassius est et profundius emarginatum, pedicellis tenuiores sunt et minus patentes, fere erecti siliqua manifeste breviores, siliquae duplo longiores, folia varie partita et semina minora. Flores desunt."

Mueller (1855) - "Suffruticose, glabrous, erect; leaves glaucous, divided into three linear-filiform segments; pedicels threadlike, three or four times shorter than the siliqua, slightly spreading; style very short or wanting; stigma dilated."

Schulz (1924) - "Caulis inferne cum petiolis papillis minuits tuberculiformibus diaphanis obsessus."

Description: Plant an erect woody undershrub, when in fruit to about 60cm high, but usually less, glabrous or the stems and proximal parts of the leaves covered with oblong to broadly triangular papillae, these usually less than $\frac{1}{4}$mm long and flattened; root a stout woody tap-root to ca. 1.5cm diameter; stems arising from ground level or from a short main stem, terete or quadrangular or finely fluted, erect or slightly spreading, to ca.$\frac{3}{4}$cm in diameter near the base, light in colour, when older usually with excoriating bark.

Leaves (all cauline) to ca. 4cm long, to ca. 1mm, usually less than

$\frac{1}{2}$mm in width, solitary or clustered, often seeming very densely clustered because of short leafy branches arising in the leaf axils; very rarely entire, usually bi- or tri- sect, the primary sectors often further divided, sometimes with regular dichotomous divisions of the second or third order; segments linear, narrow or, not uncommonly, narrowly spathulate toward the tips, rounded to acute, the segments usually arising from about the same level, the divided part usually less than half the total length; in vivo somewhat fleshy, in sicco fragile and usually much wrinkeled, often with red pigmentation at the tips.

Inflorescences usually ca. 30- to 40- flowered, sometimes reduced to 1 or a few flowers arising in a leaf axil, rather loose before anthesis, elongating afterward, length from the lowest flower to tip to ca. 15cm; flowering pedicels to ca. 12mm long, ca. 0.15-0.25mm in diameter, terete to quadrangular, ascending to slightly spreading; buds just before anthesis more or less obovoid, often a few scattered buds below the opened flowers.

Sepals oblong or elliptic or obovate, usually green, occasionally lavender, with a narrow hyaline margin, sometimes slightly cucullate distally, not saccate, initially erect but gradually spreading to horizontal or further bent back; lateral sepals ca. 2.8-4.4mm long, ca. 1.1-1.9 mm wide, average 3.8x1.4mm, ratio length to width 2.2:1-3.3:1, distally subacute to rounded; median sepals ca. 3.1-4.6mm long, ca. 1.0-2.1mm wide, average 3.8x1.6mm, ratio length to width 1.8:1-2.9:1, distally rounded.

Petals as long as the sepals to $1\frac{1}{2}$ times as long, ca. 3.0-6.0mm long, average 4.5mm, white or cream-coloured, occasionally bright yellow, yellowish in sicco; blades ca. 2.2-4.2mm long, ca. 1.7-4.5mm wide, average 3.2x3.1mm, ratio length to width of blade 0.9:1-1.3:1, usually suborbicular, less often broadly oblong to square, usually entire or sinuate, rarely retuse, usually densely veined, tapering suddenly into a narrow linear claw ca. 0.2-0.6mm wide, the blade averaging 73 per cent of the total petal length, often reflexed so the blade at right angles to the claw.

Stamens with filaments slender, linear or slightly widened at the base, white to green; anthers narrowly oblong or, less often, almost halberd-shaped, obtuse; lateral stamens ca. 3.2-4.2mm long, average 3.6mm, anthers ca. 1.5-2.1mm, average 1.7mm; diagonal stamens ca. 2.9-4.5mm, average 3.8mm, anthers ca. 1.5-2.2mm, average 1.8mm.

Ovary ca. 2.5-4.0[-5.0]mm long, sessile or on a very short stipe, linear, terete or slightly flattened dorso-ventrally; style linear to broadly clouate, short; stigma fleshy, depressed-capitate, as wide as or slightly wider than the style; ovules ca. 40-90 per ovary, more or less oblong, biseriate on slender linear to narrowly triangular funicles; lateral glands hexagonal or pentagonal to circular, usuallu open on the interior, sometimes subemarginate to open on the exterior, producing on each side of each gland a lateral appendage curving around the base of the adjacent diagonal stamen; median glands oblong lobes of tissue lying between the bases of the diagonal stamens, rarely two- or three- lobed, the glands fused and conspicuously fleshy and torulose, usually bright green.

Fruiting pedicels usually ca. 1.0-1.5cm long, exceptionally to 2.0cm, ca. 0.3mm diameter, expanded to ca. 0.5-0.7mm just below the calyx, terete or obtusely triangular, erect to slightly spreading, usually straight.

Fruit ca. [0.6-]1.0-4.0cm long, usually 2.0-3.0cm, ca. 0.8-1.5mm, usually 0.9-1.3mm across the septum, terete or latisept, linear, straight or slightly curved, usually sessile, but sometimes shortly stipitate, the stipe ca. 0.1-0.4mm long; valves somewhat convex to flat, proximally obtuse to truncate, sometimes retuse, distally subacute to rounded, sometimes truncate and retuse, with stout vein and, when mature, a reticulum of anastomosing secondary veins, often with red or magenta pigmentation especially at the margins; style linear to broadly obconical, ca. 0.4-1.4 mm, usually 0.7mm long; stigma small, depressed-capitate, sometimes cup-like, about as wide as the style; septum white, with indistinct nerve, opaque and rugulose or translucent and smooth to vitreous; funicles slender, linear to narrowly triangular, pendulous.

Seeds ca. 0.7-0.9mm long, ca. 0.4-0.6mm wide, uniseriate to subbiseriate, ovoid to oblong, plump; testa orange to reddish-brown with dark red pigmentation at the hilum, when moistened exuding a narrow band of mucus to ca. 1mm wide, the mucus emerging in discrete oblongs and thus appearing radiate; embryo exactly notorrhizal, the radicle slightly longer than the cotyledons.

Type locality: (Sisymbrium trisectum FvM., 1855)- "In the desert, on the Murray River, on Spencer's and St. Vincent's Gulf, and near Lake Torrens"

Lectotype: Crystal Brook; Oct., 1851; Mueller - MEL 758!

Other specimens seen: (see Map 3 - page 143)

South Australia: - Cooper's Creek;?;? - MEL: within ½ miles of Mooloorina homestead; 9.9.1963; Hill 1156 - AD: Muloorina Stn.; 18.7.1955; Hill 138 - AD: north of Bopeechee; 6.8.1963; Lothian 1299 - AD: Alberrie Creek; 19.8.1932; Ising coll - AD: Herrgott Springs to Strangway's Springs;?; Cleland (W.L.) - AD: Marree; 15.9.1956; Cleland - AD: Marree, 1 mile south; 15.7.1955; Hill 88 - AD: Murnpeowie; 18.5.1924; Cleland - AD: Murnpeowie H.S.; 30.8.1960; Lothian 692 - AD: Murnpeowie; 24.7.1930; Andrew - AD: Mundowndna Swamp; 20.7.1955; Lothian 1060 - AD: Farina Creek; 20.7.1955; Lothian 1056 - AD: 36.7 miles from Farina; 13.2.1937; Andrewartha - ADW: 17 miles north of Leigh Creek; 30.8. 1963; Shaw 196,197 - AD: 7 miles north of Leigh Creek township; 29.8. 1963; Shaw 183 - AD: northern spur of western range enclosing Arcoona Pound; 22.8.1956; Lothian 2022 - AD: Mt. Parry Gap; 4.6.1883; Tate - AD: Leigh Creek coalfield; 28.9.1961; Lothian 775 - AD: Mt. Lyndhurst; Aug.1898; Koch 221 - AD, B, BRI, NSW 53547: Mt. Lyndhurst; Aug. 1898; Koch 325 - NSW 53546: Mt. Lyndhurst Stn.;19.5.1924; Cleland - AD: Mt. Serle Stn.; 13.10.1962; Krachenbuehl 749 - AD: Nepabunna; 27.5.1937; Cleland - AD: Italowie Gorge; 29.5.1937; Cleland - AD: Ideyaka; 2.9. 1883; Tate? - AD: Beltana; 15.7.1955; Ising - AD: 5 miles south of Beltana; 8.4.1955; Hilton 1260 - ADW: ChambersGorge near Mt. Chambers; 12.9.1956; Eichler 12581 - AD: 11 miles west of Blinman; 28.6.1961; Shaw 23,24,25 - AD: Angorichina; 29.9.1926; Lee - AD: Angorichina Gorge, 2 miles west of chalet; 3.9.1962; Sharrad 1328 - AD: Parachilna Gap; 8.10.1918; Ising - AD: Parachilna; 3.6.1961; Donner 77- AD: Parachilna; 8.9.1962; Sharrad 1370 - AD: 6 miles south of Parachilna; 26.8.1961; Shaw 27 - AD: 7 miles south of Parachilna; 26.8.1961; Shaw 28 - AD: common along road to Parachilna; 15.7.1955; Hill 28 - AD: near Wilpena; 29.11.1930; Cleland - AD: Bunyeroo; 4.9.1956; Cleland - AD: 13 miles north of Hawker; 15.7.1955; Hill 13 - AD: between Flinders Range and Lake Torrens;?; Richards - MEL: Flinders Ranges;?;? - MEL;

Flinders Ranges;?;? - AD: 3 miles north of Hawker; 25.8.1961; Shaw 7,9,11 - AD: Hawker; 12.6.1954; Cleland - AD: Cradock; 19.7.1955; Lothian 1008 - AD: Cudnaka [Kanyaka]; Oct.1851; Mueller - MEL 778: Gordon; 11.10.1917; Cleland - AD: Quorn; 28.15.1915; Ising - AD: Woolshed Flat; 2.10.1916; Black (A.D.) - AD: Woolshed Flat; 2.9.1913; Mills - AD: Pichi Richi Pass; 28.8.1922; Cleland - AD: Port Augusta West; Sept.-Oct.1885; Lea - BM: Port Augusta; Oct.1932; school collection - AD: 46 miles north Port Augusta; 4.7.1962; Cleland - AD: near Spencer's Gulf; 1881; Lettorf - MEL: Spencer's Gulf; 1878; Felstead - MEL: Olary; 18.9.1950; Black (E.C.) - AD: Curnamona Stn.; 1931; Pinches - AD: 5 miles north Koonamore-Curnamona boundary; 25.7.1963; Shaw 136 - AD: K.V.R.; 31.7.1928; Paltridge - AD: Bindy-i, Koonamore; Aug.1930; ? - ADW: K.V.R.; 31.7.1928; Paltridge - CANB(p.i.): Koonamore - near Bindy-i Hut; 17.8.1956; Eichler 12525 - AD: Koonamore Reserve; 22.8.1931; Eardley - AD: Koonamore; 15.8.1956; Eichler 12480 - AD: K.V.R.; 28.5.1950; Green 78 - AD: Melton Stn.; 30.9.1954; Reid - ADW: 15km N.W. Teetulpa Stn.; 4.9.1961; Donner 356 - AD: Nantabibbie; 24.4.1932; Ising - AD: between Orroroo-Peterborough; 24.9.1936; Clarke - ADW: Walloway; 28.9.1916; ? - AD: Canegrass to Woolgangi; 23.9.1937; Ising - AD: Loveday; 10.7.1942; Gauba - W: Loveday; 21.8.1937; Ising coll. - AD: Morunde, Murray River; Feb.1851; Mueller - MEL 760: Blanchetown; ?;? - AD: in the Murray Desert;?;? - W: Murray Desert; ?;? - MEL 757: 1 mile west of Florieton; 30.8.1961; Shaw 49 - AD: roadside, Florieton; 30.8.1961; Symon 1276 - ADW: 25 miles east Burra on Burra-Morgan road; 20.8.1963; Shaw 167 - AD: 7 miles south The Gums on road to Bower; 20.8.1963; Shaw 173 - AD: 13 miles south The Gums ; 20.8.1963; Shaw 174 - AD: Baldina Stn., east of Burra; 11.8.1952; Symon - ADW: near

Spalding; 23.9.1942; Cleland - AD: CrystallBrook; ?; Mueller - W (lectotype of <u>Arabidella trisecta</u> var. <u>hybophora</u> Schulz): Crystal Brook; 7.10.1851; Mueller - MEL 778: near St. Vincent's Gulf; 1882; Wehl - MEL: Andamooka Opal Fields; May-June, 1942; Grund family - AD: Yudnapinna, P102; 28.8.1952; Banfield - ADW: Yudnapinna; April, 1939; Douglas - ADW: Yudnapinna Stn.; Aug.1938; Davies - ADW: Waite House, Yudnapinna; 5.7.1954; Hilton 498 - ADW: Cariewerloo; 10.3.1950; Gross - AD: Corona [Corunna]; 26.8.1927; Reid - AD: Gawler Ranges; Sept.1912; White - AD: Gawler Ranges; ?; Sullivan - MEL: 3km west of Purple Downs; 26.9.1960; Filson 3237 - AD: Arcoona, also Oakden Hills; Sept.1927; Murray 130 - AD: Arcoona; 16.8.1949; Woodroffe 6166 - ADW: Kingoonya; 23.9.1920; Ising 1810 - AD: Kingoonya; 26.8.1947; Béchervaise - MEL: 27 miles N.W. The Twins Stn.; 3.8.1963; Kuchel 592 - AD: 2 miles N. Mt. Willoughby Stn.; 4.8.1963; Kuchel 616 - AD: ca. 50 miles W. Oodnadatta on Hawks Nest Well road; 19.9.1963; Shaw 233 - AD: bank of Eatringinna Creek, De Rose Hill Stn.; 1954; Lothian 768a/1954 - AD: gorge on N.E. side of Mt. Woodroffe; 8.8.1962; Kuchel 372 - AD: upper Arkaringa Creek; 18.5.1891; Helms - NSW 53554, 53564: between camps 7 & 8, Elder Exploring Expedition; .6.5.1891; Helms - AD: 1 miles north of Wintinna Stn.; 13.8.1962; Symon 2739 - ADW: Wintinna Creek, near Wintinna H.S.; 19.9.1963; Shaw 238 - AD: 4 miles E. Mt. Willoughby; 16.9.1963; Shaw 210 - AD: Evelyn Downs; 19.7.1952; Ising - AD: Finke River; 1889; Kempe - MEL: Mt. Clarence, near Coober Pedy; 12.8.1952; Ising - AD: Wynbring; 20.8.1926; Cleland - AD: Eurio [Euria]; June, 1880; Richards - AD: 7km south of Ooldea; 22.9.1960; Whibley 761 - AD, Z, UC: head of the Great Australian Bight; Sept.1879; Richards - AD:

10 miles north of Maralinga; 19.8.1956; Forde 339 - CANB(lrrs): Maralinga; 23.9.1957; Shilling 57 - AD: Maralinga; 10.8.1956; Hill (F.L.) 526 - BM: Maralinga; 21.9.1960; Turner - AD: Maralinga; 4.9.1960; Turner - AD: Cook; 6.9.1959; Eichler 16179 - AD: Cook; 31.8.1950; Cleland - AD: Cook; 16.8.1959; Lothian 3 - AD: Cook; 16.9.1960; Wilson 1676 - AD: Hughes to Cook; 25.11.1949; Salasoo 580 - NSW 53539: Hughes; 26.4.1931; Hubbatd 8404 - BRI: Hughes; Sept.1920; Ising 1549 - AD, BRI, MEL, NSW 53543: Mona lena; Aug.1909; Deane - NSW 53553: Nullarbor Plain; 22.8.1955; Hilton - ADW: Central South Australia;?;? - AD: South Australia;?;? - NSW 53551: 16 miles S. Moolawatana H.S.; 22.8. 1963; Kuchel 847,878 - AD: Avondale H.S.; 21.8.1963; Kuchel 757 - AD: 15 miles south Blinman; 24.8.1963; Kuchel 977 - AD: Mt. Aleck-Arkaba Hills; 24.8.1963; Kuchel 1038 - AD: Mt. Aleck-Arkaba Hills; 25.8.1963; Kuchel 1078 - AD:

Victoria: - Swan Hill;?; Ross - MEL: Chinkapook; Oct.1918; Coates - NSW 53569: Chinkapook; Nov.1918; Coates - MEL: Robinvale; 19.8.1960; Begg 6 - MEL: Kulkyne National Park; Oct.1948; Beauglehole - HERB. BEAUGLEHOLE: Merrinee; 12.9.1960; Beauglehole 5275 - HERB. BEAUGLEHOLE: ca. 11 miles south of 65 mile post on Sturt Highway, far N.W. Victoria; 3.9.1948; Willis - MEL: high limestone cliffs of the Murray immediately south of Boundary Point, extreme N.W. corner of Victoria; 30.8.1948; Willis - CANB(p.i.), MEL: Victoria;?;? - MEL:

New South Wales:- Cobar; 1886; Curran 9 - MEL: Cobar; 1883; Andra 45 - MEL: Cobar; Sept.1911; Cleland - AD: [near Lake Burrumbart]; 10.5. 1836; Mitchell 141 - MEL: Murrumbidgee River; 1878; Day - MEL: Balranald; 1878; Lucas 70 - MEL: Tarella; Aug.1887; Bauerlen 26 - MEL: Wilcannia, Darling River; 1885; Kennedy - MEL: Wileannia;?;? - B: 100 miles east of Broken Hill; 20.8.1939; Pidgeon & Vickery - SYD, NSW 53556, 53561: Camp Menindie; 15.10.1860; Victorian Exploring Expedition - MEL: Menindie Rd.; 6.8.1921; Morris - ADW: between the Darling and Lachlan; ?; Burkitt - MEL: Tibooburra; 24.10.1949; Constable - NSW 10488: Mt. Brown; Sept.1939; Beadle - SYD: Fowler's Gap; Aug.1955; Paterson - NE: Fowler's Gap; Aug.1955; Dinning - NE: northern Barrier Range; 1893; Deane - MEL: Barrier Range; 1889; Wehl - MEL: Barrier Range; 1891;? - W: Purnamooto; 28.8.1911;? - AD: Stephen's Creek; 12.8.1928; Morris - ADW, BRI: near Silverton; Aug.1889; Irvine - MEL: near Silverton; 1886; Charsley - MEL: Broken Hill; 15.10.1912 & March,1913; Black (A.B.) - AD: Broken Hill; June 1917; Cleland - AD: Broken Hill; 9.2.1920; Morris 149 - ADW, NSW 53550: Broken Hill district; 6.8.1921; Morris 627 - NSW 53558: Broken Hill; Aug. 1926; Cheel - NSW 53563: Broken Hill; 20.8.1939; Pidgeon & Vickery - NSW 53560: Broken Hill; May,1939; Watson - SYD: Broken Hill; 29.8.1946; Johnson - NSW 53541: Broken Hill; Aug. 1948; Edwards - NE: Broken Hill and Tarrawingee; Aug.1893; Deane - NSW 53548: Broken Hill, 10 miles on road to Menindie; 3.9.1962; Cleland - AD: Balaclava Swamp, 45 miles E. Broken Hill; 1.4.1917; Cleland - NSW 53549: Masar Stn.; 24.7.1955; Constable - NSW 36576, NE: Darling River;?; Dallachy & Goodwin - BM, MEL: River Darling; 18.9.1860; Victorian Exploring Expedition - MEL: 60 miles west of Wentworth; 20.8. 1946; Vickery - NSW 1988:

Queensland: - Queensland, Australia; 1863[?]; Mueller - BM:

Northern Territory: - near Alice Springs; 1882; Kempe - MEL: Finke River; 1882; Kempe - MEL: 8 miles east of Mt. Sir Henry, Ayer's Range;

June,1926; Basedow 43 - AD: Basedow Range; 20.7.1889; Tietkins - AD: Mt. Olga; 1873/1874; Giles - MEL: N. Musgrave Ranges, Border of Northern Territory & South Australia; July,1926; Basedow 259 - NSW 53540: Central Australia; 23.7.1889; Tietkins - MEL:

Western Australia: - Eucla; 1882; Oliver - MEL; Reid; July,1959; McCrumm 16 47 - PERTH: Hampton Plains; 1871; Forrest - MEL: Mt. Margaret; 11.8.1931; Gardner 2471 - PERTH: Bulong; Oct. 1898;? - NSW 53559: Boulder; 18.7.1900; Campbell - BM: Boulder; 28.7.1900; Campbell - B: Kurrawang; May,1907; Cleland - NSW 53557: Coolgardie; April,1899; Helms - NSW 53570: Coolgardie; June,1899; Helms - NSW 53565: Coolgardie; July, 1899; Helms - NSW 53565, PERTH: Western Australia; Sept.1930; Ashby - BM:

Distribution: This species is known from Western Australia, the Northern Territory, South Australia, New South Wales and Victoria. It very probably occurs also in south-western Queensland, but there is only one collection from this state.

The Western Australian collections are from the Kalgoorlie area, from Eucla at the head of the Australian Bight, and from Reid on the transcontinental railline. In the Northern Territory it has been collected near Alice Springs and south-west of there toward the Musgrave Ranges.

The bulk of the available material is from South Australia and here the highest density of collections is in the Flinders Ranges and south-east of them toward the Murray River. The southern-most collection is one from Morundie on the Murray (Mueller - MEL 760), and at the present it is not uncommon as far south as the latitude of Morgan on the Murray River. There are also scattered collections from the area south-west of Oodnadatta and some from stations along the transcontinental railline.

In New South Wales A. trisecta is found generally in the north-western part of the state, at least as far east as Cobar, and to the south-east, as far as Balranald. In Victoria the collections are entirely from the north-western part along the Murray River.

Observations: Throughout its range this species is generally quite constant, although in the north-western part of New South Wales and probably also in adjacent parts of South Australia and Queensland is a form which shows characteristics of both A. trisecta and A. glaucescens. The fruits of this form are shortly stipitate and usually on rather spreading pedicels, features which suggest A. glaucescens though it has rather the leaves of A. trisecta (see under A. glaucescens).

Usually the plant branches from ground level, but there are several collections from the southern part of the Flinders Ranges in which there is a short main stem of 3-4cm length before the first branches. These plants also have leaves slightly shorter than most, being usually only about 1cm long.

Generally the petals of this species are white, but in August, 1963, the writer collected north of Leigh Creek a form which had bright yellow petals. From Leigh Creek to the Frome River, just north of Marree, this form occurred to the apparent exclusion of the ordinary white-flowered one. It was generally growing with populations of A. nasturtium and it is possible that some hybridization had occurred.

When this was investigated further it was found that yellow-flowered plants had been collected at Marree (Hill 88 - AD), Murnpeowie (Lothian 692 - AD) and possibly at Mt. Lyndhurst (Koch 325 - NSW 53546), these areas all either in the northern part of the Flinders Ranges or just to the north of them. It was also found that the plants are practically lacking papillae - "practically" because although most of the plants of this species are densely papillose, especially on the lower part of the stems, there are some which have very scattered papillae which are found only after a careful search.

There are collections of seemingly glabrous A. trisecta from other areas; several are from the Flinders Ranges, but there are also ones from Coruna (Reed s.n. - AD), Arcoona (Woodroffe 6166 - ADW), 50 miles west of Oodnadatta (Shaw 233 - AD), Maralinga (Shilling 57 - AD), and from New South Wales; for example, from Cobar (Curran 9 - MEL), Tibooburra (Constable s.n. - NSW 10488), Mt. Brown (Beadle s.n. - SYD), Silverton (Charsley s.n. - MEL) and other places in the north-western part of the state.

Unfortunately it is impossible to know if these were yellow-flowered; when the plants are dried petals of both colour forms tend to become a uniform yellow-brown and unless a note was made at the time of collection, one cannot be sure of petal colour. It would be of interest to know more of the distribution of this yellow-flowered form and of any correlation between this condition and the absence or extreme paucity of papillae. The presence of yellow petals is possibly controlled by alleles of a single gene and may be the result of some introgression from the A. nasturtium gene pool. Still in many places, especially in the southern part of the Flinders Ranges, and in the area between Margan and Burra, populations of A. trisecta and A. nasturtium grow side by side and there is no obvious evidence of hybridisation between them.

To some extent collectors have confused A. trisecta with A. glaucescens, an error made by Max Koch (1898). In his discussion of plants collected at Mt. Lyndhurst Koch remarked that he had found three forms of Sisymbrium trisectum FvM., these under his numbers 221, 325 and 328. His 221 he considered to be probably the "typical form" and the collections under this number are the ordinary papillose A. trisecta. Of Koch 325 he said,

> "[it] has pale-yellow flowers, and being generally found in the presence of S. nasturtioides, it may be a hybrid."

Koch 325 (NSW 53546) appears to be a young plant of the usual form. However, Koch 328 (AD, NSW 53545) is A. glaucescens; Koch said of it,

> "The foliage of this form is denser, the leaves are broader, somewhat thick and succulent, and the racemes more robust. The flowers of this form are always at the top end of the stalk, which gradually grows longer as the flowering proceeds; while in Nos. 221 and 325 the flowering begins at the bottom end of the raceme, which only shows buds at the top end."

This is a good comparison of A. glaucescens with A. trisecta, but Koch's remarks about the inflorescence are not quite clear.

In both of these species, as in all Cruciferae, the inflorescence is racemose, the lowermost flowers being the oldest and the development of flowers acropetal. In A. trisecta the raceme is quite loose, so that it does have flowers "at the bottom end" and "buds at the top end". On the other hand, the flowering raceme of A. glaucescens is rather compact, so that the flowers are "always at the top end of the stalk". Still there is not such a difference between them as Koch seems to imply.

It may be mentioned here that the fact of two or more of Koch's collections bearing the same number does not mean that they were made from the same plant, from the same population, at the same time, or even in the same locality. It means only that he considered these collections to represent the same species.

Although Schulz believed A. trisecta to have non-mucose seeds and so placed Arabidella in the subtribe Sisymbriinae, the seeds do exude a narrow mucus when moistened. The mucus is exuded as discrete oblong bodies, one from each papilla on the testa, and in transmitted light seems radiate; it is usually about 0.1mm wide after an extended period of soaking. However immature seeds and those from old collections may show no exudation of mucus.

Ecology and Biology: Characteristically A. trisecta is a plant of disturbed soils. In the semi-arid parts of South Australia it grows abundantly along roadsides and drainage ditches. Usually it seems to be not in deep sand, but in loamy, clayey or rocky soils. In the Flinders Ranges large plants may be found on very rocky hillsides and this was also observed near Mt. Willoughby Station south-west of Oodnadatta. Here steep rocky banks rose up from one side of the Evelyn Creek and on them were A. trisecta and A. glaucescens; neither, however, was seen in the sandy soil on the other side of the creek.

Lethian 692 (AD) from Murnpeowie near Marree is noted as growing "on a gibber plain - depression of edge of sand". Other notes are

" stony ground" (Helms s.n. - AD), "common on calcrete rise" (Forder 339 - CANB), and "very common in some depressions; red-brown loam with limestone fragments and outcrops" (Hubbard 8404 - BRI); from north-western Victoria Willis s.n. (MEL) is noted as occurring on "stony travertine plains (in "mallee savannah") - not uncommon, but apparently restricted to the open stony ground".

Similar statements were made by Black (1917) who remarked that it is "only met with in the stony country" and by Ising (1922) who was discussing the vegetation of the Oldea region. Ising wrote,

> "In depressions [in salt bush formation] there was less vegetation than on the higher ground; the smaller plants (annuals chiefly) were absent, and the formation was decidedly an open one. It was in this station that the following plants were seen: ... Blennodia trisecta ... ."

Jessup (1951) mentioned it as being rare west of Lake Torrens.

In South Australia the writer has observed this species in a triangular area of about 600 square miles which is bounded on the north and north-east by the road from Burra to Morgan, on the south by the road from Eudunda to Morgan and on the west by a line connecting Burra and Eudunda. The eastern part of this triangle lies in the flats along the Murray River, an area covered partly with mallee and partly with chenopodiaceous shrubs; here A. trisecta is a common roadside plant, often occurring with A. nasturtium. The western part, however, includes the eastern slopes of the Mt. Lofty Ranges and here it is not found, at least not in the south-western corner of the triangle which receives more rain than the rest. In the southern part of this area

A. trisecta is found only at elevations of less than about 600 feet above sea level. Its absence on the eastern slopes of the ranges may be partly artificially induced by the more intensive agricultural activity here, but it more probably the result of the higher rainfall. *A. trisecta* will probably not grow in an area with an annual rainfall of more than about 10 inches.

In the Flinders Ranges *A. trisecta* is often seen with galled inflorescences, a phenomenon apparently restricted to this area and here seen also on *A. filifolia*.

The usual flowering and fruiting time is August to September but probably flowers, at least, could be found at almost any time of the year. This species is remarkably tenacious of life - during the summer almost the entire plant dies back so that only a few inches remain above ground. Very often small plants are several years old for they have a heavy woody root which could not have developed in only a few years. With the coming of winter rains the plants grow quickly and produce fruiting racemes which may extend for as much as 50cm beyond the leafy part of the plant. However, after even the lightest rains, very small plants may produce a few flowers although these do not usually develop into fruit.

Uses and Common Names: *A. trisecta* has no especial use except that stock graze on it. Turner (1891) describes it as "a capital fodder plant for the smaller herbivora, sheep being particularly fond of it", and suggests that this is accounted for by its pungent flavour. He adds that milch cows should not be permitted to graze upon it as it gives an unpleasant taste to milk and butter.

However, a collection from Arcoona, west of Lake Torrens, (Woodroofe 6166 - ADW) is labelled as "suspected of poisoning sheep". Jessup (1951) gives no palatability rating for it.

No aboriginal name seems to have been recorded and the writer has heard no common name used by the European population. Turner (1891) referred to it as "three-leaved mustard bush", but it is unlikely that this name has ever been used.

Typification: As with the description of Erysimum trisectum FvM. no collections were cited or any mention made of localities, it was necessary to choose a lectotype for this name. With the description of Sisymbrium trisectum several localities are mentioned. However, S. trisectum FvM. (1855) cannot be necessarily regarded as a nomenclatural synonym of E. trisectum FvM. (1853) for no reference is made to the earlier publication of the latter name.

To avoid future confusion it is necessary to choose, if possible, as lectotype of Sisymbrium trisectum FvM. a plant which it is certa in that Mueller saw before 1853 and which he took into account in describing E. trisectum. There are four specimens from Crystal Brook and Cudnaka in the southern part of the Flinders Ranges which Mueller collected in October, 1851, and one from Morundie on the Murray River collected by him in February of the same year.

From these five MEL 758 has been chosen as lectotype of both names because it fits a locality mentioned with the description of S. trisectum, i.e.,"on Spencer's Gulf", it is an entire plant a nd the best of the five, and because it bears some pertinent annotations in Mueller's hand. These are "Arabis trisecta, F. Muell." and "Erysimum (Arabidella) trisecta Ferd. Mill. Nov. Holl. austral.".

The specimen selected agrees well with both descriptions and with the choice of this lectotype for both the names Erysimum trisectum FvM. and Sisymbrium trisectum FvM. they become nomenclatural synonyms.

Two varieties must be considered. One is Blennodia trisecta var. brachycarpa Benth. (1863), accepted also by Schulz, and based on a collection made in 1859 on M'Douall Stuart's expedition. Bentham wrote,

> "These specimens, ..., are in fruit only; the habit and foliage are precisely those of the common form gathered with them, but the pods are shortly oblong and very turgid, about 2 lines long; they may possibly be accidentally abnormal."

The existing specimen appears to be a fragment of a plant of A. glaucescens bearing very young fruit and it seems best that this name be treated as a taxonomic synonym of A. glaucescens.

A. trisecta var. hybophora Schulz (1924) was thought by Schulz to be distinct because of its bearing papillae. However almost all plants of A. trisecta bear papillae and it does not seem justified to maintain this variety. To prevent future confusion it is necessary to choose a lectotype. Schulz said only "Mit der typischen Pflanze."; there are only two specimens annotated by Schulz as "var. hybophora" and dated before 1924. One of these is Koch 221 (B), the other a collection from Crystal Brook (W). The latter bears no collector's name, but does have a label "Plantae Müllerianae" and was almost certainly collected by Mueller. This latter is chosen as lectotype because it is a better specimen than the other and comes from the lectotype locality of A. trisecta and was possibly collected at the same time as this lectotype.

Relationships: Arabidella trisecta is probably most closely related to *A. nasturtium* which forms a transition between the suffruticose and herbaceous species. The position of *A. trisecta* in this genus is discussed under the headings of *A. nasturtium* and *A. filifolia*.

ARABIDELLA GLAUCESCENS SHAW (SP. NOV.)

(γλαυκός = blue-grey; the foliage is glaucous when fresh)

Blennodia filifolia [non (FvM.)Benth.] Black, Fl. S. Austral.(1924) 247; (1929)687; Black, TRSSA 61(1937)243; Eardley, TRSSA 70(1946) 162; Black, Fl. S. Austral. ed.2 (1948)375.

Blennodia trisecta var. *brachycarpa* Benth., Fl. Austral.1(1863)74

Arabidella trisecta var. *brachycarpa* (Benth.)Schulz, Pflrch. 86 (1924)179.

Blennodia filifolia is, in the publications cited, a misapplied name, referring to plants now placed in *A. glaucescens*. *Arabidella trisecta* var. *brachycarpa* is a taxonomic synonym of *A. glaucescens* being based on the type of *Blennodia trisecta* var. *brachycarpa* which is discussed under *Arabidella trisecta*.

Figures: Figures 3B, 4A-F,O,P

Original description: *B. trisecta* var. *brachycarpa* Benth. - " ... the habit and foliage are precisely those of the common form gathered with them, but the pods are shortly oblong and very turgid, about two lines long; they may possibly be accidentally abnormal."

Diagnosis: Suffrutex, caulis usque ad 1m altis, rigidis, adscendentibus, glabris; foliis radicalibus nullis; foliis caulinis usque ad 7cm longis, fasciculatis vel solis, plerumque bi- vel tri- sectis, rarius integris, segmentis linearis ca. 0.5-1.5mm latis, aequilongis, carnosis, in vivo glaucis; inflorescentibus ca. 50- usque ad 60- floribus; pedicelli fructiferi ca. 7-13mm longis, 0.3-0.6mm diametro, teretibus vel quadrangularis, erectis vel patentibus, glabris; siliquis ca. 8-33mm longis, 1.0-2.5mm latis, teretibus vel latiseptis, linearis vel ellipsoideis, plerumque stipitatis (usque ad 2.2mm); stylis ca. 0.7-2.5mm longis, 0.3-0.6mm diametro; stigmatibus carnosis, depresso-capitatis, saepe stylo latioribus; seminibus ca. 0.8-1.2mm longis, biseriatis, oblongis vel ellipsoideis; cotyledonibus incembentibus exacte.

Holotype: ca. 43 miles west of Oodnadatta on Hawks Nest Well road; 19.9.1963; Shaw 231 - AD 96407053!

Description: Plant an erect woody undershrub, when fruiting to almost 1m high, but usually less; root a very woody taproot, to 2cm diameter at ground level, usually less; stems to 1cm in diameter, terete or finely fluted, glabrous, arising from near ground level, rigid and ascendant, usually whitish or cream-coloured, basally with excoriating bark.

Leaves (all cauline) to ca. 7cm long, usually less than 5cm, more or less linear, clustered or, often, solitary (but then rather closely placed); rarely entire, usually bi- or tri- sect, the primary segments often further bi- or tri- sect; segments ca. 0.5-1.5mm wide, usually less than 1.0mm, tapering to 0.3-0.5mm, more or less linear, subacute to rounded, usually arising at the same level and of about the same length, although the secondary segments often unequal; in vivo quite succulent and glaucous; in sicco brittle.

Inflorescences usually ca. 50- or 60- flowered, initially dense, much laxer after anthesis, sometimes if borne on a secondary branch reduced to 1 or a few flowers arising in a leaf axil; flowering pedicels to ca. 15mm long and ca. 0.2-0.4mm in diameter. terete or quadrangular; buds just before anthesis ovate to oblong.

Sepals narrowly obovate or elliptic or oblong to ovate, green or yellow-green; lateral sepals ca. 3.0-5.3mm long, ca. 1.1-2.5mm wide, average 4.5x2.0mm, ratio length to width 1.7:1-3.9:1, distally rounded to subacute; median sepals ca. [3.6-]4.0-5.6mm long, ca. 1.2-2.4mm wide, average 4.7x1.8mm, ratio length to width 2.2:1-3.7:1, distally usually rounded, sometimes slightly cucullate.

Petals to twice as long as the sepals,ca. 4.5-8.0mm long, average 5.7 mm, white or cream-coloured; blades ca. 2.5-4.5mm long, ca. 2.0-4.7mm wide, average 3.2x3.5mm, ratio length to width of blade 0.8:1-1.4:1, often suborbicular or ovate or obovate, margins entire or sinuate, coarsely veined, tapering suddenly into a linear or basally expanded claw, the claw ca. 0.3-0.9mm wide, the blade averaging 57 per cent of the total petal length, often reflexed so that blade at right angles to the claw.

Stamens with filaments slender, linear or slightly widened at the base, white or pale green; anthers oblong or sagittate, obtuse; lateral stamens ca. 3.4-5.7mm, average 4.6mm, anthers ca. 1.3-2.5mm, average 2.0 mm; diagonal stamens ca. 3.8-6.2mm, average 4.9mm, anthers ca. 1.5-2.6 mm, average 2.0mm.

Pistil ca. 2.7-6.0mm, usually slightly stipitate, sometimes sessile or almost so, linear to fusiform, terete or broadly elliptic; style linear or clouate; stigma depressed-capitate; ovules to 0.8mm, more or less oblong, biseriate on slender pendulous funicles, ca. 35-70; lateral nectaries pentagonal to square or suborbicular, usually open on interior, slightly emarginate on the exterior, producing on each side of each gland a lateral appendage encircling the base of the adjacent diagonal stamen; median nectary a deltoid lobe of tissue between the bases of the diagonal stamens, simple or two- or three- lobed.

Fruiting pedicels usually ca. 7-13mm, exceptionally to 20mm, ca. 0.3-0.6mm diameter, terete or obtusely quadrangular, erect or spreading, usually at an angle of about 45 degrees from the stem, straight or slightly curved distally.

Fruit ca. 8-33mm long, ca. 1.0-2.5mm across the septum, latisept or terete, linear or ellipsoid, straight or slightly curved, rarely sessile, usually on a linear stipe to 1.5mm, exceptionally to 2.2mm; valves convex, proximally rounded to truncate, distally rounded to subacute, with distinct vein; style linear to broadly obconical, ca. 0.7-2.5mm long, ca. 0.3-0.6mm diameter, ratio length to width 1.4:1-6.3:1; stigma fleshy, depressed-capitate, as wide as the style or to twice its width; septum white, with median nerve, usually translucent, but sometimes opaquely vitreous, smooth or slightly rugulose between seeds and at the edges; funicles slender, more or less linear or narrowly deltate, straight or curved.

Seeds ca. 0.8-1.2mm long, ca. 0.4-0.7mm wide, biseriate, oblong to ellipsoid, straight or curved slightly, plump; testa yellow-brown or dull reddish-brown, slightly darker at the hilum, when moistened exuding mucus to ca. 0.15mm wide, the mucus exuded as discrete oblongs and thus appearing radiate; embryo exactly notorrhizal, radicle usually slightly longer than the cotyledons.

Specimens seen: (see Map 4 - page 143)

South Australia: - Camp 33, Simpson Desert Expedition; 21.7.1939; Crocker - AD: head of valley, 5 miles north of Mungeranie homestead;

24.8.1960; Lothian 318 - AD: 5 miles north of Mungeranie homestead; 24.8.1960; Lothian 319 - AD: Camp 42, Simpson Desert Expedition; 29.7. 1939; Crocker - AD: about 8 miles south-west Marree; 14.7.1955; Hill 86 - AD: railway north of Marree;?; Cleland - AD: north of Bopeechee; 6.8.1963; Lothian 1306 - AD: Anna Creek; 10.9.1930; Cleland - AD: south of Marree; 7.4.1958; Cleland - AD: south of Marree; 7.4.1950; Lord - AD, MEL: Mundowdna Siding; 24.7.1955; Lothian 1196 - AD: Mt. Lyndhurst; Aug.1898; Koch 328 - NSW 53545: Mt. Lyndhurst; Sept.1898; Koch 328 - AD: Mt. Lyndhurst; Sept.1899; Koch 328 - AD: 2 miles west of Leigh Creek; 28.10.1953; Lothian - AD: Mt. Chambers Gorge; 30.5.1937; Cleland - AD: Chambers Gorge; 12.9.1956; Eichler 12578 - AD,L,K,UC: Gypsum Well; 14.8.1963; Lothian 2077 - AD: 4 miles north of Oodnadatta; 14.8.1963; Lothian 2042 - AD,UC,Z: Oodnadatta; Sept.1924;? - AD: 1 miles north-west of Oodnadatta; 18.6.1953; Symon - ADW: Todmorden Stn.-Coongra Creek-Boiler W.H.; 22.2.1958; Wigg - ADW: 45 miles west of Oodnadatta township; 13.9.1955; Perry 5539 - AD, CANB(lrrs),NT: ca. 53 miles east of Mt. Willoughby; 16.9.1963; Shaw 216 - AD: Arkaringa Amphitheatre; 15.8.1963; Lothian 2119 - AD: South Neales, 50 miles west of Oodnadatta; 5.8.1933; Cleland - AD: 40 miles east of Hawks Nest Well; 4.8.1963; Kuchel 636 - AD: upper Arkaringa Creek; 18.5.1891; Helms - AD,MEL: 1 mile north of Wintinna Stn.; 13.8.1962; Symon 2740 - ADW: Wintinna Creek; 19.9.1963; Shaw 237 - AD: 4 miles east of Mt. Willoughby; 16.9.1963; Shaw 210,211 - AD: ca, 1 mile east of Copper Hill H.S.; 16.9.1963; Shaw 213 - AD: 20 miles east of Evelyn Downs; 16.9.1953; Ising - AD: Evelyn Downs; Sept.-Oct.;950; Ising - AD: Evelyn Downs; 27.8.1952; Ising - AD: Evelyn Downs; 3.9.1952; Ising - AD:

Evelyn Downs; 25.8.1954; Ising - AD: Evel[illegible]; 3.9.1955; Ising - AD: between Wintinna and Mable Creek; 12.9.1947; Béchervaise - MEL: Mable Creek; 10.10.1955; Burbidge & Gray - CANB(p.i.): 8 mile digging, Coober Pedy; 2.5.1964; Lothian 2682 - AD: 5 miles north of Coober Pedy; 13.8.1962; Kuchel 445 - AD: 5km west of Coober Pedy; 29.6.1964; Eichler 17863 - AD: Stuarts Range (Coober Pedy);?; French - MEL: Stuarts Range; rec.30.7.1920; Ising coll. - AD: Coober Pedy; 2.7.1958; Cleland - AD: Coober Pedy; 5.7.1960; Cleland - AD: Coober Pedy; 15.9.1963; Shaw 205,206,207 - AD: 90 miles west of Todmorden Stn.; 8.7.1914; White - AD: De Rose Hill Stn.;Aug.1954; Lothian 845/54 - AD: Musgrave Range; July,1926; Basedow - AD:

Northern Territory or South Australia: south of Charlotte Waters; Sept.1885; Kempe - MEL: N.W. interior of South Australia;1859; McDouall Stuart's Expedition (holotype of Blennodia trisecta var. brachycarpa Benth.) - MEL:

Distribution: This species is at present known from South Australia where it has been collected most frequently in the area west of Lake Eyre. There are also scattered collections from the area north-east of the lake and south-east into the northern parts of the Flinders Ranges.

The southern-most collections of all are from Chambers Gorge in the eastern part of the Flinders Ranges, but west of Lake Torrens it seems to extend no further south than about 40 miles south of Coober Pedy.

In the north-western part of New South Wales and the adjacent parts of Queensland occur plants which have almost the fruit of this species, but the leaves of A. trisecta.

Observations: This is one of the most variable species of *Arabidella*, fruit shape and, to a much lesser extent, leaf width varying. In the area west of Lake Eyre plants of this species have leaves with the segments not more than about 1.0-1.2mm wide and fruit which are usually ellipsoid. However east of Lake Eyre and in the northern parts of the Flinders Ranges the plants have coarser leaves, about 1.0-1.5mm wide, and fruits which are more nearly linear. These eastern plants also tend to bear fruit which have a linear style about the same width as the stigma; the western ones more often have obconcial styles which are not so wide as the stigma.

Some features of the fruit of these two forms are compared in the following tabulation:

	western form 25plants	eastern form 11 plants
fruit length(mm)	9-19	10-27
fruit width(mm)	1.1-2.4	1.0-2.5
ratio L/W	4.7:1-10.3:1	7.5:1-19.5:1
average L/W	7.7:1	12.8:1
style width(mm)	0.25-0.6	0.25-0.6
stigma width(mm)	0.4-1.2	0.4-0.7[-1.0]
stipe length(mm) aver.	2.5	5.6

There are found plants which bear fruits showing all possible combinations of these characters on one raceme, an example being the collections from Anna Creek (*Cleland s.n.* - AD).

Ecology and Biology: In the far north of South Australia *A. glaucescens* occupies the ecological niche filled by *A. trisecta* in more southerly areas. It is usually seen in disturbed soil along roadsides and drainage ditches, as well as on rocky hillsides and on creek banks where there has been water erosion.

In the area south-west of Oodnadatta *A. glaucescens* is much more common than is *A. trisecta*, while in the immediate vicinity of Oodnadatta and to the north-east this species seems to have completely replaced it. *A. glaucescens* is a larger and more conspicuous plant than *A. trisecta* in the area where they occur together. Also it has more fragrant flowers. The writer has seen plants of these two species side by side, the flowers of *A. glaucescens* being surrounded by insects, those of *A. trisecta* attracting almost none.

Flowering and fruiting seem generally to occur in August and September, but with favourable rains the plants might flower in any month, although they would probably not reach fruiting stage.

Uses and Common Names: Neither uses nor common names seem to have been recorded.

