

THE GENUS *MATHEWSIA* (CRUCIFERAE)

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(received October 15th, 1965)

Among the endemic and sometimes localized genera of the *Cruciferae* occurring in South America, *Mathewsia* stands apart as an element of the distinctive desert flora of southwestern Peru and western Chile. As far as present records show, the genus is confined to a relatively narrow strip wholly west of the main Cordillera, not far from the Pacific Ocean. Some species are confined to washes or small arroyos known as quebrades. Others occur as part of the lomas vegetation of western Peru. Populations of the same species occupying different quebradas often differ from each other to a limited degree and in many instances probably little or no gene exchange occurs between them. The intervening dry areas, separating one quebrada from another, are completely unsuited to the growth of *Mathewsia* and form a natural barrier to the spread of any given population. Thus, with habitats only spottily available, the evolutionary divergence that has resulted in localized species of *Mathewsia* is readily understandable.

One of the real difficulties in studying a group of species inhabiting areas that have been infrequently visited by botanists, is the paucity of available material. Furthermore, unlike some species of *Cremolobus* (KHANNA and ROLLINS, 1965), the numbers of individuals in a given locality appear to be few and scattered. In some instances, only a single specimen of a given species has been found for study in all of the herbaria consulted. Under these circumstances, the bare essentials of the species are all that can be given and nothing can be said about their variation or distribution. The purpose of this paper is to present, as a first approximation, a taxonomic treatment of *Mathewsia* that will provide a sound basis for further research on the genus.

Mathewsia in Chile was briefly treated by GARAVENTA (1940). He recognized five species, *M. incana* Phil., *M. nivea* (Phil.) Schulz, *M. laciniata* Phil., *M. collina* Johnst., and *M. foliosa* H. & A. In this work a misinterpretation of *M. nivea* first made by SCHULZ (1928), in which the name was applied to plants with auriculate leaves and narrowly ovate fruits, was followed. It appears improbable that Schulz saw specimens of true *M. nivea*. At least, there were none cited. The material he called *M. nivea* is actually *M. auriculata* Phil. On the other hand, Garaventa was puzzled by the failure of accord between the short siliques, biseriate seeds and auriculate leaves, and the original description of *M. nivea*. It is doubtful whether he would have made the decision to place *M. auriculata* in the synonymy of *M. nivea*

had he not had the precedent of Schulz to influence him. Actually, *M. nivea* and *M. auriculata* are wholly distinct species.

Mathewsia laciniata Phil. is a later name applied to the species named *M. biennis* by Turczaninow, who attributed it to Bridges. Details are given in the discussion of *M. biennis* below. In other respects, Garaventa's treatment of *Mathewsia* for Chile coincides with the results obtained in this study of the genus. There has been no other general treatment.

GENERIC RELATIONSHIPS

SCHULZ (1936) associated *Mathewsia* with genera such as *Erysimum*, *Thelypodium*, and *Hesperis* in the tribe *Hesperideae*. All of the genera he placed in the *Hesperideae* occur in areas outside of South America, *Mathewsia* being the single exception, and I cannot find among them any that could readily be considered phylogenetically close to *Mathewsia*. In using the specific name *matthiolooides*, SCHLECHTENDAL (1857) obviously was reminded of the genus *Matthiola*, and, indeed, *Mathewsia matthiolooides* does have a general resemblance to some species of *Matthiola*. If one were to follow this as a clue and associate these genera together, *Mathewsia* would fall in the tribe *Matthioleae* as it was constituted by Schulz (l.c.). However, it would again stand alone as the only South American genus in the tribe and it is equally difficult to find any genus within it whose species are obviously related to those of *Mathewsia*.

In considering the relationships of any genus, the geographical distribution matters only insofar as it helps in providing suggestions of reasonably related genera. For this reason, the geography of a genus should not be overemphasized. On the other hand, phytogeographical information should not be completely ignored and the first place to look is nearby, not continents away. Following this suggestion, I find a more plausibly related genus in *Schizopetalon* than in either the *Hesperideae* or the *Matthioleae*. If *Mathewsia* were to be associated with *Schizopetalon*, it would then be placed in *Schizopetaleae*. However, too little is known about the relationships of these and other possibly related genera of the *Cruciferae* to justify a revision of the present system of classification at this time. We can be confident that the species of *Mathewsia* make up a well marked genus that stands somewhat apart from other genera of the family.

GENERAL CHARACTERISTICS OF THE GENUS

Most of the species of *Mathewsia* are suffruticose at base or definitely woody. The low shrubby habit is well developed in such species as *M. incana*, which is appropriately described as a low bush. There is a very dense covering of leaves on nearly all specimens of *Mathewsia* I have seen (cf. Plate VI). This feature may not extend to *M. matthiolooides* but our material of that species is too deficient to really determine the point.

The inflorescences eventually terminate every branch in *Mathewsia*

and the branches may be leafy nearly to the lower flowers, as in *M. foliosa* (Plate II, Fig. 3) and *M. biennis* (Plate III), or there may be a distinct naked peduncle, as shown by *M. incana* (Plate VI, Fig. 2) and *M. densifolia* (Plate V). The racemes of flowers vary from short to elongate and may have a dense cluster of buds at the apex during development or only a few buds loosely arranged. The fully developed infructescence reflects this variation in the inflorescence and may have the siliques densely overlapping or somewhat separated (Compare Plate II, Fig. 1 and Plate VI, Fig. 2).

Mathewsia has relatively large flowers and the flower pattern is rather consistent throughout the genus. The calyx is cylindrical with the erect equal sepals closely appressed to form a tube. There is no evidence that the sepals open at all during anthesis. The petals are yellowish throughout the genus but not a clear yellow. There are brownish tones present and in the dried specimens the petals are quite dark. The petal claw is consistently very narrow, tapering to a width comparable to that of the filaments at the point of insertion on the receptacle. The petal blade is thick and is at its widest dimension near the middle rather than at the apex as in most genera of the *Cruciferae*. Throughout the genus, the stamens are nearly equal in length and the filaments slightly exceed the calyx but the anthers are scarcely exerted from the flower.

The four nectaries are erect, considerably elongated and discrete. In several of the species, the nectaries are sufficiently persistent to be present on the receptacle when the fruits are nearly mature. The valves of the silique are flattened parallel to the septum, and may possess a central nerve. In all but two species, *M. matthioides* and *M. foliosa*, the siliques are very densely pubescent (cf. Plate V). The pubescence extends over the edge of the replum, at least above and below, and covers the style. It even extends to the interior of the valves in *M. biennis*. The plants of *Mathewsia* have a distinctive stigma. It is elongated, cylindrical and cap-like, without a noticeable indentation over the apex.

