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# SYSTEMATICS OF *LAPEIROUSIA* (IRIDACEAE–IXIOIDEAE) IN TROPICAL AFRICA<sup>1</sup>

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## ABSTRACT

The genus *Lapeirousia*, a member of the predominantly African subfamily Ixioideae of Iridaceae, is one of five genera of tribe Watsonieae and is the only one that is widespread in southern and tropical Africa. In this revision of the tropical members of the genus, 16 species are recognized, 14 assigned to the largely tropical sect. *Paniculata* (subg. *Paniculata*) and two to the largely temperate southern African sect. *Sophronia* (subg. *Lapeirousia*). One new species, *L. angolensis*, is described and *L. teretifolia* is raised from subspecies to species rank. The center for tropical African *Lapeirousia* is northern Namibia, but species occur across south tropical Africa to Mozambique and north to Ethiopia, Sudan, and Nigeria. *Lapeirousia* is one of few genera well represented in both tropical Africa and the winter-rainfall region of temperate southern Africa, and it is unique in its wide distribution in drier parts of Africa rather than the well-watered eastern highland areas of the continent. Variation among the species is largely floral, and flowers range from completely actinomorphic to medianly zygomorphic and from short-tubed to extremely long-tubed. An unusual degree of chromosomal variation occurs in sect. *Paniculata* with numbers ranging from  $n = 8, 7, 6, 5, 4$ , to 3 and karyotypes from strongly bimodal to relatively uniform. Chromosome cytology correlates to some degree with patterns of morphological variation and provides independent support for the phylogeny of the tropical species.

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*Lapeirousia*, a member of the largely African subfamily Ixioideae of the Iridaceae, is one of the few genera in the family well represented in tropical Africa and in the southern African winter-rainfall zone of the western Cape Province of South Africa and southwestern Namibia. *Lapeirousia* comprises two subgenera (Goldblatt & Manning, 1990), subg. *Lapeirousia* (17 species—Goldblatt, 1972), largely temperate, and subg. *Paniculata* with sect. *Fastigiata* (5 species—Goldblatt & Manning, in prep.) restricted to the SW Cape of South Africa, and sect. *Paniculata* (15 species) mostly tropical African (Table 1) but extending well into the Transvaal, and with a disjunct species in the SW Cape (Goldblatt & Manning, in prep.). Although centered along the west coast of South Africa, subg. *Lapeirousia* includes two species, *L. odoratissima* and *L. littoralis*, having wide ranges in tropical Africa (Table 1). Of the approximately 38 species in the genus some 21 are restricted to the southern African winter-rainfall area (Goldblatt, 1972), and 16 are largely tropical. Only *L. littoralis* (= *L.*

*caudata*) is widely shared between the two areas. The tropical African species are concentrated in south central Africa, particularly in Namibia, Angola, and Zambia with a decreasing representation in East Africa and Mozambique. Two species reach Ethiopia and one extends to Nigeria.

The taxonomy of *Lapeirousia* in tropical Africa has long been considered problematic, and there has been no complete treatment of the genus outside southern Africa since Baker's study in *Flora of Tropical Africa* (1898). Although completed at a time when tropical Africa was incompletely explored botanically, this revision admitted 14 species of true *Lapeirousia* and four more that are now treated as the genus *Anomatheca*. Since 1898, 21 tropical species have been described, making a total of some 35 for the area. The local floristic treatments published over the past 20 years for *Flora of West Tropical Africa* (Hepper, 1968), Namibia (Sölch, 1969) and Zaire (Geerinck et al., 1972), and a new species described by Wanntorp (1971) represent the only significant contributions

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TABLE 1. The species of *Lapeirousia* in tropical Africa alphabetically arranged within their sections, including a summary of their distributions.

SUBGENUS <i>PANICULATA</i> SECTION <i>PANICULATA</i>	
<i>L. abyssinica</i>	northern Ethiopia, eastern Sudan
<i>L. angolensis</i>	eastern Angola
<i>L. avasmontana</i>	western and northern Namibia
<i>L. bainesii</i>	central and northern Namibia, southern Angola, Botswana and northwestern Transvaal
<i>L. coerulea</i>	central and northern Namibia, northwestern Botswana
<i>L. erythrantha</i>	eastern Angola, Zambia, southern Zaire, Zimbabwe, Malawi, western and southern Tanzania, Mozambique, northeastern Botswana
<i>L. gracilis</i>	Namibia
<i>L. masukuensis</i>	central Mozambique, eastern Transvaal, southeastern Zimbabwe
<i>L. otaviensis</i>	central Namibia
<i>L. rivularis</i>	Namibia, southern Angola and Zambia
<i>L. sandersonii</i>	central and western Transvaal, eastern Botswana
<i>L. schimperi</i>	northern Namibia, southern Angola, Zambia, Zimbabwe, Tanzania, northern Kenya, Ethiopia, Sudan
<i>L. setifolia</i>	northern Malawi, southwestern Tanzania, Zimbabwe
<i>L. teretifolia</i>	western Zambia, northeastern Angola, southern Zaire
SUBGENUS <i>LAPEIROUSIA</i>	
<i>L. littoralis</i>	
subsp. <i>littoralis</i>	southwestern Angola, western and southern Namibia, Botswana, northern Cape, western Transvaal
subsp. <i>caudata</i>	northern Namibia, Zambia, Zimbabwe, southern Mozambique
<i>L. odoratissima</i>	northern Namibia, southern Angola, Zambia, southern Zaire, Zimbabwe, Malawi, Tanzania

to our knowledge of *Lapeirousia* outside southern Africa. The species of the winter-rainfall zone of southern Africa were revised in 1972 (Goldblatt, 1972) when *Anomatheca*, treated by Baker (1892, 1896, 1898) as a subgenus, was removed from *Lapeirousia* and restored to generic rank.

The present treatment, summarized in Table 2, represents a complete revision of *Lapeirousia* in tropical Africa. This treatment differs substantially in the delimitation of *L. erythrantha* (Geerinck et al., 1972) and includes several changes in the circumscription of species in Namibia (cf. Sölch, 1969). In Namibia I recognize *L. avasmontana* (previously included in *L. coerulea*) and *L. otaviensis* (included by Sölch in *L. bainesii*), whereas I consider *L. bainesii* and *L. vaupeliana* conspecific, although both were recognized by Sölch. The widespread *L. caudata* has an earlier synonym, *L. littoralis*, but I still consider the species to comprise two subspecies, one largely tropical and the other largely temperate (cf. Goldblatt, 1972).

Treatment of the *Lapeirousia erythrantha* complex is difficult and I doubt that any solution will ever be entirely satisfactory. I regard *L. erythrantha* as one widespread and variable species including *L. rhodesiana* and *L. briartii*, but I recognize as distinct *L. sandersonii*, *L. masukuensis*, *L. teretifolia*, *L. setifolia*, and *L. angolensis* (the last-mentioned a new species).

Geerinck et al. (1972) treated some of the foregoing species as varieties of *L. erythrantha*.

#### GENERIC DEFINITION AND RELATIONSHIPS

*Lapeirousia* is a member of the Old World and largely African subfamily Ixioideae, one of the four subfamilies of Iridaceae (Goldblatt, 1990a). It is currently assigned to tribe Watsonieae (5 genera, ca. 95 species), one of three tribes of Ixioideae (Goldblatt, 1989, 1990a), the others being the monotypic Pillansieae and the large Ixieae, with some 25 genera and over 700 species, nearly half the total for the family. Distinguishing characteristics of Watsonieae are deeply forked style branches, a derived condition (Goldblatt, 1989), and corms produced entirely from a bud near the base of the flowering stem and attached laterally to the flowering axis (Goldblatt, 1990a). The latter is thought to be ancestral to corm development in Ixieae in which the corm is formed, in part, from the base of the flowering stem, and the flowering stem is attached to the corm near the corm apex (Goldblatt, 1989).

*Lapeirousia* is readily defined by its characteristic corm and corm tunics. The corms of all species are more or less bell-shaped with a flat base or side



(Fig. 1C–H). The tunics are typically hard and cartilaginous to woody and consist of concentric layers of either densely compacted fibers or woody material of uniform texture. Corms of this shape are not found in other Watsonieae but occur in a few genera of Ixioideae where they are found in only a few specialized species of *Romulea* and *Hesperantha* (which coincidentally also have woody corm tunics). The genus probably most closely related to *Lapeirousia* is the monotypic south tropical African *Savannosiphon* Goldbl. & Marais. The two genera share two unusual features in Watsonieae, angular to winged stems and membranous walled capsules. Outgroup comparison suggests that both characters are specialized. *Lapeirousia* and *Savannosiphon* are probably most closely allied to *Thereianthus* and *Micranthus*, two small southwestern Cape genera (Goldblatt, 1989). These four genera form a clade, united by having the foliage leaves inserted on the flowering stem rather than on the corm (Fig. 1B, C); thus the leaves do not contribute to the formation of the corm tunics, as they do in *Watsonia* (the remaining genus of Watsonieae) and in the primitive monotypic Pillansieae.

The evolutionary relationships of *Lapeirousia* are discussed further in the section below dealing with phylogeny.

#### GEOGRAPHY

*Lapeirousia* is one of few widespread African genera of Iridaceae that have centers in the winter-rainfall zone of the southern African west coast and in tropical Africa (Fig. 2). This pattern is unusual for Iridaceae, in which most African genera are either restricted to the Cape region of South Africa or occur only in the summer-rainfall parts of eastern southern Africa, sometimes as far north as Ethiopia. Only *Gladiolus*, *Hesperantha*, and *Romulea* (Ixioideae), *Moraea* (Iridoideae), and *Aristea* (Nivenioideae) have ranges comparable to that of *Lapeirousia*. However, all of these genera favor mesic habitats in tropical Africa and occur either in montane and high-plateau areas or in zones of particularly high rainfall. *Lapeirousia* alone has radiated into dry parts of Africa and is well represented in Namibia, adjacent southern Angola, Botswana, and Zambia. Elsewhere in tropical Africa the number of species of *Lapeirousia* decreases rapidly; five species occur in Zimbabwe, three in Mozambique and Tanzania, two in Ethiopia, and one in Sudan and Nigeria.

The area of greatest species concentration is the northern half of Namibia (Fig. 2A). Here the endemic *Lapeirousia avasmontana* occurs locally in

the Windhoek area, and *L. gracilis* extends along the length of the country from the Fish River Canyon in the south to the Kaokoveld in the north. *Lapeirousia otaviensis* is nearly endemic, extending from the Erongo Mountains in the central west to southern Angola, and *L. coerulea*, widespread and relatively common in central and northern Namibia, also occurs in the northwest of Botswana. *Lapeirousia bainesii* is particularly common in northern Namibia, but it extends into southern Angola and across Botswana to the northwestern Transvaal. In addition, *L. schimperi*, *L. rivularis*, *L. littoralis*, and *L. odoratissima* occur widely in Namibia as well as elsewhere in tropical Africa. In temperate southern Namibia three more species of *Lapeirousia*, *L. barklyi*, *L. dolomitica*, and *L. plicata*, are predominantly southern African and have a winter-growing and spring-flowering phenology.

A second, minor center for *Lapeirousia* in tropical Africa (Fig. 2B) is western Zambia, southern Zaire, and eastern Angola where two species are endemic, *L. teretifolia* in the north and *L. angolensis* in the south. Also widely occurring in this area are *L. erythrantha*, *L. rivularis*, and *L. littoralis*. Other relatively localized species are *L. abyssinica*, restricted to northern Ethiopia; *L. masukuensis*, central and southern Mozambique, the eastern Transvaal, and southeastern Zimbabwe; and *L. sandersonii*, the central and western Transvaal and eastern Botswana. The tropical African species of *Lapeirousia* are, in general, relatively widely distributed, the most prominent example being *L. schimperi*. This species extends across south tropical Africa from northern Namibia to Zimbabwe and has a series of disjunct populations in northern Tanzania, northeastern Kenya and southern Ethiopia, northern Ethiopia, and western Sudan. *Lapeirousia erythrantha* has a comparable distribution, being common across south central Africa from eastern Angola to the Mozambique coast, and it has a series of populations in northern Nigeria. Unlike *L. schimperi*, *L. erythrantha* consists of a number of distinctive regional populations across its range.

The only species of subg. *Lapeirousia* that occur in tropical Africa, *L. littoralis* and *L. odoratissima*, also have wide distributions, the latter extending from western Angola and Namibia to central Tanzania. This contrasts with the southern African members of the subgenus that have narrow ranges, and in some cases are known from only one or two localities (e.g., *L. montana*, *L. oreogena*, *L. verecunda* [Goldblatt, 1972]).

Such disjunctions as encountered in *L. schim-*



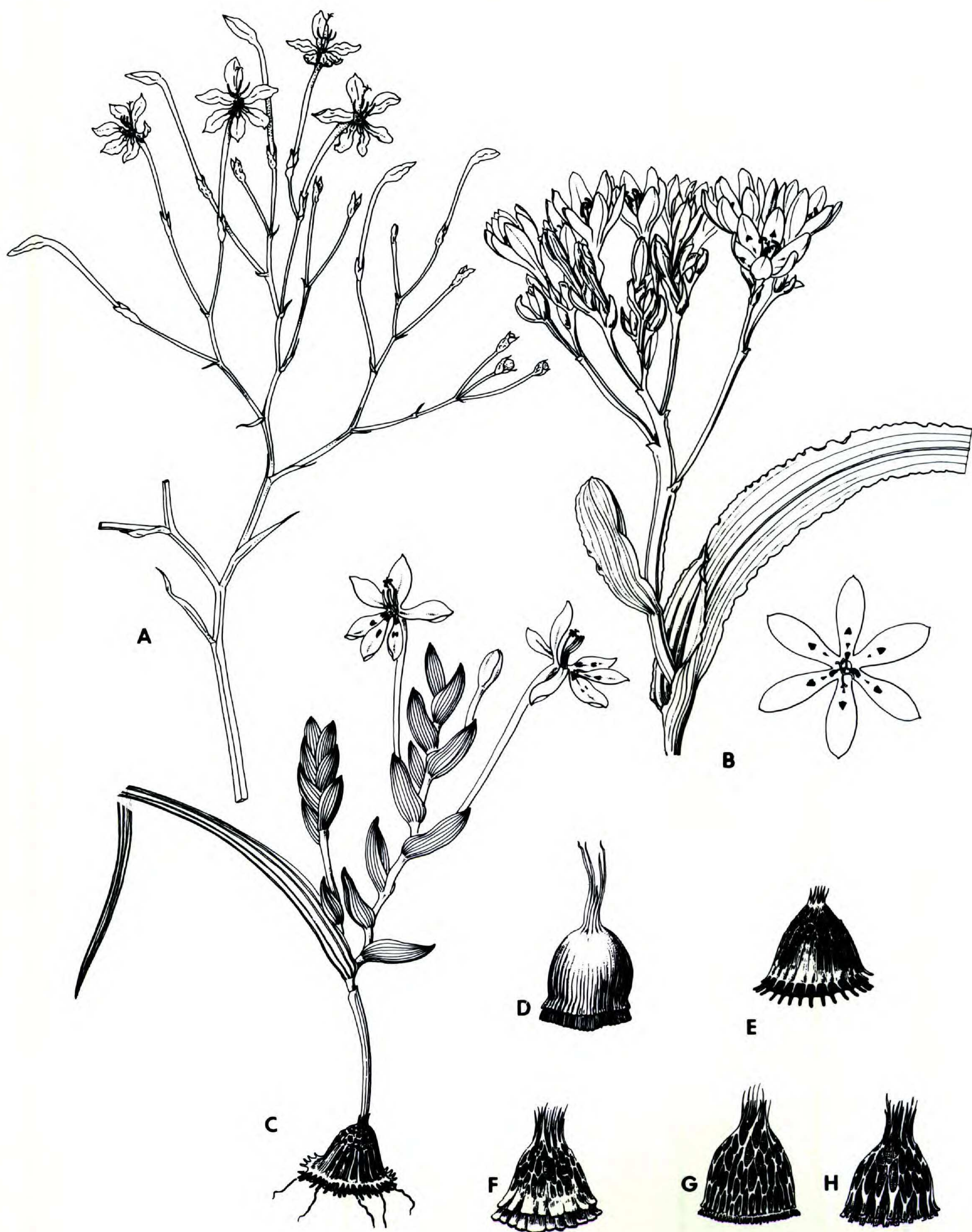


FIGURE 1. Growth forms and main flower and corm types in *Lapeirousia*.—A. *L. bainesii*, divaricately branched pseudopanicule with zygomorphic flowers (subg. *Paniculata* sect. *Paniculata*).—B. *L. corymbosa*, congested pseudopanicule with actinomorphic flowers and plane leaves with midrib (subg. *Paniculata* sect. *Fastigiata*).—C. *L. dolomitica*, branched spike, zygomorphic flowers, and corrugate leaf (subg. *Lapeirousia* sect. *Lapeirousia*).—D. *L. plicata* (subg. *Lapeirousia* sect. *Sophronia*).—E. *L. divaricata* (subg. *Lapeirousia* sect. *Lapeirousia*).—F. *L. micrantha* (subg. *Paniculata* sect. *Fastigiata*).—G. *L. bainesii*.—H. *L. coerulea* (subg. *Paniculata* sect. *Paniculata*). A–C  $\times 0.5$ , E–H full size. (Drawn by M. L. Branch & J. C. Manning.)



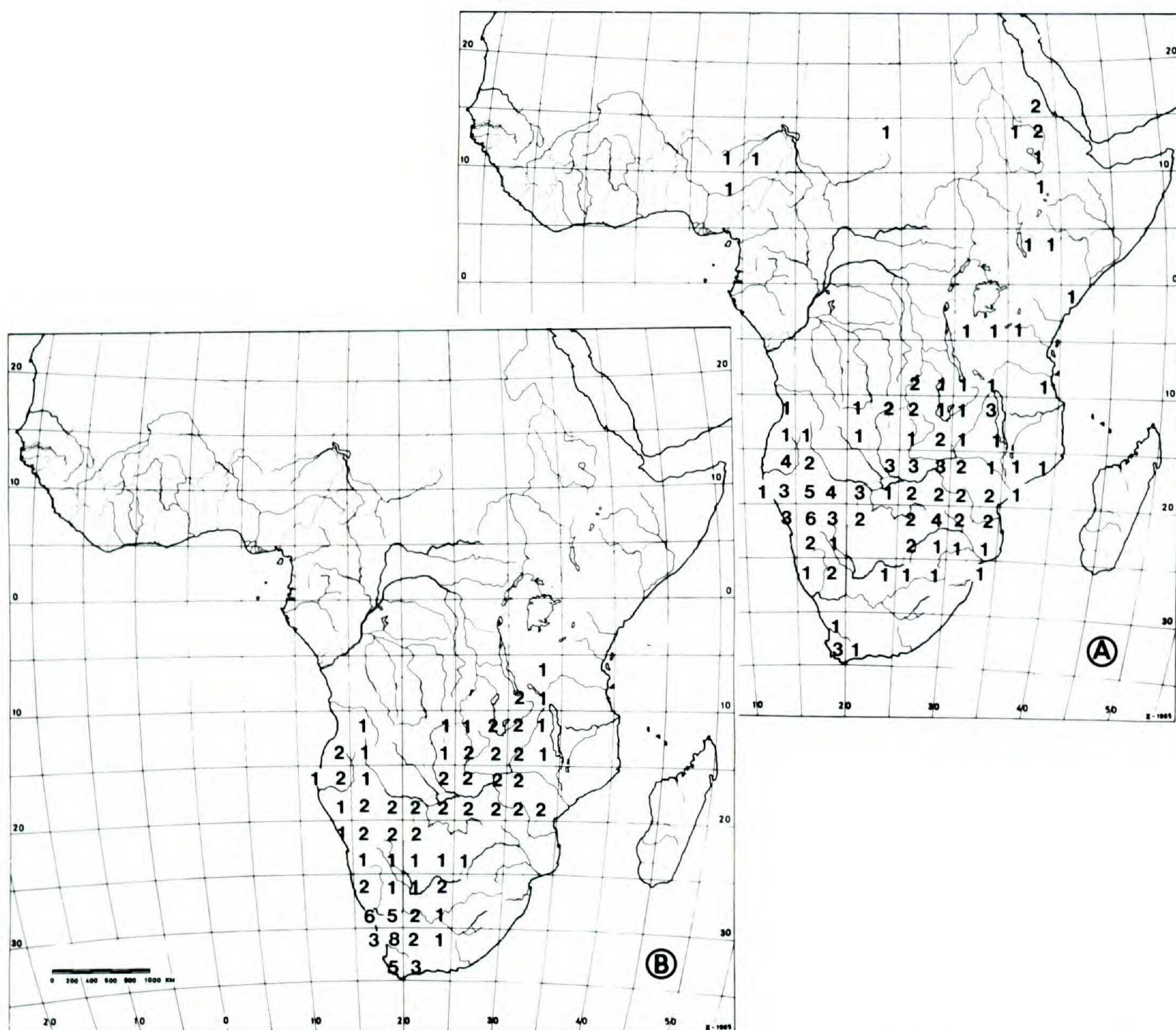


FIGURE 2. Geography of *Lapeirousia*.—A. Distribution of subg. *Paniculata*.—B. Distribution of subg. *Lapeirousia*. Figures represent the number of species recorded in each 2°30'-degree square grid.

*peri* and *L. erythrantha* are uncommon in Iridaceae, although they are known in a few species in several of the widespread African genera of the family (e.g., *Moraea schimperi*, *Gladiolus dalenii*, and *Hesperantha petitiana* [Goldblatt, 1977, 1986]). However, the pattern of narrow distributions for many species in southern Africa vs. wide ranges for most tropical species is common in Africa and is consistent with patterns for many genera in different families.

## MORPHOLOGY

### ROOTSTOCK

The most distinctive feature of *Lapeirousia*, and the one that defines it, is the flat-based corm (or more correctly flat-sided corm since the flat portion is oriented obliquely in the ground—Fig. 1). The corms are bell-shaped in all species when not distorted by growing conditions. The corm coverings or tunics reflect the corm shape and consist of a

separate basal disc and bell-shaped upper part. Other Ixioidae usually have rounded corms, although a few species of *Romulea* (de Vos, 1972) and *Hesperantha* (Goldblatt, 1984) have a flat side and are bell-shaped.

The nature of the tunics varies considerably and has substantial phylogenetic and taxonomic significance. In subg. *Lapeirousia* the tunics are dark brown, of uniformly woody texture with a smooth surface, and they fragment into irregular pieces with age. The basal margin is ornamented with teeth (cf. Goldblatt, 1972) in sect. *Lapeirousia* (Fig. 1C, E), probably a specialized condition (Goldblatt & Manning, 1990), whereas the margins in sect. *Sophronia* are entire or lightly lobed (Fig. 1D).

In subg. *Paniculata* the tunics range from blackish to pale straw in color and vary in texture from more or less woody to coriaceous. They appear to differ fundamentally from those of subg. *Lapeirousia* in consisting of densely packed fibers



instead of having a uniformly woody texture. Similar textured corm tunics are characteristic of the related genera *Thereianthus* and *Micranthus*, and tunics of densely compacted fibers appear, on the basis of outgroup comparison, to be the basic type for *Lapeirousia* (Goldblatt & Manning, 1990). The way in which the outer layers of the tunics decay in subg. *Paniculata* is often diagnostic. In the five Cape species of subg. *Paniculata* sect. *Fastigiata* (Fig. 1F) the hard, blackish layers fragment rather distinctly into vertical strips that separate from the base (Goldblatt, 1972). A similar pattern is evident in several members of sect. *Paniculata*, such as *L. erythrantha*, *L. rivularis*, and their allies in tropical Africa. The softer-textured tunics of *L. bainesii*, *L. otaviensis*, *L. gracilis*, *L. schimperi*, and *L. coerulea* are assumed to be a specialized condition. These tunics decay with age to form a coarse to sometimes fine reticulum. *Lapeirousia avasmontana*, considered conspecific with *L. coerulea* by Sölch (1969), has distinctive dark brown to blackish tunics that break with age into brittle membranous pieces. The tunics of *L. sandersonii* closely resemble those of *L. avasmontana*, and while the two species have similar divaricately branched panicles with only 1–2 flowers per branch, they nevertheless have such different flowers that it is difficult to believe they are closely related. Their similar corm tunics and inflorescence branching are regarded here as convergent (Fig. 3). The woody tunics of subg. *Lapeirousia* are considered to be a specialized condition in the genus. A few other taxa in Ixioideae have similar woody tunics (*Romulea*, *Syringodea*, *Hesperantha*, *Geissorhiza*), but the corms in these genera are rarely bell-shaped and these genera are generally considered to be only distantly related to *Lapeirousia* (Lewis, 1954; Goldblatt, 1971, 1990a).

#### CATAPHYLLS

The first foliar organs produced by the sprouting corm, the cataphylls, are entirely sheathing and submembranous. They surround the base of the stem and reach only a few centimeters above the ground. In *Lapeirousia* usually two are produced, and they are often dry and dead at flowering time.

#### LEAVES

As in most Iridaceae, the foliage leaves of *Lapeirousia* are ensiform and equitant. They are attached to the stem near the base, usually close to ground level (e.g., Fig. 1C), but unlike most genera of Ixioideae, the sheathing leaf bases do not contribute to the corm tunics. This is probably a derived condition (Goldblatt, 1989) shared, in Wat-

sonieae, with *Thereianthus*, *Micranthus*, and *Savannosiphon*, and is important in separating this line from *Watsonia*. The leaves are plane with at least a discrete central vein (pseudomidrib) in subg. *Paniculata* (e.g., Fig. 1B), but are corrugate in subg. *Lapeirousia* (e.g., Fig. 1C). Anatomical differences such as opposed vs. alternate veins and truncate ribs (Table 3) accompany the external differences (Goldblatt & Manning, 1990). In sect. *Paniculata* the leaves are typically narrowly lanceolate, but sometimes are linear (forms of *L. erythrantha*, *L. setifolia*, *L. sandersonii*) or terete (*L. teretifolia*). The leaves of *L. sandersonii* are distinctive in being particularly rigid and fibrotic and in having the several thickened veins set closely together.

#### STEMS

Stems are usually aerial and branched, and invariably angular to winged, a synapomorphy shared with *Savannosiphon*. While there are subtle differences in the degree of angularity of the stems in different species, the character is not useful taxonomically. In some species of subg. *Lapeirousia* sect. *Sophronia* in southern Africa (Goldblatt, 1972) and in the tropical African *L. odoratissima* (see Fig. 17) the stem is not produced above the ground, and the whole inflorescence is congested into a tufted, rosettelike structure borne at ground level.

#### INFLORESCENCES

A spicate inflorescence is characteristic of most Ixioideae and is a synapomorphy uniting Watsonieae and Ixieae, two of the three tribes of the subfamily (Goldblatt, 1990a). Most members of subg. *Lapeirousia* have spikes, but in a few species the whole aerial axis is contracted into a cushionlike tuft borne at or near ground level. Among the tropical species of subg. *Lapeirousia*, *L. littoralis* has spikes of 4–12 flowers, these somewhat congested and fewer-flowered in subsp. *littoralis*, and rather lax and with more flowers in subsp. *caudata*. In *L. odoratissima* the aerial stem is contracted and the plant has a tufted appearance (Fig. 17), a habit shared with and perhaps independently evolved in the southern African *L. oreogena*, *L. montana*, and *L. plicata* (Goldblatt & Manning, 1990).

An extensively ramified flowering axis is characteristic of subg. *Paniculata* (Fig. 1A, B), and, although variously called a panicle or corymb, this pseudopaniculate structure is probably a highly ramified spike. Despite sometimes highly developed branching, the ends of the main branches usually carry at least two flowers, and those below the



terminal flower are always sessile and thus arranged exactly like those in the spike of subg. *Lapeirousia* and other Ixioideae with spikes. The pseudopanicule of subg. *Paniculata* is considered a specialized condition in the genus and is the only major synapomorphy for the subgenus (Goldblatt & Manning, 1990).

The degree of inflorescence branching in subg. *Paniculata* is often typical of a species. *Lapeirousia abyssinica* has few-branched stems, and the inflorescence is virtually a branched spike, hardly or not at all different from the branched spikes found elsewhere in Ixioideae. I assume that this is a reversal from the pseudopaniculate condition. In *L. erythrantha* the main branches of the rather lax panicle have 3–5 flowers that tend to be crowded terminally, which impart a corymblike appearance to the sometimes massive inflorescence. The related *L. teretifolia* and *L. angolensis* have only one or two flowers per major inflorescence branch, a feature shared with *L. sandersonii*. *Lapeirousia masukuensis*, which resembles *L. sandersonii* in its long-tubed flowers, has in contrast 5–8 flowers on the terminal branches. Among the long-tubed species of the arid southwest, *L. bainesii* typically has 1 (or 2) flowers per main inflorescence branch, whereas *L. otaviensis* and *L. gracilis*, otherwise easily confused with *L. bainesii*, have 3–5 flowers per main branch. Similarly, an important distinction between the easily confused *L. avasmontana* and *L. coerulea* is the number of flowers on the main terminal inflorescence branches, usually 2–4 in *L. avasmontana* and seldom more than one in *L. coerulea*.

In subg. *Paniculata* the floral bracts vary little among the species except in size, and they provide limited taxonomic information. However, the bracts are membranous and dry above in sect. *Paniculata*, which outgroup comparison suggests is specialized (Goldblatt & Manning, 1990). In sect. *Fastigiata* the bracts are herbaceous. The bracts are more or less equal in length, but the inner (adaxial) bract is always smaller and is often apically forked or notched. In subg. *Lapeirousia* the bracts are herbaceous and usually have a firm texture, and the inner bracts are shorter than the outer ones. Bract morphology is variable in this predominantly southern African alliance (Goldblatt, 1972), and species can sometimes be recognized by their bracts alone.

#### FLOWERS

Floral variation is extensive in *Lapeirousia*, as much in tropical as in southern Africa. Two species,

*L. coerulea* and *L. avasmontana*, have actinomorphic flowers and short perianth tubes. Their flowers closely resemble those of the SW Cape *L. corymbosa* (sect. *Fastigiata*) and are, I assume, the basic flower type in the genus. The other species of sect. *Paniculata* have zygomorphic flowers with unilateral stamens. The acaulescent *L. odoratissima* also has actinomorphic flowers but has a long perianth tube.

There is considerable variation in perianth tube length in the genus, a feature closely related to the pollination systems of the species and not always indicative of a close phylogenetic relationship. Long tubes of ca. 12–15 cm are found in *L. schimperi* and *L. odoratissima*. A long perianth tube also characterizes *L. littoralis*, in which the degree of variation in length is unusual: subsp. *littoralis* has a tube ca. 28–35 mm long, whereas in subsp. *caudata* the length ranges from 25 to 30 mm in some northern Zambian populations to 50–70 mm in the populations from southern Mozambique. *Lapeirousia bainesii*, *L. otaviensis*, and *L. gracilis*, centered in Namibia, each have similar and relatively long perianth tubes, usually 25–35 mm long. In the *L. erythrantha* complex, *L. masukuensis* and *L. sandersonii* have tubes 15–25 mm long compared with 8–12 mm in other members of the complex, including *L. erythrantha* and *L. setifolia* in which the tube is more or less twice as long as the bracts, a condition that I assume is basal for the alliance. The two tropical species of sect. *Paniculata* with actinomorphic flowers, *L. coerulea* and *L. avasmontana*, have very short perianth tubes, less than 3 mm long, comparable to those in the southern African *L. corymbosa* complex.

The flowers of *Lapeirousia coerulea* and *L. avasmontana* resemble relatively closely those of the southern African actinomorphic-flowered species, and it seems likely in the absence of contrary evidence that the actinomorphic, short-tubed flower with a blue perianth having white markings is basal for the genus (Goldblatt & Manning, 1990). If this is correct, it follows that zygomorphic flowers have evolved independently in subg. *Paniculata* in both the Cape sect. *Fastigiata* and the tropical sect. *Paniculata*, as well as in subg. *Lapeirousia*.

Floral actinomorphy in *Lapeirousia odoratissima* may be secondary, and related to the low stature and tufted habit of this species (Goldblatt & Manning, 1990). I suggested a similar reversal of floral zygomorphy to actinomorphy in the southern African tufted species (Goldblatt, 1972).

The most common perianth form in the zygomorphic species is for the lower three tepals to be



joined for a short distance and displayed horizontally, while the upper tepal is reflexed and held more or less in the same plane as the lower tepals. This is unusual in Ixioidae in which species with zygomorphic flowers usually have the upper tepal held erect or slightly arched over the stamens. The latter type of flower is found in *L. rivularis*, while reflexed tepals are characteristic of all the members of the *L. erythrantha* alliance, including the long-tubed *L. sandersonii* and *L. masukuensis*. The reflexed upper tepal is regarded here as the basal condition, and the erect to arched tepal is considered derived.

The stamens are either erect with filaments contiguous in the actinomorphic-flowered species or unilateral and erect to arcuate in zygomorphic-flowered species. The style follows the orientation of the stamens, and is thus central and erect in species with actinomorphic flowers, and arched behind the stamens in species with zygomorphic flowers. The style branches are divided and recurved for half their length in most species of *Lapeirousia*, and this is assumed to be the basic state for the genus and the tribe Watsonieae. However, several tropical African species of *Lapeirousia* and some forms of the southern African *L. plicata* have undivided style branches. The character is variable within some populations of *L. plicata* and *L. bainesii* that I have examined in the field. It is difficult to assess the significance of this variation, and I have not regarded undivided style branches as having any taxonomic significance.

#### CAPSULES AND SEEDS

Apart from differences in the size of the capsules and the seeds they contain, fruit characters are of limited use in the taxonomy of *Lapeirousia*. The capsules have firm-membranous walls and range from globose-trigonous to more or less oblong, almost always with the outline of the seeds distorting the outer walls. The seeds are globose to slightly oblong, tapering slightly toward the funicle. The raphal ridge is the only feature distorting the otherwise uniformly microreticulate surface. The seeds are sometimes lightly distorted by pressure. Seed diameter ranges from 2.5 mm in *L. odoratissima* to 1.3–1.8 mm in *L. setifolia*.

#### CHROMOSOME CYTOLOGY

Chromosome number is remarkably variable in tropical African *Lapeirousia* (Goldblatt, 1990b). In sect. *Paniculata* haploid numbers range from  $n = 8$  (*L. avasmontana*) to  $n = 3$  (one population of *L. bainesii*) (Table 2). Numbers for subg. *Lapei-*

TABLE 2. Chromosome numbers in tropical African *Lapeirousia* (from Goldblatt, 1990b).

Species	Diploid number $2n$
SUBGENUS <i>PANICULATA</i>	
SECTION <i>PANICULATA</i>	
<i>L. abyssinica</i>	8
<i>L. angolensis</i>	unknown
<i>L. avasmontana</i>	16
<i>L. bainesii</i>	10, 6
<i>L. coerulea</i>	8
<i>L. erythrantha</i>	12
<i>L. gracilis</i>	12
<i>L. masukuensis</i>	unknown
<i>L. otaviensis</i>	10
<i>L. rivularis</i>	12
<i>L. sandersonii</i>	10
<i>L. schimperi</i>	10
<i>L. setifolia</i>	8
<i>L. teretifolia</i>	unknown
SUBGENUS <i>LAPEIROUSIA</i>	
<i>L. littoralis</i>	16
<i>L. odoratissima</i>	16, 18

*rousia* in southern Africa are  $n = 10$ , 9, and 8 (Goldblatt, 1972, 1990b). The karyotypes for all species of the subgenus are similar and strongly bimodal, comprising one long chromosome pair and six or seven small pairs less than half as long as the long chromosomes. Of the two tropical species of the subgenus, *L. littoralis* has  $n = 7$  and *L. odoratissima*,  $n = 8$  and 7.

The Cape species of subg. *Paniculata* have  $n = 10$  (Goldblatt, 1972) except *Lapeirousia neglecta* (Goldblatt & Manning, in prep.), which has  $n = 5$ , and a bimodal karyotype similar to that in subg. *Lapeirousia*. Among the tropical species, *L. avasmontana* has a karyotype most like the Cape members of the subgenus, with one long and seven short pairs in a comparably bimodal karyotype. The species presumably most closely related to *L. avasmontana*, *L. coerulea*, has  $n = 4$ , now known from seven populations. The karyotype comprises two long and two medium-sized chromosome pairs.

*Lapeirousia erythrantha* appears to be based on  $x = 6$ , a number recorded in several populations across its range from southern Malawi to northern Zambia. *Lapeirousia rivularis* also has  $n = 6$ , but the allied *L. setifolia* and *L. abyssinica* have  $n = 4$ .

The long-tubed species *Lapeirousia sandersonii*, *L. bainesii*, *L. otaviensis*, and *L. schimperi* appear to be based on  $x = 5$ . The karyotypes of the last-mentioned three species are similar to each



other, consisting of one particularly long metacentric pair and four shorter pairs, with one metacentric and the other three acrocentric. *Lapeirousia sandersonii* has a more bimodal karyotype with a long, acrocentric pair and four much shorter pairs. While this pattern seems fairly coherent, *L. gracilis*, closely allied to *L. otaviensis*, has  $n = 6$  and a bimodal karyotype of one long and five much shorter pairs. Karyotypic variation occurs in *L. bainesii*, one population of the three studied having  $n = 3$ , with a karyotype of three metacentric chromosome pairs. This pattern suggests Robertsonian fusion of the smaller acrocentric chromosomes of the presumed basic  $x = 5$  karyotype of this and related species.

Variability in the karyotypes in *Lapeirousia* is puzzling and difficult to interpret. Elsewhere (Goldblatt, 1990b) I have regarded the bimodal karyotype with  $x = 10$  as basic for the genus. It occurs in both subgenera of *Lapeirousia* and in the related *Thereianthus* and *Micranthus*, in which the karyotype is weakly bimodal. This presumes that the lower numbers,  $n = 4$  in *L. coerulea*, *L. setifolia*, and *L. abyssinica*, are derived. Judging from the chromosomal variability in *L. bainesii* alone, it seems that the chromosome constitution of *Lapeirousia* is unusually unstable. Structural rearrangement and numerical change may form part of the adaptive strategy of a genus that is remarkable in the family for having radiated in semiarid habitats more severe than those that most genera of Iridaceae favor.

#### PHYLOGENY

Within Watsonieae, *Lapeirousia* can be distinguished by its specialized flat-based, bell-shaped corm, the primary synapomorphy for the genus (Goldblatt, 1989; Goldblatt & Manning, 1990). Perhaps most closely allied to *Lapeirousia* (Goldblatt, 1989) is the monotypic *Savannosiphon* (Goldblatt & Marais, 1979), which shares with *Lapeirousia* compressed and angled to winged stems, also a derived condition, and coriaceous to membranous capsules. Except for *Savannosiphon*, which is tropical African, the remaining members of Watsonieae are southern African and are centered in the southwestern Cape. *Thereianthus* and *Micranthus* are endemic to the SW Cape, and *Watsonia* is centered there, although nearly a third of the genus occurs in eastern southern Africa. Within the tribe, *Watsonia* forms one major clade and the *Micranthus*–*Thereianthus* and *Lapeirousia*–*Savannosiphon* line form the other (Goldblatt, 1989). This latter clade is defined by having the

foliage leaves attached to the stem rather than to the corm, and in having thick, hard-textured tunics composed of compacted fibers. *Thereianthus* and *Micranthus* have an unusual type of seed, appear generally similar, and are almost certainly closely related. *Savannosiphon*, although presumed to be the genus most closely allied to *Lapeirousia*, seems rather different in its broad, soft-textured leaves, unbranched habit, and general appearance, and the possibility that it is misplaced in this scheme cannot be ignored.

Within *Lapeirousia* there are two major species clusters, treated as subgenera by Goldblatt & Manning (1990). Subgenus *Lapeirousia* has specialized corrugate leaves and some associated anatomical specializations (Goldblatt & Manning, 1990), woody corm tunics, and predominantly spicate inflorescences (the latter a symplesiomorphy) (Table 3). Predominantly southern African, the phylogeny of subg. *Lapeirousia* is not considered further here.

Subgenus *Paniculata* has unspecialized plane leaves with a central vein, tunics consisting of densely matted fibers that become ridged, cancellate, or fibrous on aging, two symplesiomorphies, and pseudopaniculate inflorescences and small floral bracts, both derived states. The SW Cape and tropical African members of subg. *Paniculata* appear to comprise separate monophyletic lines, treated as sects. *Fastigiata* and *Paniculata*, respectively (Fig. 3). The largely tropical sect. *Paniculata*, although similar in many ways to sect. *Fastigiata*, can be distinguished by its generally more lax inflorescences and small bracts that are typically dry and membranous above or entirely.