Relationships: *A. glaucescens* is most closely related to *A. filifolia* and *A. trisecta*; it differs from the former in habit and foliage and from *A. trisecta* in fruit and foliage (see discussion under *A. filifolia*).

If one hypothesizes a restriction of *A. trisecta* (or a very near ancestor) and perhaps also of *A. filifolia* to mountainous refuges during the post-Pleistocene aridity, *A. glaucescens* would then seem to have evolved after climatic conditions improved and *A. trisecta* had (re-) colonized the flatter country.

Probably, if this were so, *A. glaucescens* would have arisen from what was a Flinders Ranges population of *A. trisecta*. The high country in the north-west of South Australia was also a refuge during the arid periods, but neither A. trisecta nor A. glaucescens appear to be at all common in this area. The present range of A. glaucescens is quite distinct from that of A. trisecta although there are no known climatic or edaphic factors to explain this.

There are plants occurring in north-western New South Wales and the adjacent parts of Queensland which have the stipitate, almost linear fruits of the eastern form of A. glaucescens, but leaves which are narrow and like those of A. trisecta. In floral characters they are intermediate, the floral organs being slightly larger than those of A. trisecta. The plants vary a certain amount among themselves, but none of them can be definitely assigned to either A. trisecta or A. glaucescens. They have, perhaps, evolved from an arid period population of A. trisecta restricted to the Barrier Range in north-western New South Wales for both A. trisecta and this form occur in that area.

The following collections belong to this intermediate form:
New South Wales: - Tibooburra; Feb.1950; Burges - SYD: Tibooburra; Jan.1913; Couch - NSW 53568: Tibooburra; 2.11.1947; Black - AD: Mt. Poole Station to Milparinka; Aug.1939; Brough & Beadle - SYD: near Wittabrinna Station, ca. 4 miles north of Tibooburra; 6.6.1955; Johnson & Constable - NE, NSW 36582, NT: 4 miles south of Milparinka; 17. 11. 1949; Reik & Common - CANB(p.i.): Fowler's Gap, 70 miles north of Broken Hill; Aug.1955; Beadle - NSW 53542: Brewarrina; Nov.1903; Boorman - NSW 53566: Evelyn Creek north of Barrier Range; 1887; King - MEL: Broken Hill; Dec.1917; Andrews - NSW 53562: Broken Hill; Sept.1931; Dwyer - NSW 53735: Darling River; ?; B. - MEL: Menindie; ?; ? - MEL:

Queensland: - between Nappamerrie (Qld.) and Innamincka (S.A.) about 20km e.n.e. of Innamincka; 12.8.1962; Jackson 407 - AD: Gilruth Plains, Cunnamulla;17.7.1947; Allen - CANB(p.i.),NE: Goonamurra, near Bulo;20.9.1938; Everist 1683 - BRI: Northhampton Downs, near Blackall; 26.8.1935; Everist 1254 - BRI:

Queensland or South Australia: Cooper's Creek;?;Bailey - NSW 53567:

<u>ARABIDELLA</u> <u>FILIFOLIA</u> (FvM.)SHAW (COMB. NOV.)

(filum = thread, folium = leaf; the leaves are usually narrow and undivided)

<u>Erysimum</u> <u>filifolium</u> FvM., Linnaea 25(1853)368 (basionym)

<u>Sisymbrium</u> <u>filifolium</u> (FvM.)FvM., Trans. Vict. Inst. 1(1855)115 in obs. (nom. illegit.) [non Willd., Sp. Pl. 3(1800)495]; FvM., Pl. Col. Vict. 1(1860-1862)40;; Tate, TRSSA 3(1880)51; FvM., Census 1 (1882)5; Tate, TRSSA 6(1883)101; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral.(1890)16,206; Koch, TRSSA 24(1900)81.

<u>Blennodia</u> <u>filifolia</u> (FvM.)Benth., Fl. Austral. 1(1863)73; Tate, TRSSA 22(1898)123; Black, Fl. S. Austral.(1924)247; (1929)687; Black, TRSSA 61(1937)243; Black, Fl. S. Austral. ed.2(1948)375.

<u>Pseudarabidella</u> <u>filifolia</u> (FvM.)Schulz, Pflrch. 86(1924)257; Black, TRSSA 61(1937)243.

The above names are nomenclatural synonyms of <u>Arabidella</u> <u>filifolia</u>, being based on the same type.

<u>Figures</u>: Figure 5 N.B.: In Turner (1891) is given an illustration and description of a plant listed as "Blennodia filifolia Benth.". However the plant shown in the illustration appears to be <u>Lepidium</u> <u>leptopetalum</u> FvM., and the description refers also to this species.

<u>Original description</u>: "Erysimum filifolium, suffruticosum, glabrum, erectum, foliis lineari-filiformibus plerumque fasciculatis, pedicellis crassiusculis patentibus siliquae aequilongis, valvis subconvexis uninerviis, stylo brevi, stigmate minuto depresso vix emarginato."

Description: Plant a straggling shrub; root not seen; stems to ca. 3 feet in length, terete or finely ridged, glabrous, sometimes much branched.

Leaves (all cauline) to ca. 5.5cm long, to ca. 1.7mm wide, usually 0.8-1.2mm, filiform, solitary or, more often, clustered, usually entire, sometimes bi- or tri- sect, rounded to acute, sometimes narrowly spathulate distally, *in vivo* rather fleshy, *in sicco* very brittle.

Inflorescence to ca. 30-flowered, rather loose; flowering pedicels terete or quadrangular; buds ovoid to spherical; flowers very sweetly scented.

Sepals usually green, occasionally lavender; lateral sepals ca. [3.0-]3.3-4.3[-4.7]mm long, ca. 1.3-1.9[-2.3]mm wide, oblong or narrowly obovate, not basally saccate; median sepals ca. 3.3-4.5[-5.0]mm long, ca. 1.4-2.2mm wide, not basally saccate.

Petals to 1½ times sepals in length, ca. 4.3-6.1mm long, average 5.3mm, white; blade ca. [1.8-]2.5-3.5mm long, ca.2.2-3.6mm wide, average 2.8x2.8 mm, ratio length to width of blade 0.8:1-1.4:1, average 1.0:1, suborbicular or rhombic, distally subacute to rounded, margin entire or sinuate, tapering suddenly into a linear claw, the blade averaging 52 per cent of the total petal length, often reflexed so blade at right angle to the claw.

Stamens with filaments slender, linear, sometimes slightly expanded basally, ca. 0.2-0.5mm, usually 0.3mm wide, white; anthers rather narrowly oblong, sometimes sagittate; lateral stamens ca. 3.3-4.1[-4.7]mm, average 3.9mm, anthers ca. 1.1-1.8mm, average 1.5mm; diagonal stamens ca. 3.6-4.7[-5.3]mm, average 4.2mm, anthers ca. 1.2-1.8mm, average 1.6mm.

Pistil ca. 2.5-4.0mm, shortly stipitate, linear, terete or quadrangular; style present; stigma depressed-capitate or almost tectiform; ovules ca. 40-70 per ovary; lateral glands roughly pentagonal, open or only emarginate on interior, sometimes emarginate on exterior, producing on each side of each gland a lateral appendage encircling the bases of the adjacent diagonal stamens; median gland a triangular or oblong piece of tissue between the bases of the diagonal stamens, simple or with 2 or 3 small lobes or teeth, the lateral and median glands approximate but not fused.

Fruiting pedicels ca. 7-14mm long, to 0.6mm, usually 0.3-0.4mm in diameter, terete, usually at an angle from the stem greater than 45 degrees, often horizontal or almost so, sometimes slightly recurved.

Fruiting raceme usually quite loose.

Fruit ca. 7-28mm long, usually 12-18mm, ca. 1.0-2.0mm, usually 1.2-1.8 mm wide across the septum, latisept, on a stipe ca. 0.3-1.3mm, usually 0.5-0.8mm, long; valves shallowly convex, proximally rounded or, often, subacute; distally subacute to acute; style ca. 0.6-2.1mm, usually 0.8-1.3mm, slender and linear; stigma small, depressed-capitate; septum white, hyaline, nerve usually visible, often spongy and wrinkeled between the seeds, epidermal cells small, rounded to pentagonal, regular in size.

Seeds ca. 1.3-1.6mm long, ca. 0.6-0.8mm wide, biseriate, usually oblong, starigh or slightly curved, somewhat flattened, often with a small triangular to semi-circular wing at distal end; testa light yellow-brown, usually with some red pigment at the hilu, when moistened, copiously mucose; mucus exuded as discrete oblongs, therefore appearing radiate, ca. ½mm wide; embryo obliquely notorrhizal, the radicle slightly twisted to one side, cotyledons narrowly oblong, usually truncate, usually slightly shorter than the radicle.

Type locality: "Prope rivum Crystal Brock"

Holotype: Crystal Brock; Nov.,1851; Mueller - MEL 766!

Isotype(?): K

Other specimens seen: (see Map 4 - page 143)

South Australia: - Mt. Lyndhurst; May,1900; Koch 507 - AD: Mt. Parry Gap; 9.6.1883; Tate - AD: 5 miles N. of Beltana; 15.7.1955; Hill 23 - AD: between Gratunga and Moolooloo; 1.10.1918; Ising coll. - AD: Gratunga; 1.10.1918; Ising 459 - AD: Parachilna Gorge; 9.10.1958; Fraser - AD: Tea Cosy Creek Gorge; 8.10.1960; Filson 3491 - AD: 2 miles west of Angorichina Hostel; 3.9.1962; Sharrad 1331 - AD: between Hawker and Blinman; Sept.1956; Carrodus - AD: Wilpena Creek; 31.8.1963; Shaw 200 - AD: Brachina Gorge; 7.9.1961; Symon 1411 - AD, ADW, UC, Z: Creek bed south of Hockina; 11.4.1955; Hilton 1480 - ADW: 10 miles N. of Hawker; 20.8.1963; Kuchel 735 - AD: Apoinga; 29.9.1892; Brummitt - AD: Coroona (Iron Knob);?; Cleland (W. L.) - AD: near Whyalla-Kimba road, on hill of the Middle back Ranges; 2.10.1958; Wilson 157 - AD: South Austra lia; Nov.1903; Benham - NSW53571: N. Holl. austr. interior;?; Mueller - MEL:

Distribution: A. filifolia now seems confined to the Flinders Ranges and the Middleback Ranges, the latter south-west of Port Augusta. There is also a collection from Iron Knob which is about 35 miles north of Mt. Middleback. The southern-most locality is Crystal Brock, about 110 miles north of Adelaide, where Mueller collected the holotype in February, 1851. The writer has several times searched for this species in this vicinity, but without success. The Crystal Brook area has been used for agricultural purposes since about 1860 and it is likely that *A. filifolia* is now gone from there.

Observations: There is little variation within this species. It is distinctive in habit and should not be easily confused with any other Australian crucifer. Black (1937), in discussing this species, remarked that the leaves are mostly bisect or trisect. Black was, however, including with the true *A. filifolia* the plants now referred to *A. glaucescens* which do have divided leaves. *A. filifolia* has predominantly linear entire leaves and trisect ones are very uncommon.

Ecology and Biology: *A. filifolia* occurs on rather rough ground. It is a large straggling shrub and often grows on the steep rocky walls above creeks. The writer has seen this species in some quantity along the Wilpena Creek where it almost covered a 30 foot high rocky wall above the creek. It also occurs among rocks on hillsides - in fact, in places where the available moisture is likely to be held. This species seems to require a greater supply of water than do the other suffruticose species.

Most of the flowering and fruiting plants have been collected in September and October, but there are collections made in November and April to July. Probably some flowers or fruit could be found on *A. filifolia* at any time of the year except in severe drought conditions.

The flowers are very sweetly scented and attract many insects; several of the collections bear galled inflorescences much like those found on plants of *A. trisecta* in the Flinders Ranges, but it is not known which insect is responsible for these.

<u>Uses and Common Names</u>: There are apparently none.

<u>Relationships</u>: <u>A</u>. <u>filifolia</u> is most closely related to <u>A</u>. <u>trisecta</u> and to <u>A</u>. <u>glaucescens</u>. Black (1929, 1937) considered this species and <u>A</u>. <u>trisecta</u> to differ from each other only in fruit characters, but he was including with <u>A</u>. <u>filifolia</u> the trisect-leaved plants with stipitate fruits which are now placed in <u>A</u>. <u>glaucescens</u>.

The three suffruticose species of <u>Arabidella</u> differ among themselves in the following respects:

	<u>A</u>. <u>trisecta</u>	<u>A</u>. <u>filifolia</u>	<u>A</u>. <u>glaucescens</u>
leaves	trisect	entire	trisect
leaf width (mm)	usu. $<$0.5	usu. 0.8-1.2mm	usu. 0.5-1.5mm
fruit	sessile	stipitate	stipitate
petal length (mm)	4.5	5.3	5.7
seed length (mm)	0.7-0.9	1.3-1.6	0.8-1.2
habit	compact, erect	straggling	compact, erect

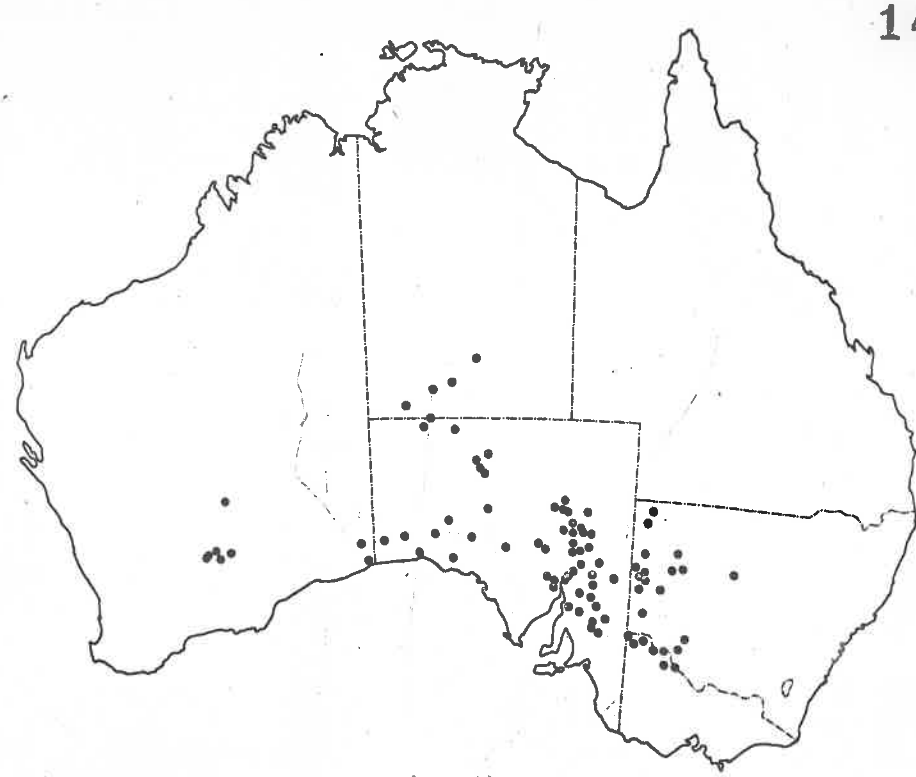
In nectary structure <u>A</u>. <u>filifolia</u> is closer to <u>A</u>. <u>glaucescens</u> than to <u>A</u>. <u>trisecta</u>. In the first two the glands are often two- or three-lobed and the entire glandular ring has a jagged appearance. In <u>A</u>. <u>trisecta</u> the median glands are usually simple and the glands as a whole are smooth and rounded.

Generally the fruit of <u>A</u>. <u>filifolia</u> is slightly wider in proportion to its length than that of <u>A</u>. <u>trisecta</u> and approaches <u>A</u>. <u>glaucescens</u> which often has an ellipsoid fruit. There is a form of this latter species, south and east of Lake Eyre, with more slender fruit than is usual, and plants of this form and of <u>A</u>. <u>filifolia</u> may be much alike in fruit characters (see discussion under <u>A</u>. <u>glaucescens</u>).

The pattern of distribution suggests that A. filifolia is probably descended from an A. trisecta-like ancestor and has become confined to an ecological niche much more narrow than that occupied by A. trisecta and A. glaucescens. Since both A. trisecta and A. filifolia occur in the Flinders Ranges, an area which was one of the main refugia during the post-Pleistocene aridity, it could be suggested that A. filifolia, which seems to have less tolerance to aridity than does A. trisecta, has been restricted to the Flinders Ranges and the eastern Eyre Peninsula ranges while A. trisecta has been able to (re-)colonize the semi-arid plains.

It is worth noting how closely the distribution of this species parallels that of Ranunculus hamatosetosus Eichler (Eichler, 1958). This species of Ranunculus occurs also in the Flinders Ranges and extends southward into the Mt. Lofty Ranges, apparently as far as Eden Valley, about 35 miles north-east of Adelaide. There is also a single collection from Iron Knob. It would be interesting to know if R. hamatosetosus is more widely spread on the Eyre Peninsula aand also if there are other species showing this sort of distribution.

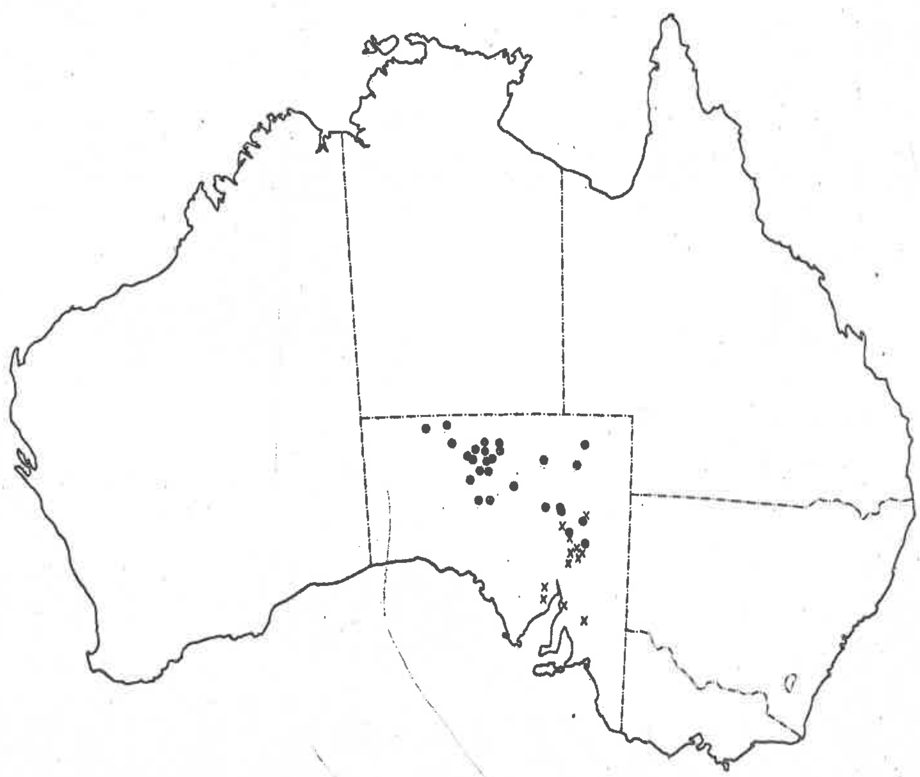
3



Map 3 - Arabidella trisecta (FvM.)Schulz

Map 4 - ● = Arabidella glaucescens Shaw
× = Arabidella filifolia (FvM.)Shaw

4



ARABIDELLA NASTURTIUM (FvM.)SHAW (COMB. NOV.)

(nasturtium = Nasturtium L., a genus in this family; because of the supposed resemblance of this species to a species of Nasturtium)

Erysimum nasturtium FvM., Linnaea 25(1853)368 (basionym).

Sisymbrium nasturtioides FvM., Trans. Vict. Inst. 1(1855)115 [non Sisymbrium nasturtium Thunb., Fl. Jap.(1784)260]; FvM., Pl. Col. Vict. 1(1860-1862)39; FvM., Fragm. 10(1876)53; FvM., Nat. Pl. Vict. (1879)32; Tate, TRSSA 3(1880)51; FvM., Census 1(1882)5; FvM., Key Vict. Pl. 2(1885)7; Tate, TRSSA 7(1885)67 in obs.; FvM., Key Vict. Pl. 1(1887-1888)130; Cleland, TRSSA 10(1888)78; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral. (1890)16,206; FvM. et Tate, TRSSA 16(1896)335; Koch, TRSSA 22(1898) 102.

Blennodia nasturtioides (FvM.)Benth., Fl. Austral. 1(1863)74 (nom. illegit.); Turner, Forage Pl. Austral.(1898)3; Black, TRSSA 41 (1917)631,638; Black, Fl. S. Austral.(1924)247; Murray, TRSSA 55(1931)99; Black, Fl. S. Austral. ed.2(1948)375.

Blennodia nasturtium (FvM.)Druce, Rep. Bot. Exch. Club 4(1917)609.

Micromystria nasturtium (FvM.)Schulz, Pflrch. 86(1924)264.

The above names are all nomenclatural synonyms of Arabidella nasturtium, being based on the same type.

Excluded: Micromystria nasturtium var. pinnatifida (Benth.) Schulz, based on Blennodia nasturtium var. pinnatifida Benth., = Arabidella procumbens (Tate)Shaw.

Figures: Turner, Forage Pl. Austral.(1891)fig.3; Schulz, Pflrch. 86(1924)fig.57; Schulz, Pflfam. ed.2 17b(1936)fig.408; Beadle, Veg. & Past. West. N.S.W.(1948)fig.71; - Figure 6

Original description: "Erysimum nasturtium, herbaceum, glabrum, erectum aut diffusum, foliis profunde tripartis, lobis eorum linearibus, pedicellis tenuibus patentibus siliquae aequilongis, valvis subconvexis uninerviis, stylo brevi vel subnullo, stigmate minuto depresso vix emarginato, petalis luteis."

Description: Plant probably annual, many-stemmed, glabrous; root a slender taproot, usually ca. 1mm diameter; stems terete or finely fluted, exceptionally to ca. 50cm high, but usually less than 25cm, fruiting plants from 3cm high, green to dark reddish-brown, initially arising from a basal rosette of leaves, usually unequal with an erect leafless or a lmost so, central stem and longer decumbent lateral stems, these leafy and sometimes much branched, these secondary branches sometimes much reduced so that the terminal inflorescence appears to arise directly from the leaf axil.

Basal leaves to ca. 3cm long, slender, to 2mm, but usually less than 1mm wide, linear, bi- or tri- sect or, rarely, entire; if trisect (the most usual condition), the central segment usually longer than the lateral segments (to 2x), these often having at or near the base a very small lobe, occasionally appearing as only a tooth; segments generally subacute to rounded, the lateral segments and teeth more often tending to subacute; lateral segments often falcate, the central one usually straight; if trisect, the lateral segments usually arising from about the same level, if bisect the segments usually of unequal length.

Cauline leaves as basal leaves, but shorter, to ca. 2cm long.

Inflorescences usually 20- 30-flowered, dense, elongating only a little until the ovaries of the lowermost flowers begin maturation, rarely with very remote buds below the lowest flowers, sometimes axillary as the result of the non-development of stems, very rarely basal; buds immediately before anthesis spherical to ovoid; flowering pedicels slender, terete.

Sepals oblong to (ob-)ovate, yellow to green with a narrow hyaline yellow or colourless margin; lateral sepals ca. 1.8-3.5mm long, ca. 0.7-1.6mm wide, the average 2.7x1.2mm, the ratio length to width 1.5:1-3.0:1, distally rounded to subacute; median sepals ca. 1.7-3.6mm long, ca. 0.7-1.9mm wide, the average 2.7x1.3mm, ratio length to width 1.3:1-3.6:1, distally rounded, narrowly oblong to suborbicular.

Petals as long as or slightly longer than the sepals, ca. 2.1-4.2mm long, ca. 0.8-2.0mm wide, the average 2.8x1.5mm, the ratio length to width 1.4:1-2.9:1; blade suborbicular, tapering into a claw ca. 0.3-0.5 mm wide, the claw usually about 40 per cent of the total length of the blade, or blade broadly obovate, the ratio length to width of the blade 0.9:1-1.7:1, or the petal as a whole gradually becoming, with a diminution of the claw, obovate; distally rounded to truncate, sometimes retuse, margins entire or sinuate; usually bright yellow, rarely almost white, in sicco often dark brown.

Stamens with filaments linear, ca. 0.1-0.2mm wide, dilated at the base, usually yellow, less often white or pale green; anthers usually broadly oblong, often almost quadrate, obtuse to truncate; lateral stamens ca. 1.7-4.5mm long, average 2.6mm, lateral anthers ca. 0.6-1.9mm long, average 1.0mm; diagonal stamens ca. 2.1-4.9mm, average 3.0mm, diagonal anthers ca. 0.5-1.9mm long, average 1.0mm.

Pistil ca. 2.0-4.0mm long, sessile or on a very short stipe, terete, linear or tapering slightly proximally and distally; style short, linear; stigma fleshy, depressed-capitate, slightly wider than the style; ovules ca. 20-60 per ovary, usually about 40, oval to round on slender pendulous funicles; glands quite variable, depending on the degree of development; lateral glands hexagonal to pentagonal to suborbicular, usually open on the exterior, emarginate to open on the interior, producing on each side of each gland a lateral appendage encircling the base of the adjacent diagonal stamen, the adjacent lateral appendages almost touching on the median line but not fused, the lateral glands sometimes only incompletely developed; median glands, if present, small conical lobes of tissue between the bases of the members of each pair of diagonal stamens, but often obsolete.

Fruiting pedicels ca. [4-]6-10[-13]mm long, ca..0.15-0.3mm in diameter, slender, usually terete or quadrangular, usually spreading at about 45 degrees from the stem, but varying from nearly erect to nearly horizontal, often with much reddish pigment.

Fruit ca. 6.0-25mm long, usually ca. 10-20mm, ca. 0.7-1.6mm, usually ca. 0.9-1.2mm across the septum, sessile or almost so, linear, straight or slightly curved, usually terete, often with red pigmentation in the replum and style; valves linear, quite convex with a distinct nerve, when mature, stramineate, sometimes slightly compressed between the seeds, proximally usually rounded, but ma y be truncate to subacute, distally rounded to subacute, often with red pigmentation especially at the edges; styles usually ca. 0.4-0.8[-1.1]mm long, sometimes obsolete, slender, linear or slightly expanded distally; stigma small, depressed-capitate, as wide as or barely wider than the style; septum white, translucent, nerve often indistinct, usually wrinkeled between seeds; funicles often filiform or na rrowly triangular, usually pendulous, slightly curv curved.

Seeds ca. 0.7-1.0mm long, ca. 0.4-0.6mm wide, usually subbiseriate to biseriate, ca. 5-30 per locule, ovoid to oblong, somewhat flattened; testa yellow to light yellow-brown, usually with darker pigmentation at the hilum, very finely papillose, when moistened, exuding mucus to ca. 0.15mm in width, the mucus clear and greyish, exuded as oblong bodies, one from each papilla on the testa, thus appearing finely radiate; embryo exactly or slightly obliquely notorrhizal, the radicle usually slightly longer than the cotyledons which are of equal length.

Type locality: "In locis humidis inter flumina Hoet et Hill nec non ad rivum Rocky Creek."

Holotype: Zwischen dem Hutt und Hill River, auch na ch der Rocky Creek zu auf trockenen Wiesen; Oct.1851; Mueller - MEL 774

Isotype?: Possibly an isotype is a plant now in B collected by Mueller at Rocky River, but undated; perhaps also to be associated is a MEL collection "N. Holl. austral interior;?; Mueller" - on the label was written by Muellerr "Erysimum (Arabidella) nasturtium".

Other specimens seen: (see Map 6 - page 176)

South Australia: - Pandie-Pandie; 26.8.1960; Lothian 450 - AD, UC,Z: 1 mile south of Qld.-S.A. border fence on the Birdsville track; 27.8. 1960; Lothian 468 - AD: north of Marree; 18.8.1930; Cleland - AD: 5 miles N. of Marree; Aug.1931; Cleland - AD: Marree; 31.7.1931; George -

ADW: Herrgott; 13.10.1907;? - AD: Callana; 21.8.1931; Ising Coll. - AD: Callana; 5.8.1932; Cleland - AD: Callana; 21.8.1931; Ising 2996 - AD: Callana; 21.8.1931; Ising - AD: Wangiana; 7.8.1931; Cleland - AD: Wangiana; 19.8.1932; Ising - AD: north of Bopeechee; 6.8.1963; Lothian 1308 - AD: north of Bopeechee; 6.8.1963; Lothian 1300, 1307 - AD: 19 miles north of Bopeechee; 6.8.1963; Lothian 1326 - AD: Beresford; 21.9. 1945; Cleland - AD: 6 miles north of Marree; 6.8.1963; Lothian 1273, 1274 - AD: Mt. Lyndhurst;?; Koch - AD: Mt. Lyndhurst; Aug.1899; Koch 201 - K, BRI, MEL, NSW 53703, AD;: Avondale H.S.; 21.8.1963; Kuchel 763 - AD: Paralana; 22.8.1963; Kuchel 959 - AD: plain between Avondale and Lyndhurst siding; 10.4.1955; Hilton 1433 - ADW: Ideyaka; 2.9.1883; Tate - AD: 7 miles north of Beltana; 29.8.1963; Shaw 182 - AD: Mt. Bayley; 10.8.1930; Andrew - AD: Mt. Aleck; 25.8.1963; Kuchel 1120 - AD: 10 miles S. of Wilpena; 25.8.1961; Shaw 16 - AD: between Flinders Range a nd Lake Torrens;?; Richards - MEL: 10 miles north of Hawker; 20.8.1963; Kuchel 725 - AD: Hawker; 25.8.1883; Tate - AD: 2 miles south of Hawker; 22.8.1960; Lothian 226 - AD: Willochra Plain, 6 miles north of Gordon; 5.8.1963; Lothian 1262 - AD: Gordon; 11.10.1917; Cleland - AD: 15 miles north of Quorn; 1.9.1963; Shaw 204 - AD: Hawker-Orroroo; 24.9. 1936; Clarke - ADW: Carrieton; 29.9.1916; ? - AD: Quorn; 1.10.1916; Cleland - AD: Quorn; 2.9.1941; Cleland - AD: 5 miles west of Port Augusta; 28.8.1955; Hilton 1978 - ADW: Spear Creek, near Port Augusta; 13.8.1937; Cleland - AD: near end of Spencer's Gulf;?; Wehl - MEL: 6 miles north of Yunta; 28.7.1963; Shaw 137 - AD: Canegrass to Woolgang-; 23.9.1937; Ising coll. - AD: Canegrass; 21.9.1937; Ising - AD: Canegr grass; 22.9.1937; Ising - AD: 18 miles east of Burra on Burra-Morgan road; 20.8.1963; Shaw 163 - AD: 14 miles west Florieton on Burra-Morgan

gan road; 13.8.1963; Shaw 150 - AD: 1 miles west Florieton; 13.8.1963; Shaw 146 - AD: Florieton; 30.8.1961; Symon 1279 - ADW: 18 miles north Bower on The Gums-Bower road; 20.8.1963; Shaw 168 - AD: L miles west of Florieton; 30.8.1961; Shaw 40,41,42,43,44,45, 46, 39 - AD: 10 miles north of Mt. Mary on road to Florieton; 13.8.1963; Shaw 143,144 - AD: Yarrowie, St. Vincent's Gulf;?;Wehl - MEL: 5 miles north of William Creek; 7.8.1963; Lothian 1345 - AD: William Creek; 18.81930; Cleland - AD: Strangway's Springs; 1895; Greatwick 36 - MEL: Beresford; 21.9. 1945; Cleland - AD: Beresford; 21.9.1945; Cleland - AD: Beresford; Sept.1942; Fuaux - MEL: Arcoona; 8.9.1927; Murray 227 - AD: Pimba; 26.8.1939; Cleland - AD: 13 miles W. Pimba; 2.8.1963; Kuchel 546 - AD: Yuddnapinna; 12.7.1954; Hilton 744 - ADW: Corocna (Iron Knob);?; Cleland (W.L.) - AD: Gawler Ranges; Sept.1913; White - AD: Gypsum Well 19 miles north of Oodnadatta; 14.8.1963; Lothian 2078, 2080 - AD: Gidjee flood plain, 4 miles north of Oodnadatta; 14.8.1963; Lothian 2065 - AD: Oodnadatta; 29.7.1952; Ising - AD: 1 miles N.W. Oodnadatta; 18.6.1953; Symon - ADW: about 5 miles west of Oodnadatta; 16.9.1963; Shaw 217 - AD: Arkaringa Creek, 12 miles north of Mt. Barry Stn.; 30.8.1955; Ising - AD: about 43 miles west of Oodnadatta on Hawks Nest Well road; 19.9. 1963; Shaw 228 - AD: about 50 miles west of Oodnadatta; 19.9.1963; Shaw 232 - AD: near Camp 9, Elder Exploring Expedition; 18.5.1891; Helms - AD; Arkaringa Creek; 14.5.1891; Helms - MEL, NSW 53698, AD: Arckaringa Amphitheatre area ; 15.8.1963; Lothian 2120, 2145 - AD: 23 miles north-east of Mt. Willoughby; 15.8.1963; Lothian 2186 - AD: ca. 5 miles east of Copper Hill Stn.; 16.9.1963; Shaw 214 - AD: Evelyn Downs; (7 collections,1951-1955); Ising - AD: S.A.;1903; Basedow - "Gov. North West Expedition 115" - NSW 53695:

Victoria: - Murray Valley Highway, near Piangil, N.W. Vic.; 4.9.1945; Willis - MEL:

New South Wales: - Jew's Lagoon (N.W. of Narrabri); Aug.1936; Blakely - NSW 53694: Burren Junction; Sept.1912; White - NSW 53700: Scone; Aug. 1913; Breakwell - NSW 53705, BM: Georianawa; Aug.1893; Lamonte 169 - MEL, BM: Angledool Stn.; Aug.1915; the manager - NSW 53704: "Birrabirramah", Pokataroo; 13.8.1952; Waterhouse 3 - NSW 53710: Walgett; Oct. 1899; Little - NSW 53709: 40 miles north of Brewarrina; 29.8.1948; Roe - NE: Ballandool River, near Walgett;?;? - MEL: Ballandool River; 1867; Locker - MEL: Bourke district; Aug.1896; Maiden - NSW 53691: near Bourke; Aug.1896; Maiden - B: Hillston-Hay road; 9.10.1947; Constable - NSW 53701: Langawirra; July,1930; Morris 2768 - ADW, BRI: County Mossgiel; Aug.1942; Beadle - SYD: Lachlan River;1879; Tucker 43 - MEL: N.S.W., Lachlan River; 1817; Cunningham 250 - BM: 15 miles east of Hay; 9.6.1952; Johnson - NSW 53707: Hay district; A ug.1952; Knowles - SYD: Hay; Sept.1889; Fletcher - NSW 53692: Hay; 6.9.1954; Whaite 1673 - NSW 53588: Murrumbidgee River; Sept.1878; Mueller - MEL: Murrumbidgee;?; Day 6 - MEL: Paradise Tank, between Deniliquin and Hay; 13.8.1949; Williams - CANB(p.i.): Wanganella, south of Hay; July,1903; Officier - NSW 53696: Wanganella, near Edwards River; 1885; Kuentz - MEL: "Zara", via Wanganella; Aug.1903; Officier - NSW 53696: "Zara" (near Deniliquin): 19.9.1951; Moore - CANB(p.i.): Wakool; spring,1941; Smith - ADW: Mt. Brown (Milparinka); Sept.1898; Corbett - NSW 53702: 5 miles north of Coally Stn.; 7.6.1955; Johnson & Constable - K, NT, NSW 39994: Paldrumatta Bore, N.S.W.; July,1900; Corbett - BM: Mt. Murchison;?; Giles - MEL: Mt. Murchison;?; Bonney 40 - MEL: upper Darling River;1886; Wurfel

- MEL: Wileannia; Sept.1910; Glenny - NSW 53697: Wilcannia; 20.8.1939; Pidgeon & Vickery - NSW 53693: Menindie aerodrome, ca. 1 mile west of township; 16.7.1955; Constable - K, MT, NSW 39991: Lake Menindie; 1.9.1946; Johnson - NSW 53706: 35 miles south of Menindie; 23.7.1960; Burbidge - NSW 53711, CANB(p.i.): Willow Pt., Anabranch of the Darling - 65 miles north of Wentworth; 27.7.1955; Constable - K, NSW 39995: between the Darling and Lachlan Rivers; Oct.1885; Brückner - MEL: Darling River; July,1893; (Miss)Tepper 36 - MEL: sandhills near the Darling; 28.6.1861; [Beckler] Victorian Exploring Expedition - MEL: Darling River;?;? - MEL: Lower Darling; Aug.1898; Byrnes - MEL: N.S.Wales;?; Fitzgerald 7 - MEL:

Probably New South Wales: - Murray River;?;D. - MEL: Murray River;?;? - NSW 53699: Flood's Creek Mezas; 18.8.1957; Carolin 306 - SYD:

Queensland: - Bullgaroo; 3.7.1942; Allen 229 - NE: Bullgaroo; 22.1.1943; Allen - CANB(p.i.): Tanbar; 20.6.1949; Everist - CANB(p.i.):

Northern Territory (?): - Linda Creek, Central Australia;1889; Henry - MEL:

Western Australia: - Giles, Rawlinson Range; 22.6.1960; Cleland - AD: Frasers Range;?;? - MEL: Coolgardie Road, ca. 7 miles southwest of Kalgoorlie, W. Aust.; 12.9.1951; Kemsley - MEL: Cummening, York East; 1892; Meal - MEL:

Distribution: This species is known from Western Australia, the Northern Territory, South Australia, Queensland, New South Wales and Victoria. In Western Australia only a few collections have been made and these are scattered from Giles in the far-eastern part of the state to Coolgardie in the south-central part.

Collections from South Australia are quite numerous, but there is a great gap between the Western Australian localities and the westernmost ones in South Australia. In the latter state this species is common in the Flinders Ranges and in the area south-east of them toward the Murray River. It also occurs to the west and south-west of Lake Torrens and between Marree and Oodnadatta, as well as to the south-west and west of the latter place. There are two collections only from the far north-eastern part of the state.

In Queensland there are only a few collections from the southern part. In New South Wales the plants are from scattered localitites and suggest that A. nasturtium might be generally distributed throughout this state west of the Dividing Range. There is only one collection from the far north-western part of Victoria.

Observations: Throughout its range this species shows some variation in fruit and flower characteristics. In habit it is quite constant, although in 1963 several collections were made in the far north of South Australia, in the area north and west of Oodnadatta, and along the rail line between Oodnadatta and Marree, which were superficially much like A. trisecta.

In some instances these plants are almost woody at the base. The writer, when collecting in the Oodnadatta area in September, 1963, was impressed by the difference in general appearance between these plants and A. nasturtium in the area south-east of the Flinders Ranges. Apart from the 1963 collections there are only a few from the far north, most of these having been made by E.H.Ising at Evelyn Downs (about 130km south-west of Oodnadatta); these collections are all like the more southerly ones. The winter of 1963 was a good season in the Oodnadatta area and it seems that these collections represent A. nasturtium growing under very favourable conditions.

Petal shape varies rather widely but seems not correlated with other morphological characters. The petals are sometimes much like those of A. trisecta; that is, with an almost orbicular blade suddenly tapering into a linear claw. They are smaller than the petals of A. trisecta, with an average length of 3.1mm, compared with one of 4.5mm. At the other extreme are petals which are obovate and clawless and almost indistinguishable from those of A. procumbens. These are generally smaller than the clawed petals, having an average length of 2.4mm. There exist all intermediates between the extremes and on most plants the petals are between the two in shape. On an individual plant, the petals are quite constant in shape, but may vary quite sharply between members of the same population.

The degree of development of the glands also varies from the fully developed lateral and median glands, as seen in A. trisecta, to the reduced lateral glands, with no median ones, seen in A. procumbens. There is, however, no apparent connection between petals of the "trisecta-type" and fully developed glands and none between "procumbens" petals and poorly developed glands. All that can be said is that petals of the "trisecta-type", or much like them, seem to be more usually found in South Australian plants, while plants from New South Wales more often tend toward the "procumbens-type".

The fruits are either terete with quite smoothly flattened valves or somewhat flattened and with the valves slightly constricted between the seeds. When terete they are much like those sometimes found on A.

eremigena. Very rarely do they have the flat sessile stigma of A. procumbens.

Among the collections is one made near Coolgardie (Komsley s.n. - PERTH) which seems rather different. The basal leaves in shape approach those of A. procumbens, being for the most part entire, those that are not having only small lobes; also the leaves are wider than the usual, to about 3mm, the lateral lobes being generally less than 1mm long. Affixed to the sheet is a copy of a report sent to J.H.Willis by R.H. Anderson of Sydney. This says, in part,

> "Its nearest affinity would appear to be with B. nasturtium (FvM.) Druce ..., but it differs from that species in the longer and more slender style, the smaller stigma and in the leaves, which are more like those of B. procumbens (Tate) J.M.Black. The habit is that of B. nasturtium rather than B. procumbens. It may prove to be an undescribed species, or possibly western form of B. nasturtium. Further collection in intermediate areas may decide this."

The most distinctive feature is the shape of the fruit; they are narrowly elliptic and usually subacute proximally and subacute to rounded distally. The fruit bear a short linear style about 0.4-0.6mm long and a depressed-capitate stigma which is broader than the style.

The floral organs are like those of A. nasturtium, although the filaments are slightly longer in relation to the overall length of the stamens, and the torus is quite flattened, forming a rim of tissue just beneath the glands. The glands are in the arrangement usual in A. nasturtium, but are shallow and not well-developed; there seem to be no median glands although the appendages of the lateral glands do touch and on casual examination seem to form a complete extrastaminal ring.

Of the other Western Australian material, a plant from Giles (Cleland s.n. - AD) seems to be ordinary A. nasturtium. However, plants from Frasers Range (anon. - MEL) and Cummening (Heal s.n. - MEL) are somewhat like the Coolgardie plant. They are small and bear no mature fruit, but the lateral glands are shallow and there are no median glands; the flowers examined do not show a torus so conspicuously flattened as does the Kemsley collection and the leaves are more like those of A. nasturtium. It seems best at present to refer these plants to A. nasturtium, but further collections from Western Australia and the adjacent parts of South Australia might help to solve the problem.

Ecology and Biology: In its ecological requirements A. nasturtium is much like A. trisecta, being common along roadsides in the southern semi-arid parts of South Australia. However, where A. trisecta occupies the edges of drainage ditches and the soil heaped up during road grading A. nasturtium usually is found, sometimes in profusion, in slight depressions where water has accumulated. Along the Burra-Morgan road and north of Yunta the writer has seen areas of more than an acre which appeared completely yellow when seen from a short distance away.

It is variously recorded as occurring on "old sanddune in S.A. and flood plain" near the Birdsville Track, "on a sandy hillside above a creek", among "gibbers, lake bed", and several times from sandy clays, these all in South Australia. From New South Wales notes are "in black soil", "on heavy grey loam", "localized in depressions", "on heavy soil" and "scald area in sandy soil". Allen s.n. (CANB) from Bullgaroo, Queensland, is noted as having grown on "heavy brown soil" and Everist 4030 (CANB) from Tanbar, Queensland, as occurring "in heavy grey clay on flooded flat".

Beadle (1948) notes that it is widely spread throughout the western part of New South Wales and adds that it becomes more common in areas which are under heavy stocking. In speaking of pastures in the northern part of the state he said, "Further heavy grazing leads to ... the dominance of ..., useless crucifers, and composites, notably Blennodia nasturtioides ... ".

Flowering and fruiting seem chiefly to occur in August and September but there are scattered occurrences in May, June, July and October. Turner (1891) remarks that the seeds germinate readily after spring rains.

Uses and Common Names: Turner (1891) commented that this species is a favourite food for sheep, probably because of its pungency. He added, however, that dairy cattle should not be permitted to graze on it as the milk would be tainted. On the other hand, Beadle (1948) remarked that it is unpalatable and of no value as a fodder.

Koch 201 bears the annotation "mustard bush", and Turner referred to it as "pinnate-leaved mustard bush" but these names seem to be not used at present.

Relationships: This species is most closely related to A. trisecta from which it differs only in habit and rather minor characters of flower and fruit. It is also closely related to A. eremigena and forms a link between A. trisecta, A. filifolia and A. glaucescens on the one hand, and A. eremigena and A. procumbens on the other. Were it not for the existence of A. nasturtium it would seem better to place these two latter species in a genus distinct from Arabidella.

A. eremigena and *A. procumbens* differ most from the other species in having angustisept fruits; this is constant in *A. procumbens* and is often seen in *A. eremigena*, especially in plants from the western part of the range. In the eastern part, however, are found plants with terete fruits and if it were not for their pubescence, it would be difficult to distinguish them from plants of *A. nasturtium*. These two species also differ from the others in lacking median glands; here too *A. nasturtium* is transitional, some plants having the well-developed glands of, for example, *A. trisecta*, others the reduced glands typical of *A. eremigena* and *A. procumbens*.

In habit too *A. nasturtium* connects the entirely herbaceous *A. eremigena* and *A. procumbens* with the three suffruticose species. The relationships among these species might be shown in the following manner:

A. glaucescens
A. filifolia
A. trisecta
A. nasturtium
A. eremigena
A. procumbens

This is meant only to indicate that *A. glaucescens* has fewer characters in common with *A. nasturtium* than does *A. filifolia*; the same is true of *A. procumbens* and *A. eremigena* respectively.

It is interesting to note that *A. trisecta* and *A. nasturtium* have the widest distributions, mostly in South Australia and New South Wales. The other species are to a much greater degree restricted in area.

It could perhaps be hypothesized that the other species of Arabidella ha ve arisen from an A. trisecta-like ancestor, A. filifolia and and A. glaucescens retaining the shrubby habit, but becoming modified chiefly in fruit characters. A. nasturtium, A. eremigena and A. procumbens have however lost the suffruticose habit, all have much smaller flowers, and the last two have developed a fruit quite different from that of A. trisecta. A. eremigena and A. procumbens stand much further from A. trisecta than do either A. filifolia or A. glaucescens.

