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# Systematics of the southern African genus *Ixia* (Iridaceae). 3. Sections *Hyalis* and *Morphixia*

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ABSTRACT

A revised classification is presented for *Ixia* L., a southern African genus restricted to the winter rainfall zone of the western part of the subcontinent, in which the four sections *Dichone* (Salisb. ex Baker) Goldblatt & J.C.Manning, *Hyalis* (Baker) Diels, *Ixia*, and *Morphixia* (Ker Gawl.) Pax are recognized and diagnosed. The circumscription of sect. *Hyalis* is emended to include both short- and long-tubed species, mostly with four or more leaves with the uppermost not sharply differentiated from the lower. This contrast with sect. *Morphixia*, also with short- and long-tubed species, in which the entirely sheathing uppermost leaf (rarely upper two leaves) is distinct from the lower two or rarely three leaves, which have well-developed blades. We revise these two sections, recognizing 18 species in sect. *Hyalis*, including the two new species, *I.* **linderi** and *I.* **recondita**, and recognizing 31 species in sect. *Morphixia*, including the 11 new species, *I.* **alata**, *I.* **cedarmontana**, *I.* **dolichosiphon**, *I.* **ecklonii**, *I.* **linearifolia**, *I.* **monticola** (previously included in *I. latifolia* var. *angustifolia*), *I.* **pavonia**, *I.* **parva** and *I.* **ramulosa** (raised from varietal rank as var. *parviflora* and var. *ramulosa* respectively of *I. latifolia*), *I.* **saundersiana** and *I.* **stenophylla** (previously *I. fucata* var. *filifolia*). We also provide a new name, *I.* **mollis** for the illegitimate homonym *I. flaccida*. Lastly, we transfer *I. purpureorosea* from sect. *Ixia* to sect. *Hyalis*. We recognize eight informal series, three in sect. *Hyalis* and five in sect. *Morphixia*. With these changes and additions the genus *Ixia* now comprises 78 species.

CONTENTS



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## INTRODUCTION

As circumscribed here, the southern African genus *Ixia* L. now comprises 78 species in the four sections *Dichone* (Salisb. ex Baker) Goldblatt & J.C.Manning, *Ixia*, *Hyalis* (Baker) Diels and *Morphixia* (Ker Gawl.) Pax. Sect. *Morphixia* has been the subject of taxonomic studies conducted over the past five years, resulting in the recognition of 11 new species and the reinstatement of one more (Goldblatt & Manning 2008a, b). In G.J. Lewis's (1962) monograph of *Ixia*, sects *Hyalis* and *Morphixia* included just 18 species. These, together with three species described before our study of the sections began (*I. pumilio*, *I. acaulis* and *I. aurea*), 13 new species described in this account, and the transfer of *I. purpureorosea* to sect. *Hyalis*, bring the total species of the two sections to 49. With the accounts of species of sects *Hyalis* and *Morphixia* scattered among several papers published from 1985 to 2008, it now seems useful to produce a summary account of these two sections.

We have also come to reconsider the infrageneric classification that we proposed in 1999 (Goldblatt & Manning 1999) and in which we recognized two subgenera: subgen. *Ixia* with sects *Dichone* and *Ixia*, and subgen. *Morphixia* with sects *Hyalis* and *Morphixia*. We present a revised infrageneric classification here, partly following Lewis (1962) in admitting four sections, *Dichone*, *Ixia*, *Hyalis* and *Morphixia*, but without division into subgenera. In this system the circumscription of sect. *Hyalis* is emended and no longer includes just long-tubed species.

### *Classification of* Ixia

Relationships within *Ixia* are difficult to gauge and in the absence of molecular studies we depend on traditional methods of morphological and anatomical comparison. As is often the case, the understanding of broad relationships is reflected in classification systems. While

we understand that morphology-based infrageneric classifications are provisional, they are always useful to some extent in grouping like species together. Lewis (1962) in her monograph of the genus recognized 44 species in two subgenera. Subgen. *Dichone* (Salisb. ex Baker) G.J.Lewis incorporated species that she transferred from *Tritonia* sect. *Dichone* and included nine species. The remaining 35 species constituted subgen. *Ixia*, in which Lewis recognized three sections: sect. *Ixia*, which included species of J.G. Baker's subgen. *Ixia* and *Eurydice* (Baker 1892, 1896); and sects *Hyalis* and *Morphixia*, which were virtually equivalent to Baker's subgen. *Hyalis* and *Morphixia*.