Except for *Lapeirousia coerulea* and *L. avas-montana*, the species of sect. *Paniculata* have zygomorphic flowers, the synapomorphy that unites these 12 species (Fig. 3). In the section, four species form a clade, defined by their long-tubed flowers, pale perianths, and moderately fibrous corm tunics. Of these four species, all except *L. gracilis* have a similar and specialized basic karyotype with  $n = 5$  and form a clade within which *L. bainesii* is defined by two synapomorphies: divaricate branching and inflorescence branches with predominantly one flower each; *L. schimperi* is set apart by two synapomorphies: exceptionally long-tubed flowers and a white perianth. I have not identified any synapomorphy for the remaining *L. otaviensis*.

The remaining eight tropical species of sect. *Paniculata* seem related, and they have flowers of similar form, color, and basic markings, yet there is no obvious synapomorphy uniting them. *Lapeirousia sandersonii* and *L. masukuensis* share one synapomorphy, a moderately long perianth tube,



and *L. sandersonii* is further distinguished by its divaricately branched inflorescence with predominantly one- or two-flowered axes and peculiar, smooth corm tunics that fragment into vertical strips. *Lapeirousia avasmontana* shares these two last-mentioned synapomorphies, but its actinomorphic perianth and different karyotype suggest that its similarities with *L. sandersonii* are the result of convergence. *Lapeirousia teretifolia* and *L. angolensis* appear united by their terete leaves.

The remaining species are undoubtedly closely related, but none share notable specializations that indicate that they are more closely allied to one another than to other species in the group. The most notable specialization is in *L. rivularis* in which the upper tepal is erect to hooded instead of being reflexed to lie in the same plane as the lower tepals. This species and *L. erythrantha* are evidently polyploid,  $n = 6$ , but this may be an independent specialization in each and is so treated here. The possession of the derived chromosome number  $n = 4$  in *L. setifolia* and *L. abyssinica* may indicate close relationship, but too few species in the alliance are known chromosomally for this character to be interpreted with confidence. No doubt relationships in this alliance will be better understood when the cytology is better known, but for the present the phylogeny cannot be further resolved objectively.

#### HISTORY OF LAPEIROUSIA

The first tropical African species of *Lapeirousia*, *L. abyssinica*, was discovered in 1809–1810 by Henry Salt during his East African travels (Salt, 1814), and it had been thoroughly documented in herbaria by 1850 when it was described as a species of *Geissorhiza* (Richard, 1850). In 1878 *G. abyssinica* was transferred to *Lapeirousia*, and the presence of the genus in tropical Africa was thus established (Baker, 1878a). Until then *Lapeirousia* was thought to be an exclusively southern African and largely Cape genus, although *Ovieda erythrantha* from Mozambique had been described in 1864 and transferred to *Lapeirousia* in 1878, at the same time as *L. abyssinica*. The early taxonomic history of *Lapeirousia* and its establishment as a genus thus largely concerns the nontropical species.

*Lapeirousia* was based on *L. compressa*, described by Pourret in 1788 from a single specimen that was thought to have been collected in Mauritius by the French botanist Philibert Commerson (Goldblatt, 1972). *Lapeirousia compressa* is, however, conspecific with the Cape and Namaqualand

endemic, *L. fabricii*, which had been described some 22 years earlier as *Ixia fabricii* by Daniel de la Roche in 1766. The first species of *Lapeirousia* known to science was described 10 years prior to this, when Linnaeus named *Ixia corymbosa*, but the species was only recognized as a member of *Lapeirousia* in 1802. Species of *Lapeirousia* described in the eighteenth century were also placed in *Gladiolus* and *Galaxia*. In 1802, Pourret's *Lapeirousia* was accepted by Ker who transferred the five species of the genus then known to it. Ker also accepted *L. juncea*, which he assigned to the new *Anomatheca* in 1805.

In 1817 Sprengel described *Ovieda*, at first without any species, but in 1825 he placed all the known species of *Lapeirousia*, including by name *L. compressa*, in *Ovieda*, which has the same circumscription as *Lapeirousia* sensu Ker. Renamed *Meristostigma* by Dietrich in 1844 because it was a homonym for *Ovieda* L., *Ovieda* Sprengel nevertheless remained in use, for example by Klatt (1866), until 1876 when J. G. Baker revived *Lapeirousia*.

*Sophronia* Licht. ex Roemer & Schult. was erected in 1817 for the acaulescent *L. plicata*, but the genus was reduced to a subgenus of *Lapeirousia* by Baker (1892). By then subg. *Sophronia* included three southern African acaulescent species, all now considered conspecific (Goldblatt, 1972). Baker did not, however, regard the acaulescent *L. odoratissima* from tropical Africa as a member of subg. *Sophronia*.

Baker also transferred *Anomatheca* Ker (1805), a genus of five central and southern African species, to *Lapeirousia* as a third subgenus (Baker, 1892). *Anomatheca* is probably most closely related to the southern African *Freesia* (Goldblatt, 1971, 1982), and it has been removed from *Lapeirousia* (Goldblatt, 1972), although Geerinck et al. (1972) treated *A. grandiflora* as a species of *Lapeirousia*. *Freesia* and *Anomatheca* are currently regarded as members of Ixieae, and their deeply divided style branches, shared with *Lapeirousia*, are regarded as a convergent development (Goldblatt, 1990a).

The knowledge of *Lapeirousia* in tropical Africa began to accumulate late in the nineteenth century when Welwitsch's Angolan Iridaceae, collected during 1853–1861 (Rendle, 1899), were studied by Baker (1878b). At this time the widespread *L. schimperii* had already been discovered in Ethiopia by Schimper and referred to *Tritonia* (Klatt, 1866), although it does not have either round-based corms with finely fibrous tunics or the undivided style branches of the latter genus. The same species



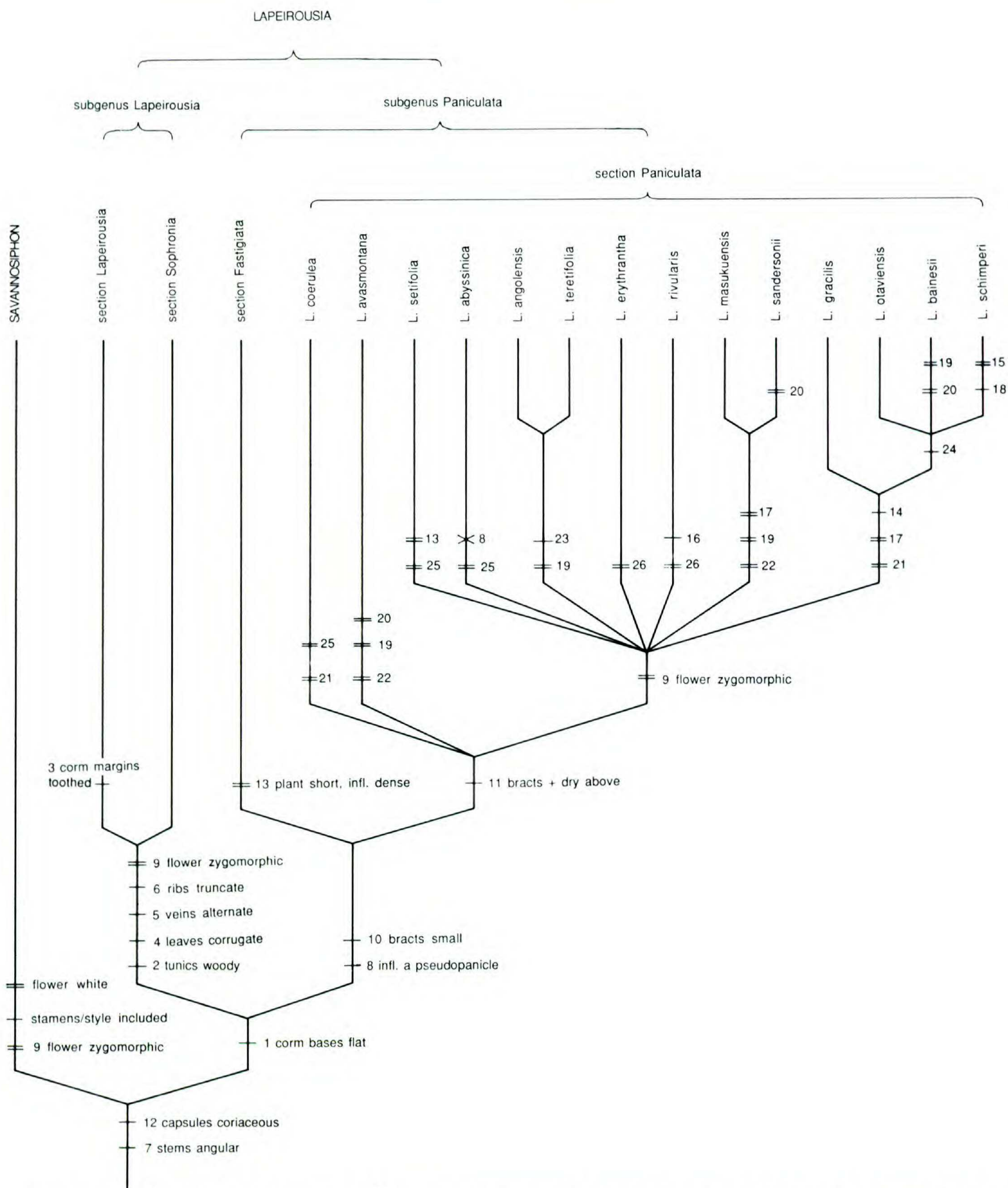


FIGURE 3. Hypothetical phylogeny of *Lapeirousia* showing the major infrageneric lineages and presumed species relationships for sect. *Paniculata*. Characters used in the cladogram are listed in Table 3. Parallelisms are indicated by double horizontal lines and reversals by crossed lines. The cladogram was generated manually: length = 44; consistency index including autapomorphies, CI = 0.64.

collected in Angola was referred by Baker (1876) to *Anomatheca* (*A. monteiroi*), and two more Angolan collections were described as *L. fragrans* and *L. cyanescens*, respectively (Baker, 1878b). *Tritonia schimperi* was transferred to *Acidanthera* (now a synonym of *Gladiolus*) by Baker (1878a), as *A. unicolor*, because its long perianth tube and

white flower accorded well with *Acidanthera*. This one species of *Lapeirousia* was thus placed in four different genera over a period of 12 years.

The tropical African species of *Lapeirousia* that occur in the northern Cape and Transvaal were discovered relatively late, with the exception of *L. littoralis*. Although based on an 1859 Welwitsch



TABLE 3. Characters used in the cladogram (Fig. 3). The derived (apomorphic) states are listed first followed by the presumed ancestral (plesiomorphic) conditions. Apomorphies for *Savannosiphon* are taken from Goldblatt (1989). Anatomical specializations for sect. *Fastigiata* known only in one species, *L. corymbosa*, are not included in the cladogram.

- 
1. Corm bases flat—corm bases rounded
  2. Corm tunics woody—corm tunics of compacted fibers
  3. Margins of corm toothed/spiny—margins of corm not elaborated
  4. Leaves corrugate—leaves plane and with a pseudomidrib
  5. Major veins alternate—major veins opposite
  6. Ribs truncate—ribs rounded
  7. Stems angular—stems terete
  8. Inflorescence a pseudopanicule—inflorescence a spike
  9. Flower zygomorphic—flower actinomorphic
  10. Bracts small—bracts relatively large
  11. Bracts  $\pm$  membranous and dry above—bracts herbaceous
  12. Capsules coriaceous—capsules woody
  13. Plants short and inflorescences congested—plants tall and inflorescences not notably congested
  14. Perianth pale-colored—perianth colored blue to purple or red
  15. Perianth white without markings—perianth pale or deeply colored, usually with markings
  16. Upper tepal erect or hooded—upper tepal recurved and lying in the same plane as the lower
  17. Perianth tube 15–40 mm long—tube rarely exceeding 15 mm long
  18. Perianth tube 8–12 cm long—tube shorter than 8 cm
  19. Branching pattern divaricate—branching  $\pm$  alternate with a main axis dominant
  20. Terminal branches of the inflorescence 1(–2)-flowered—terminal branches with more than 2 flowers
  21. Corm tunics becoming fibrous and pale with age—corm tunics remaining relatively densely fibrous and dark-colored
  22. Corm tunics smooth and decaying into vertical strips—corm tunics rough, matted, and densely to finely fibrous
  23. Leaf terete—leaf plane with midrib evident
  24. Base number  $x = 5$  (karyotype not bimodal)—karyotype bimodal and  $n = 6$  or  $5$
  25. Base number  $x = 4$ —base number higher
  26. Base number  $x = 6$  and polyploid—base number different and not polyploid
- 

of *L. littoralis* has only now been established, the species having previously been known as *L. caudata* subsp. *burchellii* (Goldblatt, 1972). *Lapeirousia caudata*, now *L. littoralis* subsp. *caudata*, was described in 1890 from specimens from northern Namibia. It was based on collections by the Finnish missionary Martti Rautanen and the Swiss botanist Hans Schinz.

The largely Transvaal *L. sandersonii* was first collected by John Sanderson in 1852, but again was named much later by Baker (1892), while *L. bainesii* was first recorded from the remote Kobi Pan in western Botswana by the landscape artist Thomas Baines in 1863 and later found by Emil Holub in 1876 and by Edward Lugard in 1887, also in Botswana. The wide distribution of this species in Namibia was discovered much later, and only in 1942 was *L. bainesii* documented in the Transvaal, where it is rare.

The first east tropical African species of *Lapeirousia* was collected by the German explorer Wilhelm Peters in Mozambique in the mid 1840s. This was the first record of the widespread and common *L. erythrantha*, described by Klatt (1864) as *Oviada erythrantha*. Later exploration in interior Mozambique and Malawi by John Kirk and David Livingstone soon provided additional records of this species. Its wide distribution and unusual variability led to *L. erythrantha* being given different names in Katanga (*L. briartii* de Wildeman, 1900), Angola (*L. spicigera* Vaupel, 1912), and Zimbabwe (*L. rhodesiana* N. E. Brown, 1911). Rudolf Schlechter's Mozambican collections made in the 1890s yielded additional *L. erythrantha*, although Vaupel (1912) described two as separate species, *L. graminea* and *L. plagiostoma*. At this time Schlechter made the first collections of *L. masukuensis*, also described by Vaupel (1912).

Knowledge of *Lapeirousia* in Namibia was particularly slow to accumulate, owing to difficulties of travel until after the First World War, despite the rich development of the genus there. The common *L. coerulea* as well as *L. otaviensis* were first collected by the Swedish traveler and explorer Ture Eén in 1879. These collections were overlooked, and *L. coerulea* was described in 1892 based on later collections, while *L. otaviensis* was named in 1936 by R. C. Foster who based the species on a 1925 collection made by Kurt Dinter. The widespread *L. littoralis* subsp. *caudata* was first collected by Rautanen in 1885 and described as *L. caudata* by Schinz. Later collections of this distinctive subspecies were given different epithets, *L. lacinulata* being described from a Zambian collection, and *L. delagoensis* from specimens from

collection from Angola, *L. littoralis* was actually first collected by William Burchell in 1812 in the northern Cape, but *L. littoralis* had already been described (Baker, 1878b) when Baker named Burchell's plants *L. burchellii* in 1892. The identity



southern Mozambique. In Namibia the common *L. bainesii* was first collected by Rautanen in 1892, but was not then associated with the Botswanan species. When collected later by Kurt Dinter, it was described as *L. vaupeliana*. Dinter's Namibian collections are particularly important as his several duplicates were distributed to many herbaria. His collections also formed the basis for *L. dinteri* (= *L. schimperi*) and *L. stenoloba* (= *L. littoralis*), described by Vaupel in 1912; *L. avasmontana*, *L. uliginosa* (= *L. schimperi*), *L. juttæ* (= *L. odoratissima*), and *L. ramossissima* (= *L. littoralis*), all described by Dinter.

Although Namibia is now fairly well explored botanically, it was only in 1971 that *Lapeirousia rivularis* was described by the Swedish botanist H. E. Wanntorp. The species had been collected as early as 1900 by H. Baum in southern Angola, and by K. H. Barnard in 1921 in northern Namibia but was confused with *L. coerulea* or other species.

Western Zambia and the eastern half of Angola await full botanical exploration, and it is from here that the two new species in this treatment come. Recognized in 1972 as a variety of *Lapeirousia erythrantha* by Geerinck et al., *L. teretifolia* is raised to species rank in this treatment. The new *L. angolensis* is incompletely known and is based on only two collections. Further exploration in Angola is expected to resolve any doubts about this species and should also make it possible to determine the identity of *L. welwitschii*, which was described by Baker (1878b) but cannot be matched satisfactorily with any known species at present owing to the state of the type material. *Lapeirousia bainesii* and *L. otaviensis* are relatively common in northern Namibia but are known from only one or two collections in southern Angola, where they may be fairly common. The establishment of the complete ranges of these species awaits further exploration of this area.

The current circumscription of *Lapeirousia* dates from 1972 (Goldblatt, 1972). In this revision of *Lapeirousia* in the winter-rainfall zone of southern Africa, *Anomatheca* was excluded from *Lapeirousia* and subg. *Sophronia* was not recognized at all. I established two sections for the 19 species treated, sect. *Lapeirousia* including *Sophronia* and sect. *Fastigiata* for the Cape species of what is now recognized as subg. *Paniculata* (Goldblatt & Manning, 1990). The infrageneric classification did not deal at all with the tropical African species, now subg. *Paniculata* sect. *Paniculata*, but recognized the apparently important distinction between corrugate-leaved subg. *Lapeirousia* with woody corm tunics and plane-leaved subg. *Panicu-*

*lata* with tunics of compressed fibers. The infrageneric classification used here (Goldblatt & Manning, 1990) is a refinement of my earlier classification.

#### ETHNOBOTANY

As early as 1912 Dinter reported on the use of the corms of *Lapeirousia* species as a food in Namibia. Dinter mentioned specifically that corms of *L. littoralis* (as *L. caudata*), *L. coerulea*, *L. schimperi* (as *L. uliginosa*), and *L. odoratissima* (as *L. juttæ*) are a valued food eaten after roasting in hot ashes. Dinter provided vernacular names *onduvi* (*ozonduvi* pl.) (Herero) and *garib* (Khoi) for *Lapeirousia*. Dinter's observation has been confirmed repeatedly by plant collectors and ethnobotanists, notably R. Story for the Kung Bushmen (*L. coerulea*, Story 6121, and *L. littoralis*, Story 6162).

Rodin (1985) documented that corms of *L. coerulea*, *L. bainesii* (as *L. vaupeliana*), and *L. schimperi* (as *L. cyanescens*) are eaten both raw and roasted by the Kwanyama Ovambos in northern Namibia. The Kung Bushmen are also reported to eat the corms of *L. odoratissima* for their water content (Marshall, 1976). The Kung are reported to bake and eat corms of *L. bainesii* or to pound the cooked corms into a meal, then eat them as a gruel with water (Fox & Young, 1982). In addition, a collection of *L. gracilis* (Seydel 3419) documents the edibility of this species.

In light of the amply documented use of the corms of several Namibian species of *Lapeirousia* as food, Watt & Breyer-Brandwijk's (1962) unsubstantiated report that *L. coerulea* is poisonous is doubtful, particularly since their tests performed on a frog for cardiac glycoside action proved negative.

*Lapeirousia* appears to have little value to human populations outside Namibia and presumably adjacent Angola and Botswana. There are, however, isolated reports that corms of *L. erythrantha* are eaten in the Shire Highlands (southern Malawi) "in time of great famine" (Buchanan 426). Collection notes (*Simpathu* 60 from Victoria Falls, Zimbabwe) also indicate that corms of *L. erythrantha* are eaten raw.

#### SYSTEMATIC TREATMENT

**Lapeirousia** Pourret, Mem. Acad. Sci. Toulouse 3: 79–82. 1788. Ker, König & Sims, Ann. Bot. 1: 238. 1804. Baker, J. Linn. Soc. Bot.



1: 154–156. 1878; Handbook Irideae 167–174. 1892; Fl. Capensis 6: 88–97. 1986; Fl. Tropical Africa 7: 350–355. 1898, excluding subg. *Anomatheca*. Sölch, Prod. Fl. Südwestafrika 155: 6–10. 1969. Goldblatt, Ann. Bot. Soc. Roy. Bot. Belgique 105: 333–351. 1972.

For the generic synonymy see Goldblatt (1972).

Plants perennial geophytes, deciduous in the dry season. *Rootstock* a bell-shaped corm with a flat base, the tunics hard-textured, woody to coriaceous, entire and concentric initially, becoming irregularly fragmented with age, or composed of compressed fibers and then becoming cancellate to loosely fibrous with age. *Cataphylls* usually 2, membranous, the inner one reaching shortly above the ground, the outer about half as long, pale to partly brown or uniformly dark brown. *Leaves* 2–several, often only 1 inserted at the base near ground level and this largest, sheathing below, blade isobilateral for the most part but often channeled above the sheath for a short distance or up to half its length, other leaves sometimes basal or more often inserted aboveground and progressively shorter above, linear to lanceolate with a plane surface and a central vein evident, sometimes terete to oval in section (subg. *Paniculata*), or corrugate and the central vein no more prominent than the other veins (subg. *Lapeirousia*). *Stem* erect, somewhat compressed and 2–3-angled, often more conspicuously so above, the angles often weakly winged. *Inflorescence* paniclelike or a simple to branched spike, the panicles often somewhat corymbose; individual flowers always with a pair

of opposed bracts at the base of the ovary; *bracts* herbaceous to membranous, the outer abaxial and often the largest, sometimes ridged or keeled, the keel sometimes crisped or toothed (subg. *Lapeirousia*); the inner bract adaxial, usually with 2 veins, and frequently bifurcate. *Flowers* actinomorphic or zygomorphic, the perianth petaloid, often brightly colored, forming a short to extended tube, the tepals subequal or unequal, then usually with the upper tepal largest and the lower 3 smallest and forming a lip and provided with nectar guides of contrasting coloration. *Stamens* symmetrically disposed or unilateral and erect to arcuate; *filaments* filiform, inserted below the mouth of the tube; *anthers* oblong to linear, longitudinally dehiscent, sub-basifixed to nearly centric. *Ovary* globose to ovoid, concealed by the bracts; *style* filiform, dividing into 3 above, the branches usually forked for up to half their length, occasionally entire or barely bifid. *Capsules* membranous to coriaceous, globose to 3-lobed; *seeds* ± globose to weakly angled by pressure, the surface rough. *Haploid chromosome numbers*  $n = 10, 9, 8, 7, 6, 5, 4, 3$ , the karyotypes often bimodal. TYPE SPECIES: *Lapeirousia compressa* Pourret (= *L. fabricii* (de la Roche) Ker).

Named by French naturalist Abbé Pierre André Pourret (1754–1818) in honor of his colleague and contemporary, Philippe Picot de Lapeirouse, botanist and mineralogist at the University of Toulouse. The first and only species to be so named was thought by Pourret to have come from Isle de France (Mauritius). Had Pourret known that it was a Cape species he probably would have placed it in *Gladiolus* or *Ixia*, genera to which other species of *Lapeirousia* were at that time assigned.

KEY TO LAPEIROUSIA IN TROPICAL AFRICA INCLUDING BOTSWANA, NAMIBIA, AND TRANSVAAL, SOUTH AFRICA

\* Species marked with an asterisk are predominantly southern African and restricted to southern Namibia, largely to the southwestern corner that receives winter rainfall. They are treated fully by Goldblatt (1972).

- 1a. Axis contracted above ground level, the inflorescence congested and plants tufted in appearance; floral bracts herbaceous and hardly different from the leaves.
  - 2a. Floral bracts 6–15 cm long; perianth tube 10–14 cm long ..... 16. *L. odoratissima*
  - 2b. Floral bracts 4–5 cm long; perianth tube ca. 3.5 cm long ..... *L. plicata*\*
- 1b. Axis including the inflorescence extending above the ground and relatively lax; floral bracts herbaceous to ± membranous and dry but unlike the foliage leaves.
  - 3a. Perianth tube (2–)2.5–15 cm long (if less than 2.5 cm then the tepals narrower than 2 mm).
    - 4a. Perianth tube 10–15 cm long; tepals 6–7 mm wide ..... 14. *L. schimperi*
    - 4b. Perianth tube 2–7 cm long; tepals 1.5–5 mm wide.
      - 5a. Tepals at least 15(–30) mm long; flowers shades of white to cream, rarely purple, with or without markings on the lower tepals.
        - 6a. Tepals 1.3–3 mm at the widest; flowers without markings on the lower tepals ..... 15. *L. littoralis*
        - 6b. Tepals 4–5 mm at the widest; flowers with violet markings on lower tepals ..... 12. *L. otaviensis*



- 5b. Tepals 8–14 mm long; flowers shades of blue to violet, sometimes white to cream, or greenish, but always with contrasting markings on the lower three tepals.
- 7a. Inflorescence a divaricately branched panicle with the main branches 1(or 2)-flowered.
- 8a. Perianth white to pale pink; corm tunics straw-colored and  $\pm$  fibrous and reticulate; perianth tube 25–34(–40) mm long, rarely shorter ..... 13. *L. bainesii*
- 8b. Perianth blue to violet; corm tunics dark brown, consisting of irregularly broken strips; perianth tube 15–18(–20) mm ..... 10. *L. sandersonii*
- 7b. Inflorescence a panicle or spike with at least some main branches 3–8-flowered.
- 9a. Perianth greenish or blue-violet with red to purple markings on the lower tepals; plants of Mozambique, Transvaal, and Zimbabwe ..... 9. *L. masukuensis*
- 9b. Perianth white or pale blue with bluish markings on the lower tepals; plants of Namibia ..... 11. *L. gracilis*
- 3b. Perianth tube 1–20(–25) mm long (if 20–25 mm then the tepals at least 2 mm wide).
- 10a. Perianth tube shorter than 2 mm; flower actinomorphic.
- 11a. Flowers 1(or 2) on terminal branches of the inflorescence; tepals 11–15.5 mm long; corm tunics dark brown to blackish and decaying irregularly into vertical strips ..... 2. *L. avasmontana*
- 11b. Flowers (2–)3–5 on terminal branches of the inflorescence; tepals 7–9.5 mm long; corm tunics light brown and forming a fibrous network ..... 1. *L. coerulea*
- 10b. Perianth tube 3–20(–25) mm long; flower medianly zygomorphic with arcuate unilateral stamens.
- 12a. Leaves corrugate and without an evident main vein; floral bracts herbaceous, usually longer than 16 mm, and the outer bract much longer than the inner; South Africa and southern Namibia.
- 13a. Perianth tube with the throat much wider than the lower part ..... *L. dolomitica*\*
- 13b. Perianth tube slender and  $\pm$  uniform throughout ..... *L. barklyi*\*
- 12b. Leaves either plane and with an evident midvein (at least when living) or rounded to terete and the midrib then not evident, but not corrugate; floral bracts herbaceous to membranous, usually shorter than 10 mm and the outer bract about as long or shorter than the inner; Transvaal, Namibia, and tropical Africa.
- 14a. Perianth tube 15–20(–25) mm long.
- 15a. Main inflorescence branches 1(or 2)-flowered; leaves 1–3 mm wide; branching  $\pm$  divaricate ..... 10. *L. sandersonii*
- 15b. Main inflorescence branches 5–8-flowered; leaves 3–6 mm wide; branching unequal with the main axis straight ..... 9. *L. masukuensis*
- 14b. Perianth tube 8–12(–15) mm long.
- 16a. Inflorescence a simple or branched spike with rarely more than 2 lateral branches; bracts 6–8(–10) mm long; plants seldom exceeding 20 cm high; plants of northern Ethiopia and eastern Sudan ..... 8. *L. abyssinica*
- 16b. Inflorescence a panicle or several-branched spike (rarely with fewer than 3 lateral branches); bracts 5–6 mm long; plants often taller than 20 cm; plants of Nigeria or south tropical Africa, including Botswana and Namibia.
- 17a. Inflorescence a lax panicle with the main terminal branches mostly 3–5-flowered; upper tepal suberect to curving forward over the stamens ..... 3. *L. rivularis*
- 17b. Inflorescence a lax to dense panicle with the main terminal branches 1–5-flowered; upper tepal erect to patent, spreading outward, thus not hooded over the stamens.
- 18a. Leaves narrow, 1–1.5 mm diam., elliptic to terete in section and without an evident midrib; perianth tube 3–5 mm long and tepals 5–14 mm long; main inflorescence branches with 1 or 2 flowers.
- 19a. Perianth tube exceeding the bracts by 2–3 mm and only slightly shorter than the tepals; tepals 5–6 mm long ..... 6. *L. teretifolia*
- 19b. Perianth tube barely exceeding the bracts and less than half as long as the tepals; tepals 12–14 mm long ..... 7. *L. angolensis*
- 18b. Leaves plane, narrow to broad, 0.5–8(–11) mm wide and always with a defined midrib; perianth tube 7–14 mm long and tepals 7–11 mm long; at least some inflorescence branches with more than 2(–8) flowers.
- 20a. Plants rarely taller than 12 cm; bracts herbaceous at anthesis; branching usually contorted ..... 5. *L. setifolia*
- 20b. Plants (15–)20–45 cm high; bracts generally membranous and dry above at anthesis; branching not contorted ..... 4. *L. erythrantha*



For the southern African countries of Botswana, Namibia, and South Africa, cited specimens are arranged according to the grid reference system based on geographical degree coordinates of latitude and longitude currently used in floristic treatments for the subcontinent (Edwards & Leistner, 1971). All type material cited was seen unless otherwise indicated.

Descriptions are based on both fresh and the available dried material, but measurements are based on living plants whenever possible. A shrinkage factor of 20% or more may be expected for flower parts, and 10% for leaves, depending on the care and method of preservation. Flower color fades progressively in dry specimens, eventually changing completely, becoming darker or lighter and sometimes ultimately disappearing. Color notes on collected specimens are desirable and are frequently mentioned by collectors.

SUBGENUS *PANICULATA* GOLDBL. & MANNING  
SECTION *PANICULATA*

1. ***Lapeirousia coerulea*** Schinz, Verh. Bot. Verein. Brandenburg 31: 212–213. 1890. Baker, Handbk. Iridae 168. 1892; Fl. Trop. Africa 7: 351. 1898. Sölch, Prod. Fl. Südwestafrika 155: 8–9. 1969 (including *L. avasmontana*). TYPE: Namibia, (Upingtonia) Om-bale, südost Ondonga, Mar. 1886, Schinz 13 (lectotype, K, here designated; isotype, COI); Hereroland, Lüderitz 28 (syntypes, B, Z); Otjitambi im Kaoko, Belck 50 (syntype, not seen). Figure 4.

*Ixia dinteri* Schinz, Mém. Herb. Boissier 20: 14. 1900. TYPE: Namibia: Karibib, Spitzkop, marshy ground, Dinter 22 (32 on the type) in 1898 (holotype, Z).

Plants (12–)15–30 cm high, branched repeatedly. *Corm* 12–16 mm diam. at the base, light brown, the tunics of pale compacted fibers decaying to become coarsely to finely fibrous and reticulate. *Cataphylls* 2, pale to light brown. *Leaves* 2–4, only the lowermost inserted at the base, this leaf longest and reaching to the middle of the inflorescence or beyond,  $\pm$  linear, 2–4(–5) mm wide, the upper leaves decreasing in size above. *Stem* compressed, 2–3-angled, often intricately branched. *Inflorescence* a lax panicle with ascending branches, the larger terminal branches bearing (2–)3–5 sessile flowers; *bracts* 3–4 mm long, herbaceous below, membranous apically and becoming completely dry in fruit, the inner bracts about as long as the outer. *Flower* actinomorphic,  $\pm$  stellate,

blue to light purple with a white hastate marking outlined in dark blue to violet (less often reddish) in the lower half of each tepal; *perianth tube* 1–1.5 mm long, cylindrical below, widening above, the cylindrical part shorter than 1 mm; *tepals* spreading below, curving upward distally, subequal, lanceolate, 7–9.5 mm long, 3–5 mm wide. *Filaments* inserted below the mouth of the tube, united basally for less than 0.5 mm by an obscure coronalike ring, erect, ca. 4 mm long, nearly contiguous around the style; *anthers* diverging, 3–3.5 mm long, curving inward after anthesis; pollen light blue-purple (white to yellow when dry). *Ovary* ca. 2 mm long, *style* erect, 6–7 mm long, dividing near the anther apices, branches ca. 1.2 mm long, barely notched apically. *Capsules* obovoid-globose, weakly 3-lobed, ca. 4 mm long; *seeds* dark brown, globose to weakly angled by pressure, 1.3–2 mm diam., tapering near the attached funicle. *Chromosome number*  $2n = 8$ .

*Flowering time.* (January)February to April.

*Distribution and habitat.* Typically a species of damp, low-lying places, *Lapeirousia coerulea* is widespread throughout the summer-rainfall part of Namibia (Fig. 4) where it occurs in seeps, seasonal vleis, damp poorly drained grassland, and shallow soil in rock outcrops where water accumulates in the wet season. There are a few records from northwestern Botswana, where it is apparently rare.

Several collections are accompanied by notes indicating that *Lapeirousia coerulea* is eaten by natives, particularly the Kung Bushmen for whom the corms are a staple, eaten after roasting in hot ash (Story 6121), or sometimes raw (Rodin, 1985).

*Diagnosis and relationships.* *Lapeirousia coerulea* and the closely allied *L. avasmontana* appear to be taxonomically isolated among the tropical African members of the genus in their short-tubed and completely actinomorphic flowers. However, their paniculate inflorescences indicate a relationship with the tropical African sect. *Paniculatae*. The actinomorphic, blue flowers with their vestigial perianth tube and unusually short, undivided style branches make the two species easy to recognize. The differences between *L. coerulea*, a species of wet low-lying places, and *L. avasmontana*, which grows in well-drained stony banks and hills (discussed in detail under *L. avasmontana*), involve vegetative and floral features, including corm tunics, branching pattern of the inflorescence, and flower size and patterning. These morphological differences, combined with the disparate



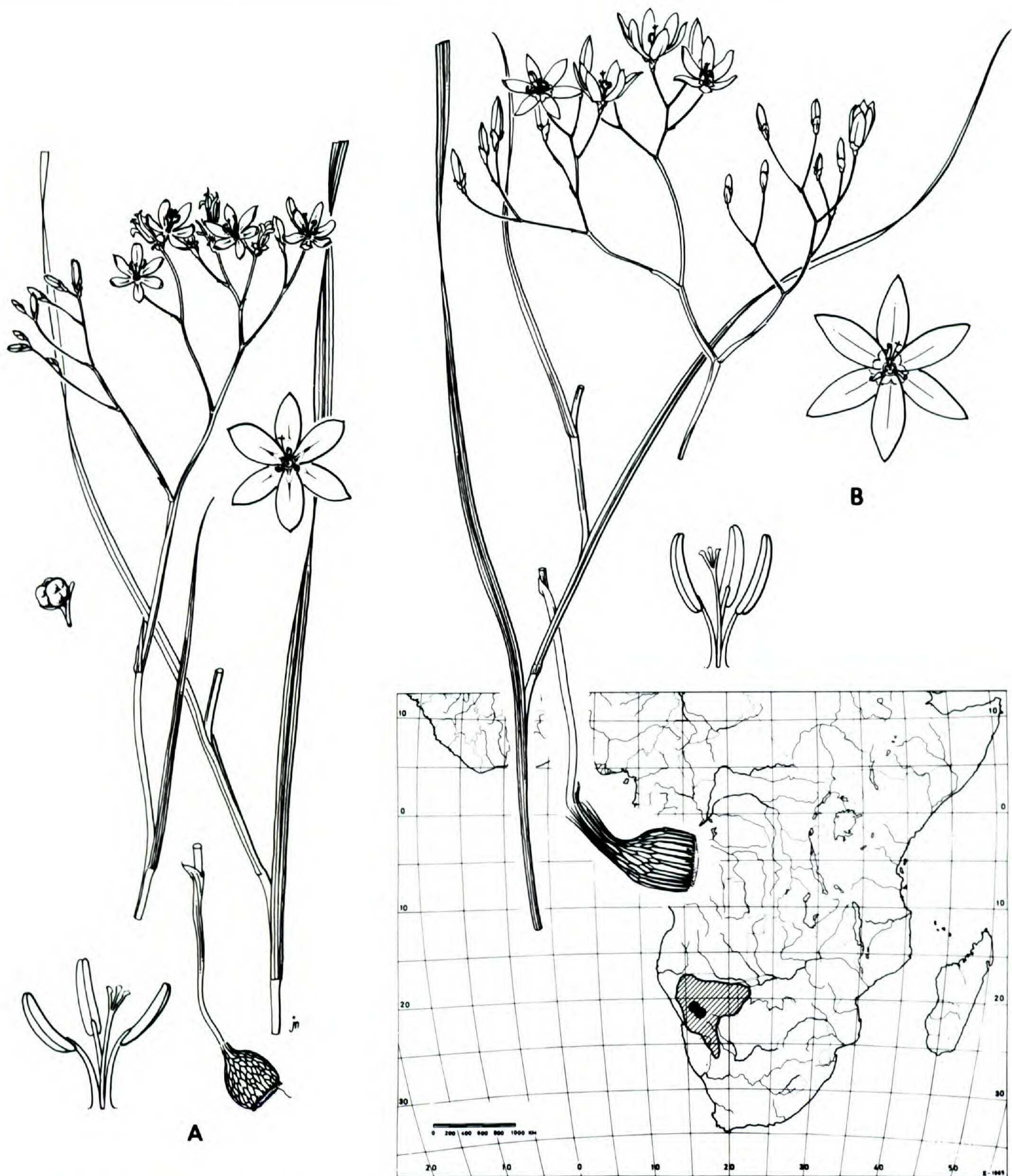


FIGURE 4. Morphology and distribution of *Lapeirousia coerulea* (A) (and hatched area) and *L. avasmontana* (B) (and closed circles). Habits and corms  $\times 0.5$ ; single flowers and fruit full size; details of stamens and style  $\times 2$ . (Drawn by J. C. Manning.)

habitat preferences and karyotypes (discussed below), compel their separation even though Sölch (1969) united them.

A diploid number of  $2n = 8$  has been recorded in seven populations of *Lapeirousia coerulea* (Goldblatt, 1990b). The karyotype consists of two larger and two smaller chromosome pairs. This low and apparently derived number also occurs in the Ethiopian *L. abyssinica* and in *L. setifolia*, both of which have karyotypes comparable to but some-

what different from that of *L. coerulea*. *Lapeirousia avasmontana* has  $2n = 16$ , but it is clearly not a direct polyploid derived from ancestors such as *L. coerulea*. Its karyotype comprises one long and seven short chromosome pairs, and it has about the same amount of chromosome material per cell as *L. coerulea*. Base number in *L. coerulea* is consistent with its placement in sect. *Paniculatae*. Despite its actinomorphic flowers, *L. coerulea* is probably most closely related to the *L. erythrantha*



group of species, all of which have longer-tubed, zygomorphic flowers. Chromosome numbers in the section are  $2n = 12, 10, 8,$  and  $6$  (Goldblatt, 1990b), and the karyotypes in the group are weakly, if at all, bimodal. The simple flower structure of *L. coerulea* makes it appear to be close to the basal stock of the tropical African species.

**History.** The widespread *Lapeirousia coerulea* was first collected in 1879 by the Swedish traveler and explorer Ture Eén on his second major expedition to Namibia. This early record received no attention, and collections made after 1885 independently by Hans Schinz, August Lüderitz, and Waldemar Belck formed the basis for the protologue published by Schinz in 1890. In 1900 Schinz also described *Ixia dinteri*, a species undoubtedly conspecific with *L. coerulea*, based on specimens collected by Kurt Dinter in 1898.

