DEVIA XEROMORPHA, A NEW GENUS AND SPECIES OF IRIDACEAE–IXIOIDEAE FROM THE CAPE PROVINCE, SOUTH AFRICA[1]

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ABSTRACT

Devia xeromorpha, a new genus and species of Iridaceae–Ixioideae, is a local endemic of the Roggeveld Escarpment in the western Karoo, South Africa. The new taxon is probably most closely related to the southern and tropical African *Crocosmia*, a member of subtribe Tritoniinae of Ixioideae–Ixieae. *Devia xeromorpha* is remarkable in the Tritoniinae in its narrow, four-grooved leaves; dusty pink, actinomorphic flowers with helically rotated anthers; and tussock-forming habit. The foliar marginal epidermal cells are heavily thickened, and submarginal sclerenchyma is absent; the bundle caps are strongly developed and reach to the epidermis; and stomata are restricted to the laminar grooves. The seed coat of *Devia* is of the basic type for Iridaceae in its brown, microreticulate outer surface. Basic chromosome number for Tritoniinae is $x = 11$ but *Chasmanthe* and some species of *Tritonia* have $n = 10$. *Devia*, with $n = 10$, is consistent with this pattern, but it differs from *Crocosmia* which has the basic number for the subtribe. Although some of the differences between *Devia* and *Crocosmia* reflect xeromorphic adaptations in the former (persistent tunics, proteranthous and peculiar fibrotic leaves), the genus appears to have followed an independent evolutionary pathway, becoming specialized in the structure of the leaf and in orientation of the stamens and style.

A new species of Iridaceae subfamily Ixioideae, discovered by the first author in 1981 in fruit on the Roggeveld Escarpment in the western Karoo of the Cape Province, South Africa, was collected in full flower in January 1989. The ample material that is now available makes it clear that the plant is not only a new species but also that it does not accord with any genus of Iridaceae so far described. The species is assigned to a new genus, *Devia*, named in honor of Dr. M. P. de Vos, of Stellenbosch, South Africa, in recognition of her extensive systematic, anatomical, and embryological research in Iridaceae and other families of southern African plants.

Devia (Fig. 1) is characterized by large, persistent corms with tough long-lived fibrous corm tunics; a branched spike of numerous, small actinomorphic flowers; small membranous bracts; a style with short, apically notched branches; helically rotated stamens; and globose capsules with one or two large seeds per locule. The leaves are unusual in both their structure and phenology. They are heavily fibrous and have two large grooves running the length of each surface, between the central (pseudomidrib) and secondary veins. The leaves are proteranthous and are quite dry by anthesis, and their persistent bases accumulate for years in a thick fibrous mass around the base of the plants. Vegetative increase in the number of corms results in a clumped habit, and the plants sometimes grow in dense concentrations among low shrubs or on open slopes.

LEAF ANATOMY

The leaves of *Devia* are unusual in Ixioideae, although they conform to the basic isobilateral (equitant) type for the family. The central veins are heavily thickened, and deep grooves run the length of both surfaces between the pseudomidrib and secondary veins (Figs. 1K, 2A). There is also a pair of shallow grooves between the margin and secondary veins. A formal anatomical description follows.