Lewis distinguished subgen. *Ixia* by the conduplicate, channelled style branches that are stigmatic in the distal part, combined with conventional linear to linear-oblong anthers with narrow thecae, both probably ancestral for Crocoideae and certainly for Ixieae Dumort. (1822) [the tribal name has priority over Croceae Dumort. (1829), the latter used by Goldblatt *et al*. 2006 in error]. In contrast, subgen. *Dichone* included species with involute style branches (thus cylindric and tubular) and consequently stigmatic only at the tips, and usually with what Lewis called subdidymous anthers, with short, broad thecae and a narrow connective. Whereas the style branches of her two subgenera are readily distinguished, the difference in the anthers is less obvious but nevertheless valid. Essentially, the anthers of *Dichone* have reduced, unusually short connectives, and in several species the anthers themselves are extremely short, thus broadly oblong to suborbicular.

Lewis's subdivision of subgen. *Ixia* into three sections reduced Baker's subgenera to sectional rank, not of course including subgen. *Eurydice* (which included only *I. monadelpha*). Lewis, thus reverted in part to the earlier classification of *Ixia* by Pax (1888) in the first edition of *Die natürlichen Pflanzenfamilien*, in which he subdivided *Ixia* (not then including subgen. *Dichone*) into sects *Ixia*, *Eurydice* and *Morphixia*. Bentham & Hooker's (1883) treatment of *Ixia*, however, appears to be the first to include an infrageneric classification of the genus. Not only did they reunite *Ixia* and *Morphixia* but categorically stated that they admit no sections, the distinctions among the species being too weak, although they recognized two series, *Ixia* (including sect. *Eurydice*) and *Morphixia* (the latter including the species of *Hyalis* as well).

Prior to 1883, *Ixia* had been reserved only for the species that we now consider members of Lewis's sect. *Ixia*. The remaining species (Lewis's *Hyalis* and *Morphixia*) had been segregated in the genus *Morphixia* by Ker Gawler (1827). Baker's subgen. *Hyalis* included long-tubed species now referred to four separate genera, *I. paniculata* and one species each of *Thereianthus* G.J.Lewis, *Tritonia* Ker Gawl. and *Tritoniopsis* L.Bolus. *Hyalis* as a genus (Salisbury 1812) was exactly equivalent to *Morphixia* (according to the species assigned to *Hyalis* by Salisbury), a fact noted by Bentham & Hooker, but is invalid in lacking a description. The name was subsequently validated by Baker but at subgeneric rank. Lewis (1962) effectively lectotypified sect. *Hyalis* by citing *I. paniculata* as the type and excluding from the genus the remaining species placed there by Baker.

Sect. (or subgen.) *Morphixia* included species with style branches and anthers of the subgen. *Ixia* type, but a short perianth tube, expanded distally (thus funnel-shaped), with decurrent filaments inserted at the junction of the narrow, lower part of the perianth tube with the wider, upper part. Sect. *Ixia* included species with a largely filiform tube (of the subgen. *Dichone* type), and filaments inserted at the top of the tube, not decurrent, and contiguous or even partly or fully united, thus occluding the mouth of the tube. The practical distinction is that the tube walls in the narrow part of the tube in sect. *Ixia* tightly sheath the style, effectively closing the tube, whereas in sect. *Morphixia*, the tube is hollow as the walls do not touch the style, and the tube contains nectar at the base. Nectar is rarely present in sect. *Ixia* and when it is, e.g. in *I. flexuosa*, it rises by capillary action to the mouth of the tube.