**Additional specimens examined.** BOTSWANA. NGAMILAND: 19.21 (Aha Hills) Xangwe, Mar. 1961 (CB), *Gibson 186* (MO, WIND); Dobe region, north of Aha Hills near Namibian border, dry pan, 25 Apr. 1980, *Smith 3496* (MO, PRE, SRGH); Dobe, 19 Sep. 1964, *Lee 13* (SRGH); hard clay in dry pan, Quangwa River catchment,  $19^{\circ}35' 21^{\circ}2''$ , 23 Apr. 1981, *Smith 3674* (BR, PRE). GHANZI: 21.22 (Kobe) pan on farm 102, Kuki, 21 Feb. 1970 (AC), *Brown & Brown 8723* (C, PRE, SRGH); 53 km NE of Ghanzi on the road to Maun,  $22^{\circ}05' 21^{\circ}26''$ , seasonally flooded limestone outcrops, 29 Dec. 1977, *Skarpe 213* (K, MO, PRE, UCBG). NAMIBIA. OVAMBOLAND: 17.15 (Ondangua) 3 km S of Oshikango, 3 Apr. 1973 (BD), *Rodin 9203* (K, M, MO, PRE, WIND). ETOSHA: 18.15 (Okahakana) Etosha Pan, large vlei 5 mi. W of Okondeka, 27 Mar. 1963 (DD), *Giess et al. 6056* (M, WIND); NW Ecke des Etosha National Park, trockene randzone von vlei, 18 Mar. 1974, *Mermüller & Giess 30378* (M, PRE). GROOTFONTEIN: 19.17 (Tsumeb) 25 km from Tsumeb toward Ondangua, 14 Feb. 1983 (BA), *Lavranos & Pehlemann 21101* (WIND); farm Toevlug, lime marl, 5 Feb. 1971, *Giess 11292* (K, MO, PRE, SRGH, WAG, WIND); farm Goab, spring meadows, 29 Jan. 1978 (CA), *Giess 14955* (M, MO, PRE, WAG, WIND); 19.18 (Grootfontein) Grootfontein, red loamy flats (CA), Jan. 1935, *Schoenfelder 35* (K, PRE); 13 mi. N of Grootfontein, 14 Jan. 1934, *Schoenfelder 434* (PRE); farm Kumkaus (GR 552), in vlei, 7 Mar. 1974, *Merxmüller & Giess 30107* (M). OKAVANGO: 19.20 (Tsumkwe) pans at Tsumkwe, 14 Jan. 1971 (DA), *Giess et al. 11076* (M, S, PRE, WIND); Tsumkwe, 14 Jan. 1958, *Story 6121* (M, PRE, SRGH). OUTJO: 22.15 (Otjijhorongo) farm Goreis, red loam sand, 17 Feb. 1971 (BB), *Giess 11248A* (K, M, PRE, WIND). OTJIWARONGO: 20.16 (Otjiwarongo) Otjiwarongo (BC), s.d., *Barnard 198* (SAM); 30 km S of Otjiwarongo, 1985 (CB), *Lavranos 22698* (MO); 20.17 (Waterberg) omuramba at Omam, 11 Mar. 1940 (CA), *Volk 2845* (WIND). GOBABIS: 21.18 (Steinhausen) farm Wilhelmsruhe, 10 Feb. 1982 (DC), *Rauh 57762* (WIND). WINDHOEK: 22.17 (Windhoek) Neudam Experimental Farm, 22 Mar. 1960 (AD), *van Vuuren 1027* (K, M, PRE, SRGH, WIND); Ongombo, N of Neudamm, 26 Dec. 1963, *Giess 243* (M); farm Otjikundua 67 mi. WSW of Steinhausen, open vlei, 19 Feb. 1955 (BA), *de Winter*

2409 (K, M, NBG, PRE, WIND); farm Aris, S of Windhoek, omuramba, 1 Mar. 1953 (CA), *Walter & Walter 1550* (B, BR, WIND). OMARURU: 21.15 (Karibib) Ohere-Oos, granite flats, 14 Feb. 1958 (BA), *Merxmüller & Giess 1583* (M, PRE, WIND); 30 km NW Omaruru, 19 Apr. 1968, *Wanntorp 805* (K, S). KARIBIB: 21.15 (Karibib) Ameib Ranch, granite rock flushes at Bull Parties, 15 Mar. 1988 (DC), *Goldblatt & Manning 8811A* (M, MO, PRE, WAG, WIND); 22.15 (Trekopje) Okongawa, Granitbankberg, 4 Feb. 1934 (BB), *Dinter 6957* (B, BOL, G, K, HBG, M, PRE, S, WIND, Z). OKAHANDJA: 21.16 (Okahandja) farm Omatako View, 15 Feb. 1974 (BA), *Woortman 116* (M, PRE, WIND); farm Omongongua, shallow depressions in omuramba, 27 Mar. 1960 (DB), *Seydel 2203* (B, K, GH, MO, WIND); farm Omungongua, Okahandja, 1953, *Walter & Walter 1510* (B, K); farm Okambahe, ca. 16 mi. W of Okahandja on the road to Karibib, 21 Dec. 1963 (DC), *Giess et al. 5058* (M, MO, PRE, WIND). REHOBOTH: 23.16 (Nauchas) farm Göllschau, 27 Jan. 1972 (BC), *Giess & Hübsch 11600* (M, PRE, WIND); 23.17 (Rehoboth) farm Gravenstein, 20 Nov. 1956 (BC), *Volk 11503* (M, MO, WIND); farm Tsumis, sandy soil (CA), *Müller 1396* (M, PRE, WIND). KEETMANSHOOP: 26.18 (Keetmanshoop) Spitzkoppe, 7 Apr. 1984 (AD), *Craven 1533* (WIND). WITHOUT PRECISE LOCALITY: NAMIBIA: Damaraland, 1879, *Eén s.n.* (BM); Otavital, 26 Feb. 1925, *Dinter 5663* (B, GH, Z); Kalahari, 1886, *Ross s.n. ex Herb. Schinz* (M); farm Schoengelegen, 22 Feb. 1961, *Seydel 2609* (BR, COI, M, MO, WAG).

**2. *Lapeirousia avasmontana*** Dinter, Feddes Rep. 29: 256. 1931. TYPE: Namibia: Lichtenstein, Auas Mountains, 20 Feb. 1923, *Dinter 4454* (holotype, B; isotypes, GH, K (photo), S, Z (3)). Figure 4.

Plants 20–30 cm high, branched repeatedly. *Corm* 15–20 mm at the widest diam., tunics dark brown to blackish, the inner layers  $\pm$  woody, the outer decaying irregularly, often into vertical strands. *Cataphylls* 2, membranous, usually brownish, the inner one reaching shortly above the ground. *Leaves* 3–4, linear, 2–3 mm wide, only the midrib prominent, the lowermost leaves inserted near ground level and longest, usually slightly longer than the inflorescence, other leaves inserted above the ground and progressively smaller above, those subtending branches becoming bractlike. *Stem*  $\pm$  divaricately branched above, rounded to lightly triangular, sometimes obscurely winged or ridged at one or more of the angles. *Inflorescence* a rounded corymbose panicle, the ultimate branches with 1 (or 2) flowers; *bracts* 5–6 mm long, herbaceous below, membranous in the upper half and bent outward by the tepals, becoming completely dry in fruit, the inner bract about as long or longer than the outer. *Flower* actinomorphic, blue to light purple with a white heart-shaped mark feathered purple on the edges in the lower midline of each tepal; *perianth tube* ca. 1 mm long, cylindrical in the lower



half, widening above; *tepals* spreading outward and curving upward apically, subequal, lanceolate to elliptic, 11–15.5 mm long, (4–)5–7 mm wide. *Filaments* inserted at top of the slender part of the tube, erect, 4–5 mm long, in the lower half nearly contiguous around the style, diverging above; *anthers* diverging, 4–5 mm long, curving inward after anthesis; pollen light blue-purple to whitish. *Ovary* ca. 2 mm long; *style* erect, 6–7 mm long, dividing near the anther apices, branches ca. 1.2 mm long, barely notched apically. *Capsules*  $\pm$  globose, weakly 3-lobed, showing the outline of the seeds, 6–8 mm long, ca. 7 mm diam.; *seeds* globose, dark brown, 1.5–2 mm diam., rounded to weakly angled by pressure, tapering toward the attached funicle. *Chromosome number*  $2n = 16$ .

*Flowering time.* February to April.

*Distribution and habitat.* *Lapeirousia avasmontana* is endemic to central interior Namibia, where it is locally common on the hills and mountains around Windhoek and in the north toward Okahandja (Fig. 4). Apparently preferring well-drained sites, it grows on open, stony, sloping ground. Depending on the rainfall, flowering may last between three and eight weeks. New branches continue to be produced from the cauline leaf axils as long as the ground remains moist, and a late rainfall can stimulate production of a second flush of flowering from new branches on the same flowering stem. The bright blue flowers are visited by a variety of insects including bees, wasps, and butterflies. No measurable nectar is produced, and presumably the only reward to insect visitors is pollen. The very short perianth tube and blue, stellate flower suggest that the species, like the morphologically similar *L. coerulea*, depends on short-tongued pollen-foraging bees for pollen transfer.

*Diagnosis and relationships.* The large, pale blue (blue-lilac) flowers with a white center, completely actinomorphic perianth and stamens, and large umbrellalike, paniculate inflorescence distinguish *Lapeirousia avasmontana* from other tropical and subtropical African species of the genus. It is most easily confused with the more widespread Namibian species *L. coerulea*, which has similar but smaller actinomorphic flowers. *Lapeirousia avasmontana* has dark brown, more or less woody corm tunics that break into vertical strips as they decay and a divaricately branched inflorescence, the terminal branches of which bear a single (rarely two) flowers. Both features contrast strongly with *L. coerulea*, which has light brown tunics that

become fibrous and reticulate as they decay, and a less strongly branched inflorescence of ascending branches, some of which terminate in spikes of 3–5 flowers. The flowers of the two species also differ, those of *L. avasmontana* having somewhat larger, pale blue tepals 11–15.5 mm long, with heart-shaped white markings, compared with those of *L. coerulea* having tepals 8–9 mm long, with hastate white markings. These differences were noted in the protologue by Dinter (1931), who was aware of the possible confusion between *L. avasmontana* and *L. coerulea*.

Chromosome cytology provides additional information about the status of *Lapeirousia avasmontana*. Its diploid chromosome number is  $2n = 16$ , and the strongly bimodal karyotype consists of 2 long and 14 short chromosomes (Goldblatt, 1990b). *Lapeirousia coerulea* has, in contrast,  $2n = 8$  and a karyotype of four long and four shorter chromosomes. Despite the apparent numerical polyploid relationship, their karyotypes differ so much that it is clear that a more complex situation is involved. Karyology supports the separation of the two species and suggests that they are not particularly closely related.

*History.* *Lapeirousia avasmontana* was discovered in 1923 by Kurt Dinter who described it in 1931. In the protologue *Lapeirousia avasmontana* was compared closely with the similar *L. coerulea* which, as Dinter pointed out, grows in a different habitat and differs in the several vegetative and floral morphological features mentioned above. Although *L. avasmontana* was included in *L. coerulea* in the *Prodomus Flora Südwestafrika* (Sölch, 1969), I have no hesitation in recognizing it as a separate species.

*Additional specimens examined.* NAMIBIA. WINDHOEK: 22.16 (Otjimbingwe) farm Onduno, Hochflaeche, 27 Feb. 1966 (BD), Meyer 115 (MO, WIND); farm Terra Rossa, rocky slope, 13 May 1973 (CD), Giess 13498 (K, M, NBG, PRE, WAG, WIND); farm Friedenau, 25 Mar. 1982 (DB), Müller & Kolberg 2039 (PRE, WIND); 16 Apr. 1939 (fl & fr), Gassner 134 (M); 22.17 (Windhoek) Elisenheim, Erosberge, below Wächter, smooth shale slopes, 28 Feb. 1974 (AC), Merxmüller & Giess 30017 (K, M, S, PRE, SRGH, WAG, WIND); near Brakwater on the Windhoek-Okahandja road, 14 Mar. 1959, de Winter & Giess 7136 (M, PRE, WIND); Auasberge near Windhoek, Moltkeblick, 24 Mar. 1969 (CA), Meyer sub Giess 10725 (WIND); 5 km W of Windhoek on Daan Viljoen road, stony quartz hill slopes, 14 Mar. 1988, Goldblatt & Manning 8798 (E, K, M, MO, NBG, PRE, S, WAG, WIND).

**3. *Lapeirousia rivularis*** Wanntorp, Svensk. Bot. Tidskr. 65: 53–56. 1971. Roessler &



Merxmüller, Mitt. Bot. Staatssamml. München 15: 394–395. 1979. TYPE: Namibia: Karibib, farm Ameib, ca. 25 km NE of Usakos, granite kopje S of track, ca. 5 km E of farmhouse, 15 Apr. 1968, *Wanntorp & Wanntorp* 907 (holotype, S; isotype, M). Figure 5.

Plants 30–45 cm high, paniculately branched. *Corm* 12–22 mm wide at the base, tunics dark brown to blackish, coarsely fibrous or cancellate. *Cataphylls* 2, membranous, pale to dark brown, the inner one reaching shortly above the ground. *Leaves* 3–5, the lower 2  $\pm$  basal, bifacial and channeled for at least half their length, reaching to about the base of the inflorescence, linear and unifacial above, 2–3 mm wide, firm-textured, midrib lightly raised, the upper leaves subtending the branches of the inflorescence, bifacial for all or most of their length, progressively shorter above. *Stem* weakly compressed and 3–4-angled, usually laxly branched. *Inflorescence* a rounded to elongate panicle, the ultimate branches bearing (1–)3–5 flowers, laxly arranged; *bracts* 4–6(–9) mm long, green below, membranous and reddish in the upper half, apically dry and brown-tipped in bud, later becoming dry for  $\frac{2}{3}$  of their length, inner bract about as long as the outer and entire or apically forked. *Flower* zygomorphic, pale blue-mauve with white to cream nectar guides on the lower 3 tepals outlined in deep violet, sometimes with a median red streak, the reverse of the tube bluish; *perianth tube* ascending, narrowly funnel-shaped, ca. 1.3 mm wide at the base, 3 mm at the mouth, 7–9 mm long, weakly curved in the upper third; *tepals* lanceolate, subequal in size, (7–)10–13 mm long, 4–5 mm wide, the margins somewhat undulate, the upper tepal suberect to arching over the stamens, others directed forward, the lower 3 nearly horizontal, joined for ca. 1 mm longer than the upper, sometimes each with an obscure to conspicuous bump or callus in the median lower half. *Filaments* unilateral and arcuate, 8.5 mm long, inserted 3–4 mm below the mouth of the tube; *anthers* parallel and contiguous, 3.5–4 mm long, blue-mauve; pollen pale blue-mauve, fading to yellow. *Ovary* globose, ca. 2 mm long, *style* arched behind the stamens, dividing near the anther apices, 18–20 mm long, *branches* ca. 3 mm long, each shortly to deeply divided (occasionally entire) for up to half their length, ultimately recurving. *Capsule* 4–5 mm long; *seeds*  $\pm$  globose, 16–21 mm diam., brown. *Chromosome number*  $2n = 12$ .

*Flowering time.* (Mid January) February to early April.



FIGURE 5. Morphology of *Lapeirousia rivularis*. Habit and corm  $\times 0.5$ ; flower full size. (Drawn by M. L. Branch.)

*Distribution and habitat.* *Lapeirousia rivularis* appears to be largely a species of locally wet sites in semiarid southwestern tropical Africa (Fig. 6). The type locality is in western Namibia at the southern end of the Erongo Mountains, and it extends from here to northern Namibia and southern Angola. There are also several records from southern and central Zambia where plants are more robust, perhaps a reflection of the wetter climate. The usual habitat is along temporary streams, seeps, or rock flushes, and in Zambia I have seen it in rocky grassland at poorly drained but not notably wet sites. The species probably also occurs in Zim-



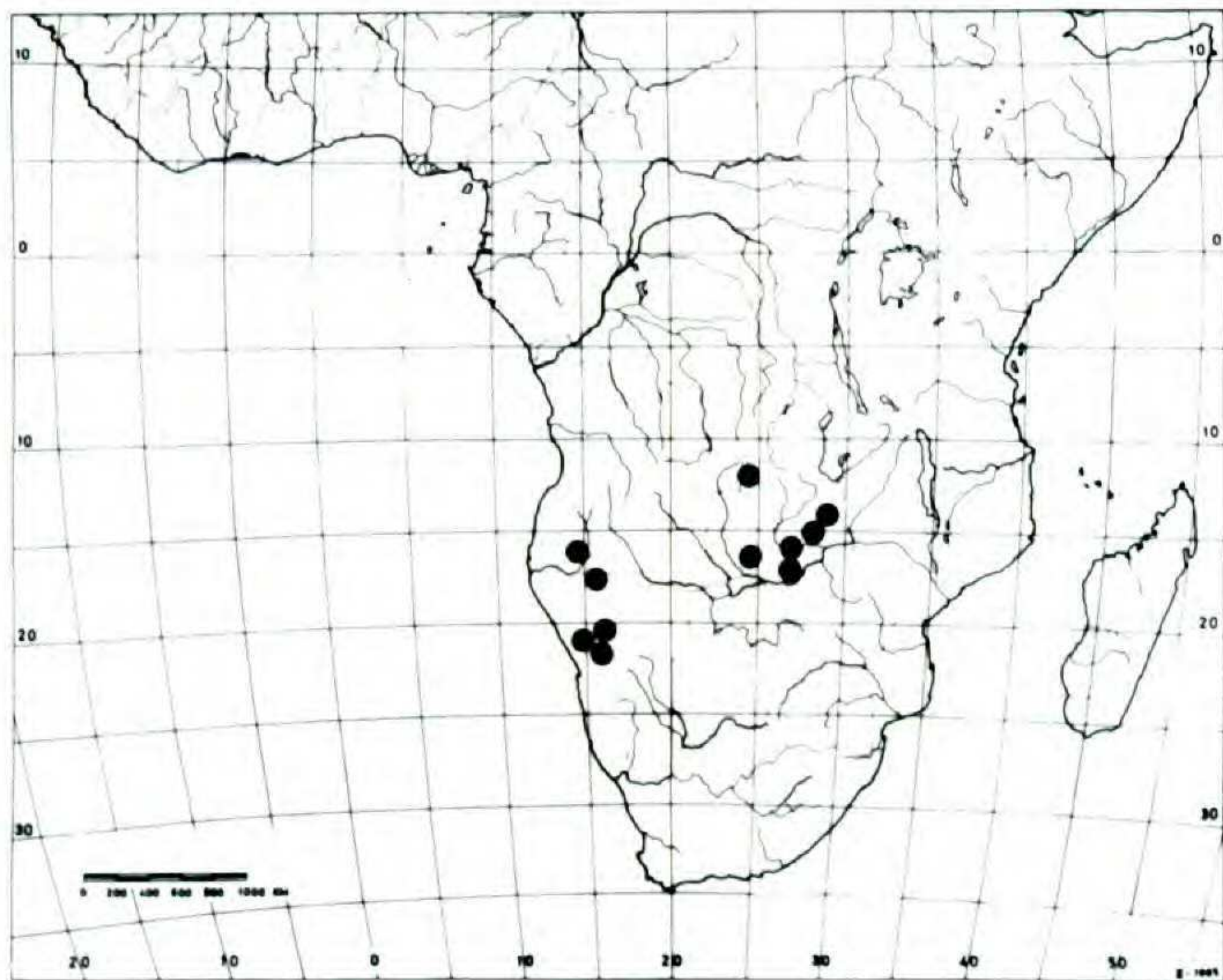


FIGURE 6. Distribution of *Lapeirousia rivularis*.

babwe, but I have seen no specimens that I can confidently refer here although some specimens (e.g., *Eyles 1952*; *Drewe 68*; *Mitchell 1319*) may belong to this species.

*Diagnosis and relationships.* The zygomorphic, pale blue flower with a perianth tube 7–9 mm long, an upper tepal erect to somewhat hooded over the arcuate stamens and style, and the upper lateral tepals directed forward are the principal features that distinguish *Lapeirousia rivularis* from other tropical African species of *Lapeirousia*. It is probably closely related to the *L. erythrantha* complex and is most often confused with the blue-flowered form of *L. erythrantha*, from which it is difficult to distinguish when dry. The flowers of *L. erythrantha* and *L. rivularis* are similarly colored and proportioned, with a perianth tube 7–9 mm long (–15 mm in *L. erythrantha*) and tepals about as long as the tube. When seen alive, the difference in flower form is striking. *Lapeirousia erythrantha* and its allies have the upper tepal erect to recurved and the upper laterals reflexed. Thus when the flowers are fully open the upper tepals lie in more or less the same horizontal plane as the liplike lower three. Sometimes close examination of herbarium material makes it possible to see this difference, but often the flowers are too distorted. In general *L. rivularis* has a more lax, open panicle typically with 3–5 flowers on the major terminal branches, whereas in *L. erythrantha* the most common type of inflorescence is comparatively dense with flowers crowded terminally on the branches.

It is uncertain whether *Lapeirousia welwitschii*, described by Baker in 1878 and based on specimens collected by Welwitsch in central Angola, is conspecific with *L. rivularis*. The general aspect of the type specimens is similar to

dwarfed forms of *L. rivularis*, especially its type, but the flowers are so shrunken and distorted that I hesitate to decide whether *L. welwitschii* is conspecific with *L. rivularis* or is a stunted form of *L. erythrantha*. The name is excluded until plants can be re-collected at the type locality, Pungo Andongo.

The collection from southern Angola, *Baum 958*, is somewhat unusual. Most of the many plants of the collection have unbranched stems, thus the inflorescence is a simple spike, others have one branch, and only a few have more than two branches (one specimen at Z has five branches). That the reduced branching is the result of abnormal growing conditions is as likely as the alternative that the population represents a genetic variant.

*History.* *Lapeirousia rivularis* was described by the Swedish botanist Hans-Erik Wanntorp in 1971, although he was not the earliest to record the species. It appears to have been first collected in Namibia by the South African zoologist K. H. Barnard, who found it on the northern border of Namibia along the Cunene River in 1921. The type locality of *L. rivularis*, the farm Ameib at the southern end of the Erongo Mountains, is the most southern station for *L. rivularis*, and plants from here can be recognized by the toothlike callus present in the midline of the lower three tepals. This tooth has little taxonomic significance. It appears occasionally in several species of *Lapeirousia*, and I have noted it in a few individuals in populations of the western Cape *L. anceps* and *L. divaricata*, and in some Namibian populations of *L. bainesii* and *L. gracilis*. A tepal tooth is a common feature in *Tritonia* (Ixiodeae–Ixieae), in which it defines some sections of the genus (de Vos, 1982), but even in this genus the expression of the character may sometimes vary; a callus or tooth may develop on only one tepal or on none. In *Lapeirousia* the presence of a tooth alone cannot be treated as evidence for recognition of species or even infraspecific taxa.

*Additional specimens examined.* ANGOLA. CUNENE: between Kiseve and Humbe, 1,100 m, (16°40' 14°57') 1 Apr. 1900, *Baum 958* (BM, BR, COI, E, G, K, M, S, Z). NAMIBIA. OVAMBOLAND: 17.15 (Ondangua) Engela Mission, shallow vlei in black sticky clay, 16 Feb. 1959 (BD), *de Winter & Giess 7061* (B, K, M, PRE, SRGH, WIND). OTJIWARONGO: 20.16 (Otjiwarongo) Otjiwarongo, not on summit but high up, 16 Mar. 1980 (BC), *Craven 1129* (WIND). KARIBIB: 21.14 (Uis) Brandberg, Sonuseb, common on top of Sonuseb saddle at water hole, 12 Apr. 1985 (BA), *Craven 2277* (WIND); 21.15 (Karibib) farm Ameib, below Jatow cave, somewhat marshy granite soil, 19 Mar. 1963 (DC), *Giess 13132* (B, M, PRE, WIND); 22 Mar. 1965, *Giess 8452* (K, M, MO, WAG, WIND);



17 Mar. 1963, *Giess et al.* 5795 (B, M, PRE, WIND); farm Ameib, coarse sandy, marshy ground below granite outcrops at the Devils Pulpit, 18 Mar. 1968, *Giess* 10248 (M, WIND); 5 Apr. 1974, *Merxmüller & Giess* 30699 (B, M, K, PRE, SRGH, WAG, WIND); Ameib, Philips Caves, edge of stream, 19 Mar. 1963, *Hardy & de Winter* 1420 (B, K, M, PRE, WAG). ZAMBIA. CENTRAL: Lusaka District, campus of the Univ. of Zambia, 19 Jan. 1973, *Strid* 2884 (C, K, MO); Lusaka, off Church Road in grounds of Evelyn Hone College, 11 Jan. 1986, *Goldblatt* 7537 (E, K, MO, NBG, PRE, S, WAG, WIND); Lusaka, Concord Ranch, 3 mi. S of Chisamba Station, dambo grassland, 19 Jan. 1973, *Benson* 214 (K); Mambwa, 27 Dec. 1963, *van Rensburg* 2644 (K, SRGH); Kabwe District, Bonanza, 10 km NW of Kabwe, dambo grassland, 19 Jan. 1973, *Kornás* 3023 (K). SOUTHERN: Mazabuka, Ridgeway road, 15 Dec. 1931, *Trapnell* 588 (BR, K, PRE, Z); Kafue-Mazabuka, 17 mi. SSE of Nega-Nega, 23 Dec. 1970, *Symoens* 13881 (BR, K, M); Siantonola, 10 mi. NNW of Pemba, wet drainage line, 28 Dec. 1962, *Angus* 3453 (B, K, WAG). NORTHWESTERN: Kalene Hill, Mwinilunga, seasonally damp ground on sandstone outcrops, 15 Dec. 1963, *Robinson* 6051 (M, WAG). WESTERN: Machili, moist pan margins, 24 Dec. 1960, *Fanshawe* 6015 (BR, K, LISC, SRGH). WITHOUT PRECISE LOCALITY. NAMIBIA: 1921, *Barnard* 201 (SAM); between Kapichu and the Kunene banks, *Barnard* 142 (SAM); Mafa, *Barnard* 197 (SAM).

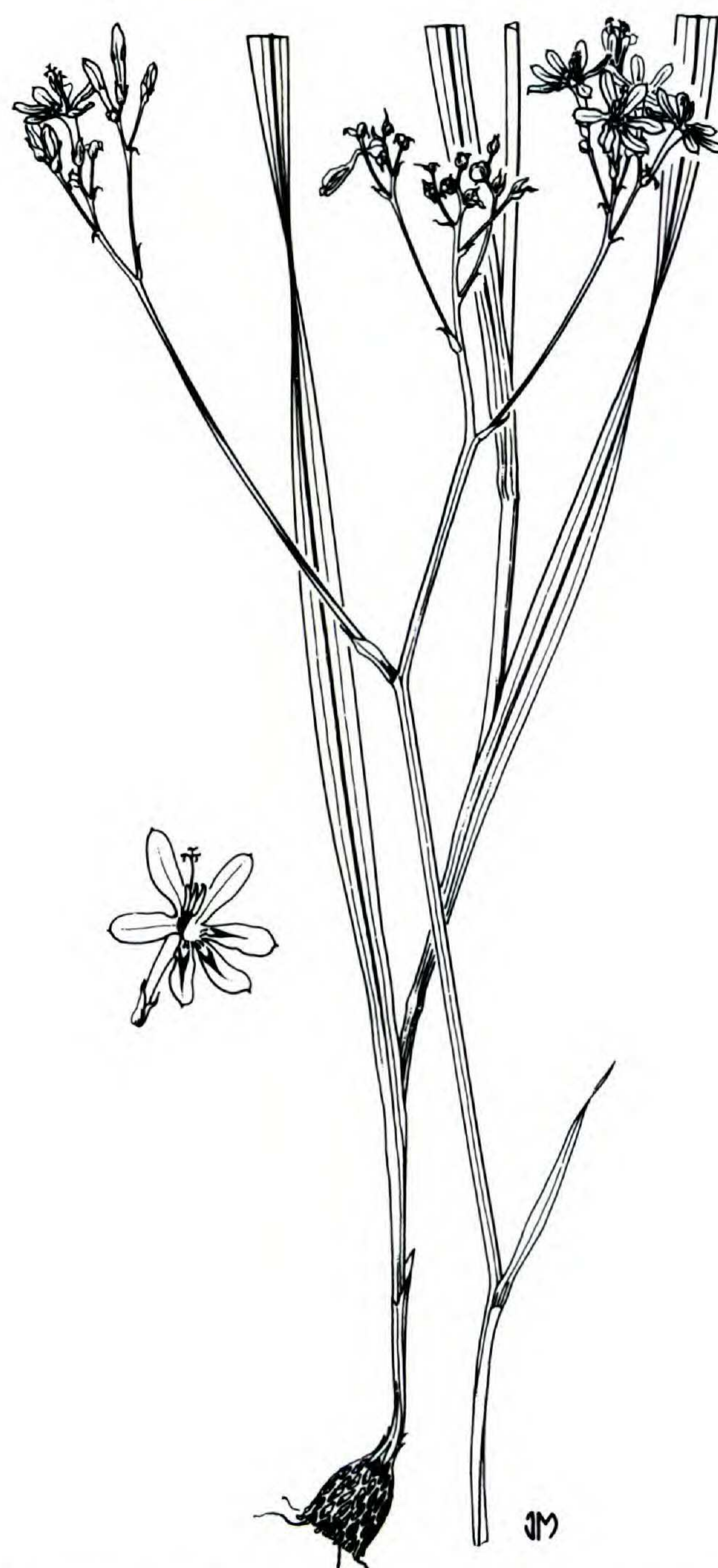


FIGURE 7. Morphology of *Lapeirousia erythrantha*. Habit  $\times 0.5$ ; flower full size. (Drawn by J. C. Manning.)

**4. *Lapeirousia erythrantha* (Klotzsch ex Klatt)**

Baker, J. Linn. Soc. Bot. 16: 155. 1878; Handbk. Irideae 168. 1892; Fl. Trop. Africa 7: 351–352. 1898. Geerinck et al., Bull. Soc. Roy. Bot. Belgique 105: 335–344. 1972 (but including *L. teretifolia* and *L. welwitschii*). *Ovieda erythrantha* Klotzsch ex Klatt in Peters, Reise Nach Mossambique, Volume 6 Bot. 2: 516, t. 58. 1864. TYPE: Mozambique: Borror, Caboceira, *Peters s.n.* (holotype, B). Figure 7.

*Lapeirousia sandersonii* sensu Baker in Fl. Trop. Africa 7: 352. 1898.

*Lapeirousia erythrantha* var. *briartii* (de Wild. & Durand) Geerinck, Lisowski, Malaisse & Symoens, Bull. Soc. Roy. Bot. Belgique 105: 337–340. 1972. *Geissorhiza briartii* de Wild. & Durand, Compte Rendu Soc. Roy. Bot. Belgique 39: 105. 1900. TYPE: Zaire: Mussimu, Haut Lualaba, *Briart s.n.* (holotype, BR).

*Lapeirousia erythrantha* var. *rhodesiana* (N. E. Br.) Marais ex Geerinck et al., Bull. Soc. Roy. Bot. Belgique 105: 336. 1972. *Lapeirousia rhodesiana* N. E. Br., Kew Bull. 1906: 169. 1906. Sealy, Bot. Mag. ns. 172: t. 349. 1959. Hepper, Fl. West Trop. Africa, 2nd edition, 3: 141. 1968. TYPE: Zimbabwe (Rhodesia): Mashonaland, headlands between Salisbury and Umtali, *Cecil* 154 (holotype, K).

*Lapeirousia graminea* Vaupel, Bot. Jahrb. Syst. 48: 533. 1912. TYPE: Mozambique: 25 Mile Station (Dondo), in forest, *Schlechter* 12238 (holotype, B).

*Lapeirousia spicigera* Vaupel, Bot. Jahrb. Syst. 48: 547–548. 1912. TYPE: Angola, Huilla: *Antunes* 256 (holotype, B).

*Lapeirousia plagiostoma* Vaupel, Bot. Jahrb. Syst. 48:

547. 1912. TYPE: Mozambique, Station Howesa, rocky slopes, *Tiesler* 46 (holotype, B).

*Lapeirousia montana* Hutchinson, Kew Bull. 1921: 403. 1921, nom. illeg., non *L. montana* Klatt (from S. Africa, Goldblatt, 1972: 52). Hutchinson & Dalziel, Fl. W. Trop. Africa, 1st edition, 2: 376. 1935. *Lapeirousia nigeriensis* R. Foster, Contrib. Gray Herb. 114: 48. 1936, nom. nov. pro *L. montana* Hutchinson. TYPE: Nigeria: top of Zaranda Mountain, 5,800 ft., *Lely* 189 (lectotype, K, here designated); Neill's Valley, 2 mi. E of Government Station, Naraguta, *Lely* 271 (syntype, K? not seen).

Plants (15–)20–45 cm high, paniculately branched. *Corm* 8–16 mm wide at the base, tunics blackish, of densely compacted fibers, the outer layers coarsely fibrous, sometimes becoming  $\pm$  reticulate and fine, then forming a matted layer.



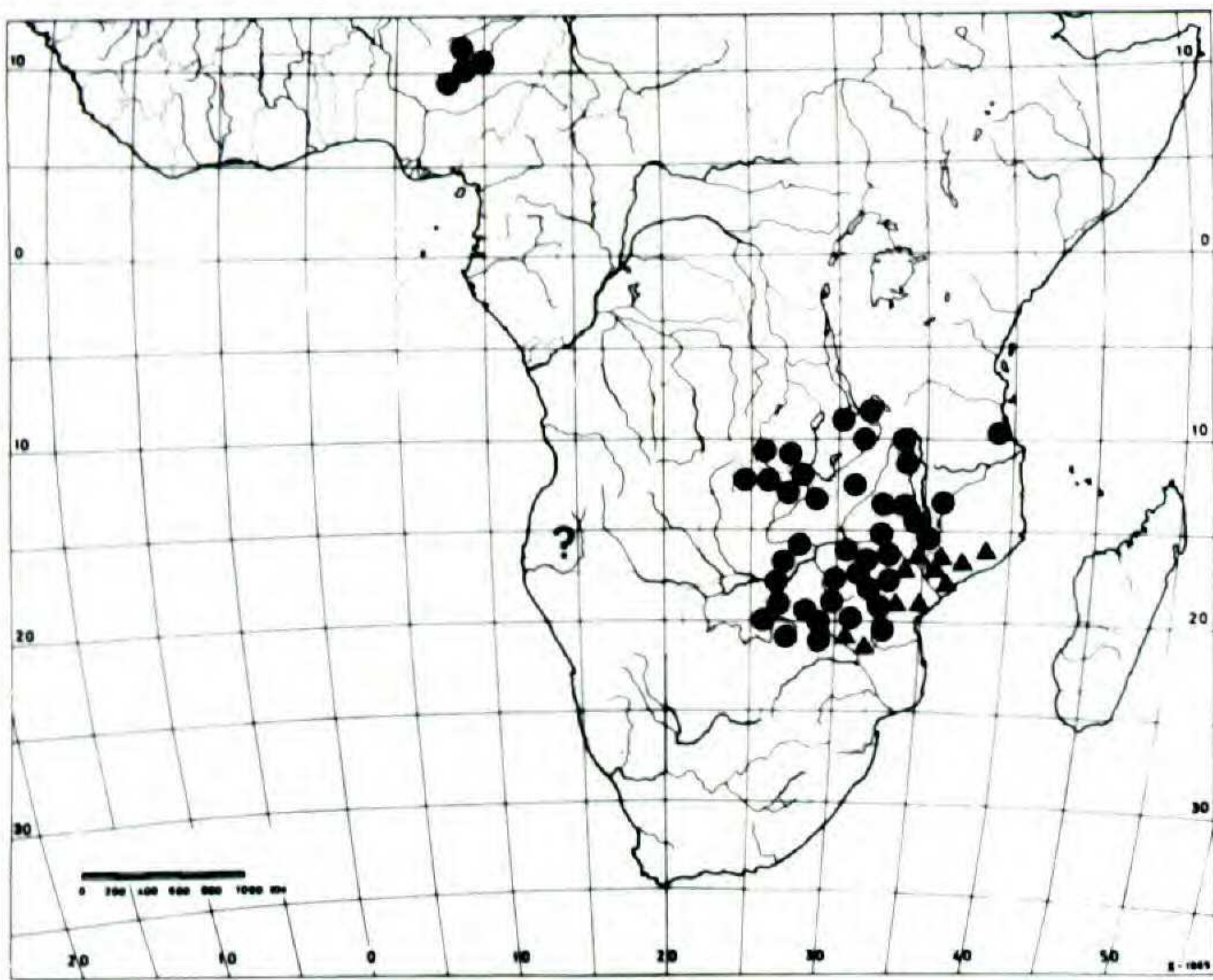


FIGURE 8. Distribution of *Lapeirousia erythrantha*. The question mark indicates the doubtful locality of the type collection of *L. spicigera* from southwestern Angola. Triangles represent red-flowered populations and dots those with blue flowers.

*Cataphylls* 2, the inner one reaching shortly above ground level, usually dark brown. *Leaves* 3–4, the lower 2–3 longest and  $\frac{1}{3}$ – $\frac{2}{3}$  as long as the stem, the upper decreasing in size and becoming progressively bractlike above; the basal leaves 2–3, linear to lanceolate, sometimes somewhat falcate, (2–)4–8(–11) mm wide; only the midrib prominent when live. *Stem* compressed and 2-angled below, branched repeatedly, 3-angled above. *Inflorescence* a several- to many-branched panicle, often assuming a corymbose appearance, the ultimate branches bearing (2–)3–6(–8) flowers, these often crowded terminally; *bracts* 3–6 mm long, green below, dry and membranous above in bud, becoming entirely dry and transparent, brownish in the upper third, the outer bract obtuse, usually slightly longer than the inner one, the inner acute or apically bifurcate. *Flower* zygomorphic, either blue-violet having the lower tepals each with a hastate white mark outlined dark blue to purple, or the flower crimson red and then usually without markings but occasionally the lower tepals each with a white median streak (rarely white, either uniformly or with dark markings); *perianth tube* (6–)7–11(–14) mm long, slender below, expanded somewhat and slightly curved near the throat; *tepals* subequal in size, lanceolate-spathulate, acute to obtuse, (6–)7–11 mm long, 2–3(–4) mm wide, lying nearly in one plane, the uppermost tepal held apart from the others and reclined, the lower 3 narrower at base thus  $\pm$  clawed, set closely together and joined for ca. 1 mm longer than the upper. *Filaments* unilateral and arcuate, 4–6 mm long, inserted ca. 1.5 mm below the mouth of the tube; *anthers*

parallel and contiguous, (2.5–)3–4 mm long, pale bluish to white, purple or red; pollen whitish. *Ovary* globose, 1–2 mm long, *style* arched behind the stamens, dividing at mid to upper anther level, ca. 1.5 mm long, *branches* 1–1.5 mm long, recurving and forked for  $\frac{1}{3}$ – $\frac{1}{2}$  their length. *Capsule* 3-lobed, 3–4 mm long, outline of the seeds distorting the walls; *seeds* globose, 2–5 per locule, nearly globose, 1.6–1.9 mm diam., dark brown, weakly to strongly reticulate. *Chromosome number*  $2n = 14$  (? =  $12 + 2B$ ),  $12 + 0-3B$ .

*Flowering time.* (Mid December) late January to March, depending on when the summer rains begin.

*Distribution and habitat.* As circumscribed here, *Lapeirousia erythrantha* has a wide distribution across south tropical Africa (Fig. 8). It extends from eastern Angola and southern Zaire through Zambia and northeastern Botswana to Zimbabwe, Malawi, western and southern Tanzania, and the coast of central Mozambique. It is a variable species and has differentiated into a number of local races or forms, which are dealt with below. The most common species of *Lapeirousia* in central Africa, *L. erythrantha*, can frequently be found in rocky outcrops throughout its range, or less often in open grassland or woodland. Its frequency in thin soils in rocky sites suggests that the corms are protected in such habitats, while in deeper ground they are accessible to rodents, porcupines, and perhaps other animals. There seems no a priori reason for the apparent preference for rocky habitats, and plants grow well in cultivation in almost any type and depth of soil. The small flowers, conspicuous in the dense inflorescences, are visited and presumably pollinated by large numbers of various bees and wasps that forage for nectar and pollen in warm weather.

Annotations on two specimens indicate that *Lapeirousia erythrantha* is edible (*Simpthu* 90, Victoria Falls; *Buchanan* 426, Shire Highlands, eaten in time of great famine). However, there appears to be no record of the species being significant in the diet of any human population.