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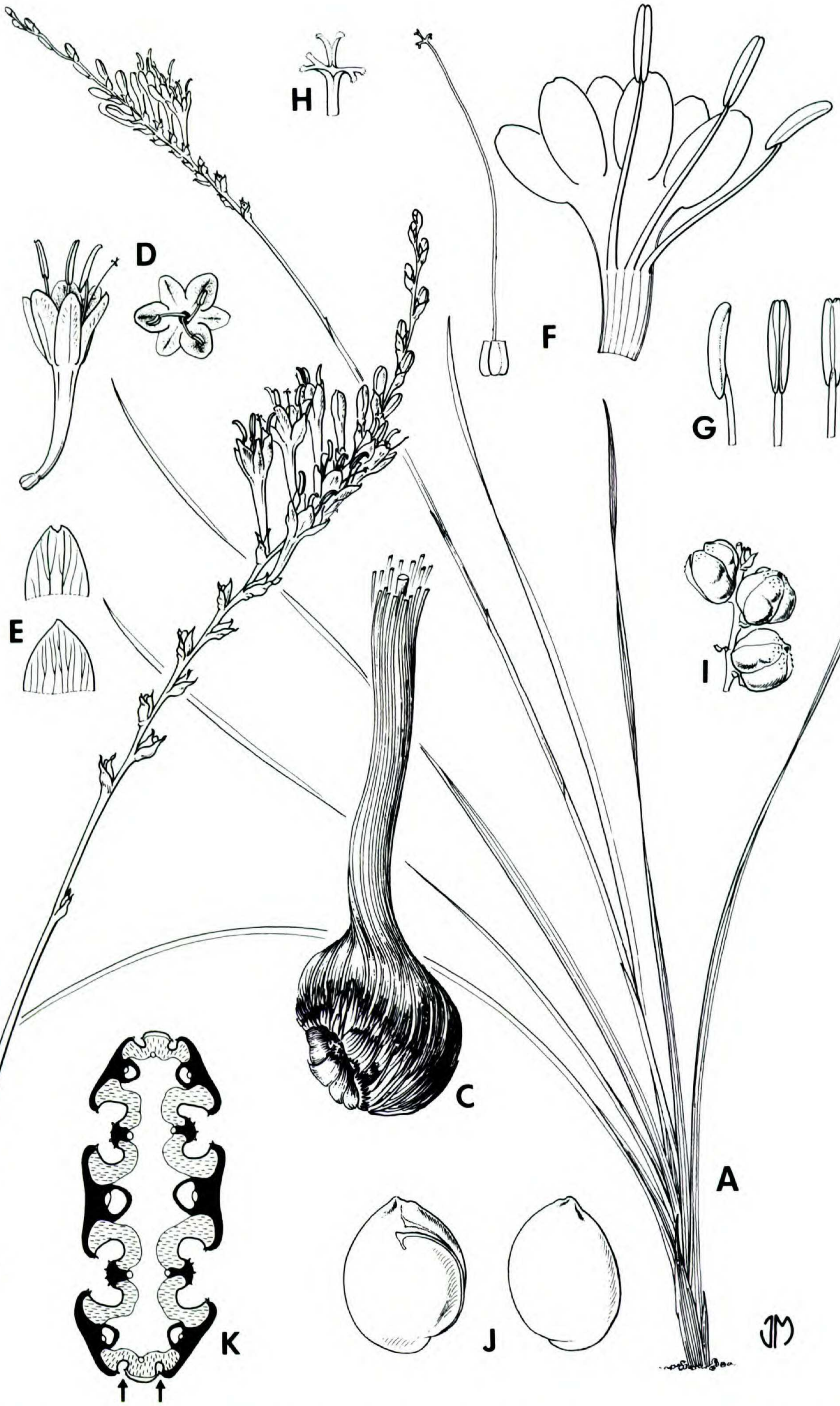

FIGURE 1. Habit, reproductive morphology, and leaf anatomy of *Devia xeromorpha* (*Snijman & Manning 1194*).—A. Habit, ×0.5.—B. Flowering spike, full size.—C. Corm, ×0.67.—D. Side and top view of flower, ×2.—