Lewis's remaining section, *Hyalis*, comprised species with an elongate and more or less cylindric or evenly flared perianth tube, usually exceeding 20 mm. We find her distinction between *Morphixia* (tube up to 20 mm long) and *Hyalis* (tube 20 mm long or longer) arbitrary, and Lewis herself noted that populations of *I. longituba* (sect. *Hyalis*) sometimes have a tube 15–18 mm long. We have encountered additional exceptions, notably in a plant allied to *I. paucifolia* which has a tubular perianth tube 15–18 mm long (22–34 mm in typical *I. pauciflora*). Moreover, sect. *Hyalis sensu* Lewis appears to us an artificial assemblage of species of two lineages: species allied to *I. paniculata* with an indeterminate number of leaves (at least four) and outer floral bracts with a single prominent vein and one prominent terminal tooth; and *I. pauciflora* and its allies, which always have with three leaves, two basal with well-developed blades and the upper leaf entirely sheathing, and outer floral bracts with three prominent veins and three subequal terminal teeth. These latter vegetative features exactly match most members of sect. *Morphixia*, including its type.

In our previous classification of the genus (Goldblatt & Manning 1999) we were influenced by the filiform nature of the perianth tube (the walls of which clasp the style) shared by sect. *Ixia* and subgen. *Dichone* to treat the two as sections of subgenus *Ixia*. The remaining species then fell in subgen. *Morphixia*. The latter, based on *Morphixia* Ker Gawl., is here lectotypified by *M. aulica* (Aiton) Ker Gawl. (now *I. latifolia*)—Lewis actually listed *I. latifolia* as the type, the current name for *M. aulica*, technically an error explained below. It is now clear that the development of the filiform perianth tube has occurred independently in several other genera of Crocoideae as part of pollination syndromes in which floral rewards have shifted from nectar to pollen (Goldblatt & Manning 2006). This floral morphology is therefore not necessarily an indicator of relationships.

During our examination of *Ixia* for this revision we have found that the supposed floral distinction between subgenera *Ixia* and *Morphixia* to be weak. Several species assigned to sect. or subgen. *Morphixia*, notably *I. odorata*, *I. orientalis* and *I. tenuifolia* have the lower part of the perianth tube ± filiform, and the shorter upper part expanded, and in practice they cannot be easily distinguished from *I. flexuosa* of subgen./sect. *Ixia*. The distinction between *I. flexuosa* and *I. orientalis* is especially

problematic, and rests on the insertion of the filaments and secondarily on the length of the perianth tube, a useful but not always reliable criterion. Both have scented, pink or white flowers, style branches dividing below or opposite the base of the anthers, and the upper part of the tube short and flared, and containing traces of sweet nectar. *Ixia purpureorosea*, included by Lewis in sect. *Ixia*, has a perianth tube like that of *I. tenuifolia*, filiform below but expanded in the upper third to quarter and containing nectar, and decurrent filaments: we transfer the species to sect. *Hyalis*.

A simple solution to this inconsistency would be to transfer species of *Morphixia* with a filiform perianth tube to subgen. *Ixia* but the difficulty associated with placing species in these two infrageneric taxa suggests that their subgeneric rank is not merited and that these two taxa are better treated as sections. Sect. or subgen. *Dichone*, however, remains easy to distinguish and although we prefer to regard the taxon as a section, we note its isolation in tribe Ixieae in both anther and style branch characters. *Dichone* does share with *Ixia* a basic chromosome number of $x = 10$ (*Tritonia*, in which *Dichone* was included by Baker, has $x = 11$), transparent to translucent floral bracts, usually the outer with three but sometimes just a single prominent vein and associated three-toothed or one-toothed apices, the inner bract with two prominent veins and two-toothed. Pollen grains examined to date (Goldblatt *et al*. 1991) also show that both subgenera *Dichone* and *Ixia* have a single-banded operculum, in contrast to the two-banded operculum in other genera of subfamily Crocoideae, which is the ancestral condition. Leaf anatomy of both taxa also shows leaf margins with undifferentiated epidermal cells and a subepidermal strand of sclerenchyma (De Vos 1982; Rudall & Goldblatt 1991), apparent reversals to the ancestral state for Crocoideae. As we noted above, however, the ancestral leaf margin condition for Crocoideae is a subepidermal strand of sclerenchyma associated with a marginal vein. The latter, not present in *Ixia*, renders the leaf margin condition in the genus unique in Ixieae but not in Crocoideae—*Melasphaerula* (Gladioleae) has anatomically similar leaf margins (Rudall 1995).