In all but two species, the seeds are well separated into two rows in each valve (Plate VI, Fig. 2). The separation is less definitive in *M. matthioides* and scarcely so at all in *M. nivea*. The septum is thick and spongy in most of the species, tending to invest the seeds in deep depressions within it. The seeds are wingless and are much shorter than the width of the silique. The cotyledons are basically incumbent throughout the genus although in a few instances the radicle was not in a central position at the back of one of the cotyledons.

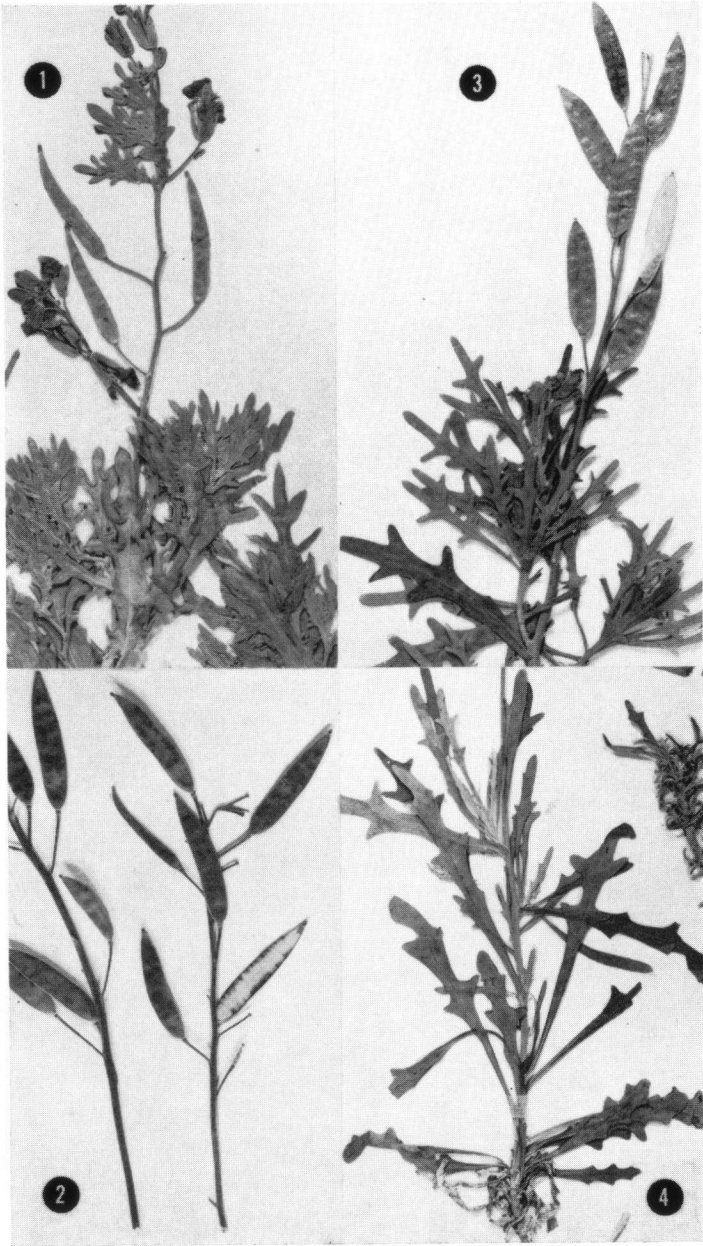
Aside from *M. matthioides*, which is nearly glabrous, and *M. foliosa*, which is covered with minute trichomes, *Mathewsia* is characterized by the presence of a thick, dense indument. The trichomes are predominantly dendritic in form and are highly branched. The overall effect of the indument is to make the plants look tawny or off-white rather than green.

Type species: *Mathewsia foliosa* Hook. et Arn.

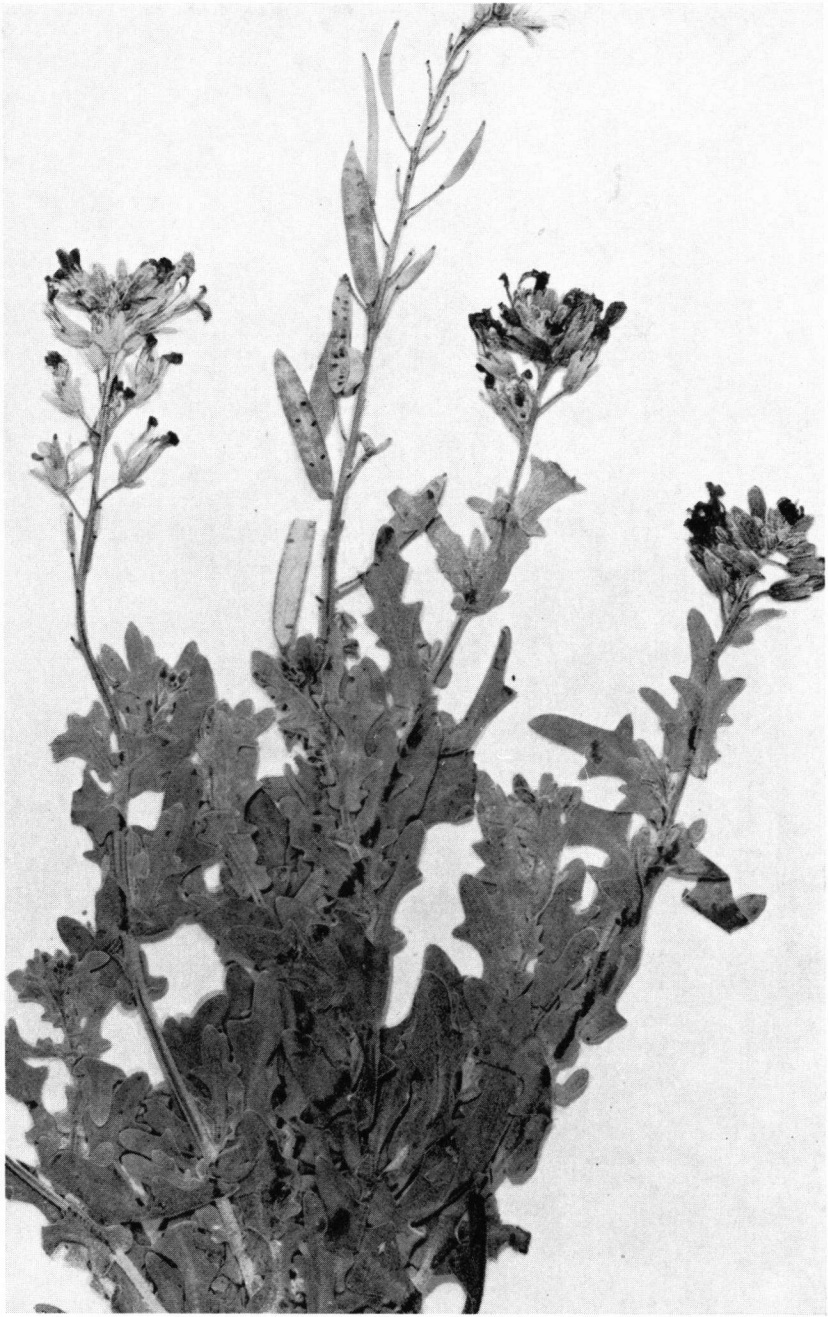


Mathewsia matthioides (Schlecht.) C. Muell. Photo of a portion of an isotype at Geneva. Note the exerted style in the lower flower at upper right of plate. The beak of the silique is evident at lower left.