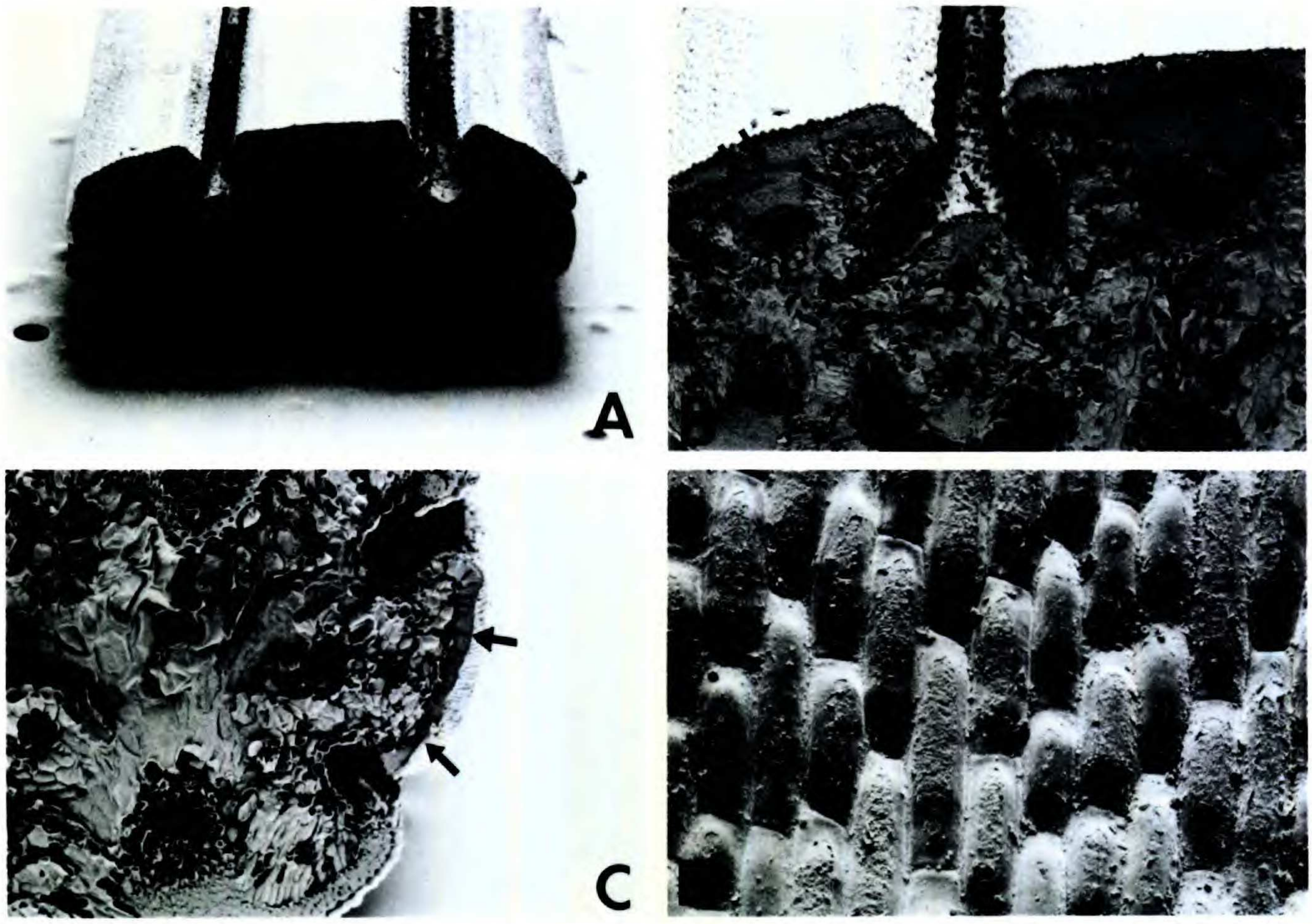

FIGURE 2. Scanning electron micrographs of critical-point dried leaves of *Devia xeromorpha* (*Snijman & Manning 1194*).—A. Leaf transection, ×25.—B. Laminar groove showing papillate ridge (single arrow) and vascular girders (double arrow) ×60.—C. Leaf margin showing thickened marginal palisade epidermis (arrowed), ×100.—D. Leaf surface, without stomata, showing elongate, epapillate epidermal cells.