*Diagnosis and relationships.* One of the several species of *Lapeirousia* with a strongly ramified, paniculate inflorescence, *L. erythrantha*, can be distinguished by its relatively small flowers, typically (but not always) soft-textured leaves with a conspicuous midrib, and perianth tube seldom exceeding 12 mm. The flowers are somewhat crowded at the apices of the branches of the inflorescence, and the terminal branches are spikes of 3–8 sessile



flowers. The orientation of the tepals is also distinctive; the tepals lie in more or less the same plane (Fig. 7), with the three lower tepals connate for about 1 mm and held closely together while the upper tepal is recurved and held apart from the others. Similar flowers also characterize *L. sandersonii* and *L. masukuensis*, both of which have a perianth tube 15–25 mm long. *Lapeirousia sandersonii* has different corm tunics and an inflorescence in which the ultimate branches have only one or two flowers.

The Ethiopian *Lapeirousia abyssinica* is closely allied to *L. erythrantha* but has a less ramified inflorescence, and the plants are seldom taller than 15 cm high. The flowers are virtually indistinguishable from those of *L. erythrantha*. The difference in chromosome number,  $2n = 12$  in *L. erythrantha* vs.  $2n = 8$  in *L. abyssinica*, was a significant reason for my decision to continue to recognize the two species as distinct.

Also closely related is *Lapeirousia setifolia*, a dwarf species of rocky, high-altitude sites in Malawi, Tanzania, and Zimbabwe. Again the flowers of the two species are nearly identical, but the short stature of *L. setifolia* combined with its rather intricately branched inflorescence and chromosome number of  $2n = 8$  suggest its separate status.

*Lapeirousia rivularis* is almost indistinguishable from *L. erythrantha* when pressed, but they have different flowers. In *L. rivularis* the upper tepal is arched forward over the stamens and style branches. This important difference between the two species is generally obscured in herbarium specimens. *Lapeirousia rivularis* grows in seasonally wet sites from central Zambia across southern Angola to northern Namibia, and it thus overlaps in distribution with *L. erythrantha*.

I have raised to species rank *Lapeirousia teretifolia*, a plant of western Zambia and western Shaba, treated by Geerinck et al. (1972) as a variety of *L. erythrantha*. No doubt closely related to *L. erythrantha*, it has particularly small flowers with a pale bluish to white perianth and a highly ramified inflorescence with only one, or rarely two, flowers on the terminal branches. The leaves are terete, a condition that does not occur in any of the several forms of *L. erythrantha*.

*Variation.* Comprising a number of more or less distinct races or forms, *Lapeirousia erythrantha* presents a difficult problem in circumscribing the species and its close allies. I treat the species fairly broadly and do not attempt to establish an infraspecific taxonomy, such as that of Geerinck et al. (1972) who recognized four varieties in Zaire.

The difficulty is the existence of numerous intermediates and parallel forms in different parts of the range. However, it is useful to discuss the main variants here, each of which has been described at some time as a distinct species. The most distinct of the variants is the typical form, which has small to moderate-sized flowers with a deep red perianth (occasional white-flowered plants are albino sports). It occurs in relatively dry sites at low to middle elevations from coastal central Mozambique around Beira inland to southern Malawi and southeastern Zimbabwe. Plants grow in open ground or rocky sites in *Mopane* or dry *Brachystegia* woodland. The unusual intense red perianth (dark maroon on drying) suggests that this form merits taxonomic recognition, but after examining the ample material now at hand, and living populations of red- and blue-flowered forms, I have concluded that they are simply color forms.

Populations of plants with flowers more or less the same size but with purple or blue perianths occur in southern and central Malawi and are identical in all respects but color with plants from populations with either uniformly red or blue flowers. In the Masvingo area of Zimbabwe there are red-flowered populations with large flowers that correspond in size to those of blue-flowered plants that occur in central Zimbabwe and are often referred to *L. rhodesiana*.

In the main part of its range across Zambia and southern Zaire *Lapeirousia erythrantha* is relatively uniform, although flower size seems to decrease moving from east to west and south to north. The small-flowered plants correspond to *L. briartii*, a species described from Zaire. Plants more or less matching this form but with short stature, unusually narrow leaves (generally about 1.5–2 mm wide), and small flowers occur in northwestern Zambia and adjacent western Tanzania. This combination of characters suggests affinity with *L. teretifolia*. However, the 2–4-flowered terminal inflorescence branches of the northeastern Zambian plants and their flat leaf blades are unlike the predominantly 1-flowered inflorescence branches and terete leaves of *L. teretifolia*. I believe that the general similarity here is superficial and does not indicate close relationship. The northeastern Zambian plants presumably represent a regional form of *L. erythrantha*. The name *L. erythrantha* var. *welwitschii* sensu Geerinck et al. (1972) applies to narrow-leaved specimens of *L. erythrantha* otherwise corresponding to the type of *L. briartii*. The type of *L. welwitschii* is from central Angola, and I have not been able to identify it satisfactorily owing to its poor preservation (see excluded species).



A particularly unusual form of *Lapeirousia erythrantha* occurs locally in western Shaba at Etoile (Kalukuluku) Mine (*Symoens 10141*; *Ndjele 1087*; *Lisowski 115, 117*). It has rigid leaves, which appear in the dried material to lack a distinct midrib, and has rather open ramified panicles. The flowers appear to be similar to those in other populations of *L. erythrantha* from Zaire. This may be a race adapted to highly mineralized soils.

In eastern Zimbabwe, populations appear to consist largely of plants with a very open inflorescence and a reduced number of flowers (1–3) on each inflorescence branch. These plants correspond with *L. graminea*, the type of which is from Tete Province, Mozambique.

In western Zimbabwe and adjacent parts of Botswana, plants have rather large flowers with perianth tubes usually 10–14 mm long. These populations are the least well understood of the variants of *Lapeirousia erythrantha* and are sometimes referred to *L. rhodesiana* (or *L. erythrantha* var. *rhodesiana*). The type of *L. rhodesiana* is from Headlands in eastern Zimbabwe and does not correspond exactly to the western Zimbabwe and Botswana plants, which may on further study be found to be a separate species.

A few populations in central and northern Malawi stand out in having flowers with a particularly long perianth tube and have sometimes been referred to *L. sandersonii*. However, their corms and the number of flowers on the inflorescence branches correspond exactly to *L. erythrantha*, as does the chromosome number,  $2n = 12$ , and karyotype in one population sampled. Moreover, individuals within these populations vary for tube length, which ranges from 12 to 20 mm (e.g., *Goldblatt 7535*).

*History.* *Lapeirousia erythrantha* was first collected by the German physician and explorer Wilhelm Peters in the years 1842–1848 when he traveled in Mozambique under the patronage of King Friedrich Wilhelm IV. Later the Scottish explorer Sir John Kirk, who accompanied David Livingstone on his Zambezi expedition in 1858, also recorded the species in the lower Shire valley in Mozambique. Kirk collected it again in the following years on subsequent expeditions to the African interior. The species was described by F. W. Klatt (1864), who saw only the Peters collection, and referred to *Ovieda*, a synonym of *Lapeirousia* used from 1815 to 1876.

In the *Flora of Tropical Africa*, Baker (1898) recognized *L. erythrantha* for red-flowered plants, and he referred blue-flowered plants to the Trans-

vaal species, *L. sandersonii*. A collection from Zaire of the common blue-flowered form of *L. erythrantha* was described as *L. briartii* by de Wildeman in 1900. Similar plants from Zimbabwe were assigned to *L. rhodesiana* by N. E. Brown (in 1906), while those from Mozambique were treated by Vaupel (1912) as *L. graminea* and *L. plagiostoma*. A specimen collected in southwestern Angola was referred to *L. spicigera* by Vaupel. *Lapeirousia spicigera* is unusual in having up to 10 flowers crowded on the terminal branches of the few-branched inflorescence. No other specimens of *L. erythrantha* have been recorded from this part of Angola, and there is consequently some doubt about the provenance of the collection.

To this growing number of named blue-flowered forms of *Lapeirousia erythrantha* John Hutchinson in 1921 added *L. montana*, based on specimens from Nigeria. A homonym for a southern African species (*Goldblatt, 1972*), this name was replaced by *L. nigeriensis* by R. C. Foster (1936). The Nigerian populations were referred to *L. rhodesiana* by Hepper (1968). They correspond most closely to western Zimbabwe plants of *L. erythrantha* in flower size, but the plants are comparatively short in stature.

The treatment of some variants of *Lapeirousia erythrantha* as formal taxonomic varieties by Geerinck et al. (1972) was an attempt to deal with the variation in the species in Zaire. W. Marais (pers. comm.) proposed treating *L. sandersonii* (including *L. masukuensis*) and the southern African and Angolan *L. bainesii* (including *L. otaviensis*) as varieties of *L. erythrantha*, but all four of these are in my opinion separate species, as is *L. teretifolia*, which Geerinck et al. treated as a variety of *L. erythrantha*.

*Additional specimens examined* (red-flowered and blue-flowered forms, corresponding to the types of *L. erythrantha* and *L. briartii*, respectively, are listed separately).

Red-flowered Forms. MALAWI. SOUTHERN REGION: Blantyre, savanna woodland, Michiru, 4,000 ft., 26 Dec. 1966, *Chimphamba 9* (K, MAL, SRGH); Blantyre, Chichiri campus near upper hostel, 2 Jan. 1966, *Binns 164* (MAL); Blantyre District, 3.6 mi. W of Mpatamanga Gorge, 7 Jan. 1969, *Eccles 223* (K, MAL, SRGH); Lirangwe, ca. 20 mi. N of Blantyre, open ground in woodland, 16 Jan. 1967, *Hilliard & Burt 4500* (E, K, MAL); Manganja Hills N of the Shire River, 1861, *Waller s.n.* sub *Kirk s.n.* (K); Manganja Hills, Dec. 1861, *Kirk s.n.* (K); Chileka, Blantyre District, 11 Feb. 1947, *Klein-schmidt s.n.* (GH 15726, K); near Chileka Post Office, *Goldblatt 7524* (MAL, MO, NBG, PRE, WAG); foot of Mt. Mulanje, Tinyande Estate at Mulanje Reserve boundary, open woodland, 27 Dec. 1986, *Chapman & Chapman 8315* (MO). MOZAMBIQUE. MOZAMBIQUE: Nampula, 7 Jan. 1937, *Torre 1278* (COI); Nampula, monte Nas-



sapo, andados 23 km de Nampula para Meconandados, 13 Jan. 1964, *Torre & Paiva 9911* (LISC). TETE: Tete, Chioco, at km 48 on the road to Mocubura, 15 Feb. 1968, *Torre & Correia 17670* (LISC). ZAMBEZIA: Serra Tumbine, E of Mlanje town hall, 17 Jan. 1971, *Hilliard & Burtt 6295* (E, LMU); 97 km NE of Mopeia Velha on the road to Quelimane, woodland bordering a vlei, *Pope & Müller 547* (LISC, LMA, MO, SRGH); Namagoa Estate, Mocuba District, Namagoa, 200 ft., Dec.-Jan. 1943, *Faulkner 156* (BR, COI, K, P, PRE, S, SRGH); near Shire River, between the mouth and Morrumbala, Dec. 1858, *Kirk 16* (K). MANICA & SOFALA: Dombe District, above the E bank of the Makuripini 5 km above the confluence of the Haroni, woodland clearing, 6 Jan. 1969, *Bisset 13* (K, LISC, PRE, SRGH); Manica, Moribane (frontier), 17 Nov. 1942, *Salbany 86* (LISC); Chimorio, Garuzo, fazenda Martinoti, 8 Jan. 1948, *Barbosa 814* (LISC); 25 Mile Station (Dondo), 200 ft., 10 Apr. 1898, *Schlechter 12238* (B, K). ZIMBABWE. MASVINGO: Fort Victoria (Masvingo), Jan. 1948, *Fitt s.n.* (SRGH 19039 in BR, K); Mtoko District, Monissi Camp, rocky outcrop, 2,900 ft., 13 Feb. 1962, *Wild 5640* (BR, K, MO, SRGH); 7 mi. E of Fort Victoria, grassy roadside, Dec. 1957, *Miller 4893* (K); 29 mi. ESE of Ngundu Halt on Triangle road, wet vlei at foot of granite hill, 15 Jan. 1963, *Leach 11592* (K, LISC, MO, PRE); Chibi District, kopje near Madzivire Drive, grassland, 30 Dec. 1962, *Moll 484* (K, SRGH); Fort Victoria, Duvali Ranch, 21 Jan. 1948, *Fisher 1387* (PRE), *1390* (SRGH); 5 mi. from Fort Victoria on the Sabie road, wet pan, Jan. 1969, *Goldsmith 10/69* (K, LISC, MO, PRE, SRGH).

Blue-flowered Forms. ANGOLA. MOXICO: W of River Kaperu, grassland, 10 Jan. 1938, *Milne-Redhead 4030* (BR, K, LISC, PRE). HUILA: *Antunes 256* (B) [can this locality be correct?]. BOTSWANA. NORTH EAST: Ramakgwebane area near Tsessebe Station, 6 Jan. 1974, *Ngoni 243* (MO, SRGH); border near Plumtree, sandy flat roadside, 7 Mar. 1961, *Richards 14552* (K, SRGH). CENTRAL: Bakalaka area, between Francistown-Maun road and Marapong, 26 Jan. 1967, *McClintock K73* (K); between Francistown and Nata River, on Maun road, 21 Jan. 1959, *West 3898* (BR, K, LISC, PRE); 22.27 (BB), Selebi, Jan. 1978, *Kerfoot 8007* (PRE). MALAWI. CENTRAL REGION: Lakeview, Dedza Plateau, roadside, 5,500 ft., 22 Dec. 1976, *Pawek 12010* (K, MAL); 15 km N of Ncheu, around granite dome, 9 Sep. 1986, *Goldblatt 7534* (MO); 2 mi. E of the State House, Lilongwe, rock outcrop, 11 Jan. 1984, *May 1* (MAL); Dedza, *Brachystegia* woodland on Kanjoli Hill, 13 Feb. 1967, *Salubeni 563* (K, LISC, PRE, SRGH); Lilongwe, Dzalanyama Forest Reserve, valley NW of Kazuzu hill, 24 Feb. 1982, *Brummitt 16078* (K); road to Dedza Forestry School, around quarry, 9 Jan. 1986, *Goldblatt 7535* (MAL, MO, PRE); Chongoni Forest Reserve, 24 Feb. 1986, *La Croix 2698* (MO). SOUTHERN REGION: Zomba, Old Naisi Road, 11 Jan. 1978, *Masiye 26* (M, MAL, MO, SRGH, Z); Zomba, Old Naisi Road, 1 mi. E of herbarium, rock outcrop, 23 Dec. 1980, *Chapman 5500* (BR, MAL, MO), 5 Jan. 1986, *Goldblatt 7514* (MO); Blantyre District, grassland north of Lundu, 7 Jan. 1986, *Goldblatt 7525* (MO); Zomba, rock outcrop opposite university across Mponda stream, 6 Jan. 1986, *Goldblatt 7521* (MO); Matope, Blantyre, 6 Jan. 1956, *Jackson 1777* (BR, K, MAL); Shire Highlands, Oct. 1879, 1880, *Buchanan 50* (E); 1891, *426* (E) "eaten in time of great famine." NORTHERN REGION: Rumphu District, Luwachi dispensary ridge, 24 Dec. 1972, *Pawek 6122* (MAL); Karonga District, Sangilo Point, 705 m, 2 Jan.

1973, *Pawek 6304* (MAL, SRGH), 24 Feb. 1978, *Pawek 13822* (BR, MO, WAG); Rumphu District, Chiweta, 474 m, near lake shore, 30 Dec. 1986, *La Croix 4255* (MO). MOZAMBIQUE. TETE: Angónia, 2 Dec. 1980, *Macuácuá 1363* (MO, PRE, WAG); Chioco, km 49 estrada para Mocubura, 15 Feb. 1968, *Torre & Correia 17677* (LISC); Cabora Bassa, planalto do Songo, 21 Jan. 1973, *Torre et al. 18820* (LISC). NIASA: Mandimba, 9 Dec. 1941, *Hornby 3518* (PRE). NIGERIA. BAUCHI: Vom, Bauchi Plateau, shallow soil on rocks, Dec. 1979, *Young 244* (K); Bauch Plateau, *Lely 259* (K); 3 mi. S of Rishi, Lame District, 3 June 1955, *Sumerhayes 56* (K). PLATEAU: Miago, near Jos, 23 May 1968, *Daramola s.n.* (BR, FHI 61986, K); *Lowe 1330* (K, WAG); Jos, July 1974, *Sharland 429* (K); Jos District, Naraguta, 10 May 1965, *Olorunfemi s.n.* (FHI 55801 in K). TANZANIA. MTWARE: Lindi, Mar. 1952, *Semsei 701* (B, K, PRE); Tendaguru, 100 km NW of Lindi, 17 Feb. 1935, *Schlieben 6010* (B, BR, K, M, P, S, Z). RUKWA: Ufipa, Ilembe, 2,100 m, 18 Mar., *Richards 8781* (K). ZAIRE. SHABA: Elisabethville, 28 Mar. 1912, *Bequaert 294* (BR); mont Namuntamba, forêt claire, 13 Feb. 1987, *Billiet & Jadin 4137* (BR); entre village Kamina et Kyalwe, 3 Jan. 1972, *Bulaimu 311* (BR); Welgelegen, 1912, *Corbisier & Florent 632* (BR); Kafubu, forêt, 21 Mar. 1970, *De Georgi 357* (BR, S); mont Mukuen, 8 Jan. 1957, *Detilleux 361* (BR); Elisabethville, 22 Jan. 1926, *Hirschberg 60* (K, PRE); Feb. 1912, *Homblé 118* (BR); vallée de Kapiri, Feb. 1913, *Homblé 1192* (BR); près de Kipushi, 10 Mar. 1970, *Lissowski 111* (BR); roadside 12 km from Lubumbashi to Likasi, 1,200 m, 18 Feb. 1970, *Lisowski 112* (BR); open forest on hill near Lukuni, 21 km NW of Lubumbashi, 1,300 m, 25 Jan. 1970, *Lisowski 114* (B, K); Lupembe valley, ca. 28°28' 12", 27 Jan. 1905, *Kassner 2391* (BR, E, K, P, Z); Chabara, colline cuprifère, 1,430 m, 10 Jan. 1981, *Malaisse 11446* (BR); Mwashya, 935 m, 30 Jan. 1981, *Malaisse 11558* (BR); route Gombela à Poste Luishi, 30 km NE Gombela, 8 Feb. 1982, *Malaisse & Robbrecht 1851* (BR); Fungurume, 15 Feb. 1983, *Malaisse & Robbrecht 2181* (BR); 30 km ESE Kolwezi, colline cuprifère, 1,300 m, 17 Feb. 1982, *Malaisse & Robbrecht 2407* (BR); Haut-Katanga, 12 km S of Elisabethville, 17 Nov. 1928, *Quarré 1017* (BR, K); Haut-Katanga, valley of the Lubumbashi near Elisabethville, Mar. 1933, *Quarré 3103* (BR, K, P, PRE, WAG); Jan. 1938, *5029* (BR, K); Lubumbashi, Feb. 1935, *Quarré 4459b* (BR); vallée de la Kisanga, sol humide, noir, Mar. 1946, *Quarré 8178* (BR); Keyberg, 8 km SW d'Elisabethville, rocky wooded hill, Jan. 1947, *Schmitz 1303* (BR); Jan. 1953, *Schmitz 4303* (BR); rocky hill 10 km S of Elisabethville, Feb. 1954, *Schmitz 4582* (BR, K, NBO); 25 km NW de Elisabethville, forêt claire, 30 Jan. 1959, *Schmitz 6771* (BR); open *Brachystegia* forest, ca. 14 km from Lubumbashi, 17 Feb. 1966, *Symoens 12244* (BR, K); 24 Jan. 1971, *Symoens 14049* (BR, K, M); ancien mine de cuivre de l'Etoile (Kalukuluku), 11 km à Elisabethville, 20 Mar. 1963, *Symoens 10141* (BR, LISC, K, SRGH); 10 Feb. 1966, *Symoens 12206* (B, BR, K); 18 Mar. 1983, *Ndjele 1087* (BR); 21 Feb. 1971, *Lisowski 115* (BR, K); 14 Jan. 1971, *Lisowski 117* (B, BR, K). ZAMBIA. COPPERBELT: Luanshya, grassy dambo, 22 Jan. 1954, *Fanshawe 711* (BR, K, NDO); Luanshya, gravelly pan, 18 Jan. 1955, *Fanshawe 1800* (K, NDO); 23 Mar. 1955 (fr), *Fanshawe 2211* (K, NDO); Solwezi, chipya dambo, 9 Jan. 1969, *Mutumushi 2895* (NDO, SRGH); Solwezi District, N of the Lumwana River, near Lumwana Mission, shallow soil



over rock, 11°49' 25°7', 19 Jan. 1975, *Brummitt, Polhill & Chisumpa 13867* (K, NDO, SRGH, WAG); Mufulira, 4,000 ft., rocky shallow soil at riverside, 8 Feb., *Cruse 187* (BR, K); S of Mufulira near Kafue bridge, cliffs and rock outcrops, 17 Jan. 1986, *Goldblatt 7575* (MO); Parklands, Kitwe, bush at the end of Lincoln Ave., 2 Mar. 1961, *Linley 85* (K, LISC, MO, SRGH); Kitwe, hill woodland, 6 Mar. 1964 (fr), *Mutumushi 668* (K, NDO, SRGH); Kitwe, laterite in Miombo, 16 Feb. 1967, *Mutumushi 1810* (BR, K, NDO); Chati Forest Station, rocky hill in Champala Nature Reserve, 14 Jan. 1986, *Goldblatt 7567* (MO, NDO). NORTHERN: Abercorn District, Isanya, 12 Jan. 1952, *Richards 460* (K); flat wet site above escarpment, Chilongwelo, 5 Mar. 1952, *Richards 901* (BR, K); plain of death, Chilongwelo, 4,800 ft., 15 Feb. 1955, *Richards 4495* (BR); Mningi pans, Abercorn, among rocks, 22 Feb. 1959, *Richards 10957* (BR, K, MO); Abercorn (Mbala), Itembwe Gap, 19 Jan., *Richards 18829* (K); Mbala District, St. Paul road, near Kafedro, 5,000 ft., 22 Feb. 1968, *Sanane 52* (K); 4 mi. from St. Paul Mission, Kilala village, among flat rocks and short grass, 7 Mar. 1968, *Sanane 81* (BR, K). NORTHWESTERN: Mwinilunga District, just N of Mwinilunga, shallow soil overlying laterite, 26 Jan. 1938, *Milne-Redhead 4361* (BR, K). CENTRAL: Sanje Hill, *Faden et al.*, 74/83 (MO, US); Chakwenga headwaters, 100–129 km E of Lusaka, 14 Feb. 1965, *Robinson 6384* (B, M). EASTERN: Fort Jameson (Chipata), Sumbi Hills, 950 m, 3 Jan. 1959, *Robson 1025* (BR, K, LISC, PRE, SRGH); Fort Jameson District, Zingali Hill, 14 Feb. 1961, *Grout 256* (BR, K); Luangwa Valley, siltstone areas near Kapamba River, *Astle 5794* (NDO, SRGH). SOUTHERN: Choma District, Maamba, 40 km N of Choma, 9 Feb., *Chisumpa 454* (K, NDO); Mazabuka District, 158 mi. S of Lusaka, open woodland, 1 Jan. 1958, *Noak 316* (K, SRGH); Mazabuka District, 4 mi. from Chirundi Bridge, mopane woodland, 6 Feb. 1958, *Drummond 5493* (BR, LISC, PRE, SRGH); Batoka Gorge, 3 Feb. 1963, *Mitchell 17151* (B, K, SRGH). ZIMBABWE. MASHONALAND WEST: Lomagundi, Silverside Mine, 20 Jan. 1962, *Jacobsen 1614* (PRE). MASHONALAND EAST: Domboshawa Mission, grassland, 27 Dec. 1971, *Norrgrann 80* (MO, SRGH); Dombashawa, granite slopes, 16 Feb. 1958, *Leach s.n.* (BR, GRA, K, P, SRGH 83649); 3 Apr. 1977, *Grosvenor & Renz 1302* (K, MO, PRE, SRGH); 3 Apr. 1986, *Bayliss 10367* (MO); *Bamps et al. 902* (BR, SRGH); Salisbury District, Ruwa, farm Tanglewood, Dec. 1958, *Miller 5583A* (BR, SRGH). MASHONALAND CENTRAL: Darwin District, Kandeya Native Reserve, 3,200 ft., 17 Jan. 1960, *Phipps 2293* (BR, MO, PRE, SRGH); Sipolilo, below escarpment N of Sipolilo, 30 Jan. 1948, *Whellan 296* (K, SRGH). MANICALAND: Melssetter, Mt. Selinda, farm Gungunyema, Dec. 1939, *Obermeyer 2283* (M, PRE); Inyanga, Nyamaropa Tribal Trust, *Biegel 1741* (MO, SRGH); Makoni, between Umtali and Rusape, near Inyanga road, 29 Feb. 1930, *Friess et al. 4012* (BR, PRE, S); Mtare District, Zimunya's Reserve, sandy open country, 25 Jan. 1959, *Chase 7045* (BR, K, LISC, PRE, SRGH); Kelly's Park, 18 mi. NW of Mtare, 27 Nov. 1948, *Chase 983* (BR, LISC, P, SRGH); Chipinga District, Giriwayo, 1,230 ft., 19 Jan. 1957, *Phipps 34* (K, PRE, SRGH). MASVINGO: Tokwe River, Mashaka-Ft. Victoria road, 15 Mar. 1958, *Leach 8232* (K, SRGH); 5 mi. from Fort Victoria on Sabi road, Jan. 1969, *Goldsmith 11/69* (K, MO, S, SRGH). MATABELELAND NORTH: Nyamandhlovu Pasture Station, Jan. 1953, *Plowes 1540* (K, MO, LISC, SRGH); Shangani, Mar. 1918, *Eyles 953* (K,

P, SAM, SRGH); Wankie District, Victoria Falls village, 17 Jan. 1974, *Gonde 47/73* (K, S, SRGH); Victoria Falls, 10 Feb. 1912, *Rogers 13008* (PRE); Wankie National Park, Mopane savanna, 25 Feb. 1967, *Rushworth 229* (BR, K, SRGH); Bulawayo, May 1915, *Rogers 13504* (K, PRE, Z); near Circular Drive, Bulawayo, 31 Jan. 1976, *Cross 352* (K, MO, PRE, SRGH). MATABELELAND SOUTH: Matobo, 6 Dec. 1947, *West 2442* (MO, SRGH); Matopos, Nov. 1922, *Eyles 3752* (SAM); Tuli Experimental Station, Gwanda District, 14 Jan. 1965, *Norris-Rogers 586* (K, SRGH); southern outskirts of Bulawayo, Jan. 1972, *Goldblatt 606* (BOL). MIDLANDS: Gwelo District, Mlezu school, 8 Feb. 1965, *Molife sub Biegel 37* (BR, MO, SRGH); Que Que, Feb. 1935, *McLeod 42* (PRE). WITHOUT PRECISE LOCALITY: ZIMBABWE: Matabeleland, Feb. 1886, *Elliot s.n.* (K); South African Goldfields, 1870, *Baines s.n.* (K).

**5. *Lapeirousia setifolia*** Harms, Bot. Jahrb. Syst. 30: 278. 1902. *Lapeirousia erythrantha* var. *setifolia* (Harms) Geerinck et al., Bull. Soc. Roy. Bot. Belgique 105: 344. 1972. TYPE: Tanzania. Eastern Livingstone Mountains, Ubena, Tsausingewe District, 2,100 m, Mar. 1899, *Goetze 812* (holotype, B; isotypes, BR, E).

Plants small, 5–10(–15) cm high. *Corm* 10–12 mm diam. at the base, tunics with the inner layers firm and unbroken, becoming decayed and  $\pm$  fibrous with age, dark brown. *Cataphylls* usually 2, pale and membranous below, brownish apically. *Leaves* 3–7, the lower 2–4 clustered basally, ascending, or the lower leaves spreading, the lowermost longest and exceeding the inflorescence, those above decreasing in size progressively, linear above and 0.5–1 mm wide, usually channeled to above the midline and noticeably broadening toward the base. *Stem* irregularly flexuose and somewhat twisted, several- to many-branched, 3–4-angled. *Inflorescence* a congested pseudopanicule, the ultimate branches bearing 2–4 flowers, the internodes half as long as the bracts; *bracts* herbaceous, often purple-flushed, 4–5 mm long, the inner as long or slightly shorter than the outer, the apices dry and apiculate, recurved. *Flower* zygomorphic, blue to violet, the lower tepals each with a white and dark blue marking in the lower midline; *perianth tube* 8–10 mm long, slender, expanded and curved in the upper 1.5 mm; *tepals* narrowly lanceolate, 7–9 mm long, ca. 2 mm wide, spreading at right angles to the tube. *Filaments* unilateral, exerted 2–2.5 mm from the tube; *anthers* parallel and contiguous, ca. 1.5–2 mm long, yellow (at least when dry). *Ovary* ca. 1 mm long, *style* dividing near mid anther level, the branches ca. 1 mm long, divided for about half their length. *Capsule* globose-trilobed, ca. 2 mm long; *seeds* globose-



oblong, sometimes flattened or lightly angled on the raphal side, 1.3–1.8 × 1–1.3 mm, red-brown. Chromosome number  $2n = 8$ .

*Flowering time.* February to March.

*Distribution and habitat.* *Lapeirousia setifolia* has a scattered distribution across south tropical Africa (Fig. 9). Its northern limit is in the highlands of western Tanzania at the northeast end of Lake Malawi, and across the lake on the Nyika Plateau of Malawi. Populations also occur in the Inyanga Highlands of eastern Zimbabwe and in the lower and drier Matopos Hills of southwestern Zimbabwe. The habitat is one typical of *Lapeirousia*, exposed rock outcrops in shallow soil. Dwarf plants from the Chimanimani Highlands of eastern Zimbabwe possibly also belong here, but they have larger flowers and more likely are depauperate *L. erythrantha*.

*Diagnosis and relationships.* *Lapeirousia setifolia* can usually be distinguished with ease from *L. erythrantha* and other members of this complex by its low stature, seldom exceeding 15 cm, leaves narrower than 2 mm, and somewhat contorted inflorescence branches. The flowers are fairly typical of the complex, having a violet perianth and relatively short perianth tube, but they are generally smaller than those of most forms of *L. erythrantha*, and they have narrow tepals ca. 2 mm wide and a particularly narrow perianth tube.

Slightly more robust plants from rocky sites in the Matopos area of western Zimbabwe are included here with some hesitation. It is possible that they are dwarfed specimens of the form of *Lapeirousia erythrantha* that occurs widely across south central Africa. However, *L. erythrantha* in western Zambia has large flowers with unusually broad tepals unlike *L. setifolia*. Plants from the higher Chimanimani Mountains of Zimbabwe perhaps belong in *L. setifolia*, but the available specimens are more like *L. erythrantha* although low in stature and with a few straight branches. Their branching pattern and relatively large flowers with broad tepals are quite typical of *L. erythrantha*.

A single gathering from Zaire, *Lisowski 9954b* from the Marungu Plateau, that was assigned to *Lapeirousia setifolia* (as var. *setifolia*) by Geerinck et al. (1972) has larger flowers and bracts than *L. setifolia* and has a poorly ramified inflorescence of weakly twisted branches. It does not seem appropriate to place *Lisowski 9954b* in *L. setifolia*. It is perhaps a stunted form of *L. erythrantha*, which is well represented in Zaire, possibly growing under unusual edaphic conditions,

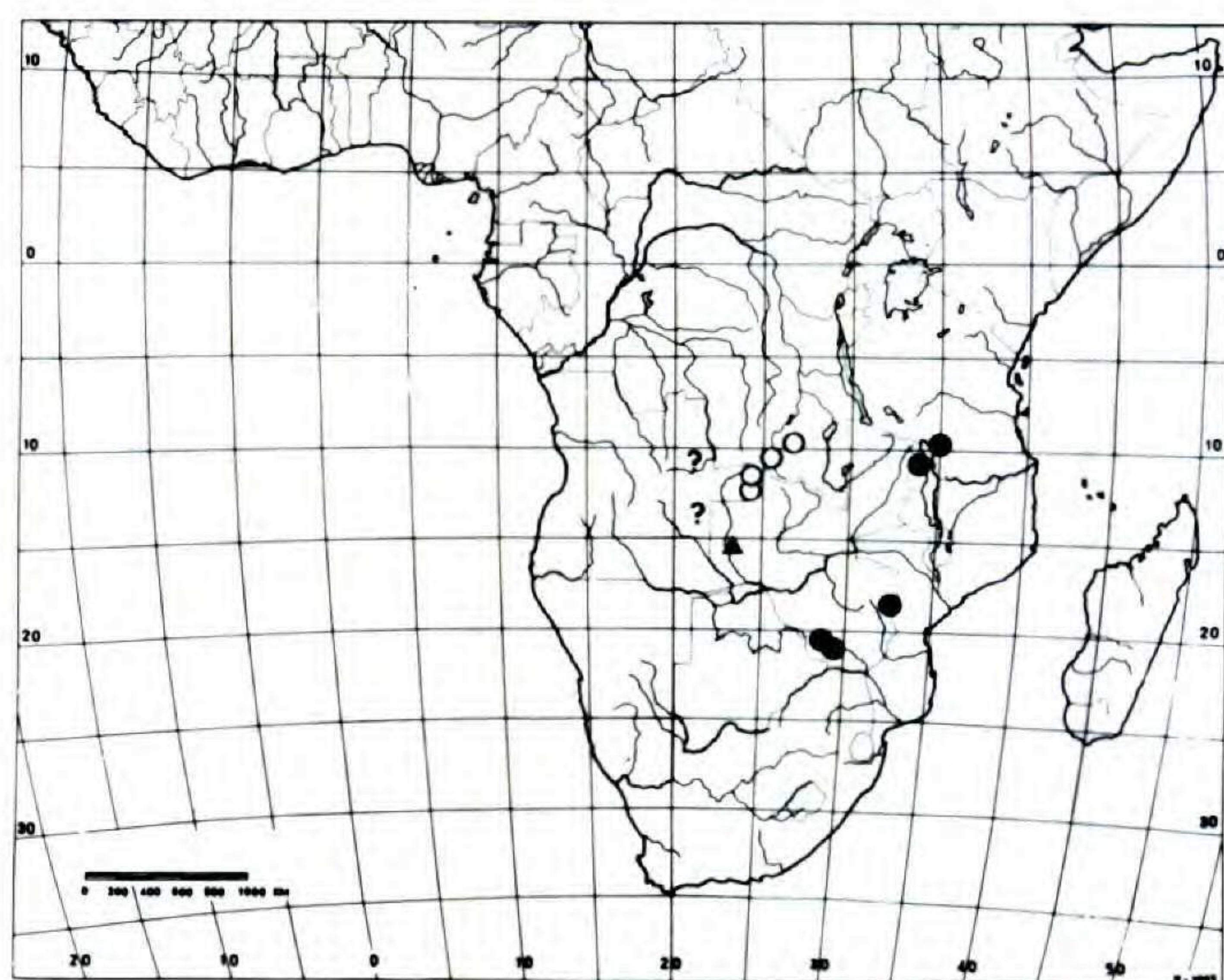


FIGURE 9. Distribution of *Lapeirousia setifolia* (dots), *L. teretifolia* (open circles), and *L. angolensis* (triangle). The question mark indicates uncertainty about the exact placement in Angola of the single collection each of *L. teretifolia* and *L. angolensis*.

not uncommon in this area of highly mineralized soils.

*Additional specimens examined.* MALAWI. NORTHERN PROVINCE: Nyika Plateau, shallow soil over rocks, 2,400 m, 14 Mar. 1961, *Robinson 4495* (K, M, MO); Nyika Plateau, Chelinda Bridge, 7,500 ft., 29 Mar. 1970, *Pawek 3421* (B, K, MAL, MO); 12 Apr. 1969 (fr), *Pawek 2160* (K, MAL); 27 Apr. 1973 (fr), *Pawek 6674* (C, MO); Karasamba road 7 mi. E of Chelinda, 4 Mar. 1977, *Pawek 12431* (BR, MO, WAG); Nyika Plateau, 18 Feb., *Richards 14395* (K); Chosi road, Nyika Plateau, 17 Feb. 1976, *Phillips 1227* (K, MAL, MO, WAG); rocks above Chelinda Bridge, 2 Mar. 1967, *Jones & Binns 269* (MAL); Nyika, just after Chosi turnoff, 2,250 m, 14 Feb. 1987, *La Croix 4321* (MO); Nyika Plateau, S of Chelinda camp on the road to Mt. Chosi, among rocks, 10 Mar. 1977, *Grosvenor & Renz 1118* (MO). TANZANIA. IRINGA: Eastern Livingstone Mountains, Ubena, Tsausingewe District, 2,100 m, Mar. 1899, *Goetze 812* (B, BR, E). ZIMBABWE. MASHONALAND EAST: Inyanga, shallow waterlogged soil on granite at Matemma, 11 Jan. 1967, *Plowes 2841* (BR, P). MATABELELAND SOUTH: Matobo District, farm Besna Kobila, shallow soil over rock, Dec. 1954, *Miller 2568* (K, PRE); Mar. 1960, *Miller 7261* (PRE, SRGH); Besna Kobila, grassland, Jan. 1954, *Miller 2063* (K, LISC, SRGH); Matopos, Feb. 1903, *Eyles 1176* (SRGH); Matopos, Amatyundula, 5,000 ft., 22 Dec. 1920, *Borle 43* (PRE, SRGH); Matobo, farm Quasinga, 4,700 ft., Dec. 1953, *Miller 2004* (B, BR, LISC, PRE, S).

6. *Lapeirousia teretifolia* (Geerinck et al.) Goldblatt, comb. et stat. nov. *Lapeirousia erythrantha* var. *teretifolia* Geerinck, Lisowski, Malaisse & Symoens, Bull. Soc. Roy. Bot. Belgique 105: 342. 1972. TYPE: Zaire. Shaba: Plateau de la Manika, env. 2 km W de Katema, 20 Jan. 1969, *Lisowski, Malaisse & Symoens 182* (lectotype, BR, here designated—no holotype was indicated from among



the several duplicates of the type collection; isotypes, K (also EBV, POZ not seen)).

Plants 20–40 cm high. *Corm* 9–13 mm diam., tunics dark brown to blackish, woody, the outer layers breaking into vertical parallel segments. *Cataphylls* 1 or 2, the upper (or only) one reaching shortly above the ground, dark brown, apparently dry by anthesis. *Leaves* 3–4, the lowermost inserted near the ground and longest, the upper leaves decreasing in size above, the longest about half as long to as long as the stem,  $\pm$  terete to elliptic in section, without a discrete midrib, rigid, 1–1.5 mm diam. *Stem*  $\pm$  terete below, lightly 3–4-angled above. *Inflorescence* a rounded to columnar panicle, the main axis usually dominant, the terminal branches 1–2(–3)-flowered; *bracts* (2.5–) 3–4 mm long,  $\pm$  membranous, transparent below, rust-brown above or brownish entirely, the inner bract slightly longer than the outer. *Flowers* weakly zygomorphic, whitish to pale lilac, the lower tepals each with a darker blue to violet median streak in the lower midline; *perianth tube* 4–5 mm long, slender, slightly expanded above; *tepals* subequal, spreading  $\pm$  at right angles to the tube, 5–6 mm long, the uppermost held apart from the others, the lower 3 held closely together. *Filaments* unilateral, erect, 3.5–4 mm long, exerted 2–2.5 mm from the tube; *anthers* parallel and contiguous, 2–3 mm long; pollen yellow. *Ovary* globose, 1–1.5 mm long, *style* arching behind the stamens, dividing at mid anther level, branches ca. 1 mm long, usually divided for about half their length, sometimes for less. *Capsule* and *seeds* unknown. *Chromosome number* unknown.

*Flowering time.* February to April.

*Distribution and habitat.* *Lapeirousia teretifolia* is a fairly local endemic of interior central Africa. It occurs in southern Zaire on the Manika Plateau where it extends from the Parc National de l'Upemba in the north to Musokantanda in the southwest; in Zambia it is restricted to the Mwinilunga District in the northwest; and there is one record from Cacumbe, a locality I have not been able to place, in northeastern Angola. Collection information indicates that *L. teretifolia* grows in seasonally moist or waterlogged ground.