Some of these are probably species which are quite young evolutionarily, a fact which would help to account for the great variation seen in them. However, in spite of all the differences among them they form a quite natural group which is not closely related to any other Australian genus.

ARABIDELLA EREMIGENA (FvM.)SHAW (COMB. NOV.)

(ἐρημία = desert, γένος = race, offspring; the first collections were made in semi-arid parts of Queensland and New South Wales)

Sisymbrium eremigenum FvM., Fragm. 2(1861)143 (basionym); FvM., Census 1(1882)5; FvM., Sec. Census 1(1889)9.

Blennodia eremigena (FvM.)Benth., Fl. Austral. 1(1863)74 "eremigera"; Black, Fl. S. Austral.(1929)687; Johnson et Cleland, TRSSA 67(1943) 154; Eardley, TRSSA 70(1946)162.

Microsystria eremigena (FvM.)Schulz, Pflreh. 86(1924)264.

The above names are nomenclatural synonyms of Arabidella eremigena, being based on the same type.

Figures: Figure 7

Original description: "Annuum, erectum, pubescens, foliis parvis pinnatilobis, lobis lineari-lanceolatis lobulatis v. edentulis, pedicellis patentibus siliquae subaequilongis vel ea dimidis brevioribus, petalis flavis sepala viridia paulo superantibus, staminibus corollam paene aequantibus, antheris cordato-oblongis, siliquis lineari-cylindricis, valvis lenissime uninervatis, seminibus fuscis uniseriatis laevibus latitudinem septi saltem semiaequantibus. ... Herba saepius spithamaea, pluricaulis, pilis simplicibus confertis canescens. Folia pollice saepius breviora. Petala 1''' paulo excedentia. Siliqua ½-1" longa, ½-¾''' lata. Semina circiter 1/3''' longa.

A Sisymbrio nasturtioide (F.M. Transact. Vict. Inst. i.115; Plants indigenous to Vict.i.39) videtur specifice distinctum."

Description: Plant probably annual, many-stemmed, pubescent, including sepals and ovary, with erect or appressed simple hairs; root slender, usually ca. 1mm diameter, but to 3mm; stems to ca. 35cm, but fruiting plants as low as 5cm, usually terete, less often quadrangular or otherwise angled, arising from a basal rosette of leaves, usually erect, sometimes decumbent or prostrate, often much branched, usually equal or the central stem leafless and shorter than the leafy lateral stems, sometimes much reduced.

Basal leaves to ca. 6cm, usually obovate and pinnatifid with 4-5 lobes per side, these more or less linear and usually entire but sometimes remotely dentate or with secondary lobes, the terminal lobe usually narrowly spathulate; the leaves rarely spathulate and entire; leaves tapering into a slender petiole about as long as the blade.

Cauline leaves to ca. 4cm, but usually less than 2cm, usually pinnatifid with 1-4 lobes per side, these opposite or alternate, spathulate or linear, straight or falcate-curved, rounded to subacute, sometimes finely dentate or with small teeth in the sinuses, the terminal lobe linear or obovate to narrowly spathulate, entire or with 1 or 2 small teeth, rounded to subacute, leaves sessile to very shortly petiolate.

Inflorescences to about 45-flowered, dense, after anthesis elongating to ca. 15cm, occasionally with scattered buds below the lowermost flowers, sometimes basal or axillary as result of non-development of stems; buds more or less spherical.

Sepals oblong, green or lavender with a narrow hyaline, colourless or lavender margin, often persistent below the young fruit; lateral sepals ca. 1.9-2.8mm long, ca. 0.7-1.4mm wide, average 2.3x1.0mm, the ratio length to width 1.6:1-3.6:1, distally subacute, sledom rounded; median sepals ca. 2.0-3.0mm long, ca. 0.8-1.5mm wide, average 2.4x1.0mm, the ratio length to width 1.8:1-2.8:1, distally rounded to subacute, sometimes slightly cucullate.

Petals about 1½ times as long as the sepals, ca. 2.5-3.9mm long, ca. 0.9-2.0mm wide, the average 3.2x1.3mm, ratio length to width 1.7:1-3.5:1, oblong to spathulate, sometimes gradually tapering into a broad claw, distally rounded or truncate, then sometimes retuse or emarginate, usually white or yellow, rarely lavender, ra ther coarsely veined.

Stamens with filaments distally linear, basally suddenly widening and cochlear or only slightly broadened, usually white or pale green, occasionally lavender; lateral stamens ca. 1.8-3.4mm, average 2.5mm; anthers ca. 0.7-1.5mm, average 0.9mm; diagonal stamens ca. 2.0-3.4mm, average 2.5mm; anthers ca. 0.6-1.4mm, average 0.9mm.

Pistil ca. 1.6-2.5[-3.2]mm, sessile, linear, usually terete, glabrous or sparsely pubescent; style linear to shortly obconical; stigma depressed-capitate, slightly wider than the style; ovules ca. 50 per ovary; lateral nectaries reduced to triangular or oblong or ovoid lobes of tissue, one on each side of each lateral stamen; median nectaries lacking.

Fruiting pedicels ca. 3-11[-15]mm long, ca. 0.2-0.4[-0.5]mm, usually ca. 0.3mm, in diameter, linear, terete or quadrangular or flattened, sometimes slightly expanded distally, usually spreading at 45 degrees or less from the stem, but sometimes horizontal or slightly recurved.

Fruit ca. 4-20mm long, ca. 0.6-1.4mm across the septum, sessile, linear and straight, usually angustisept, less often terete; valves convex or keeled with a distinct nerve and, when mature, stramineate or reticulate, glabrous or sparsely to densely pubescent; proximally usually truncate, sometimes rounded, distally rounded or tapering and subacute; style less than 1mm to obsolete, linear to broadly obconical; stigma depressed-capitate or almost tectiform, as wide as or slightly wider than the style; septum white, opaque, sometimes fenestrate with a longitudinal slit, nerve indistinct, usually smooth or, sometimes, rugulose, especially at the margins; funicles linear or narrowly triangular, straight or slightly curved.

Seeds ca. 0.7-1.1mm x 0.4-0.6mm, uniseriate, ovoid to oblong, straight, plump; testa light yellow-brown or orange-brown to red-brown, usually with dark red or black pigmentation at the hilum; when moistened, rapidly exuding mucus to ca. 0.15mm wide, the mucus clear and greyish, exuded as discrete short cones, less often as cylinders or clavate bodies, thus appearing radiate; embryo exactly or obliquely notorrhizal, the radicle shorter or longer than, or equal to, the usually oblong cotyledons.

Type locality: "Ad flumen Balonne. Sir Th. Mitchell. Ad flumen Darling prope Bamamero. Dr. Beckler."

Lectotype: Ballonia [?] (eastern subtrop. Australia); 11.11.1846; Mitchell - MEL 772!

Other specimens seen: (see Map 5 - page 176)

South Australia: - Diamantina at Pandie-Pandie; 15.8.1934; Cleland - AD: Pandie-Pandie Stn.; 11.6.1963; Reid - ADW: Diamantina; 14.8.1934; Cleland - AD: Diamantina; Aug.1930; Morgan - AD: Diamantina; May,1931; Reese - AD: between Nappamerrie and Innamincka; 12.8.1962; Jackson 409 - UC, Z, AD: Innamincka, Cooper's Creek; 29.5.1924; Cleland - AD: Cooper's Creek at Innamincka; May,1924; Cleland - AD: In Cooper's Creek, Innamincka; 3.10.1960; Filson 3414 - AD: Tinga-Tingana; 23.9.1916; White - AD: Lower Strzelecki Creek;?;? - AD: between Herrgott and Innamincka; June,1916; Cockburn - AD: Marree; 30.6.1930; George - ADW: Marree;

31.7.1931; George - AD, ADW: Warburton River; ?; E.G.M. - AD: Cowarie Stn. - Camp 37, Simpson Desert Expedition; 24.7.1939; Crocker - AD: near Camp 39, Simpson Desert Expedition; 27.7.1939; Crocker - AD:

Queensland: - near Balmy Creek; 30.8.1846; Mitchell 267 - BM: Roma;?; ? - MEL: Roma; 25.10.1933; White 9556 - BRI: Roma;?; Bailey - NSW53712: Maranoa;?; Roe - CANB(p.i.): sub-tropical New Holland (Camp 29); 1846; Mitchell 520 - K: Amboola; 13.10.1948; Everist 3529 - BRI, CANB(p.i.): "Warrie", Nindigully; 25.10.1947; Roe - NE: "Warrie", Nindigully; 19.7.1937; Roe 10 - CANB(p.i.): Wyandra; 22.8.1958; Carolin - SYD: Gilruth Plains, Cunnamulla; 2.7.1942; Allen 264 - NE: Gilruth Plains, Cunnamulla; Oct. 1942; Allen 441, 444 - CANB(p.i.): Gilruth Plains, Cunnamulla; 8.9.1944; Allen 619 - CANB(p.i.): "Fanaroo", Eulo; Sept.1931; Young 65 - BRI: Goonamurra near Eulo; 20.9.1938; Everist 1682 - BRI: Caiwarro; 1886; Cotter - MEL: Currawilla - about 100 miles W. Windorah; 9.6.1949; Everist 3931 - BRI, CANB(p.i.), K: Birdsville; 31.8.1957; Filmer - AD: Diamantina River, 1½ miles west of Roseberth Homestead; 1.10.1960; Wilson 3347 - AD: Wallumbilla; Dec.1916; Bick - BRI: Wallumbilla; Sept.1925; Francis - BRI: Mulligan River; Feb.1904; Clarke - NSW53596:

New South Wales: - Collarenebri; 2.9.1951; Waterhouse - SYD: Hungerford-Brindingabba; Oct.1912; Boorman - NSW53594: Thurloo Downs- Berrawinnia Downs; Oct.1912; Boorman - NSW53582: Glenroy Stn., Wanaaring; 8.8.1948; Riches 16 - CANB(p.i.), BRI: Wanaaring; 1.6.1947; Johnson 547/132 - NSW6048: C. Ularara; Sept.1941; Beadle - SYD: Paroo R. district; Sept. 1900; Betche - NSW53738: Urisino-Thurloo Downs; Oct.1912; Boorman - NSW53595: Milparinka; 25.8.1921; Morris 827 - NSW53590: Milparinka;1940;

Beadle - SYD: Yancannia; 20.8.1923; MacGillivray - ADW: Cobham's Lake; Oct.1887; Bauerlen 466 - MEL: Tarella; Aug.1887; Bauerlen 74 - MEL: Bamamero; 1860; Victorian Exploring Expedition - MEL: Bamamero; Dec.1860; Beckler - K: Darling River; Dec.1860; Beckler - BM: Bamamero, Darling River; Dec.1860; Beckler - MEL 773: Darling River;?;? - NSW 53593: western N.S.W.; 1940;? - SYD:

Distribution: This species occurs in north-eastern South Australia, south-western Queensland and north-western New South Wales. In South Australia the southern-most locality is Marree and it has not been reported from the area west of Lake Eyre. In Queensland it has been collect ed as far east as the longitude of Roma, and in New South Wales it has been found at Collarenebri, almost exactly south of Roma. Collarenebri is almost 300 miles east of Hungerford from which is the next most easterly collection in New South Wales, but it is very likely that *A. eremigena* occurs in the intermediate areas.

Observations: From north-eastern South Australia to eastern Queensland can be traced a clinal variation in a few characters, the most obvious being fruit length (the most short-fruited plants from the western part of the range) and type of pubescence. The lectotype, from near the eastern limit of the range, is covered with simple hairs which are curved upward at the base and then appressed to the organ bearing them; the maximum length is about 0.4mm, but they are usually about ¼mm long. The fruit, glabrous or almost so, are usually about 10mm long, although some are as much as 15mm. Although most of the remaining entire fruits on the plant were crushed in pressing, they seem to have been almost terete; the style is linear, about 0.3mm long, and bears a small depressed-capitate sitgma as wide as the style.

A representative short-fruited South Australian specimen (Crocker - AD) from near Cowarie Station, is quite densely covered with flattened simple hairs usually about ½mm long, although some are ¾mm, which are often twisted and almost erect. In width they are usually about 0.05mm, although some are 0.1; the hairs are usually subacute, but the shorter ones, especiallym may be spathulate. The fruit valves are rather sparsely pubescent with hairs similar to, but slightly shorter than those on the other plant parts.

The fruit valves are noticeably convex and the fruits are angustisept, the average width across the septum being about 0.7mm, the average fruit width, measured across the valves, about 1.4mm. The style is obsolete or very shortly obconical (0.1-0.2mm) and the stigma is flat and depressed. The floral organs, especially sepals and stamens, are slightly shorter than those of the lectotype.

From west to east there is a gradual increase in fruit length, a transition from erect to appressed ha irs, a change from angustisept to terete fruits, a trend toward glabrous fruit and a slight increase in size of the floral organs. Although on casual inspection the lectotype and the Cowarie Station plant might appear to belong to different species, a series of intermediates proves the connection between them. Becasue the intermediates do exist there has been made no separation of the South Australian material as representing an infraspecific taxon. Further collections from north-eastern South Australia and south-western Queensland would probably support this decision.

The plants described are extremes and there are many sorts of intermediates; the appressed hairs, which are not infrequently distally spathulate, may be found on fruit valves of plants which otherwise bear erect hairs, even though these appressed hairs are usually associated with the glabrous-fruited eastern form.

The plants from Bamamero which Mueller cited seem somewhat out of place, for in nature of the fruit they resemble more closely the extreme eastern material than they do the other collections from the north-western part of New South Wales, although they do have the longer erect hairs characteristic of the western plants.

Note-worthy are two plants, both collected near Bulo, Queensland, which have glabrous fruit with very convex valves and longer styles (0.6-1.0mm); the width across the septum is about 0.7-1.3mm, that across the valves about 1.7-2.2mm. Although they differ somewhat from the rest of the collections, especially by the very convex valves and longer styles, they seem certainly to belong to this species.

Ecology and Biology: Little is known of the ecology of this species. It seems to occur both on sand and on heavier soils. Crocker s.n.; 27.7.1939 (AD) from north-east of Lake Eyre is annotated as occurring on the edge of a small claypan and material from New South Wales was collected from "river flats" and "mulga scrub". Notes with Queensland plants include "hard brown pebbly clay loam", "red soil", "gutters in clayey soil", "brown loamy soil", "red-brown sandy loam among gidgea scrub", "in chocolate clay soil" and "in loose alluvial sand in shallow gully". This species is ephemeral and probably appears very quickly after spring and summer rains. Most of its range lies between the areas of maximum summer and maximum winter rainfall and the rains here come irregularly.

Flowering and fruiting specimens have been chiefly collected in July-September with scattered collections from February, May, June and December.

Uses and Common Names: A. eremigena is eaten by stock and is said to be "good sheep feed" (Riches 16 - CANB, BRI). Beadle (1948) several times refers to Blennodia cardaminoides as being a useful fodder plant. It is probably that the plants to which he referred are really A. eremigena; the collections made by Beadle which were determined as Blennodia cardaminoides are A. eremigena.

In the north-eastern part of South Australia these plants are eaten by the aborigines, being steamed like spinach. Common names recorded in this area are "priddiwalkatji" (Ngameni tribe) and "priddiwarrukatji (Wonka-nguru tribe). The names refer to the fact that the plants are eaten by emus (warrukatji) (see Johnson and Cleland, TRSSA 67(1943)154).

Typification: With the original description are mentioned collections made by Sir Thomas Mitchell from the Balonne River in southern Queensland and by Dr. Beckler "prope Bamamero" on the Darling River in western New South Wales.

Of the Mitchell collections available the only one which it seems certain that Mueller saw is MEL 772, collected at "Ballonia [?] (eastern subtropical Australia)" and dated November 11, 1846. Of Beckler's collections from Bamamero [Pamamaroo, near Menindie, N.S.W.] only two are in MEL and it is probable that they were seen by Mueller.

From these three the Mitchell collection has been chosen as lectotype for it is a better specimen than the others and is representative of a considerable part of the total collections of this species.

In the description Mueller wrote "Siliquae ½-1" longa, ½-¾"' lata".

Both the Balonne River plant and those from Pamamaroo have fruits about ½" long and the writer has seen none on these plants which approach one inch in length. Otherwise the plants agree with the description.

Relationships: A. eremigena is most closely related to A. nasturtium and A. procumbens. It differs from the former cheifly in being pubescent and in having normally pinnatisect leaves rather than trisect. Although the terete fruits of some plants of A. eremigena strongly suggest those of some plants of A. nasturtium, the angustisept ones point out its connection with A. procumbens. It otherwsie differs from A. procumbens in being pubescent, in having smaller floral organs and in being usually erect in habit.

As is mentioned in the discussion of A. nasturtium, A. eremigena and A. procumbens form a group rather distinct from the suffruticose species of Arabidella, but connected with them through A. nasturtium.

ARABIDELLA PROCUMBENS (TATE)SHAW (COMB. NOV.)

(procumbens = leaning forward, spreading; the stems are prostrate)

Blennodia nasturtioides var. pinnatifida Benth., Fl. Austral. 1 (1863)74.

Sisymbrium procumbens Tate, TRSSA 7(1885)67 (basionym); Tate, TRSSA 6(1883)101 (nom. nud.); Tate, TRSSA 7(1885)72; Tate, TRSSA 12(1889)71; Tate, Fl. S. Austral.(1890)16,206; Koch, TRSSA 22 (1898)102.

Blennodia procumbens (Tate)Tate, TRSSA 22(1898)123; Black, Fl. S. Austra l.(1924)247; Black, Fl. S. Austral.(1929)687; Black, Fl. S. Austral. ed.2(1948)375.

Lemphoria procumbens (Tate)Schulz, Pflreh.86(1924)268.

Microsystria nasturtium var. pinnatifida (Benth.)Schulz, Pflreh. 86(1924)264.

Microsystria nasturtium var. pinnatifida is a taxonomic synonym of Arabidella procumbens, being based on the type of Blennodia nasturtioides var. pinnatifida Benth. which is discussed below; the other names cited above are nomenclatural synonyms of A. procumbens, being based on a common type.

Figures: Schulz, Pflreh. 86(1924)fig.1; Schulz, Pflfam. ed.2 17b(1936)fig.124; Troll, Die Infloress.(1964)fig.466(3),467; Figure 8.

Original description: "A small glabrous annual, with a few prostrate branches radiating from a leafy rosette, usually under six inches diameter. Radical leaves on long petioles about one inch long, oblong, coarsely toothed or shortly pinnatifid; stem leaves few, lyrate-pinnatifid to spathulate. Flowers small, few, yellow. Fruiting racemes of the lateral branches about one inch long with slender spreading pedicels; the pedicels about two and a-half lines long, shorter than fruit; from the radical rosette there arise a few flowers borne on erect pedicels, the fruiting pedicels longer than the pods. Pod broad, about six inches [lines] long, blunt at the top and slightly attenuated at the base, tipped by a short, broad persistent stigma. Valves nearly flat, with a prominent midrib, and conspicuously longitudinally and reticulated veined. Sepals spreading, overtopping the yellow petals. Seeds small, ovate, moderately compressed."

Description: Plant herbaceous, usually prostrate, glabrous, many-stemmed; root a slender short taproot; stems to ca. 15cm, central stem leafless or reduced, the terminal inflorescence then appearing to arise from the basal rosette of leaves, lateral stems usually procumbent, sometimes ascendant.

Basal leaves to ca. 5cm, rarely entire, usually lyrate-pinnatifid with 3-7 lobes per side, lobes opposite or, less often, alternate, usually obtuse, the terminal lobe obovate-oblong, rounded or, more rarely, subacute, leaves tapering into a comparatively long slender petiole.

Cauline leaves to ca. 2.5cm, as basal leaves, but sometimes almost sessile.

Inflorescences to 30-flowered, but usually less, initially very dense, elongating after anthesis; buds ovate to spherical; flowering pedicels terete, slender.

Sepals oblong to ovate, green with a narrow hyaline margin, distally slightly tapering and rounded to subacute, not saccate basally; lateral sepals ca. 1.8-2.3mm long, ca. 0.6-0.8mm wide; median sepals ca. 1.7-2.3mm long, ca. 0.5-0.6mm wide, usually rounded distally and sometimes slightly cucullate.

Petals slightly longer than the sepals, ca. [1.4-]1.6-2.0[-2.2]mm long, ca. [0.4-]0.5[-0.7]mm wide, usually with no distinction between blade and claw, cuneate to obovate, rounded to truncate, sometimes retuse, yellow or white (the latter fide Schulz).

Stamens with filaments slender and linear, slightly dilated at the base, white or pale green; lateral stamens ca. 1.8-2.0mm, anthers obtuse, oblong, ca. 0.4-0.5mm; diagonal stamens ca. 1.9-2.3mm, anthers as those of lateral stamens.

Pistil ca. 2.5mm, sessile or, rarely, very shortly stipitate, linear, terete or flattened dorso-ventrally; style very short and stout or obsolete; stigma fleshy, depressed-capitate or more or less two-lobed; ovules ca. 60 per ovary, biseriate, ovate on thin straight funicles; lateral glands usually reduced to more or less bilobed semicircular pieces of tissue, one on each side of each lateral stamen, or if more fully developed, suborbicular to pentagonal, producing lateral appendages, those of the opposite glands nearly meeting on the median line; median glands obsolete.

Fruiting pedicels usually to 1.5cm long, exceptionally to ca. 2.5cm, slender, spreading, sometimes recurved or pendulous.

Fruit ca. [4-]10-17mm long, ca. 0.7-1.2mm wide across the septum, terete or flattened laterally, therefore angustisept, linear, straight, sessile or on a very short stipe (to ca. 0.3mm); valves convex, sometimes carinate, proximally tapering and rounded, sometimes subacute or almost runcate, distally rounded to truncate, with a slender nerve and, when mature, longitudinal striations; style stout and short or obsolete; stigma fleshy, depressed-capitate or more or less bilobed; septum white with a median nerve, hyaline, not fenestrate; funicles to ca. 0.5mm long, slender, linear, pendulous.

Seeds ca. 0.6-0.8mm long, ca. 0.4-0.5mm wide. biseriate, oblong to ovoid, plump; testa yellow to light brown with red to orange-brown pigmentation at the hilum, when moistened, exuding a narrow mucus to ca. 0.1mm, mucus exuded as discrete hemispheres or short oblong bodies, thus appearing radiate; embryo exactly notorrhizal, with radicle usually slightly longer than the narrowly oblong cotyledons.

Type locality: "Claypans near Termination Hill, Lake Torrens Plain"

Holotype: Claypan, Ideyaka [near Termination Hill]; 2.9.1883; Tate- AD 96445354!

Isotypes: Lake Torrens Plain near Termination Hill; 2.9.1883; Tate - MEL 767, MEL !

Other specimens seen: (see Map 5 - page 176)

South Australia: - Östlich und westlich von Flinders Range, Leighs Creek, Farina, Lake Torrens Gebiet; 1902-1904; Basedow 365 - B: William Creek; 10.9.1932; Cleland - AD: ca. 38 miles E. Dalhousie Springs; 9.8.1963; Lothian 1591 - AD: Condiments Plain near Mt. Barry Station; 13.7.1952; Ising - AD:

New South Wales: - between the Darling and Lachlan; ?; Burkitt - MEL (type of B. nasturtioides var. pinnatifida Benth.): Livingstone; Aug.

1942; Beadle - SYD: near Billilla, Darling River; Aug.1942; Beadle - SYD: 50 miles north-east of Menindie; Aug.1942; Beadle - NSW 53597: Kooringbirry[= Koonenberry]; Sept.1887; Bauerlen 200 - MEL: Paldrumatta Bore; 23.7. 1900; Corbett - MEL, NSW 53599: Barrier Range; 1889; Irvine - B,W:

Without locality: ?;?; Tate? - NSW 53598:

Distribution: A. procumbens is known only from north-western New South Wales and the Lake Eyre basin in South Australia. Probably this species occurs more widely than the available material suggests but it is inconspicuous and probably short-lived, so has escaped the notice of collectors.

Observations: There is little variation among plants of A. procumbens. It is usually a rather straggling prostrate plant with scattered leaves and, often, fruit arising from the basal rosette of leaves because of the non-development of a stem.

Schulz(1924) describes this species as having white petals, but Tate described them as yellow and on all the plants seen by the writer they have been yellow. Although Schulz refers to the seeds as being "humida valde mucosa" and in his drawing shows them as exuding a broad radiate mucus, all those examined by the writer have exuded only a narrow band of mucus. Also Schulz described the septum as "saepe fenestratum", but the writer has seen no fenestrate septa on either of the collections in B and W which were seen and annotated by Schulz.

Ecology and Biology: Little is known of this species; the available notes indicate that it occurs in areas which have been flooded and would hold water for some time. The type collection was made on a clay pan and other comments about collections are "flat area between dunes", "lake bed", and "on tracks in mud on dry lake bed". Beadle (1948) mentions that it is one of the few species capable of colonizing claypans, among the others being Minkea australis and Marsilea drummondii.

The time of flowering and fruiting seems to be July to September, but it would probably occur after rains at any time of year.

Uses and Common Names: Beadle(1948) described it as being of no fodder value. Schulz quotes Basedow as giving the name "creeping mustard bush" but it is unlikely that this name is ever used.

Relationships: Tate(1885) re marked of this species,

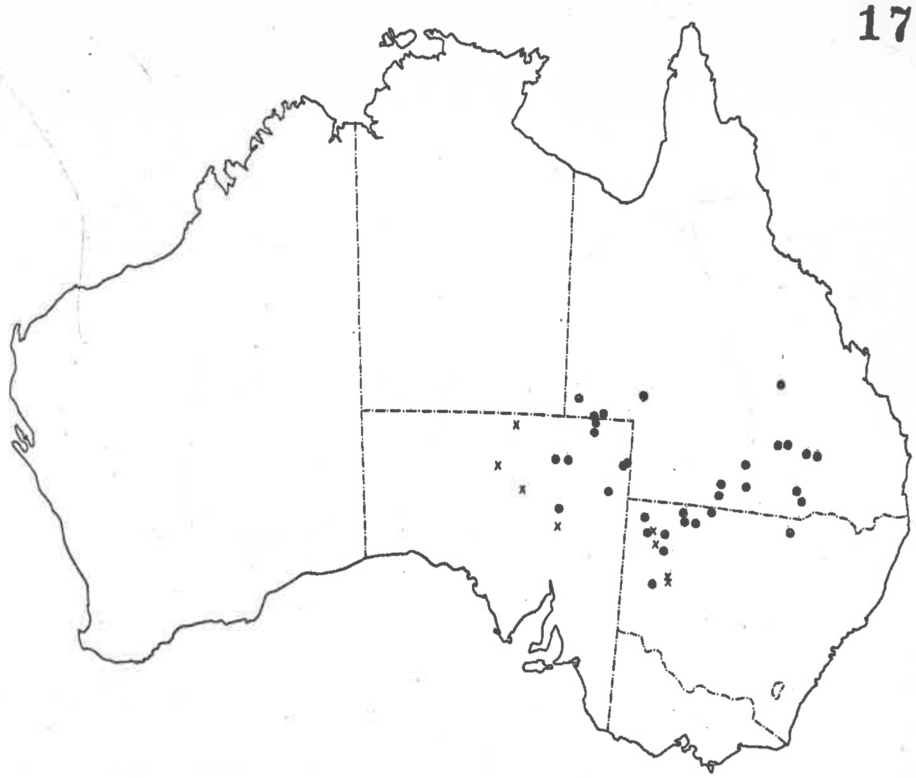
"Among Australian congeners, S. procumbens approaches to S. nasturtioides, from which it differs in habit, form of leaves, in the spreading not erect pedicels, stouter pods, etc."

It is certainly related to A. nasturtium, but the pinnatifid leaves and the angustisept fruits, along w ith the reduced lateral glands, suggest rather a closer relation to A. eremigena.

This species and A. eremigena stand rather remote from the suffruticose species of Arabidella, but are connected with them through A. nasturtium, as is mentioned in the discussion of the latter species.

Note: Blennodia nasturtioides var. pinnatifida was described from a single collection made by Burkitt in New South Wales. Bentham described it as having "leaves small, on long petioles, with few short lateral lobes and a larger terminal one." The Burkitt specimen is, however, A. procumbens.

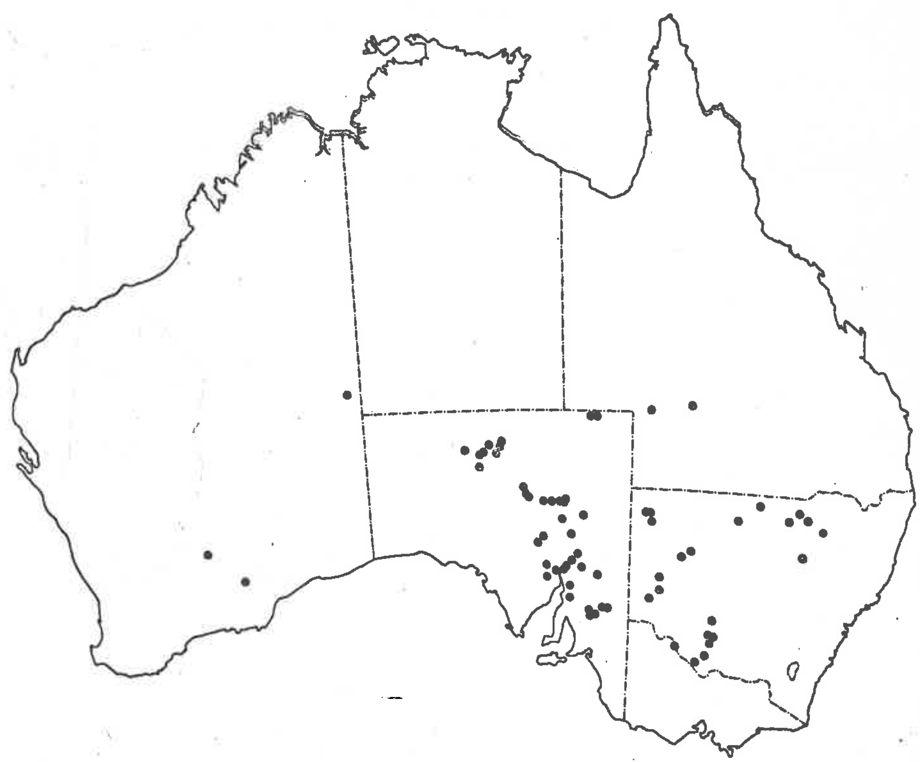
5



Map 5 - ● = Arabidella eremigena (FvM.)Shaw
× = Arabidella procumbens (Tate)Shaw

Map 6 - Arabidella nasturtium (FvM.)Shaw

6



<u>HARMSIODOXA</u> SCHULZ

(Harms and δόξα = praise; named in honour of Hermann Harms)

Schulz, Pflrch. 86(1924)260; Schulz, Pflfam. ed.2 17b(1936)638.

<u>Original description</u>: "sepala suberecta, exteriora oblonga, interiora oblongo-ovata; omnia apice obtusa et basi aequalia . Petala primo alba, tandem pallide violacea; lamina obovata vel oblongo-cuneata, paucivenosa. Stamina 6; filamenta ad basin dilatata, tandem rubescentia; antherae breviter oblongae vel subquadratae, obtusae. Glandulae nectariferae confluentes, laterales clausae vel intus apertae, medianae torosae et emarginatae, interdum in medio separatae. Pistillum ampullaceum, sessile; ovarium dense hirtum, ovulis 12-22 praeditum; stylus tenuis; stigma minutum, depresso-capitatum, stylo aequilatum. Siliqua abbreviatae, oblongae, utrinque praesertim ad apicem attenuatae, stylo tenui terminatae, biloculares, septiferae, bivalves, dehiscentes, valvis convexis basi obtusiusculis apice a cutis nervo medio tenui praeditis extrinsecus interdum etiam intus pilis simplicibus et ramosis hispidulis; placentae tenues, conspicuae; septum valde hyalinum, fragile, album, opacum, rugulosum, enerve vel tenuiter uninerve. Semina subbiseriata, ovoidea, funiculo tenui pendula, pallide brunnea, sublaevis, statu humido valde mucosa, exacte vel oblique notorrhiza. - Plantaeaannuae, pilis tenuibus brevibus simplicibus vel bifurcatis vel trifurcatis vel bis bifurcatis usque ad sepala (incl.) scabriusculae. Caulis plerumque a basi ramosus. Folia petiolata, lyrato-linnatipartitatvel grosse dentata. Racemus ebracteatus. Pedicelli fructiferi tenues.

Species 3 in planitiebus arenosis Australiae crescunt.

<u>Harmsiodoxa blennodioides</u> (FvM.)Schulz

<u>Harmsiodoxa cunninghamii</u> (Benth.)Schulz

<u>Harmsiodoxa brevipes</u> (FvM.)Schulz

<u>Description</u>: <u>Calyx</u> open; sepals spreading or, occasionally, almost erect, usually green, sometimes lavender, with a narrow hyaline margin, on the abaxial side usually pubescent with sessile or shortly stipitate branched hairs, the margins, however, not pubescent; <u>lateral sepals</u> oblong to obovate or deltate, usually both absolutely and relatively wider than the median, usually slightly saccate at the base, distally somewhat tapering and usually subacute to acute, less commonly, rounded; <u>median sepals</u> oblong to narrowly obovate, sometimes elliptic, proximally usually somewhat tapered, not saccate, distally rounded, sometimes slightly cucullate.

<u>Petals</u> usually at least $1\frac{1}{2}$ times, to $2\frac{1}{2}$ times, the sepals in length, white, pink, or lavender, usually with distinct blade and claw, but not uncommonly without such distinction and then obdeltate or obovate; if clawed, claw usually more or less linear and about as long as or slightly shorter than the blade; blade suborbicular or obovate, sometimes oblong, margins usually entire or sinuate, apically usually rounded, sometimes truncate and then retuse or emarginate, usually quite coarsely veined, tapering suddenly or gradually into the claw.

<u>Stamens</u> 6, erect or somewhat spreading, filaments linear and slightly dilated at the base, or more broadened and spathulat, often widened unevenly, the greater width on the lateral side of the vein, white or pale green, sometimes pink or lavender; a nthers oblong or almost quadrate, rounded or, sometimes, subacute, yellow.

<u>Lateral nectaries</u> each surrounding the base of a lateral stamen, generally triangular to pentagonal, sometimes square or suborbicular, usually

quite shallow, open on the interior, open or emarginate on the outer side, producing from each side of each gland a lateral appendage encircling the base of the adjacent diagonal stamen and forming there a distinct triangular lobe; median nectaries usually obsolete, but very rarely glandular tissue occurring between the bases of the diagonal stamens, the tips of the lateral appendages approximate but not fused.

Pistil sessile, linear to ampulliform, terete, glabrous or pubescent with short branched hairs; ovules usually subbiseriate, suborbicular to elliptic, pendulous on short slender curved funicles, ca. 4-14 per cell; style linear or slightly obconical, short or, as long as the ovary; stigma fleshy, depressed-capitate, as wide as or slightly wider than the style.

Fruit bilocular, bivalved, dehiscent, sessile, linear or fusiform, straight or curved, terete or quadrangular or somewhat flattened dorso-ventrally, therefore latisept; valves usually quite convex, with a more or less obvious midnerve, when mature brown, often with some red or magenta pigmentation, the exterior pubescent with sessile or shortly stipitate bifurcate to ramose or simple hairs, the simple hairs often restricted to the distal end, interior of the valve glabrous or sparsely pubescent with short bifurcate hairs, valves proximally tapering slightly and truncate or rounded, rarely subacute, distally rounded to subacute; style linear or slightly obconical; stigma depressed-capitate, as wide as or slightly wider than the style.

Septum white, usually opaque, apparently not fenestrate, with a more or less distinct vein, smooth or rugulose especially at the margins and/or the proximal end; funicles linear or narrowly triangular, straight or slightly curved, pendulous.

Seeds usually subbiseriate, ca. 3-12 per cell, oblong to ovate or obovate, plump, not winged; testa orange-brown to dark red-brown, slightly darker at the hilum, finely papillose, when moistened exuding from each papilla a cylinder of mucus, each cylinder seeming to contain a tightly coiled grey spiral thread; embryo exactly or slightly obliquely notorrhizal, cotyledons elliptic to oblong, rounded or truncate, usually slightly shorter than the radicle.

Plant probably annual, herbaceous, few- to many- stemmed, usually erect, occasionally prostrate and spreading, pubescent, including sepals and ovary, with simple or sessile or shortly stipitate bifurcate or branched hairs; stems arising from a basal rosette of leaves and equal, or a central leafless stem and leafy lateral stems, the central stem sometimes reduced to an apparently basal inflorescence, stems sometimes much branched.

Basal leaves rosulate, usually obovate or oblanceolate in outline, rarely entire, usually dentate or, most commonly, pinnately lobed, sometimes very deeply so, usually on slender petioles, sometimes almost sessile.

Cauline leaves scattered, usually obovate to elliptic, entire or rather coarsely dentate, occasionally, especially lower leaves, pinnately lobed, shortly petiolate or sessile on cuneate bases.

Root a slender taproot.

Inflorescences ebracteate, terminal on stems, dense, initially corymbose but after anthesis elongating and therefore racemose, the central stems sometimes reduced s o inflorescence seems basal; buds immediately before anthesis spherical to ovoid or oblong; flowering pedicels short, slender; fruiting pedicels very short and quite stout, erect or somewhat spreading or, rather slender and slightly spreading to almost horizontal, rarely slightly recurved.

Three species in semi-arid parts of Western Australia, the Northern Territory, South Australia, Queensland, NewSouth Wales and Victoria.

Harmsiodoxa blennodioides (FvM.)Schulz - LECTOTYPE SPECIES

Harmsiodoxa brevipes (FvM.)Schulz

Harmsiodoxa puberula Shaw

Key to the species of Harmsiodoxa:

A Pedicels as long as or longer than the fruit

B Fruit with short almost sessile hairs, all of about same length

C Valves glabrous inside; petals ca.4-8mm long ..... H. puberula

C Valves pubescent inside; petals ca. 2.5-4mm long . H. brevipes var. major

B Fruit with longer hairs, those at distal end longer than those at proximal end .... H. blennodioides

A Pedicels shorter than the fruit

D Valves with distal hairs simple, erect, to ca. 1mm .. H. brevipes var. brevipes

D Valves with distal hairs branched, appressed, to ca. ½mm .. H. brevipes var. major

Relationships: Harmsiodoxa is probably most closely related to Scambopus from which it chiefly differs in lacking median glands. It seems to be closely related to no other Australian genus.

HARMSIODOXA BLENNODIOIDES (FvM.)SCHULZ

(blennodioides = like Blennodia R.Br.; because of the resemblance of this species to Blennodia canescens R.Br.)

Schulz, Pflrch. 86(1924)261.

Erysimum blennodioides FvM., Linnaea 25(1853)367 (basionym); FvM., Census 1(1882)5; FvM., Sec. Census 1(1889)9.

Erysimum blennodes FvM., Trans. Phil. Soc. Vict. 1(1855)100 (nom. nud.); FvM., Pl. Col. Vict. 1(1860-1862)40, pro syn.; FvM., Fragm. 11(1878)27 (nom. nud.).

Blennodia lasiocarpa FvM., Trans. Phil. Soc. Vict. 1(1855)100 (nom. nud.); FvM., Enum. Pl. Gregory (1859)4 (nom. seminud.); FvM., Pl. Col. Vict. 1(1860-1862)40; Benth.,Fl. Austral. 1(1863)76; Turner, Forage Pl. Austral. 1(1891)4; Tate, TRSSA 22(1898)123; Black, TRSSA 41(1917)637; Black, Fl. S. Austral.(1924)247; (1929)687;

Blennodia cunninghamii Benth., Fl. Austral. 1(1863)76.

Sisymbrium lasiocarpum (FvM.)FvM., Fragm. 7(1869)20;

Erysimum lasiocarpum (FvM.)FvM., Nat. Pl. Vict. 1(1879)34; FvM., Fragm. 11(1879)60; Tepper, TRSSA 3(1880)34; Tate, TRSSA 3(1880)51; Kempe, TRSSA 3(1880)129; FvM., Key Vict. Pl. 2(1885)7; FvM., Key Vict. Pl. 1(1887-1888)129; Tate, TRSSA 12(1889)71; Tate, Fl. S. Austral. (1890)16,206; Tate, Horn Exped. pt.3(1896)138; Koch, TRSSA 24(1900)81.

Erysimum cunninghamii (Benth.)FvM., Census 1(1882)5.

Blennodia blennodioides (FvM.)Druce, Rep. Bot. Exch. Club. 4(1917) 609; Ising, TRSSA 61(1937)222; Eardley, TRSSA 70(1946)162; Black, Fl. S. Austral. ed.2(1948)376; Chippendale, TRSSA 82(1959)329.

Harmsiodoxa cunninghamii (Benth.)Schulz, Pflreh. 86(1924)262.

Erysimum blennodioides, Erysimum blennodes, Blennodia lasiocarpa, Sisymbrium lasiocarpum, Erysimum lasiocarpum and Blennodia blennodioides are nomenclatural synonyms of Harmsiodoxa blennodioides, being based on a single type. Erysimum cunninghamii and Harmsiodoxa cunninghamii are taxonomic synonyms of the above names, being based on the type of Blennodia cunninghamii which is discussed below.

Figures: FvM., Pl. Col. Vict. 1(1860-1862)t.2; FvM., Nat. Pl. Vict. 1(1879)fig.6; FvM., Key Vict. Pl. 2(1885)fig.8; Turner, Forage Pl. Austral.(1891)fig.4; Black, Fl. S. Austral. ed.2(1948)fig.600; Hayek, Beih. Bot. Centralbl. 27(1911)fig.8(12); - Figure 9, 13 C-E.

Original description: "Erysimum blennodioides, herbaceum, humilius, diffusum, pube stellari ramosave canescens foliis lanceolatis remote dentatis, pedicellis patentibus siliqua fere duplo brevioribus, nervo valvarum obsoletissimo, filamentis lineari-subulatis, petalis albis. ... Herba sequentis magnitudine. Folia circiter 1" longa. Petalorum lamina obovata ungui fere duplo longior."

Description: Plant herbaceous annual, densely pubescent, including sepals and, sometimes, the ovary, with sessile or shortly stipitate branched hairs; stems to ca. 30cm high, few or many, terete or finely fluted, erect, more or less leafy, arising from a basal rosette of leaves, equal or the central stem leafless; lateral branches numerous, often much branched.

Basal leaves to ca. 10cm long, ca. 2cm wide, narrowly obovate, coarsely lobed or toothed, 1-3 lobes or teeth per side, these more or less triangular, rounded to subacute, usually opposite, often with small secondary teeth, especially on the distal side, terminal lobe broadly triangular usually; sometimes blade with only few small acute teeth, but always tapering into a long slender petiole.

Cauline leaves to ca. 8cm long, usually much shorter, to ca. 2cm wide, more or less obovate, with ca. 1-4 coarse acute teeth or acute-subacute lobes per side or irregularly dentate with several teeth per side, terminal lobe more or less triangular, acute to subacute; sessile on cuneate base or tapering into a slender linear petiole.

Inflorescences to ca. 40-flowered, initially dense, elongating after anthesis; flowering pedicels slender, erect to spreading; buds before anthesis oblong to ovoid.

Sepals usually green, sometimes lavender, with a narrow hyaline margin extending almost to the base, adaxially glabrous, abaxially densely pubescent with bifurcate or branched hairs; lateral sepals ca. 2.0-3.1 mm long, ca. [0.9-]1.1-1.8mm wide, the average ratio length to width 1.8:1, broadly oblong to deltate, apically subacute to acute, occasionally rounded, basally usually slightly saccate; me dian sepals ca. 1.7-3.0 mm long, ca. 0.8-1.5mm wide, the average ratio length to width 2.2:1, oblong to narrowly obovate, apically rounded, sometimes tapering distally and thus approaching the narrowly deltate form of the lateral sepals.

Petals ca. 3.6-6.0mm long, usually with distinct blade and claw, white, sometimes pink or lavender; blade ca. 2.0-3.7mm long, ca. 1.9-3.7mm wide, average ratio length to width 1.1:1, oblong, suborbicular or broadly obovate, usually quite scarsely veined, margin entire, apically rounded or, less often, truncate and then often emarginate, tapering gradually into the more or less linear claw, this usually slightly shorter than the blade; sometimes without obvious distinction between blade and claw, the petal then elongatedly deltate, average ratio length to width 1.9:1.

Stamens usually with filaments linear distally but proximally expanded and often narrowly spathulate, white or pale green, sometimes pale pink or lavender; anthers oblong or, less often, quadrate, usually rounded or subacute; lateral stamens ca. 1.5-3.3mm, anthers ca. 0.6-1.1mm; diagonal stamens ca. 2.1-4.1mm, filaments often unequally broadened, the greater width on the lateral side, anthers ca. 0.5-1.0mm.

Pistil ca. 1.6-3.4mm, ampulliform to almost linear, terete, sessile, pubescent or, often, glabrous; style long, slender, to same length as pistil; stigma depressed-capitate, usually slightly wider than the style; ovules ca. 10-25 per cell, suborbicular to oval, pendulous on slender curved funicles.

Fruiting pedicels ca. 2.5-13.0mm long, ca. 0.3-0.7mm diameter, spreading to horizontal, usually at an angle from the stem of 45-90 degrees, linear or slightly expanded distally, terete or quadrangular.

Lateral nectaries pentagonal to triangular, often open both on interior and exterior, on each side with a lateral appendage forming a distinct lobe at the base of each diagonal stamen; median nectaries obsolete.