LEAF TRANSVERSE SECTION

Blade isobilateral, monofacial, more or less oblong, with large paired, opposed grooves (sinuses) between the median and submarginal vein pairs (Fig. 2A–C), the sinuses with low median ridges, and with a pair of smaller shallow sinuses (Fig. 1K) without median ridges between the submarginal and marginal veins. *Cuticle* thick and domed over the cells, but thin within the sinuses. *Epidermis* cells wider than high, outer walls thickened and minutely denticulate in those along the ribs; cells 2–4 times longer than wide in surface view, without papillae (Fig. 2D); marginal cells palisade, heavily thickened (Fig. 2C), especially on the anticlinal walls; long papillae on the cells on the lips of the sinuses and on the ridges within the larger sinuses (Fig. 2B). *Stomata* restricted to the sinuses, sunken; guard cells with a slight outer cuticular lip, much smaller than the neighboring epidermal cells, which overarch them. *Vascular bundles* in two opposite rows, highly variable in size: primary vascular bundles median (forming the pseudomidrib); secondary bundles submarginal; tertiary bundles single below each margin and also in two opposed pairs, between the primary and secondary bundles (below the sinus ridges); 2–6 quarternary or minor bundles alternating with the others, and one centripetal to each marginal tertiary bundle. Xylem pole oriented to the interior except in the marginal tertiary bundle, which is bicollateral and oriented at right angles to the rest. The xylem and phloem poles in the primary and secondary bundles separated by two layers of parenchymatous cells. *Outer sheath* of bundle sheaths a continuous layer of sclerenchyma in primary and secondary bundles, extending as T-shaped girders to the epidermis, the crossbars three or four cells thick, reaching to the edges of the ridges; outer sheath also extending as a sclerenchymatous girder to the epidermis from the submarginal tertiary bundles (Fig. 2B); inner sheath sclerenchymatous as a complete sheath in primary

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E. Bracts, ×3.—F. Dissected flower with ovary and style, ×3.—G. Anthers, ×4.—H. Apex of style and style branches, ×7.—I. Capsules, full size.—J. Seeds, ×5.—K. Leaf transection (small submarginal sinuses arrowed), ×20.

and secondary bundles, forming bundle caps only in tertiary bundles. *Chlorenchyma* forming broad bands surrounding the sinuses, about eight rows deep, cells at most slightly elongated. *Central ground tissue* of large loosely packed parenchymatous cells, separated from chlorenchyma by an incomplete band of tanniniferous cells one or two cells wide; tanniferous cells also present sporadically in the chlorenchyma and outer sheath of marginal tertiary or quarternary vascular bundles.

Chromosome Cytology

A diploid chromosome number of $2n = 20$ was determined from mitosis in root tips harvested from sprouting corms. The root tips were pretreated in hydroxyquinoline and squashed after hydrolysis in FLP orcein following a technique outlined elsewhere (Goldblatt, 1980, 1981). The chromosomes are relatively small, 2–3 μm long, and range from acro- to submetacentric. Two slightly longer chromosome pairs can be distinguished, and a pair of small satellites is located on the short arm of one of the short chromosome pairs. The chromosomes are comparable in size to those of most genera of Ixioideae (Goldblatt, 1971). The karyotype matches closely those described for *Ixia* and *Dierama* ($x = 10$) in number and appearance of the chromosomes and with *Tritonia* and *Crocosmia* ($x = 11$) in general appearance (Goldblatt, 1971; de Vos, 1982a).

Relationships

The affinities of *Devia* are most likely with *Tritonia*, *Crocosmia*, and *Chasmanthe* (Ixieae–Tritoniinae sensu Goldblatt, 1971). *Devia* shares with most species of these genera a leaf structure in which the marginal epidermis is heavily thickened and not associated with submarginal sclerenchyma, while the laminar bundles have thick sclerenchyma caps often extending to the epidermis as girders (cf. de Vos, 1982b, 1984). This type of leaf anatomy is uncommon in Ixioideae but is also found in *Sparaxis*, *Synnotia*, *Freesia*, *Anomatheca*, *Tritoniopsis*, and *Anapalina* (unpublished).