*Diagnosis and relationships.* *Lapeirousia teretifolia* is a member of the tropical African *L. erythrantha* complex, with which its general form and flower correspond, yet it merits species recognition. It has a more or less terete leaf, an open paniculate inflorescence with the main terminal branches 1–2- or rarely 3-flowered, a low stature,

and somewhat smaller flowers than are normally found in *L. erythrantha*. Flower color also differs; the perianth is whitish to pale blue or lilac, whereas *L. erythrantha* has blue or red flowers. *Lapeirousia teretifolia* occurs partly within the range of *L. erythrantha* and, as indicated by collection data, in rather wetter habitats.

*History.* First collected in 1938 by E. W. Milne-Redhead, *Lapeirousia teretifolia* has remained difficult to place. It was treated as var. *teretifolia* of the widespread *L. erythrantha* by Geerinck et al. (1972), but it seems altogether more distinctive than the several forms of this widespread species and has accordingly been raised to full species rank.

*Additional specimens examined.* ANGOLA. LUNDA: Cacumbe, near River Cacumbe, 6 Dec. 1946, Gossweiler 13942 (K). ZAIRE. SHABA: env. de Katema, 12 Jan. 1971, Lisowski et al. 13243 (BR); plateau de Manika, près de Katema, 12 Jan. 1971, Lisowski et al. 13302 (B, BR, K); 35 km SW Kolwezi vers Musokatanda, plateau de Manika, 17 Feb. 1982, Malaisse & Robbrecht 2349 (BR, K); Parc National de l'Upemba, 13 Feb. 1948, de Witte 3341 (BR, K, WAG). ZAMBIA. NORTHWESTERN: Mwinilunga District, Kalenda plain below the W side of Matonchi Hill, 1,300 m, 18 Feb., Hooper & Townsend 162 (K, SRGH); Kalenda plain opposite Matonchi farm, seasonally inundated shallow soil over laterite, 18 Nov. 1937, Milne-Redhead 3301 (BR, K, PRE); Kalenda Ridge W of Matonchi farm, laterite, among *Vellozia*, 22 Jan. 1938, Milne-Redhead 4280 (BR, K, LISC, PRE); Mwinilunga District, Luakera Falls, sandy slope, 25 Jan. 1938, Milne-Redhead 4339 (BR, K, LISC, PRE); Matonchi farm, peaty soil, 19 Nov. 1962, Richards 17294 (K); 15 km W of Kalene Hill, 14 Jan. 1963, Robinson 6031 (BR, K, M, SRGH); Ikelenge, Mwinilunga District, 16 Apr. 1963, Robinson 6597 (K, SRGH), 2.1960, Pinhey 7 (SRGH).

7. ***Lapeirousia angolensis*** Goldblatt, sp. nov.  
TYPE: Angola. Moxico: a few mi. W of River Kaperu (Kapelu), boggy grassland, 10 Jan. 1938, Milne-Redhead 4037 (holotype, K; isotypes, BM, BR, LISC, P, PRE).

Plantae 24–30 cm altae, tunicis cormi atrobrunneis, foliis teretibus vel ellipticis, inflorescentis paniculatis paucifloris, ramis terminalibus 1–2 florum, bracteis (4–)5–6 mm longis, floribus pallide violaceis, tubo perianthii 3.3 mm longis, tepalis 13–14 mm longis, filamentis ca. 6 mm longis, exsertis 5 mm tubo.

Plants 24–30 cm high. *Corm* 13–16 mm diam., tunics dark brown to blackish, composed of hard layers of densely compacted fibers, the outer layers breaking into parallel vertical sections. *Cataphylls* 2, membranous and dark brown, the inner one reaching shortly above the ground. *Leaves* 2–3, the lowermost inserted near the ground and longest, about half as long to as long as the inflorescence,



the upper leaves decreasing in size progressively,  $\pm$  terete to elliptic in section, without a discrete midrib, rigid, 1–1.5 mm diam. in the middle. *Stem* weakly compressed, 2-angled below, 3-angled above the branches; branching divaricate. *Inflorescence* a rounded panicle with relatively few flowers, the main axis usually dominant, the terminal branches 1–2-flowered; *bracts* (4–)5–6 mm long,  $\pm$  membranous, green below, rust-brown above, becoming brownish entirely, the inner slightly longer than the outer. *Flowers* zygomorphic, pale violet, the lower tepals each with a pale yellow median streak edged in purple on the lower midline; *perianth tube* 3.3 mm long, slender, slightly expanded above; *tepals* subequal (their orientation uncertain),  $\pm$  differentiated into a claw below, 12–14 mm long, the limb lanceolate, 1.5–2 mm wide, the margins undulate, the upper tepal apparently held apart from the others, the lower 3 tepals united below for ca. 2 mm and held closely together. *Filaments* unilateral, erect, ca. 6 mm long, exerted 5 mm from the tube, reddish; *anthers* parallel and contiguous, 3.5 mm long, violet; pollen pale. *Ovary* globose, ca. 1.5 mm long, *style* arching behind the stamens, dividing toward the apex of the anthers, branches ca. 1.4 mm long, undivided, recurving. *Capsule* and *seeds* unknown. *Chromosome number* unknown.

*Flowering time.* February to April.

*Distribution and habitat.* *Lapeirousia angolensis* is known only from three gatherings made in western Zambia and eastern Angola (Fig. 9). It occurs in boggy grassland, probably in seasonally inundated areas. This type of habitat is most often associated with *L. rivularis* and may indicate a phylogenetic relationship between the two.

*Diagnosis and relationships.* The most unusual feature of *Lapeirousia angolensis* is its flower with long narrow tepals that greatly exceed the fairly short perianth tube. The tepals appear to be subequal, but the lower three are connate for ca. 2 mm more than the upper three, and hence are shorter. I have not seen live material, and the flower description is a reconstruction that may not be entirely accurate. Clearly the flower is substantially different from that of any other species of the *L. erythrantha* complex. The tube is only 3.3 mm long and does not or barely exceeds the bracts, and the unusually long tepals are thus at least three times as long. The union of the lower three tepals for ca. 2 mm is an additional feature that separates *L. angolensis* from the other species in the complex. The narrow terete leaf is reminiscent of *L.*

*teretifolia*, but the lax panicle and larger bracts and flowers are quite different from this small-flowered species. The style branches are undivided, a feature that is not uncommon in the tropical African species of *Lapeirousia*, and this helps little in placing the species.

*History.* *Lapeirousia angolensis* is poorly known, having been collected just three times, first by a Mlle. Kiener prior to 1896, at Haut-Zambèse, a locality too vague to be placed. Later collections are from eastern Angola and western Zambia, in areas that are seasonally inundated. Until now the species has not been associated with any other, although it bears a fair resemblance to *L. erythrantha*.

*Specimens examined.* ANGOLA. MOXICO: a few mi. W of River Kaperu (Kapele), boggy grassland, 10 Jan. 1938, *Milne-Redhead* 4037 (BM, BR, K, LISC, PRE). ZAMBIA. WESTERN: Mongu flood plain, damp grassland, 29 Jan. 1966, *Robinson* 6830 (K). WITHOUT PRECISE LOCALITY: ?ZAMBIA: Haut-Zambèse, *Kiener* s.n. before 1896 (P).

8. *Lapeirousia abyssinica* (R. Br. ex A. Richard) Baker, J. Linn. Soc. Bot. 16: 155. 1878; Fl. Trop. Africa 7: 351. 1898. Andrews, Flow. Pl. Sudan 3: 293. 1956. Cufodontis, Enum. Pl. Aethiopiae Sperm. 2: 1592. 1972. *Geissorhiza abyssinica* R. Br. ex A. Richard, Tent. Fl. Abyssinica 2: 308. 1850. TYPE: Ethiopia: Maigoigoi ad Dobre Sina, *Quartin Dillon & Petit* s.n. (lectotype, P, here designated; islectotype, BR); Selleuda prope Adoua, *Quartin Dillon* s.n. (syntype, P); Maigoigoi, *Schimper* s.n. (syntype, P). [*Geissorhiza abyssinica* R. Br. in Salt, Voyage to Abyssinia, Appendix 1. 1814, nom. nud.] Figure 10.

*Montbretia abyssinica* Hochst. ex A. Richard, Tent. Fl. Abyssinica 2: 308. 1850. TYPE: Ethiopia: collibus prope Adoua, flor. et fruct. Octobre, *Schimper* 329 (lectotype, P, here designated; islectotypes, BM, BR, G, K, M, P).

*Montbretia gallabatensis* Schweinf. ms (*Schweinfurth* 1, BM, G, K, P).

Plants generally small, 9–15 cm high but occasionally to 35 cm, sparsely branched. *Corm* 8–12 mm diam., tunics brown to gray, densely fibrous, the outer layers becoming finely fibrous and reticulate. *Cataphylls* 2, the inner one pale and membranous, reaching shortly above the ground, the outer shorter and dark brown. *Leaves* 3, the lower 2 at least usually inserted near ground level, the lowermost longest and about as long as to slightly exceeding the inflorescence, lanceolate, 3–5 mm wide in the midline. *Stem* compressed and



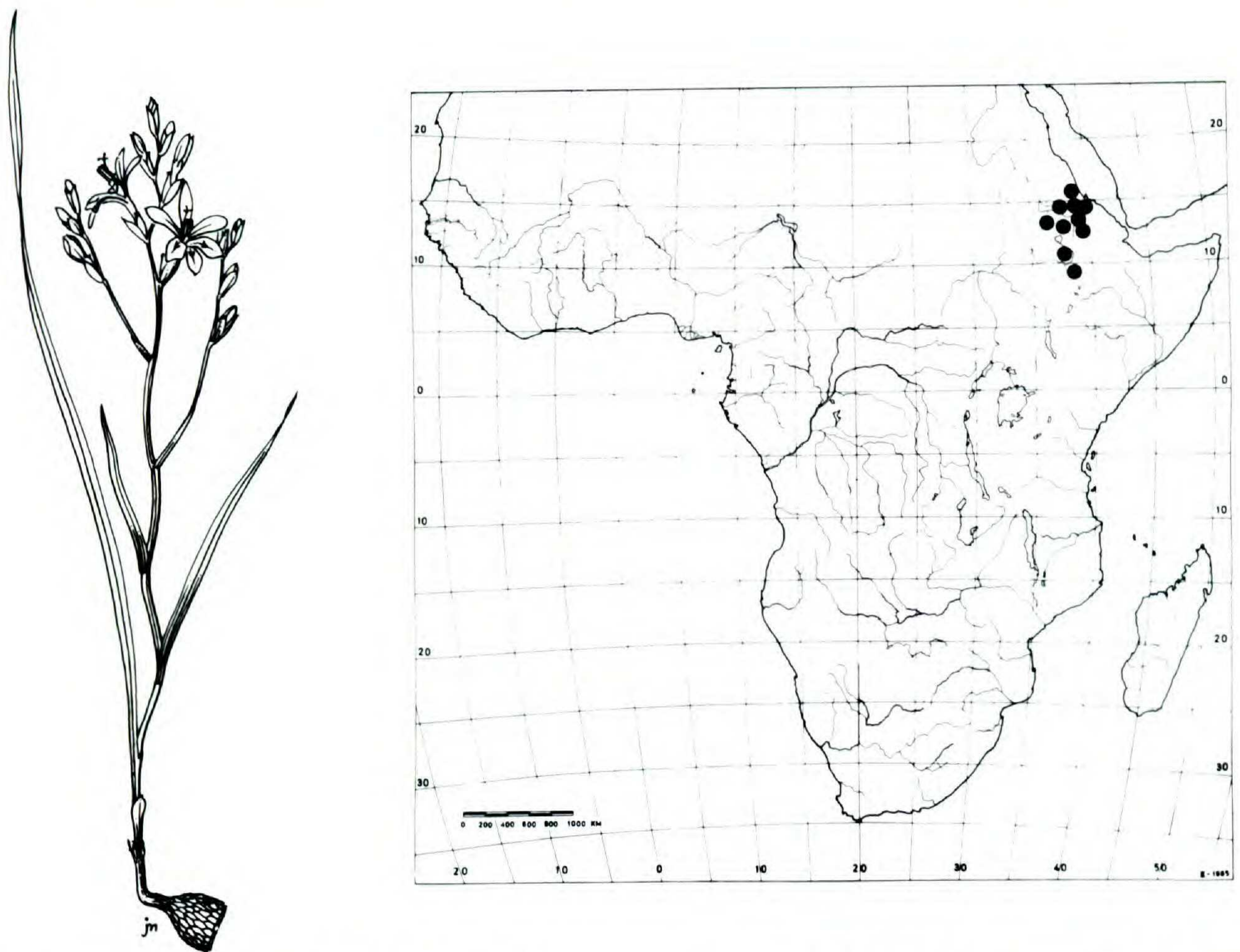


FIGURE 10. Morphology and distribution of *Lapeirousia abyssinica*. Habit  $\times 0.5$ . (Drawn by J. C. Manning.)

2–3-angled, sometimes narrowly winged above. *In-florescence* a spike or few-branched pseudopanicule, the main axis 5–7-flowered, the secondary axes with fewer flowers; *bracts* herbaceous, often flushed red to purple, becoming dry in late flower, 6–8 (–10) mm long, the outer bract nearly always exceeding the inner. *Flower* zygomorphic, violet, the lower 3 tepals each with a white median streak edged with a darker band of purple in the lower midline; *perianth tube*  $\pm$  straight, narrowly funnel-shaped, ca. 9 mm long; *tepals* unequal, lanceolate, the lower 3 horizontal to descending, held close together and forming a lip, ca. 9 mm long, to 2 mm wide, the upper 3 larger, the uppermost  $\pm$  erect, the upper laterals reflexed, ca. 9 mm long, to 3 mm wide. *Filaments* ca. 6 mm long, unilateral, exerted 3 mm from the tube; *anthers* parallel and contiguous, ca. 3 mm long, pale gray; pollen whitish. *Ovary* ovate-obovate, ca. 2 mm long; *style* unilateral, arching behind the stamens, dividing between the middle and apex of the anthers, branches ca. 2 mm long, barely notched apically. *Capsules* globose-trigonous, 3–4 mm long, showing the outline of the seeds; *seeds* red-brown, globose, ca. 1.2 mm diam. *Chromosome number*  $2n = 8$ .

*Flowering time.* Late August to early October.

*Distribution and habitat.* *Lapeirousia abyssinica* is fairly widespread in the northern half of Ethiopia, where it occurs in shallow soils, usually in rocky sites from northern Shoa Province in the south to Eritrea in the vicinity of Keren in the north. The record indicates that the species is most common in Tigray, the origin of numerous collections. It is recorded from a variety of substrates but is apparently most often found associated with limestone rocks. A collection from “Gallabat near Matamma” (*Schweinfurth 1*) is probably from eastern Sudan close to the Ethiopian border, and is so cited by Andrews (1956).

*Diagnosis and relationships.* Evidently closely related to *Lapeirousia erythrantha*, and clearly a member of this tropical African species complex, *L. abyssinica* is a plant of low stature with a relatively few-branched to unbranched inflorescence that is essentially a spike. The main axis has 5–7 flowers and the branches typically fewer. The flowers are virtually identical to those of *L. erythrantha* in their blue-violet color, white and dark blue nectar guides on the lower tepals, and erect to reflexed upper tepal. The chromosome number is  $2n = 8$  in the one population counted



(Goldblatt, 1990b), whereas *L. erythrantha* has a basic diploid number of  $2n = 12$ .

*History.* First collected by Henry Salt in Tigray, northern Ethiopia in 1810–1811, *Lapeirousia abyssinica* was listed without description by Robert Brown as *Geissorhiza abyssinica* in the *Appendix to Salt's Travels* (Salt, 1814). Schimper used the name for some of his collections of the species, and Achille Richard validated it in 1850. In the same work Richard described *Montbretia abyssinica*, validating Hochstetter's manuscript name that appeared on the labels for Schimper 329. Although undoubtedly conspecific, *Geissorhiza abyssinica* and *Montbretia abyssinica* are based on different type specimens. *Geissorhiza abyssinica* was transferred to *Lapeirousia* by J. G. Baker in 1876.

*Additional specimens examined.* ETHIOPIA. ERITREA: near Asmara, 7,600 ft., thin soil, flat open land, 29 Aug. 1954, *Colville 19* (K); Keren road 20 mi. NW of Asmara, sandy waste ground around granite boulders, 26 Aug. 1959, *Mooney 8071* (BR, K, S); Mt. Presso, Scimenzana, 2,500 m, 28 Aug. 1902, *Pappi 814* (BR, G, GH, MO, P, U); Scimenzana, Monti Presso, Senafé, 2,500 m, 28 Aug. 1902, *Pappi 816* (P, S). GOJAM: near Ejube, 15 mi. S of Debra Marcos,  $10^{\circ}15' 37^{\circ}48''$ , 7,000 ft., 11 Sep. 1957, *Hallier 931* (K). CONDER: Gondar, *Rochet de Hericourt s.n.* (P). SHOA: Royaume de Choa, 1847, *Rochet de Hericourt s.n.* (P); Muger valley, ca. 100 km N of Addis Abeba, gypsum hill, 1,800 m,  $9^{\circ}30' 38^{\circ}25''$ , *Edwards et al. 97* (MO). TIGRAY: 40 km S of Kwiha, 2,100 m, gentle slopes on limestone,  $13^{\circ}11' 39^{\circ}32''$ , 12 Aug. 1973, *Gilbert & Getachaw 2625* (K); 3 km N of Adua bridge, Mai-Gougae road to Axum, 1,820 m, slate,  $14^{\circ}9' 38^{\circ}38''$ , 22 Aug. 1973, *Aweke & Gilbert 747* (K, WAG); 37 km S of Quiha, road to Maichew, 2,150 m, 5 Sep. 1970, *de Wilde 6984* (BR, M, MO, WAG); 8 km SW of Inda Selassie on Gondar road, 1,830 m, shallow soil over basalt, seasonally waterlogged, 29 Aug. 1973, *Gilbert & Getachaw 2919* (C, K); near the pass of Atbara, sand, *Salt 37* (BM); valee d'Adoua, Aug. 1839, *Quartin Dillon & Petit s.n.* (P); prope Adouam, Oct. 1839, *Schimper 645* (BM, G, P); Shire, 1853, *Schimper s.n.* (P); 37 km S of Quiha, road to Maichew, dry limestone hills, low shrubland, 5 Sep. 1970, *Amshoff 6984* (MO). SUDAN: Gallabat, near Matamma, 24 June 1861, '*Montbretia gallabatensis* Schweinf.', *Schweinfurth 1* (BM, G, K, P) (possibly in Ethiopia). WITHOUT PRECISE LOCALITY: ETHIOPIA: Abyssinia, *Pearce s.n.* in 1820 (BM); 1861, *Parkyn s.n.* (K); vallée Mareb, *Rochet de Hericourt s.n.* (BM); Aaosa, 6,000 ft., 8 Sep. 1852 (fr), *Schimper 563* (P (2)); Woina, 6,000–7,000 ft., 24 Aug. 1852, *Schimper 563* (BR, K, P).

**9. *Lapeirousia masukuensis*** Vaupel & Schlechter, Bot. Jahrb. Syst. 48: 545–546. 1912. TYPE: Mozambique. Inhambane: Masuku forest, 10 Feb. 1898, *Schlechter 12109* (holotype, B; isotypes, BR, COI, G, K, P, PRE, SAM).

Plants 40–60 cm high. *Corm* campanulate, ca. 15 mm diam. at the base, light brown, tunics coriaceous with a reticulate surface, the outer layers decaying to become coarsely fibrous. *Cataphylls* usually 2, membranous, light brown, the upper one longer and reaching shortly above ground level. *Leaves* 4–6, the lowermost inserted close to the ground and largest, the remaining becoming progressively smaller above, the longest usually slightly exceeding the inflorescence, narrowly linear-lanceolate, the midribs prominent, 3–6 mm wide near the midline. *Stem* compressed and 2-angled to winged below, 3-angled and lightly winged above the branches. *Inflorescence* a branched spike or pseudopanicule, the main axis  $\pm$  straight and dominant, the major ultimate branches forming spikes of 5–9 flowers, the flowers often crowded with the bracts overlapping and (1–)1.5–2 internodes long; *bracts* herbaceous at anthesis, becoming dry and scarious toward the end of flowering, then either pale throughout or brownish above and pale below with streaks of brown on the nerves, 5–7 mm long, the inner bract about as long as the outer or slightly shorter. *Flowers* zygomorphic, either blue to violet or greenish cream, the lower tepals each with a purple to red and white hastate median streak in the lower half; *perianth tube* cylindrical, (15–)20–25 mm long, slightly expanded in the upper 4 mm; *tepals* subequal, 8–10 mm long, lanceolate, ca. 3 mm wide, spreading at right angles to the tube and lying in  $\pm$  the same plane, the upper tepal held apart from the others. *Filaments* unilateral,  $\pm$  erect, ca. 5 mm long, exerted 2.5–3 mm from the tube; *anthers* parallel and contiguous, 3.5 mm long, probably pale yellow when live. *Ovary* ca. 1.5 mm long, style unilateral and arching behind the stamens, dividing near the upper  $\frac{1}{3}$  of the anthers, the branches ca. 2 mm long, divided for about  $\frac{1}{2}$  their length. *Capsules* depressed-globose,  $\pm$  3-lobed and showing the outline of the seeds, ca. 5 mm diam.; *seeds* globose, ca. 2 mm diam. *Chromosome number* unknown.

*Flowering time.* February to April.

*Distribution and habitat.* *Lapeirousia masukuensis* is restricted to southeastern tropical Africa, where it extends from coastal central and southern Mozambique in the provinces of Inhambane and Maputo (Sul do Save) westward into the lowlands of the eastern Transvaal of South Africa and southeastern Zimbabwe (Fig. 11). There is an apparent gap in the distribution between the Kruger National Park on the Transvaal border and the Mozambique coast, but this may be due to inadequate sampling in interior Mozambique. A single



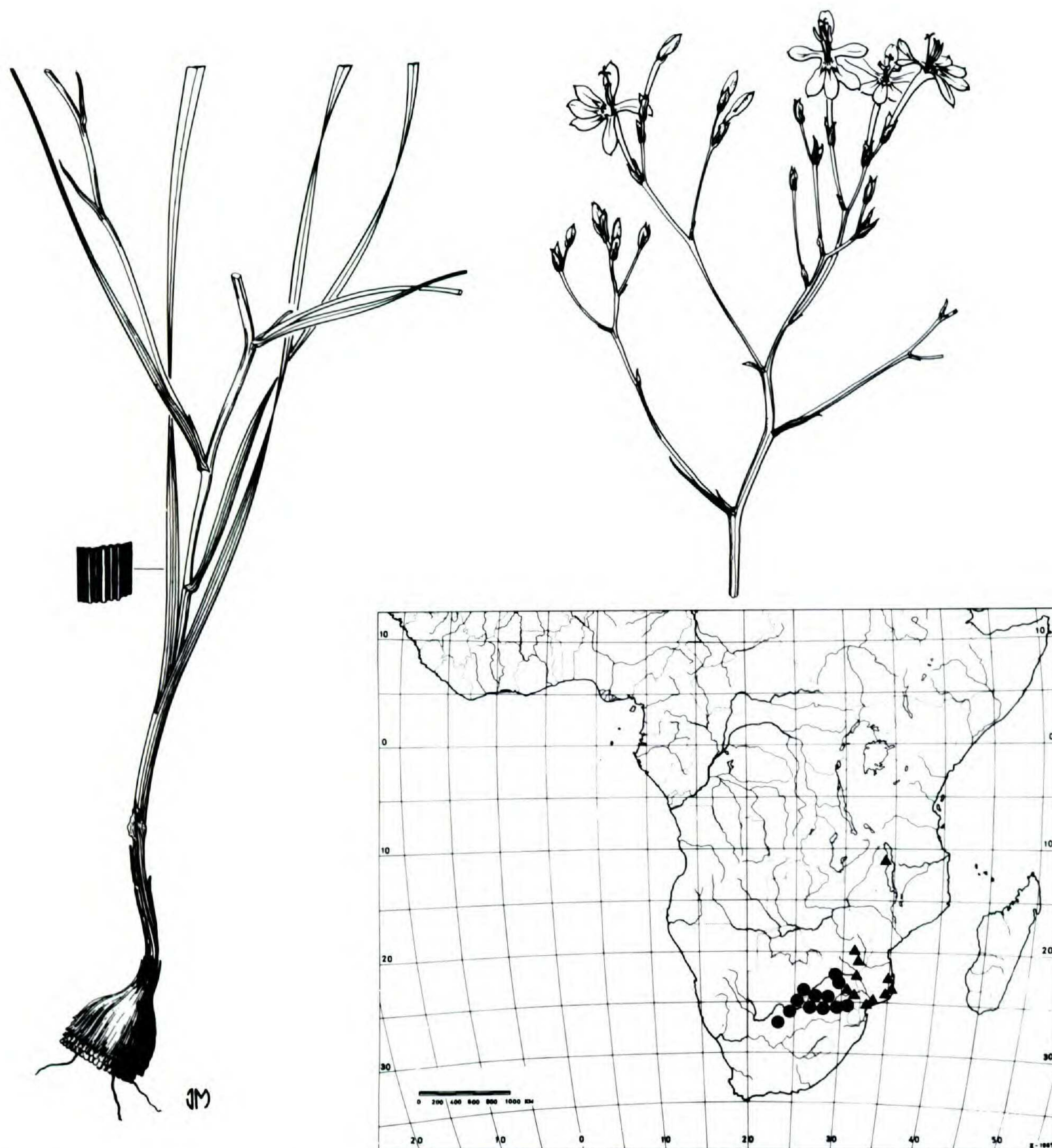


FIGURE 11. Morphology and distribution of *Lapeirousia sandersonii* (dots) and distribution of *L. masukuensis* (triangles). Habit and inflorescence  $\times 0.5$ ; leaf detail  $\times 1.5$ . (Drawn by J. C. Manning.)

collection from northern Malawi is provisionally referred to this species although its identity remains uncertain. The collection data make it clear that *L. masukuensis* prefers relatively wet habitats. Most specimens are recorded as growing in vleis, the edge of swamps, or in seasonally waterlogged flats.

*Diagnosis and relationships.* The comparatively tall stature, usually over 45 cm high, alternate branching pattern, ultimate inflorescence branches bearing 5–9 apically crowded flowers, and the long straight perianth tube 20–25 mm long are the main distinguishing features of *Lapeirousia masukuensis*. Plants from the Mozambique coast are described as having greenish flowers with

red markings, an unusual color in the genus. However, in the eastern Transvaal, Zimbabwe, and Malawi *L. masukuensis* has flowers with a dark blue-violet perianth with white markings that are typical of related species, such as *L. erythrantha* and *L. sandersonii*. The long perianth tube and general appearance of the flowers, including their color, suggest a relationship with the western Transvaal and Botswana species *L. sandersonii*, and it is usually under this name that specimens of *L. masukuensis* have been placed in herbaria until now. *Lapeirousia sandersonii* is a shorter plant, rarely exceeding 35 cm, with a dichotomous and often intricately branched habit, and the ultimate branches of the inflorescence have one, two,



or rarely three flowers. The corms of the two species also differ, those of *L. masukuensis* being relatively small and having the outer tunic layers fibrous and reticulate, whereas the larger corms of *L. sandersonii* have dark brown tunics that decay irregularly into smooth vertical strips. The corms of *L. masukuensis* resemble closely those of *L. erythrantha* with which it is perhaps most closely allied.

Plants from the Transvaal and Zimbabwe are more variable than those from Mozambique and particularly so in regard to the length of the perianth tube and the number of flowers on the terminal branches of the inflorescence. Generally plants from the Transvaal and Zimbabwe have five or six flowers per branch compared with 6–9 in Mozambique, and the perianth tube is 15–22 mm long. A notable example is *Mauve 4326*, 10 m N of Abel Erasmus Pass, which has some flowers with a perianth tube just 15 mm long, while others have a tube up to 22 mm. It is difficult to explain such gross variation in a feature such as perianth tube length, but this degree of variability is noted in a few collections of other tropical African *Lapeirousia*, e.g., *L. bainesii*, *L. sandersonii*, and *L. erythrantha*.

*History.* Discovered in 1898 by the widely traveled German botanist and prolific collector Rudolf Schlechter, *Lapeirousia masukuensis* was described by Vaupel and Schlechter in 1912. It appears to be comparatively rare, particularly in Zimbabwe and Mozambique. An early collection made by the French missionary Henri Junod at Shilouvane in the Transvaal bears the manuscript name *L. junodii* N. E. Br., indicating that Brown also considered the species distinct from *L. sandersonii*.

*Additional specimens examined.* MALAWI. NORTHERN PROVINCE: 20 mi. NW of Rumphu, 1,400 m, 11 Mar. 1978, hard, packed, rocky soil, *Pawek 14048* (K, MAL). MOZAMBIQUE. INHAMBANE: Quissico, 28 Feb. 1955, *Exell, Mendonca & Wild 703* (LISC, SRGH); between Morumbene and Massinga, 26 Feb. 1955, *Exell, Mendonca & Wild 652* (LISC, SRGH); Inhambane-Velho, June 1938, *Gomes & Sousa 2133* (COI, K). MAPUTO: Manhica, vale do Incomati, 26 Mar. 1979, *de Koning 7353* (K, LISC, LMA); Marracuene, between the Incomati pontoon and Lake Pati, 40 km from the pontoon, 24 Mar. 1954, *Barbosa & Balsinhas 5450* (LISC, LMA); Vila Luisa, Macaneta, 18 Apr. 1974, coastal dune, *Balsinhas 2699* (LMA, PRE); Marracuene, ao km 12 de Vila Luiza para Manhica, 6 Feb. 1969, *Correia & Marques 591* (WAG). SOUTH AFRICA. TRANSVAAL: 22.31 (Pafuri), Kruger National Park, Klapperfontein, 21 Jan. 1953 (CA), *van der Schijff 1858* (PRE); 23.30 (Tzaneen) Hans Merensky Nature Reserve, mopane veld in damp earth along sloop, 11 Feb. 1971 (DA), *Oates 371* (PRE); Merensky Nature Reserve, waterlogged clay loam in vlei, 2,000 ft., 15 Mar. 1977, *Zambatis 737* (PRE); 24.30 (Pilgrims Rest), Shilouvane, Jan. 1919 (AB), *Junod 4139* (G, M, PRE);

Shilouvane Plaine, s.d., '*L. junodii* N. E. Br.' *Junod 736* (G, K); 10 m N of Abel Erasmus Pass, grass in bushveld, 16 Dec. 1964 (DA), *Mauve 4326* (K, PRE); 24.31 (Acornhoek), farm Grootdraai, stony flats, 1,500 ft., 15 Nov. 1973 (AA), *Zambatis 543* (MO); Klaserie, farm Sark, seasonal seep in sandy clay, 28 Jan. 1982 (AC), *Zambatis 1345* (PRE); Kruger National Park, 25 Feb. 1953 (AD), *van der Schijff 2365* (PRE); Pumbe, Satara, sandy soil, Mar. 1967 (BB), *van Wyk 4783* (PRE); Manyeleti Game Reserve, clay, 400 ft., 9 Mar. 1977, *Bredenkamp 1762* (PRE). ZIMBABWE. VICTORIA: Bikita District, Burchenough-Fort Victoria road, 16 May 1962, *Noel 2427* (K, LISC, SRGH); near Morgenster Mission, 17 Mar. 1958, *Leach 8219* (SRGH); Kyle National Park, clay slope above granite outcrop, 9 Feb. 1972, *Gibbs Russel 1465* (SRGH); Kyle Dam, shade in gully by granite outcrop, 8 Jan. 1972, *Gibbs Russel 1452* (SRGH); Bellingwe, near the Mnene road, among rocks, *Norlindh & Weimarck 5202* (BR, PRE, S, SRGH).

**10. *Lapeirousia sandersonii* Baker, Handbk. Irideae 169. 1892; Fl. Cap. 6: 95. 1896; Fl. Trop. Africa 7: 352. 1898, excl. specimens cited. van Druten, Fl. Pl. Africa 31: 1226. 1956. Letty, Wild Flowers of the Transvaal 77, t. 37. 1962. TYPE: South Africa: Transvaal, *Sanderson s.n.* (lectotype, K, here designated); Rhenosterpoort, *Nelson 402* (syntypes, K, PRE); Transvaal, without precise locality, *Todd 20, 21* (syntype, K). As no type was indicated in the protologue, a lectotype has been selected from among the four specimens from South Africa cited in *Flora Capensis* (1896). None of the several more from tropical Africa cited by Baker (1898) are this species. The Sanderson collection from the Transvaal chosen as the lectotype is already so annotated in the Kew Herbarium (by N. E. Brown ?). Figure 11.**

*Lapeirousia bainesii* var. *breviflora* Baker, J. Linn. Soc. Bot. 16: 156. 1856, nom. nud. (no specimen cited, but *Nelson 402*, see above, is so annotated).

Plants 18–35 cm high. *Corms* 2.5–3 cm diam., tunics dark brown, coriaceous internally, decaying somewhat irregularly into vertical segments, seldom becoming fibrous and never reticulate. *Cataphylls* usually 2, dark brown, the inner one reaching to shortly above ground level, the outer much shorter. *Leaves* 2–4, ± linear, 2–3 mm wide, firm to rigid, the midrib and lateral veins fairly prominent and closely set, the lowermost longest and usually exceeding the inflorescence, the upper leaves progressively shorter. *Stem* compressed, 2-angled to winged below, triangular above the branches and often lightly winged on the angles. *Inflorescence* much branched, sometimes intricately so, the branches ± divaricate but unequal and a main axis



usually evident, the ultimate branches 1–2(–3)-flowered; *bracts* (4.5–)5–8(–10) mm long, herbaceous with brown tips in bud, often flushed purple, becoming scarious throughout in later flower and brown almost entirely. *Flowers* zygomorphic, blue to violet, the lower 3 tepals each with a deep red to purple and white spear-shaped nectar guide in the lower midline; *perianth tube* 15–18(–20) mm long, slender, but slightly wider in the upper 2–3 mm; *tepals* subequal, 10–11 mm long, lanceolate, 3–3.5 mm wide, the upper held apart from the others and reflexed, the lower 3 joined for about 1 mm and forming a lip, when fully open all held in  $\pm$  the same nearly horizontal plane. *Filaments* unilateral,  $\pm$  erect, ca. 5 mm long, exerted 3 mm from the tube; *anthers* parallel and contiguous, 3–4 mm long, purple; pollen pale yellow. *Ovary* ovoid, ca. 2 mm long, *style* dividing near the apex of the anthers, the branches simple or divided for a short distance, ca. 1.5 mm long. *Capsules* depressed globose, ca. 5 mm diam., 4–5 mm long; *seeds* nearly globose, ca. 2 mm diam. *Chromosome number*  $2n = 10$ .

*Flowering time.* December to April.

*Distribution and habitat.* *Lapeirousia sandersonii* is native to the interior of eastern Botswana and the adjacent part of South Africa, where it occurs in the relatively dry northern and western Transvaal and the northern Cape (Fig. 11). It appears to be most common in the Pretoria and Rustenburg areas of the Transvaal, and, according to the collection record, relatively rare in the northern Transvaal and Botswana. The easternmost records from the cool, high, well watered Dullstroom, Belfast, and Middleburg areas of the eastern Transvaal are surprising in view of the rest of the range in semiarid country, but the eastern populations differ in no significant way from those occurring further west. The habitat is always rocky, and usually well drained, such as hill slopes, ridges and summits. Corms are seldom collected, which probably reflects the difficulty in extracting them from rocky ground.

*Diagnosis and relationships.* Clearly a member of the *Lapeirousia erythrantha* complex, *L. sandersonii* has the repeatedly branched, pseudopaniculate inflorescence and blue-violet flowers that characterize most tropical African species of *Lapeirousia*. It can be distinguished from the related *L. erythrantha* by its longer perianth tube 15–20 mm long, and by its usually highly ramified and divaricately branched inflorescence with 1–2 (–3) flowers on the major terminal branches. *La-*

*peirousia sandersonii* is most easily confused with occasional longer-tubed forms of *L. erythrantha* that occur in eastern Zimbabwe and Malawi, but these plants have shorter bracts 4–6 mm long, and less-branched inflorescences with 3–5 flowers per main terminal branch. These long-tubed forms of *L. erythrantha* are particularly variable and consist of plants with tubes ranging from 12 to 15 mm. A population from near Dedza in central Malawi that is particularly variable for perianth tube length has a chromosome number of  $2n = 12$  exactly corresponding to that in surrounding populations of *L. erythrantha* and unlike the karyotype of subsp. *sandersonii*, which has  $2n = 10$  (Goldblatt, 1990b).

Also easily confused with *L. sandersonii* is *L. masukuensis* of the eastern Transvaal, southeastern Zimbabwe, and Mozambique. This species has flowers with a particularly long perianth tube, typically 20–25 mm long, soft-textured leaves, coarsely fibrous to reticulate outer tunic layers, and 5–9 flowers per major terminal inflorescence branch. The two have often been confused, and the later name, *L. masukuensis*, has not been used in herbaria. It seems distinct from *L. sandersonii*, not only in several morphological characters but also in the lowland distribution, from 2,000 ft. to near sea level, and preference for wet sites such as vleis, seeps, or seasonally waterlogged flats.

A few collections of *Lapeirousia* from the Waterberg in the western Transvaal broadly resemble *L. sandersonii* in habit, leaf, and corm, but the flowers have a perianth tube 10–12 mm long (e.g., *Werdermann & Oberdieck 1640*). The short perianth tube in *L. sandersonii* from this area is puzzling. These plants are indicated by an asterisk in the exsiccatae.

*History.* Collected first by John Sanderson, probably in 1852 when he traveled to Rustenberg and the Magaliesberg on his only journey to the Transvaal, *Lapeirousia sandersonii* first appeared in the literature as "*L. bainesii* var. *breviflora*," a nomen nudum of J. G. Baker (1876). Baker subsequently described *L. sandersonii* in 1892, and it was so treated in *Flora Capensis* and *Flora of Tropical Africa*. W. Marais (pers. comm.) suggested that it be assigned infraspecific status in *L. erythrantha* although he preferred varietal rank.