Facing p. 104.



Figs. 1 & 2. *Mathewsia collina* Johnston (Johnston 3599, GH). Figs. 3 & 4. *M. foliosa* Hook. & Arn. (Fig. 3, Bertero 1296, G; Fig. 4, Bridges 479, GH).

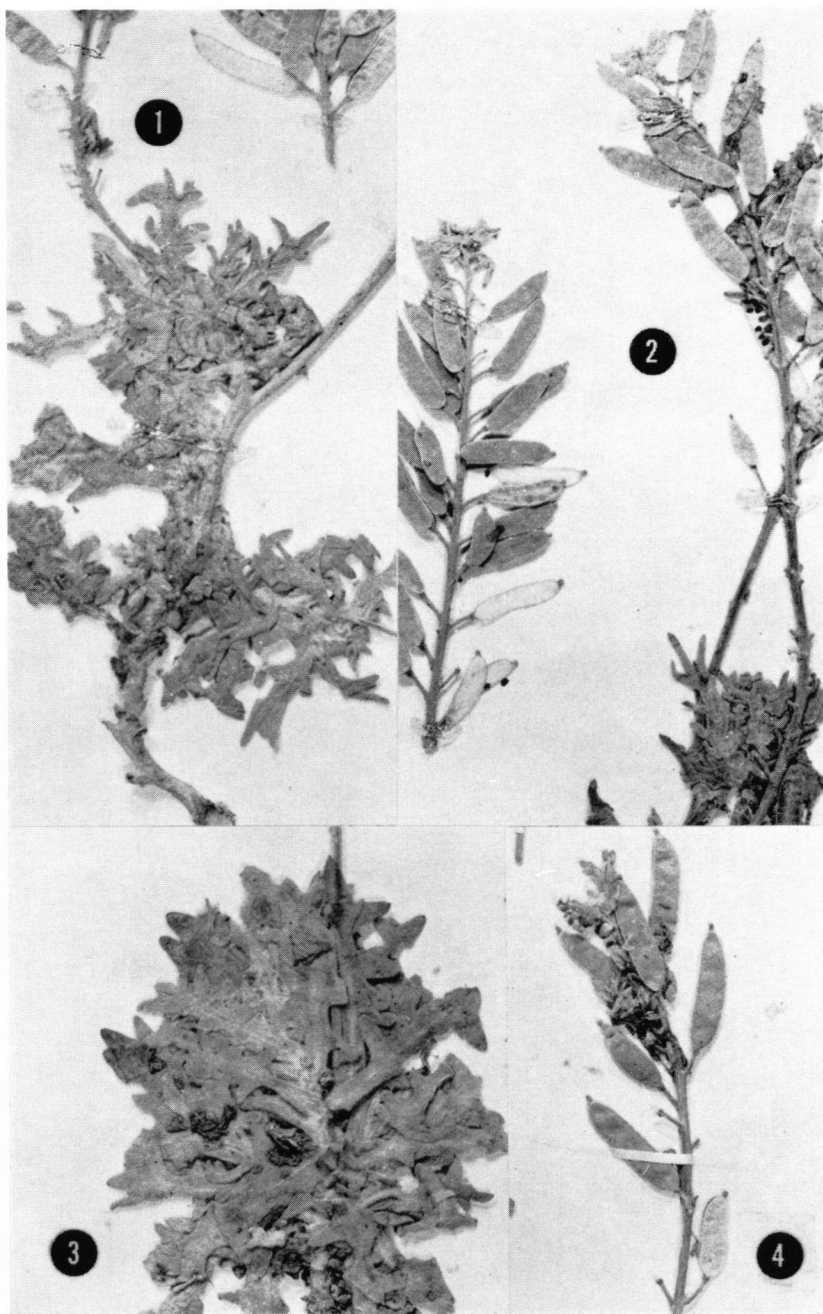


athewsia biennis Bridges ex Turcz. (Bridges 1281, GH).



Mathewsia peruviana Schulz (Ferreyra 12493, GH).

Plate IV



Figs. 1 & 2. *Mathewsia densifolia* Rollins, var. *densifolia* (Ferreya 11678, GH)
Figs. 3 & 4. *M. densifolia* var. *stylosa* Rollins (Vargas 8587, GH).

Plate V



Figs. 1 & 2. *Mathewsia incana* Philippi (Fig. 1, Gigoux 13, GH; Fig. 2, Johnston 5774).
Figs. 3 & 4. *M. auriculata* Philippi (Figs. 3 & 4, Wagenknecht 18409, GH). Note
auriculate leaves in Fig. 3, whitish pistils in Fig. 4.