Devia shares with *Crocosmia* and *Chasmanthe* rounded, hard-walled capsules containing few seeds, up to two per locule in *Devia*, and short, apically stigmatic and sometimes bifurcate style branches; and with *Crocosmia* alone, a persistent corm. *Tritonia* has many-seeded capsules, smaller and usually angular seeds, and typically obovoid capsules. *Devia* differs from both *Crocosmia* and *Chasmanthe* in several significant features. The leaves of *Devia* are unique in Tritoniinae in having paired longitudinal grooves, although this is a common xeromorphic feature of several genera of other subtribes of Ixioideae (e.g., *Gladiolus* spp., *Geissorhiza* spp., and most notably, *Romulea*). The flowers are actinomorphic but with spirally rotated stamens and an eccentric style. Species of *Crocosmia* and *Chasmanthe* (de Vos, 1984, 1985) are mesomorphic and have broad, soft-textured leaves, either plane or plicate, and with the exception of *Crocosmia aurea* Planchon, zygomorphic flowers. In *Crocosmia* and *Chasmanthe* but not *Tritonia* the pseudomidrib consists of several pairs of vascular bundles (de Vos, 1984, 1985). Perianth color in *Crocosmia* and *Chasmanthe* is orange to red (yellow in one variant of *Chasmanthe floribunda* (Salisb.) N.E.Br.), which also contrasts with the dusty pink perianth of *Devia*. The stamens in *Crocosmia* and *Chasmanthe* are never spirally rotated, but are either unilateral and arched below the upper tepal in zygomorphic-flowered species or straight and surrounding the central style in actinomorphic-flowered *Crocosmia aurea*.

The diploid chromosome number in *Devia*, $2n = 20$, corresponds with that of *Chasmanthe* ($x = 10$) but not with *Crocosmia* ($x = 11$) (Goldblatt, 1971; de Vos, 1984).

Devia is probably most closely allied to *Crocosmia*, yet in addition to the differences discussed above, the seeds of *Crocosmia* have a thick hydrophilic coat (possibly an adaptation for bird dispersal) that becomes loose on dehydration and then can be abraded easily (de Vos, 1982b). The seed coat of *Devia* appears to be of the basic type for Iridaceae, having a brown, microreticulate outer surface.

Although some of the differences between *Devia* and *Crocosmia* reflect xeromorphic adaptations in the former (persistent tunics, proteranthous and peculiar fibrotic leaves), the genus appears to have followed an independent evolutionary pathway and become specialized in the structure of the leaf and orientation of the stamens and style.

Systematics

Devia xeromorpha Goldbl. & Manning, gen. et sp. nov. TYPE: South Africa. Cape: Roggeveld Escarpment, farm Vierfontein, NW of Sutherland, rocky loam in renosterveld, *Snijman & Manning 1194* (holotype, NBG; isotypes, K, MO, PRE, S, STE, WAG). Figures 1–3.

Plantae 50–70 cm altae, cormo globoso 2–2.7 cm diam., persistentis, tunicis fibrosis, foliis siccis sub anthesi linearibus 35–45 cm longis 2.5 mm latis, inflorescentia