Fruit when mature ca. 4-25mm, usually less than 15mm long, across the septum ca. 1.1-3.0mm, more or less fusiform-curved or straight, sessile; valves quite convex, proximally rounded to truncate, distally subacute to rounded, with a more or less prominent vein, the proximal third with sessile or shortly stipitate bifurcate or tau-shaped hairs grading distally into terete or flattened-acute simple hairs; style slender, linear, ca. 0.5-2.0mm long, ca. 0.1-0.3mm diameter; stigma depressed-capitate, often wider than the style; septum white, opaque, with more or less distinct vein, smooth except proximally where often rugulose, epidermal cells small and regular; funicles short, slender, pendulous. Seeds ca. 1.2-2.2mm long, ca. 0.7-1.2mm wide, broadly oblong to obovate (3:2), plump, subbiseriate, ca. 3-12 per cell; testa dull red-brown with slightly darker area at the hilum, densely papillose, when moistened exuding mucus as a slender cylinder, one from each papilla, the mucus thus having a radiate appearance; embryo exactly notorrhizal, radicle as long as or slightly longer than the cotyledons, cotyledons oblong, rounded or truncate.

Type locality: "Ad ripam fluminis Murray arenosam inter locum Morunde et versuram orientalem"

Lectotype: Murray Banks; Feb., 1851; Mueller - MEL 768!

Other specimens seen: (see Map 8 - page 221)

South Australia: - Camp 32, Simpson Desert Expedition; 18.7.1939; Crocker - AD: Camp 38; 26.7.1939; Crocker - AD: Warburton River;?; Tate - AD: Lake Eyre;?; Lewis - AD, MEL: sandhills 15 miles west of Innamincka; 2.10.1916; White - AD: Murtree, Strzelecki Creek; 22.9.1916; White - AD: Tinga-Tingana, Strzelecki Creek; 23.9.1916; White - AD: Tingatingana near Lake Blanche; 1885; Mrs. Burkitt - MEL: Strzelecki Creek;?; Tate? - AD: Koonamore; 24.5.1928; Osborn - SYD: Bindy-i, Koonamore; 21.8.1930;? - ADW: Koonamore; 14.8.1956; Eichler 12466 - AD: Alligator Gorge; 1.10.1960; Hill 1025 - AD: Canegrass; 21.8.1937; Ising - AD: Berri, R. Murray; 2.10.1915;? - AD: Morgan; 8.9.1883; Tate - AD:

sand, River Murray; 8.9.1883; Tate - AD: Morgan; 17.4.1919; Beck - AD: near Morgan; 19.4.1919; Ising coll. - AD: N. Holl. austr. - in itinere fl. Murray ostiam versus collegit; April,1849; Hillebrand - MEL: Ardrossan; Sept.1880; ? - AD: Yorke Peninsula; ? & 1879; Tepper 168, 239, 413 - MEL: Evelyn Downs; 19.7.1952; Ising - AD: 20 miles west of Emu; 3.9.1956; Forde 468 - AD, CANB(p.i.): Ooldea; ?; Tietkins - MEL: Tomkinson Ranges; 24.8.1954; Cleland - AD: Along track to Mt. Davies, ca. 65km west of Musgrave Park Homestead; 6.9.1963; Eichler 17296 - AD, RSA:

South Australia or Queensland: - Diamantina River; May,1931; Reese - AD: Cooper's River; [1858]; Gregory - MEL:

South Australia or Northern Territory: - between the Alberga and Mt. Olga; 1874; Giles - MEL: ?; ?; Horn Expedition - NSW 53600:

Victoria: - Lake Boga; 24.9.1903; Bird 12 - MEL: near Cannie rail station; Sept.1926; St. Johns - MEL: 34 miles west of Swan Hill; 19.8.1946; Browne 27 - MEL: Gayen; Sept.1913; Williamson - NSW 53623: Mildura; 5.9.1912; Williamson - MEL: Mildura; Sept.1912; Williamson - MEL: Mildura; July,1889; Wilson 37 - MEL: Mildura; July,1946; Williams - AD: between Euston and Mildura (on Victorian side of border); 19.8.1946; Vickery - NSW 1989: near junction of Darling and Murray River, Victoria; Oct.1887; Minchin - MEL: Pine Plains, W. Wimmera; 1889; Davis - MEL: Pine Plains; 1898; McLennan - MEL: ad Wimmera. colon. Victoriae; ?; Dallachy - BM: Jeparit; 8.9.1916; W.R.A.B. - MEL: Pine Plains, Dimboola; 1889; Davis - MEL: Wimmera; 1889; Bosisto - MEL: Vict.; ?; ? - MEL: Mallee, Victoria; Oct.1898; French - MEL: Murray "Victoria, Mueller"; ?; Mueller? - K:

New South Wales: - Collarenebri; 1951; Waterhouse - SYD: "Piangobla"

Collarenebri; Jan.1948; Waterhouse - SYD: "Burdekin", Collarenebri; 17.9.1950; Waterhouse 15 - NSW 53681: near Wanjan, Pilliga Scrub; 11.10.1918; Cleland - AD: Baradine; 3.11.1954; Johnson & Constable - NSW 39890: plains near Baradine; Oct.1899; Forsyth - NSW 53657: Baradine; Oct.1932; Rupp - NSW 53656: Warrumbungle Mts.; Nov.1933;? - K: Gilgandra; 16.10.1904; Cambage 1120 - NSW 53655: Boomley; 19.8.1950; Johnson & Constable - NSW 16463: Dubbo-Beni road; 23.8.1950; Constable - NSW 16458: near Dubbo, Macquarie River;?; Moore - MEL: plains near Dubbo; Oct. 1883; Betche - NSW 53653: abundant near Dubbo, Nyngan on the rail line; 13.9.?; ? - MEL: Dubbo; Aug.1903; Boorman - NSW 53652: Dubbo; Oct. 1906; Boorman - NSW 53666: Trangie; Sept.1916; Larcombe - NSW 53658: Trangie-Narromine; 27.8.1947; Moore 616 - CANB(p.i.): Narromine; April,1913; Breakwell - NSW 53654: Tomingley to Peak Hill; Sept. 1898; Maiden - NSW 53664: Bogan Gate; Nov.1906; Boorman - NSW 53643: Condobolin; Sept.1948; Beadle & Tupper - SYD: Euabalong; May,1906; Boorman - NSW 53645: Lachlan River;?; Cunningham - B: Lachlan River; ?;Cunningham 248 - BM: Lachlan River;?;? - NSW 53688: Wirchilleba and other stations, Lachlan District; 1883; Duff 79 - MEL: West Wyalong; 26.9.1938; Pearson - NSW 53641: Wyalong; 22.9.1906; Boorman - NSW 53640: Wyalong; Oct.1903; Boorman - NSW 53639: Barmedman; Oct. 1916; Dwyer - NSW 53637: Ardlethan; 30.9.1916; Cambage 4183 - NSW 53635: Barellan; July,1917; Burke - NSW 53636: Griffith; July,1928; Blakely & Shirers - NSW 53634: Naranderra; April,1913; Stock Inspector - NSW 53633: Urana; Sept.1893; ? - NSW 53632: Hay; 22.9.1889; Fletcher - NSW 53631: Murrumbidgee; Sept.1878; Mueller - MEL: "Zara", via Wanganella; Aug.1903; Officer - NSW 53629: Wanganella; May,1903; Officer - NSW 53628: 6 miles west of Hay; 8.9.1954; Whaite 1679 - NSW 53630: Paika; 1887; Thom - MEL: Enngonia; 23.8.1958; Carolin 674 - SYD: Castlereagh, N.S.W.;?; Woolls - MEL: Warrie Stn, Castlereagh R.;?; Lamonte 130 - BM: Warrego River near the Qld. boundary; Sept.1884; Henry - MEL: Bourke; Aug.1896; Maiden - NSW 53674: Bourke; Sept.1912; Boorman - NSW 53675: Bourke district; ?; McDougall - NSW 53676: upper Darling River; 1886; Wurfel - MEL: Byrock; Nov.1903; Boorman - NSW 53673: Coolabah; 30.8.1900; Helms - NSW 53670: Coolabah; Dec.1908; Maiden & Boorman - NSW 53671: Coolabah; Sept.1898; Peacock - NSW 53687: Coolabah; Aug.1910; Maiden & Boorman - NSW 53686: Coolabah (Farm); Aug.1910; Maiden & Boorman - W: Nyngan; Sept.1913; Brookwell - NSW 53659: Nyngan; 11.9.1947; Constable - NSW 4456: Nyngan; Aug.1903; Boorman - NSW 53660, NSW 53661: Nyngan; May, 1913; Maiden - NSW 53736: 25 miles west of Nyngan; 19.8.1939; Pidgeon & Vickery - NSW 53662: about ½ way, Nyngan to Cobar; Aug.1939; P.B. & N.C.B. - SYD: Boggy Mt.; July,1903; Boorman - NSW 53663: Restdown; June,1903; Baker 3290 - K: betw een the Bogan and Darling; 1877; Norton - MEL: Cobar; Sept.1911; Cleland - AD: Cobar; Sept.1939; Beadle - SYD: Cobar; Aug.1939; P.B. & N.C.B. - SYD: Cobar; 1883; Andre 48 - MEL: Cobar; Aug.1911; Abrahams 38 - NSW 53684: Paroo River District; Sept.1900; Betche - MEL, NSW 53679, NSW 53678: Paroo River; 1923; Collins - SYD: Wanaaring; 12.9.1947; per public school - NSW 53680: Dunlop Stn, Louth; July,1903; Etheridge - NSW 53672: 75 miles west of Cobar on Wilcannia road; 20.7.1960; Burbidge 6615 - NSW 53690, CANB(p.i.): Milparinka; Aug. 1939; P.B. & N.C.B. - SYD: Evelyn Creek north of Barrier Range; 1887; King - MEL: Yandama Stn.; July,1910; Collier - NSW 53677: White Cliffs; 17.7.1914; Ferrell 6 - NSW 53669: Tarella; Aug.1887; Bauerlen 73 - MEL:

valley in Mutuanji [Noonthorangee Range];?; Beckler - MEL: Wilcannia; Sept.1910; Glenny - NSW 53667, NSW 53668: Wilcannia, R. Darling; June,1893; (Miss) Tepper 84 - MEL: Broken Hill- Wilcannia road; 22.6. 1949; Campbell - CANB(p.i.): Fowler's Gap to Packsaddle; 27.8.1939; P.B. & N.C.B. - SYD: Barrier Ranges, N.S.W.; ?;? - W: Barrier Ranges, N.S.W.; June,1889; Irvine - MEL: Barrier Ranges, N.S.W.; 1887; Wehl - MEL: Barrier Range; Sept.1921; Collins - SYD: Broken Hill; 15.10.1912; Black(A.B.) - AD: Broken Hill; Oct.1917; Black(A.B.) - AD: Broken Hill; Aug.1926; Cheel - NSW 53648: Broken Hill;4.7.1920; Morris 262 - ADW: Broken Hill; 3.4.1921; Morris 554 - NSW 53651: Broken Hill and Tarrawingee; Aug.1892; Deane - NSW 53650: Broken Hill; 20.8.1939; Pidgeon & Vickery - SYD: Broken Hill; 23.8.1939; Pidgeon & Vickery - NSW 53649: Broken Hill; Dec.1917; Andrews - NSW 53647: Mundi Mundi Plains; 9.8. 1950; Whaite - NSW 53685: near Silverton;1889; Irvine - MEL: 5 miles east of Broken Hill (Thorndale); 18.6.1921; Morris 600 - NSW 53646: Stephens Creek; 24.8.1921; Reed - AD: be tween the Darling and Lachlan River; 1885; Brückner - MEL: near Pilpa; 18.6.1861; Victorian Exploring Expedition - MEL: sandhills on the Darling; 28.6.1861; Victorian Exploring Expedition - MEL: Menindie-Ivanhoe; 28.8.1957; Carolin 351 - SYD: Lake Mudgee H.S., 62 miles south of Broken Hill; 21.7.1955; Constable - NSW 39958, NT: Darling River; ?; Mueller - K: Darling River; [1860-1861]; Victorian Exploring Expedition - K: Darling; Oct.1844; Sturt - BM: Darling;?; Mueller - BM: Darling River;?; Dallachy & Goodwin - MEL: R. Darling;?; D. - MEL: lower Darling River;?; - MEL: Bilbarke Camp; Oct.1860; Beckler - K: lower Darling River;?; Byrnes - MEL: ?; 28.9.1860; Victorian Exploring Expedition - MEL: Wentworth, Darling River;?; Mrs. Forde - MEL: junction of Murray and Darling River;1889; Miss Holding - MEL: in campis aridis ad fl. Murray, lacum Benanee et juxta flum. Murrumbidgee;?; Mueller - MEL: interior N.S.W.; 1817; Cunningham 248 - K: Lacresse Island, Cambridge Gulf, N.W. coast Australia [this is certainly wrongly labelled]; 1819; Cunningham 248 - K: N.S.W.; 1822; Cunningham - K: ?; 16.7.?; Cunningham - K: N.S.W.; 1817; Fraser - BM: interior of N.S.W.; 1817; Fraser - BM: N.S.W.; 1818; Fraser 706 - BM: N. Holland;?; Fraser - K: interior of N.S.W. & Qld.;?; Mitchell - BM: N.S.W.; 1877; Fitzgerald 2, 4 - MEL:

New South Wales, Victoria or South Australia: - in collibus arenosis ad fl Murray; Oct.1853; Mueller - MEL: Murray River;?;? - MEL: Murray River;?; D. - MEL: Murray River;?;? - NSW 53624: Murray; ?; Mueller - MEL:

Locality uncertain: - N. Holl.?; Mueller - W: Wilkie's Creek;?;? - MEL:

Queensland: - sub-tropical New Holland; 1846; Mitchell - K: last station of Mr. Mawson; 2.4.1843; Leichhardt - NSW 53642, MEL: Darling Downs near Wallangarra; Sept.1944; Clemens - BRI: "Retreat", 40 miles north of Gooniwindi; 2.4.1963; Pedley 1233 - BRI: Roma; 26. 10.1933; White 9434 - BRI: Amby Downs;?;? - BRI: Amby Downs;?; Bailey - BRI: Amby Downs;?; Bailey - NSW 53625: Amby Downs;?; Colonial Botanist[Bailey] - MEL: about 5 miles north of St. George; 12.9.1959; Everist 6107 - BRI: Irrigation Commission Office, St. George; July, 1960; Kirkpatrick - BRI: Maranoa;?; Bailey - MEL: Thallon; July,1937; Roe - CANB(p.i.): "Binda Bore", north of Bollon;?; Grauck & Holland - CANB(p.i.): "Tilquin", Bollon; 8.10.1948; Callendar 20 - CANB(p.i.):

Curriwillughi[Currawillinghi];?; Dalton - MEL: Curriwillughi;?; Locker 15 - MEL: Mitchell district, about 5 miles south-west of Yalleroi; 22.10.1940; Smith & Everist 921 - BRI: Northhampton Downs, near Blackall; 27.8.1935; Everist 1279 - BRI: Northhampton Downs; 26.8.1935; Everist 1296 - BRI: Mitchell district, Blackall; 2.9.1938; Everist 1620 - BRI: Mitchell district, 3 miles west of Blackall; 29.3.1940; Everist 2083 - BRI: Mitchell district[Mt. Enniskillen];14.12.1941; White 11629 - BRI: Tambo; 21.8.1958; Carolin 658 - SYD: Tambo; 9.12.1935; Everist 1457 - BRI, CANB(p.i.): Augathella; Sept.1937; Brass & White 26 - BRI: between the Barcoo and Roma;1871;Birch - MEL: Elming Station; 23.7.1947; Everist 3114 - BRI: Gilruth Plains; spring 1950; Baker (M.C.) - CANB(p.i.): 15 miles west of Cunnamulla; 26.7.1948; Roe - NE: between the Paroot[Paroo R.] and Grey Range; 1881; Morton - MEL: Bulloo River;1878; Moore(R.) - MEL: between Stokes Range and Coopers Creek;[1861]; Wheeler - MEL:

<u>Northern Territory</u>: - vicin. Ellery Creek; 23.9.1955; Burbidge - CANB(p.i.): Alice Springs; 1877; Fillaeller - MEL: between Alice Springs and Charlotte Waters; May,1875; Giles - MEL: 36 miles north-east Angas Downs homestead; 30.8.1955; Chippendale - BRI, CANB(p.i.), NSW 53627, NT: Hermannsburg; 11.8.1929; Cleland - AD:

<u>Distribution:</u> This species is known from semi-arid parts of the Northe rn Territory, South Australia, Queensland, New South Wales and Victoria. It probably occurs also in the south-eastern part of Western Australia.

There are only a few collections from the Northern Territory and these are from the area south and south-west of Alice Springs. In

South Australia it is spread from the Tomkinson Range in the far north-west across to Innamincka in the north-east and south to the Murray River. It has also been collected on the Yorke Peninsula by Otto Tepper in 1879 aand 1880, but as this area has been used for agricultural purposes for many years it is unlikely that it still occurs there.

In Queensland H. blennodioides is known from the south-central part, the eastern-most collection being from Wallangarra, about 125 miles south-west of Brisbane. The bulk of the collections are from New South Wales, where this species seems to be generally distributed throughout the state west of the Dividing Range, the most easterly locality being in the Warrumbungle Mountains about 300 miles north-west of Sydney.

The Victorian collections are from the north-western part of the state.

Observations: This is the most variable species of Harmsiodoxa, the most conspicuous variation being in petal colour, petal size and shape, fruit shape and the sort of pubescence on the valves.

The petals may be white, pink or lavender, and these three colours may appear at random in a population. In shape the petals may be clawed, with a suborbicular blade, ot with no obvious distinction into blade and claw, the petals then being elongatedly deltate. Usually the petals of an individual flower are quite constant in absolute dimensions, but there may be a considerable variation, especially in the ratio of length to width.

Fruit shape and pubescence vary a great deal, but this is not at random; for example, plants from Victoria can always be distinguished from those from the Northern Territory. The available Victorian material, all from the north-western corner of the state, has fruits which are fusiform and usually falcate. Generally the valves taper proximally and are rounded to truncate; distally the valves are also tapered and are subacute to acute. The styles are slender, usually less than 0.2 mm in diameter and are usually about 1.0-2.0mm long, although on some plants there are many shorter ones.

The most striking characteristic of these Victorian plants is the pubescense on the valves; it is chiefly composed of simple flattened hairs which may be 0.1mm in width and 1.5mm long. The longest hairs are on the distal ends of the valves; toward the proximal end they are shorter and mixed with shortly stipitate, erect, bifurcate hairs. Certain of the older collections from this area seem to have glabrous fruits, but this is because the hairs have been broken off.

With the Victorian plants should be compared those from the Northern Territory. The pubescence on the fruit is rather sparse and the distal hairs are predominantly bifurcate, with unequal arms and are usually less than ½mm long. Mixed with these a re simple hairs which are usually slightly longer, to about 0.4mm. The bifurcate hairs are shortly stipitate and all are terete. At the proximal end the hairs are usuallybifurcate, these usually having equal arms, or tau-shaped or, less often, simple.

The Northern Territory plants have fruits nearly linear or slightly wider at the distal end - the valves are slightly tapered and rounded at both ends. The styles are usually about 0.7x0.2mm, and the stigma is more often the same width as the style. It may be noted that these plants have fruits which are almost terete and straight; some appear angustisept, but this is probably caused during pressing. On the Victorian plants the fruits are latisept.

These forms are the extremes of a series which can be followed across Queensland and through New South Wales. In these states are found intermediates with all possible combinations of fruit and pubescence characters.

The material from South Australia is not abundant but it does sample many parts of the state. Collections from the western part, such as Tietkens s.n. (AD) from Ooldea, Forde 463 (AD) from near Emu and Cleland s.n. (AD) from the Tomkinson Ranges tend toward the Northern Territory form. Those from the central-eastern part, for example, Eichler 12466 (AD) from Koonamore, Ising s.n. (AD) from Canegrass a nd Tate s.n. from the Murray River are more like the Victorian form.

Plants from the north-eastern part of South Australia, such as Crocker s.n. (AD) from the Warburton River and Tate s.n.(AD) from the Strzelecki Creek are intermediates with varying combinations of fruit and pubescence characters. Wehl s.n.(MEL) from Yarrowie [Appila] tends toward the Victorian form, while Hill 1025 (AD) from Alligator Gorge near Port Augusta bears fruit which in shape and style characteristics are more like the Victorian plants, although the pubescence is rather of the Northern Territory form.

Thus in South Australia it seems that plants from west and north-west of the Flinders Ranges are outliers of the Northern Territory form; those from east of the Flinders and Mt. Lofty Ranges are of the Victorian form, while those from the north-eastern plains a nd the few collected within the ranges are intermediates.

The Queensland plants are of interest; they are, on the whole, from the area east of a north-south line drawn from Blackall to Cunnamulla, this line being about 430 miles west of Brisbane. Many of these plants show a combination of characters which can, for convenience, be referred to as the Queensland form. This is intermediate between the Northern Territory and Victorian forms; it has the fruit shape and large admixture of bifurcate hairs characteristic of the Northern Territory plants, but the styles are longer and thinner than on these.

Some of these have previously been determined as Blennodia cunninghamii Benth., the reluctance to identify them with H. blennodioides being understandable, as they look quite different from the typical Victorian form. Almost all possible combinations of characters appear in these Queensland plants, many of them really being a short-haired Victorian form. Among representative Queensland collections are White 9434 (BRI), Smith & Everist 921 (BRI), Everist 1279 (BRI), 1457 (BRI, CANB), 1620 (BRI), 2083 (BRI) and White 11629 (BRI). From south-western Queensland there are only a few collections which are all intermediates between the Northern Territory a nd Queensland forms.

Fruit shape differs somewhat, the Northern Territory and Queensland forms having fruits which are usually straight and not tapered; the Victorian fomr, however, generally has fruit which are curved and narrowed at the proximal end. Various dimensions are compared in the following table:

	N.T.	Qld.	Vict.
fruit length(mm)			
max.	12.0	9.2	13.5
aver.	9.3	7.7	9.3
min.	7.3	5.2	6.0
fruit width(mm)			
max.	1.9	2.0	3.3
aver.	1.6	1.4	2.1
min.	1.3	1.1	1.3
$\frac{\text{max. width}}{\text{basal width}}$ (fruit)			
max.	2.3:1	2.8:1	3.4:1
aver.	1.8:1	2.0:1	2.7:1
min.	1.6:1	1.7:1	2.2:1
$\frac{\text{length}}{\text{width}}$ (style) aver.	3.4:1	7.2:1	4.9:1
length distal hairs (mm)			
max.	0.25	0.40	2.0
aver.	0.20	0.25	1.0
min.	0.13	0.15	0.6

In New South Wales can be traced the transition between the Northern Territory and Victorian forms. Here H. blennodioides occurs on the western slopes of the Dividing Ranges and on the plains lying to the west. Plants from he northern part of the state show characteristics of the Queensland form, but to the southward Victorian characteristics predominate. Those from the far-western part of New South Wales are like those in the adjacent parts of South Australia and resemble the Victorian plants.

Generally the hairs on the vegetative parts are sessile or shortly stipitate; they are often once or twice bifurcate a lthough many can be described only as irregularly branched. There is not such a high percentage of cruciform and then branched hairs as is found on plants of H. puberula.

Ecology and Biology: Although distributed over a wide area H. blennodioides seems more or less restricted to sandy or light soils, although there are scattered references to its occurrence on heavier soils. Beadle (1948) noted that in parts of western New South Wales it is common, particularly in well-stocked areas and added that heavy grazing of pastures can lead to a complete monopolization of them by this species.

Under the usual climatic conditions these plants are ephemerals appearing after rains and quickly flowering and setting fruit. Probably they will reach the flowering stage after effective rains at almost any time of year, for, although most of the collections bearing flowers or fruit have been made in the period July to September, flowering plants have been collected in every month except February. Turner (1891) comments that the seed germinates freely after spring rains and added that the plant makes its growth during the hottest part of the year. However there is comparatively little material which has been collected during the summer months.

As happens with several of these species, if the plant is well developed and then receives no rain during a period of several weeks, it quickly dies back, eventually losing its leaves. If rain falls between the beginning of leaf fall and the time of death, it quickly develops new lateral shoots and the process is repeated.

In July, 1963, the writer brought back from Koonamore Station, south of Lake Frome, plants which were partly dried off. On being placed into water, these remained alive for almost four months, during this time producing several new side shoots on which flowers were borne.

Uses and Common Names: Turner (1891) remarks that these plants have a somewhat pungent taste which makes them attractive to stock. Beadle (1948) describes this species as being palatable to sheep and of value as a fodder.

Turner cites "hairy podded cress" as a common name but this is probably not used.

Typification: As Mueller cited no specimens with his description, it was necessary to choose a lectotype. The locality given, "Ad ripam fluminis Murray arenosam inter locum Morunde et versuram orientalem" is between Morundie, which was a police station on the eastern bank of the Murray River, just south of present-day Blanchetown, and Morgan, where the river bends to the east.

In MEL is a plant collected by Mueller in February, 1851, (MEL 768) the locality being given as "Murray Banks". On the label is written in Mueller's hand "Erysimum (Varinia) blennodioides Ferd. Müll. n.g., antia sub nom. Blennodia canescente erratim missum". As this plant agrees with the description, was collected by Mueller before the date of publication of the name and does not disagree in locality with Mueller's citation, it seemed best to choose this as lectotype. This conclusion is supported by Mueller's comment on the label that the taxon represented here was earlier, and erroneously, associated with Blennodia canescens - hence the epithet "blennodioides". There are other Mueller collections which were considered, but they are undated and give much less information on the label.

It should be noted that Mueller apparently never published Varinia either as the name of a genus or of a subgenus of Erysimum. Besides his use of it on the lectotype sheet here, it also appears on a collection of H. brevipes var. brevipes from Cudnaka [Kanyaka] which was annotated by Mueller as "Erysimum (Varenia)brevipes".

Relationships: H. blennodioides seems equally closely related to H. brevipes and to H. puberula. On fruit characteristics alone it may be difficult to separate the first two for the pubescence pattern on the exterior of the fruit is about the same as is fruit shape in many cases. However, H. blennodioides has fruit valves glabrous on the inner surface, while those of H. brevipes are pubescent. H. brevipes is the only species in the "Blennodia group" which shows this phenomenon.

H. puberula may be distinguished from the others by the slightly larger fruit and by its short appressed hairs.

Note: In 1863 Bentham published the names Blennodia cunninghamii, describing it in the following manner:

"A tufted herbaceous perennial, more or less hoary with soft stellate hairs, occasionally mixed with simple ones; annual stems erect or decumbent at the base, from a few inches to 1 ft. high, slightly branched. Radical leaves petiolate, 1 to 2 in. long, oblong or lanceolate, scarsely toothed or shortly pinnatifid; stem-leaves small and few, from lanceolate to nearly obovate. Flowers small, apparently white. Fruiting racemes loose, 2 to 4 in. long, with spreading pedicels. Pod 4 to 5 lines long, acute at the top and at the base, tipped by a very short subulate style, pubescent with simple or stellate hairs, or nearly glabrous; valves very convex, with a prominent midrib. Seeds oval-oblong, smooth, the mucus rather copious.

Queensland. Flats on the Maranoa, Mitchell.

N.S. Wales. Bathurst Plains and other parts of the interior of the colony, A. Cunningham, Fraser."

The chief differenses between a plant answering to this description and one of H. blennodioides are the following:- "pod ..., acute at the t top and at the base"; usually the fruits of H. blennodioides are rounded to truncate at the base: - "valves very convex, with a prominent midrib"; the valves of H. blennodioides usually cannot be described as very convex and the midrib, although distinct, is not prominent.

The following nine collection are those which probably have been seen and determined as Blennodia cunninghamii by Bentham:

BM: N.S.W.; Fraser - Arabis species found on all the Barren Lands west of Fields plains advanced in flower in June and July.

This plant is H. blennodioides.

K: (1) 16 July - Arabis - A. Cunningham - ex Herb. Hook.

This plant is H. blennodioides.

(2) Nov. Holl. - Fraser - ex Herb. Hook.

This plant is H. blennodioides.

(3) Sub-Tropical New Holland - 1846 - Sir. T.L. Mitchell - ex Herb. Hook.

There are two plants, both of which are H. blennodioides.

(4) Interior N.S.W. - 1817 - A. Cunningham 248

This is also H. blennodioides.

(5) Lacrosse Island. Cambridge Gulf. N.W. Coast of Australia - 1819 - A.Cunningham 248

This plant is H. blennodioides and agrees with Cunningham's other 248. The locality given is certainly wrong.

(6) Sub-Tropical New Holland - Aug.1846 - Sir T.L. Mitchell 497 -Camp 29 - ex Herb. Hook.

This plant bears no fruit, only buds and flowers; it is very possibly the Queensland form of H. blennodioides.

(7) N.S.W. - Colony 1822 - A. Cunningham - ex Herb. Hook.

This plant agrees with Bentham's description in having a short style and a prominent midrib. It is not H. blennodioides and resembles a young plant of Drabastrum alpestre. However, the fruit are in shape more nearly those of the former than of the latter species. Dr. S. T. Blake, at present Australian liason officer at Kew, has been asked to reëxamine the plant, but at the time of writing no answer had yet been received from him.

MEL: Arabis sp. Bathurst plains - A. Cunningham - MEL 775

These plants are not H. blennodioides; they seem to be the same as K(7) above and also resemble Drabastrum alpestre.

The Mitchell collections from subtropical New Holland dated 1846 [K(3)] include two entire plants mounted on a single sheet together with a Cunningham collection [K(1)]. If the better of the Mitchell plants (that on the right) be chosen as lectotype of the name Blennodia cunninghamii this name and Harmsiodoxa blennodioides become taxonomic synonyms.

It seems certain that the taxon which Bentham had in mind when describing _B. cunninghamii_ is _H. blennodioides_; the discrepancies in the description of the former seem to have entered through the inclusion of the Cunningham plants [K(7), MEL 775]. The identity of these plants is still uncertain.

All the plants which have, since Bentham's time, been determined (by Schulz and by others) as _B. cunninghamii_ are _H. blennodioides_, very often the Queensland form.

HARMSIODOXA PUBERULA SHAW (SP. NOV.)

(puberula = downy, with short hairs; the pubescence of this species is short and appressed)

Figures: Figures 10, 13H,I

Diagnosis: Herba annua vel perennis(?), caulibus usque ad 50cm altis, tenuibus, adscendentibus vel decumbentibus, stellato-puberula (sepalis et ovario incl) pilis sessilibus vel breviter stipitatis ramosis adpressis; foliis radicalibus usque ad 12cm longis, laminis late oblanceolatis vel oblongis, dentatis vel pinnatilobis, utrinque lobis 3-5, in petiolos tenues angustatis; foliis caulinis usque ad 10cm longis, 2½cm latis, oblanceolatis vel obovatis, integris vel remote dentatis, utrinque 2-4 dentibus, inferioribus pinnatilobis non numquam, utrinque lobis 3-5 linearis vel triangularis, sessilis vel breviter petiolatis; inflorescentibus ca. 20- usque ad 30- floribus; pedicellis fructiferis ca. 4-12mm longis, ca. 0.6-0.9mm diametro, erectis vel patentibus; siliquis usque ad 2.5cm longis, ca. 1.4-3.0mm latis, teretibus vel latiseptis, linearis vel late fusiformibus; valvis pubescentibus, pilis omnis brevibus, ramosis, adpressis, sessilibus vel brevissime stipitatis; stylis ca. 0.8-1.6mm longis, ca. 0.3mm diametro; stigmatibus capitatis, plerumque depressis; seminibus ca. 1.7-2.0mm longis, subbiseriatis, oblongis vel ellipsoideis; cotylodonibus incumbentibus exacte.

Holotype: Flood plain near Cadelga; 29.8.1960; Lothian 606 - AD 96045034!

Description: Plant herbaceous annual, pubescent, including sepals and ovary, with sessile or very shortly stipitate bifurcate or branched hairs; stems to ca. 50cm high, few to many, terete or finely fluted, erect, more or less leafy, arising from a basal rosette of leaves, equal or with a central leafless stem, slightly shorter than the leafy lateral stems which are often much branched.

Basal leaves to 12cm, usually less than 6cm long, with blades broadly oblanceolate to oblong, finely dentate, the teeth acute or obtuse, or sinuate or pinnately lobed, lobes 3-5 per side, more or less triangular, subacute to rounded, apically rounded to subacute, tapering suddenly into a slender petiole, sometimes dentate, as long as or slightly longer than the blade.

Cauline leaves to ca. 10cm long, usually less than 5cm, to 2½cm wide, oblanceolate to obovate, lower leaves tapering into a slender petiole to as long as the blade; upper leaves shortly petiolate or almost sessile, entire or sinuate or remotely toothed, 2-4 per side, usually opposite and acute to rounded or sometimes pinnately lobed with 3-5 linear or triangular lobes per side, subacute to rounded, apically rounded or, less often, subacute.

Inflorescences usually ca. 20-30-flowered, initially dense, but elongating after anthesis; flowering pedicels 4-7[-12]mm long, slender, erect to spreading; buds before anthesis oblong, spherical or ovate.

Sepals green or lavender, with a narrow hyaline margin, adaxial side glabrous, abaxial side pubescent with ramose hairs; lateral sepals ca. 2.9-3.6[-3.9]mm long, ca. [1.2-]1.6-2.0mm wide, the average ratio length to width 1.9:1, oblong to lanceolate, apically subacute or, sometimes rounded, basally usually slightly saccate; median sepals ca. 2.7-3.5mm long, ca. 0.9-1.6mm wide, the average ratio length to width 2.3:1, oblong, apically rounded, basally slightly tapering, not saccate.

Petals ca. 4.0-8.2mm long, usually lavender, sometimes white, in sicco usually white or yellow; blades ca. 2.0-5.0mm long, ca. 2.0-5.0mm wide, ratio length to width 0.8:1-1.4:1, average 1.0:1, orbicular to obovate, densely veined, entire or sinuate, sometimes emarginate apically and almost cordate, tapering suddenly or gradually into a linear claw usually about the same length as the blade or slightly shorter, the blade averaging 56 per cent of the total petal length.

Lateral stamens [2.7-]3.0-4.3mm long, filaments linear or slightly expanded at the base, straight or slightly curved; anthers ca. 0.8-1.5mm, oblong or slightly narrowed at apex, yellow; diagonal stamens ca. 3.4-4.4[-4.7]mm long, otherwise as lateral stamens; anthers ca. 0.8-1.2mm, otherwise as those of the lateral stamens.

Pistil ca. 2.5-3.5mm long, linear, terete, sessile, pubescent with short branched hairs or, rarely, subglabrous; style linear or slightly obconical; stigma fleshy, depressed-capitate, as wide as or slightly wider than the style; ovules ca. 10-25 per ovary; funicles slender, pendulous; lateral glands triangular or square or circular, open on the interior, producing on each side a lateral appendage forming a distinct triangular lobe at the base of each diagonal stamen; median glands obsolete.

Fruiting pedicels ca. 4-12mm long, ca. 0.6-0.9mm in diameter, erect to spreading, very rarely slightly recurved.

Fruit to ca. 2.5mm long, ca. 1.4-3.0mm across the septum, usually linear or broadly fusiform, straight or sometimes falcate-curved; valves proximally tapering gently and truncate or, sometimes, rounded, distally subacute to slightly rounded, with a distinct, but not prominent, vein, quite densely pubescent with small sessile or very shortly stipitate bifurcate or branched hairs, those at the distal end differing from

from those at proximal end; style ca. 0.8-1.6mm long, ca. 0.3mm wide, linear or slightly obconical; stigma usually depressed-capitate, as wide as or slightly wider than the style; septum white, semi-opaque, with more or less distinct vein, epidermal cells irregular in outline; funicles linear or slightly widened at the base, straight or slightly curved, pendulous.

Seeds ca. 1.7-2.0mm long, ca. 1.1-1.4mm wide, oblong to ovoid; testa orange-brown to red-brown with slightly darker pigmentation at the hilum, finely punctate, when moistened exuding mucus as tightly coiled threads one from each papilla, thus appearing radiate; seeds ca. 3-10 per cell, subbiseriate; embryo exactly notorrhizal, radicle of same length as or slightly longer than the oval cotyledons.

Specimens seen: (see Map 7 - page 221)

South Australia: - 60 miles east-south-east of Bluff (Roseberth) along Miranda track; 29.8.1960; Lothian 595 - AD, UC, Z: Paralana Hot Springs; 22.8.1963; Kuchel 956 - AD:

New South Wales: - Burren Junction; 5.10.1936; per Glenfield Vet. Res. Stn. - NSW 53605: Burren district; Oct.1936; Vickery - NSW 53603: Pilliga; Sept.1932; Rupp 25 - NSW 53601: 80 miles north-west of Walgett; 29.7.1948; Roe - NE: Louth; Sept.1910; Abraham 479 - NSW 53606: Bootra-Urisino;?; Morris 946 - ADW: Milparinka; Aug.1939; P.B. & N.C.B. - SYD: Coally (south of Milparinka); 1.7.1955; Johnson & Constable 937 - NSW 39948: Wilcannia; 20.8.1939; Pidgeon & Vickery - NSW 53604, NSW 53602: near Wilcannia; Aug.1939; J.M.P. & J.W.V. - SYD: Nicholson; Aug.1942; Beadle - SYD: [on the Darling?]; 6.12.1858;? - MEL:

Queensland: - Tanbar; 20.6.1949; Everist 4029 - BRI, CANB(p.i.): Thargomindah; 3.9.1923; MacGillivray - BRI, ADW: south-western Queensland; Aug.1910; Little - BRI:

<u>Northern Territory or South Australia</u>: - south of Charlotte Waters; Sept.1885; Kempe - MEL:

<u>Distribution</u>: There are only a few collections of this species; these indicate that it occurs in the far north-eastern part of South Australia, in south-western Queensland and in north-western and north-central New South Wales.

<u>Observations</u>: There is little variability within this species and it is usually easy to distinguish from the other species of <u>Harmsiodoxa</u> and from other <u>Cruciferae</u> found in Australia. Unfortunately there is only one collection bearing ripe fruit (<u>Vickery s.n.</u> - NSW 53603) and this is composed only of a number of fruiting racemes, but there seems no doubt that these belong to this species.

The hairs are usually sessile or almost so and are often cruciform, the arms being bifurcate. The arms are generally parallel to the organ bearing the hair, and the hairs often appear stellate. The plant, with the exception of stamens, style and replum, is pubescent and to the unaided eye looks canescent.

<u>Ecology and Biology</u>: Little is known of this species, but it seems to grow both in sand and in heavier soils. <u>Lothian 595</u> (AD) is annotated "<u>Blennodia</u> on low sandhill ..." while other comments are "in heavy grey clay on flooded flat" (<u>Everist 4029</u> - BRI, CANB), "grey clay, overgrazed Mitchell grass pastures" (<u>Roe s.n.</u> - NE), "occasional on treeless plains" (<u>Johnson & Constable 937</u> - NSW 39948) and "pine box woodland" (<u>Beadle s.n.</u> - SYD). Flowering and fruiting occurs chiefly in the months July to October.

Uses and Common Names: There appear to be neither uses nor common names recorded.

Relationships: H. puberula seems equally closely related to H. blennodioides and to H. brevipes. It is most obviously distinguished from them by the very short appressed hairs.

<u>HARMSIODOXA</u> <u>BREVIPES</u> (FvM.)SCHULZ

(brevis = short, pes = foot; the fruiting pedicels are short)

Schulz, Pflrch. 86(1924)263

<u>Erysimum</u> <u>brevipes</u> FvM., Linnaea 25(1853)367 (basionym); FvM., Trans. Phil. Soc. Vict. 1(1855)100; FvM., Nat. Pl. Vict. 1(1879) 53; Tepper, TRSSA 3(1880)34; Tate, TRSSA 3(1880)51; FvM., Census 1(1882)5; Tate, TRSSA 4(1882)104; Rep. Field Nat. Soc., TRSSA 8 (1886)193; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral.(1890)16,206; FvM. et Tate, TRSSA 16(1896) 335; Koch, TRSSA 22(1898)102.

<u>Blennodia</u> <u>brevipes</u> (FvM.)FvM., Pl. Col. Vict. 1(1860-1862)41; Benth., Fl. Austral. 1(1863)75; Tate, TRSSA 22(1898)123; Ostenf., Dansk. Vidensk. Selsk. Biol. Medd. 3/2(1921)65; Black, Fl. S. Austral.(1924)247; Black, TRSSA 62(1938)101; Black, Fl. S. Austral. ed.2(1948)375. [This species was referred to <u>Blennodia</u> by Mueller, Trans. Phil. Soc. Vict. 1(1855)100, but the necessary combination was not made.]

<u>Sisymbrium</u> <u>brachypodum</u> FvM., Fragm. 7(1869)20; FvM., Fragm. 10 (1877)119; FvM., Fragm. 11(1878)6 [βραχύς = short; πούς = foot]

<u>Sisymbrium</u> <u>brevipes</u> (FvM.)FvM., Fragm. 10(1876)53 (nom. illegit.) [non Kar. et Kir., Bull. Soc. Nat. Mosc. 15(1842)154]

The above names are nomenclatural synonyms of <u>Harmsiodoxa</u> <u>brevipes</u>, being based on the same type.

<u>Figures</u>: Hayek, Beih. Bot. Centralbl. 27(1911)fig.8(13); Black, (1924)fig.113 A-E; Schulz, Pflrch. 86(1924)fig.7A; Black, Fl. S. Austral. ed.2(1948)fig.529 A-E; - Figures 11, 13F,G

Original description: "Erysimum brevipes, herbaceum elatius, erectum, foliis irregulariter lobatis ambitu lato-lanceolatis, lobis inferiorum antice grosse-dentatis, pedicellis crassis erectiusculis siliqua quater quinquisve brevioribus, nervo valvarum ultra medium evanico, filamentis lineari-filiformibus, petalis albis.••• Herba robusta ulnam alta. Folia 1-2" longa. Petala minora quam in duobus sequentibus, breviter unguiculata. Semina vix matura obscuro-fusca. Anthesis: primo vere."

Description: Plant small herbaceous annual, pubescent including sepals and ovary with simple or sessile or shortly stipitate bifurcate or branched hairs; stems to ca. 40cm high, but usually much less, few to many, erect or prostrate with spreading branches, equal or with a leafless central stem and longer lateral stems, often reddish-purple; root a slender taproot, ca. 0.5mm diameter at ground level.

Basal leaves to ca. 13cm long, but usually less than 4cm, blades remotely dentate to coarsely pinnatisect, lobes opposite or almost exactly alternate, rounded or, often, mucronulate, primary lobes sometimes with a smaller triangular-rounded lobe or tooth on distal side, terminal lobe usually more or less triangular, leaves tapering into slender petioles or, less often, almost sessile.

Cauline leaves ca. 0.5-3.5[-4.0]cm long, oval to obovate, lowermost leaves shortly petiolate and almost pinnatifid, upper leaves with 2 or 3 coarse acute teeth on a side, terminal lobe obtuse to subacute, sessile on cuneate base or on a short petiole.

Inflorescences usually with fewer than 20 flowers, initially densem then elongating; flowering pedicels slender, erect or somewhat sptr

Sepals green with a narrow hyaline margin, adaxially glabrous, abaxially pubescent with shortly stipitate forked hairs, rarely with simple hairs; lateral sepals ca. 1.6-2.7mm long, ca. 0.6-1.2mm wide, the average ratio leng th to width 2.4:1, oblong to obovate to deltate, apically usually rounded or subacute, basally usually slightly saccate; median sepals ca. 1.5-2.7mm long, ca. 0.6-1.2mm wide, the average ratio length to width 2.5:1, more or less oblong or basally slightly narrowed and almost oval, apically rounded, sometimes slightly cucullate, basally not saccate.

Petals ca. 2.2-4.1mm long, lavender, pink or white, *in sicco* usually yellow, usually with obvious distinction between blade and claw; blade ca. 1.0-1.7[-2.0]mm long, ca. 0.7-1.4mm wide, ratio length to width 1.1:1-2.1: 1, average 1.4:1, usually obovate, sometimes suborbicular or almost oblong, coarsely veined, margin entire or sinuate, apically rounded to truncate, then sometimes emarginate, usually tapering into a slender more or less linear claw, usually slightly longer than the blade, the blade averaging 47 per cent of the total petal length; sometimes with no distinction between blade and claw, the petal then usually narrowly obovate, the average ratio length to width 3.1:1.

Stamens usually with filaments linear to tapered distally and slightly broadened at the base, sometimes narrowly clavate, green or, often, lavender, usually darker distally; anthers oblong,sometimes quadrate, usually rounded, yellow; lateral stamens ca. 1.6-3.0mm long, anthers ca. 0.3-0.8mm, usually 0.4-0.5mm long; diagonal stamens ca. 1.8-3.2mm long, anth thers ca. 0.3-0.7mm, usually 0.3-0.5mm; filaments often broader on lateral side of vein.

Pistil ca. 1.5-3.5mm, ampulliform to ovoid, terete, sessile, shortly pubescent; style short, linear; stigma depressed-capitate, as wide as or slightly wider than the style; ovules ca. 8-14, suborbicular to ovoid; funicles short, slender, pendulous; lateral glands not fully developed, a more or less crescent-shaped lobe of tissue, one on each side of each lateral stamen, sometimes only a small lobe at the base of each diagonal stamen; median glands obsolete.

Fruiting pedicels ca. 1.0-3.5[-7.0]mm long. ca. 0.4-0.7mm in diameter, spreading to erect, terete or, often, quadrangular.

Fruit ca. 0.6-1.7cm, usually 1.0-1.2cm long, ca. 2.0-2.5mm in width across the septum, fusiform-curved, tapering at proximal end, sessile, terete or slightly compressed dorso-ventrally, therefore latisept; valves convex, proximally rounded to narrowly truncate, distally rounded to narrowly truncate or subacute, vein almost obsolete, inner surface usually sparsely pubescent with bifurcate hairs, exterior pubescenttwith hairs usually sessile or shortly stipitate, bifurcate proximally, distally hairs usually simple, erect, often flattened at the base, acute to ca. 1.0mm, longer than proximal hairs; style ca. 0.4-1.0mm, linear; stigma s mall, depressed-capitate, as wide as or slightly wider than the style; septum white, opaque, with vein, rugose, especially at edges, epidermal cells small, rounded, round to more or less oblong, irregularly arranged.