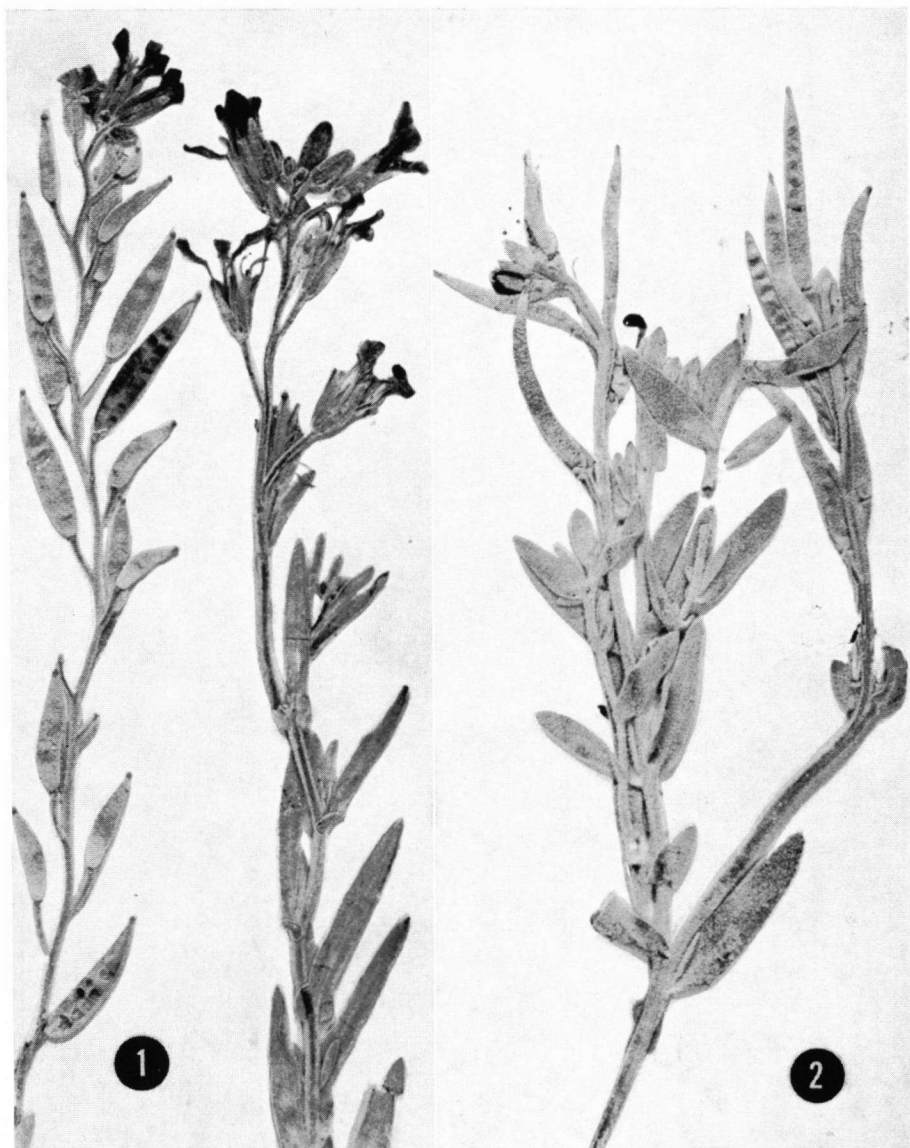


Fig. 1. *Mathewsia auriculata* Philippi (Geisse 47, NY). Fig. 2. *M. nivea* (Phil.) Schulz (Gigoux 1886, GH).

TAXONOMIC TREATMENT

Mathewsia Hook. & Arn., Hook. Bot. Misc. 3: 140. 1832.

Machaerophorus Schlecht., Linnaea 28: 469. 1857.

KEY TO THE SPECIES

- A. Leaves sinuate dentate to lobed, greenish to canescent.
 - B. Siliques glabrous.
 - C. Siliques narrowly linear, beaked toward apex, 4–6 cm long; pedicels glabrous. 1. *M. matthioides*
 - C. Siliques narrowly ovate, not beaked, 1.5–2 cm long; pedicels finely pubescent 2. *M. foliosa*
 - B. Siliques densely pubescent.
 - D. Lower flowers of raceme bracteate; valves pubescent on inner surface 3. *M. biennis*
 - D. Lower flowers of raceme without bracts; valves glabrous on inner surface.
 - E. Pedicels ascending, 6–10 mm long; leaves dorsiventral, strongly nerved below.
 - F. Pubescence uniform on leaves and stems; trichomes short stalked, leaves lobed 4. *M. collina*
 - F. Pubescence on stems and leaf veins much coarser than on leaf surfaces; trichomes long stalked; leaves mostly sinuate 5. *M. peruviana*
 - E. Pedicels widely spreading, 3–5 mm long; leaves similar above and below, scarcely nerved 6. *M. densifolia*
- A. Leaves entire, canescent.
 - G. Leaves narrowly linear; seeds nearly round, reticulate; infructescences borne on naked peduncles 7. *M. incana*
 - G. Leaves oblong; seeds definitely longer than broad, smooth; infructescences borne on leafy branches.
 - H. Leaves auriculate; siliques narrowly ovate; seeds in two separated rows in each valve of the silique 8. *M. auriculata*
 - H. Leaves non-auriculate; siliques linear, seeds in a single row in each valve of the silique 9. *M. nivea*

1. ***Mathewsia matthioides*** (Schlecht.) C. Muell.

Walp. Ann. Bot. Syst. 7: 144. 1868.

Machaerophorus matthioides Schlecht., Linnaea 28: 469–471. 1857.

Plants nearly glabrous throughout; cauline leaves linearly pinnatifid; rachis of infructescence markedly flexuose; pedicels straight,

divaricate, 1–2 cm long; flowers erect, style becoming exerted as flower matures; sepals linear-oblong, ca. 1.5 cm long, glabrous; petals unguiculate, up to 2.5 cm long, claw long, narrow and gradually expanded to a thickened blade; siliques divaricately ascending to erect, narrowly linear, flattened, glabrous, 4–6 cm long, 2–2.5 mm wide, tapering above into a definite beak that is up to 1 cm long; styles 2–3 mm long; stigma globular to cylindrical; septum spongy, much involuted and nearly investing the seeds; funiculi stout, ca. 1 mm long, seeds not filling silique width, more or less in two rows in each valve, wingless, oblong and plump, ca. 1.5 cm long, less than 1 mm wide; cotyledons incumbent.

Peru: rupestribus Cordillerae de Tuno-Maio, M. 1854, "W. Lechler pl. Peruviana". Ed. R. F. Hohenacker. 1702 (G, isotype).

There is no doubt about the correctness of placing this species in the genus *Mathewsia*. It not only has many of the characteristics exhibited by species of *Mathewsia* but there are no easily observable features that would justify its being withdrawn from the genus. This is true even though the species has much larger flowers, narrower and longer fruits than any other known species and a distinctive narrowing silique apex that forms a beak below the style. The upper portions of the stems, particularly the rachises of the inflorescences, are markedly flexuose. The flowers and fruits are borne on stiff pedicels that arise on the outside of each bend of the rachis (Plate I).

Apparently *M. matthioloides* is rare because only the type collection is known. The isotype from Geneva that I have studied consists of only the upper portion of the plant. The oldest flower of the inflorescence on one branch has the stigma considerably exerted. This suggests the possibility of protandry in the species.

2. *Mathewsia foliosa* Hook. & Arn.

Hook. Bot. Misc. 3: 140–141, tab. XCVI. 1832.

Plants suffrutescent, 2–5 dm high, usually with an elongated foot below the active leaves; leaves densely overlapping on the stems, narrowed to the base, deeply lobed to nearly pectinate, densely pubescent with minute dendritic trichomes, margins rolled toward under side; sepals erect, densely pubescent, 5–8 mm long; petals 1.5–2 cm long, claw exceeding sepals in length, blade narrowing toward apex, yellowish; pedicels slender, straight, ascending, 1–1.5 cm long; valves veiny, central nerve prominent; style 1–1.5 mm long; siliques flattened, narrowly oblong, 1.5–3 cm long, 5–7 mm wide; seeds oblong, plump, wingless, in two separated rows in each valve; cotyledons incumbent.