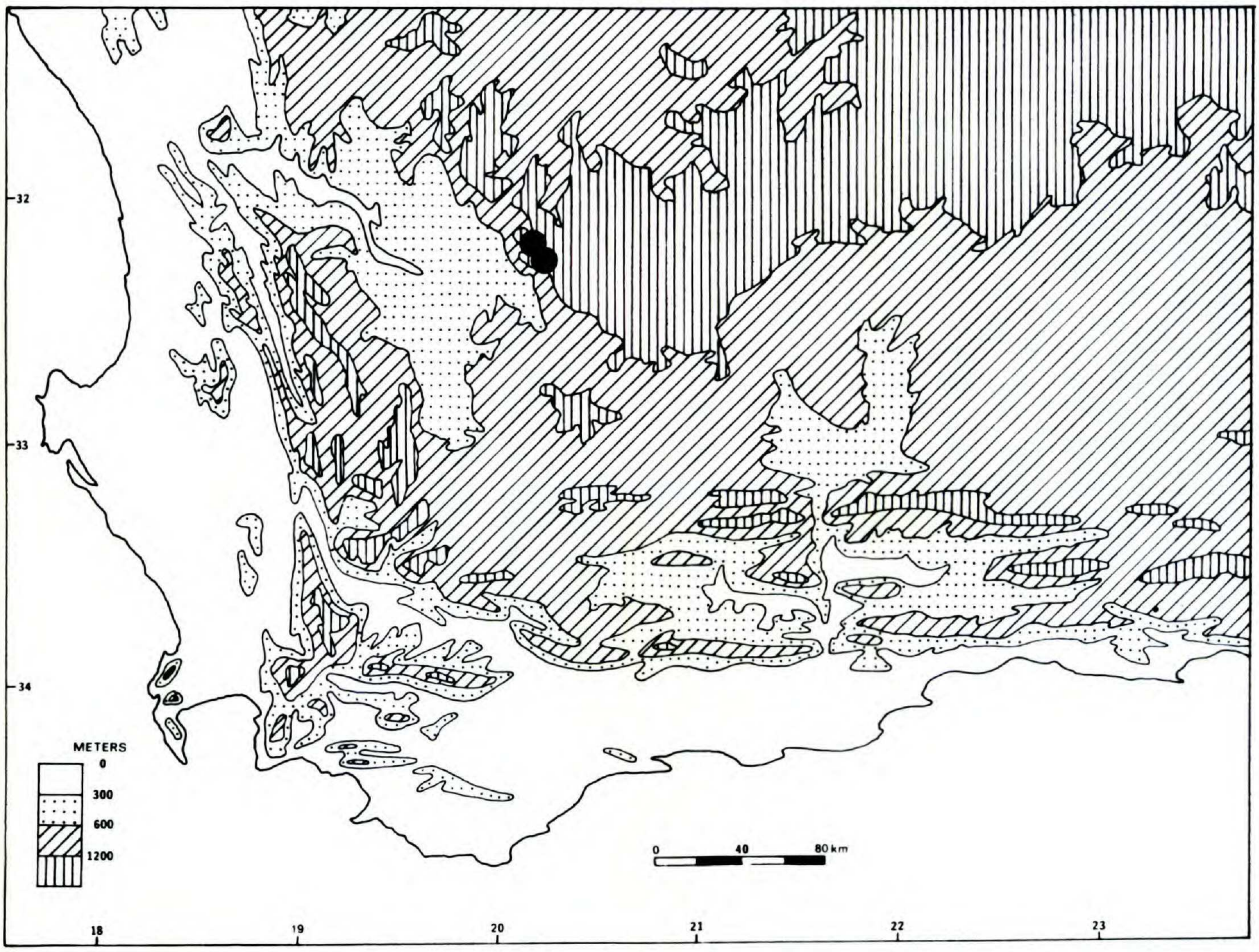

FIGURE 3. Southwest portion of southern Africa showing the distribution of *Devia xeromorpha*.

spica 18–26 florum secunda, floribus actinomorphibus roseo-bubalinis, tubo anguste infundibuliformis ca. 9 mm longo, tepalis ovatis ca. 6 mm longis, staminibus helice rotatis, stylo eccentricis, ramis ad apicem furcatis, capsulis globoso-trigonis, seminibus (0)1–2 per loculis, 2–3 angulatis, 3.5–4.5 mm longis.