*Additional specimens examined* (unusual short-tubed forms are indicated by an asterisk [\*]). BOTSWANA. KGATLENG: 24.25 (Gaborone) near Molepolole, shale, 15 Apr. 1930 (BC), *van Son s.n.* (PRE 28664); W of Gaborone Dam (DB), 1976, *Mott 928* (SRGH, UCBG). NGWAKETSE: 25.25 (Mafeking) 6 mi W of Kanye, 12 Feb. 1971 (AB), *van Rensburg B4226* (PRE). SOUTH



AFRICA. CAPE: 26.24 (Vryburg) Moshesh near Mosita, ironstone koppie, 10 Apr. 1945 (BB), *Brueckner* 470 (K, PRE); Vryburg, 5 Feb. 1948 (DC), *Rodin* 3501 (K, MO, P, PRE, S); 27.23 (Kuruman) Bathlaros, Apr. 1921 (AC), *Silk* 231 (K); 7 mi. SW of Kuruman, *Wisura* 2003 (NBG). TRANSVAAL: 22.29 (Waterpoort) Zoutpansberg, 1 mi. from Dandy farm, road to Sand River, S slopes in rocky outcrop, 3 Apr. 1957 (DC), *Meeuse* 10212 (K, M, PRE, SRGH); farm Thornhill 743, red sand in riverine woodland, 18 Mar. 1985 (DD), *Raal* 434 (PRE); 22.30 (Messina) Louis Trichardt, farm Rietbok 226, among rocks in montane scrub forest, 1,476 m, 25 Mar. 1982 (CC-CD), *Venter* 7812 (PRE); 23.27 (Ellisras) \*Waterberg, 67 mi. N of Vaalwater on Beauty road, 3 Feb. 1983 (DB), *Reid* 656 (PRE); \*Waterberge, between Groothoek and Vaalwater, 1,000 m, 6 Jan. 1959 (?), *Werdermann & Oberdieck* 1640 (B, BR, GH, K, MO, PRE, WAG); 24.28 (Nylstroom) \*Vlakfontein, 3 mi. N of P. O. Palala, 29 Jan. 1960 (BC), *Codd* 9975 (PRE); Sterkrivier Nature Reserve, rocky slope in mixed woodland, below slabs of bedrock, 13 Mar. 1973 (BD), *Jacobsen* 2794 (PRE); koppie 19 km from Warmbaths on Kwaggasnek road, W slope, 13 Feb. 1981 (CC), *Herman* 227 (PRE); 24.30 (Pilgrims Rest) 5.3 m from Burgersfort on Steelpoort rd., 2,500 ft., 14 Mar. 1953 (CB), *Story* 4067 (GRA, K, PRE, SRGH); 25.26 (Zeerust) Zeerust, 28 Jan. (CA), *Thode* A1503 (GH, K); Zeerust, Feb. 1912, *Jenkins* TM11660 (K, PRE); 15 m E of Swartruggens, bushveld on ridges (DB), 14 Feb. 1956, *Acocks* 18747 (K); 15 mi. E of Swartruggens on the Rustenburg road, 25 Feb. 1947, *Sidey* 83 (S); Koster, among rocks in kloof, 1 Apr. 1929 (DD), *Gilmore* 1915 (G); 25.27 (Rustenberg) Rustenberg, 4,000 ft., stony hillside near town, July 1904 (fl & fr) (CA), *Pegler* 1108 (GRA, K, PRE, SAM); 22 m W of Rustenberg, 14 Feb. 1956, *Leistner* 539 (K, PRE); Rustenberg, Tierkloof, moeras by wildreservaathek, 13 Mar. 1976, *Venter* 654 (K, MO, PRE, SRGH, WAG); Rustenberg Nature Reserve, rocky hillsides in grassland, 25 Feb. 1970, *Jacobsen* 745 (PRE); 16 km from Palala on road to Bamboeskloof, 9 Mar. 1978 (CC), *Germishuizen* 735 (PRE); Breedtsnek, grass on open mountain top, 7 Apr. 1939 (fr) (CD), *Connell* 42 (PRE); Brits, Silikaatsnek, top of poort in shallow sand over quartzite (DB), *Codd* 736 (PRE); 14 Feb. 1946, *Story* 810 (PRE); Krugersdorp, Jack Scott Nature Reserve, 2 Feb. 1961 (DC), *Wells* 2305 (K); 25.28 (Pretoria) Hornsnek Pass, Magaliesberg, W side, S slope in grassland, 31 Jan. 1983 (CA), *Perry* 2017 (NBG); Hornsnek, 12 km W of Pretoria, 12 Jan. 1956, *Schlieben* 7751 (B, BR, G, HBG, K, M); Hornsnek, light shade on summit among rocks, 10 Feb. 1951, *Prosser* 1604 (K, NBG, PRE); N slopes of Magaliesberg, 25 Mar. 1945, *Mogg* s.n. (K, M, PRE 27329, S, SRGH); The Willows, Pretoria, 9 Mar. 1906, *Burt Davy* 5333 (GRA, K), 1703 (K); Cullinan, farm Vaalwaterkrans, 25.2 km from Pretoria on Roodeplaat Dam road, 28 Feb. 1980 (CB), *Retief & Herman* 159 (MO, PRE); Pienaarspoort, 17 mi. E of Pretoria, 20 Feb. 1959, *Brent* 138 (K, PRE); Tierpoort Vakansieoord, E of Pretoria, sandstone rock crevices and slopes, 8 Mar. 1977 (CD), *van Jaarsveld* 1870 (NBG); Donkerhoek, 20 mi. E of Pretoria, 19 Mar. 1959, *Codd* 9908 (K, PRE); 19 Mar. 1959, *Letty* 428 (K, PRE); Donkerhoek, rocky koppie, 11 Mar. 1943, *Verdoorn* 1908 (PRE); Premier Mine, Jan. 1919 (DA), *Rogers* 22415 (K, P, SAM); June 1921, *Rogers* 24146 (B, BR, G, GRA, K, LISC, MO, P, S, SAM); Renosterkop, Bronkhorstspuit District, 7 Feb. 1932 (DB), *Young* 2116 (K,

PRE); farm Valsspruit, 19 km N of Bronkhorstspuit, 10 Feb. 1984, *Crosby* 64 (PRE); 25.29 (Witbank) Loskop Dam, Nooitgedacht, shallow ground on summit, 9 Feb. 1967 (AD), *Theron* 1214 (PRE); 5 mi. W of Middelburg, 30 Jan. 1929 (CD), *Hutchinson* 2716 (K, PRE); Botsabelo, Renosterpoort, mountain summit, Mar. 1878, *Nelson* 402 (K, PRE); 25.30 (Lydenburg) hills above Dullstroom, 23 Feb. 1937 (AC), *van der Merwe* 1255 (B, K, PRE); Dullstroom, among dolerite rocks on farm Valleispruit, 6,500 ft., 30 Jan. 1933, *Galpin* 13369 (K, P, PRE); farm Onverwacht 99, E aspect on shallow stony ground, s.d., *Engelbrecht* s.n. (PRE 664971); Belfast, Feb. 1909 (CA), *Doidge* 4800 (K); 26.27 (Potchefstroom) Dassiesrand, Potchefstroom, 23 Mar. 1940 (CA), *van der Westerhuizen* 1114 (PRE). WITHOUT PRECISE LOCALITY. SOUTH AFRICA: Transvaal, Oct. 1869, *Buchanan* 20, 21 (or Todd sub Buchanan); Jan. 1924, *Rogers* 28286 (G, K) (as Natal, Weenen, Culvers 6,000 ft., which is almost certainly incorrect).

**11. *Lapeirousia gracilis* Vaupel, Bot. Jahrb. Syst. 48. 548. 1912. Sölch, Prod. Fl. Südwestafrika 155: 9. 1969. TYPE: Namibia: Great Namaqualand, Doorns, dolomite, 1,450 m, Mar. 1907, *Range* 292 (holotype, B; K (photo), M, fragment). Figure 12.**

Plants (12–)15–30 cm high, often fairly slender, but occasionally robust, few- to several-branched. *Corm* 12–18 mm at the widest diameter, narrowly campanulate, tunics light brown, coriaceous, outermost layers becoming coarsely fibrous, the fibers extending upward as short spines. *Leaves* 2–3 (–4), the lowermost inserted just below the ground, the lower or second leaf usually the largest, the upper decreasing in size, becoming bractlike, linear to narrowly lanceolate, 3–5(–8) mm at the widest, the longest about as long or somewhat longer than the inflorescence, somewhat thickened around the midvein, a second vein on either side of the midvein also sometimes evident. *Stem* erect below, branching  $\pm$  divaricately and the branches ascending but flexed to become  $\pm$  erect at the base of the flowers, 2-angled and winged below the first branch, 3-angled and winged above, the wings often prominent. *Inflorescence*  $\pm$  paniculate or the branching sparse, the ultimate branches short spikes of (1–) 2–6 flowers; *bracts* (4–)6–7 mm long, herbaceous below, becoming  $\pm$  membranous above, sometimes flushed purple, sometimes membranous and completely dry before anthesis, then usually transparent or with fine brown veins, subequal or the inner or outer larger. *Flowers* zygomorphic, white to pale blue or mauve, the lower 3 tepals yellow at the base and outlined distally by a dark violet margin, and each marked with a purple median streak or spot, occasionally one or more of the lower tepals with a small median toothlike callus in the midline, lightly fragrant; *perianth tube* cylindrical, slightly



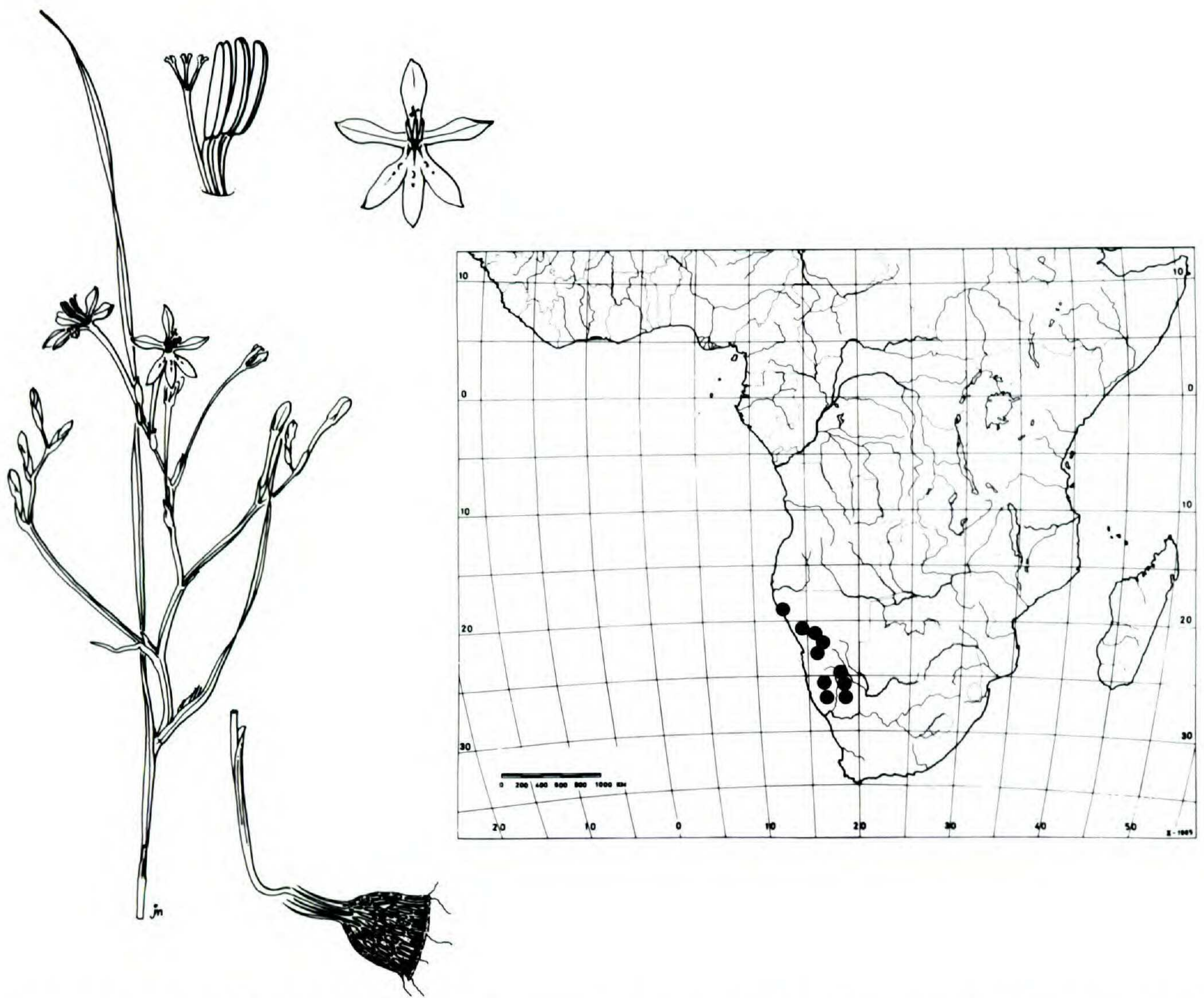


FIGURE 12. Morphology and distribution of *Lapeirousia gracilis*. Habit and corm  $\times 0.5$ ; single flower full size; details of stamens and style  $\times 2$ . (Drawn by J. C. Manning.)

curved outward at the apex, (21–)25–38 mm long; *tepals* nearly equal in size, lanceolate, ca. 10 mm long, 4–5 mm wide, the margins lightly undulate, the lower 3 closer together, apparently forming a lip, the uppermost held apart and nearly erect to reflexed, rarely the lower 3 tepals each with a short median toothlike callus. *Filaments* unilateral, exerted for ca. 2 mm; *anthers* parallel and contiguous, ca. 5 mm long, pale lilac; pollen cream. *Ovary* obovoid, ca. 2 mm long, *style* arching behind the filaments, dividing near the apex of the anthers, branches 1.5–2 mm long, forked for ca. 0.5 mm, ultimately recurving. *Capsules*  $\pm$  globose, obtusely trigonous, 4–5 mm long, 5–6 mm diam.; *seeds* globose to weakly angular, ca. 2 mm diam., dark brown. *Chromosome number*  $2n = 12$ .

*Flowering time.* Late January to April.

*Distribution and habitat.* *Lapeirousia gracilis* is endemic to Namibia, where it occurs in a relatively broad band along the west central part of the country (Fig. 12). It occurs in rocky sites or sometimes on sandy flats; especially in more

arid areas it is often associated with springs or other places where additional water supplements the sparse rainfall. The range of *L. gracilis* extends from the Fish River Canyon in the south to the Hoanib River in the Kaokoveld in the north. Flowering normally takes place at the end of summer, mostly in February and March but sometimes as late as May. An October-blooming collection, *Craven 1341*, from the Brandberg is difficult to explain; perhaps it indicates an unusual rainfall pattern in a particular year. The spring-blooming specimens do not appear to differ from those collected flowering in the summer.

*Diagnosis and relationships.* The slender perianth tube 25–38 mm long, white to pale blue flower color, and comparatively slender habit make most specimens of *Lapeirousia gracilis* easy to recognize. It most closely resembles *L. bainesii* and *L. otaviensis*, both of which have similarly long-tubed flowers. *Lapeirousia bainesii* has white to pale pink flowers with dark red to brown markings and a tube 35–47 mm long. It also has a



more robust habit and longer floral bracts 7–12 mm long; the highly ramified inflorescence has only 1(–2) flowers per ultimate branch. Occasional robust specimens of *L. gracilis* must be examined carefully to avoid confusing them with depauperate *L. bainesii*.

Confusion with *Lapeirousia otaviensis* is more likely since this species, like *L. gracilis*, has an inflorescence with the main terminal branches bearing 2–5 flowers. The flowers and bracts of *L. otaviensis* are larger and the perianth tube slightly longer than in *L. gracilis*. The latter typically has short and transparent floral bracts 4–7 mm long, a useful guide when flower size is intermediate and perianth color is unknown. Sölch (1969) distinguished *L. gracilis* by its shorter perianth tube and more slender habit but not by flower color, which he described as white in both this and *L. bainesii*. This is generally incorrect for *L. gracilis*; although the flowers fade after drying and appear white, I have seen few collections describing the living flower as white and several that indicate shades of blue, evidently the more common perianth color in *L. gracilis*.

Phylogenetic relationships are difficult to postulate with confidence in *Lapeirousia*, but it seems plausible that *L. gracilis*, *L. bainesii*, and *L. otaviensis* are immediately allied, sharing the derived features of pale-colored flowers having an extended perianth tube and pale, reticulate corm tunics (Table 3). The chromosome number of *L. gracilis*,  $2n = 12$ , and bimodal karyotype (Goldblatt, 1990b) differ from that in *L. otaviensis* and *L. bainesii*, which have  $2n = 10$  or 6 and nonbimodal karyotypes.

**History.** Discovered in 1907 by the German geologist Paul Range near Doorns in southern Namibia, *Lapeirousia gracilis* was described in 1912 by Vaupel. It was for many years poorly known but botanical exploration in the 1960s and 1970s has revealed a coherent distribution pattern.

**Additional specimens examined.** NAMIBIA. KAOKOVELD: 19.12 (Hoanib Mouth) Hoanib River valley, ca. 20 km inland, rocky hills among boulders, 20 Apr. 1985 (BD), *Moss & Jacobsen K311* (PRE, WIND). OMARURU: 21.14 (Uis) Brandberg, 17 Oct. 1981 (AB), *Craven 1341* (WIND); Brandberg, Orabeswand, 2,000 m, 6 Apr. 1964, *Nordenstam 3666* (M, S). KARIBIB: 21.15 (Karibib) farm Klein Spitzkoppe, coarse granitic sand, W slopes and below the summit, 23 Feb. 1965 (CC), *Giess 8496* (B, K, M, MO, PRE, S, WAG, WIND); 22.15 (Trekopje) farm Tsabichab, cracks in marble rock around spring, 19 May 1973 (BA), *Giess 12744* (K, M, MO, S, WIND); 22.16 (Otjimbingwe) Namibrand, Karibib, Otjosandu, 1 Mar. 1963 (AA), *Seydel 3419* (B, C, G, GH, K, MO, S, SRGH, WAG, WIND). REHOBOTH: 23.16 (Nauchas) farm

Weisenfels, 11 Mar. 1953 (AD), *Walter & Walter 1675* (B, WIND); 23.17 (Rehoboth) Buellspport, flats, Mar. 1949 (?), *Strey 2700* (PRE). MALTAHOHE: 25.16 (Helmeringhausen) farm Chamchawib, 23 Jan. 1974 (DB), *Giess & Robinson 13255* (K, M, MO, PRE, WAG, WIND); farm Saraus, lower pass, in black limestone, 18 Feb. 1963, *Giess et al. 5229* (M, MO, PRE, WIND). MARIENTAL: 24.17 (Mariental) farm Haribes, dry sterile vlei, 1 Mar. 1963 (DA), *Giess et al. 5571* (M, PRE, WIND); 27 Apr. 1956, *Volk 12105* (M, WIND); 25.17 (Gibeon) Asab, hard clay along the railtracks, May 1913 (BD), *Dinter 3061* (SAM); 13 Mar. 1988, *Goldblatt & Manning 8770* (K, MO, NBG, PRE, S, WIND). KEETMANSHOOP: 26.18 (Keetmanshoop) Spitzkoppe, 7 Apr. 1984 (AD), *Craven 1666* (WIND). WARMBAD: 27.17 (Chamaites) Fish River Canyon, river camp, 30 Mar. 1953 (DA), *Walter & Walter 2263* (B, WIND); Fish River Canyon, middle plateau, 23 Feb. 1963, *Leipert 4221* (WIND); Fish River Canyon Reserve, edge of the canyon, 12 May 1965, *Meyer 4* (M, WIND); Seeheim, Apr. 1900, *Schafer 383* (B). WITHOUT PRECISE LOCALITY: NAMIBIA: Quartel/Rehoboth, 10 Apr. 1911 (fr), *Dinter 2152* (SAM).

**12. *Lapeirousia otaviensis*** R. Foster, Contr. Gray Herb. 127: 45–46. 1939. (*Lapeirousia bainesii* sensu Sölch, Prod. Fl. Südwestafrika 155: 8. 1969.) TYPE: Namibia: Auros farm near Otavi, 11 Feb. 1925, *Dinter 5577* (holotype, GH; isotypes, B, G, PRE, SAM, Z (3)). Figure 13.

Plants 30–55 cm high, repeatedly branched. *Corm* 2–2.5 cm diam., tunics light brown, coriaceous, becoming reticulate and coarsely fibrous with age, sometimes ultimately finely fibrous. *Cataphylls* 2, membranous, the inner reaching to shortly above the ground. *Leaves* 4–7, ± linear (to narrowly lanceolate), gray-green, only the midrib prominent, the lower 2–4 basal and longest, 5–9 mm wide, exceeding the inflorescence by 5–10 cm; upper leaves cauline and decreasing in size above, those subtending the branches becoming bractlike. *Stem* weakly compressed below, triangular in the middle part and rectangular above, the angles lightly winged, the main axis straight, branches diverging at 45–80°. *Inflorescence* a ± corymbose pseudopanicule, the main terminal branches with (1–)3–5 flowers in a short spike; *bracts* herbaceous, lanceolate and acute, often flushed red above, becoming dry apically, usually quite dry when the flowers have wilted, (7–)8–11 mm long, the inner often longer than the outer. *Flowers* zygomorphic, white to cream, sometimes flushed pale lilac, rarely purple, the lower 3 tepals each marked with violet streak in the midline and with darker double purple to red lines near the base, rarely the upper tepals with a pale purple median line, unscented and opening in mid morning; *perianth tube* 40–45 mm long, straight, very



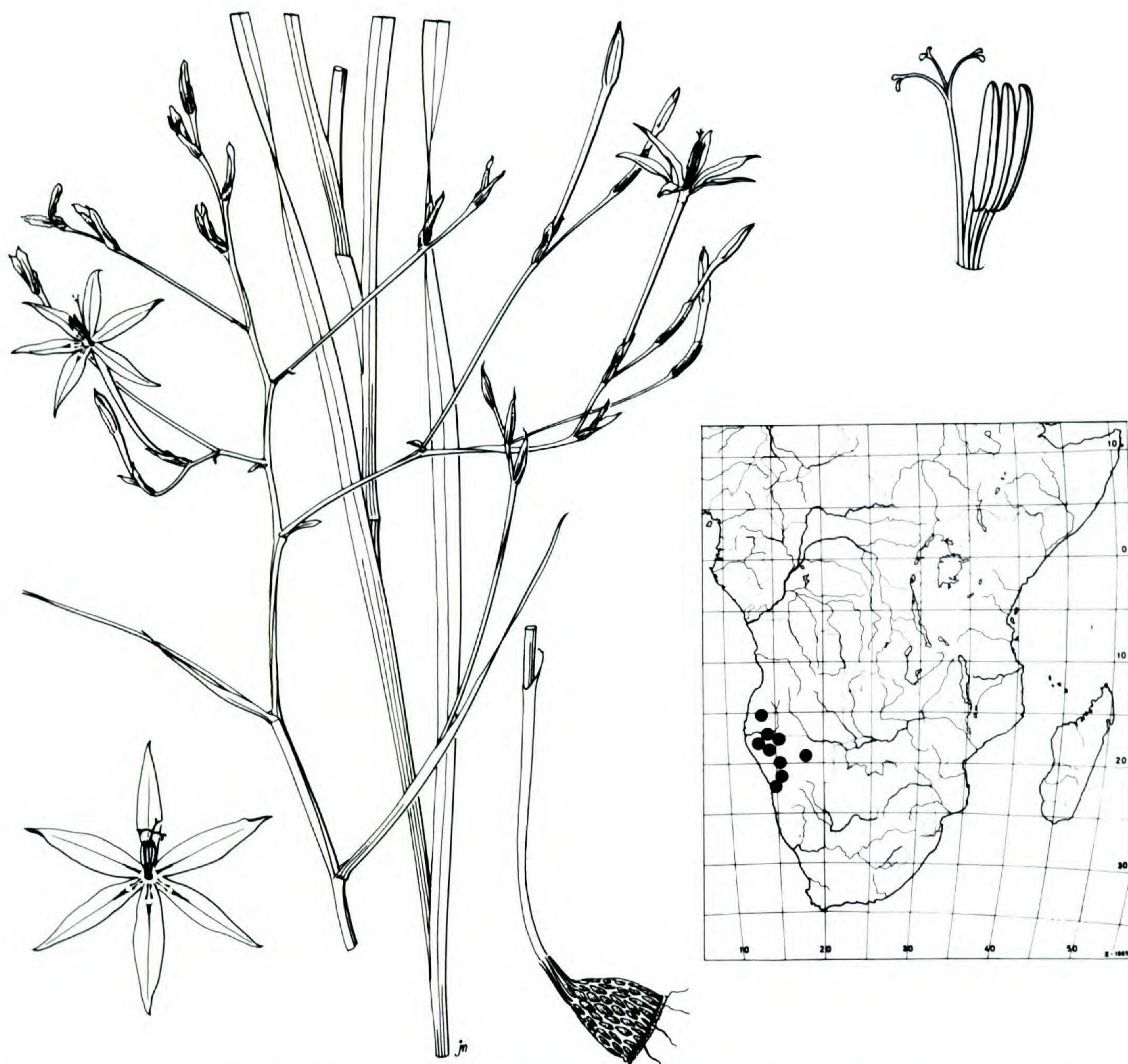


FIGURE 13. Morphology and distribution of *Lapeirousia otaviensis*. Habit  $\times 0.5$ ; single flower full size; details of stamens and style  $\times 2.5$ . (Drawn by J. C. Manning.)

gradually flared from the base, about 1.2 mm diam. below, 2.2 mm diam. at the mouth; *tepals* subequal, lanceolate, widest in the middle, the margins straight, 15–19 mm long, 4–5 mm wide, spreading almost at right angles to the tube, the uppermost slightly larger than the others, weakly to strongly acute. *Filaments* unilateral, exerted for 4–5 mm from the tube, white; *anthers* parallel and contiguous, 5–6 mm long, gray-purple; pollen white. *Ovary*  $\pm$  ovoid, ca. 2 mm long; *style* nearly straight, lying behind the filaments, the branches usually dividing at (or to 3 mm beyond) the anther apices, branches ca. 2 mm long, forked for  $\frac{1}{3}$ – $\frac{1}{2}$  their length, diverging but barely or not at all recurved. *Capsules* globose trigonous, ca. 7 mm long; *seeds* not known. *Chromosome number*  $2n = 10$ .

*Flowering time.* February to April.

*Distribution and habitat.* Of relatively restricted distribution, *Lapeirousia otaviensis* occurs in a wide arc from the Erongo Mountains in western Namibia through the hills south of Etosha Pan to the Otavi Hills in the northeast and locally also in southern Angola (Fig. 13). It is apparently confined to rocky outcrops, usually growing in granite, but in the Otavi Hills it occurs on local shale outcrops, not in the dolomite that predominates in this area.

*Diagnosis and relationships.* The large flower with a long perianth tube 4–5 cm long, white to lilac perianth with lanceolate tepals, and the ultimate branches of the inflorescence having up to five flowers (and rarely fewer than two) distinguish *Lapeirousia otaviensis*. It has often been confused in herbaria with the apparently related



*L. bainesii* and was even regarded as identical to this species by W. Marais (pers. comm.; Geerinck et al., 1972), under the name *L. erythrantha* var. *bainesii*. *Lapeirousia otaviensis* and *L. bainesii* both merit specific status. They can be separated by a series of characters, and they do not intergrade with each other or with any of the forms of *L. erythrantha* and its close allies. *Lapeirousia bainesii* has flowers with a slightly shorter perianth tube 30–40 mm long, this often purplish in color, and has more or less clawed, white tepals with undulate margins. The inflorescence of *L. bainesii* branches divaricately, and the ultimate branches have one or rarely two flowers. *Lapeirousia otaviensis* is restricted to rocky sites of granite or shale, whereas *L. bainesii* occurs in deep hard sand in level savanna or bushveld.

An interesting color variant of *Lapeirousia otaviensis* occurs on the plateau and higher parts of the Erongo Mountains (Craven & Craven 115; Lavranos 22693). This has purple flowers in contrast to the white or pale lilac elsewhere. Apart from the perianth color, there seem to be no significant differences between this and the more widespread color form.

A collection from southern Angola made in 1909, Pearson 2738, is assigned here, but the poorly preserved plants are either depauperate or possibly belong to the related *L. gracilis*. The perianth tube is 35–48 mm long, within the range of variation encountered in *L. otaviensis*. The brown-tipped bracts are 7–9 mm long, which corresponds with *L. otaviensis* but is also in the upper range for *L. gracilis*. The latter is centered in southern to west central Namibia, whereas *L. otaviensis* occurs across northern Namibia so that the latter determination is phytogeographically the more likely.

*History.* Although first collected in 1879 in “Damaraland” by Ture Een, an early botanical explorer in Namibia, *Lapeirousia otaviensis* was described in 1939 by the American R. C. Foster from a gathering made in 1925 by Dinter at Auros farm near Otavi. This was the first collection of *L. otaviensis* to be distributed widely to herbaria. It seems to have been recognized as a distinct species by accident, as Foster compared it to the very different, short-tubed *L. avasmontana* in the prologue. The reason for this is obscure and may have been because he had misidentified material of the latter. Apparently Foster was unaware at this time of the similarities that *L. otaviensis* shared with *L. bainesii*, and with which *L. otaviensis* became confused later. In the *Prodromus Flora Südwestafrika* (Sölch, 1969) *L. otaviensis* and *L.*

*bainesii* were treated as conspecific and distinguished in the key by having several-flowered ultimate inflorescence branches. Sölch reserved the name *L. vaupeliana* Dinter for what is here called *L. bainesii*. The type material of *L. vaupeliana* has all the characters of *L. bainesii*, including one-flowered ultimate inflorescence branches.

*Additional specimens examined.* ANGOLA. HUILA: damp sandy places near Monino, Humpata Pass, 3 Apr. 1909, Pearson 2738 (K). CUNENE: top of Ruacana Falls, N bank, crevices in moist springs, 30 Apr. 1967, Rycroft 2443 (NMG, WIND). NAMIBIA. KAOKOVELD: 17.12 (Posto Velho), granite slope at Ombepera, rock crevices, corms edible, 10 Apr. 1957 (BD), de Winter & Leistner 5481 (B, K, M, PRE, WIND); Orumana, stony flats below dolomite ridge, 20 Mar. 1974 (BD), Merxmüller & Giess 30407 (M, PRE, SRGH, WAG, WIND); Kunene River banks, Mar. 1925, Barnard 1381 (SAM). KARIBIB: 21.15 (Karibib), W edge of the Erongo Mountains above farm Ameib KAR 60, 27 Mar. 1976 (DC), Craven & Craven 115 (WIND); Erongo Plateau, among granite boulders, 1985, Lavranos 22693 (E, K, M, MO, P, S); 22.15 (Trekkoje) Okongava, granite slope on Kalkberg, 4 Feb. 1934 (BB), Dinter 6962 (B, BM, G, HBG, K, M, PRE, S, WIND, Z). OMARURU: 20.15 (Ohjhorongo) 90 km from Omaruru on the road to Fransfontein, Table Mountain, by Ozondati, 11 Apr. 1968, Wanntorp & Wanntorp 840 (K, S). OUTJO: 19.14 (Kamanjab) 8 km N of Kamanjab-Nord, granite domes, 18 Mar. 1974 (DB), Merxmüller & Giess 30392 (K, M, PRE, WAG, WIND); Kamanjab, dry granite hills in rock crevices, 2 Mar. 1957, de Winter & Leistner 5132 (B, K, M, PRE, WIND); Kamanyab, Mar. 1925, Thorne s.n. (SAM 31741); 20.16 (Otjiwarongo) Paresis Mts. (AD), Barnard 201 (SAM). GROOTFONTEIN: 19.17 (Tsumeb) farm Auros, slopes behind the farm house in grassy sites, 1,800 m, 10 Mar. 1974 (DA), Merxmüller & Giess 30186 (M, PRE, WAG, WIND); Auros Farm, shale hills near the farm house, 21 Mar. 1988, Goldblatt & Manning 8837 (E, K, M, MO, NMG, PRE, S, WAG, WIND). WITHOUT PRECISE LOCALITY: NAMIBIA: Damaraland, 1879, Een s.n. (BM); Kunene River banks, Mar. 1925, Barnard 1381 (SAM).

**13. *Lapeirousia bainesii* Baker, J. Bot. 14: 338. 1876; Handbk. Irideae 170. 1892; Fl. Trop. Africa 7: 352. 1898. Sölch, Prod. Fl. Südwestafrika 155: 8. 1969 (but applied to *L. otaviensis*). TYPE: Botswana: Kobe Pan (inter Koobie et N Shaw valley), Baines s.n. (lectotype, annotated as “TYPE” by N. E. Brown, and confirmed here as lectotypified, K); South Africa. Transvaal: Todd s.n. (syntype, K—as Todd 19). Figure 14.**

*Lapeirousia vaupeliana* Dinter, Feddes Rep. 18: 436. 1922. Sölch, Prod. Fl. Südwestafrika 155: 8. 1969. TYPE: Namibia: Gameros (cult. Okahandja), Dinter 3087 (lectotype, B, designated by Sölch in 1959); Gameros, Dinter 2787a (syntype, SAM); Okakeua u. Okanjatu, Dinter 3374 (syntype, SAM).

Plants 30–60 cm high, usually repeatedly branched. Corm 13–20 cm diam., tunics middle



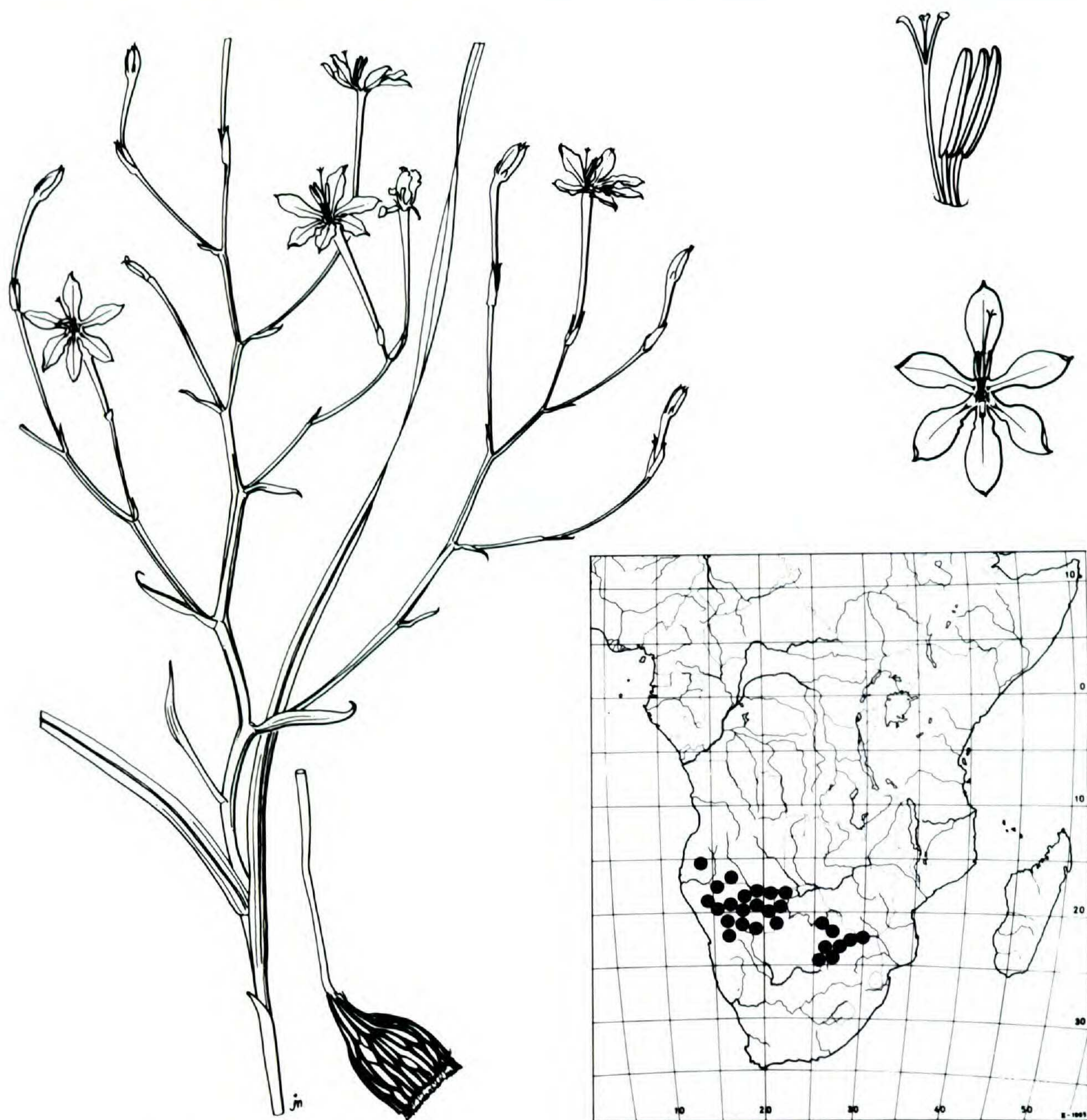


FIGURE 14. Morphology and distribution of *Lapeirousia bainesii*. Habit and corm  $\times 0.5$ ; single flower full size; details of stamens and style  $\times 2$ . (Drawn by J. C. Manning.)

to dark brown, coriaceous to cartilaginous internally with the veins sharply outlined, decaying to become  $\pm$  fibrous, the fibers wiry and coarse. *Cataphylls* 2, pale and membranous, the inner reaching 2–4 cm above the ground. *Leaves* narrowly lanceolate to linear, glaucous, 5–7 mm wide, usually slightly longer than the inflorescence, midrib prominent and a lateral vein on either side of the midvein evident. *Stem* compressed and 2-winged below, 3–4-angled and winged above, the wings sometimes slightly crisped to serrulate. *Inflorescence* a pseudopanicule, the branching divaricate, ultimate branches with 1(–2) flowers, the axes angularly trigonous; *bracts* 7–10(–12) mm long, herbaceous below, dry before anthesis, becoming membranous, dry and light brown especially above and the apices often darker brown, the inner slightly larger than the outer. *Flowers* zygomorphic, white to cream,

sometimes flushed pale pink, the tube pale purple, the lower 3 tepals each usually marked with a red to brown streak in the lower half and a dark mark at the base, the top of the throat red on the lower side, sweetly scented and opening in the mid to late afternoon; *perianth tube* cylindrical, slightly expanded in the upper 5 mm, 25–34(–40) mm long, usually inclined; *tepals* subspathulate, widest in the upper third,  $\pm$  clawed (rarely with a toothlike callus on each of the 3 lower tepals), the margins undulate, nearly equal in size or the uppermost often slightly larger, 9–12(–15) mm long, 3–4 mm wide, the lower 3 closer together, forming a lip, the uppermost often slightly larger than the others and held apart,  $\pm$  upright to reflexed at right angles to the tube. *Filaments* unilateral, exerted for 3.5–5 mm, white; *anthers* parallel and contiguous, 4.5–6 mm long, light purple; pollen cream. *Ovary* ca.



2 mm long, ovoid; *style* arching over the stamens, dividing between the middle and apex of the anthers or sometimes exceeding them, branches spreading, virtually undivided or notched apically, ca. 2 mm long. *Capsules* obovoid to globose, 5–6 mm long; *seeds* globose, ca. 2 mm diam. *Chromosome number*  $2n = 10, 6$ .

*Flowering time.* January to April, rarely late November or December.

*Distribution and habitat.* A relatively common species of the dry interior plains of southern Africa, *Lapeirousia bainesii* extends from near Windhoek in central Namibia to the Cunene River in the north, into southern Angola, and across the Kalahari to eastern Botswana and the northwestern Transvaal (Fig. 14). It favors hard flat sandy ground where the corms may be lodged up to 30 cm below the surface. I have never seen it in rocky terrain, where it apparently is replaced by the related and morphologically similar *L. otaviensis*. The flowers open in the late afternoon and last through the night and into the following day, then they wilt rapidly in the dry, hot daylight conditions. The freshly opened flowers have a strong sweet and pleasant fragrance and produce abundant nectar. *Lapeirousia bainesii* is probably pollinated by hawkmoths. Like several other species of *Lapeirousia* in Namibia (see Ethnobotany), the corms of *L. bainesii* are reportedly eaten raw or roasted by the native population (Rodin, 1985).

*Diagnosis and relationships.* A long perianth tube, whitish perianth with pink to red markings near the base of the lower tepals, and a divaricately branched inflorescence with the branches bearing one or rarely two flowers immediately distinguish *Lapeirousia bainesii*. The perianth tube is usually (< 20)25–35(–40) mm long. The corm tunics are composed of light brown, densely compacted fibers, the outer layers of which become increasingly reticulate with age. These corm tunics, combined with the pale, long-tubed flower and a basic chromosome number of  $x = 5$ , suggest a close relationship with *L. otaviensis* and *L. schimperi*, and to a lesser extent with *L. gracilis*, which has a different karyotype (Goldblatt, 1990b) but also  $n = 5$ . The similarity in the size and general shape of the flowers of *L. otaviensis*, *L. gracilis*, and *L. bainesii* has led to much confusion in the past, but field studies in Namibia have indicated convincingly that these are three separate species with different ranges and habitat preferences as well as slightly different flowers and inflorescence structures (Figs. 12–14).

Specimens from central Botswana near Ma-cheng, *Hansen 3357*, appear to represent a very odd form of *L. bainesii*. The flowers have a short tube 14–20 mm long (vs. 25–35 mm long in most other collections of the species). In other respects the plants accord with *L. bainesii*, including the fairly distinctive perianth coloring. The collection may represent a hybrid population, then most likely with *L. sandersonii*, the only other species of *Lapeirousia* recorded from this part of Botswana.

One of the few collections that I have seen from Angola, *Barbosa & Moreno 10181* from Chibia, is unusual in having a wine red perianth tube. The reverse of the outer tepals is a similar dark color, although the condition in the living plants may have been somewhat different. The significance of this variation cannot be properly assessed until more material from Angola can be examined.

*History.* Apparently first collected in 1863 by the nineteenth-century English landscape artist Thomas Baines and named in his honor, *Lapeirousia bainesii* was described by J. G. Baker in 1876. The species was based largely on Baines's collection but also on a second gathering from the Transvaal made by a certain Mr. Todd, about whom I have not been able to obtain information. Baines's plants were collected in western Botswana near Kobe Pan, an area still poorly known botanically.

Plants from west central Namibia were described in 1922 as the separate *Lapeirousia vaupeliana* by Dinter, based on three of his own collections. The distinction that Dinter made between this and the avowedly related *L. bainesii* was the red-violet flower with darker veins in his species compared with the white flowers of *L. bainesii* with dark brown markings. These differences do not seem significant and certainly do not merit recognition of *L. vaupeliana* as a separate species.