Seeds ca. 1.2-1.7mm long, ca. 0.9-1.3mm wide, more or less oblong, plump; testa dull red-brown tp dark brown, slightly darker at the hilum, testa with small tuberculiform papillae, when moistened, exuding mucus in cylinders, each containing a tightly coiled spiral thread, thus appearing radiate, subbiseriate, ca. 4-6 per cell; embryo exactly or slightly obliquely notorrhizal, usually with radicle about same length as the cotyledons.

Type locality: "In collibus subarenosis juxta omnem Rocky River"

Holotype: In collibus subarenosis prope Rocky River; Oct.1851; Mueller - MEL 757!

Other specimens seen: (see Map 7 - page 221)

South Australia: - John's Creek;?; Tate - AD: 8 miles south of Blinman;25.8.1961; Shaw 19,20 - AD: Wilpena, lower slopes Mt. John; 15.9. 1960; Symon 623 - ADW: floor and sides of Wilpena Pound; 16.9.1960; Symon 679 - ADW: Wilpena - lower slopes Mt. John; 4.9.1961; Symon 1339 - ADW: Mt. Aleck, Arkaba Hills; 25.8.1963; Kuchel 1116 - AD: Quorn; 27. 8.1936; Cleland - AD: Quorn; 2.9.1941; Cleland - AD: Cudnaka;?; Mueller - MEL: Wirrabara Forest;?; Gill 91 - MEL: Gladstone; 15.8.1906; Black(?) - AD: Gladstone; 23.10.1915; Black(?) - AD: Halbury; 6.9.1909; Black(?) - AD: Kinchina; 24.10.1930; Ising coll. - AD: Barmera;25.8. 1941; Cleland - AD: Loveday; 10.9.1942; Gauba - W: Murray River; Dec. 1854; Mueller - MEL: Murray;?; Mueller - K: ca. 15km west-south-west of Purnong, 1.5km north-east of turnoff to Walker Flat on road from Purnong to Mannum; 11.8.1963; Eichler 17205 - AD: Yorke Peninsula;1879; Tepper - MEL: Yorke Peninsula; 1879; Tepper 86 - MEL: Ardrossan; Sept. 1880;? - AD: Ardrossan; Oct.1879; Tepper - AD: Nonning;24.8.1928; Cleland - AD: Lake Gilles;?; Burkitt - MEL: Mt. Wudinna;7.9.1938; Johns - AD: Gawler Ranges; Sept.1912; White - AD: Arkaringa Creek; 13.5.1891; Helms - MEL: Arkaringa Creek; 13.5.1891; Helms - AD: between Spencer's Gulf and Mt. Eba;[1875]; Giles - MEL: Fowler's Bay;?;Richards - MEL: Nov. Holland. meridional. in reg. inter.;?;? - W:

Victoria: - Murray River;?;(Miss) Macadam - MEL: Swan Hill:0; Gammoun - MEL: Ouyen; Sept.1913; Williamson - MEL: Underbool; Sept.-Oct.1915; Malone - NSW 53612: 3 miles north 65 mile post on Sturt Highway along track to Berribbee Tank; 2.9.1948; Willis - MEL: Pine Plains, West Wimmera; 1889; Davis - MEL: near Beulah; 15.9.1903; Reader - MEL: Yarriambiark Creek; 18.8.1903; Reader - MEL: Ellam; 12.10.1912; W.R.A.B. - MEL: Jeparit; 11.9.1916; W.R.A.B. - MEL: Wimmera;1892; St. Eloy D'Alton - MEL: cultivation, paddocks; 21.9.1897; Reader - MEL:

New South Wales: - Lake Cargelligo Dist.;1903; St. Eloy D'Alton - MEL:

Western Australia: - Eucla;1877; Richards - MEL: Fraser Range;?; Helms - NSW 53610: between Esperance Bay and Fraser's Range;1876; Dempster - MEL: Fraser Range;12.10.1891; Helms - AD: Fraser Range; 12.10.1891; Helms - MEL: near Coolgardie;1895; Spencer Moore 95,96 - BM: Nannine; Sept.1903; Fitzgerald - NSW 53611: Cowcowing; Sept.-Oct.1904; Koch - PERTH: Sources of the Swan River;1889; Eaton - MEL: Swan River;?; Drummond, fourth series, no.128 - BM,K,W,KW(?): Swan River;1846; Drummond 10 - K:

Locality uncertain: - ?;?;? - NSW 53609:

Distribution: H. brevipes is the most widely spread species of Harmsiodoxa, occurring in Western Australia, South Australia, Victoria and, apparently, in New South Wales. In Western Australia the collections are scattered from Cowcowing, about 100 miles north-east of Perth, across to Eucla, near the South Australian border.

In South Australia this species seems most common in the southern part of the Flinders Ranges and on the plains to the south-east, although there are scattered collections from the far north, the Yorke Peninsula, the Erye Peninsula, and near the head of the Great Australian Bight. It extends further south than most of this group, the southern most collection being from near Kinchina, about 5 miles west of Murray Bridge. The variety var.major is more northerly, having been collected near Lake Frome and in the Oodnadatta area.

In Victoria only the typical variety has been found and it is restricted to the drier areas of the north-west. From New South Wales there are only two collections, St. Eloy D'Alton s.n. (MEL) from near Lake Cargelligo which is the typical variety and Tucker 47 (MEL) from the Lachlan River which is H. brevipes var. major, but is mixed on a sheet with H. blennodioides. This seeming rarity in New South Wales is surprising as this species does occur in north-western Victoria and eastern South Australia.

Observation: There is little variation in this species except in length of the fruiting pedicels and length of the hairs on the fruit valves. On plants of the typical variety the pedicels are usually short and stout, but occasionally are as long as 7mm; a plant with longer pedicels which is only in fruit is often difficult to distinguish from some forms of H. blennodioides, unless the inner surface of the valves is checked for the presence of pubescence. The variety var. major usually bears fruit on longer pedicels, to 15mm, and these plants might be confused with H. puberula. Both varieties of H. brevipes do differ from the other species of Harmsiodoxa in having much smaller flowers and fruit valves which are sparsely pubescent on the inner side.

The typical variety shows on the fruit the same phenomenon as does H. blennodioides. At the proximal end the hairs are usually bifurcate with more or less erect arms; toward the distal end there are gradually more hairs which are simple or with one arm shorter than the other. The hairs are shortly stipitate; those at the proximal end are usually less than 0.3mm long - at the distal end they may be as much as 1mm, but are usually less. The other parts of the plant have hairs which are shortly stipitate to sessile and bi- or tri- furcate to irregularly branched.

The variety var. major has much the same pattern of pubescence, but the hairs of the distal end of the valves are not strikingly longer and are often evenly bifurcate. On all parts of the plant the hairs seem quite silky and are often appressed to the organ bearing them. Were it not for the smaller flowers, some specimens of this variety could be confused with H. puberula.

It is usually easy to recognize H. brevipes, but two collections from the Arcoona area in the Flinders Ranges (Eichler 12664, 12827 - AD) are difficult. These are both rather robust plants which seem intermediate between H. brevipes and H. blennodioides. The fruit are on longer pedicels than is usual for H. brevipes but the flowers are, in size, much more like those of H. brevipes than those of H. blennodioides. For the present it seems best to refer them to H. brevipes var. major.

Ecology and Biology: As is true of the other species of Harmsiodoxa, H. brevipes generally occurs in the more southerly semi-arid areas and usually grows in sandy soil. The chief period of flowering and fruiting is in July through October, but, given rain, flowering probably occurs at any time of year. Willis s.n. (MEL), from the far northwest of Victoria, is annotated "common in open grassy situations on low sandhills with B. cardaminoides FvM.".

Uses and Common Names: Koch 330 (B, BRI, MEL, NSW 53608, W, NSW 53622) is annotated "good fodder". No common names seem to have been recorded.

HARMSIODOXA BREVIPES VAR. MAJOR SHAW (VAR. NOV.)

Diagnosis: A varietate typica differt:

Foliis radicalibus plerumque integris vel sinuatis; pedicellis fructiferis ca. 2-7[-15]mm longis, ca. 0.5-0.8[-1.0]mm diametro; valvis exteriore canescentibus pilis bifurcatis vel ramosis, sessilis vel brevissime stipitatis; septis levioribus; seminibus ca. 1.5-2.1mm longis, ca. 1.0-1.4mm latis, pro rata longioribus.

Holotype: Evelyn Downs; 19.7.1952; Ising - AD 96112032!

Other specimens seen: (see Map 7 - page 221)

South Australia: - Mt. Lyndhurst; Aug.1898; Koch 330 - B: Mt. Lyndhurst; Oct.1898; Koch 330 - BRI, MEL, NSW 53608: Mt. Lyndhurst; May, 1899; Koch 330 - W: Mt. Lyndhurst;?; Koch 330 - NSW 53622: Areoona Creek - south of Areoona Bluff Range; 16.9.1956; Eichler 12664 - B, GH, Z, AD: Areoona Pound (ca. 10km east of Owieandana Hut); 20.9.1956; Eichler 12827 - AD: John's Creek;?; Tate - AD: 5 miles north of William Creek; 7.8.1963; Lothian 1348 - AD: Arkaringa Creek, 12 miles north of Mt. Barry; 30.8.1955; Ising - AD, UC: Evelyn Downs; Oct.1950; Ising - AD: Evelyn Downs; 23.7.1952; Ising - AD: Evelyn Downs; 9.8.1952; Ising - AD: Evelyn Downs; 27.8.1952; Ising - AD: Evelyn Downs; 15.9.1952; Ising - AD: Evelyn Downs; 14.8.1955; Ising - AD: Arkaringa Creek; 13.5.1891; Helms - AD, NSW 53607: Arkaringa Creek; 13.5.1891; Helms - AD, MEL:

New South Wales: - Lachlan River;1879; Tucker 47 - MEL:

Distribution: This variety has been collected in the Flinders Ranges, south-west of Lake Eyre and in the vicinity of Evelyn Downs Station, about 90 miles south-west of Oodnadatta, all in South Australia, as well as in south-central New South Wales.

Ecology and Biology: So far as is known the ecological requirements are the same as for the typical variety. Flowering and fruiting seem to occur chiefly in July to October; probably flowering, at least, can take place at any season after rain.

Relationships: This species seems equally closely related to H. blennodioides and H. puberula.

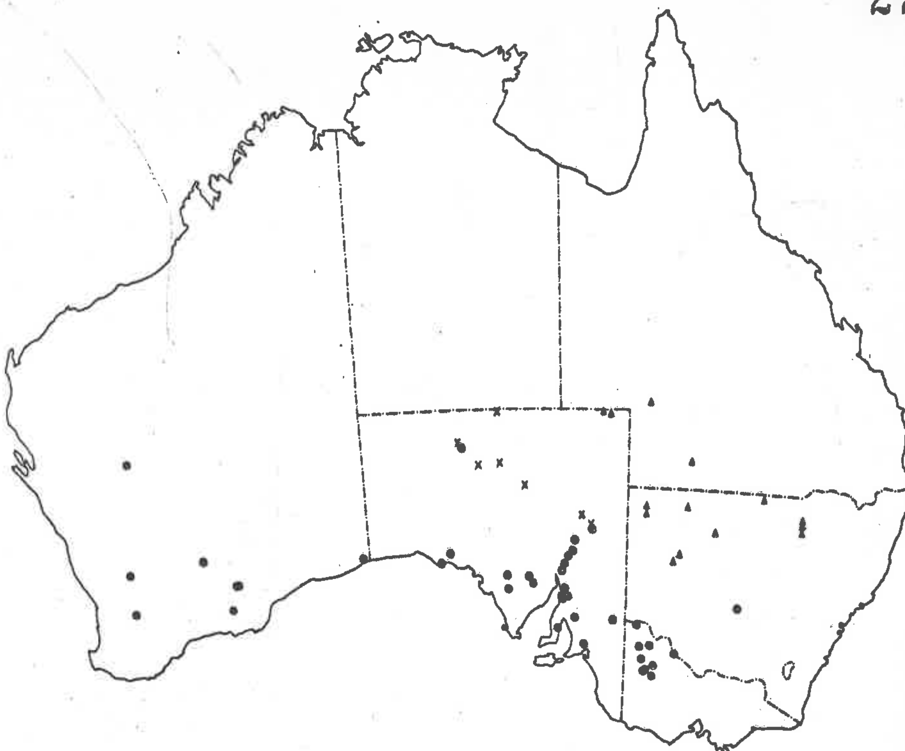
Note: A possible synonym of H. brevipes is Alyssopsis drummondii Turcz., Bull. Soc. Nat. Mosc. 27/4(1854)291. Turczaninow described this species citing Drummond, series 4, no.128, collected in Western Australia, and this description agrees with H. brevipes. Turczaninow was not certain to what genus this plant belonged and included it in Alyssopsis for want of a better place. In 1877 and 1878 Mueller remarked that A. drummondii Turcz. was synonymous with his Sisymbrium brachypodum. Schulz (1924) cited A. drummondii Turcz as a synonym of Harmsiodoxa brevipes.

There are in BM, W, and K collections labelled as being no 128 from Drummond's fourth series and these plants are all H. brevipes var. brevipes. Towards the end of this work was received from KW a photograph of the plant from Turczaninow's herbarium which is labelled as "Drummon, 4th series, no. 128". On the label is written Alyssopsis drummondii, but this plant is not the same as the other collections under this number and does not agree with Turczaninow's description.

It is woody at the base and gives the impression of a suffruticose perennial which has just put forth a new season's growth. Also the fruits, which seem to be young, are on long slender pedicels and seem to be almost obovoid; the inflorescence appears to be not so dense as it is in H. brevipes.

On seeing this photograph authentic material of _H. brevipes_ var. _brevipes_ was sent to Kiev asking that it be compared with the Turczaninow plant in regard to these critical points, but at the time of writing no reply had been received.

7



Map 7 - ● = Harmsiodoxa brevipes var. brevipes

× = Harmsiodoxa brevipes var. major Shaw

▲ = Harmsiodoxa puberula Shaw

Map 8 - Harmsiodoxa blennodioides (FvM.)Schulz

8

SCAMBOPUS SCHULZ

(σκαμβός = curved, πούς = foot; the fruiting pedicels are recurved)

Schulz, Pflrch. 86(1924)259; Schulz, Pflfam. ed.2 17b(1936)637.

Original description: Schulz (1924) - "Plantae mihi tantum delineatae ex herbario Kewensi visae, pilis simplicibus vel ramosis vel stellatis hispidulae. Flores flavi. Siliquae breviusculae, curvatae, turgidae, pubescentes, oligospermae. Semina humida mucosa."

Schulz (1936) - "Sep. lange bleibend, eiförmig, innere an der Basis kaum gesackt. Pet. gelb, verkehrt-eiförmig, kurz genagelt. Ovar eiförmig-länglich, mit wenigen Samenanlagen; Griffel dünn, Narbe etwas breiter als dieser. Schoten länglich, gekrümmt, an der Spitze in den kurzen Griffel verschmälert; Klappen stark gewölbt und durch ein hervorragenden Mittelnerv gelielt. Samen wenig, ziemlich gross, eiförmig, leich zusammengedrückt. - Einjährige, niedrige, aufsteigende, mit einfachen, zweigabeligen und ästigen Haare ± dicht bekleidete Kräuter. Stengel meist vom Grunde an ästig. Blätter länglich-lanzettlich, entfernt gross gezähnt. Blüten mittelgross. Trauben unbeblättert. Schoten auf spreizenden, aufwärts gekrummten Stielen."

Scambopus curvipes (FvM.)Schulz

Scambopus richardsii (FvM.)Schulz

Description: Calyx open; sepals usually spreading, occasionally erect or almost so, usually green with a narrow hyaline margin, pubescent on the abaxial side with shortly stipitate bifurcate or branched hairs; lateral sepals oblong or deltate, usually slightly wider than the median sepals, sometimes slightly saccate basally, distally rounded to subacute; median sepals usually more or less oblong, less often obovate, not basally saccate, distally rounded to truncate, sometimes slightly cucullate.

Petals usually slightly longer than the sepals, to about twice as long, yellow, clawless or with a very short linear claw, usually suborbicular to obovate, sometimes deltate, entire or, rarely, retuse or emarginate, rounded to truncate, rather coarsely veined.

Stamens 6, erect or somewhat spreading, filaments slender distally but suddenly widening at the base, often spathulate, white to yellow or pale green; anthers oblong, obtuse, yellow.

Lateral glands each surrounding the base of a lateral stamen, circular to square, usually open both on the interior and exterior, producing from each side of each gland a lateral appendage curving around the base of the adjacent diagonal stamen; median gland a triangular to oblong lobe of tissue between the bases of the members of each pair of diagonal stamens; median glands and the tips of the lateral appendages touching, but not fused, when fully developed.

Pistil sessile, ampulliform to linear, terete or slightly compressed laterally, therefore angustisept, glabrous or pubescent with hairs mostly simple; ovules subbiseriate, ca. 8-22 per cell, oblong to ovate, pendulous on slender linear or narrowly triangular funicles; style linear or narrowly obconical; stigma depressed-capitate, as wide as or slightly wider than the style.

Fruit bilocular, bivalved, dehiscent, sessile, fusiform and usually curved, quadrangular or slightly latisept; valves very convex, generally keeled, with a prominent nerve and, when mature, a reticulum of secondary veins, brown, usually with magenta pigmentation on the midrib, pubescent with simple or sessile or shortly stipitate bifurcate or branched hairs, proximally tapering and subacute to rounded, usually slightly recurved, distally tapering and usually subacute; style linear and short, slender; stigma depressed-capitate, as wide as or slightly wider than the style.

Septum white, opaque, with nerve, slightly rugose; funicles linear to to narrowly triangular, pendulous.

Seeds generally subbiseriate, ca. 3-20 per cell, oblong, plump, not winged; testa reddish-brown, with darker pigmentation at the hilum, papillose, when moistened, mucose, the mucus exuded as discrete grey, elongate spirally coiled threads, one from each cell of the testa, the mucus thus appearing radiate; embryo exactly notorrhizal, the cotyledons slightly longer than the radicle.

Plant probably annual, herbaceous, several-stemmed, erect, pubescent, including the sepals, with sessile or shortly stipitate branched hairs; stems arising from a basal rosette of leaves, equal or with a leafless central stem and remotely leaved decumbent lateral stems.

Basal leaves rosulate, usually narrowly obovate, entire or dentate or pinnatisect, petiolate.

Cauline leaves scattered, obovate to linear, entire or dentate, on slender petioles or almost sessile on narrow cuneate bases.

Root a slender taproot.

Inflorescences ebracteate, terminal on stems, initially corymbose, but after anthesis elongating and racemose; buds just before anthesis more or less oblong; flowering pedicels slender, usually spreading, sometimes almost erect; fruiting pedicels slender, spreading, usually recurved and then ascendant or almost horizontal and straight.

One species in South Australia in the Flinders and Gawler Ranges and the Lake Torrens basin.

Scambopus curvipes (FvM.)Schulz

Excluded species: *Scambopus richardsii* (FvM.)Schulz, Pflrch. 86 (1924)260.

Erysimum richardsii FvM., Fragm. 10(1877)105 (basionym)

Sisymbrium richardsii (FvM.)FvM., Census 1(1882)5.

Blennodia richardsii (FvM.)FvM., ex Tate, Trans. Phil. Soc. Ad.(1879) 121 (nom. nud.)

Blennodia richardsii (FvM.)FvM. ex Black, Fl. S. Austral.(1924)247.

The holotype, collected at Eucla, Western Australia, bears no ripe fruit, but the appressed simple hairs and the very much angustisept ovary indicate that it is *Phlegmatospermum cochlearinum* (FvM.)Schulz. This was first pointed out by Black (1937) who added that the Helms collections from the Arkaringa Creek which were determined as *Sisymbrium richardsii* by Mueller and Tate are also *P. cochlearinum*.

Relationships: *Scambopus* stands in an interesting position, being apparently most closely related to *Harmsiodoxa*. However, *Scambopus* differs from *Harmsiodoxa* in having median glands and in usually having fruits which are quadrangular rather than terete or slightly latisept. Admittedly these are not great differences and a quadrangular fruit is not very far removed from a terete one; still comparatively minor differences must often be used in circumscribing genera in this family and *Scambopus* is quite distinct from *Harmsiodoxa*.

The quadrangular fruit is somewhat suggestive of that of Drabastrum, but there are really no other significant similarities between the two and it is not likely that they are closely related.

Mueller also recognized the similarities between Harmsiodoxa and Scambopus; in MEL is a plant collected by Mueller in November, 1851, probably near Crystal Brook, South Australia. It is labelled, in Mueller's hand, "Erysimum curvipes Ferd. Mull." but under this was written, also by Mueller, "Subgen: Varenia [(n.g.)] erysimoides"; this comment was later crossed out, presumably by Mueller himself. This is the same name for a subgenus of Erysimum which occurs on sheets of H. blennodioides and H. brevipes.

It is unfortunate that Mueller did not publish any of his ideas about relationships within these groups. The grouping of H. blennodioides, H. brevipes and S. curvipes under Varenia, and of Arabidella trisecta, A. filifolia and A. nasturtium under Arabidella, as is suggested in Mueller's annotations, would have presented a much more natural arrangement than does Mueller's published work.

SCAMBOPUS CURVIPES (FVM.)SCHULZ

(curvus = bent; pes = foot; the fruiting pedicels are recurved)

Schulz, Pflrch. 86(1924)259.

Erysimum curvipes FvM., Linnaea 25(1853)368 (basionym); FvM., Trans. Phil. Soc. Vict. 1(1855)100; FvM., Nat. Pl. Vict. 1(1879)34; Tate, TRSSA 3(1880)51; FvM., Census 1(1882)5; FvM., Key Vict. Pl. 2(1885) 7; FvM., Key Vict. Pl. 1(1887-1888)129; Tate, TRSSA 12(1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral.(1890)16,206.

Blennodia curvipes (FvM.)FvM., Rep. Babb. Exped. (1859)7; FvM., Pl. Col. Vict. 1(1860-1862)42; Benth.,Fl. Austral. 1(1863)75; Tate, TRSSA 22(1898)123; Black, TRSSA 45(1921)12; Ising, TRSSA 46(1922) 597; Black, Fl. S. Austral.(1924)247; Black, Fl. S. Austral. ed.2(1948)375.

Sisymbrium curvipes (FvM.)FvM., Fragm.7(1869)20.

Erysimum curvipes, Blennodia curvipes and Sisymbrium curvipes are nomenclatural synonyms of Scambopus curvipes, these names being based on a single type.

Figures: Figures 12, 13 A,B.

Original description: "Erysimum curvipes, herbaceum, humilius, adscendens, pube contexta canescens, foliis angusto-lanceolatis remote dentatis, pedicellis divaricatis curvato-adscendentibus siliquae aequilongis, nervo valvarum prominte, filamentis lineari-filiformibus, petalis luties. ... Herba digitum ad spithaman alta. Folia pollicaria. Petala lato-obovata 2-3"' longa brevissime unguiculata. Semina fusca, ovata, leniter compressa, fere lineam mentientia.

Anthesis: primovere"

Description: Plant herbaceous, pubescent; stems to ca. 30cm high, exceptionally to 50cm, terete or finely fluted, rigid.

Basal leaves usually less than 6-8cm long, exceptionally to 16cm, entire or with 1,2 or several rounded to acute teeth per side or pinnatifid with as many as 6 lobes per side, these opposite or alternate, usually subacute, often very small toward base of leaf, leaves rounded to subacute distally, tapering into a narrow petiole.

Cauline leaves usually less than ca. 3½cm long, entire or with a few small teeth per side, or ca. 3-5cm, exceptionally to 10cm, pinnatifid with usually three lobes or teeth per side, sessile or shortly petiolate.

Inflorescences usually ca. 10-20-flowered, dense, after anthesis elongating; flowering pedicels slender, usually spreading; buds more or less oblong.

Sepals usually oblong or deltate to ovate, usually green with a narrow hyaline margin; lateral sepals ca. 2.6-4.0mm long, ca. 1.0-2.0mm wide, average 3.3x1.4mm, ratio length to width 1.8:1-3.1:1, oblong to deltate, rounded to subacute, sometimes slightly saccate basally; median sepals ca. 2.9-4.0mm long, ca. 1.0-1.9mm wide, average 3.4x1.5mm, ratio length to width 1.8:1-3.2:1, more or less oblong or ovate, rounded to truncate, sometimes slightly cucullate, not basally saccate.

Petals to about twice as long as the sepals, ca. 3.4-6.6mm long, ca. 2.4-5.3mm wide, average 4.9x3.8mm, ratio length to width 1.1:1-1.5:1, usually suborbicular to ovate, clawed or with a very short claw less than 0.5mm in length.

Lateral stamens ca. [2.4-]3.1-4.0mm long, average 3.3mm, filaments ca. 0.1-0.2mm diameter distally, basally expanded to ca. 0.5-0.7mm, white, yellow or pale green; a nthers ca. 1.0-1.7mm, average 1.4mm, oblong, yellow; diagonal stamens ca. 2.6-4.1mm long, average 3.4mm, otherwise as lateral stamens; anthers ca. 1.0-1.8mm, average 1.4mm, as those of the lateral stamens.

Pistil ca. 2.0-4.0mm long, ampulliform to linear, terete or slightly ang gustisept, sessile, glabrous or pubescent; style linear or narrowly obconical; stigma depressed-capitate; nectaries as in generic description.

Fruiting pedicels ca. 1-2cm long, sometimes to 3cm, ca. 0.4-0.7mm in diameter, slender, usually recurved.

Fruit ca. 10-20mm, usually 10-15mm long, septum usually ca. 2mm wide, but to 3mm; valves convex or keeled, with a prominent nerve, pubescent, ha irs to ca. 0.5mm, usually shorter at proximal end of the valve; style ca. 0.5-1.3mm, linear and slender; stigma depressed-capitate.

Seeds ca. 1.1-1.5x0.9-1.1mm, subbiseriate, ca. 3-20 per cell, oval, plump, not winged; testa reddish-brown, at the hilum with darker pigmentation; embryo exactly notorrhizal, cotyledons slightly longer than the radicle.

Type locality: "Prope rivum Crystal Brook"

Holotype: Crystal Brook; Oct., 1851; F. Mueller - MEL 769

Isotype?: S. Australia, Crystal Brook; ?; ex Herb. Muell. - K

Other specimens seen: (see Map 10 - page 241)

South Australia: - 28 miles S. Parachilna; 26.8.1961; Shaw 31 - AD: Edlowie; 25.8.1883; Tate - AD: Arcoona, west of Lake Torrens; Sept. 1927; Murray 131 - AD: Bookaloo; Aug. 1939; E.C. Black - AD: Yudnapinna Stn., Lawrence's Flat. P102; July, 1939; Douglas - ADW: Yudnapinna Stn., Lawrence's Flat. P102; Sept. 1939; Douglas - ADW: Yudnapinna Stn., P162; 28.8.1952; J. W.B[anfield] - ADW: Yudnapinna Stn., Waite House; 5.7.1954; Hilton 502,514 - ADW: grown from Yudnapinna soil at W.A. R. I. ; July,1945; Burbidge - ADW: N.W. of Port Augusta; July, 1915; per Mrs. Smedley - AD: Lincoln Gap; ?; Cleland - AD: Lincoln Gap; 29.9.1942; Cleland - AD: between Iron Knob and Port Augusta; 30.9.1955; Caulfield 275 - AD: Corunna (Iron Knob);?; Cleland,W.L. - AD: Whyalla-Kimba; July,1955; Higginson - AD, UC, Z: Tarcoola; 22.9.1920; Ising coll.-AD: Tarcoola; 22.9.1920; Ising 1767 - MEL, NSW53574, BRI: N.H. austr. interior.; Nov.1851; Mueller - MEL: South Australia; ?; Mueller - AD: ?;?;? - NSW53573;

The following specimens are almost certainly Scambopus curvipes, but do not bear ripe fruit.

Lake Gilles;?; Burkitt - MEL: Barunga Range; 22.7.1884; Dixon - AD: Yudnapinna Stn., Horse Paddock; 6.6.1954; Banfield - ADW: Wilgena; June, 1912; J.W.M. - AD: Gladstone; 5.9.1912;? - AD:

Distribution: This species appears to occur only in South Australia, having been collected in the Flinders Ranges, the ranges south-west of Port Augusta, the Lake Torrens basin and at Tarcoola. As is true of several species in this group, the holotype and a few other collections are from Crysta l Brook in the southern part of the Flinders Ranges; this area has for many years been used for agricultural purposes and it is very doubtful that this species still occurs here.

Observations: The main variation is in size and foliage. The plants in Shaw 31 (AD) are only a few inches high and are bearing fruit; with these can be compared some of the Yudnapinna plants which are as much as 30cm high. These differences in size are only the consequence of more or less favourable conditions.

Although previous authors have generally described the leaves as being entire or remotely toothed, the basal leaves are often pinnatisect. This is especially noticeable on some of the Yudnapinna plants. It should be remarked that this species seems to lose its leaves easily for many of the collections are entirely leafless, being only bare stems and fruiting racemes.

Mueller described the corolla parts as being scarcely longer than the sepals and this was repeated by Schulz, but in all the plants examined the petals have been at least 1½ times to twice as long as the sepals. In fact the flowers are rather conspicuous because of the large expanse of blade beyond the calyx. It should also be noted that the seeds seem to be not more than 1½mm long although Schulz described them as being 2mm in length.

<u>Ecology and Biology</u>: Little is known of <u>S. curvipes</u> in these respects, but it probably occurs most commonly on light sandy soils. <u>Murray 131</u> (ADW) is annotated as occurring on "sandhills or bluebush flat" and on collections from Yudnapinna it is said to be very common in this area. The writer has seen this species in the field only once, between Hawker and Parachilna in the Flinders Ranges, and here it was growing on sandy soil in depressions by the roadside.

<u>Uses and Common Names</u>: Neither uses nor common names have been recorded.

<u>Relationships</u>: These are discussed under the genus <u>Scambopus</u>.

<u>DRABASTRUM</u> (FVM.)SCHULZ

(Draba = genus in this family)

Schulz, Pflrch.86(1924)257; Schulz, Pflfam.ed.2 17b(1936)636.

<u>Blennodia</u> sect. <u>Drabastrum</u> FvM., Trans. Phil. Soc. Vict. 1(1855)100.

<u>Original description</u>: Mueller (1855)- "Silique lanceolate, by its convex one-nerved valves almost tetragonal."

Schulz (1924) - "Sepala erecto-patentia, aequalia, oblongo-obovata, apice rotundata, basi non saccata. Petala alba, denique ad unguiculum violacea; lamina suborbiculata, subito in unguiculum tenuem paulo breviorem contracta. Stamina 6; filamentia linearia, tandem violacea; antherae brevissime oblongae, obtusatae. Glandulae nectariferae laterales annuliformes videntur, medianae mihi non visae. Pistillum anguste ampullaceum, sessile; ovarium 12-16- ovulatum; stylus tenuis, brevissimus; stigma depresso-capitatum, stylo latius. Fructus brevissimi, quadrangulari-ellipsoidei, utrinque acuti, leviter curvati, stylo gracili 0.75-1 mm longo coronati, 6-8 mm longi, 2,5 mm lati, valvis valde convexis nervo medio crasso instructis; septum album, fragile, opacum, laeve. Semina 3-8 in quoque loculo, inordinate biseriata, ovoidea, obscure brunnea, eleganter reticulata, nitidula, statu humido mucosa. - Planta humilis, perennans, pluricaulis. Caules pilis ramosis brevibus usque ad sepala (incl.) stellato-pubescentes, centralis aphyllus, laterales remote foliati. Folia plurima basalia, rosulata, simplicia, petiolata. Racemus nudus. Pedicelli fructiferi tenues.

Species unica in montibus Australia e austro-orientalis crescit."

<u>Drabastrum</u> <u>alpestre</u> (FvM.)Schulz

<u>Description</u>: <u>Calyx</u> open; sepals spreading or, less often, almost erect, basally not saccate, usually green, sometimes lavender, with a narrow hyaline margin, usually sparsely pubescent on the abaxial side; <u>lateral sepals</u> oblong to obovate, usually wider than the median, distally usually subacute; <u>median sepals</u> often oblong, sometimes obovate, distally rounded, sometimes slightly cucullate.

<u>Petals</u> about $1\frac{1}{2}$ to 3 times as long as the sepals, usually white, sometimes lavender, with distinction between blade and claw; blade oblong to broadly obovate or suborbicular, entire or sinuate, rounded or truncate, sometimes retuse or emarginate, coarsely veined, tapering suddenly into a slender linear claw.

<u>Stamens</u> 6, somewhat spreading, filaments linear or slightly dilated at the base, white, often becoming violet distally; anthers quadrate to shortly oblong, obtuse, yellow.

<u>Lateral glands</u> each surrounding the base of a lateral stamen, subquadrate, emarginate on interior, open on the exterior, with short lateral appendages, or, reduced to a small triangle of tissue on either side of each of the stamens; <u>median glands</u> lacking.

<u>Pistil</u> sessile, linear to fusiform or narrowly ampulliform, straight, terete, glabrous; <u>ovules</u> irregularly biseriate, pendulous on slender linear funicles, ca. 5-12 per cell; <u>stigma</u> small, depressed-capitate, usually slightly wider than the style.

<u>Fruit</u> bilocular, bivalved, dehiscent, sessile, ellipsoid to obovoid, usually slightly curved, terete or quadrangular; <u>valves</u> very convex, often almost keeled, with stout nerve and often a coarse reticulum of secondary veins, often reddish-purple, glabrous or, rarely, with a few

scattered branched hairs, proximally tapering and almost truncate, rarely, rounded, distally acute to rounded; style linear, slender, short; stigma depressed-capitate, as wide as or slightly wider than the style.

Septum white, opaque, sometimes fenestrate, nerved, proximally horizontally wrinkled; funicles linear, slender, slightly curved, pendulous.

Seeds irregularly biseriate, ca. 1-9 per cell, ovoid, plump, not winged; testa shiny, dark red-brown or brown, slightly darker at the hilum, conspicuously reticulate, when moistened, mucose, the mucus exuded as discrete hemispheres or short oblongs, often appearing nonpradiate; embryo exactly notorrhizal, radicle straight, longer or shorter than the broadly linear to suborbicular cotyledons.

Plant perennial with woody base, few- to many-stemmed, erect, usually low, densely pubescent to, and including, the sepals with sessile or shortly stipitate branched hairs; stems arising from a basal rosette of leaves, equal or, more commonly, with a leafless central stem and remotely leaved lateral stems.

Basal leaves rosulate, narrowly obovate to narrowly spathulate, finely dentate or, not uncommonly, pinnatifid, usually on petioles as long as, or to 2½ times the blade, very rarely almost sessile on cuneate bases.

Cauline leaves few, scattered, more or less obovate, entire or coarsely dentate, sessile on cuneate bases or very shortly petiolate.

Root stout and woody.

Inflorescences ebracteate, terminal on s tems, initially dense, but elongating after anthesis; buds just before a nthesis spherical to ovoid; flowering pedicels slender, usually somewhat spreading; fruiting pedicels rigid, spreading to horizontal or almost so, straight or slightly curved.

One species in alpine and subalpine parts of New South Wales and Victoria.

Drabastrum alpestre (FvM.)Schulz

Relationships: Drabastrum stands quite isolated from the other genera in this group; if it is at all closely related to any it must be to Harmsiodoxa, the absence of a median gland and the fusiform fruits suggesting the affinity with the latter genus. It differs very much from Blennodia and it is difficult to understand the fact that Mueller originally described D. alpestre as a species of Blennodia.

Although Mueller at one time included D. alpestre in Capsella and Bentham commented that it seemed to form a transition between Capsella and Blennodia (sensu Bentham), it differs from Capsella in not having a laterally compressed fruit. The valves are somewhat keeled but the width in the plane of the septum is not significantly less than that in the plane at right angles to that of the septum.

On some of Mueller's own collections of D. alpestre are annotations in his hand suggesting that it might be better placed in Moricandia or Diplotaxis. He chiefly based these suggestions on the fact that "the cotyledons are at times slightly bent inwards". The writer has seen no evidence of this in any of the collections, including Mueller's own, which have been examined. Furthermore the cotyledons of both Moricandia and Diplotaxis are not "slightly bent"; these genera belong to the tribe Brassiceae and the cotyledons are conduplicate, being sharply folded and enclosing the radicle. Drabastrum also differs from these two genera in many other respects, particularly in the nature of the fruit.

<u>DRABASTRUM ALPESTRE</u> (FVM.)SCHULZ

(alpestre = of the alps; this species occurs chiefly in the Australian Alps)

Schulz, Pflreh. 86(1924)257.

<u>Blennodia alpestris</u> FvM., Trans. Phil. Soc. Vict. 1(1855)100 (basionym); FvM., Pl. Col. Vict. 1(1860-1862)40; Benth., Fl. Austral. 1(1863)77.

<u>Capsella blennodina</u> FvM., Pl. Col. Vict. 1(1860-1862)42.

<u>Sisymbrium alpestre</u> (FvM.)FvM., Fragm. 7(1869)20.

<u>Erysimum capsellinum</u> FvM., Nat. Pl. Vict. 1(1879)35; FvM., Census 1(1882)5; FvM., Key Vict. Pl. 2(1885)7; FvM., Key Vict. Pl. 1(1887-1888)129; FvM., Sec. Census 1(1889)9.

<u>Erysimum blennodinum</u> (FvM.)Kuntze, Revis. gen. pl. 2(1891)933.

<u>Blennodia alpestris</u>, <u>Capsella blennodina</u>, <u>Sisymbrium alpestre</u>, <u>Erysimum capsellinum</u> and <u>Erysimum blennodiunum</u> are nomenclatural synonyms of <u>Drabastrum alpestre</u>, these names being based on a single type.

<u>Figures</u>: Schulz, Pflrch.86(1924)fig.15; Schulz, Pflfam. ed.2 17b (1936)fig.406; - Figure 14.

<u>Original description</u>: "Perennial, dwarf, stems erect, nearly naked, thinly pubescent, rarely branched; leaves lanceolate or ovate, toothed or nearly entire, gradually tapering into the petiole; flowers white, corymbose; style short; pedicels divaricate, of the length of the siliqua; vlaves distinctly one-nerved; seeds disposed in two rows, brown, minutely foveolate."

Description: Plant an undershrub, sometimes with a woody underground rhizomatous part bearing at least two aerial stem systems; stems to 30cm high but usually much less, exceptionally to ca. 40cm, erect, rigid, terete or finely fluted, reddish-brown or reddish-purple; root often with woody laterals.

Basal leaves ca. [1-]2-4 [-6]cm long, to ca. 1½cm wide, usually with 3-4 coarse teeth per side or a few small acute teeth, or pinnatifid or entire or sinuate, rounded to subacute, sparsely pubescent or subglabrous, petioles sometimes remotely toothed and short.

Cauline leaves ca. 0.3-0.8 [-1.5]cm long, to ca. 1cm wide, often with 1, less often with 2, broadly acute teeth per side, sometimes entire, usually subacute, subglabrous, sessile or shortly petiolate.

Inflorescences to ca. 30-flowered, dense, after anthesis elongating and often very loose; flowering pedicels usually terete; fruiting racemes to 12cm long, usually much less; fruiting pedicels to ca. 1½cm.

Sepals usually oblong to ovate, usually green, sometimes lavender, with a narrow hyaline margin; lateral sepals ca. 2.1-3.4mm long, ca. 1.0-1.9 mm wide, average 2.9x1.5mm, ratio length to width 1.8:1-2.1:1, often broadly obovate or oblong, usually subacute, not saccate; median sepals ca. 2.3-3.5mm long, ca. 0.8-1.5mm wide, average 2.9x1.2mm, ratio length to width 2.1:1-2.0:1, oblong to obovate, rounded and sometimes cucullate, not saccate.

Petals to about twice as long as the sepals, ca. 4.0-6.3mm long, average 5.3mm, clawed; blades ca. 2.5-4.5mm long, ca. 2.0-3.7mm wide, average 3.4x2.9mm, ratio length to width 1.0:1-1.4:1, oblong to suborbicular, sometimes almost obcordate, rounded or truncate, tapering into a slender linear claw, the blade averaging 65 per cent of the total petal length; petals white or lavender, often only the claw and the lower part of the blade lavender, the veins usually purple.

Lateral stamens ca. 2.0-2.8mm, average 2.3mm, filaments to 0.5mm wide, linear or slightly expanded basally, white or lavender; anthers ca. 0.6-1.0mm, average 0.8mm, quadrate to oblong, yellow; diagonal stamens ca. 2.5-4.0mm, average 3.1mm, otherwise as lateral stamens; anthers ca. 0.5-1.0mm, average 0.7mm, as those of lateral stamens.

Pistil ca. 2.3-3.2mm long, linear to fusiform or ampulliform, straight, terete, glabrous; style linear, slender; stigma depressed-capitate; nectaries as generic description.

Fruiting pedicels ca. 4-8[-14]mm long, average 0.4-0.5mm diameter, spreading to horizontal, densely pubescent.

Fruit ca. 4-8[-11]mm long, ca. 1.2-2.0mm wide across the septum; epidermal cells of the septum more or less rectangular with straight or sinuate walls, becoming irregular in shape toward the edges; style ca. [0.4-]0.7-0.8[-1.1]x0.1-0.3mm; stigma depressed-capitate.

Seeds ca. 0.8-1.2mm long, ca. 0.6-0.8mm wide, irregularly biseriate, usually 5-6 per cell, these mostly in the distal end of the fruit, ovoid, plump, not winged; mucus exuded to ca. ½mm; embryo exactly notorrhizal, cotyledons longer or shorter than the radicle.

Type locality: "In subalpine grassy places on the sources of the Murray and Snowy River."

Holotype: Sources of the Murray and Snowy River; 4-5000'; Feb. 1854 [fide Willis]; Mueller - MEL 776!

Isotypes: K!, BM!, MEL 777 (?)!

Other specimens seen: (see Map 10 - page 241)

New South Wales: - Cooma to Nimitybelle; Dec.1896; Maiden - NSW53577: Cooma; 2.11.1908; Cambage 2104 - NSW53578: Cooma; Sept.1913; Boorman - NSW53576, BM, MEL: Murrumbidgee River Crossing, 5 miles N.W. of Cooma; 21.10.1948; Willis - MEL: Kiandra distr.; Feb.1897; Betche - NSW53575: Happy Jack's Plain, headwaters of the Happy Jack River ca. 15 miles S. of Kiandra; 18.1.1958; Thompson - NSW53580: Murray River, N.S.Wales;?; ? - MEL: Oldbury on Trap Mountain, upwards of 300 ft. altitude; ?; Atkinson - MEL: near Bathurst; ?;? - MEL:

Victoria: Suggan Buggan; Oct.1939; Hunter - MEL: Hinnomunjie, near Omeo (junction of Livingstone Ck. & Mitta Mitta River); 27.9.1882; Stirling - MEL: Mitta Mitta; ?;? - K:

Distribution: This species occurs in the mountains south-west of Sydney and extends southward into Victoria. Most of the collections in New South Wales are from the area south of the Australian Capital Territory, but *D. alpestre* has been collected as far north as Bathurst, N.S.W.

Observations: Most of the availalbe plants are less than 15cm high, although the Suggan Buggan River plant, which is an almost leafless stem bearing an infructescence, is 40cm long. Apart from this there is no noteworthy variation in this species.

The most distinctive organs are the petals and the seeds. The petals are usually white with the veins purple, although sometimes the claw and the lower part of the blade, or the entire petal. may be coloured. The seeds are plump and a deep reddish-brown in colour; the testa is coarsely reticulate and the mucus is exuded as discrete bodies, one from each intrareticular area. The reticulate outer layer of the testa is easily removed, exposing the finely reticulate inner layer. Within these is a thin whitish layer of endosperm.

Uses and Common Names: Neither uses nor common names have been recorded.

Relationships: These are discussed under *Drabastrum* (FvM.)Schulz.

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Map 9 - Geococcus pusillus Drumm. ex Harv.

Map 10 - ● = Scambopus curvipes (FvM.)Schulz
× = Pachymitus cardaminoides (FvM.)Schulz
▲ = Drabastrum alpestre (FvM.)Schulz

10

<u>PACHYMITUS</u> SCHULZ

(παχύς= thick; μίτος= thread; the fruiting pedicels of <u>P.</u> <u>cardaminoides</u> are stout)

Schulz, Pflrch.86(1924)266; Schulz, Pflfam.ed.2 17b(1936)639.

<u>Original description:</u> Sepala erecto-patentia, subaequalia, oblong, obtusa, basi non saccata. Petala alba, anguste obovato-cuneata, apice rotundata. Stamina 6, erecta; filamenta filiformia; antherae subquadratae. Glandulae nectariferae minutae, laterales semicirculares et intus apertae videntur, medianae tenuiter torosae? Pistillum cylindricum, sessile; ovarium 24-36-ovulatum; stylus brevissimus; stigma depresso-capitatum. Siliquae brevisusculae, lineares, obtusiusculae, biloculares, septiferae, bivalves, dehiscentes, valvis utrinque obtusis uninervibus; placentae tenues; septum tenerrimum, album, crispum, interdum fenestratum. Semina irregulariter biseriata, oblongo-ellipsoidea, brunnea, humida mucosa (sec. F.v.Mueller), notorrhiza, funiculis filiformibus pendula. — Plantae annuae, pilis ramosis plerisque bifurcis rarius simplicibus usque ad sepala (incl.) obsessae, a basi ramosae. Caulis centralis fere scaposus, laterales adscendentes. Folia petiolata, runcinato-pinnatipartita. Racemus nudus. Pedicelli fructiferi valde incrassati.

Species 2 in arenosis humidis et ericetis Australiae obviae."