Plants 50–70 cm high, growing in dense tufts. *Corm* depressed-globose, 5–6 internodes long, 2–2.7 cm diam., surface and inner tissue bright orange, persisting for several years, thus several corms lying above one another; tunics coarsely fibrous, persisting for several years and forming a thick neck around the base. *Cataphylls* 2, cartilaginous, pale or becoming dry and brown, especially above the ground, the inner largest and reaching 2–4 cm above the ground, sheathing the leaves initially, later decaying. *Leaves* dry at anthesis, usually 6, linear, 35–45 cm long, 2.5 mm wide, tapering gradually to a pungent apex, narrowly oval in section with the central vein area heavily thickened, and with 2 narrow grooves running the length of each surface. *Stem* (0)1–3-branched, sheathed entirely by 5–6 imbricate bracts, these dry by anthesis. *Inflorescence* a spike, the main axis bearing 18–26 flowers, the lateral spikes with 5–10 flowers, secund, axes ascending; *bracts* paired and opposed, dry-membranous, 2.5–4 mm long, translucent at the edges, minutely brown-speckled toward the center and base, the outer bracts enclosing the inner ones and acute, the inner bracts about as long as the outer ones but forked apically. *Flowers* actinomorphic, dusty dull pink, odorless, the style eccentric; *perianth tube* narrowly funnel-shaped, ca. 9 mm long, the lower cylindric part 5–6 mm long, straight or curving upward; *tepals* ascending, ovate, ca. 6 mm long, ca. 3.5 mm wide. *Filaments* inserted at the base of the upper part of the tube, rotated counterclockwise the width of one tepal, ca. 9 mm long, thus reaching to the tepal apices; *anthers* opposite the inner tepals, longitudinally dehiscent, sub-basifixed, thecae separate in the lower quarter, linear, ca. 4 mm long, yellow. *Ovary* obovoid, ca. 1.8 mm long, *style* ca. 16 mm long, reaching to about mid anther level, branches ca. 0.5 mm long, bifid, stigmatic only at the apices. *Capsules* globose-trigonous, 5–6 mm high, 6–8 mm wide, cartilaginous, hard when dry, pale straw-colored, lightly verrucose toward the

apex; *seeds* (0)1–2 per locule, dark brown, 2–3-angled, surface microreticulate, 3.5–4.5 mm long, ca. 3 mm at the widest, funicle whitish, often persisting, lightly adhering to the raphe. *Chromosome number* $2n = 20$.

Flowering time. December and January.

Distribution and habitat. *Devia xeromorpha* is restricted to the highest parts of the Roggeveld Escarpment in the western Karoo (Fig. 3). Extensive populations occur northwest of Sutherland in the vicinity of Sneeukrans on several farms that extend along the steep escarpment edge. The elevation in this part of the escarpment is 4,800–5,600 ft. (1,100–1,300 m), and the area receives slightly higher precipitation than the surrounding, somewhat lower country. The escarpment extends for a considerable distance to the north, almost as far as Calvinia, and it seems likely that *Devia* may occur elsewhere along the escarpment in areas of higher elevation and precipitation, but it has yet to be recorded except close to Sneeukrans. The leaves emerge in March in early autumn and grow throughout the winter and spring, the wettest period in the Roggeveld. They begin to dry out in November and are usually dead at flowering time, which occurs in summer, normally the dry season here.

Several individuals of a small species of long-tongued fly in the Bombyliidae were observed visiting and probing the flowers of *Devia* in the mid-morning, and may be the pollinator.

Additional specimens examined. SOUTH AFRICA. CAPE: 32.20 (Sutherland) Uitkyk farm, Roggeveld NW of Sutherland (AD), *Goldblatt 6357* (MO); Sneeukrans, south of Voelfontein, ca. 4,500 ft., *Goldblatt 6343* (MO).

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