*Lapeirousia otaviensis* was regarded as a synonym of *L. bainesii* by Sölch (1969) in his treatment for the *Prodromus Flora von Südwestafrika*. However, he upheld *L. vaupeliana*, distinguishing it in the diagnostic key by the ultimate branches of the inflorescences each bearing a single flower in contrast to *L. bainesii*, in which the ultimate branches are spikes (i.e., with two or more sessile flowers). In fact the type specimen of *L. bainesii* has single flowers on the ultimate inflorescence branches and is conspecific with the later *L. vaupeliana*, whereas *L. otaviensis*, with its 3–5-flowered inflorescence branches and different flowers, is distinct from *L. bainesii*.

*Additional specimens examined.* ANGOLA. HUILA: 16



km from Quihita to Vila de João de Almeida (Chibia), black soil under *Acacia*, *Barbosa & Moreno 10181* (COI, LISC). CUNENE: Namakunde, *Barnard 139* (SAM); *Rautanen 702* (Z). BOTSWANA. NGAMILAND: 19.21 (Aha Hills) Aha Hills, 110 km W of Nokaneng (CB), *Wild & Drummond 6919* (BM); Dobe, 26 km N of Aha Hills, SWA border (CA), *Wild & Drummond 7202* (K, PRE); 20.21 (Koanaka Hills) near SWA border fence, sandy grassland, (?), *Smith 3330* (MO); 20.23 (Kwebe Hills) Ngamiland, Kwebe, *Lugard 179* (GRA, K). CENTRAL: 20.25 (Mompse) Odiakwe, savanna, W of Francistown just N of Mkarikari Pan (AB), *Wild & Drummond 6826* (K); 21.25 (Lothlekane) Ngamiland, near Bachakuru, white and chocolate (DD), *Lugard 242* (K); 23.26 (Mahalapye) Mahalapye Exp. Morale, shallow gritty sandy loam (BB), *Yalala 356* (K, LISC, PRE); Mahalapye, *Camerik 215* (PRE); 23.27 (Ellisras) 10 mi. W of Macheng towards Mahalapye, woodland, 23°10' 27°20' (AB), *Hansen 3357* (C, K, PRE, WAG). KGATLENG: 24.26 (Mochudi) Mochudi (AC), *Harbor sub Rogers 6569* (G, K, PRE); *Harbor s.n.* (PRE 14060). NAMIBIA. ETOSHA: 18.14 (Otjitundua) Etosha National Park, S of Okawao, red chalky sand (DD), *Giess & Loutit 14195* (WIND); 19.14 (Kamanjab) Etosha National Park, Kaross (B), *Volk & Le Roux 808* (PRE, WIND). OKAVANGO: 17.19 (Rundu), 14.6 mi. E of Runtu on Sambiu road (DD), *de Winter & Marais 4558* (K, M, WIND); 17.20 (Sambio) Masari, Kavango (CC), *Vorster 2788* (PRE); 18.19 (Karkuwise) Cigarette, NE of Karkuwise (DC), *Maguire 2217* (NBG), *2381* (NBG, PRE); 19.20 (Tsumkwe) 300 m S of main Tsumkwe-Grootfontein road, border of Agriculture Dept. farm (CB), *Hines 363* (WIND); 6 km E of Tsumkwe on the road to Botswana, white sand (DA), *Giess et al. 11033A* (WIND). OVAMBOLAND: 17.15 (Ondangua) Odanga, no date (DD), *Barnard 195* (SAM), *199* (SAM); 100 km E Oshikango, corm eaten raw or roasted (BD), *Rodin 9295* (K, M, MO, PRE, WIND). KAPRIVI: 18.21 (Andara) Bagani Camp, Kaprivi side of river (BA), *de Winter & Wiss* (PRE). GROOTFONTEIN: 19.16 (Gobaub) farm Norabis 387, W of Otavi, thornveld on red sandy loam (DD), *Goldblatt & Manning 8826* (MO, PRE, WIND); 19.17 (Tsumeb) Otavi (CB), *Dinter 5755* (B, G, PRE, Z); Grootfontein, Otjirukaku (DB), *Seydel 2068* (B, BR, C, GH, K, M, MO, S, WAG, WIND); 19.18 (Grootfontein) farm Oliewenhof, sehr häufig auf der Palmfläche (CB), *Merxmüller & Giess 30153* (K, M, WIND, PRE, S, SRGH, WAG); 20.16 (Otjiwarongo) farm Wittenberg 90, red sand, *Goldblatt & Manning 8832* (MO). OKAHANDJA: 21.16 (Okahandja) Omatako View (BA), *Woortman 152* (M, WIND); 20.17 (Waterberg) Quickborn, sand (AA), *Bradfield 196* (K, PRE). OUTJO: 20.16 (Otjiwarongo) Outjo (AA), *Rautanen 389* (Z). WINDHOEK: 21.17 (Otjosondou) 48 km along Kapps Farm road from Steinhausen, compact sand (DC), *Goldblatt & Manning 8808* (E, K, M, MO, NBG, PRE, S, WAG, WIND). COBABIS: 21.18 (Steinhausen) deep red sand, farm Mex, pink to white, (AB), *Immelman 526* (K, PRE); farm Mex, 45 km N of Witvlei, red sand, *Germishuizen 2662* (PRE, WIND); 21.19 (Epikuro) Epikuro Reserve 30 mi. NE of Epata, Eiseb Omuramba (AA), *Giess 9746* (WIND); 23.18 (Leonardville) sandfeld, Gamoros (cult.) (AB), *Dinter 2788a* (SAM). KEETMANSHOOP: 25.18 (Tses) Kalaharirand, Tutara, farm Okamatangara (DB), *Seydel 2549* (BR, K, M, MO, SRGH, WAG). SOUTH AFRICA. TRANSVAAL: 22.29 (Waterpoort) Dongola Reserve, 10 mi. SE Reserve, farm Coila (AD), *Codd & Dyer 3780* (E, K, PRE); Dongola, Zoutpansberg (BC), *Pole Evans 4305* (K, MO, PRE, SRGH); Soutpansberg, 1.5

mi. NW of Wyliespoort, 2,800 ft., *Codd 8367* (PRE); 23.27 (Ellisras) Potgietersrust District, 2 m NE Tomburke, red gritty flats (BB), *Codd 6614* (K, PRE, SRGH); 19 mi. E of Ellisras, cultivated land (DB), *Louw 3506* (AAU). WITHOUT PRECISE LOCALITY: BOTSWANA: Bakwena Territory, Sirorume River S of Tropic of Capricorn, *Holub s.n.* (K).

**14. *Lapeirousia schimperi*** (Aschers. & Klatt) Milne-Redhead, *Kew Bull.* 307. 1934. Quezel, *Fl. Veg. Pl. Darfur & Jeb Gurgeil* (Dossiers Rech. Coop. Prog. 45: 134. 1969. Cufodontis, *Enum. Pl. Ethiopiae Sperm.* 2: 1592. 1972. Wickens, *For. Bull. new ser.* 14: 39. 1969; *Fl. Jebel Marra* 158. 1976. *Tritonia schimperi* Aschers. & Klatt, *Linnaea* 34: 697. 1866. Schweinfurth, *Beitrag Fl. Aeth.* 1867. [*Acidanthera unicolor* Hochst. ex Baker, *J. Linn. Soc. Bot.* 16: 160. 1878; *Handbk. Iridaeae* 188–189. 1892; *Fl. Trop. Africa* 7: 359. 1898, nom. superfl. pro *Tritonia schimperi* Aschers. & Klatt (1866) (Schimper, *Plantae Abyssinicae* 2304).] TYPE: Ethiopia. Tigray: woods and thickets near Goelleb on the river Tacazze, 4,000 ft., *Schimper 2304* (lectotype, B, here designated; isolectotypes, K, P); Yemen: *Schimper s.n.* (syntype, B?, not seen and perhaps lost). Figure 15.

*Lapeirousia angolensis* (Baker) R. Foster, *Contr. Gray Herb.* 114: 48. 1936. *Anomatheca angolensis* Baker, *J. Bot.* 14: 337. 1876. [*Lapeirousia monteiroi* Baker, *Fl. Trop. Africa* 7: 355. 1898, nom. illeg. superfl. pro *A. angolensis* Baker.] TYPE: Angola. Without precise locality, cult. Kew, *Monteiro s.n.* (holotype, K).

*Lapeirousia fragrans* Welw. ex Baker, *Trans. Linn. Soc. London (Bot.) ser. 2, 1: 272–273.* 1878. TYPE: Angola. Huila: ad Morro de Lopollo, 5,200 ft., stony and rocky places, Dec. 1859, *Welwitsch 1552* (holotype, K; isotypes, BM, C, COI, G, P).

*Lapeirousia cyanescens* Welw. ex Baker, *Trans. Linn. Soc. London (Bot.) ser. 2, 1: 272.* 1878. Sölch, *Prod. Fl. Südwestafrika* 155: 9. 1969. Cufodontis, *Enum. Pl. Ethiopiae Sperm.* 2: 1592. 1972. TYPE: Angola. Huila: hills near Humpata, Apr. 1860, *Welwitsch 1553* (lectotype, K, here designated; isolectotypes, B, BM, COI, G).

*Lapeirousia edulis* Schinz, *Bull. Herb. Boissier* 4 (Appendix 3): 49. 1896. TYPE: Namibia: Amboland, W of Olukonda, 5 Apr. 1893, *Rautanen 106* (lectotype, Z, here designated; isolectotypes, K, P (2), Z (3)).

*Lapeirousia porphyrosiphon* Baker, *Fl. Trop. Africa* 7: 353. 1898. TYPE: Botswana. Ngamiland: Kalahari Desert near Mamunwe, 26 Feb. 1897, *Lugard 338* (holotype, K).

*Lapeirousia erythrae* Chiovenda, *Ann. Bot. Roma* 9: 139. 1911. TYPE: Ethiopia. Eritrea: Acchelé Guzai (Ocule Cusai) near Loggo Sarda, Deggahen, 2,600 m, 15 Sep. 1902, *Pappi 1414* (lectotype, G, here designated; isolectotypes, GH, MO); Bogos near



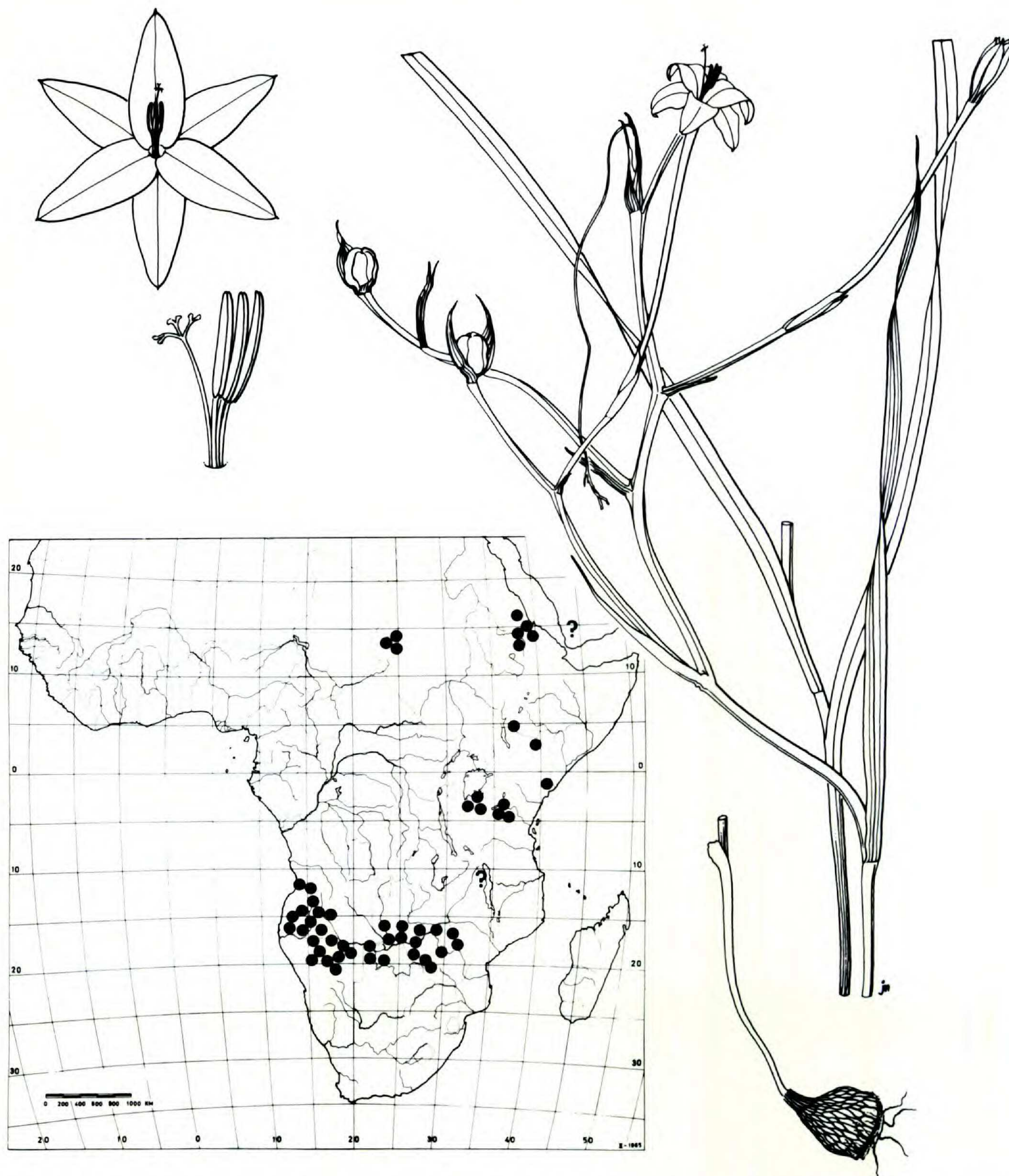


FIGURE 15. Morphology and distribution of *Lapeirousia schimperi*. Stations in Malawi and Yemen indicated with a ? require verification and remain doubtful. Habit and corm  $\times 0.5$ ; single flower full size; details of stamens and style  $\times 2.5$ . (Drawn by J. C. Manning.)

Cheren, 24 Aug. 1903, *Pappi* 7088 (? FI, not seen); Dembelas towards the Mai Albo, 25 Sep. 1903, *Pappi* 6072 (? FI, not seen).

*Lapeirousia montaboniana* Chiovenda, Ann. Bot. Roma 9: 140. 1911. TYPE: Ethiopia. Eritrea: Bogos near Cheren, 24 Aug. 1906, *Pappi* 7087 (? FI, not seen).

*Lapeirousia uliginosa* Dinter, Die vegetabilische Veldkost Deutsch-Südwest-Afrikas 13-14. 1912. TYPE: none cited.

*Lapeirousia dinteri* Vaupel, Bot. Jahrb. Syst. 48: 544-545. 1912. TYPE: Namibia: Damaraland, Aukos-

Kreyfontein, 28 Dec. 1908, *Dinter* 810 (holotype, B; isotypes, B, SAM (2)).

Plants (20-)30-80 cm high, usually several-branched. *Corm* 18-22 mm diam. at the base, tunics composed of compacted fibers, light to dark brown, the outer layers becoming loosely fibrous and reticulate. *Leaves* linear, 3 or more, the lower 2 largest and usually slightly longer than the inflorescence, decreasing in size above and becoming bractlike, narrowly lanceolate, 5-10(-15) mm wide,



the midrib lightly raised. *Stem* rounded below, to nearly square and 4-angled to 4-winged above. *Inflorescence* a lax pseudopanicule, the ultimate branches with 1–3 sessile flowers; *bracts*  $\pm$  equal, (10–)20–35(–45) mm long, herbaceous becoming membranous above to almost completely dry and papery, then light to dark brown, apices dark brown. *Flowers* zygomorphic, white to cream, rarely pale violet, when whitish sometimes fading or drying lilac especially on the tube, opening in the evening and then sometimes scented; *perianth tube* cylindrical, slender, 10–14(–15) cm long; *tepals* lanceolate, extended  $\pm$  at right angles to the tube, 18–22 mm long, 6–7 mm at the widest. *Filaments* unilateral, erect, exerted 5–7 mm from the tube; *anthers* parallel and usually contiguous, 6–7 mm long, cream; pollen cream. *Ovary* ca. 4 mm long, rapidly elongating after fertilization; *style* filiform, arching behind the filaments, dividing at or up to 3 mm beyond the anther apices, branches ca. 2 mm long, forked for ca.  $\frac{1}{3}$  their length. *Capsules* obovoid-oblong, 8–12 mm long, partly enclosed in the bracts; *seeds* globose to slightly angular, sometimes tapering to a persistent funicle, 2–2.5 mm diam. *Chromosome number*  $2n = 10$ .

*Flowering time.* Mid to late summer, December to March, in central and south tropical Africa; north of the equator mostly in September and October, in Kenya and Ethiopia also April to June.

*Distribution and habitat.* *Lapeirousia schimperi* has a remarkably wide distribution across Africa (Fig. 15). It extends from southwestern Angola, north-central Namibia, and northern Botswana through southern Zambia to Zimbabwe in an almost continuous belt. Further north its distribution is scattered, and it occurs in northern Tanzania, eastern Kenya, southern Ethiopia, disjunctly in northern Ethiopia, and the Jebel Marra and Jebel Gurgeil highlands of northwest Sudan. It is almost certainly absent from Zaire, Uganda, central and western Kenya, and southern Tanzania, but the species probably occurs in western Somalia (although I have seen no records from there). A plant from Yemen is cited in the protologue, but I have seen no collections from this country. I have also had seeds of plants said to have been collected on the Nyika Plateau in Malawi. The Malawi and Yemen records require confirmation. Despite the questions about the distribution of *L. schimperi*, there is no doubt that it is absent from large parts of tropical Africa, and its unusual discontinuous range is noteworthy.

*Lapeirousia schimperi* grows in moist situations in otherwise largely arid country. It typically occurs

in washes, the so-called omurambas of Namibia, dambo margins, stream sides, seasonal marshes, and in damp grassland. The flowers open in late afternoon and last through the night, but gradually wilt the next day. Some collections note a sweet fragrance when the flowers are open, but live plants from Namibia that I have examined were scentless, suggesting variation in this character. The edible corms are eaten either raw or roasted by the Ovambo of northern Namibia (Rodin, 1985) and the Kung Bushmen (Marshall, 1976).

*Diagnosis and relationships.* The large white flower with a perianth tube 10–15 cm long and the laxly branched inflorescence distinguish *Lapeirousia schimperi* readily from most other species in the genus. The paniculate inflorescence, plane leaves with a well-defined midrib, and corm tunics of compacted fibers place it in sect. *Paniculata*. It has no obviously close relatives in this alliance, composed largely of plants with small flowers and typically multibranched pseudopanicles with crowded flowers. Its basic chromosome number,  $n = 5$ , and karyotype (Goldblatt, 1990b) and usually light brown, fairly fibrous corm tunics are shared with *L. otaviensis* and *L. bainesii*, suggesting that they may be the closest allies of *L. schimperi*. Those two species, centered in northern Namibia and adjacent Botswana, also have pale flowers with relatively long perianth tubes, but their inflorescences are more compact, and they are not likely to be confused with *L. schimperi*.

Unusually long-tubed white flowers characterize two other tropical African species of *Lapeirousia*, *L. odoratissima* and *L. schinzii*, both of which have corrugate leaves and woody corm tunics, which place them in sect. *Lapeirousia*; the floral similarity must be due to convergence. Presumably all are pollinated by hawk moths.

*Lapeirousia schimperi* exhibits relatively little variation for a species with such a wide distribution. Some specimens from Angola and Namibia in the southwest of its range have unusually short bracts in the 15–20 mm range (e.g., Giess & Loutit 14123), but at least some plants from Namibia have bracts up to 35 mm long, thus comparable to those in plants from tropical and northeastern Africa in which the bracts range from 35 to 45 mm.

Some collections from Ethiopia and Sudan (e.g., Schimper 2304, 431) also have pale or fairly dark brown, particularly short bracts 10–15 mm long. Their flowers have a perianth tube 7–8 cm long. Such plants may be depauperate owing to a particularly dry growing season, or they may represent



an ecotype or race that constantly has these features.

*History.* Although a well-defined species, *Lapeirousia schimperi* has a long and confused history. This is largely due to its wide distribution rather than to any conviction that its synonyms were species distinct from those from distant parts of its range. The type locality is in northern Ethiopia, where collections were made in the 1840s by Quartin Dillon and Petit and later by Schimper in 1852–1864. The species was named in Schimper's honor by Ascherson & Klatt (1866), who referred it to the otherwise southern African genus *Tritonia*. Three separate collections from southwestern Angola made at this period by Joachim Monteiro and Friedrich Welwitsch were described by J. G. Baker as *Anomatheca angolensis* (1876), *L. cyanescens* (1878), and *L. fragrans* (1878), respectively, without reference to the Ethiopian species. Later collections from Namibia were named independently by Hans Schinz as *L. edulis* in 1896 and Friedrich Vaupel as *L. dinteri* in 1912. Plants from Botswana, collected by E. J. Lugard, were assigned to *L. porphyrosiphon* (Baker, 1898), while in 1911 A. Chiovenda described *L. erythrae* and *L. montanoboniana* based on contemporary collections from Eritrea. Only in 1934 was *Tritonia schimperi* transferred to *Lapeirousia*, but for many years the name *L. porphyrosiphon* was used for the species in south tropical Africa.

*Additional specimens examined.* ANGOLA. CUANZO SUL: road from Nova Redondo to Lobito, 60 m, 17 Apr. 1969, *Teixeira et al.* 11412 (LISC). CUNENE: Rocades, centro do Estudos do Cunene, *da Silva* 2991 (BR, K, PRE); Humbe, bords du Cunene, Tyipelongo-Mucopé-Donguena, s.d., *Bonnefoux & Villain* 58 (P). HUAMBO: Cuima, Eleude Mission, Dec. 1940, *Faulkner* A390 (K, PRE); road from Nova Lisboa to Luanda, Serra do Cusava, 26 Dec. 1970, *Moreno* 311 (LISC, M); vicinity of Nova Lisboa near Cruzeiro, banks of Cuando River, 26 Mar. 1971, *da Silva* 3522 (LISC, PRE); Chianga, ca. 1,700 m, 5 Mar. 1962, *Teixeira & Andrade* 6542 (COI, LISC). HUILA: hills near Humpata, Feb. 1899, *Antunes* 724 (P), Mar. 1902, *DeKindt* 3213 (449) (LISC, P); Tundavala, 14°50' 13°22', 2,230 m, 7 Mar. 1973, *Bamps et al.* 4057 (BR, K, LISC); Quilengues-Chingoroi, 5 Dec. 1962, *de Menezes* 384 (K, LISC, PRE, SRGH); Chitanda munding, 1,100 m, 28 May 1905, *Baum* 949 (BM, COI, E, G, K, M, S, Z); Caconda, Mar. 1880, *Anchieta* 15 (LISU); Mar. 1882, *Anchieta* 34 (LISU); Dec. 1882, *Anchieta* 131 (LISU); Ganguelas, Vila Artur de Paiva-Cutato, *Mendes* 3329 (LISC); Vila Artur de Paiva (Vila de Ponte), granja da administração, 1,470 m, 1 Jan. 1960, *Mendes* 1919 (LISC); near Huila, *Mendes* 1512 (LISC); Sá da Bandeira, *Torre* 8629 (LISC). NAMIBE: hills on road between Namibe (Mossamedes) and St. Nicolau, *Kers* 3646 (PRE). BOTSWANA. NGAMILAND: 17.25 (Livingstone) S side of Chobe River, above Kasane, May 1972, *Sheppe* 167 (SRGH); 18.21 (Andara) SW end of

Tsodilo Hills, open savanna, 11 Mar. 1985 (DD), *Long* 12330 (E); 19.23 (Maun) Khwai/Maxwe road, Moremi Wildlife Reserve, 16 Mar. 1977 (BC), *Smith* 1936 (BR, K, SRGH). ETHIOPIA. SIDAMO: near the Sagan River, ca. 500 m, 37°45' 4°47', *Acacia* woodland in grass, 27 May 1974, *Sandford* sub *Ash* 2498 (K). TIGRAY: near Goelleb on River Tacazze, 4,000 ft., 28 Aug. 1854, '*A. unicolor*' *Schimper* 2304 (BM, K, P). GONDER: Simen, Dsha Dsha, 22 Aug. 1853, *Schimper* 431 (P). KENYA: Somali border, open grassland, 23 Aug. 1961, *Gillespie* 250 (BR, K, P); Kiunga, 55 mi. NE of Lamu, 9 Aug. 1961, *Gillespie* 176 (BR, K); Kaiunga, 5 Apr. 1910, *Battiscombe* 231 (K); Dandu, eroded gravels at foot of mountain, 4 June 1952, *Gillett* 13426 (K). NAMIBIA. OVAMBOLAND: 17.15 (Ondangua) 100 km E of Oshikango, 19 Apr. 1973 (BD), *Rodin* 9295A (M, MO, PRE, WIND). OKAVANGO: 17.18 (Kuring Kuru) Katui-Tui, maize land in sandy loam, 15 May 1965 (fr) (AD), *Barnard* 191 (WIND); Kuring-Kuru, Okavango riverbank in forest, 28 Mar. 1966 (DA), *Soni s.n.* (WIND 3938); 17.19 (Runtu) swampy marshes below Runtu, 31 Jan. 1956 (AD), *de Winter & Marais* 4469 (K, M, PRE, WIND, Z); 18.19 (Karkuwisa) grass flats, Karkuwisa, 4 Mar. 1958 (DC), *Merxmüller & Giess* 1795 (BM, K, M, PRE, WIND); 18.21 (Andara) Kaprivi side of the river at Andara Mission, crevices on rocky outcrops, 23 Feb. 1956 (AB), *de Winter & Marais* 4820 (K, PRE, WIND); Okavango River, 19 km N of Shakawe on the Botswana border, 16 Mar. 1965 (BA), *Wild & Drummond* 7093 (K, LISC, M, PRE, SRGH). KAPRIVI: 17.24 (Katima Mulilo) Katima Mulilo, vlei, 30 Jan. 1975 (AD), *Vahrmeijer & du Preez* 2496 (MO, PRE). ETOSHA: 18.16 (Namutoni) Etosha National Park, Bigales Huh, 15 Feb. 1974 (C), *Le Roux* 644 (PRE, WIND); 19.15 (Okakuejo) Etosha Pan, black peat soil on the road to Ombika, 4 Apr. 1980 (BB), *Giess* 15472 (M, MO, PRE, WIND); Etosha National Park, 2.5 km E of Okakuejo-Ombika road, 5 Mar. 1976 (BD), *Giess & Loutit* 14123 (K, M, MO, PRE, WIND); gray-black peat flats N of Ombika, *Le Roux* 321 (PRE, WIND); 19.16 (Gobaub) Etosha Game Park, near Homob water hole, 11 Feb. 1966 (AA), *Tinley* 1285 (M, PRE, WIND). GROOTFONTEIN: 19.16 (Gobaub) farm Neidau North 78, heavy black clay with limestone, seasonally waterlogged, 19 Mar. 1988 (DC), *Goldblatt & Manning* 8831 (MO, WIND); 19.17 (Tsumeb) farm Malta, 5 Feb. 1971 (AB), *Giess* 11226 (M, PRE, WIND); farm Kumkauas, large colonies among tough grasses, 30 Jan. 1971 (CA), *Giess* 11212 (M, WAG, WIND); 9 Mar. 1974, *Merxmüller & Giess* 30175 (K, M, PRE, S, SRGH, WAG, WIND). SUDAN. DARFUR: Jebel Marra, E of Zalinjea, 3,500 ft., poorly drained, 13 Aug. 1964, *Wickens* 2101 (K); Suni-Tuora Tanje, 7,800 ft., moist soils, 21 Sep. 1964, *Wickens* 2695 (K); Nyertete, 3,700 ft., *Wickens* 2126 (K); Gur Lambang, lava soils, 6,300 ft., 17 Sep., *Wickens* 2589 (K); 1 hour on path from Taurotonga to Kilokitting, 2,000 m, basalt, 15 Sep., *Jackson* 4073 (K). TANZANIA. ARUSHA: Magugu/Sangaiwe Hills, 70 mi. WSW of Arusha, 3,500 ft., Mar. 1967, *Beesley* 265 (BR, K); Mbulu District, Tarangire National Park, 1,066 m, 14 Feb. 1970, *Richards* 25422 (K). DODOMA: Great North Road, Kalo, 15 mi. N of Kondoa, 5,050 ft., black clay in vlei, 11 Jan. 1962, *Polhill & Paulo* 1132 (BR, K, LISC, P, PRE). MWANZA: Mwanza, s.d., *Davis* 180 (K). SHINYANGA: near Shinyanga, Jan. 1933, *Bax* 399 (BR, K); Huru-huru-Mantini road, Shinyanga, 3,800 ft., 16 Jan. 1932, *Burt* 3511 (BM, BR, K); Nindo, Jan. 1972, *Stefanescu* 125 (K). ZAMBIA. SOUTHERN: Livingstone, 20 Jan. 1929,



*Grant 4507* (MO, PRE); Victoria Falls road, Livingstone, 20 Jan. 1919, *Young 17315* (BM); Kafue basin, Monze near Lochinvar Ranch, mixed *Acacia* woodland, 31 Jan. 1964, *van Rensburg KBS2708* (K, SRGH). WESTERN: Machili, dambo margin, *Fanshawe 6243* (NDO, SRGH); Machili basin, *Martin 725* (BM, NDO); Masese, pan margins, 9 Jan. 1961, *Fanshawe 6098* (BR, K, NDO, SRGH). ZIMBABWE. MASHONALAND CENTRAL: N of Sipolilo, 30 Jan. 1948, *Whellan 313* (K, LISC). MASHONALAND EAST: near Salisbury, *Young sub Moss 17315* (K). MASHONALAND WEST: Urungwe District, Mense Pan, 11 mi. ESE of Chirundu bridge, *Drummond 5346* (BM, BR, K, LISC, PRE, SRGH). MATABELELAND NORTH: Bulawayo, Feb. 1923, *Borle 361* (K, M, PRE); 7 Jan. 1898, *Rand 232* (BM); Victoria Falls, Jan. 1905, *Allen 146* (K, SRGH); Jan. 1906, *256* (K, SRGH); Jan. 1910, *Rogers 5415* (K, SRGH, WAG, Z); Wankie National Park, Sinamatella Dam ca. 1 mi. from the camp, 24 Feb. 1967, *Rushworth 174* (MO, SRGH); Wankie, Shapi Camp, Kalahari sand, 27 Feb. 1967, *Rushworth 269* (BR, K, LISC, PRE, SRGH); Wankie, Shapi road, in vlei, 15 Feb. 1956, *Wild 4747* (K, PRE, SRGH); Insiza District, Shangani, farm Bon Accord, cracks in granite whalebacks and in black vlei soil, 26 Jan. 1976, *Glasse s.n.* (C, MO, SRGH); Nyamandhlovu, Pasture Station, black vlei soil, *Plowes 1661* (K, LISC). MATABELELAND SOUTH: Matobo District, 3 Feb. 1948, *West 2678* (MO, SRGH); 7.2 km S of Bulawayo Post Office, S side of Johannesburg road, *Acacia* woodland, 22 Jan. 1976, *Cross 340* (K, MO, PRE, SRGH). MIDLANDS: Que Que to Gwelo, main road, *Davey 1* (K, PRE, SRGH). WITHOUT PRECISE LOCALITY: ?ANGOLA: 1878, *Capello 20* (LISU); *Welwitsch 4108* (P). BOTSWANA: Ngamiland, Jan. 1931, *Curson 75* (PRE). ETHIOPIA: Tigre & Begemdir, 21 Aug. 1862, *Schimper 909* (BM); Habab, 5,000 ft., Sep. 1872, *Hildebrandt 374* (BM); Abba Heruke, 6 Aug. 1852, *Schimper s.n.* or *431* (P); Masser, 4 Sep. 1853 (fr), *Schimper s.n.* or *431* (P). NAMIBIA: Kapichu, Mar. 1923, *Barnard 137* (SAM).

SUBGENUS *LAPEIROUSIA* SECTION *SOPHRONIA*  
(LICHT. EX ROEMER & SCHULTES)  
GOLDBL. & MANNING

**15. *Lapeirousia littoralis*** Baker, Trans. Linn. Soc. London, Bot. ser. 2, 1: 273. 1878. TYPE: Angola. Namibe: sandy coastal hills ad Praia da Amelia prope Villa de Mossamedes, July 1859, *Welwitsch 1546* (holotype, BM—see discussion of the type specimen).

Synonyms are listed under the two subspecies.

Plants (5–)10–35 cm high, simple or often with 1–few(or many) branches, these either long or clustered near the base. *Corm* campanulate, 10–14 mm wide at the base, tunics woody, brown, the outer layers breaking irregularly, rarely becoming fibrous, the basal margin crenate or rarely bluntly denticulate. *Cataphylls* usually 2, the outer one short and the inner reaching almost to ground level, membranous. *Leaves* few to several, linear, 1.5–4 mm wide, lightly corrugate, the lowermost in-

serted at or just below the ground and longest, often as long as the inflorescence or rarely somewhat longer, ascending to falcate or trailing, upper leaves progressively shorter. *Stem* simple or branched, the branches either crowded below or laxly arranged,  $\pm$  rounded to weakly angled below the nodes. *Inflorescence* comprising 1–several lax to fairly congested branches of 5–12 flowers; *bracts* herbaceous, weakly keeled, the outer 10–20(–25) mm long, the inner smaller, becoming membranous, apically forked. *Flowers* zygomorphic, white to cream, greenish yellow, or light purplish brown, with a strong sweet fragrance; *perianth tube*  $\pm$  dimorphic, slender below, curving outward and expanded above, (20–)30–45(–70) mm long, the upper part ca. 6 mm long; *tepals* subequal, narrowly lanceolate to linear-filiform, 13–30 mm long, 1.3–2.5(–3) mm wide, acute to attenuate, spreading equally at right angles to the tube, vertical. *Filaments* unilateral and arcuate, exerted 2–3 mm; *anthers* parallel, 4–5 mm long, cream; pollen cream. *Ovary* globose, ca. 3 mm long; style arching behind the stamens, branching between the base and middle of the anthers, the branches divided for about  $\frac{1}{3}$  their length, ascending below, recurved above and usually tangled in the anthers. *Capsules* globose, 6–8(–11) mm long; *seeds* globose, ca. 2 mm diam. *Chromosome number*  $2n = 16$ .

*Flowering time.* Usually late December to March in tropical Africa (subsp. *caudata* and subsp. *littoralis*); September and October in southern Namibia and South Africa (subsp. *littoralis*) but also at other times.

*Distribution and habitat.* *Lapeirousia littoralis* occurs in a wide swath across south tropical Africa (southwestern Angola, northern Namibia, Zambia, Zimbabwe, Botswana, southern Mozambique) with southward extensions into the arid parts of southern and western Namibia and the northern Cape and Namaqualand in South Africa (Fig. 16). It blooms in the wet season, usually not long after the first soaking rains. Thus the Namaqualand and southern Namibian populations usually flower in the spring (August to October) following the winter rainfall that prevails along the southwestern African coast. Elsewhere populations generally flower in early to late summer, not long after the beginning of the summer rains of tropical and eastern southern Africa. In southern Mozambique populations appear to bloom in almost any month, reflecting the nonseasonal rainfall pattern of the southeast coast. *Lapeirousia littoralis* favors sandy, well-drained soils, sometimes occurring on sand dunes. The probable pollinators are moths, given the pale-



colored, very fragrant, long-tubed flowers. However, the style branches are tangled with the anthers, and self-pollination seems probable in the absence of insect-mediated pollen transfer.

*Diagnosis and relationships.* Characterized by pale, uniformly colored flowers with a long, dimorphic perianth tube that curves outward and is expanded above, *Lapeirousia littoralis* can usually be recognized by its flowers alone. Its vegetative and floral morphology are remarkably variable. Plants from northern Namibia, Zambia, Zimbabwe, and Mozambique have relatively long, sometimes lax spikes with short bracts 10–18 (–23) mm long and are usually 20–30 cm tall. The flowers in all collections from these relatively well-watered areas have long, narrow tepals 25–30 mm long and about 1.3 mm wide. As the flowers fade and dry, the tepals become distinctively filiform.

Plants from arid southwestern Angola, western and southern Namibia, and from the northwestern Cape and Namaqualand in South Africa tend to be shorter, often having the branches crowded at the base. In these plants the spikes are shorter, usually 10–15 cm high, and sometimes congested, and the bracts are usually 15–20(–25) mm long. The flowers in these populations have tepals about 20 mm long and 2–2.5 mm wide. When dry they do not always assume the filiform shape of the northern populations.

These two series of populations are usually easy to separate and might be regarded as different species except for the morphologically intermediate populations in central Namibia and southern Botswana that are often not easily assigned to either major group. The intermediates suggest that separation at subspecific rank is the most appropriate treatment for the southern and tropical populations of the species. The shorter form, first described by J. G. Baker in 1878 as *L. littoralis*, later as *L. burchellii* (1892), and then by Dinter as *L. ramosissima*, was first regarded as a subspecies of *L. caudata* by Goldblatt and Marais (Goldblatt, 1972), essentially for the reasons outlined above. *Lapeirousia streyi* from the Namib Desert south of the Kuiseb is regarded as belonging here, but it is close to being intermediate between the shorter subsp. *littoralis* and the taller subsp. *caudata*.

Plants from southern Mozambique, mostly from immediately around Maputo (Lourenço Marques), seem best treated as belonging to subsp. *caudata*. They stand out in having particularly long-tubed flowers and in often being very robust. The tubes are sometimes up to 7 cm long, compared with the 3.5–4 cm usual in central African plants. Floral

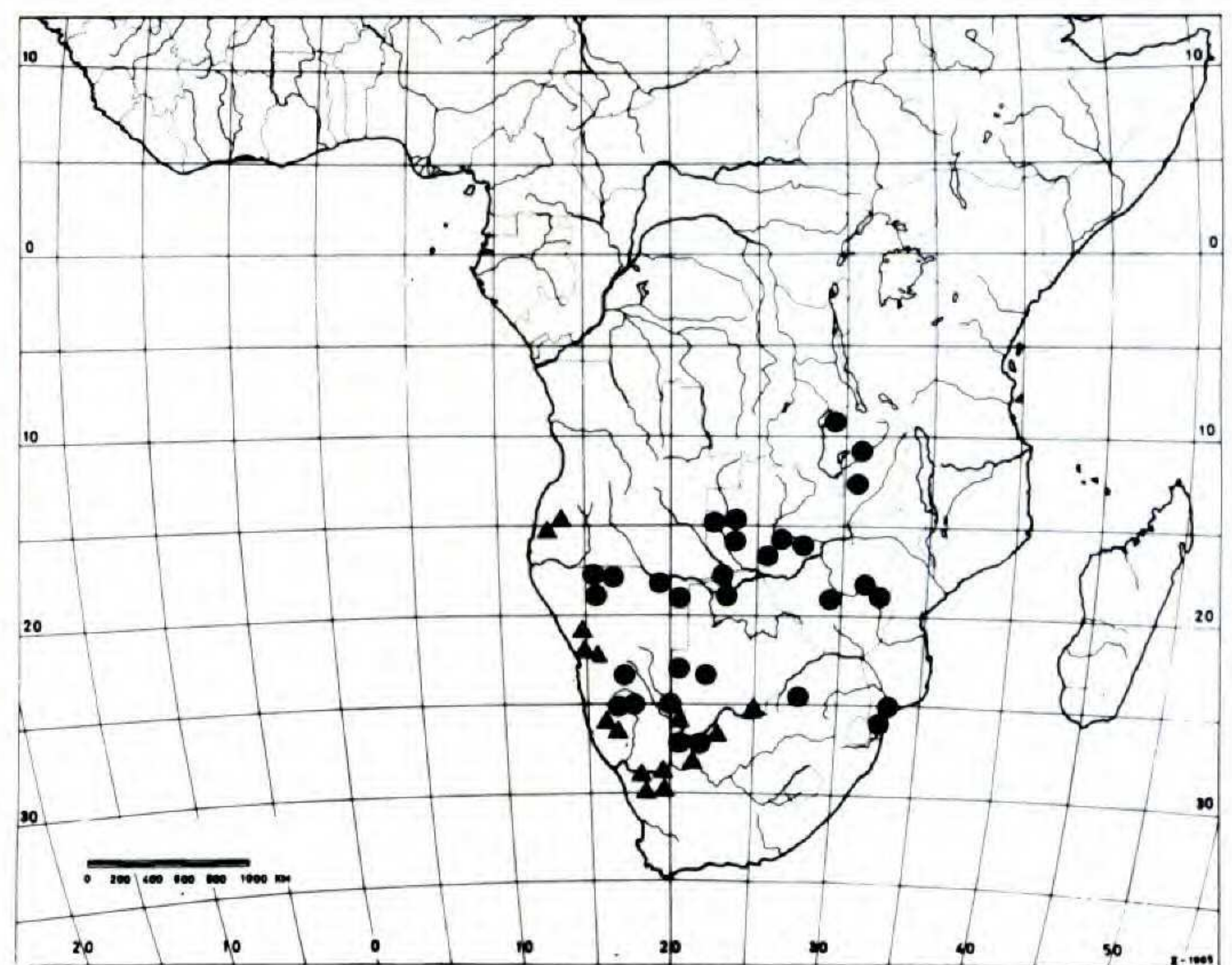


FIGURE 16. Distribution of *Lapeirousia littoralis*: subsp. *littoralis* represented by triangles, subsp. *caudata* by dots.

variation is notable also in plants from western Zambia, and a collection from Mongu (Robinson 6749) has flowers with perianth tubes 8–13 mm long and tepals ca. 18 mm long. Such isolated variation, particularly in tube length, also occurs in other species of *Lapeirousia* and appears to have no taxonomic significance.