<u>Pachymitus</u> <u>cardaminoides</u> (FvM.)Schulz

<u>Pachymitus</u> <u>lucae</u> (FvM.)Schulz

<u>Description:</u> <u>Calyx</u> open; sepals spreading or, less often, almost erect, usually green with a narrow hyaline margin and on the abaxial side sparsely pubescent with shortly stipitate branched hairs; <u>lateral</u>

sepals usually more or less oblong, sometimes obovate or ovate, usually broader than the median, sometimes slightly saccate basally, distally rounded to subacute; median sepals usually oblong or narrowly obovate, proximally slightly tapering, not saccate, distally rounded or, less often, subacute, often slightly cucullate.

Petals to twice as long as the sepals, probably always white, usually cuneate to narrowly obovate and without distinction into blade and claw, entire or sinuate, apically rounded or truncate, then often slightly retuse or emarginate, coarsely veined; sometimes clawed, then the blade oblong, often broadly so, or obovate to suborbicular, tapering gradually into a rather slender claw, the same length as the blade or slightly longer.

Stamens 6, erect or somewhat spreading, filaments more or less linear or slightly dilated basally, white or pale green, the diagonal filaments often suddenly contracted and slightly curved distally; anthers oblong or almost quadrate, obtuse, yellow.

Lateral glands each surrounding the base of a lateral stamen, usually quardangular and open on the interior and the exterior, often the sides suppressed, the gland then appearing as four lobes of tissue, producing from each side of each gland a lateral appendage curving around the base of the adjacent diagonal stamen; median glands, if present, oblong or triangular pieces of tissue between the bases of the members of each pair of diagonal stamens.

Pistil sessile, linear, more or less terete, glabrous; ovules subbiseriate to biseriate, oblong to elliptic, pendulous on short linear funicles, ca. 10-20 per cell; style usually obconical, sometimes linear; stigma fleshy, depressed-capitate, usually slightly wider than the style.

Fruit bilocular, bivalved, dehiscent, sessile or on a very short stipe, linear, straight or slightly curved, terete or quadrangular; valves convex to keeled, with a prominent vein and a less distinct reticulum of veins more or less parallel to the longitudinal axis, often somewhat constricted between the seeds, shiny, often, when ripe, reddish-purple, subglabrous or generally pubescent with simple or sessile or very shortly stipitate bifurcate hairs, the hairs usually denser distally; valves proximally tapered and usually rounded, rarely truncate, but not uncommonly subacute, almost always flared or reflexed, distally tapering slightly and rounded to truncate, sometimes retuse or emarginate; style linear or slightly tapering distally or obconical; stigma small, depressed-capitate, as wide as or slightly wider than the style.

Septum white, opaque, vein more or less distinct, slightly rugulose; funicles linear, short, straight or slightly curved, pendulous.

Seeds uniseriate to subbiseriate, ca. 10-20 per cell, oblong to ovoid, plump; testa dull orange-brown, finely papillose, when moistened, mucose, the mucus exuded as discrete oblongs, each with a conical central core, thus having a finely radiate appearance.

Plant probably annual, herbaceous, few- to many-stemmed, erect, pubescent, including the sepals, with simple or shortly stipitate tau-shaped or branched hairs; stems arising from a basal rosette of leaves, equal, or a leafless central stem with leafy lateral stems.

Basal leaves rosulate, lobed or pinnatifid, often deeply dissected, or remotely dentate, petiolate.

Cauline leaves scattered, ovate to elliptic, entire or coarsely dentate, sometimes deeply dissected, shortly petiolate or sessile on cuneate bases.

Root a slender taproot.

Inflorescences ebracteate, terminal on the stems, initially rather dense and therefore corymbose, but after anthesis elongating and racemose, sometimes quite lax; sometimes stems much reduced so inflorescence appears basal; *buds* immediately before anthesis spherical to oblong; *flowering pedicels* slender, more or less erect; *fruiting pedicels* rigid, gradually expanded distally, usually spreading to horizontal, rarely almost erect.

On species in the Murray lands of South Australia and the adjacent parts of Victoria.

Pachymitus cardaminoides (FvM.)Schulz

Treated as a synonym of *P. cardaminoides* is *P. lucae* (FvM.)Schulz.

Relationships: *Pachymitus* has several features in common with the other genera of the "Blennodia group", but is nevertheless quite distinct from them. It differs from *Harmsiodoxa* in having median glands, in having fruit which are linear rather than fusiform, and in the sort of mucus exuded by the testa. From *Scambopus* it differs most in the shape of the fruit and in the type of mucus. From the other genera of this group it is also set apart by characters of this sort.

PACHYMITUS CARDAMINOIDES (FvM.)SCHULZ

(cardaminoides = like Cardamine L., a genus in this family)

Schulz, Pflrch. 86(1924)266.

Sisymbrium cardaminoides FvM., Trans. Phil. Soc. Vict. 1(1855)34 (basionym); FvM., Hook. J. Bot. Kew Misc.8(1856)4; FvM., Pl. Col. Vict. 1(1860-1862)40; FvM., Fragm. 11(1878)27; FvM., Nat. Pl. Vict. 1(1879)32; Tate, TRSSA 3(1880)51; FvM., Census 1(1882)5; FvM., Key Vict. Pl.2(1885)7; Key Vict. Pl. 1(1887-1888)131; Tate, TRSSA 12 (1889)71; FvM., Sec. Census 1(1889)9; Tate, Fl. S. Austral.(1890) 17,206; Tate, TRSSA 22(1898)123.

Blennodia cardaminoides Benth., Fl. Austral. 1(1863)75; Tate, TRSSA 22(1898)123,124,239; Black, TRSSA 41(1917)638; Black, Fl. S. Austral.(1924)247; Black, Fl. S. Austral. ed.2(1948)376.

Erysimum cardaminoides (FvM.)FvM., Fragm. 11(1879)59 in obs.

Erysimum lucae FvM., Fragm. 11(1879)59.

Sisymbrium lucae (FvM.)FvM., Census 1(1882)5; FvM., Key Vict. Pl. 1(1887-1888)131.

Pachymitus lucae (FvM.)Schulz, Pflrch.86(1924)267.

Sisymbrium cardaminoides FvM., Erysimum cardaminoides (FvM.)FvM., and Blennodia cardaminoides Benth. are nomenclatural synonyms of Pachymitus cardaminoides (FvM.)Schulz, these names being based on a single type; Sisymbrium lucae (FvM.)FvM. and Pachymitus lucae (FvM.)Schulz are taxonomic synonyms of the preceeding names, being based on the type of Erysimum lucae which is discussed below.

Figures: Figure 15

Original descriptions:

Sisymbrium cardaminoides FvM. (1855): "Sisymbrium cardaminoides. (Sect. Arabidopsis). Annual, diffuse, somewhat hairy; leaves lanceolate, entire or on both sides with one or two teeth; pedicels expanded, hardly half as long as the silique; nerve of the valves thin; petals white; filaments linear-subulate; style short; stigma indistinctly bilobed.
On sandridges near the entrance of the Murra y River."

Blennodia cardaminoides Benth. (1863): "A slender or small annual like B. nasturtioides, but more or less clothed with a minute stellate pubescence, sometimes scarsely visible without a lens. Leaves pinnatifid, the radical ones with rather numerous small, ovate triangular or lanceolate lobes, the terminal ones confluent, the lower ones becoming distinct segments along the petiole; stem leaves few and small, with few short lobes. Flowers white (or pink?), the sepals barely one line long. Petals obovate, twice as long. Fruiting raceme loose and slender, 2 to 4 inches long, with slender spreading pedicels. Pod 4 to 6 lines long, scarcely 1 line broad, usually curved, narrowed toward the base, glabrous orwith a very minute stellate tomentum; valves very convex and keeled. Seeds small, ovate, emitting mucus when soaked.
N.S.Wales. Darling River, Victorian Expedition.
Victoria. Sand-ridges and heaths on the Glenelg, F. Mueller, Robertson.
S. Australia. Near Wellington, and other places near the mouth of the Murray, F. Mueller."

Erysimum lucae FvM.(1879): "Pilis brevibus ra mosis vel bisectis laxe parceque pubescens, foliis caulinis inciso-dentatis vel inferne pinnatifidis, dentibus lobisque acutis, pedicellis sub anthesi calyci fere aequilongis, sepalis paene aequalibus, petalis sursum albis vel purpurascentibus calycem dimidio vel triente superantibus, siliquis pedicello crassiusculo bis terve longioribus lineari-teretibus stylo brevissime terminatis, valvis prominule uninerviis, seminibus irregulariter biseriatis.

Ad junctionem fluviorum Murray- et Darling-River; Dr. T.P.Lucas.

Planta ad sesquipedem alta nisi procerior, adscendens. Folia ima sicut radix ignota; folia caulina superiora ½-1" longa, petiolo breviore praedita. Sepala circiter sesquilinearis, oblongo-ovalia, diu erecta, denique patentia, margine anguste albo-membranea. Petala sursum obovata, deorsum valde angustata et hinc flavido-viridula. Stamina 6, libera, quorum longiora corollam fere aequantia; filamentia omnia edentula; antherae ovatae, basi cordatae. Stigma fere sessile, depressum, lenissime lobatum. Siliquae pollicares vel paulo longiores, circiter lineam crassae, in pedicello patulo erectiusculae vel leniter patentes. Septum membraneum, enerve. Funiculi brevissimi, subulato-setacei. Semina vix matura fulva, fere ovata, 1/3-1/2"' longa, nitida. Cotyledones incumbentes.

Congenerum haec species proxima E. cardaminoides ... quocum tam in Sisymbrium quam in Erysimum poni possit; specifice discedere videtur habitu robustiore, pedicellis crassioribus, stigmate majore, siliquis evidenter longioribus."

Description: Plant herbaceous, pubescent; stems usually less than 30cm, but in favourable conditions may be much taller, terete or finely fluted, usually pubescent, but occasionally subglabrous, then usually more densely pubescent on the adaxial side of the fruiting pedicels, usually reddish-purple.

Basal leaves exceptionally to 20cm, but usually less than 12cm, to 3cm in width, usually less than 2cm, pinnately lobed, lobes usually opposite, linear to deltate, usually acute, sometimes rounded, horizontal or runcinate, often with a small acute tooth in the distal sinus; terminal lobe deltate or suborbicular or elliptic, sometimes with one coarse subacute tooth per side, sometimes mucronate; leaves tapering into a long slender petiole.

Cauline leaves to ca. 5cm long and ca. 3cm wide, entire or remotely dentate with small, more or less deltate, acute teeth or deeply pinnatisect with 1-3 linear to narrowly deltate, acute to subacute lobes per side, the terminal lobe acute to rounded.

Inflorescences to ca. 40-flowered, usually ca. 25- 30- flowered, usually dense; flowering pedicels ca. 0.2mm diameter, slender, not much expanded, more or less erect; buds spherical to oblong.

Sepals oblong or ovate or obovate, usually green with a narrow hyaline margin; lateral sepals ca. 2.1-3.0mm long, ca. 0.8-1.3mm wide, average 2.6x1.1mm, ratio length to width 2.1:1-3.0:1, usually oblong, rounded to subacute, sometimes slightly saccate basally; median sepals ca. 2.3-3.3 mm long, ca. 0.8-1.1mm wide, average 2.7x1.0mm, ratio length to width 2.5:1-3.3:1, oblong or narrowly obovate, rounded or subacute, often slightly cucullate, not basally saccate.

Petals about twice as long as the sepals, ca. 3.5-5.6mm long, ca. 1.1-2.7mm wide, average 4.9-1.8mm, ratio length to width 2.0:1-3.7:1, cuneate to obovate; if clawed, ratio length to width of blade 1.0:1-1.2:1, blade averaging 53 per cent of the total petal length.

Lateral stamens ca. 2.5-4.1mm, average 3.4mm, filaments linear or slightly expanded basally, white or pale green; anthers ca. 0.5-0.9mm, average

0.7mm, oblong to quadrate, ob tuse, yellow; diagonal stamens ca. 2.0-3.2mm, average 2.6mm, filaments sometimes suddenly contracted distally, otherwise as those of the lateral stamens; anthers ca. 0.5-0.9mm, average 0.7mm, otherwise as those of the lateral stamens.

Pistil ca. 3.5-5.5mm, linear, straight, terete, glabrous; style linear to obconical; stigma fleshy, depressed-capitate.

Fruiting pedicels ca. 4.5-16mm, exceptionally to 40mm (reduced basal raceme), diameter at proximal end ca. 0.3-0.7mm, at the distal 0.4-1.4mm, usually about twice to three times as wide at distal as at proximal end, usually spreading at an angle greater than 45 degrees, rarely at ca. 15 degrees, usually straight, sometimes slightlu curved, occasionally somewhat reflexed and then ascendant.

Fruit ca. 8-19mm long, ca. 0.7-1.6mm across the septum; valves convex to keeled, with a prominent vein, proximally flared, pubescent with hairs to ca. 0.2mm long; style to ca. 1.2mm, sometimes very short, then ca. 0.3-0.4mm; stigma depressed-capitate.

Seeds ca. 0.8-1.0x0.5-0.6mm, uniseriate to biseriate, ca. 10-20 per cell, oblong to ovoid, plump; mucus appearing finely radiate; embryo exactly notorrhizal, radicle slightly longer than the cotyledons.

Type locality: "On sandridges near the entrance of the Murray River"

Lectotype: In campis arenosis inter Straitalbin [Strathalbyn] et Wellington; 5.10.1848; Mueller - MEL 762!

Other specimens seen: (see Map 10 - page 241)

South Australia: - between Flinders Range and Lake Torrens;?; Richards - MEL: Berri, R. Murray; 2.10.1915; Andrew - AD: Noora; 5.10.1915; Andrew - MEL: Loveday; 20.7.1942; Gauba - W: Murray River-Murray Desert;?;

Mueller(?) - MEL 763: Murray Scrub; 7.9.1883; Tate - AD: River Murray; 22.8.1881; Tate - AD: River Murray;?; Tate - AD: Morgan, River Murray; 8.9.1883; Tate - AD: Karoonda; 18.8.1924; Cleland - AD: Kinchina; 1.8. 1925; Cleland - AD: cliffs, W. of Morphett Vale; 9.7.1882; Tepper - MEL: Pt. Pomonda, Lake Alexandrina; 3.10.1880; Tate - AD: Ardrossan;?; Tepper - AD: Monalena; July,1909: Deane - NSW53585:

New South Wales: - Condobolin-Euabalong Road; Aug.1897; Maiden - NSW53584: Lake Cargelligo; Sept.1918; Boorman - NSW53582: Griffith; 17.9.1938; Cross - NSW53592: Barmedman; Aug.1915; Dwyer - NSW53589: Brookong-Wagga Wagga; 1873; Crouch - MEL: Murrumbidgee;?; Day - MEL: Wangenella near Edwards River; 1885; Kuentz - MEL: Zara, via Hay; Aug.1903; Officer - MEL: Wakool; Spring,1941; Smith - ADW: Lower Lachlan River; Sept.1878; Mueller - MEL: Lachlan River; Sept.1878; Mueller - MEL: Lachlan River; ?;? - B: Wentworth;?; Forde - MEL: junction of the Darling and Murray River; July,1887; Holding - MEL: Darling and Murray River junction; 1880; Warburton - NSW53591: clayflats on the Darling;[1860-1861]; Beckler - MEL 764:

Victoria: - Borung;?; Reader - MEL: Borung; 13.9.1903; Reader - MEL: Borung; 16.9.1903; Reader - MEL: Mildura;1889; Wilson (J. B.) - MEL: Mildura; 4.9.1912; Williamson - MEL: junction of the Darling and Murray Rivers; Oct.1887; Minchin - MEL: 3 miles N. of 65 miles post on Sturt Highway, along track to Berribee Tank; 2.9.1948; Willis - MEL: about 10 miles S. of 65 mile post on Sturt Highway; 3.9. 1948; Willis - MEL: Underbool; Sept.-Oct.1915; Malone - NSW53586: Wyperfield;Oct.1960; Maroske 24 - MEL: Lake Hindmarsh;?;St. Eloy D'Alton 45 - MEL: Jeparit; 20.9.1898; Willaimson 584 - MEL: Wimmera River; Oct.1899; Walter -

NSW53582: Yarrambiack Creek; Oct.1886; Walter - MEL: Shire of Dimboola; 1.7.1886; Reader - MEL: Shire of Dimboola; 4.9.1892; Reader - MEL: Shire of Dimboola; 16.9.1898; Reader - MEL: near Dimboola;?;? - MEL: near the Rifle Range, Dimboola; 20.9.1948; Willis - MEL: Dimboola & Nhill; 12.11.1899; St. Eloy D'Alton 5 - MEL: Nhill;?; St. Eloy D'Alton 5 - MEL: Nhill;?; St. Eloy D'Alton 58 - MEL: Katyil West; 12.8.1900; Reader - MEL: near Casterton; Nov.1904; Waters - MEL: Casterton;?; Waters - MEL: Glenelg River;?; Robertson - MEL 765, K: entrance of the Glenelg River; 1891; Eckert 118 - MEL: Maryvale; 1898; Macpherson - MEL: Mallee, Vict.;Oct.1898; French - MEL: Wimmera; Sept.1884; Mueller - MEL: Wimmera; Sept.1892; Eckert 21 - MEL: ?; 25.9.1892; Reader - MEL:

Distribution: This species is known from Victoria, New South Wales and South Australia. In Victoria the collections cover the western part of the state from the far north-western corner to the lower Glenelg River in the south-west. In New South Wales it seems restricted to the south-western part of the state.

In South Australia P. cardaminoides appears to be most common along the Murray River, although there are collections from Ardrossan on the Yorke Peninsula, Mt. Remarkable, and Monalena. The last locality should, perhaps, be queried as the next most westerly collection is from Ardrossan.

Observations: There is little variation in this species. The genus owes its name to the stout fruiting pedicels which are often of a greater diameter at the distal end than at the proximal end. However, this is not constant and there are many plants with pedicels which are quite linear.

The pubescence presents not distinctive features, being made up of short branched hairs. The fruit valves are almost glabrous with a few hairs at the distal end. These hairs may be simple, or sessile or very shortly stipitate bifurcate hairs to about ½mm long. The leaves bear sessile or shortly stipitate bifurcate to stellate hairs.

The cauline hairs are almost sessile and branched with the arms appressed to the stem, or stipitate and tau-shaped or bi- or trifurcate, or even more complexly branched. These stem hairs may be as much as ¾mm long, but are usually less. Occasionally, eve n though the hairs on the stems are branched, there may be long simple hairs on the adaxial side of the fruiting pedicels and the secondary stems.

It has often been suggested that Geococcus pusillus Drumm. ex Harv. is a form of this species. The writer feels that this is not so; even when P. cardaminoides is stunted it does not approach the habit of G. G. pusillus which is essentially stemless. Also G. pusillus always has much smaller flowers, a differently shaped ovary (conical as opposed to linear for P. cardaminoides) and a smaller fruit. The fruit of G. pusillus is often somewhat misshapen as a result of its being forced into the earth, but even when one finds a plant with fruit which have not been buried, they a re not of the size and shape of those of P. cardaminoides.

Ecology and Biology: P. cardaminoides is an ephemeral and appears after winter rains. The most usual months for flowering are August through October.

It probably occurs most commonly on light sandy soils; among annotations with collections of this species are "sandridges" (Reader s.n.;

16.9.1903 - MEL), "open grassy sandhills" (*Willis s.n.*; 3.9.1948 - MEL), and "heaths on the Glenelg River" (*Robertson s.n.* - MEL 765, K).

Uses and Common Names: Neither uses nor common names have been recorded.

Relationships: These are discussed under *Pachymitus* Schulz.

Note: Although *Sisymbrium cardaminoides* was published by Mueller in 1855, Bentham (1863) cited "B. cardaminoides, F. Muell. Herb. (as a Sisymbrium)". The form of this citation suggests that Bentham may not have known of the valid publication of *S. cardaminoides*. Therefore one cannot necessarily interpret Bentham's species as being based on the type of *S. cardaminoides*.

To avoid confusion it seems advisable to choose the holotype of *S. cardaminoides* as lectotype of *B. cardaminoides*, making the two names nomenclatural synonyms. This is possible if Bentham saw the type of *S. cardaminoides* FvM.; this appears probable from Bentham's citation of specimens.

The type locality of *S. cardaminoides* is given as "On sandridges near the entrance of the Murray River". The only collection made by Mueller which agrees with this locality and is dated before the publication of *S. cardaminoides* is MEL 762. It was collected by Mueller on October 5, 1848, and the locality is given as " In campis arenosis inter Straitalbin [Strathalbyn] et Wellington"; this is only a few miles from where the Murray River enters the sea.

This collection was seen by Bentham for it bears his mark on the label and is probably the one referred to by him as coming from South

Australia. Therefore this collection which is the holotype of _S. cardaminoides_ is choosen as the lectotype of _B. cardaminoides_ Benth., the two names thus becoming nomenclatural synonyms.

In 1924 Schulz published _P. cardaminoides_ var. _dasycarpus_, distinguished from the typical variety, said to have glabrous fruit, by having the fruit sparsely pubescent. It does not seem justified to maintain this variety for on no plant seen by the writer have all the fruits been either glabrous or pubescent.

However there seems to exist no collection annotated by Schulz as being the variety var. _dasycarpus_. Until such a collection is found it is necessary to maintain the name, although it has been used by no one after Schulz.

The name _Erysimum lucae_ was published in 1879 by Mueller who based it on a collection made by Lucas near the junction of the Murray and Darling Rivers. The type collection made in September, 1878, by T.P. Lucas and labelled as being from Balranald (MEL 770) is a rather robust specimen of _P. cardaminoides_. In K is a collection made by Lucas at Balranald which is probably an isotype.

GEOCOCCUS DRUMM. EX HARV.

(γῆ = earth, κόκκος = fruit; the fruits are buried in the ground)

Drummond ex Harvey, Hook. J. Bot. Kew Misc. 7(1855)52; Walp., Ann. 4(1857)208; Benth. & Hook., Gen. Pl. 1(1862)83; Benth., Fl. Austral. 1(1863)79; Prantl, Pflfam. 3(2)(1890)205; Tate, Fl. S. Austra l.(1890) 47,206; Hayek, Beih. Bot. Centralbl. 27(1911)324; Black, Fl. S. Austral.(1924)248; Schulz, Pflrch.86(1924)258; Schulz, Pflfam. ed.2 17b (1936)637; Black, Fl. S. Austral. ed.2(1948)376.

Original description: "Calyx tetraphyllus, foliolis patentibus. Petala 4, oblonga, exunguiculata, calyce breviora. Stamina 6, tetradynama, filamentis applanatis. Ovarium biloculare, ovatum, pauci-ovulatum. Stigma sessile. Silicula oblonga, subcompressa, se pto latiusculo, bivalvis, valvibus membranaceis rugulosis venosis. Semina in loculis 3-4, ovalis, convexa. Cotyledones plano-convexae, lineares, incumbentes. — Herbula minima, annua, subacaulis; foliis e collo radiantibus pinnatifidis, laciniis oppositis tria ngularibus; floribus axillaribus solitariis minimis sub anthesi sessilibus demum longe pedunculatis, pedunculo fructifero deflexo in humum siliculam celante.

Geococcus pusillus, J. Drum."

Description: Calyx open; sepals usually spreading, sometimes almost erect, usually pa le green with a narrow hyaline margin, sparsely pubescent on the abaxial side with sessile to shortly stipitate irregularly branched hairs; lateral sepals ovate to deltate, usually slightly wider than the median sepals, not saccate basally, distally acute to subacute; median sepals oblong to obovate, not saccate basally, distally subacute to rounded.

Petals often about the same length as the sepals, but sometimes slightly longer or shorter, white or cream-coloured, clawless or the blade tapering gradually into a more or less linear claw, obovate to ovate, subacute to rounded, rather coarsely veined.

Stamens 6, erect or slightly spreading, filaments more or less clavate, usually expanded proximally, white or pale green; anthers oblong to square, rounded to truncate, yellow.

Lateral glands indistinct, appearing as oblong or semicircular pieces of tissue, each subtended by a petal; median glands apparently obsolete.

Pistil sessile, more or less conical, terete or slightly compressed dorso-ventrally, glabrous or very sparsely pubescent with very shortly stipitate irregularly branched hairs; ovules subbiseriate to biseriate, ca. 4-20 per cell, oblong, pendulous on slender linear funicles; style very short and obconical or obsolete; stigma small, depressed-capitate, as wide as the style if present.

Fruit bilocular, bivalved, dehiscent, sessile, usually linear, sometimes nearly square in outline, almost always latisept, rarely terete, brown, glavrous or pubescent with sessile or shortly stipitate bifurcate to irregularly branched hairs; valves usually almost flat, rarely convex, usually with a distinct nerve and, when mature, a reticulum of secondary veins, proximally rounded to truncate, reflexed or flared so that de from the dorso-ventral aspect the fruit is sagittate, distally rounded to subacute; style short and linear or obconical or obsolete; stigma depressed-capitate, as wide as the style.

Septum pale-yellow or cream-coloured, opaque, with nerve, smooth, coriaceous; funicles linear to narrowly triangular.

Seeds subbiseriate to biseriate, ca. 2-12 per cell, oblong to obovate, plump, not winged; testa light orange-brown with darker pigmentation at the hilum, papillose, when moistened slightly mucose, the mucus exuded as very small oblong to hemispherical bodies, one from each papilla; embryo notorrhizal, the cotyledons usually shorter than the radicle and shortly stipitate.

Plant annual, herbaceous, short-stemmed, prostrate, pubescent, including the sepals, with sessile or shortly stipitate branched ha irs; main stem almost always much reduced so terminal inflorescence appears basal; lateral stems usually very short and often much thickened, prostrate, bearing very crowded leaves.

Basal leaves rosulate, erect or spreading, more or less linear, pinnatisect, petiolate.

Cauline leaves crowded on stems, otherwise as the basal leaves.

Root a slender taproot.

Inflorescences ebracteate, terminal on stems, initially dense and elongating only slightly after anthesis; buds just before anthesis obovoid to spherical; flowering pedicels slender, spreading or descendent; fruiting pedicels usually stout, almost always descendent and burying fruit in gr ground, sometimes horizontal and spreading.

One species in semi-arid parts of Western Australia, South Australia, New South Wales and Victoria.

Geococcus pusillus Drumm. ex Harv.

Treated as a taxonomic synonym of G. pusillus is G. fiedleri Scheuermann, Feddes Rep. 47(1939)262.

<u>Relationships</u>: <u>Geococcus</u> appears to be closely related to no other Australian genus. If it is related to any, it is to <u>Pachymitus</u> which it resembles somewhat in nature of the fruit.

GEOCOCCUS PUSILLUS DRUMM. EX HARV.

(pusillus = very small; the plant is a small prostrate annual)

Drumm. ex Harv., Hook. J. Bot, Kew Misc. 7(1855)52; FvM., Pl. Col. Vict. 1(1860-1862)223; Benthm. Fl. Austral. 1(1863)80; FvM., Fragm. 7(1869)19; Fragm. 10(1876)53; Fragm. 11(1878)6; FvM., Nat. Pl. Vict. 1(1879)36; Tate, TRSSA 3(1880)51,90; Tepper, TRSSA 3(1880)175,177; FvM., TRSSA 3(1880)172; FvM., Key Vict. Pl. 1(1887-1888)131; FvM., Sec. Census 1(1889)5; Tate, Fl. S. Austral.(1890)15,17,206; Tate, TRSSA 22(1898)122,123,124; Reader, Vict. Nat. 21(1905)177; Ewart, Proc. Roy. Soc. Vict. 20(1907)79,80; Maid. et Betche, Cens. N.S. Wales Pl.(1916)84; Black, TRSSA 41(1917)45; Black, Fl. S. Austral. (1924)248; Schulz, Pflrch.86(1924)256; Black, TRSSA 58(1934)177; TRSSA 64(1940)373 in obs.; Fl. S. Austral.ed.2(1948)376; Troll, Die Infloresz.(1964)497.

Geococcus fiedleri Scheuermann, Feddes Rep. 47(1939)262; Black, TRSSA 64(1940)372; Fl. S. Austral. ed.2(1948)377 (pro syn.)

G. fiedleri Scheuermann is a taxonomic synonym of G. pusillus Drumm. ex Harv., being based on a different type.

Figures: Ewart, Proc. Roy. Soc. Vict.20(1907)fig.10A,11; Black, TRSSA 64(1940)fig.2; Troll, Die Infloresz.(1964)fig.472,473; - Figure 16

Original description: see under Geococcus Drumm. ex Harv.

Description: Plant herbaceous prostrate annual, pubescent, including sepals and, sometimes, the pistil, with sessile or shortly stipitate branched hairs; stems few to many, very short and thickened, horizontal and spreading, often densely leaved, very often producing secondary stems.

Basal leaves to 20cm, but usually less than 10cm, to 2cm in width, usually more or less oblong and tapering proximally, pinnatifid, to ca. 15 lobes per side, these linear to deltate, opposite or alternate, usually rounded to subacute, sometimes acute, often bearing a secondary lobe or tooth in the sinus on the distal side of the lobe; terminal lobe orbicular to obovate, usually with one secondary tooth or lobe on a side; leaves always tapering into a slender petiole.

Cauline leaves very crowded, otherwise as basal leaves.

Inflorescences few-flowered, initially dense, elongating very little after anthesis, that of the main stem always appearing basal as a result of suppression of the stem; flowering pedicels to ca. 2cm long, slender, spreading or descendent; buds before anthesis obovoid to spherical.

Sepals pale green, with a narrow hyaline margin, on abaxial side often sparsely pubescent; lateral sepals ca. 0.5-1.1mm long, ca. 0.3-0.8mm wide, average ratio length to width 1.5:1, more or less ovate to deltate, apically acute to subacute, basally not saccate; median sepals ca. 0.6-1.2mm long, ca. 0.4-0.7mm wide, average ratio length to width 1.6:1, oblong to obovate, subacute to rounded, basally not saccate.

Petals ca. 0.6-1.0mm long, ca. 0.2-0.4mm wide, with obovate to ovate blade gradually tapering into a more or less linear claw, or clawless, the entire petal then obovate to ovate, rather coarsely veined, margin entire, apically rounded, white or cream-coloured.

Lateral stamens ca. 0.7mm, filaments expanded basally, white or pale green; anthers ca. 0.4mm, oblong to square, rounded to truncate, yellow; diagonal stamens ca. 0.8mm, filaments as those of the lateral stamens; anthers ca. 0.3mm, as those of the lateral stamens.

Pistil ca. 0.6-1.0mm ,sessile, more or less conical, terete or slightly compressed dorso-ventrally; style very short (ca. 0.2mm) or obsolete; stigma depressed-capitate, a bout same width as the style.

Fruiting pedicels to ca. 4cm long, but length variable on a single plant, horizontal to descendent, often burying fruit in the ground.

Fruit ca. 0.3-1.5cm long, ca..1.0-1.5mm across the septum, epidermal cells of the septum usually oblong to fusiform, sessile, usually linear, almost always latisept, rarely terete; valves usually almost flat, usually with a distinct nerve and, when mature, a reticulum of secondary veins, proximally flared; style ca. 0.1-1.0mm long, often obsolete; stigma depressed-capitate.

Seeds ca. 1.1-1.3x0.7-0.8mm, usually biseriate, usually 2-12 per cell, sometimes only 2 or 3 as result of abortion of many ovules, oblong to obovate, plump, mucous narrow; embryo exactly notorrhizal, cotyledons sometimes shortly stipitate, about same length as the radicle.

Type locality: "Hab. Northern Districts; among a cluster of Boordis' (a species of Kangaroo-rat) holes on the limestone part of Conolly's station ••• J.D. [Western Australia]"

Holotype: between Moore and Muchison Rivers. W. Australia; 1853; J. Drummond - K!

Isotype(?): West Australia; 1854; Drummond 114 - BM!

Other specimens seen: (see Map 9 - page 241)

South Australia: - Mt. Parry; 9.8.1951; Royce 3514 - PERTH, CANB(p.i.): 10 miles S. Blinman; 31.8.1963; Shaw 198;- AD: 10 miles S. Wilpena; 25.8.1961; Shaw 13,17 - AD: Koonamore; Aug.1930; Osborn - SYD, CANB(p.i.): Koonamore; 19.8.1930; Paltridge - SYD,CANB(p.i.): Koonamore; 24.8.1930; ? - ADW: Koonamore; Aug.1945; Eardley - ADW: Koonamore; 21.8.1930;

Paltridge - AD: Koona more; 14.8.1956; Eichler 12451 - K,L,P,TI, UC, B,GH,AD: Yednalue; 1.9.1963; Shaw 202 - AD: Quorn; Sept.1930; Cleland - AD: Carrieton; 29.9.1916; Black - MEL: Mt. Remarkable; 14.7.1898; Johncock - AD: Booleroo Centre; 30.7.1939; Brooks - ADW: Kinchina; 29.6.1936; Ising - AD: Ardrossan; July ?; Tepper 978 - AD: Yorke Peninsula;?; Tepper - MEL: Lincoln Gap; 24.9.1942; Cleland - AD: 7 miles east of Iron Knob; 25.8.1928; Cleland - AD: Yudnapinna; 11.9. 1945; Burbidge - ADW: Wudinna; 8.9.1938; Johns - AD: 3 miles W. of Wirrilta [Wirrulla?]; 20.8.1955; Hilton - ADW: Fowler's Bay;?; Richards - MEL:

Victoria: - Leitchville; Nov.1905; ? - MEL: Terrick Pine Forest, E.S.E. of Pyramid Hill; 3.9.1945; Willis - MEL: Borung; 10.11.1904; Reader - MEL: Witchipool; Nov.1903; Dyer - MEL: 3 miles W. Calder Highway beside Millewa Road; 19.8.1951; Ramsay - MEL: Calder Highway at Hattah, N.W.Victoria; 6.9.1941; Willis - MEL: (near Minyip) Wimmera; Aug.1894; Eckert - MEL: Wimmera; 1892; Eckert - MEL, NSW53534: between rivers Richardson and Wimmera;?; Curdie - MEL: Dimboola;?;St. Eloy D'Alton - MEL: You Yangs; 1.9.1910; Pitcher - MEL: near Durdidwarrah Creek between Melton and Parwan; 25.9.1915; Sutton and St. John - MEL: Durdidwarrah Creek; 26.9.1915; Sutton 1661 - K: head of Bullocky Springs Gully, Lower Glenelg River, far S.W.Victoria (11 miles S.W. Winnap); 31.10.1948; Willis - MEL: Wombeota; 25.9.1945; Moore - CANB(p.i.):

New South Wales: - Trangie; 20.9.1951; Biddescombe - CANB(p.i.): Cobar; Aug.1915; Haviland - NSW53538: Pulpalla near Cobar; Sept.1884; Josephson - MEL: Lachlan River; Sept.1878; Mueller - MEL: Murrumbidgee;?; Day 15 - MEL: Wanganella; Oct.1903; Officer - AD: Wanganella; Oct.1903; Officer - NSW53536: Zara; Aug.1903; Officer - NSW20561, K: Zara, Wanganella; Sept.1915; Officer - NSW53535: Faulkiner Memorial Field Station, Deniliquin; Sept.1915; Willoughby - CANB(p.i.): Tolarno Stn., S. of Menindie, N.S.W.; 23.7.1960; Burbidge 6639 - NSW53537, CANB(p.i.): lower Darling River;?;? - MEL: Junction of Darling and MurrayyRiver; 1889; Holding - MEL: ?; July,1889; Holding - MEL:

Western Australia: - Fraser Range; 9.8.1951; Royce 3514 - PERTH, CANB(p.i.): between Esperance Bay and Fraser's Range; 1876; Dempster - MEL:

Victoria or New South Wales: - Murray River;?; Allen - MEL: Murray River; June,1889; M'Adams 9 - MEL: Murray River;?;? - MEL:

Tasmania: - King Island; 1876; Spong - NSW20560, K: (This locality should be queried; if the plants were collected on King Island, they w ere almost certainly introduced.

Germany: - Leipzig; 27.5.1940; Fiedler - B (type G. fiedleri Scheuermann)

Distribution: This species has been collected in semi-arid parts of Western Australia, South Australia, New South Wales and Victoria. In South Australia the greater part of the collections are from the Flinders Ranges, but there are scattered ones from the Lake Frome basin, the Murray mallee area, and from the Yorke and Eyre Peninsulas.

The New South Wales collections are generally from the south-western part of the state. Those from Victoria are also from the western part of the state, where it has been collected near the coast, as well as from near Melbourne.

This species is probably much more abundant than the collections indicate, for it is inconspicuous and has probably been overlooked by collectors.

Observations: This species has often been said to be a form of Pachymitus cardaminoides, an idea which originated with Bentham (1863) who wrote,

"This curious little plant, unknown from any other locality [other than that of the type] may possibly prove to be a condition of some species having usually dimorphous flowers, in which the more perfect onesare not developed. If so, it may very likely be a Blennodia, of some species of which it has the radical leaves."

This suggestion was elaborated upon by several subsequent authors who were reluctant to believe that G. pusillus could be a distinct species. Tepper (1880) wrote, "Geococcus pusillus is remarkable for being strongly suspected of having two widely different growth forms. The principal one pushes its fruit below the soil while perfecting and ripening; the other, generally a weaker plant, has an upright stalk, and resembles very much a Cardamine." This "other form" to which Tepper refers is certainly P. cardaminoides.

The writer finds it difficult to understand how it was possible to consider these plants to be forms of one species; they differ sharply in habit, fruit and flowers, and there appear to be no intermediate forms between them.

Mueller (1888) was the first to definitely state that G. pusillus was a synonym of P. cardaminoides. Under Sisymbrium cardaminoides he described the "Geococcus-state" of this species in the following manner:

"Or in a stemless state of this plant [fruits] very short, rather thick and turgid, singly forming on their stalks, and during maturation burying themselves in the ground; the flowers of this state very minute."

The following year in his Second Census Mueller wrote, "Geococcus pusillus = Sisymbrium cardaminoides". In a note on G. pusillus for the Victorian Naturalist (1892), Mueller was apparently less sure of the identity of these two, remarking only that G. pusillus might be a stemless state of a plant normally developing otherwise, and saying, "Its foliage is not unlike the radical leaves of Sisymbrium cardaminoides, with which it is moreover not rarely associated."

Tate (1898) seemed to be somewhat uncertain of the status of G. pusillus. He praised "Bentham's perspicuity in regard to G. pusillus, which subsequent investigations have proved him to be correct". However, a few sentences after, he said that in the light of the fact that Blennodia (sensu Bentham) was represented in Western Austra lia by only three species, B. trisectum, B. richardsii and B. brevipes, it was inconsistent to regard Drummond's plant as belonging to B. cardaminoides, pointing out that the "normal state" of this latter species was not known to occur in the area where Drummond's type was collected.

Tate mentioned three collections of "so-called" G. pusillus from South Australia which he had seen, one from Ardrossan gathered by Tepper, one from Mt. Remarkable made by Johncock, and one from Cradock. He admitted that although the foliage of these plants was like that of P. cardaminoides, the other pla nt parts did not agree with those of this species.

He then continued to say,"These marked differences must be related to the habit of dimorphism, ...", and remarked that he had a collection of P. cardaminoides from Cooper's Creek which showed single-flowered stalks horizontal among the radical leaves and suggested that this plant was showing a "slight passage towards a fully developed 'geococcus-state' ". However, this collection from Cooper's Creek is Arabidella eremigena which often does have a few apparently basal flowers represent ting the inflorescence of a suppressed stem. The writer has seen two of the South Australian collections mentioned by Tate, those of Tepper and of Johncock (both AD), and these are both ordinary G. pusillus.

Tate concluded that there exist " two very dissimilar states of Blennodia cardaminoides, which have in common virtually only leaf form".

In 1905 F.M. Reader published in the Victorian Naturalist some notes on Geococcus pusillus in which he clearly pointed out that this species is distinct from P. cardaminoides. He had observed the growth of G. pusillus and noted that in favourable conditions it ma y produce short ascendent stems. However he was firm in maintaining it as a distinct species and Geococcus as a distinct genus.

The last mention of this problem seems to have been made by Ewart (1907) who suggested that "Geococcus pusillus might possibly be a form of Sisymbrium cardaminoides, produced as the result of continual grazing or cropping". However, Ewart concluded that G. pusillus should be maintained until such time as cultural experiments prove it to be only a form of another species.

The present writer has several times observed this species in the field and has found no evidence that it is a form of P. cardaminoides or of any other species. It shows a considerable variation in fruit shape a nd in the lobing of the leaves, but it never approaches P. cardaminoides in habit or in nature of the fruit. It is true that the leaves ma y resemble the radical leaves of P. cardaminoides, but this is the only point of resemblance between them.

Furthermore the writer has seen G. pusillus growing luxuriantly in areas where P. cardaminoides has never been found. There are records of the occurrence of the latter species in the northern part of South Australia, but these are all based on collections of A. eremigena which has often been confused with P. cardaminoides.

It must be emphatically stated that Geococcus is a genus quite distinct from Pachymitus and there is no evidence that G. pusillus ever approaches P. cardaminoides. It consistently has a different habit, much smaller flowers, fruits which are smaller and differently shaped, and slightly different nectaries.

Variation: G. pusillus varies most noticeably in the lobing of the leaves and in fruit shape. Usually there are not more than about nine lobes on a side although there do occur plants bearing leaves with as many as fifteen lobes per side. The lobes may be strictly alternate or strictly opposite or mixed - often the lobes at the distal end of the leaf are opposite while those toward the proximal end are much smaller and alternate.

Generally the leaves are less than 10cm long, but they may reach 20cm. A plant collected by the writer in the Flinders Ranges (Shaw 202-AD) was 48cm in diameter when living.

The fruit is linear but may vary in ratio of length to width. Usually the fruit is 3 or 4 times as long as wide, but some fruits are almost square. Not uncommonly the fruit is twisted or bent and this is especially true if the plant grew in a hard soil. The valves are flared at the proximal end and in this respect do resemble those of P. cardaminoides.

In most cases the fruiting pedicels turn sharply downward so that the fruits are buried, but it is not unusual to see pedicels which are horizontal. The writer has seen only one plant with an aerial fruiting raceme (Willis s.n. - MEL); the raceme is about 2½cm long and bears fruit which do not differ noticeably from those on the same plant which were buried.

The cause of the apparent geotropism of the fruiting pedicels is not known. It seems to be not a genuine geotropism for the writer suspended upside down several plants which when brought from the field already had the pedicels turned sharply downward. During a period of almost a month in suspension the pedicels grew almost 2cm in length, but did not change from the direction in which they had originally been growing. It seems also to be not a case of negative phototropism for the pedicels of the suspended plants were growing toward the source of light.

Ecology and Biology: G. pusillus appears to grow equally well on sand and on heavier soils, for the writer has collected it on both.

Usually the plants grow closely together and under favourable conditions may cover an area of several square feet. Among the annotations are "sandy creekbed" (Shaw 13 - AD), " very common on rocky hillside" (Shaw 198 - AD), "clay soil" (Biddiscombe s.n. - CANB) and "partially cleared area with low herbage on heavy soil" (Burbidge s.n. - NSW53537).

Uses and Common Names: No uses have been recorded for G. pusillus. Sutton and St. John s.n. (MEL) bears the annotation "earth cress" but this seems to be not a commonly used name.

Note: In 1939 were described by Scheuermann, under the name G.

fiedleri plants which were found growing in a garden in Leipzig where waste from Australian wool had been thrown. It was described as having leaves with 12-14 lobes per side and fruit 1cm long which are lanceolate and acute. J.M.Black (1940) compared this description with the South Australian collections of *Geococcus* and decided that they were all *G. fiedleri*. However in the second edition of his Flora (1948) Black included them in *G. pusillus* and cited *G. fiedleri* as a synonym.

The writer has seen the holotype of *G. fiedleri* (B); the collection is quite ordinary *G. pusillus*, perhaps larger than some, but this may be attributable to its having grown under favourable conditions. Thus *G. fiedleri* Scheuermann must be treated as a taxonomic synonym of *G. pusillus* Drum. ex Harv.

FIGURE 1

<u>Blennodia</u> <u>canescens</u> R.Br.

habit x1

(from <u>Shaw 225</u>)

FIGURE 2

<u>Blennodia</u> <u>canescens</u> R.Br.

A: fruit x10

B: distal end of fruit x10

(A from <u>Ising 1192</u>; B from <u>Cleland s.n.</u> [18.8.1930])

<u>Blennodia</u> <u>pterosperma</u> (Black)Black

C: fruit x10

D: distal end of fruit x10

(from <u>Shaw 185</u>)

<u>Blennodia</u> <u>canescens</u> R.Br.