Chile: without locality, 1828, *Peppig 145* (G); 1829, *John Style* (G); *Bridges*, [Cuming] (G); *Bertero* (GH); *M. Guillemín* (GH). Prov. Valparaíso: Cliffs at Playa Aucha, Valparaíso, *Bridges 479* (GH, isotype; photo of type at GL); Valparaíso, 1835, *Dr. Gay* (G); Valparaíso. 1856–57, *Ph. Germain* (G); Valparaíso, Sept., 1830, *M. Bertero 1296* (G, GH, NY); Valparaíso, July 24, 1931, *C. Junge* (BAB, AA); Valparaíso, July 15, 1931, *F. Jaffuel 1753* (GH); Quintero, Nov., 1923, *Werdermann 27* (BAB, F, G, GH, UC, US); Quintero, Sept., 1963, *O. Zöllner 319* (GH). Prov. Coquimbo: Coquimbo, July-Aug., 1856, *W. H. Harvey* (GH); Viña del Mar,

Aug. 27, 1933, *D. H. Behn* (UC); Loma Frai Jorge, Aug. 17, 1917, *C. & O. Skottsberg* 853 (F, NY); Zapallar, Sept. 20, 1923, *D. H. Behn* (F).

The very dense, minute, highly branched trichomes covering the leaves, stems, pedicels and sepals in *M. foliosa* do not produce a canescent appearance as in such species as *M. nivea* and *M. incana*. The glabrous siliques are also in striking contrast to the indument covered parts of the plant. In this species, as in others of the genus, the seeds are small compared to the total width of the siliques and basically form two separate rows. Here they tend to lie near the replum margin, leaving a relatively large unoccupied space toward the center of the silique. The septum of the silique is a dense opaque structure but without the spongy convoluted characteristic found in the septum of *M. matthiolooides*.

All of the specimens referable to *M. foliosa* without question, have leaves that gradually taper to a narrow base without auricles (Plate II, Fig. 4). However, there is a specimen collected at Valparaiso without flowers or fruit and now deposited in the Museum of the University of La Plata, that seems to belong to *M. foliosa* but the leaves are auriculate at the base. If the leaf variation ranges as widely as this specimen would suggest, the variation pattern is somewhat broader than I have indicated. Actually, it is probable that the fragment in question represents an entirely different species.

Hooker's illustration of *Mathewsia foliosa* provides a good indication of the habit of this species. There must be a rather extensive woody "foot" present on most plants but it is difficult to be sure on this point because the lower woody portion of the plant is usually not included as part of the specimen. As far as I can determine, the plants are not extensively branched. Usually there are two to four branches arising at points considerably above the base.

3. *Mathewsia biennis* Bridges ex Turcz.

Bull. Soc. Nat. Mosc. 36: 550. 1863.

M. laciniata Philippi, Anal. Univ. Chile, 81: 194. 1892.

Perennial with a short suffruticose foot, branched from near the base; stems whitish pubescent, leafy, 2–3 dm high, leaves mostly sessile, auriculate, deeply dentate to irregularly lobed, oblong in outline, densely pubescent with highly branched trichomes, 2–4 cm long, 1–1.5 cm broad, lowermost leaves sometimes with a broad petiole and no auricles; lower flowers often bracteate; sepals erect, pubescent, narrowly oblong, 7–9 mm long, 1.5–2 mm wide; petals unguiculate, yellowish, 13–16 mm long, 2–3 mm wide, blade ovate, blunt at apex, claw very narrow; stamens equal or nearly so, anthers ca. 3 mm long; pedicels straight, divaricately ascending, whitish pubescent, 4–6 mm long; siliques ascending, flattened, whitish pubescent, narrowly oblong, 1.5–2.5 cm long, 3–4 mm wide, valves pubescent on inner surface, replum pubescent on outer margin; stigma conical, elongated; style less than 0.5 mm long; seeds in two distinct rows (Plate III), oblong, plump, reticulate, ca. 15 mm long, just above 1 mm wide, not mucilaginous; cotyledons incumbent.

Chile: without locality or other data, *Fielding* (GH); hills near Loz Pozos, between Huasco and Copiapo, Prov. Coquimbo, 1844, *Bridges 1280* (G, GH, isotypes); Desert of Atacama, 1885-87, *William Geisse 158* (NY, isotype of *M. laciniata*).

A specimen of *M. biennis* at Kew has the following label data: "Hexaptera pinnatifida 4 1-2 ft Dec. 6 Jan. 2 Mts. near snow E & N side of the Andes, Bridges 1118". These data appear to be erroneous because the species does not grow "near snow" or East and North of the Andes. The specimen is so similar to the material of Bridges 1280, I am inclined to believe it is a part of that collection that has somehow gotten wrong label data.

The original description of *M. biennis* was given by TURCZANINOW (1854) without a specific epithet being mentioned. Later (1863) he supplied the name *M. biennis* for the species, attributing it to Bridges. Turczaninow's assumption that the species is a biennial is almost certainly based upon the appearance of the specimens and not upon a knowledge of the growth cycle of the species. The specimens do look somewhat like a biennial but I believe the hard woody foot is more indicative of a perennial species. I am familiar with many desert species that flower the first year and if collected as specimens at that time would then be taken for annuals or at most biennials. However, these same plants continue to live and become increasingly shrubby over a period of years.

It is quite probable that the material of this species I have studied is all traceable to two collections, one by Bridges and the other by Geisse. The Fielding specimen certainly looks enough like Bridges 1280 to be part of the same collection.

4. *Mathewsia collina* Johnston

Contrib. Gray Herb. 85: 148. 1929.

Small fruticose bush with semi-decumbent outer branches, 3-5 dm high; stems leafy, whitish below with a fine, dense pubescence, greenish above; leaves sessile, dentate to pinnately lobed, narrowly oblong in outline, with a strong single nerve, 4-6 cm long, 1-2 cm wide, densely pubescent with minute highly branched trichomes, somewhat greenish in appearance, lowermost subauriculate, upper auriculate; inflorescence pedunculate, peduncle 3-6 cm long; sepals erect, narrowly oblong, densely pubescent, 6-8 mm long, 2-3 mm wide; petals cream-colored, 10-14 mm long, 3-4 mm wide, unguiculate, spatulate, broadest about middle of blade and narrowing to a blunt apex, claw slender; single stamens barely shorter than paired stamens; anthers acute at apex, ca. 3 mm long; pedicels 6-10 mm long, slender, straight, divaricately ascending, usually at about a 45 degree angle, densely pubescent, slightly expanded at summit; 4 conspicuous triangular nectar glands persistent on receptacle; siliques flattened, lanceolate, rounded below, gradually tapering above, 2-3 cm long, 3-4 mm wide, densely pubescent with minute highly branched trichomes; valves covering replum except at base and apex, glabrous on interior; replum pubescent at base and apex; style less than 1

mm long, densely pubescent; stigma expanded, nearly entire, immature seeds in two distinct rows, plump, very slightly longer than broad, reticulate, ca. 1.5 mm long, emitting a mucilaginous coating when wet; disposition of cotyledons with respect to radicle not determinable.

Chile: infrequent on talus slope, steep hillside, ca. 6 km north of Port and opposite Caleta Duendes, Tocopilla, Dept. Tocopilla, Prov. Antofagasta, Oct. 18, 1925, *I. M. Johnston 3599* (GH, type); Tocopilla, Oct., 1932, *Felix Jaffuel 2580* (GH).