*Lapeirousia littoralis* has a diploid number of  $2n = 16$  and a dimorphic karyotype of one very long and seven short chromosome pairs. This is characteristic of subg. *Lapeirousia*, a largely western Cape and Namaqualand alliance comprising 17 species (Goldblatt, 1972) with corrugate leaves, woody corm tunics, and spicate or tufted inflorescences. There seems no doubt that *L. littoralis* belongs in this section despite its predominantly tropical distribution. The tufted tropical species, *L. odoratissima*, which has a larger flower with a perianth tube 10–14 cm long, seems most likely the closest relative of *L. littoralis*, an assumption based largely on the similarity of the flowers of the two species. Other species of sect. *Lapeirousia* that seem morphologically close to *L. littoralis* include the South African *L. arenicola* and *L. anceps*, both of which have long-tubed flowers with narrow tepals. In these two species the perianth has contrasting markings on the lower tepals unlike *L. littoralis*.

*History.* The fruiting type collection of *Lapeirousia littoralis* was made by Friedrich Welwitsch in July 1859, and was described by J. G. Baker in 1878, based solely on this collection. The type locality is near Mossamedes on gravelly hills around Praia da Amelia in southwestern Angola, now the province of Namibe. The type material is in poor condition and consists of depauperate plants with



branches produced from near the ground, bracts ca. 12 mm long, capsules ca. 9 mm long, and linear, lightly corrugate leaves. Alone the specimen cannot be matched with confidence, and until now *L. littoralis* has not been identified with any known species of the genus. However, another collection from southwestern Angola, *Torre 8824*, previously assigned to *L. caudata*, comprises plants that are clearly the same as those collected by Welwitsch, and they have flowers that correspond to the southern African and Namibian *L. caudata* subsp. *burchellii* (Goldblatt, 1972).

The latter taxon, based on *Lapeirousia burchellii*, was first recorded in October 1812 when the English botanist and explorer William Burchell reached the northern Cape. Burchell's collections were described formally by J. G. Baker in 1892 and were not considered to be a subspecies of *L. caudata*, the name used until now for *L. littoralis*, until later (Goldblatt, 1972). *Lapeirousia ramossissima*, collected near Gründorn in southern Namibia by Dinter and described by him, matches closely the type collections of *L. burchellii* and *L. littoralis*. A third species, *L. streyi* from west-central Namibia, is close to being intermediate between *L. littoralis* and plants from tropical Africa that have somewhat longer and narrower tepals and taller stems. These characteristics correspond to *L. caudata*, which was based on plants collected at Olukonda in northern Namibia and described by Hans Schinz in 1890. Plants matching *L. caudata* are now known to occur widely across south-central Africa from northern interior Namibia, across Zambia to Zimbabwe, with an isolated series of populations in southern Mozambique. Currently regarded as *L. caudata* subsp. *caudata* (Goldblatt, 1972), it now becomes *L. littoralis* subsp. *caudata*. The history of this subspecies is discussed below.

#### KEY TO THE SUBSPECIES OF *LAPEIROUSIA LITTORALIS*

- 1a. Perianth tube 28–35 mm long; tepals 13–15 mm long and 2–3 mm wide; bracts 15–20 (–25) mm long ..... 15b. subsp. *littoralis*  
 1b. Perianth tube (25–)30–45(–70) mm long; tepals 18–30 mm long and 1.3–2 mm wide; bracts 10–18(–23) mm long ..... 15a. subsp. *caudata*

**15a. Subsp. caudata** (Schinz) Goldbl., comb. et stat. nov. *Lapeirousia caudata* Schinz, Verh. Bot. Vereins. Brandenburg 31: 213. 1890. Baker, Handbk. Irideae 172. 1892. Sölch, Prod. Fl. Südwestafrika 155: 10. 1969. Goldblatt, Contrib. Bolus Herb. 4: 30–33. 1972. TYPE: Namibia: Amboland, Olukonda, *Rautanen 2* (lectotype, Z, designated by Sölch on

the sheet; isoelectotype, Z); Olukonda, *Schinz 2, 15*, or *s.n.* (probable syntypes, G, K, Z).

*Lapeirousia delagoensis* Baker, Handbk. Irideae 171–172. 1892; Fl. Cap. 6: 94. 1896. TYPE: Mozambique: Delagoa Bay, Lourenço Marques, sandy places, *H. Bolus 7618* (lectotype, K, here designated; isoelectotypes, BOL, G, SAM).

*Lapeirousia lacinulata* Vaupel, Bot. Jahrb. Syst. 48: 546–547. 1912. TYPE: Zambia: Kantanina Hills, *Kässner 2170* (holotype, B; isotypes, BM, BR, E, HBG, K, P, Z).

Plants 20–30 cm high, usually with a few long branches produced from near the base. *Inflorescence* a spike of 8–12 flowers; *bracts* 10–18(–23) mm long. *Flowers* with a perianth tube (25–)30–45(–70) mm long; *tepals* (18–)25–30 mm long and 1.3–2 mm wide, usually  $\pm$  filiform, especially when dry.

*Distribution.* Subspecies *caudata* has a wide range across south-central tropical Africa (Fig. 16). It extends from northern Namibia across western and southern Zambia to Zimbabwe. There is also a series of isolated populations in southern Mozambique.

*History and typification.* Subspecies *caudata* was first gathered in 1885 at the Finnish Mission Station at Olukonda in northern Namibia by the Swiss botanist Hans Schinz. Schinz later described it in 1890 based on his and the Finnish missionary Martti Rautanen's ample but confusingly labeled collections at the Zurich Herbarium. A sheet collected by *Rautanen* in 1887 was designated the lectotype by Sölch in 1959 and this choice appears to be suitable.

Corresponding closely with *Lapeirousia caudata*, although from northern Zambia, *L. lacinulata* was collected by T. Kässner in 1906 and described by Vaupel in 1912. He distinguished *L. lacinulata* on the basis of its slender habit, low stature, and shorter perianth tube only 2.5 cm long (actually 2.5–2.8 cm), in contrast to *L. caudata* in which the perianth tube is 3–4(–7) cm long. The distinction seems minor and is not sufficient for the separation of the species. A few other collections of subsp. *caudata* have a similar short perianth tube but not the slender habit. The isolated Mozambican populations near Maputo were discovered by the missionary Henri Junod in 1890 and subsequently by the Cape botanist Harry Bolus in 1886. Bolus's collection was referred by J. G. Baker (1892) to the new species *L. delagoensis*.

*Additional specimens examined.* BOTSWANA. NGAMILAND: 18.23 (Siambiso) sandy floodplain of Kwando River, 18°5' 23'20" (AB), *Smith 2222* (K, PRE, SRGH).



KGALAGADI: 23.20 (Ukwi) 120 km WNW of Hukuntsi on track to Ncojane, 23°41' 20"47", open sandy savanna (DC), 13 Mar. 1979, *Skarpe* 333 (K, PRE, SRGH, UCBG); 23.22 (Kang) Kang, 320 km W of Gaborone, 3,500 ft. (DD), 20 Oct. 1975, *Mott* 772 (SRGH, UCBG). MOZAMBIQUE. MAPUTO: Delagoa Bay, near Lourenço Marques, 30 Nov. 1897, *Schlechter* 11540 (B, BR, G, P, PRE, SAM); *Rogers* 22475 (K, PRE); 1890, *Junod* 24 (G, Z); 1896, *Junod* 486 (G, P, Z); Costa do Sol, sand dunes, 2 Mar. 1960, *Balsinhas* 126 (B, BR, K, LMA, P, PRE); 22 July 1965, *Caldeira & Marques* 595 (LMU, WAG); Sul do Save, Marracuene, between Lourenço Marques and Costa do Sol, Jan., *Pedro & Bachir* 3846 (LMA); *Exell et al. s.n.* (LISC); between Vila Luiza and Manhiça, 17 Nov., *Myre & Carvalho* 1043 (LMA); Polana Beach, Delagoa Bay, *Thoday* 169 (SAM). NAMIBIA. OVAMBOLAND: 17.15 (Ondangua) Ondangua, open sandy flats, 5 Feb. 1959 (DD), *de Winter & Giess* 6877 (M, WIND); 1924, *Liljeblad* 190 (Z); 17.16 (Enana) Oniipa, eroded field, 7 Mar. 1967 (CC), *Soini* 429 (WIND); Olukonda, 30 Jan. 1887, *Rautanen* 2 (Z), Feb. 1894 (CC), *Rautanen* 170 (B, G, Z); *Schinz* 2 and *s.n.* (B, K, Z); 30 Dec. 1885, *Schinz* 15 (Z); 18.15 (Okahakana) Onambeke-Onolongo (?BB); Apr. 1923, *Barnard* 141 (SAM), 573 (SAM). OKAVANGO: 17.19 (Runtu) 10 km E of Runtu, Jan. 1956 (DD), *Kruger* 1 (PRE); 19.20 (Tsumkwe) 15 km E of Tsumkwe on road to Botswana, 10 Jan. 1971 (DA), *Giess et al.* 11196 (WIND); Tsumkwe, hard black sand, Oberflachenkalk, 13 Jan. 1971, *Giess et al.* 11050 (WIND); Simkue, 157 mi. E of Grootfontein, *Acacia-Combretum* parkland, 17 Jan. 1958 (DB); *Story* 6162 (M, PRE, SRGH, WIND). KAPRIVI: 17.24 (Katima Mulilo) Mpilila Island, locally common near marsh, 12 Jan. 1959, *Killick & Leistner* 3325 (PRE, SRGH, WIND). REHOBOTH: 23.17 (Rehoboth) farm Arovley, red sand, 14 Feb. 1965 (AA), *Giess* 8401B (M, WIND). MARIENTAL: 25.17 (Gibeon) sandbodem, Sudkalahari bis Gibeon, May 1912 (BA-BB), *Range* 1455 (SAM). SOUTH AFRICA. CAPE: 24.20 (Unions End) Kalahari Park, Khaapan, Jan. 1978 (BD), *van der Walt* (PRE); 28.21 (Upington) ca. 40 km N of Upington at the S edge of the Kalahari, 1 Apr. 1980 (AB), *Snijman* 235 (NBG); 28.22 (Glen Lyon) sandveld W of Padkloof, on dune running parallel with the Langebergen, 15 Mar. 1937 (DA), *Acocks* 2057 (PRE). TRANSVAAL: 24.28 (Nylstroom) Waterberg, Zandriverspoort near Alma, farm Witpoort, 5 Mar. 1979 (AC), *van Wyk* 2680 (M, PRE). ZAMBIA. NORTHERN: Shiwa Ngandu, 17 Jan. 1937, *Ricardo* 147 (BM). LUAPULA: Lake Mweru, sandbank above high water mark, 13 Nov. 1957, *Fanshawe* 3941 (BR, K, NDO, P). CENTRAL: Serenje District, Kanona, July 1968, *Williamson* 1337 (K, MO, PRE, SRGH). SOUTHERN: Mazabuka, Ridgeway road, stony red soil, 2 Dec. 1931, *Trapnell* 538 (BR, K, PRE); Machili, 10 Dec. 1960, *Fanshawe* 5959 (K, NDO, SRGH); 27 Dec. 1960 (fr), *Fanshawe* 6026 (K, NDO, SRGH); 3 mi. from Namwala on Ngama road, 16 Dec. 1962, *van Rensburg* 1101 (BR, K, LISC, PRE, SRGH); Namwala, Kalahari, sand in dambo, 3,300 ft., *van Rensburg* 2039 (K, SRGH). WESTERN: Barotse-land, 6 mi. N of Senaga, moist sandy soil at edge of plains, 1 Aug. 1952, *Codd* 7329 (BM, BR, K, MO, PRE, S, SRGH); Kalabo, river bank, 2 Aug. 1962, *Robinson* 5437 (K, P, SRGH); Kalabo District, between Sandaula pontoon and Kalabo, edge of grassy floodplain, 12 Nov. 1959, *Drummond & Cookson* 6389 (E, K, LISC, MO, SRGH); Mongu, Barotse-land, 22 Dec. 1965, *Robinson* 6749 (K, M, SRGH, WAG); Sesheke District, no date,

*Gairdner* 69 (K). ZIMBABWE. MATABELELAND NORTH: Shangani River, NE of Bulawayo, 7 Jan. 1898, *Rand* 229 (BM). MASHONALAND EAST: Salisbury, Nov. 1919, *Eyles* 1885 (K, PRE, SAM, SRGH); Hunyani District, Old Charter road, 27 Dec. 1926, *Eyles* 4622 (S, SRGH); Marandallas, Looe, near stream, 22 Dec. 1948, *Wild* 2716 (BR, K, S, SRGH). MIDLANDS: Gwelo, whitewaters dam, *Loveridge* 596 (K, SRGH); Charter District, 27 Dec. 1926, *Charter* 4622 (K). WITHOUT PRECISE LOCALITY: NAMIBIA: Otjiluo, 3 Dec. 1909, *Dinter* 886 (SAM); Onolongo, *Barnard* 572 (SAM); Omatako, im muramba, 14 May 1939, *Volk* 2056 (M).

### 15b. Subsp. *littoralis*

*Lapeirousia caudata* subsp. *burchellii* (Baker) Marais & Goldbl., Ann. Bolus Herb. 4: 30–33. 1972. *Lapeirousia burchellii* Baker, Handbk. Irideae 171. 1892; Fl. Cap. 6: 93–94. 1896. TYPE: South Africa. Cape: 26.23 (Morokweng) Chooi Desert, Oct. 1812 (AC), *Burchell* 2350 (lectotype, K, designated by Goldblatt, 1972; isolectotypes, G, P).

*Lapeirousia ramosissima* Dinter, Feddes Rep. 29: 255. 1931. TYPE: Namibia. Lüderitz: dunes near Gründorn, *Dinter* 5043 (holotype, B; isotypes, BOL, BR, G, K, PRE, SAM, Z).

*Lapeirousia streyi* Suesseng., Mitt. Bot. Staatssamml. München [1](3): 88. 1951. TYPE: Namibia. Lüderitz: dunes S of the Kuiseb, *Strey* 2587 (holotype, M; isotype, PRE (cited in error as holotype by Goldblatt, 1972)).

Plants 10–15(–20) cm high, usually with 1–several short branches produced from near the base. *Inflorescence* usually a crowded cluster of short spikes, each 4–8-flowered; *bracts* 15–20 (–25) mm long. *Flowers* with a perianth tube 28–35 mm long; *tepals* 13–15 mm long and 2–3 mm wide, not usually filiform even on drying.

*Distribution.* Subspecies *littoralis* occurs in an arc from a somewhat isolated northern extension in southwestern Angola through western and southern Namibia and the northern Cape Province of South Africa into southern Botswana (Fig. 16). In Namibia it extends from near the Brandberg in the central west to the Lüderitz District in the south. In South Africa subsp. *littoralis* occurs in interior Namaqualand east of Springbok and in the northern Cape.

*Additional specimens examined.* ANGOLA. NAMIBE: near Mossamedes close to Vila Arriaga, 7 Feb. 1956, *Torre* 8824 (LISC). BOTSWANA. NGWAKETSE: 25.25 (Mafekeng) Moropedi ranch, 15 Sep. 1978 (CA), *Hansen* 3455 (C, K). NAMIBIA. OMARURU: 21.14 (Uis) Brandberg, B. W. Mine–Uis Mine road, sand in rocky ground, 14 Mar. 1963 (AA), *Kers* 942 (WIND); Messumberge, foot of mountains, 19 Mar. 1967 (AC), *Giess* 9689 (M, PRE, WIND); Nabab Hill, Brandberg area, 4 Mar. 1978 (AB), *Craven* 715a, 715b (WIND). SWAKOPMUND: 22.15 (Trekopje) 1 mi. NW of farm Bloemhof (AD), *Giess et al.* 5079 (M, WIND); 23.15 (Rostock) Namib Park, Tumasberg at campsite (BA), *Giess* 13550 (M, WIND).





FIGURE 17. Morphology and distribution of *Lapeirousia odoratissima*. Habit and corm  $\times 0.5$ ; detail of stamens and style  $\times 2$ . (Drawn by J. C. Manning.)

MALTAHÖHE: 25.16 (Helmeringhausen) farm Duwisib, 17 May 1956 (BC), *Volk 12782* (M, MO). LÜDERITZ: 26.16 (Aus) dunes 15 mi. W of Aus (CB), *Giess & van Vuuren 828* (WIND); 13 mi. W of Aus, coarse sand, *Giess & van Vuuren 824* (M, WIND). SOUTH AFRICA. CAPE: 25.20 (Mata-Mata), Kalahari Gemsbok Park, between the Nosob and Auob dunes, 25 Apr. 1960 (BC), *Barnard 807* (PRE); Kalahari Gemsbok Park, 6 mi. SE of Kaffer Pan, loose red sand on dune top, 22 Apr. 1960 (CC), *Leistner 1874* (M, MO, PRE); 26.23 (Morokweng) Chooi Desert, Giraffe Station, Oct. 1812 (AD), *Burchell 2341* (K); 27.18 (Violsdrif) Namaqualand, 15 km S of Violsdrif, Koubank River, 7 July 1976 (DA), *Giess 14536* (M, WIND); 28.18 (Warmbad) Goodhouse, 27 July 1950 (CD), *Barker 6263* (NBG); 2 mi. S of Goodhouse, 27 July 1950, *Lewis 2272* (SAM); 28.21 (Upington) Upington, sandveld, s.d. (AC), *Mostert 1416* (PRE); 28.24 (Kimberley) 18 mi. SSW of Schmidtsdrift, red sand (CA), 24 Sep. 1961, *Leistner 2866* (B, G, PRE); 29.17 (Springbok) 25 mi. N of Okiep on Goodhouse road (BD), *Lewis 5517* (NBG); 29.18 (Gamoep) Little Bushmanland, Keuzabies (AB), *Schlechter s.n. or 103* (B, BOL, COI, E, G, MO, P, PRE); Aggenys, 10 mi. W of the farmhouse, 4 Sep. 1971 (BD), *Wisura 2222* (NBG); Ratelkraal, 7 Sep. 1950 (CA), *Barker 6755* (BOL, NBG); 25 mi. E of Springbok, *van Breda 1370* (PRE); 29.19 (Pofadder) 20 mi. from Pofadder on the road to Springbok, *Strauss 123* (NBG).

**16. *Lapeirousia odoratissima*** Baker, Trans. Linn. Soc. London (Bot.) ser. 2, 1: 273. 1878;

Handbk. Irideae 173. 1892; Fl. Trop. Africa 7: 354. 1897. Sölch, Prod. Fl. Südwestafrika 155: 10. 1969. Geerinck et al., Bull. Soc. Roy. Bot. Belgique 105: 344–346. 1972. TYPE: Angola: sandy woods near Lopollo, *Welwitsch 1551* (lectotype so annotated, BM; islectotypes, B, BM, C, G, K). Figure 17.

*Lapeirousia stenoloba* Vaupel, Bot. Jahrb. Syst. 48: 548. 1912. TYPE: Namibia: Omaheke, 1,300 m, in brown sand, 17 Mar. 1911, *Seiner 329* (lectotype designated by Sölch on sheet, B); Omaheke, Jan. 1909, *Dinter 642* (syntype, SAM, as Okanakasura).

*Lapeirousia congesta* Rendle, J. Linn. Soc. Bot. 30: 435. 1895. Baker, Fl. Trop. Africa 7: 354. 1897. TYPE: Tanzania, "between Zanzibar and Uyui" [the latter near Tabora], *Taylor s.n.* in 1886 (holotype, BM).

*Lapeirousia juttæ* Dinter, Die Vegetabilische Veldkost Deutsch-Südwest-Afrikas 13–14. 1912. TYPE: not cited.

Plants 10–18(–25) cm high, with a condensed aerial axis sometimes rosettelike, rarely the stem partly aerial and with expanded internodes. *Corm* campanulate, 15–20 mm wide at the base, tunics woody, brown, the outer breaking irregularly, rarely becoming fibrous by decay. *Cataphylls* usually 2, the outer one short, the inner reaching almost to ground level, membranous. *Leaves* few, often



only 2 (but hardly distinguishable from the bracts except by position), linear, corrugate, the lowermost inserted below the ground, exceeding the bracts and up to twice as long, to 30 cm long, 3–5 mm wide. *Stem* comprising 1 long basal internode to 8 cm long, usually reaching to just below ground level, upper internodes contracted, rarely 5–10 mm long, the aerial stem 2–5(–10) cm long; simple or with several branches, each subtended by leaves or by leafy bracts. *Inflorescence* comprising 1 or more congested spikes,  $\pm$  umbellate in appearance, flowers 3–6 per branch; *bracts* herbaceous, 6–15 cm long, lanceolate, the outer lightly corrugate, the inner about  $\frac{1}{3}$  shorter than the outer,  $\pm$  membranous. *Flowers* actinomorphic, hypocrateriform, white to ivory, usually strongly scented especially in the evenings; *perianth tube* cylindrical, 10–14 cm long; *tepals* narrowly lanceolate, attenuate, 35–40 mm long, extended horizontally or sometimes slightly drooping, widest in the lower third and there 4–5 mm wide. *Filaments* ca. 4 mm long, exerted for 1.5–2 mm, symmetrically disposed; *anthers* 6–8 mm long, linear, white; pollen yellow. *Ovary* ca. 3.5 mm long, *style* usually ultimately reaching to about the apex of the anthers, sometimes shorter, branches 3–4 mm long, forked for ca. half their length, diverging and recurved. *Capsules* obovoid-oblong, 15–18 mm long, concealed in the leaf and bract bases; *seeds*  $\pm$  globose to somewhat angled by pressure, 2–2.3 mm at the widest diameter. *Chromosome number*  $2n = 16, 18$ .

*Flowering time.* December to March, occasionally in April; flowers opening near sunset and white, ivory by morning and gradually wilting during the day.

*Distribution and habitat.* Although distributed widely across south tropical Africa, *Lapeirousia odoratissima* is apparently common only in Namibia where it occurs most often in sandy flats in the central and upper half of the country. Collections from a number of scattered sites indicate a fairly wide distribution across south tropical Africa except along the east coast and near interior. It extends from southwestern Angola, Zambia, and adjacent Shaba Province of Zaire to central and northern Malawi, Zimbabwe, and in locally dry sites in western and central Tanzania. *Lapeirousia odoratissima* probably also occurs in Botswana although there are no records from that country. Largely a plant of semiarid habitats, *L. odoratissima* also occurs in *Brachystegia* woodland and in exposed places in montane sites, such as the Nyika Plateau in Malawi and the Inyanga High-

lands in Zimbabwe, as well as open grassland and *Acacia* savanna.

Little is known about its biology but the large, long-tubed, and usually intensely fragrant flowers are presumably pollinated by hawkmoths. My observations on plants in Namibia indicate that flowers open toward sunset, at which time they are creamy white. By morning the perianth has turned ivory to buff, and the tepals droop slightly below the horizontal; they wilt by the end of the day. The flowers are most intensely fragrant when they first open but maintain their scent through the following day. Ample nectar is produced in the perianth tube. Up to 25  $\mu$ l was measured in one flower in which the nectar sugar concentration ranged from 16% to 25%. Observations made by Jean Pawek in Malawi confirm my phenological studies: she recorded that buds open between 5:30 P.M. and 6 P.M. but have wilted at least by 10 A.M. (earlier than in Namibia). Flowering phenology is seldom recorded and the presence of fragrance only rarely.

The corms of *Lapeirousia odoratissima* are reported to be edible and to comprise part of the diet of the Khu Bushmen of Namibia (Marshall, 1976).

*Diagnosis and relationships.* The usual tufted or rosettelike growth habit combined with the large white flowers with an exceedingly long perianth tube 10–14 cm long set *Lapeirousia odoratissima* well apart in the genus. The other tufted to rosette-forming species of sect. *Sophronia* are all southern African and have smaller flowers, colored pale blue to violet. The chromosome number,  $2n = 16$  or  $18$ , is the same as in the largely southern African subg. *Lapeirousia* and different from most of the tropical African species with pseudopaniculate inflorescences. Subgenus *Lapeirousia* includes the south tropical African *L. littoralis*, which has somewhat similar white flowers with a shorter but still substantial perianth tube usually 25–45 mm long. *Lapeirousia littoralis* has an aerial stem, and is not likely to be confused with *L. odoratissima*. *Lapeirousia odoratissima* is probably most closely related to *L. littoralis* rather than to the rosettiform southern African species of sect. *Sophronia*.

Flowers very similar to those of *Lapeirousia odoratissima* are found in *L. schimperi* (sect. *Paniculata*), but clearly this species is only distantly related to *L. odoratissima*, and it has the plane leaves and lax pseudopaniculate inflorescence characteristic of sect. *Paniculata*. The long-tubed flowers of these two species are presumably pollinated



by the same agent, most likely a hawkmoth, and are a notable example of convergence in two distantly related species of the same genus.

*History.* *Lapeirousia odoratissima* was discovered in southern Angola in 1859 by Friedrich Welwitsch, and his collection was described by J. G. Baker in 1878. Another early collection was made by the Rev. W. E. Taylor in central Tanzania in 1886 and was described as *L. congesta* by A. B. Rendle, who distinguished it from *L. odoratissima* on the basis of a more congested habit. Rendle described the plant as having a stem forming a dense sessile head above the first leaf. This is not strictly true, although the internodes of the stem and inflorescence axis are shorter than in the type of *L. odoratissima*, which has among the longest internodes found in the species. From the ample material available it now seems clear that the variation between the extremes represented by the two collections is continuous, and there is no reason to consider them separate species.

Later collections from then German South West Africa made by Kurt Dinter and Franz Seiner were described as *Lapeirousia stenoloba* by Vaupel (1912). He considered these Namibian populations to constitute a species related to *L. odoratissima*, differing by a robust habit and particularly narrow and attenuate tepal apices. Many Namibian specimens of *L. odoratissima* differ from those in tropical Africa by their branched stems and numerous flowers, but intrapopulational variation is considerable in this species, and there are often few-branched or even unbranched plants in populations of more robust ones with several branches, thus the difference does not seem significant taxonomically.

*Additional specimens examined.* ANGOLA. HUILA: 58 km on road from Sá de Bandeira to Vila Paiva Couceiro, 9 Jan. 1973, *Couto 287* (K, LISC, SRGH); Huila Plateau, dry sandy terrain, Nov.–Dec. 1895, *Berthelot 342* (P); Tchivinguire, 22 Jan. 1962, *Barbosa & Moreno* (COI); Huila, sandy prairies, 1,740 m, Jan. 1899, *Dekindt 733* (LISC, P); Huila, 1883, *Newton 231* (COI, Z); between Huila and Palanca, 26 Jan. 1956, *Mendes 1423* (LISC); Ganguelas, 12 km from Vila Artur toward Galangue, 1,500 m, 5 Jan. 1960, *Mendes 1970* (LISC); Chicungo, ca. 1,700 m, 12 Feb. 1973, *Teixeira & Andrade 8446* (LISC). HUAMBO: Benguela Plateau, near River Catumbela near the forte Princeya Amelia Kubango, Sep. 1906, *Gossweiler 99* (K); country of the Ganguellas and Ambuellas, Vila da Ponte, Dec. 1932, *Gossweiler 4022* (COI, K); Mt. Moco, Anhara de Moco (12.15 CD), 19 Dec. 1973, *Huntley et al. 113* (PRE). BIÉ: Andulo, Cruzamento N Lubia a 7 km from Nharea, 1,400 m, 24 Nov. 1965, *Teixeira et al. 9518* (LISC). CUNENE: Cuvelai ca. 20 km from Cuvelai to Chamutete, 10 Feb. 1973, *Menezes, Barosso & Sousa 4444* (LISC, SRGH); Cuvelai

ca. 16 km from Cuvelai to Bambi, 12 Feb. 1973, *Menezes, Barosso & Sousa 4506* (LISC, SRGH). CUANDO-CUBANGO: Menongue, Caiundo, Capico, near Missão, 1,200 m, 30 Jan. 1960, *Mendes 2234* (LISC). MALAWI. NORTHERN PROVINCE: Mzimba District, 22 mi. W of Mzuzu, Kasitu River, 3,800 ft., 2 Mar. 1974, *Pawek 8611* (MO); Mzimba District, 7 mi. S of Mutini, W toward Rukuru River, ca. 1,260 m, 31 Jan. 1976, *Pawek 10798* (K, MAL, MO); Nyika Plateau, grassland at radio transmitter, 4,100 ft., 19 Feb. 1976, *Phillips 1251* (MO); Mzimba District, 5 mi. W of S49 toward Vuvumwe bridge, 20 Jan. 1978, *Pawek 13642* (BR, MO, SRGH, WAG); Mzimba District, edge of dirt road in sand, behind Ekwendeni, 26 Feb. 1978, *Pawek 13931* (K, MAL, MO); Mzimba District, ca. 10 km N of Mphembe, *La Croix 4304* (MO). CENTRAL PROVINCE: Chitipa District, Kaseye Mission 10 mi. E of Chitipa, 1,270 m, closed in daytime, 26 Dec. 1977, *Pawek 13376* (K, MAL); Lilongwe-Dzalanyamas road near Ketete bridge, dry sandy dambo, 6 Feb. 1957, *Robson 1483* (BM, K, MAL, PRE, SRGH); Kasungu Game Reserve, white sand, 20 Jan. 1970, *Hall-Martin 577* (PRE); Dowa District, Kongwe Forest Reserve, shallow gravel over rocks with *Xerophyta*, 7 Mar. 1982, *Brummitt et al. 16394* (K). NAMIBIA. KAKOVELD: 18.13 (Ohopoho) Okakura, 28 Feb. 1913 (DA), *Dinter 3322* (SAM). KAKOVELD: 19.14 (Kamanjab) N of Otjovasandu in red sand, 11 Mar. 1976 (BA), *Giess & Loutit 14191* (WIND). OUTJO: 19.14 (Kamanjab) Etosha National Park, Kaross, 9 Apr. 1974 (fr) (B-), *Volk & Le Roux 807* (WIND); between Kaross and Kamanyab (BC), *Thorne s.n.* (SAM 313743); 19.15 (Okaukuejo) 10 km W of farm Uitzig, ca. 60 km ENE of Otjiwarongo, grassveld on red sandy loam, 9 Feb. 1983 (CB), *Lavranos & Pehlemann 21059* (MO, WIND). OVAMBOLAND: 17.15 (Ondangua) Ondonga (DD), *Barnard 196* (SAM); 18.15 (Okahakana) Onolongo–Onambeke, Apr. 1923 (?BB), *Barnard 136* (SAM). GROOTFONTEIN: 19.16 (Gobaub) farm Norabis 387, thornveld, 18 Mar. 1988 (fr) (DD), *Goldblatt & Manning 8824* (MO); 19.17 (Tsumeb) Auros (Otavi), 10 Feb. 1925 (DA), *Dinter 5599* (B, G, GH, PRE, SAM, Z); 19.18 (Grootfontein) 30 mi. N of Gautscha Pan, 10 Feb. 1958 (CA), *Story 6460* (PRE); Oliewenhof farm, sandy flats, 8 Mar. 1974 (fr) (CB), *Merxmüller & Giess 30147* (M, WIND). OTJIWARONGO: 20.17 (Waterberg) Otjiwarongo District, farm Okosongomingo, 4 Mar. 1974 (CA), *Merxmüller & Giess 30023* (M, PRE, WAG, WIND). OKAHANDJA: 21.16 (Okahandja) Omatako View, red sand, 4 Mar. 1974 (BA), *Woortman 256* (WIND); 21.17 (Otjosondou) Okahandja District, farm Hochveld, brown sandy loam, 30 Apr. 1963 (fr) (BD), *Giess et al. 6672* (WIND); Okahandja, 22 Feb. 1928 (DD), *Bradfield 385* (PRE). WINDHOEK: 21.17 (Otjosondou) 35 km from Steinhausen to Windhoek on Kapps farm road, 15 Mar. 1988 (DD), *Goldblatt & Manning 8807* (MO); 22.17 (Windhoek) farm Bodenhausen, near the river, 7 Mar. 1959 (BC), *Seydel 1771* (M, WIND). COBABIS: 19.20 (Tsumkwe) Grootfontein District, ca. 3 mi. S of Nama Pan (DC), *Story 6275* (M, PRE, WIND); 20.20 (Kaukaveld) Kaukaveld, 56 mi. N of Eiseb Omuramba toward Kano Vlei, 13 Apr. 1967 (fr) (AD), *Giess 9815* (WIND); 21.18 (Steinhausen) 15 km from Steinhausen to Windhoek on Kapps Farm road, 15 Mar. 1988 (fr) (CC), *Goldblatt & Manning 8803* (MO). TANZANIA. IRINGA: 12 mi. SE of Iringa, 5,500 ft., well-drained red soil, 8 Feb. 1962, *Polhill & Paulo 1390* (B, BR, K, LISC, P, PRE, SRGH). RUKWA: Sumbawanga, Ufipa, among roadside grasses, 6,300 ft., 29 Jan. 1950,



*Bullock* 2357 (B, BR, K, MO, S); Ufipa Plateau, *Michelmore* 1065 (K). ZAIRE. SHABA: Mamea Plain, 9 Jan. 1938, *Paterson s.n.* (K); plateau de Manika, 12 km SW de Kolwezi, 5 Jan. 1983, *Schaijes* 1779 (BR); ca. 2 km W de Katema, 21 Jan. 1969, *Lisowski et al.* 179 (BR). ZAMBIA. COPPERBELT: Kasempa District, Chati Forest Reserve, W of Kasempa road, sandy edge of path to dambo, 12 Jan. 1961, *Linley* 55 (MO, SRGH); Chati dambo, Jan. 1962, *Odgers* 675 (NDO). EASTERN: Luangwa Valley near Mupomadzi River, 2,000 ft., 15 Jan. 1966, *Astle* 4415 (K, SRGH). NORTHERN: Mbala District, Mbala, 13 Jan. 1970, *Sanane* 984 (K, P); Mbala District, Chenda farm, dam, grassland, 13 Jan. 1965, *Richards* 19554 (K); Abercorn-Lunzua Falls road, red sand at top of escarpment, 1,500 m, 26 Jan. 1962, *Richards* 15962 (K); Mbala District, road to Inono village, sandy track, 5,000 ft., 18 Jan. 1955, *Richards* 4142 (BR, K). NORTHWESTERN: Mwinilunga District, S of Samuteba on Solwezi Mwinilunga road, sandy dambo, 19 Jan. 1975, *Brummitt et al.* 13875 (K, NDO, SRGH); Mwinilunga Subdistrict, plain, Feb., *Marks* 136 (K). SOUTHERN: Machili, woodland, 22 Dec. 1960, *Fanshawe* 5994 (K, NDO, SRGH); Choma, shallow gravel soil in miombo, 20 Jan. 1956, *WRB* 235 (NDO); Victoria Falls, 3,000 ft., *Rogers* 5393 (K). WESTERN: Barotseland, Moufu, sandy grassland at edge of woodland, 22 Dec. 1965, *Robinson* 6749 (WAG); Sesheke, Jan. 1925, *Borle s.n.* (PRE, SRGH). ZIMBABWE. MANICALAND: Inyanga District, Juliasdale, Pteridium grassland W of Punch Rock, in fire break, 1,925 m, 24 Dec. 1972, *Biegel* 4122 (K, LISC, MO, PRE, SRGH); Inyanga National Park, near Maroro bridge, 23 Jan. 1975, *Burrows* 705 (NBG, SRGH); Inyanga District, sandy level river bank, *Chase* 581 (BM, K, SRGH); Inyanga, 6,000 ft., *Bayliss* 10641 (MO); Inyanga, grassland along the road, 1,700 m, 13 Jan. 1931, *Fries et al.* 4244 (BM, BR, PRE, S); Rusape, 23 Jan. 1939, *Hopkins s.n.* (SRGH 7042); Manica District, Odnani River valley, 1915, *Teague* 334 (K). MASHONALAND NORTH: Lomagundi, Audley farm, Darwendale, 24 Jan. 1969, *Biegel* 2843 (PRE, SRGH); Bindura, 8 Jan. 1932, *Brain* 8063 (SRGH). MASHONALAND EAST: Macheke, 5,000 ft., sweet scent, *Eyles* 1989 (K, PRE, SRGH); near Salisbury, Jan. 1912, *Craster* 75 (K); Salisbury District, Lake McIlwaine, *Plowes* 2548 (BR, K, LISC, PRE, SRGH); Marandellas, dry veld, Dec. 1947, *Dehn* 108 (M, SRGH); Marandellas Pasture Station, 16 Jan. 1931, *Rattray* 233 (SRGH); Nuza Plateau near Panga, Jan. 1935, *Gilliland* 1408 (BM, K). MATEBELELAND NORTH: Victoria Falls, Jan. 1910, *Rogers* 5393 (SRGH); Shangani/Bubi District, Gwampa Forest Reserve, Kalahari sand in *Baikiaea* woodland, *Goldsmith* 87/56 (K, PRE, LISC, SRGH). MIDLANDS: Gokwe, *Brachystegia* woodland on sand, 2 Feb. 1964, *Bingham* 1201 (K, SRGH). WITHOUT PRECISE LOCALITY: NAMIBIA: ?17.14 (AC) Kunene River banks, Mar. 1923, *Barnard* 135 (SAM); ?19.15 (BB) Okakuja, Jan. 1912, *Dinter* 2574 (BM, K, SAM); Apr. 1912 (fr), *Dinter* 2649 (SAM); Mar. 1913, *Dinter* 2788 (SAM).

#### EXCLUDED SPECIES

*Lapeirousia graebneriana* Harms, Bot. Jahrb. Syst. 28: 366. 1901. TYPE: Tanzania, Uhehe: Ufuagi, 1,800 m, Mar. 1899, *Goetze* 748 (holotype, B; isotype, BR) = **Anomatheca laxa (Thunb.) Goldbl.** Fairly typical of the

species, with a slender narrow perianth tube, but the bracts are 10–15 mm long, the lower flower with the largest bracts.

*Lapeirousia holostachya* Baker, Kew Bull. 390. 1894; Fl. Trop. Africa 7: 354. 1897. TYPE: Tanzania. Fwambo, *Carson* 14/1893 (holotype, K, not seen). = **Radinosiphon leptostachya (Baker) N. E. Br.** (Carter, Fl. Pl. Africa 35: pl. 1384. 1962).

*Lapeirousia welwitschii* Baker, Handbk. Irideae 168–169. 1892. TYPE: Angola: Malange, Pungo Andongo, 9°40' 15°35', Jan. 1857, *Welwitsch* 1531 (BM, annotated as lectotype in unknown hand; isolectotypes, C, COI, G, K, P). The type specimens are poorly preserved, especially the flowers, and as discussed under *L. rivularis*, may be either *L. rivularis* or *L. erythrantha*. The type locality must be visited to resolve this question.

*Lapeirousia erythrantha* var. *welwitschii* (Baker) Marais ex Geerinck, Lisowski, Malaisse & Symoens, Bull. Soc. Roy. Bot. Belgique 105: 340–341. 1972.

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