We propose the following infrageneric taxonomy in which we recognize four sections:

**Ixia** sect. **Dichone** *(Salisb. ex Baker) Goldblatt & J.C.Manning* in Bothalia 29: 63 (1999).

Vegetatively identical to sect. *Ixia*, but flowers with a filiform perianth tube, the tube usually relatively short; anthers short, oblong to suborbicular, usually so-called subdidymous; style branches filiform-tubular and involute, thus stigmatic only at apices. The stamens are unilateral and reclinate in some species and the anthers are then horizontal to pendent; in a few species the anthers are incompletely dehiscent, opening from the base. Flowers are usually shades of pink (rarely white), but blue-mauve in *I. brevituba.* The subgenus currently has 10 species (Lewis 1962; Goldblatt & Snijman 1985; Manning & Goldblatt 2006) but several more await formal publication. No infrasectional classification has been proposed.

**Ixia** sect. **Ixia**

Flowers with a filiform perianth tube, usually well developed and sometimes elongate; anthers linear, dehiscent along their entire length; style branches narrowly channelled (Lewis 1962, described the style branches as conduplicate, but they are not folded together, but rather form a narrow channel) and stigmatic along the margins, sometimes only toward the tips. The stamens are always symmetrically arranged with the filaments inserted at the base of the tepals and not decurrent. Leaf number is indeterminate, but usually at least four and up to 10. The upper leaves decrease in size progressively above, becoming partly to largely sheathing, but lack a sharp distinction between basal foliage and upper sheathing leaves. Flowers are usually unscented and often brightly coloured and frequently have a dark central mark, either restricted to the tepal bases or including the filaments and sometimes the anthers and style branches. Nineteen species are currently recognized.

**Ixia** sect. **Morphixia** *(Ker Gawl.) Pax* in Die natürlichen Pflanzenfamilien 2,5: 154 (1888).

Perianth tube hollow; filaments inserted within the tube and decurrent, not connivent at the base. The style branches are usually fairly short and recurved, but of the same type as in sect. *Ixia*. Although usually central, the stamens are occasionally unilateral (a feature not known to Lewis): horizontal in *Ixia pauciflora*, declinate in *I. reclinata* and ± arcuate in *I. stenophylla*. The tepals are seldom brightly coloured, more often being muted shades of blue-grey, mauve pink, or white and only rarely with weakly developed markings. Floral scent is common and usually reminiscent of rose to violet but *I. rivulicola* has a rich floral scent with notes of passion fruit and sweet pea. Nectar is always present in the base of the perianth tube, sometimes in substantial quantities. An important feature of the section is that leaf number is determinate, usually three, occasionally more, and the basal leaves with expanded blades are sharply distinct from the uppermost one or two, which are entirely sheathing. We recognize thirty-one species in the section.

**Ixia** sect. **Hyalis** *(Baker) Diels* in Engler & Prantl in Die natürlichen Pflanzenfamilien, edn 2, 15a: 486 (1930).

A residual group includes species with style and anthers of the sect. *Ixia* type; an indeterminate leaf number, the upper leaves weakly differentiated from the lower, and usually with free blades; and tubular or funnel-shaped perianth tube ranging from hollow throughout to filiform in the lower two thirds and expanded above (thus with decurrent filaments). Nectar is normally produced and the flowers are often scented (depending on the pollination system—those pollinated by long-proboscid flies are unscented). The outer bracts with usually only one prominent central vein are a feature of most species. The circumscription of sect. *Hyalis* adopted here thus differs from Lewis's in that it is not restricted to species with an elongate perianth tube although the type species, *Ixia paniculata*, has the longest tube in the genus. We recognize eighteen species here.