Johnston correctly placed this species near *M. laciniata* [= *M. biennis*] and *M. foliosa*. In many ways it is intermediate between them in its characteristics (Plate II, Figs. 1 & 2). For example, the pubescence of *M. collina* is much finer and less matted than in *M. biennis* and does not produce the white tomentose appearance characteristic of *M. biennis*. On the other hand, the trichomes of *M. collina* are not as minute as those covering the leaves and stems of *M. foliosa* and the appearance of plants of the latter species is greener than in *M. collina*. In *M. foliosa* particularly, the covering of trichomes is relatively inconspicuous to the naked eye. The three species mentioned, although related, are amply distinct from one another and can be readily separated, as shown by the characters stressed in the key.

Unfortunately, I have not had mature seeds available for dissection and could not determine the exact position of the cotyledons with respect to the radicle. The shape of the seed suggests that the cotyledons might be accumbent. If that is so, *M. collina* differs from other species of the genus in this respect.

5. *Mathewsia peruviana* O. E. Schulz

Notizbl. Bot. Gart. Berl. 10: 562. 1929.

Plants suffruticose at base, pubescent throughout with mixtures of highly branched dendritic and sessile trichomes, leafy below the inflorescences, whitish tomentose, up to 5 or 6 dm high; leaves sinuate dentate to irregularly lobed, narrowly obovate to oblong in outline, sessile, upper auriculate and amplexicaule, lower subauriculate to auriculate, 4–12 cm long, 1–4 cm wide, dorsiventral, densely pubescent with minute highly branched trichomes on upper surface, often with larger stalked dendritic trichomes sparsely scattered over the surface and abundant along the mid-vein, lower surface pubescent with predominantly stalked branching trichomes; inflorescences 1–3 dm long, pedunculate, peduncle ca. 5 cm long, sepals narrowly oblong, acute, densely pubescent, 6–8 mm long, ca. 2 mm wide; petals unguiculate, yellowish, 14–18 mm long, ca. 4 mm wide, blade ovate, abruptly narrowed to a slender claw, tapered to a blunt apex; stamens equal, filaments equalling sepals at full anthesis, elongating as the flower ages, nectar glands persistent, lingulate; anthers ca. 3 mm long; pedicels divaricately ascending, straight or slightly incurved, 6–9 mm long; sometimes secund; siliques densely pubescent, flattened, narrowly ovate, rounded below, tapered above, 2–3 cm long, 4–5 mm wide, replum pubescent on outer margin; styles pubescent, 1–2 mm long; stigma

conical, nearly 1 mm long; seeds in two distinct rows, immature in the available material (Plate 4).

Peru, Dept. Arequipa, Prov. Caravelí: Lomas de Atico, Loma llamada del Taro, 1863, *Raimondi 11632* (Photo of type, F, GH); Lomas de Atico, entre chala y Camaná, Oct. 3, 1957, *Ramon Ferreyra 12493* (GH); same locality, Oct. 10, 1956, *Ferreyra 11946* (GH).

Raimondi gave the flower color as white on the label of the type specimen but Schulz evidently felt this might be an inaccuracy. In the original description, he was careful to attribute the designation of white flower color to Raimondi and, at the same time, indicated that in the dried specimens the color was obscurely brown. In both collections Ferreyra made, he noted the flower color to be "amarillentas" or yellowish. This fits the pattern for the genus and I am reasonably certain *M. peruviana* has yellowish flowers.

The lack of adequate material of *M. peruviana* leaves a lot to be desired in the way of information. Practically nothing about the range of variation can be discerned from the two specimens at hand because, although they both fit the general description of *M. peruviana*, they differ from each other in important ways and may possibly represent distinct taxa.

6. *Mathewsia densifolia* Rollins, sp. nov.

Plants herbaceous above and with a woody foot below, 1–2 dm high, densely covered throughout with a whitish to tawny indument of highly branched and matted trichomes; leaves densely clustered above the naked woody foot, sessile or short-petiolate, non-auriculate, oblong in outline, pinnately lobed, 2–4 cm long, ca. 1 cm wide, lobes linear-oblong to broader; inflorescence pedunculate; sepals erect, narrowly oblong, 5–6 mm long, 1.5–2 mm wide, densely pubescent; petals yellowish, unguiculate, narrowly spatulate with a narrow claw and attenuate to a narrow apex, widest above middle, 12–15 mm long, 2.5–3 mm wide; stamens nearly equal, pedicels straight, divaricately ascending to more widely spreading, 3–5 mm long; conspicuous, persistent, lanceolate nectar glands present on receptacle; siliques sessile, divaricate, flattened, oblong, rounded above and below, densely pubescent, ca. 1.5 cm long, 3.5–4.5 wide; replum covered by valves and glabrous except at apex and base where trichomes are present; stigma sessile or on a short style less than 1 mm long, conical, ca. 1 mm long; septum convoluted, dense, nearly enveloping seeds; seeds in two distinct rows, plump, longer than broad, ca. 2 mm long, ca. 1.5 mm broad, reticulate, conspicuously mucilaginous; cotyledons incumbent to obliquely incumbent.

Planta suffruticosa incana 1–2 dm alta; foliis oblongis pinnatifidis cano-pubescentibus sessilibus non-auriculatis 2–4 cm longis, ca. 1 cm latis; sepalis erectis anguste oblongis pubescentibus 5–6 mm longis, 1.5–2 mm latis; petalis unguiculatis fulveis anguste spathulatis superne attenuatis 12–15 mm longis, 2.5–3 mm latis; infructescentiis pedunculatis; pedicellis divaricatis rectis pubescentibus 3–5 mm longis; siliquis oblongis obtusis compressis cano-pubescentibus ca. 1.5 cm longis,

3.5–4.5 mm latis; seminibus oblongis emarginatis brunneis reticulatis ca. 2 mm longis, ca. 1.5 mm latis; cotyledonibus incumbentibus.

Key to the Varieties

Stigma sessile; leaf-segments narrowing to an acute apex
 6a. var. *densifolia*
 Stigma raised on a definite style; leaf-segments obtuse and broader
 6b. var. *stylosa*

6a. ***M. densifolia***, var. ***densifolia***

Type in the Gray Herbarium collected at Lomas de Tambo, Prov. Islay, Dept. Arequipa, Peru, Dec. 2, 1955, *Ramon Ferreyra 11678*.

6b. ***M. densifolia*** var. ***stylosa*** Rollins, var. nov.

Planta suffruticosa; foliis obtusis, stylis plus minusve 1 mm longis.

Type in the Gray Herbarium collected at Ilo, Lomas de Mostacilla, Prov. Maguegua, Dept. Maguegua, Peru, Nov., 1949, *C. Vargas C. 8587*.