E: petal x10

F: lateral sepal x10

G: lateral stamen x10

H: median sepal x10

I: diagonal stamen x10

J: pistil x20

K: seed x10

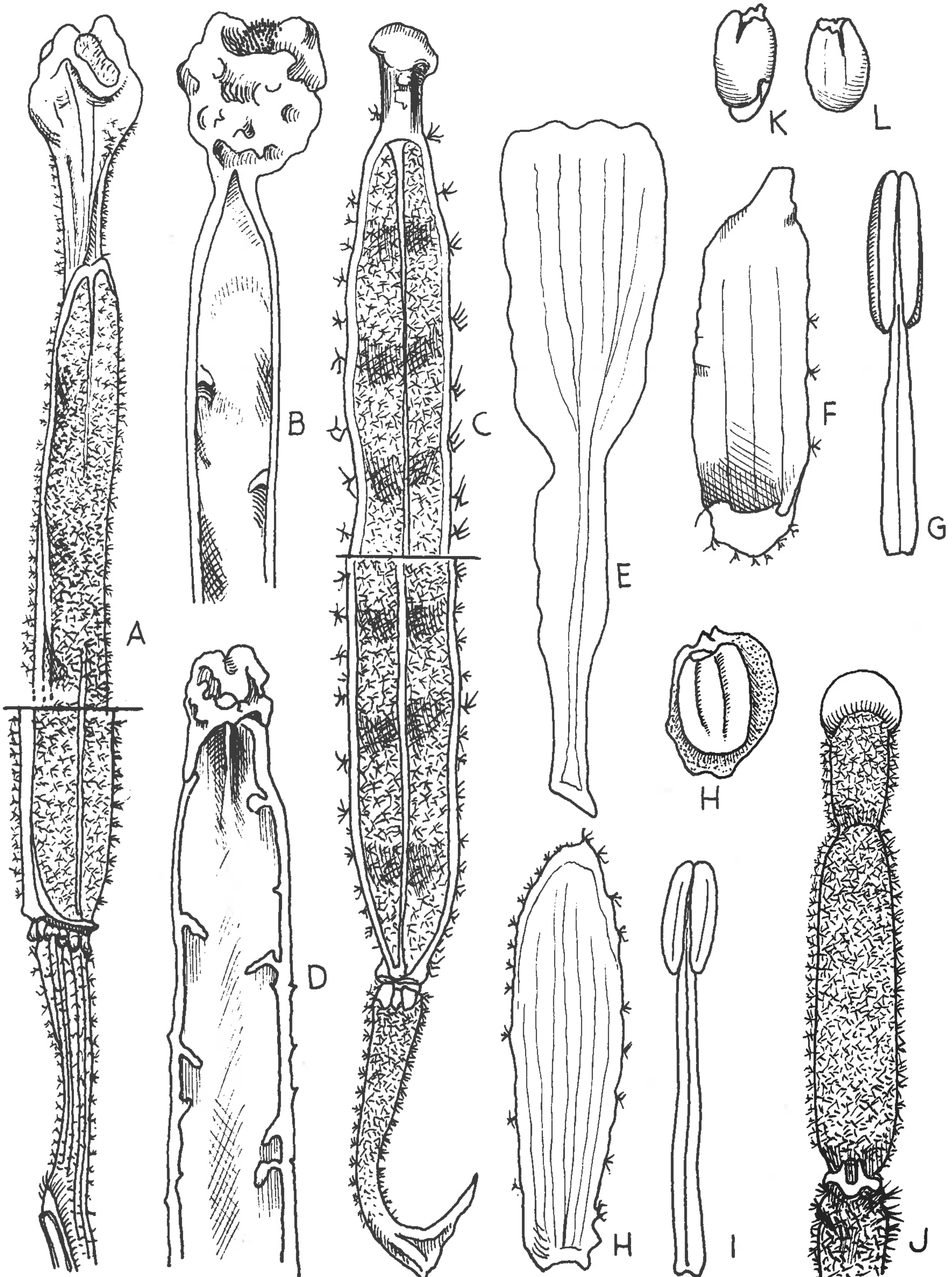
L: seed x10

(all from <u>Hill 134</u>)

<u>Blennodia</u> <u>pterosperma</u> (Black)Black

M: seed x15

(from <u>Shaw 185</u>)



A
B
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L

FIGURE 3

Arabidella trisecta (FvM.)Schulz

A: fruiting raceme (Sharrad 1328) x1½

Arabidella glaucescens Shaw

B: fruiting raceme (Shaw 231) x1½

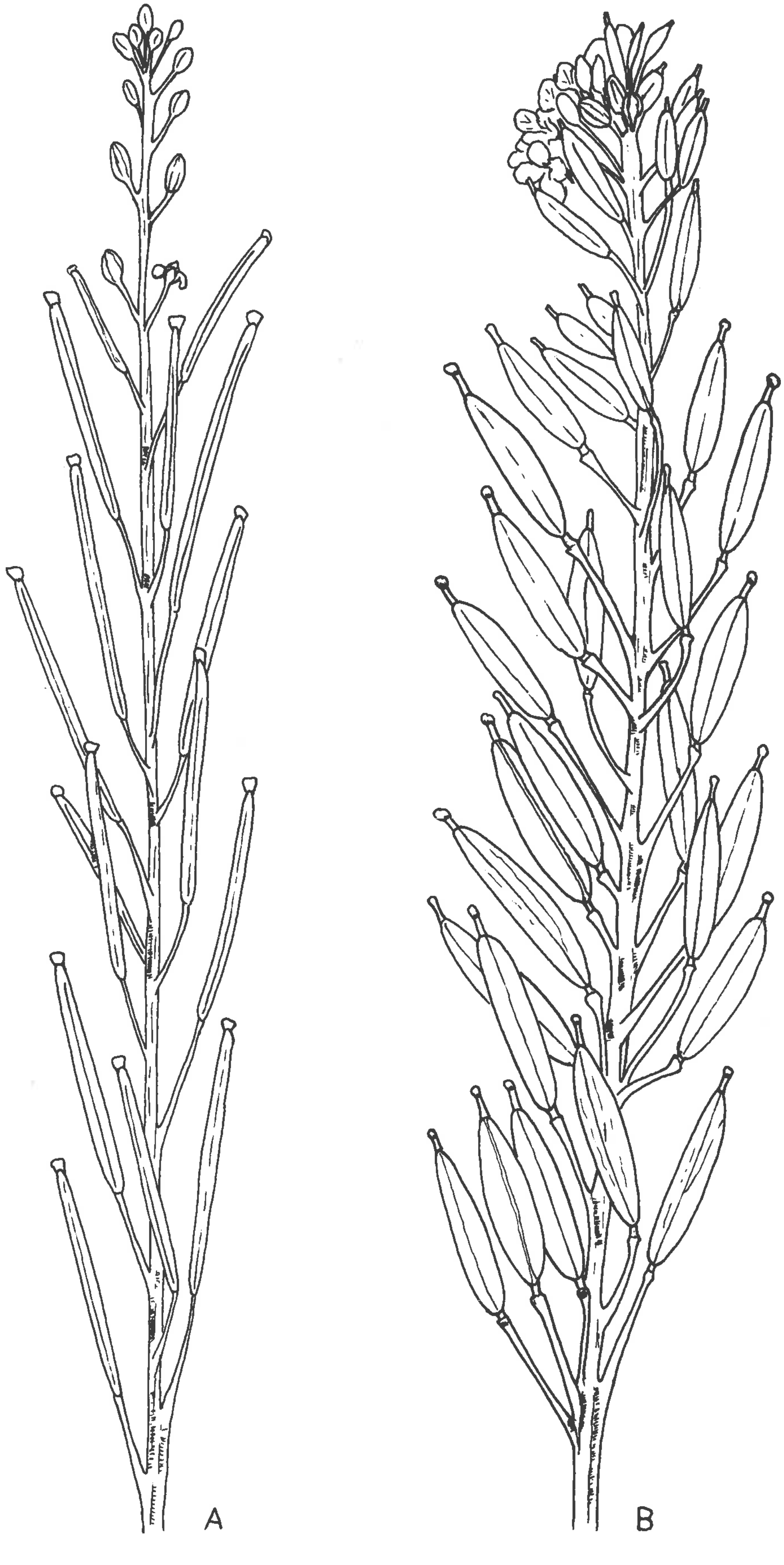
A B

FIGURE 4

Arabidella glaucescens Shaw

A: petal x10

B: median sepal x10

C: diagonal stamen x10

D: lateral sepal x10

E: lateral stamen x10

F: pistil x20

(all from *Shaw 231*)

Arabidella trisecta (FvM.)Schulz

G: petal x10

H: median sepal x10

I: diagonal stamen x10

J: lateral sepal x10

K: lateral stamen x10

L: pistil x20

M: fruit x10

N: seed x10

(all from *Sharrad 1328*)

Arabidella glaucescens Shaw

O: fruit x10

P: seed x10

(from *Shaw 231*)

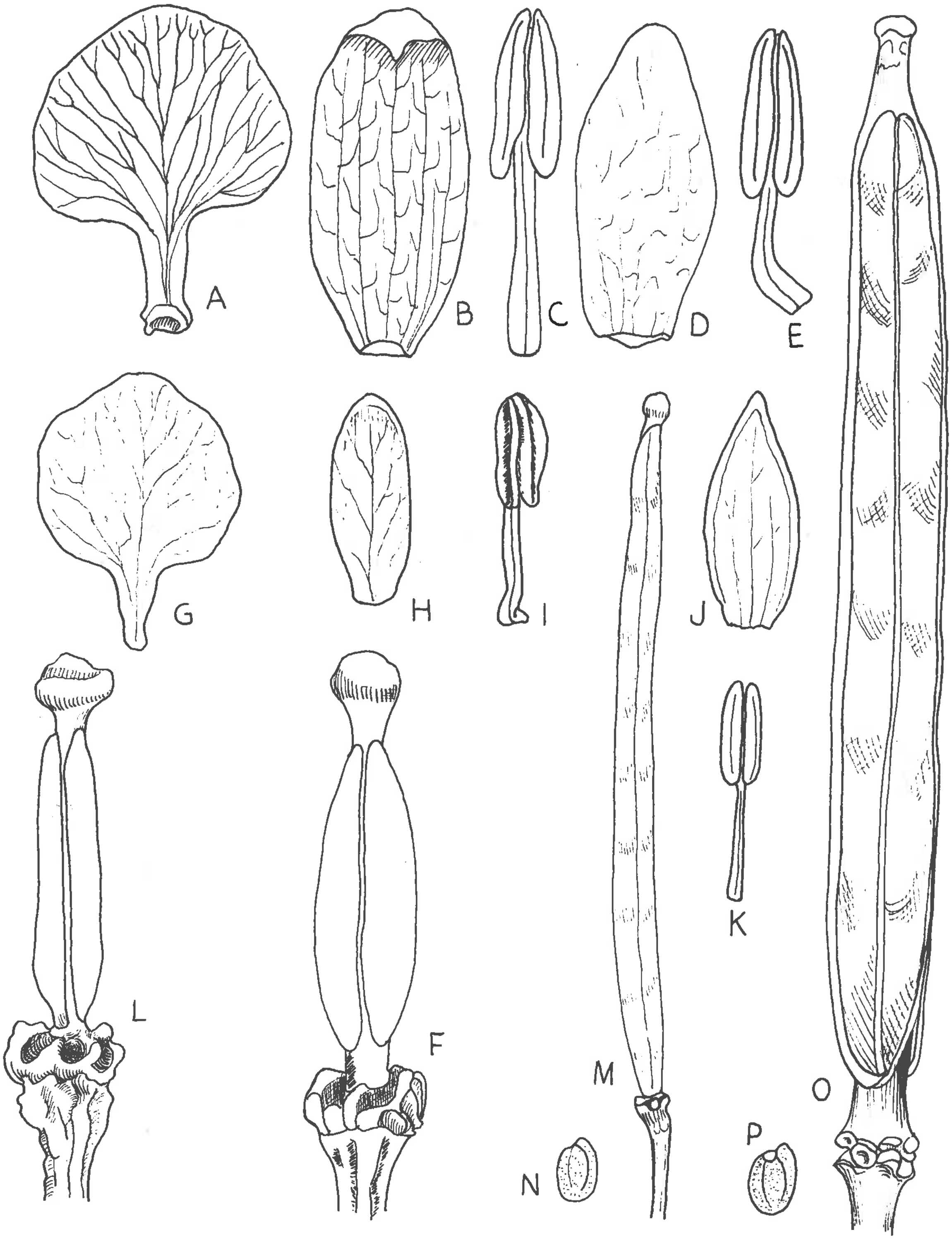
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FIGURE 5

Arabidella filifolia (FvM.)Shaw

A: fruiting raceme x2

B: petal x10

C: median sepal x10

D: diagonal stamen x10

E: lateral sepal x10

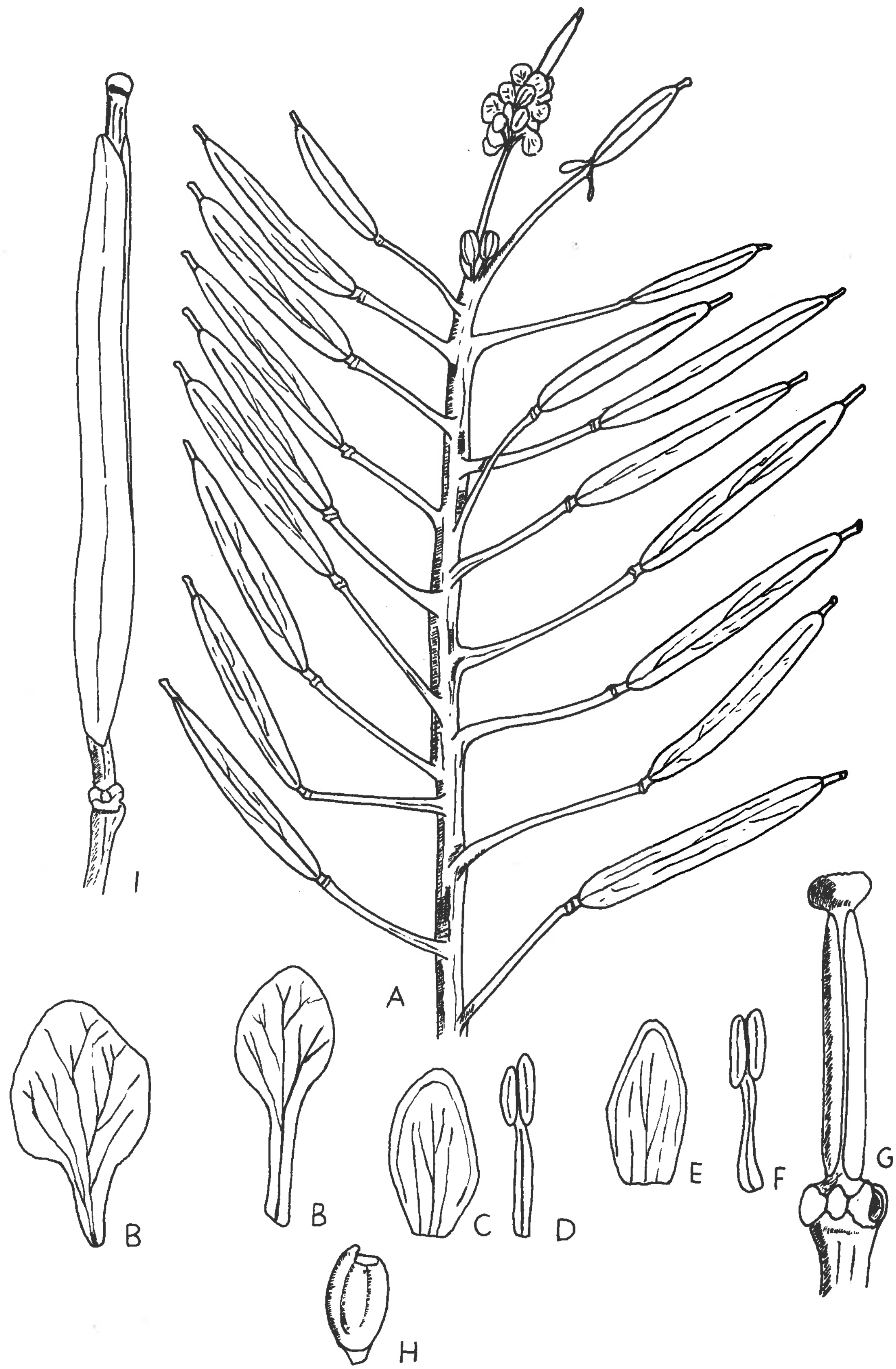
F: lateral stamen x10

G: pistil x10

H: seed x15

I: fruit x10

(all from Sharrad 1331)



I
A
B
B
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H

FIGURE 6

Arabidella _nasturtium_ (FvM.)Shaw

A: habit ×1

B: petal ×10

C: petal ×10

D: petal ×10

E: median sepal ×10

F: diagonal stamen ×10

G: lateral sepal ×10

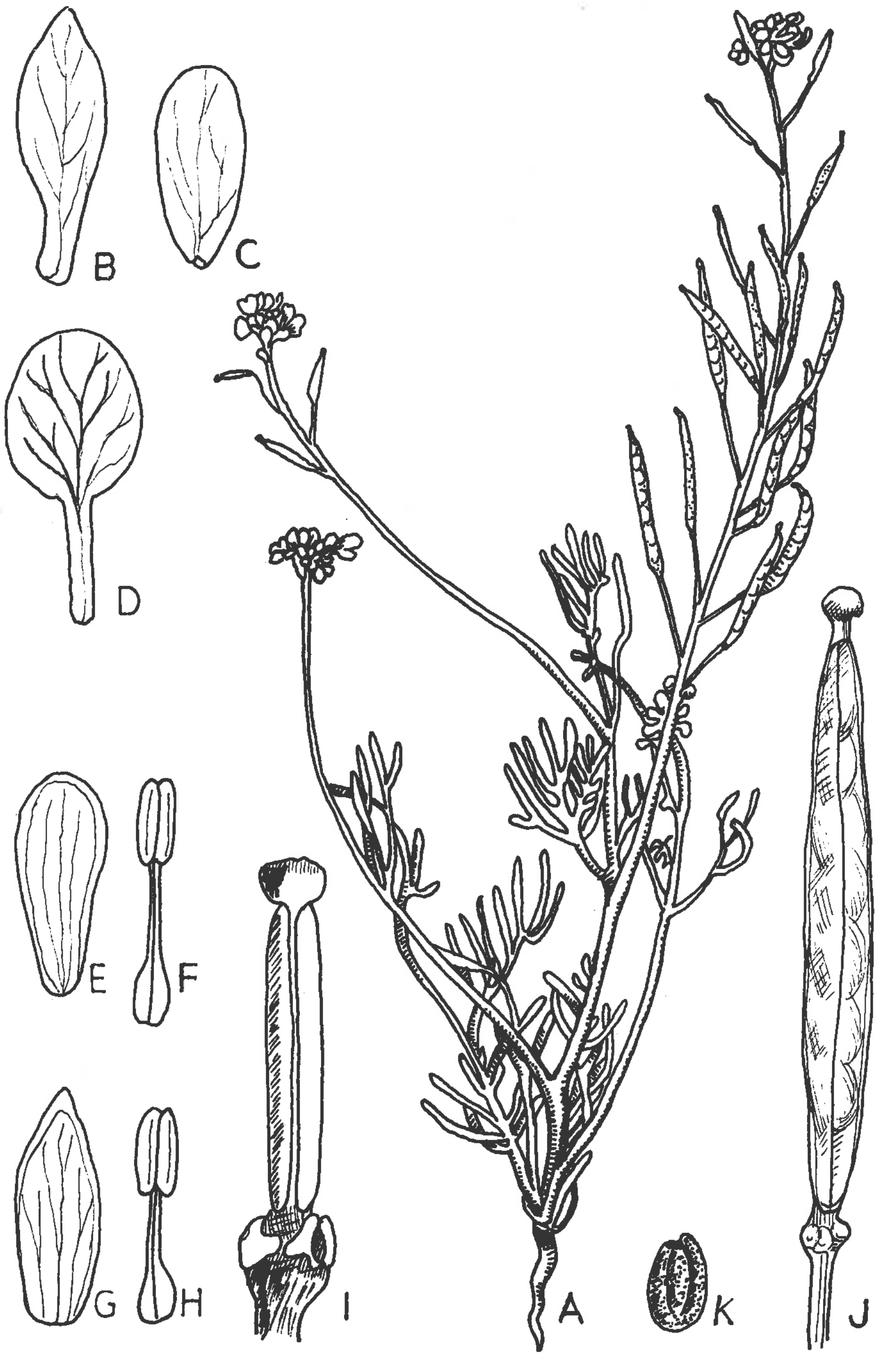
H: lateral stamen ×10

I: pistil ×10

J: fruit ×10

K: seed ×10

(B and C from _Constable s.n._ [16.7.1955]; others from _Shaw 46_)


B
C
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A
K
J

FIGURE 7

Arabidella eremigena (FvM.)Shaw

A: habit x1

B: petal x10

C: median sepal x10

D: diagonal stamen x10

E: lateral sepal x10

F: lateral stamen x10

G: pistil x20

H: fruit x10

I: fruit x10

(I from _Everist 3529_; others from _MacGillivray s.n._)

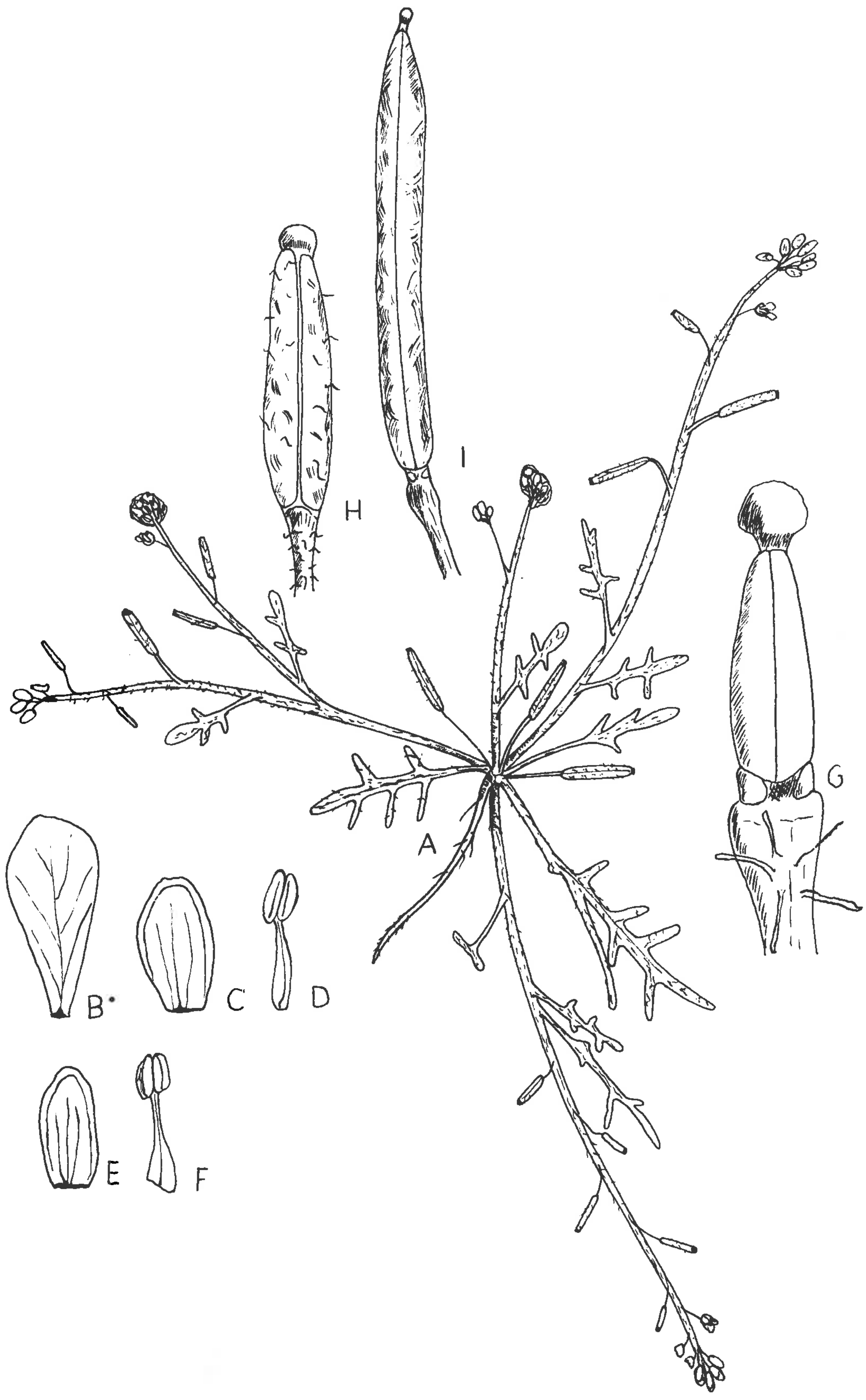
A
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FIGURE 8

Arabidella procumbens (Tate)Shaw

A: habit x1

B: petal x10

C: median sepal x10

D: diagonal stamen x10

E: lateral sepal x10

F: lateral stamen x10

G: pistil x10

H: fruit x10

I: seed x10

(all from _Ising s.n._)

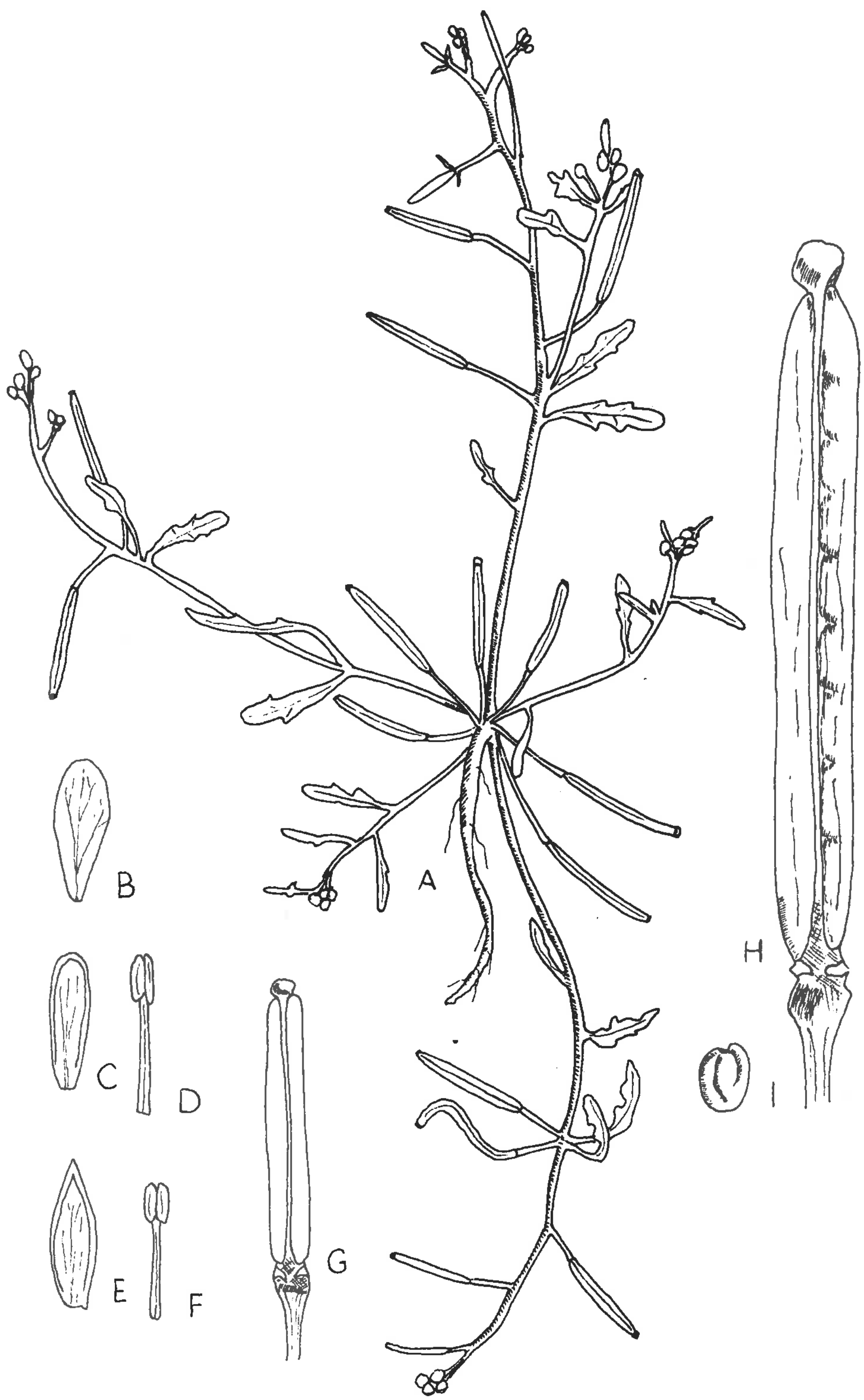
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FIGURE 9

Harmsiodoxa blennodioides (FvM.)Schulz

A: habit x1

B: petal x10

C: petal x10

D: petal x10

E: median sepal x10

F: diagonal stamen x10

G: lateral sepal x10

H: lateral sepal x10

I: lateral stamen x10

J: pistil x20

(all from Williams s.n.)


A
B
C
D
E
F
G
H
I
J

FIGURE 10

Harmsiodoxa puberula Shaw

A: habit x1

B: petal x10

C: median sepal x10

D: diagonal stamen x10

E: lateral sepal x10

F: lateral stamen x10

G: pistil x20

(all from _Lothian 606_)


A
B
C
D
E
F
G

FIGURE 11

<u>Harmsiodoxa brevipes</u> (FvM.)Schulz

A: habit x1

B: petal x10

C: diagonal stamen x10

D: median sepal x10

E: lateral stamen x10

F: lateral sepal x10

G: pistil x20

(all from <u>Lothian 1348</u>)


A
B
C
D
E
F
G

FIGURE 12

Scambopus curvipes (FvM.)Schulz

A: habit x1

B: petal x10

C: median sepal x10

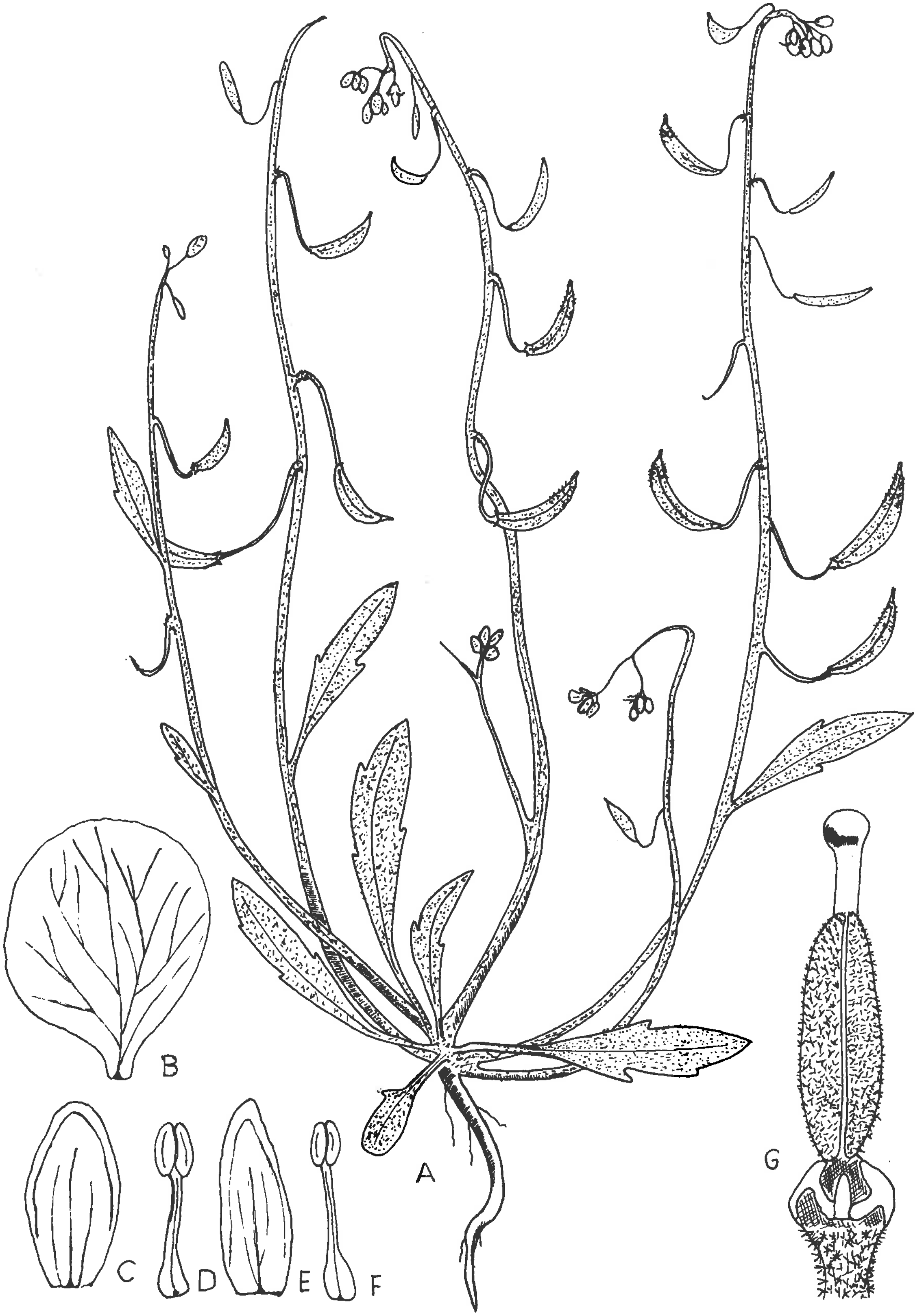
D: diagonal stamen x10

E: lateral sepal x10

F: lateral stamen x10

G: pistil x20

(all from *Murray 131*)



A
B
C
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E
F
G

FIGURE 13

Scambopus curvipes (FvM.)Schulz

A: fruit x10

B: seed x10

(from _Murray 131_)

Harmsiodoxa blennodioides (FvM.)Schulz

C: fruit x10

D: fruit x10

E: seed x10

(C from _Chippendale s.n._; D and E from _Williams s.n._)

Harmsiodoxa brevipes (FvM.)Schulz

F: fruit x10

G: seed x10

(from _Lothian 1348_)

Harmsiodoxa puberula Shaw

H: fruit x10

I: seed x10

(from _Vickery s.n._)

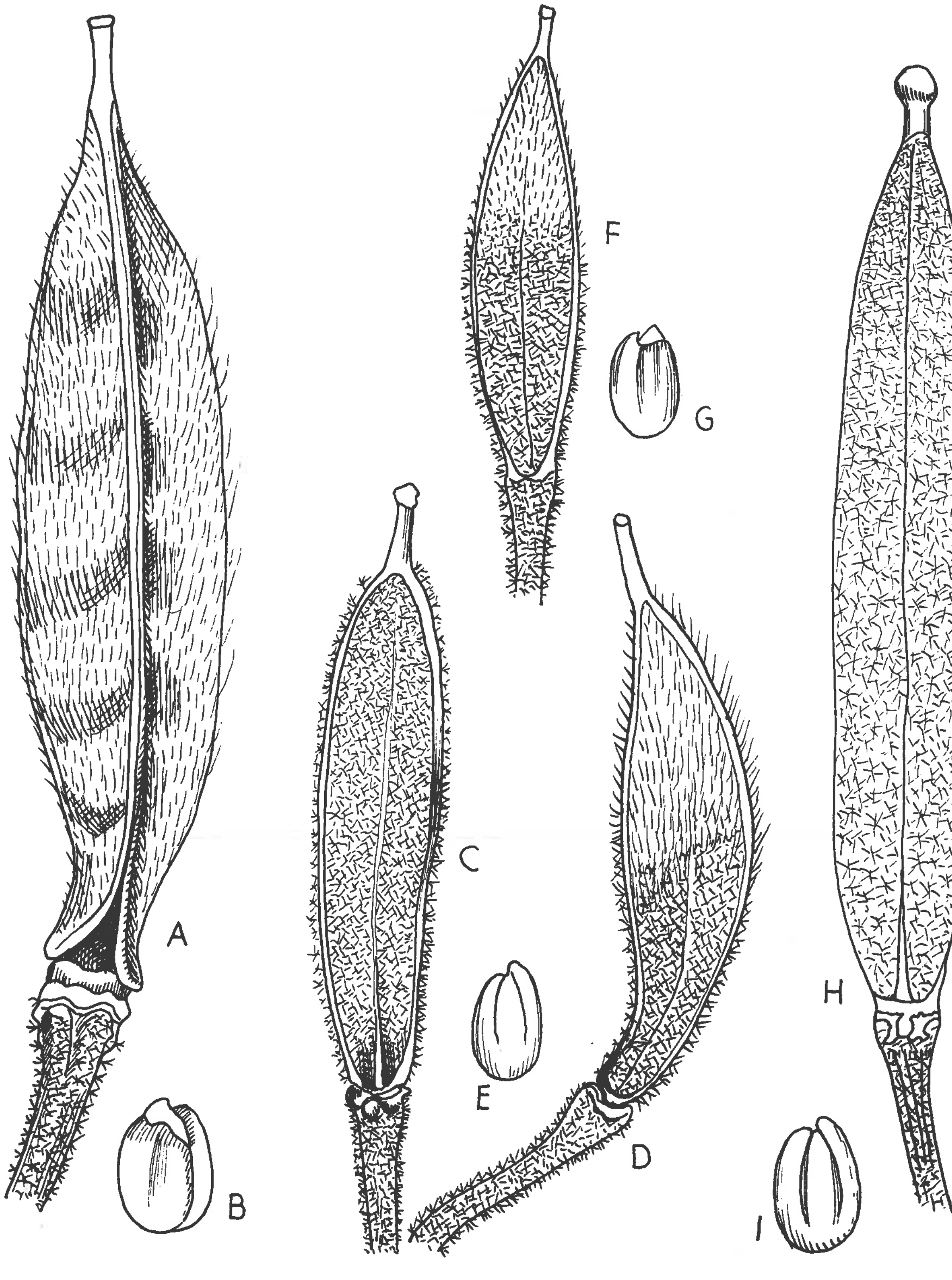
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FIGURE 14

<u>Drabastrum</u> <u>alpestre</u> (FvM.)Schulz

A: habit x1

B: petal x10

C: median sepal x10

D: diagonal stamen x10

E: lateral sepal x10

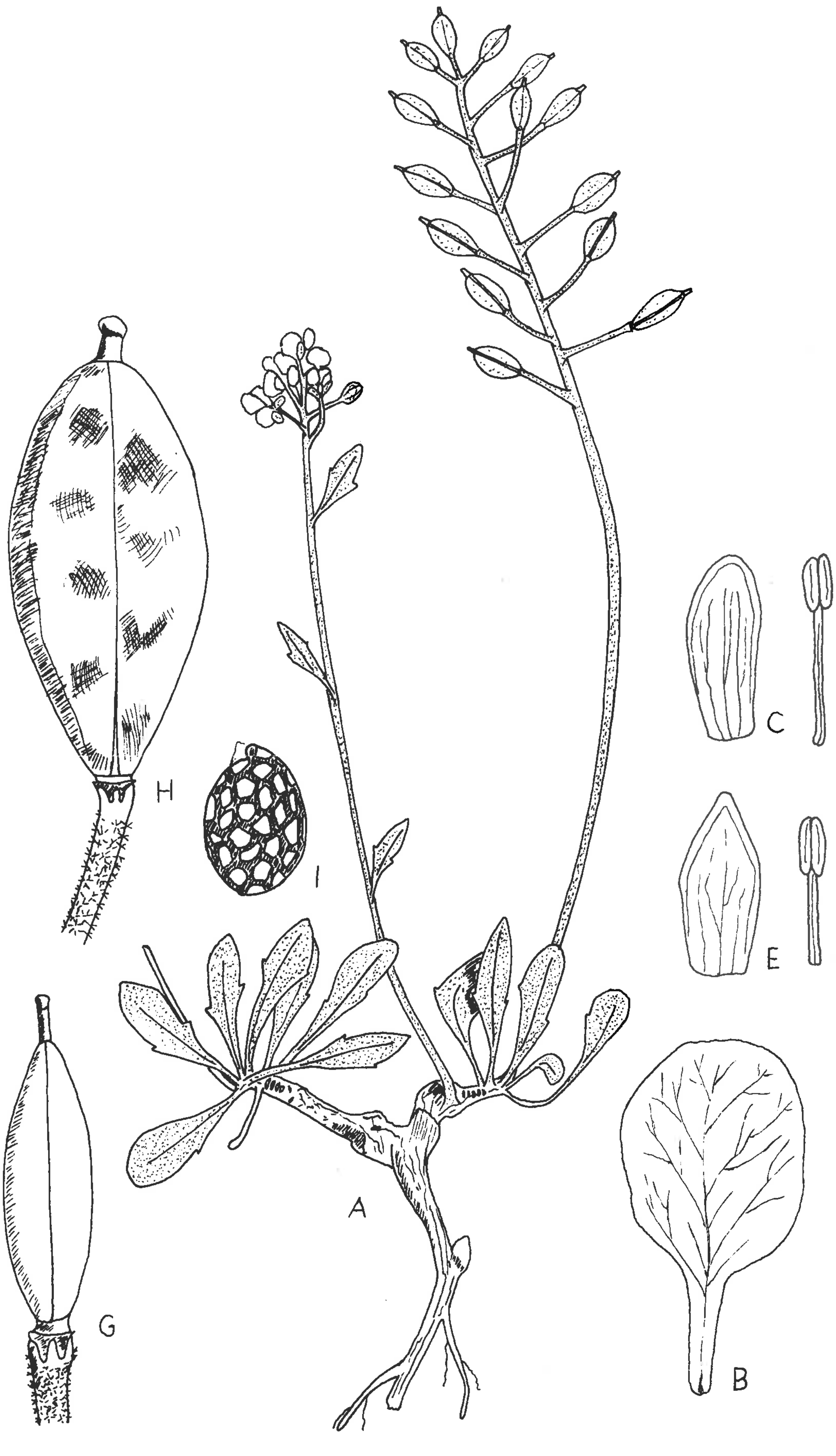
F: lateral stamen x10

G: pistil x20

H: fruit x10

I: seed x10

(all from <u>Thompson s.n.</u>)


A
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I

Figure 15

Pachymitus cardaminoides (FvM.)Schulz

A: habit x1

B: petal x10

C: median sepal x10

D: diagonal stamen x10

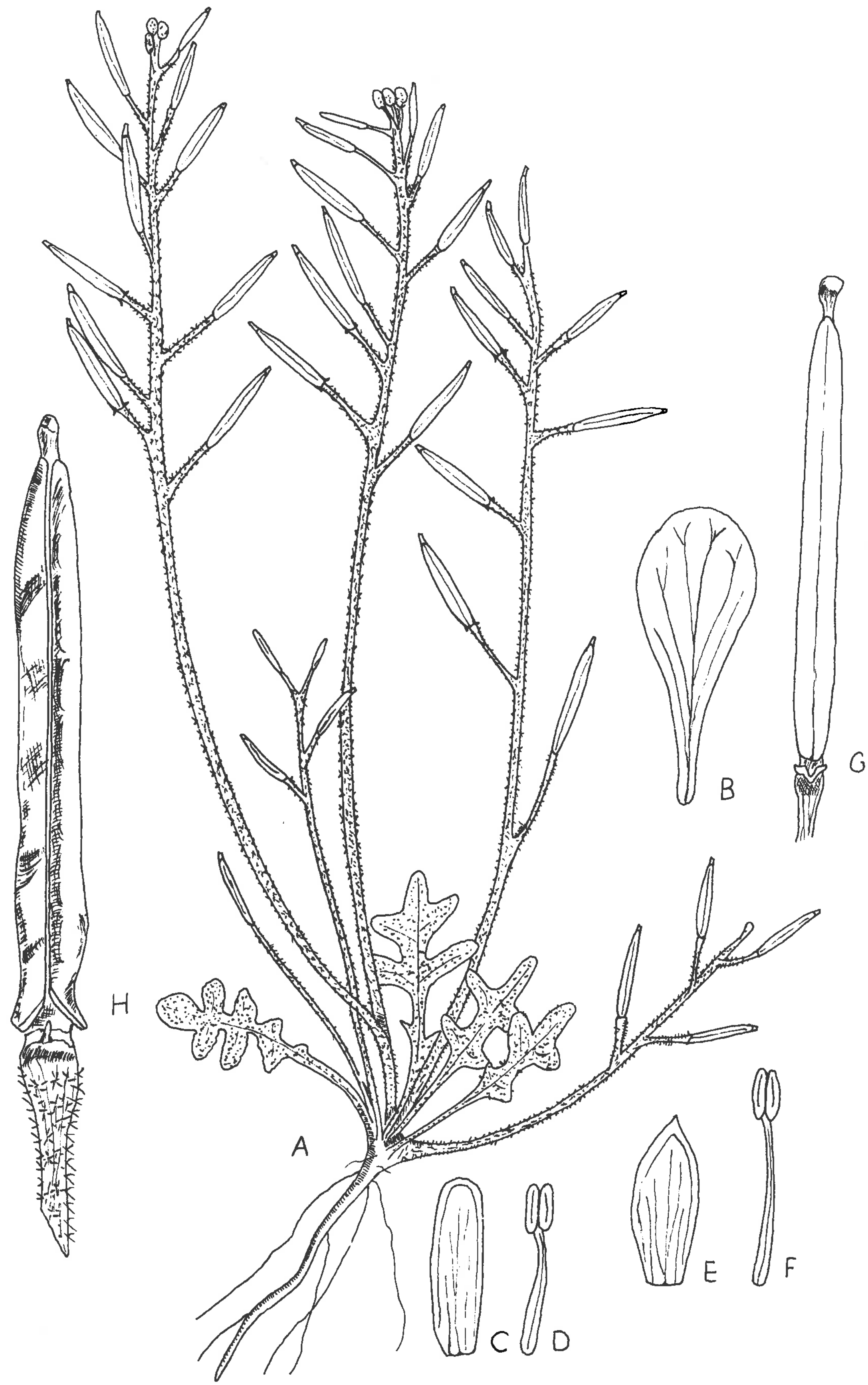
E: lateral sepal x10

F: lateral stamen x10

G: pistil x20

H: fruit x10

(all from D'Alton 5)


A
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G
H

FIGURE 16

<u>Geococcus</u> <u>pusillus</u> Drumm. ex Harv.