Mathewsia densifolia has the silique shape and disposition in the infrutescence (Plate V) characteristically found in *M. incana* but the leaves are not at all linear and entire but are more like those of *M. linearifolia*. From an examination of a photograph of the type of *M. peruviana*, I was nearly ready to conclude that the specimens here described should be referred to *M. peruviana*. However, the receipt from Professor Ramon Ferreyra of good specimens from the type locality of *M. peruviana* made it abundantly clear that three, not two, very distinct species of *Mathewsia* occur in Peru, *M. matthioides*, *M. peruviana* and *M. densifolia*.

It is risky to set up two varieties of a species on the basis of only two collections but such a treatment represents my best estimate of the taxa present. Although no real evidence on population variation is available, the fact that the specimens from two different locations show two differences that may be presumed to be correlated, strongly suggests the presence of two minor taxa in these separated lomas.

According to the collector's notes, *M. densifolia* grows below 700 meters in rocky or gravelly places.

7. ***Mathewsia incana*** Philippi

Fl. Atacama 8. 1860.

Plants shrubby and considerably branched above the base, 3–10 dm high, up to 8 dm in diameter, branches erect, mostly terminated by inflorescences; leaves densely covering the actively growing parts of the bush, linear, entire, narrowed to base, non-auriculate, 2–5 cm long, 2–4 mm wide, whitish from a dense thick covering of highly branched trichomes; buds oblong; sepals remaining erect during anthesis, densely pubescent, 5–7 mm long; petals linear with a very

narrow claw, yellowish, 10–14 mm long; stamens exceeding the calyx, all six filaments nearly equal in length; infructescence narrow, racemose, elevated on a naked peduncle, pedicels straight, divaricately ascending, 5–10 mm long, scarcely expanded at summit; siliques narrowly ovate to narrowly oblong, flattened, erect to slightly divergent, 1.5–2.5 cm long, 3.5–5 mm wide, valves densely pubescent, 1-nerved below, replum pubescent on outer margin, septum dense, spongy, style pubescent, 0.5–1 mm long, stigma enlarged and elongated, entire; seeds wingless, plump, only very slightly longer than broad, ca. 1 mm long, in two well separated rows; cotyledons incumbent (Plate VI, Figs. 1 & 2).

Chile: Desert of Atacama, Sept.–Oct. 1890, *T. Morong 1129* (NY, US); Carrizal Bajo, *R. A. Philippi* (CORD); western part Prov. Atacama, 1922, *E. E. Gigoux 13* (GH); Quebrada del Leon, north of Caldera, Copiapo, Atacama, Oct. 20, 1938, *Worth and Morrison 16148* (UC); same locality, Nov., 1924, *Werdermann 442* (BAB, GH, NY, UC, US); vicinity of Aguada Grande, near Antofagasta, Atacama provincial boundary, Dec. 16–18, 1925, *Johnston 5774* (GH); region about Aguada Cachina, ca. 6 km inland from Caleta Esmeralda, Taltal, Antofagasta, Dec. 14–15, 1925, *Johnston 5748* (F, GH); El Rincon, just north of Paposo, Taltal, Antofagasta, Dec. 7, 1925, *Johnston 5516* (GH).

Mathewsia incana is found in dry areas near the coast of northern Chile. It is definitely of shrubby growth, and appears to vary considerably in compactness and height. One report indicates the plants may attain a height of as much as 2 meters. However, many plants are only a few decimeters tall. Active leaves tend to be concentrated near the ends of branches and there are extensive areas on the older parts of the plants that are essentially devoid of leaves or sometimes possess only dead leaf-remnants.

The growing parts of *M. incana* are very densely and thickly clothed with white highly branched trichomes. JOHNSTON (1929) in an apparently contradictory statement says that the siliques of the type and his own collection from Aguada Grande are glabrate or inconspicuously pubescent. However, I have carefully studied his collection (no. 5774) and find the siliques densely pubescent with minute trichomes but with mature valves that appear non-pubescent to the naked eye. I have not seen the type of *M. incana*. However, Johnston compared one of his own specimens with the Philippi type in Santiago and annotated the material as being the equivalent of the type. Johnston's specimen was collected in the type locality. There is no problem in fixing the proper application of the name.

The name *Mathewsia angustifolia* Philippi has appeared in synonymy under *M. incana* in at least two places but I cannot find evidence that it was properly published. It appears to be merely a name without any status and need not be taken into account in any way.

8. *Mathewsia auriculata* Philippi

Anal. Univ. Chile 81: 193. 1892.

Small shrub or woody-based perennial, densely clothed with whitish or tawny highly branched trichomes, branched near base and above,

2–4 dm high; leaves entire, sessile and auriculate, densely and thickly pubescent, oblong, obtuse, 1.5–4 cm long, 3–5 mm wide, overlapping along the active portions of the stems; inflorescences 5–10-flowered on leafy branches; sepals oblong, densely pubescent, erect at anthesis, 6–8 mm long; petals yellowish, linear-spatulate, 12–15 mm long, claw very narrow; filaments of all stamens nearly equal in length, anthers narrowly oblong, lobes separated at base; pedicels straight, erect to divaricate, 5–10 mm long, scarcely expanded at summit; siliques narrowly ovate, flat, tapering to rounded at apex, densely pubescent including replum margin and style, 1.5–4 cm long, 4–6 mm wide; style 0.5–1.5 mm long; stigma enlarged, cylindrical; septum dense, spongy, nearly embedding seeds; seeds oblong, wingless, plump, ca. 1.5 mm long, 1 mm wide, in two separated rows in the silique; cotyledons incumbent (Plate VI, Figs. 3 & 4; Plate VII, Fig. 1).

Chile: Desert of Atacama, *R. A. Philippi* (CORD, US, isotypes; F. GH, photo of specimen at B); 1885–7 *William Giesse* (NY); Huasco, Atacama, *R. A. Philippi* (CORD, US); Quebrada Canchas, Copiapo, Atacama, Sept., 1924, *Werdermann 422* (GH, UC); Cuesta Monte Grande, 20 km on road Rivadavia to Pisco Elqui, Elqui, Coquimbo, Aug. 5, 1939, *Wagenknecht 18409* (F. GH, UC).

The typification of *M. auriculata* has presented something of a problem because no Philippi specimen bearing the locality “Carrizal Bajo”, as given in the original publication of the name, could be located. Apparently Muñoz (1960) did not locate the type at the time he listed the specimens with which Philippi names are to be associated and this raises the question as to whether the type is preserved at the Museo Nacional in Santiago. However, the application of the name is quite certain on the basis of two sheets labeled “*Mathewsia auriculata* Ph. desertum Atacama” in the handwriting of Philippi. These sheets are on loan from the Museo Botánico at Córdoba and the U.S. National Herbarium. It is reasonably certain these are isotypes and I have so labeled them.

Philippi also collected and distributed specimens of this species with the label name *M. subauriculata*. These were obtained at Huasco. I cannot find that Philippi ever published the epithet *subauriculata* but it was picked up, apparently from the labeled specimen at Berlin, by Gilg and Muschler (1909). They gave the name in a new combination as a variety of *M. auriculata*. However, no description was supplied and, since the name had no published status previously, it is a *nomen nudum*. These Philippi specimens do differ from the type material of *M. auriculata* in minor ways, but considered in the frame of the total known variation of *M. auriculata*, they scarcely represent a distinctive formal taxon of any rank.

Mathewsia auriculata is most closely related to *M. nivea* and *M. incana*. From *M. nivea*, the species differs in having the seeds in two well separated rows in the silique instead of the nearly single row characteristic of *M. nivea*, by having a narrowly ovate broad silique in contrast to a linear much narrower one as in *M. nivea*, and by having definitely auriculate leaves instead of non-auriculate leaves. Actually, the silique-

shape is somewhat similar in *M. auriculata* and *M. incana*, but here the leaf-shape is widely different. In *M. incana*, the leaves are linear and non-auriculate, whereas in *M. auriculata*, they are oblong and auriculate. These two species can be readily distinguished from the seeds alone. The seeds of *M. incana* are nearly round or only very slightly elongated and the surface is conspicuously reticulate, while those of *M. auriculata* are smooth-surfaced, and at least one and one-half times longer than broad. Of course, it is difficult to be certain about growth habit unless one has had field experience with the species, but from what I can learn from label data and published sources, *M. incana* tends to be a relatively tall, somewhat sprawly shrub, often growing to a meter or more in height, while *M. auriculata* is a low subshrub, woody at the base only, and usually a few decimeters high.

9. ***Mathewsia nivea*** (Phil.) O. E. Schulz

Notizbl. 10: 465. 1928. Based on *Sisymbrium niveum* Phil.

Fl. Atac. 8. tab. I, fig. A 1-5. 1860.

Hesperis nivea (Phil.) O. Ktze., Revis. Gen. Pl. pt. 2: 935. 1891.

Plant suffruticose at base, fully clothed with a very dense whitish to tawny indument, trichomes of two types; dendritic type with a central axis fewer in number and exceeding in length a more extensive, compact and more highly branched type; leaves entire, sessile, rounded at base but not auriculate, 1.5-2.5 cm long, 4-8 mm broad; stems branched above; sepals erect, non-saccate, 8-10 mm long; petals erect, linear to linear-spatulate, 15-18 mm long; pedicels thick, erect, 3-5 mm long, summit markedly expanded, nectary prominent; siliques erect to slightly divaricate, crowded, linear-oblong, 2-3 cm long, 2.5-3 mm wide; septum dense but not spongy; style densely pubescent, less than 1 mm long; stigma bilobed; seeds in a single row, oblong, ca. 2 mm long, wingless; cotyledons incumbent, unequal, radicle exceeding the cotyledons (Plate VII, Fig. 2).

Chile: Prov. Atacama. Quebrada de Doña Ines Chica, Dept. Chanaral, Jan. 1886, E. E. Gigoux (GH); gulch below hospital, vicinity of Portrerillo, Oct. 22, 1925, Johnston 2666 (GH); below Mina Maricunga, in Quebrada del Mono, Dept. Copiapo, Nov. 3-4, 1925, Johnston 4847 (GH).

It is clear from Philippi's original description and drawing of *Sisymbrium niveum* that this species does belong to the genus *Mathewsia*, a disposition now well established. One point stressed by Philippi but ignored or overlooked by later authors is that the seeds are disposed in a single row in the silique. In many crucifers, there is variation as to seed disposition and this feature needs to be handled with caution. In this case, the single-rowed seeds do not provide a mandate to place *M. nivea* in *Sisymbrium* as Philippi believed, but, on the other hand, this character does aid in establishing the distinctness from closely related species having two rows of seeds.

SCHULZ (1928) attributed material (*Werdermann 422*) to *M. nivea* that is actually *M. auriculata*. From his listing of *M. auriculata* as a synonym in *Die Natürlichen Pflanzenfamilien* (1936), I assume he

considered both names to apply to the same species. However, I do not agree that this is the case

This species grows in the mountains of northern Chile at altitudes of 2500 to 3500 meters. The few specimens I have studied certainly do not indicate the total geographic range. According to Johnston's notes, the plants grow in loose soils on hillsides or at the base of talus slopes and are definitely woody at the base where the main branches of the plants arise. All of the principal branches and most of the subsidiary branches above are terminated by a compact racemose inflorescence that is less than a decimeter long. In habit and general appearance *M. nivea* is somewhat like the North American *Nerisyrenia camporum*.

Flowering material of *M. nivea* is most likely to be confused with *M. auriculata*. However, the base of the leaf of *M. nivea* is definitely not auriculate, even though in some plants the leaf scarcely narrows at the point of attachment to the stem. In fruit, there is no problem of distinguishing between these two species, because in *M. nivea*, the silique is linear and the seeds are in one row, whereas in *M. auriculata*, the silique is narrowly ovate and the seeds are in two well separated rows.

SPECIES EXCLUDED OR NAMES OF UNCERTAIN APPLICATION

M. boliviana Gilg and Muschl., Engl. Bot. Jahrb. 42: 464. 1909 = *Kardamoglyphos nana* Schlechtd. 1856 = **Rorippa nana** (Schlechtd.) Macbr.

M. diffusa Rusby, Bull. N. Y. Bot. Gard. 4: 322. 1907 = *Kardamoglyphos nana* Schlechtd. = **Rorippa nana** (Schlechtd.) Macbr.

Both *M. boliviana* and *M. diffusa* were based on the same collection, Miguel Bang, no. 1967, from Bolivia. I have seen five sheets of this number at F, NY, US.

M. linearifolia Turcz., Bull. Soc. Nat. Mosc. 36: 550. 1863. This name is based on a collection of Bridges, from Coquimbo, Chile, in the Turczaninow herbarium, which I have not seen. The description does not come even close to fitting any Bridges specimen of *Mathewsia* I have studied from the British Museum, Kew, Geneva or Gray, all of which have substantial if not complete sets of Bridges' Chilean collections. Since neither flowers nor fruit were described by Turczaninow, the description is not very helpful in trying to locate the proper application of the name. At this time, I have not been able to determine to what species of plants (in *Mathewsia* or out) the name *M. linearifolia* applies.

ACKNOWLEDGEMENTS

I am indebted to the Directors and Curators of the following herbaria for making materials in their care available for my study: British Museum (Natural History), London; Chicago Natural History Museum; Conservatoire de Botanique, Geneva; Herbarium of the University of California, Berkeley; Museo Botanico, Universidad Nacional de Córdoba; The New York Botanical Garden; Royal Botanic Gardens, Kew; and the United States National Herbarium, Smithsonian Institution,

Washington. These materials and the specimens in the Gray Herbarium are cited according to the abbreviations given by Lanjouw and Stafleu (1964).

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