A: habit x1½

B: petal x10

C: lateral sepal x10

D: lateral stamen x10

E: median sepal x10

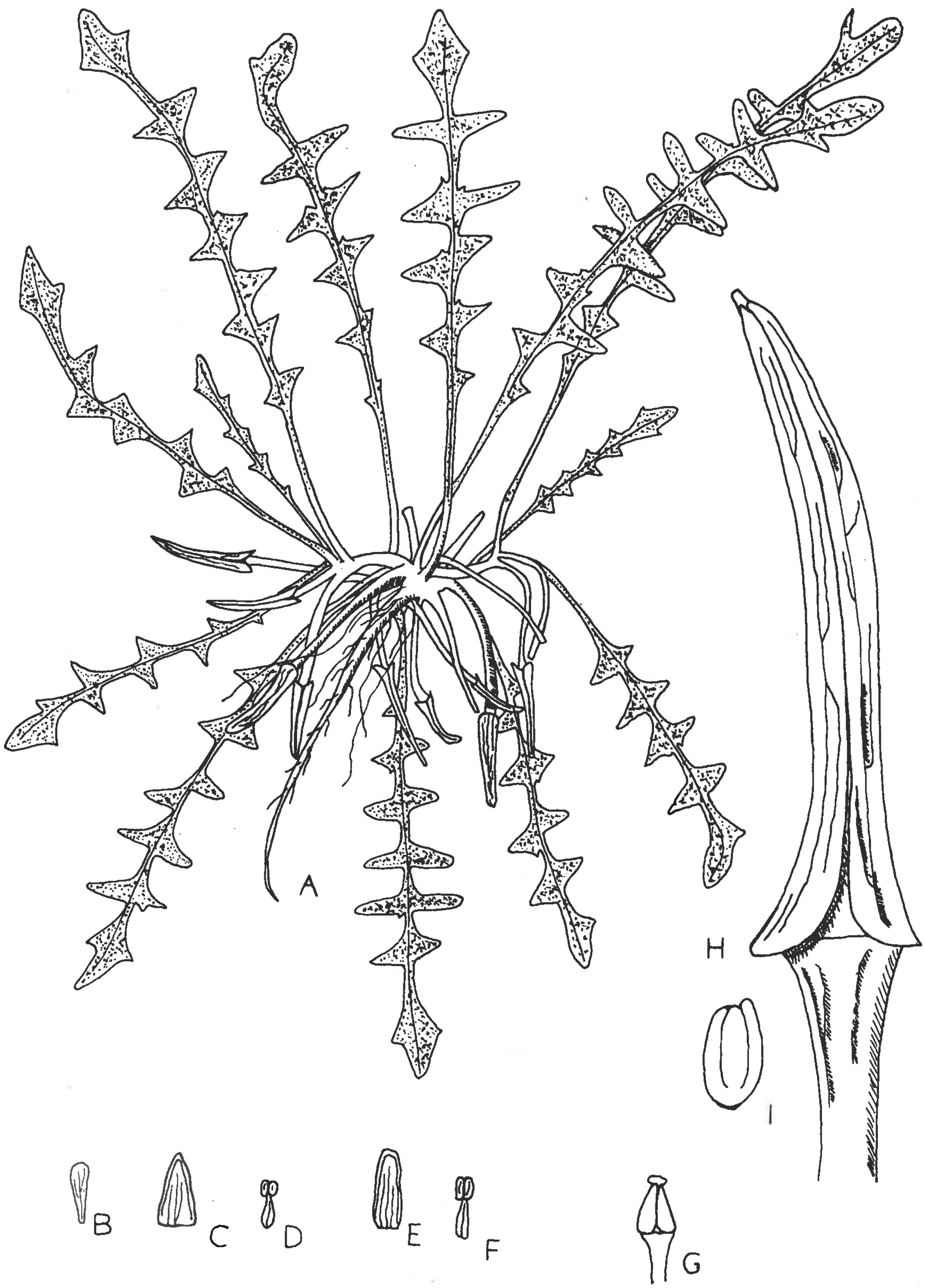
F: diagonal stamen x10

G: pistil x10

H: fruit x10

I: seed x10

(all from <u>Eichler 12451</u>)



A
B
C
D
E
F
G
H
I

INDEX OF SCIENTIFIC NAMES

Names -

underlined: names used in this revision for the groups here discussed

x: names occurring as synonyms

unmarked: incidental references

!: new combinations and new names

§: subgenera or sections of genera; the rank is indicated in the text

Numbers -

double underlining: first page of systematic treatment of group cited

single underlining: distribution map

asterisk: occurrence in a key

( ) : page on which the name is cited as a synonym

(( )) : page on which the name is used as a misapplied name

LIST OF COLLECTORS

The first number (in Roman numerals) is that of the genus, the s econd (in Arabic numerals) is that of the species; a or b indicates a taxon of infraspecific rank. For the monospecific genera only the Roman numerals are used. (T) indicates holo- or lecto- type of the indicated taxon.

Blennodia canescens R.Br.	I 1
B. pterosperma (Black)Black	I 2
Arabidella trisecta (FvM.)Schulz	II 1
A. glaucescens Shaw	II 2
	II 2a (a form - see page 134)
A. filifolia (FvM.)Shaw	II 3
A. nasturtium (FvM.)Shaw	II 4
A. eremigena (FvM.)Shaw	II 5
A. procumbens (Tate)Shaw	II 6
Harmsiodoxa blennodioides (FvM.)Schulz	III 1
H. puberula Shaw	III 2
H. brevipes var. brevipes	III 3a
H. brevipes var. major Shaw	III 3b
Scambopus curvipes (FvM.)Schulz	IV
Drabastrum alpestre (FvM.)Schulz	V
Pachymitus cardaminoides (FvM.)Schulz	VI
Geococcus pusillus Drumm. ex Harv.	VII

Abraham 479: III 2. - Abrahams 38: III 1. - Allen s.n.: I 1, II 2a, II 4, VII. - Allen 229: II 4. - Allen 264: II 5. - Allen 441: II 5. - Allen 444: II 5. - Allen 619: II 5. - Andra 45: II 1. - Andra 48: III 1.

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GUIDE TO LOCALITIES

Alberga Creek	S.A.	N. & N.W. Oodnadatta
Alberrie Creek	S.A.	ca. 52km W. Marree - on rail line
Alice Springs	N.T.	ca. 250km N. South Australian border
Alice Well	N.T.	ca. 165km S. Alice Springs
Alligator Gorge	S.A.	ca. 45km S.E. Port Augusta
Amboola	Qld.	ca. 25km W. Mitchell
Amby Downs	Qld.	ca. 27km E.S.E. Mitchell
Anabranch of the Darling River	N.S.W.	west of lower Darling River - flows into Murray R. ca. 12km W. Wentworth
Andamooka Opal Field	S.A.	ca. 230km N.N.W. Port Augusta
Andamooka Station	S.A.	ca. 200km N.N.W. Port Augusta
Andrewilla	S.A.	ca. 75km S. Birdsville, Qld.
Angas Downs Station	N.T.	ca. 205km S.W. Alice Springs
Angledool	N.S.W.	ca. 105km N.N.W. Walgett
Angorichina	S.A.	ca. 165km N.N.E. Port Augusta - between Parachilna and Blinman
Anna Creek	S.A.	ca. 210km W.N.W. Marree - on rail-line
Apoinga	S.A.	ca. 30km S. Burra
Appila = Yarrowie	S.A.	ca. 85km S.E. Port Augusta
Arckaringa Amphitheatre	S.A.	ca. 80km S. W. Oodnadatta
Arckaringa Creek	S.A.	ca. 110km S.W. Oodnadatta
Arcoona Pound	S.A.	ca. 65km E. Leigh Creek
Arcoona Station	S.A.	ca. 175km N.W. Port Augusta

Ardlethan	N.S.W.	ca. 55km N.E. Narrandera
Ardrossan	S.A.	ca. 80km N.W. Adelaide - north-eastern coast of Yorke Peninsula
Arkaba Hills	S.A.	ca. 105km N.E. Port Augusta
Australian Alps	N.S.W. Vict.	S.E. New South Wales and N.E. Victoria
Augathella	Qld.	ca. 155km N.W. Mitchell
Avondale Station	S.A.	ca. 75km S.E. Oodnadatta
Ayers Range	N.T.	ca. 250km S.S.E. Alice Springs
Bacchus Marsh	Vict.	ca. 52km W. Melbourne
Balaclava	S.A.	ca. 85km N. Adelaide
Balaclava Swamp	N.S.W.	ca. 75km E. Broken Hill
Baldina Station	S.A.	ca. 43km E. Burra
Ballandool River	N.S.W. Qld.	N.W. Walgett
Balmy Creek	Qld.	ca. 130km N.E. Tambo
Balonne River	Qld.	S. Qld. - flows through St. George
Balranald	N.S.W.	ca. 165km E.S.E. Wentworth
Bammaro = Pamamaroo	N.S.W.	see Pamamaroo
Baradine	N.S.W.	ca. 137km S.E. Walgett
Barcoo River	Qld.	S.W. Qld. - joins Coopers Creek
Barellan	N.S.W.	ca. 53km N. Narrandera
Barmedman	N.S.W.	ca. 30km S.E. West Wyalong
Barmera	S.A.	ca. 185km N.E. Adelaide - near River Murray
Barrier Range	N.S.W.	N. Broken Hill
Barunga Range	S.A.	ca. 140km N. Adelaide

Basedow Range	N.T.	ca. 205km S.W. Alice Springs
Bathurst	N.S.W.	ca. 155km W.N.W. Sydney
Beltana	S.A.	ca. 195km N.N.E. Port Augusta on rail line
Bendigo	Vict.	ca. 140km N.W. Melbourne
Beni	N.S.W.	ca. 15km N.E. Dubbo
Beresford	S.A.	ca. 140km W.N.W. Marree - on rail line
Berrawinia Downs	N.S.W.	ca. 80km N.W. Wanaaring
Berri	S.A.	ca. 190km N.E. Adelaide
Berribbeee Tank	Vict.	ca. 77km W.S.W. Wentworth, N.S.W.
Beulah	Vict.	ca. 100km S. Ouyen
Bight, Great Australian		S. Western Australia and South Australia
Bilbarks (Bilbarka) Camp	N.S.W.	ca. 5km N. Pooncarie
Billilla	N.S.W.	ca. 40km S.W. Wilcannia on Darling R.
Binda Bore	Qld.	ca. 25km N.W. Bollon
Bindy-1	S.A.	see Koonamore Vegetation Reserve
Birdsville	Qld.	ca. 12km N. South Australian border
Birdsville Track	S.A.	
	Qld.	Marree to Birdsville
Birrabirramah	N.S.W.	near Pokataroo
Blackall	Qld.	ca. 840km N.W. Brisbane
Blanchetown	S.A.	ca. 110km N.E. Adelaide - on Murray R.
Blinman	S.A.	ca. 75km N.N.E. Port Augusta
Bluff Station	Qld.	= Roseberth (q.v.)
Bogan Gate	N.S.W.	ca. 105km N.E. West Wyalong

Boiler Waterhole	S.A.	ca. 80km W.N.W. Oodnadatta
Bollon	Qld.	ca. 180km S.S.W. Mitchell
Boochamatta	S.A.	ca. 85km W. Broken Hill
Bookaloo	S.A.	ca. 75km N.W. Port Augusta on rail line
Booleroo Centre	S.A.	ca. 70km S.E. Port Augusta
Boomley	N.S.W.	ca. 50km N.E. Dubbo
Boorthana	S.A.	ca. 130km S.S.E. Oodnadatta - on rail line
Bootra	N.S.W.	ca. 110km S. E. Milparinka
Bopeechee	S.A.	ca. 55km W. Marree - on rail line
Boppy Mt.	N.S.W.	ca. 45km E. Cobar
Borung	Vict.	ca. 70km N.W. Bendigo
Boulder	W.A.	ca. 10km S. Kalgoorlie
Bourke	N.S.W.	ca. 450km N.E. Broken Hill on Darling
Bower	S.A.	ca. 110km N.E. Adelaide
Brachina Gorge	S.A.	ca. 10km E. Brachina rail crossing
Brachina rail crossing	S.A.	ca. 140km N.N.E. Port Augusta
Brewarrina	N.S.W.	ca. 90km E.N.E. Bourke
Brindingabba	N.S.W.	ca. 50km E.S.E. Hungerford
Broken Hill	N.S.W.	ca. 450km N.E. Adelaide, S.A.
Brookong	N.S.W.	ca. 15km S.W. Lockhart - Lockhart ca. 55km S.S.E. Narrandera
Bullgaroo = Bulgroo	Qld.	ca. 230km S.W. Blackall
Bullocky Springs Gully	Vict.	ca. 17km S.W. Winnap on lower Glenelg River - far S.W. corner of state
Bulloo River	Qld.	S.W. Qld. - flood plain into N.W. New South Wales

Bulong	W.A.	ca. 33km E. Kalgoorlie
Bundooma	N.T.	ca. 145km S. Alice Springs
Bunyeroo	S.A.	ca. 135km N.E. Port Augusta
Burdekin Station	N.S.W.	near Collarenebri
Burra	S.A.	ca. 145km N.N.E. Adelaide
Burren	N.S.W.	ca. 20km N.N.W. Burren Junction
Burren Junction	N.S.W.	ca. 80km E. Walgett
Byrock	N.S.W.	ca. 77km S.E. Bourke
Cadelga	S.A.	ca. 110km E.S.E. Birdsville, Qld.
Caiwarro	Qld.	ca. 115km S.W. Cunnamulla
Calder Highway	Vict.	Melbourne to Mildura
Callana	S.A.	ca. 15km W. Marree - on rail line
Camps 7-8 Elder Exploring Expedition	S.A.	ca. 130km W. Everard Ranges
Camp 9 Elder Exploring Expedition	S.A.	ca. 8km S.W. Camp 8
Camp 11 Simpson Desert Expedition	N.T.	ca. 340km E.S.E. Alice Springs
Camp 29 Mitchell Expedition 1846	Qld.	ca. 25km N. Mitchell
Camp 31 Simpson Desert Expedition	S.A.	just S. Goyder's Lagoon
Camp 33 Simpson Desert E Expedition	S.A.	ca. 160km S.S.W. Birdsville, Qld.
Camp 37 Simpson Desert Expedition	S.A.	ca. 230km N.N.E. Marree at Cowarie Station
Camp 38 Simpson Desert Expedition	S.A.	ca. 12km W.S.W. Camp 37
Camp 39 Simpson Desert Expedition Expedition	S.A.	ca. 195km N. Marree

Camp 42 Simpson Desert Expedition	S.A.	junction Macumba and Warburton R.
Canberra	A.C.T.	ca. 230km S.W. Sydney
Canegrass	S.A.	ca. 60km N.N.E. Morgan
Cannie	Vict.	ca. 130km N.W. Bendigo
Caraweena	S.A.	ca. 185km E.N.E. Marree - on Strzelecki Creek
Cariewerloo	S.A.	ca. 55km W. Port Augusta
Caroona = Coruna	S.A.	see Coruna
Carrieton	S.A.	ca. 70km E. Port Augusta
Casterton	Vict.	ca. 350km W. Melbourne
Castlereagh River	N.S.W.	N.-C. New South Wales - passes Coonamble
Chambers Gorge	S.A.	ca. 55km E.N.E. Blinman
Charlotte Waters	N.T.	ca. 240km S.S.E. Alice Springs
Cheeseman's Peak turnoff	S.A.	ca. 220km S.W. Ernabella
Chinapook	Vict.	ca. 153km S.E. Wentworth
clayflats on the Darling	N.S.W.	near Pamamaroo
Clayton River	S.A.	ca. 45-50km N.E. Marree - flows into Lake Eyre
Clayton River crossing	S.A.	ca. 50km N.N.E. Marree
Coally Station	N.S.W.	ca. 25km S.E. Milparinka
Cobar	N.S.W.	ca. 395km E.N.E. Broken Hill
Cobham's Lake	N.S.W.	ca. 50km S.E. Milparinka
Cobham Station	N.S.W.	as preceeding
Collarenebri	N.S.W.	ca. 70km N.E. Walgett
Condiments Plain	S.A.	Mt. Barry Station (q.v.)
Condobolin	N.S.W.	ca. 95km N. West Wyalong
Coober Pedy	S.A.	ca. 475km N.W. Port Augusta

Cook	S.A.	ca. 715km W.N.W. Port Augusta on rail line
Coolabah	N.S.W.	ca. 130km S.E. Bourke
Coolgardie	W.A.	ca. 35km S.W. Kalgoorlie
Cooma	N.S.W.	ca. 105km S. Canberra
Coonamble	N.S.W.	ca. 110km S.S.E. Walgett
Coondambo Siding	S.A.	ca. 250km N.W. Port Augusta - on rail line
Coongra Creek	S.A.	ca. 80km W.N.W. Oodnadatta
Cooper's Creek	S.A. Qld.	far N.-E. South Australia and S.-W. Queensland
Copper Hill Station	S.A.	ca. 110km S.W. Oodnadatta
Coruna	S.A.	ca. 65km S.W. Port Augusta
County Ularara	N.S.W.	N.-W. New South Wales
Coward Springs	S.A.	ca. 125km W.N.W. Marree - on rail line
Cowcowing	W.A.	ca. 105km N.E. Perth
Cradock	S.A.	ca. 80km N.E. Port Augusta
Crystal Brook	S.A.	ca. 100km S.S.E. Port Augusta
Cudnaka = Kanyaka	S.A.	ca. 65km N.E. Port Augusta
Culpaulin	N.S.W.	ca. 25km S.W. Wilcannia on Darling R.
Cummening	W.A.	prob. Cummenin or S. Kumminin - this ca. 45km N.E. Corrigin - Corrigin ca. 190km E.S.E. Perth
Cunnamulla	Qld.	ca. 285km S.W. Mitchell
Curnamona Station	S.A.	ca. 120km N. Yunta
Currawille	Qld.	ca. 210km N.E. Birdsville
Curriwillughi	Qld.	ca. 135km S.S.W. St. George

Dalhousie Springs	S.A.	ca. 115km N. Oodnadatta
Darling River	N.S.W.	N.-W. & W. parts of state - joins Murray River at Wentworth
Deep Well Siding	N.T.	ca. 70km S.S.E. Alice Springs
Deep Well Station	N.T.	ca. 10km N.E. Deep Well Siding
Deniliquin	N.S.W.	ca. 170km S.W. Narrandera
De Rose Hill Station	S.A.	ca. 250km N.W. Oodnadatta
Diamantina River	Qld.	S.-W. part - passes near Birdsville
Dimboola	Vict.	ca. 335km W.N.W. Melbourne
Dubbo	N.S.W.	ca. 290km N.W. Sydney
Dunlop Station	N.S.W.	ca. 105km S.W. Bourke on Darling R.
Durdidwarrah Creek	Vict.	ca. 40km W.N.W. Melbourne
Eatringinna Creek	S.A.	De Rose Hill Station
Ediowie	S.A.	ca. 130km N.N.E. Port Augusta on rail line
Edward Creek	S.A.	ca. 100km S.S.E. Oodnadatta on rail line
Edwards River	N.S.W.	S. Deniliquin-flows into Murray R.
Elizabeth River	S.A.	enters Pernatty Lagoon ca. 100km N.W. Port Augusta
Ellam	Vict.	ca. 40km N. Dimboola
Ellery Creek	N.T.	ca. 110km W.S.W. Alice Springs
Ellis Bore	S.A.	ca. 85km W. Todmorden on Alberga R.
Elming Station	Qld.	= Elmina Stn.? - ca. 12okm N.E. Cunnamulla
Emu	S.A.	ca. 250km N. Watson - Watson on East-West rail line
Enngonia	N.S.W.	ca. 85km N. Bourke

Ernabella	S.A.	ca. 350km W.N.W. Oodnadatta
Esperance Bay	W.A.	ca. 590km S.E. Perth
Etudinna	S.A.	ca. 105km N.E. Marree
Euabalong	N.S.W.	ca. 115km N.W. West Wyalong
Eucla	W.A.	southern coast - ca. 15km W. South Australian border
Eulo	Qld.	ca. 65km W.S.W. Cunnamulla
Eurio = Euria	S.A.	ca. 60km N.E. Fowler's Bay
Euston	Vict.	ca. 65km N.E. Ouyen on Murray R.
Evelyn Creek	N.S.W.	Barrier Range - N. Broken Hill
Evelyn Creek	S.A.	ca. 115km S.W. Oodnadatta
Evelyn Downs	S.A.	ca. 105km S.W. Oodnadatta
Everard Park Station	S.A.	ca. 275km W. Oodnadatta
Everard Ranges	S.A.	ca. 300km W. Oodnadatta
Farina	S.A.	ca. 50km S.S.E. Marree on rail line
Finke River	N.T. S.A.	S.-C. Northern Territory & N.-C. South Australia
Flinders Ranges	S.A.	N.-E. Port Augusta - between Lakes Torrens and Frome
Flood's Creek Mesas	N.S.W.	ca. 110km N. Broekn Hill
Florieton	S.A.	ca. 50km S.E. Burra
Fort Grey	N.S.W.	ca. 100km N.W. Milparinka
Fowler's Bay	S.A.	ca. 490km W. Port Augusta
Fowler's Gap	N.S.W.	ca. 95km N.N.E. Broken Hill
Fraser's Range	W.A.	ca. 180km S.E. Kalgoorlie

Gawler Ranges	S.A.	upper Eyre Peninsula
George Gill Range	N.T.	ca. 235km S.W. Alice Springs
Gidgee flood plain	S.A.	ca. 65km N. Oodnadatta
Giles	W.A.	ca. 130km N.W. of N.W. corner of S.A.
Gilgandra	N.S.W.	ca. 90km E.S.E. Coonamble
Gilruth Plains	Qld.	ca. 30km W.S.E. Cunnamulla
Gladstone	S.A.	ca. 185km N. Adelaide
Glenelg River	Vict.	far S.-W. part of state
Glenroy Station	N.S.W.	= Lenroy Stn.? ca. 20km N.E. Wanaaring
Goonamurra	Qld.	near Eulo
Gooniwindi	Qld.	ca. 300km S.W. Brisbane
Goorianawa	N.S.W.	ca. 55km S.E. Coonamble
Gordon	S.A.	ca. 60km N.E. Port Augusta
Goyders Lagoon	S.A.	ca. 350km N.N.E. Marree
Great Australian Bight		S. of Western Australia and South Australia - head of Bight ca. 200km E. of W.A. border
Grey Range	Qld.	ca. 85km N. New South Wales border far S.-W. Qld.
Gfiffith	N.S.W.	ca. 70km N.W. Narrandera
Gums Station	S.A.	ca. 40km S.E. Burra
Gypsum Well	S.A.	ca. 30km N. Oodnadatta
Halbury	S.A.	ca. 12km N.E. Balaclava
Hale River	N.T.	S.-E. Northern Territory - in western part of Simpson Desert
Hampton Plains	W.A.	ca. 85km E.S.E. Kalgoorlie

Happy Jack's Plain	N.S.W.	ca. 25km S. Kiandra
Hattah	Vict.	ca. 35km N. Ouyen
Hawker	S.A.	ca. 90km N.E. Port Augusta
Hawker Creek	S.A.	as preceeding
Hawks Nest Well	S.A.	ca. 120km W. Oodnadatta
Hay	N.S.W.	ca. 160km W.N.W. Narrandera
Henbury Station	N.T.	ca. 120km S.W. Alice Springs
Hermannsburg	N.T.	ca. 115km W.S.W. Alice Springs
Herrgott	S.A.	= Marree
Herrgott Springs	S.A.	= Marree
Hillston	N.S.W.	ca. 100km N.N.W. Griffith
Hinnomunjie	Vict.	ca. 10km N.N.E. Omeo
Hitchfeld's sandhills	S.A.	near Lake McFarlane
Hookina	S.A.	ca. 90km N.N.E. Port Augusta
Hopetoun	Vict.	ca. 75km S. Ouyen
Horseshoe Bend	N.T.	ca. 170km S. Alice Springs
Hughes	S.A.	ca. 780km W.N.W. Port Augusta on East-West rail line
Hungerford	N.S.W.	ca. 190km N.W. Bourke - on N.S.W.-Qld. border
Hutuanji	N.S.W.	= Noonthorangee Range, ca. 150km N.E. Broken Hill
Ideyaka	S.A.	ca. 35km N.W. Leigh Creek
Idracowra Station	N.T.	ca. 130km S.S.W. Alice Springs
Indiana Station	N.T.	ca. 160km N.E. Alice Springs
Innamincka	S.A.	ca. 325km N.E. Marree

Irrapatana	S.A.	ca. 165km N.W. Marree
Italowie Gorge	S.A.	ca. 30km E. Leigh Creek
Ivanhoe	N.S.W.	ca. 275km S.E. Broken Hill
Jeparit	Vict.	ca. 40km N. Dimboola
Jew's Lagoon	N.S.W.	N.W. Narrabri
John's Creek	S.A.	ca. 165km N.E. Hawker - enters Lake Frome
Kalgoorlie	W.A.	ca. 510km E.N.E. Perth
Kapunda	S.A.	ca. 75km N.N.E. Adelaide
Karoonda	S.A.	ca. 105km E. Adelaide
Katyil West	Vict.	ca. 18km N.E. Dimboola
Kenmore Park	S.A.	ca. 330km W.N.W. Oodnadatta
Kiandra	N.S.W.	ca. 70km N.W. Cooma
Kimba	S.A.	ca. 145km S.W. Port Augusta
Kinchina	S.A.	ca. 60km S.E. Adelaide
King Island	Tas.	in Bass Strait - between Tas. & Vict.
Kingoonya	S.A.	ca. 285km N.W. Port Augusta
Koonamore Station	S.A.	ca. 60km N. Yunta
Koonamore Vegetation Reserve	S.A.	on Koonamore Station
Kooringberry = Koonenberry	N.S.W.	ca. 180km N.E. Broken Hill
Kulgera Station	N.T.	ca. 250km S.S.W. Alice Springs
Kulkyne National Park	Vict.	ca. 75km S.E. Wentworth, N.S.W.
Kurrawang	W.A.	ca. 15km S.W. Kalgoorlie
Lachlan River	N.S.W.	S.-C. New South Wales

Lake Alexandrina	S.A.	ca. 70km S.E. Adelaide
Lake Blanche	S.A.	ca. 160km E.N.E. Marree
Lake Boga	Vict.	ca. 130km E.S.E. Ouyen
Lake Burrumbart	N.S.W.	ca. 60km N.E. Balranald
Lake Callabonna	S.A.	ca. 190km E.S.E. Marree
Lake Cargelligo	N.S.W.	ca. 100km N.W. West Wyalong
Lake Eyre	S.A.	north-eastern part of state
Lake Frome	S.A.	ca. 260km N.E. Port Augusta
Lake Gilles	S.A.	ca. 100km W.S.W. Port Augusta
Lake Harry	S.A.	ca. 40km N.E. Marree
Lake Hindmarsh	Vict.	ca. 40km N.N.W. Dimboola
Lake Kudgee	N.S.W.	ca. 95km S.S.E. Broken Hill
Lake McDonald	N.T.	ca. 510km W. Alice Springs
Lake McFarlane	S.A.	ca. 110km N.W. Port Augusta
Lake Menindie	N.S.W.	N.W. Menindie
Lake Torrens	S.A.	ca. 65km N. Port Augusta
Lake Tyrell	Vict.	ca. 50km S.E. Ouyen
Lake Wittakilla	S.A.	ca. 190km E.N.E. Leigh Creek junction Yandama & Boolkaree Cks.
Langawirra	N.S.W.	ca. 90km N.E. Broken Hill
Leigh Creek	S.A.	ca. 365km N.N.E. Port Augusta
Leitchville	Vict.	ca. 90km N. Bendigo
Level Post Bay	S.A.	S.-E. side of Lake Eyre
Lincoln Gap	S.A.	ca. 20km S.W. Port Augusta
Linda Creek	N.T. Qld.	ca. 480km E.N.E. Alice Springs
Livingstone	N.S.W.	county in W.-C. New South Wales

Livingstone Creek	Vict.	near Omeo - joins Mitta Mitta R.
Louth	N.S.W.	ca. 90km S.W. Bourke on Darling R.
Loveday	S.A.	ca. 5km S.W. Barmera
Lyndhurst	S.A.	= Mt. Lyndhurst
Mable Creek	S.A.	ca. 195km S.W. Oodnadatta
Macquarie River	N.S.W.	ca. 160km N.N.E. Nyngan
Macumba River	S.A.	N.E. Oodnadatta, flows into L. Eyre
Macumba Station	S.A.	ca. 40km N.E. Oodnadatta
Maralinga	S.A.	ca. 30km N. Watson on E-W rail line
Maranoa River	Qld.	S. Qld. - Mitchell to St. George
Marree	S.A.	ca. 340km N. Port Augusta
Maryvale	Vict.	ca. 130km E.S.E. Melbourne
Mazar Station	N.S.W.	ca. 100km S.W. Broken Hill
Melton	Vict.	ca. 35km W.N.W. Melbourne
Melton Station	S.A.	ca. 30km N.N.W. Yunta
Menindie	N.S.W.	ca. 100km S.E. Broken Hill
Merrinee	Vict.	ca. 30km S.S.W. Wentworth, N.S.W.
Mildura	Vict.	ca. 25km S.E. Wentworth, N.S.W.
Millewa	Vict.	ca. 65km S.W. Wentworth, N.S.W.
Millewa County	Vict.	N.-W. part of state
Milparinka	N.S.W.	ca. 250km N.N.E. Broken Hill
Minnie Downs	S.A.	ca. 105km S.S.E. Birdsville, Qld.
Minyip	Vict.	ca. 50km E. Dimboola
Mitchell	Qld.	ca. 520km W.N.W. Brisbane
Mitta Mitta	Vict.	ca. 65km N.N.W. Omeo
Monalena	S.A.	cited as "near W.A. border" but

		Monalena Stn. ca. 105km N.W. Port Augusta
Moolawatana Station	S.A.	ca. 155km E.S.E. Marree
Moolooloo Station	S.A.	ca. 30km N.N.W. Blinman
Mooloorina Station	S.A.	see Mulorrina Stn.
Moore River	W.A.	enters sea ca. 70km N.W. Perth
Moorilyana	S.A.	ca. 240 km W.N.W. Oodnadatta
Mootwingee	N.S.W.	ca. 110km N.E. Broken Hill
Morgan	S.A.	ca. 145km N.E. Adelaide on Murray R.
Morphett Vale	S.A.	ca. 25km S. Adelaide
Morundie	S.A.	ca. 110km N.E. Adelaide - near Blanchetown
Mossgiel	N.S.W.	ca. 50km S.E. Ivanhoe
Mt. Aleck	S.A.	ca. 20km N.N.E. Hawker
Mt. Bayley	S.A.	ca. 12km N. Beltana
Mt. Barry Station	S.A.	ca. 115km S.W. Oodnadatta
Mt. Brown	N.S.W.	ca. 12km S.W. Milparinka
Mt. Cavanagh	N.T.	ca. 260km S.S.W. Alice Springs
Mt. Chambers Gorge	S.A.	ca. 35km E.N.E. Blinman
Mt. Clarence	S.A.	Stuarts Range - near Coober Pedy
Mt. Eba Station	S.A.	ca. 310km N.W. Port Augusta
Mt. Enniskillen	Qld.	ca. 60km S.E. Blackall
Mt. Gunson mine	S.A.	ca. 145km N.W. Port Augusta
Mt. John	S.A.	ca. 135km N.E. Port Augusta - Wilpena Pound
Mt. Lyndhurst Station	S.A.	ca. 85km S.E. Marree
Mt. Margaret	W.A.	ca. 225km N.N.E. Kalgoorlie
Mt. Mary	S.A.	ca. 120km N.E. Adelaide

Mt. Murchison	N.S.W.	ca. 30km E.N.E. Wilcannia on Darling
Mt. Olga	N.T.	ca. 370km S.W. Alice Springs
Mt. Oxley	N.S.W.	ca. 45km E.S.E. Bourke
Mt. Parry	S.A.	ca. 20km W.N.W. Leigh Creek
Mt. Peole Station	N.S.W.	ca. 15km N.W. Milparinka
Mt. Quinn	N.T.	ca. 50km W. Henbury Station
Mt. Remarkable	S.A.	ca. 50km S.E. Port Augusta - at Melrose
Mt. Sarah	S.A.	ca. 65km N. Oodnadatta
Mt. Serle	S.A.	ca. 40km E. Leigh Creek
Mt. Sir Henry	N.T.	ca. 10km W. Mt. Cavanagh
Mt. Willoughby Station	S.A.	ca. 140km W.S.W. Oodnadatta
Mt. Woodroffe	S.A.	ca. 380km N.W. Oodnadatta - Musgrave Ranges
Mt. Wudinna	S.A.	ca. 210km W.S.W. Port Augusta
Mulligan River	Qld.	W. Birdsville
Muloorina Station	S.A.	ca. 50km N.N.W. Marree
Mundi Mundi Plains	N.S.W.	ca. 40km N.W. Broken Hill
Mundowdna Siding	S.A.	ca. 15km S. Marree
Mundowdna Swamp	S.A.	as preceeding
Mungeranie	S.A.	ca. 180km N.N.E. Marree
Murchison River	W.A.	enters sea ca. 150km N. Geraldton
Murnpeowie Station	S.A.	ca. 90km E. Marree
Murray River		boundary between N.S.W. & Vict. - enters sea in S.A. ca. 80km S.E. Adelaide
Murray Valley Highway	Vict.	northern part - follows Murray R.
Murrumbidgee River	N.S.W.	S.-C. New South Wales - enters Murray R. S.-W. Balranald

Musgrave Ranges	S.A.	ca. 340km N.W. Oodnadatta
Murtree = L. Murteree	S.A.	ca. 240km E.N.E. Marree
Nannine	W.A.	ca. 520km N.W. Kalgoorlie
Nantabibbie	S.A.	ca. 90km N.N.E. Burra on Broken Hill rail line
Nappa Merrie	Qld.	ca. 25km N.E. Innamincka, S.A.
Narrabri	N.S.W.	ca. 165km E.S.E. Walgett
Narrandera	N.S.W.	ca. 110km S.S.W. West Wyalong
Narromine	N.S.W.	ca. 35km W. Dubbo
Neales River	S.A.	W. & S.E. Oodnadatta
Nepabunna	S.A.	ca. 55km E.S.E. Leigh Creek
New Crown Station	N.T.	ca. 230km S.S.E. Alice Springs
Nhill	Vict.	ca. 40km W.N.W. Dimboola
Nicholson	N.S.W.	coutny in W.-C. New South Wales
Nimitybelle	N.S.W.	ca. 350km S.S.W. Sydney
Nindigully	Qld.	ca. 40km S.E. St. George
Nonning	S.A.	ca. 110km W. Port Augusta
Noora	S.A.	ca. 30km S.E. Berri
Northhampton Downs	Qld.	ca. 25km E.S.E. Blackall
Nullarbor Plain	S.A.	far S.-W. part of state
Nyngan	N.S.W.	ca. 145km N.W. Dubbo
Oakden Hills Station	S.A.	ca. 125km N.W. Port Augusta
Olary	S.A.	ca. 250km E. Port Augusta
Oldbury	N.S.W.	ca. 15km from Berrima - Berrima ca. 105km S.W. Sydney
Omeo	Vict.	ca. 245km E.N.E. Melbourne

Oodnadatta	S.A.	ca. 580km N.W. Port Augusta - on Alice Springs rail line
Ooldea	S.A.	ca. 590km W.N.W. Port Augusta - on East-West rail line
Ooraminna	N.T.	ca. 50km S. Alice Springs
Oratunga	S.A.	ca. 175km N.N.E. Port Augusta
Orroroo	S.A.	ca. 80km E.S.E. Port Augusta
Ouyen	Vict.	ca. 115km S.S.E. Wentworth, N.S.W.
Packsaddle	N.S.W.	ca. 155km N.N.E. Broken Hill
Paika	N.S.W.	ca. 20km N. Balranald
Paldrumatta Bore	N.S.W.	ca. 60km S.E. Milparinka
Panaramittee	S.A.	ca. 10km S. Yunta
Pandie Pandie Station	S.A.	ca. 25km S. Birdsville, Qld.
Parachilna	S.A.	ca. 160km N.N.E. Port Augusta
Paradise Tank	N.S.W.	ca. 40km S. Hay
Paroo River	N.S.W.	N.-W. New South Wales
Parwan	Vict.	ca. 35km W.N.W. Melbourne
Peak Hill	N.S.W.	ca. 65km S.W. Dubbo
Peake River	S.A.	ca. 65km S.S.E. Oodnadatta
Pedirka	S.A.	ca. 100km N.N.W. Oodnadatta
Penaroo Station	Qld.	ca. 30km N. Eulo
Peterborough	S.A.	ca. 110km S.E. Port Augusta
Piangil	Vict.	ca. 90km E. Ouyen
Piangobla Station	N.S.W.	ca. 40km N.W. Collarenebri
Pichi Richi Pass	S.A.	between Quorn and Port Augusta
Pilliga Scrub	N.S.W.	S.-W. Narrabri - Pilliga ca. 85km W. Narrabri

Pilpa	N.S.W.	N. Scopes Range - ca. 70km E. Broken Hill
Pimba	S.A.	ca. 165km N.N.W. Port Augusta
Pine Plains	Vict.	ca. 110km N. Dimboola
Point Pomonda	S.A.	L. Alexandrina - ca. 85km S.E. Adelaide
Pokataroo	N.S.W.	ca. 15km S.E. Collarenebri
Pooncarie	N.S.W.	ca. 100km N.E. Wentworth
Port Augusta	S.A.	ca. 320km N.N.W. Adelaide - near head of Spencer Gulf
Pulpalla	N.S.W.	ca. 70km N.W. Cobar
Purnamooto	N.S.W.	ca. 30km N.N.W. Broken Hill
Purnong	S.A.	ca. 95km E. Adelaide
Purple Downs	S.A.	ca. 200km N.W. Port Augusta
Pyramid Hill	Vict.	ca. 80km N.N.W. Bendigo
Quorn	S.A.	ca. 30km N.E. Port Augusta
Reedy Creek	N.T.	George Gill Range - ca. 235km S.W. Alice Springs
Reid	W.A.	ca. 630km E. Kalgoorlie
Restdown Station	N.S.W.	ca. 60km S.E. Cobar
Retreat	Qld.	ca. 65km N. Goondiwindi
Richardson River	Vict.	ca. 70km S.E. Dimboola
Ringwood Station	N.T.	ca. 110km E. Alice Springs
Robinvale	Vict.	ca. 65km N.E. Ouyen on Murray R.
Rocky River	S.A.	ca. 17km S.W. Gladstone
Roma	Qld.	ca. 95km E. Mitchell
Roseberth Station	Qld.	ca. 20km N. South Australian border

Rumbalara	N.T.	ca. 190km S.S.E. Alice Springs
St. George	Qld.	ca. 440km W.S.W. Brisbane
St. Vincent's Gulf	S.A.	east of Yorke Peninsula
Scone	N.S.W.	ca. 195km N.N.W. Sydney
Silverton	N.S.W.	ca. 25km N.W. Broken Hill
Simpson Desert	S.A. N.T.	south-eastern N.T. and adjacent S.A. north of Lake Eyre
South Neales	S.A.	south branch of Neales R. - immediately south & west of Oodnadatta
Spalding	S.A.	ca. 160km N. Adelaide
Spear Creek	S.A.	ca. 20km S.E. Port Augusta
Spencer Gulf	S.A.	between Eyre and Yorke Peninsulas
Stephen's Creek	N.S.W.	ca. 15km N. Broken Hill
Stokes Range	Qld.	ca. 450km S.W. Cunnamulla
Strangway's Springs	S.A.	ca. 150km W.N.W. Marree
Strathalbyn	S.A.	ca. 50km S.E. Adelaide
Strzelecki Creek	S.A.	N.-E. part of state - Innamincka to Lake Blanche
Stuart's Range	S.A.	E. Coober Pedy
Sturt Highway		S.A., also ± follows Murray R. into S. part N.S.W.
Suggan Buggan	Vict.	ca. 65km E.N.E. Omeo
Swan Hill	Vict.	ca. 290km N.W. Melbourne
Swan River	W.A.	S.-W. part - flows through Perth
Tambo	Qld.	ca. 95km S.E. Blackall
Tanbar	Qld.	ca. 250km E. Birdsville

Tarcoola	S.A.	ca. 360km N.W. Port Augusta
Tarella	N.S.W.	ca. 80km N.W. Wilcannia
Tarrawingee	N.S.W.	ca. 55km N. Broken Hill
Tea Cosy Creek Gorge	S.A.	ca. 15km E.S.E. Parachilna
Teetulpa Station	S.A.	ca. 6km N. Yunta
Tempe Downs	N.T.	ca. 170km S.W. Alice Springs
Termination Hill	S.A.	ca. 45km N.W. Leigh Creek
Torrick Pine Forest	Vict.	E.S.E. Pyramid Hill
Thallon	Qld.	ca. 75km S.S.E. St. George
Thargomindah	Qld.	ca. 190km W. Cunnamulla
The Gums Station	S.A.	ca. 40km S.E. Burra
The Twins Station	S.A.	ca. 350km N.W. Port Augusta
Thorndale	N.S.W.	ca. 8km E. Broken Hill
Thurloo Downs	N.S.W.	ca. 80km N.W. Wanaaring
Thylungra	Qld.	ca. 210km N. Thargomindah
Tibooburra	N.S.W.	ca. 290km N.N.E. Broken Hill
Tietkins Birthday Creek	S.A.	ca. 365km N.W. Oodnadatta
Tilcha	S.A.	ca. 265km E. Marree
Tilpa	N.S.W.	ca. 115km N.E. Wilcannia on Darling R.
Tilquin Station	Qld.	ca. 8km S. Dollon
Tinga-Tingana	S.A.	ca. 220km E.N.E. Marree
Todmorden Station	S.A.	ca. 60km N.W. Oodnadatta
Tolarno Station	N.S.W.	ca. 45km S. Menindie on Darling R.
Tomingley	N.S.W.	ca. 50km S.W. Dubbo
Tomkinson Range	S.A.	extreme N.-W. corner of state
Trangie	N.S.W.	ca. 85km S.E. Nyngan

Umbeara Well	N.T.	ca. 225km S. Alice Springs
Underbool	Vict.	ca. 50km W.S.W. Ouyen
Urana	N.S.W.	ca. 70km S.W. Narrandera
Urisino	N.S.W.	ca. 190km E. Milparinka
Wagga Wagga	N.S.W.	ca. 95km S.E. Narrandera
Wakool	N.S.W.	ca. 55km W. Deniliquin
Walgett	N.S.W.	ca. 500km N.W. Sydney
Wallangarra	Qld.	ca. 200km S.W. Brisbane
Walloway	S.A.	ca. 75km E.S.E. Port Augusta
Wallumbilla	Qld.	ca. 40km E. Roma
Wamboota	Vict. ? N.S.W.	cited as Vict., but probably Womboota in N.S.W. ca. 50km S.S.W. Deniliquin
Wanaaring	N.S.W.	ca. 180km W.N.W. Bourke
Wanganella	N.S.W.	ca. 40km N.N.W. Deniliquin
Wangiana	S.A.	ca. 40km W. Marree
Wangan	N.S.W.	ca. 30km S. Pilliga
Wantapella Bore	S.A.	ca. 185km W. Oodnadatta
Warburton River	S.A.	enters N.-E. part Lake Eyre
Warrego River	N.S.W.	SW.-C. part of state - enters Darling R. ca. 70km S.W. Bourke
Warrie Station	Qld.	near Nindigully
Warrie Station	N.S.W.	ca. 40km S. Coonamble
Warrina	S.A.	ca. 50km S.S.E. Oodnadatta
Warrumbungle Mts.	N.S.W.	ca. 130km S. Narrabri
Wellington	S.A.	ca. 85km S.E. Adelaide - near Lake Alexandrina
Wentworth	N.S.W.	junction of Murray & Darling R.

Wentworth (cont'd)		ca. 90km E. South Australian border
West Wyalong	N.S.W.	ca. 350km W. Sydney
Whyalla	S.A.	ca. 60km S.S.W. Port Augusta
Wilcannia	N.S.W.	ca. 150km E.N.E. Broken Hill
Wilgena	S.A.	ca. 15km S.E. Tarcoola
Wilkie's Creek	N.S.W.	ca. 50km W.N.W. Walgett
William Creek	S.A.	ca. 175km S.E. Oodnadatta
Willochra Plain	S.A.	ca. 45km N.E. Port Augusta
Willow Point	N.S.W.	ca. 105km N. Wentworth on Anabranch of Darling R.
Wilpena	S.A.	ca. 135km N.E. Port Augusta
Wilpena Creek	S.A.	as preceeding
Wimmera	Vict.	district in west-central part
Winnap	Vict.	lower Glenelg River - ca. 40km S. Casterton
Wintinna Station	S.A.	ca. 130km W.S.W. Oodnadatta
Wirchilleba	N.S.W.	ca. 110km S.S.E. Cobar
Wirrabara Forest	S.A.	ca. 30km N.N.W. Gladstone
Wirrilta = Wirrulla ?	S.A.	Wirrulla ca. 300km W. Port Augusta
Witchipool	Vict.	ca. 75km E.N.E. Dimboola - near Litchfield
Wittabrinna	N.S.W.	ca. 7km N. Tibooburra
Woolgangi	S.A.	ca. 50km N.N.W. Morgan
Woolshed Flat	S.A.	ca. 20km E.N.E. Port Augusta
Wudinna	S.A.	ca. 220km S.W. Port Augusta
Wyalong	N.S.W.	ca. 5km E. West Wyalong
Wyandra	Qld.	ca. 100km N.N.E. Cunnamulla

Wynbring	S.A.	ca. 460km N.W. Port Augusta
Wyperfield	Vict.	ca. 80km N. Dimboola - near Yaapeet
Yaapeet	Vict.	ca. 75km N. Dimboola
Yadlaceena = Yadlakina	S.A.	ca. 30km N.W. Leigh Creek
Yalleroi	Qld.	ca. 50km N.E. Blackall
Yancannia	N.S.W.	ca. 230km N.E. Broken Hill
Yandama Station	N.S.W.	ca. 45km W.N.W. Milparinka
Yarriambiack Creek	Vict.	ca. 50km N.E. Dimboola - flows into L. Coorong near Hopetoun
Yarrowie = Appila	S.A.	ca. 85km S.E. Port Augusta
Yednalue	S.A.	ca. 90km N.E. Port Augusta
Yorke Peninsula	S.A.	between Spencer Gulf and Gulf of St. Vincent
You Yangs	Vict.	ca. 45km S.W. Melbourne
Yudnapinna	S.A.	ca. 70km N.W. Port Augusta
Yunta	S.A.	ca. 160km E. Port Augusta
Zara	N.S.W.	ca. 10km N.W. Wanganella

N.B.: Clover Creek — N.S.W. — location unknown

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