Within sects *Hyalis* and *Morphixia* we recognize eight informal clusters of species sharing one or more derived features, for convenience called series (Table 1). We believe that most of these are monophyletic but some may be paraphyletic. The species of sect. *Hyalis* are distributed among three separate series and those of sect. *Morphixia* among five.

TABLE 1.—Classification of sects *Hyalis* and *Morphixia* (total 49 *Ixia* species). New species are in bold type

1. Sect. *Hyalis* (18)
1.1. Series *Hyalis* (8)
*pumilio*
*leipoldtii*
*longituba*
*bellendenii*
*splendida*
***linderi***
*acaulis*
*paniculata*
1.2. Series *Fucatae* (4)
*cochlearis*
*fucata*
*stohriae*
***recondita***
1.3 Series *Angustisiphon* (6)
*orientalis*
*odorata*
*esterhuyseniae*
*aurea*
*tenuifolia*
*purpureorosea*
2. Sect. *Morphixia* (31)
2.1. Series *Morphixia* (8)
*divaricata*
***saundersiana***
*latifolia*
***monticola***
***parva***
***ramulosa***
***ecklonii***
*brunneobracteata*
2.2. Series *Brevitubae* (5)
*marginifolia*
***pavonia***
***linearifolia***
***alata***
*thomasiae*
2.3. Series *Paucifoliae* (4)
*paucifolia*
***dolichosiphon***
***cedarmontana***
***stenophylla***
2.4. Series *Rapunculoides* (9)
*rapunculoides*
*robusta*
*rivulicola*
*lacera*
***mollis***
*namaquana*
*oxalidiflora*
*sobolifera*
*contorta*
2.6. Series *Capillares* (5)
*capillaris*
*exiliflora*
*pauciflora*
*dieramoides*
*reclinata*

*Important taxonomic characters*

*Corms*: provide several valuable taxonomic characters. They are typically ± globose, but conical in *I. acaulis*. Apart from corm size, which is loosely correlated with plant size, corms vary notably in the position of cormlets (cormels). These propagules are usually sessile and located at the base of the main corm. The presence of slender, flattened stolons, each bearing a terminal cormlet, readily separate *Ixia oxalidiflora* from *I. namaquana* and *I. sobolifera* from several other species of the *I. rapunculoides* group and *I. brunneobracteata* from its close allies. *Ixia purpureorosea* and *I. paniculata* (series *Hyalis*) are the only other species in sects *Hyalis* and *Morphixa* that produce stolons. In sect. *Ixia* only *I. calendulacea* Goldblatt & J.C.Manning, *I. maculata* L. and *I. stolonifera* G.J.Lewis produce stolons. The distribution of this character then, appears to provide no indication of relationship, nor is it correlated with soil preference for it is present in species of sandy or clay habitats. Corm tunics, derived from the bases of cataphylls, range from coarsely to finely fibrous, the latter conspicuous in the *I. capillaris* group (series *Capillares*). Finely fibrous tunics combined with different flower colour and soil preference separate *I. cedarmontana* from the similarly long-tubed *I. paucifolia* in which it has until now been included. In the stoloniferous *I. oxalidiflora* and *I. sobolifera*, the tunics are softly papery rather than composed of a discrete network of fibres and they do not accumulate to any extent. The semi-aquatic *I. rivulicola* has thin, almost membranous tunics that do not persist, and *I. monticola* has dry, chestnut-brown, onion skin-like tunics that rarely accumulate from one season to the next.

*Flowering stem and branching pattern*: the stem is terete and comparatively thin, firm and wiry. It is usually branched and branching patterns are often distinctive. The flowering stem and spike are aerial, well developed and terete except in *Ixia acaulis*, in which the flowers are borne on an underground stem. During development of the capsules of this species the stem elongates so that the ripe seeds are displayed at ground level.

The branches of *Ixia contorta*, *I. parva* and some populations of *I. latifolia* are short and twisted, whereas in the closely related *I. divaricata*, the branches are straight, usually relatively long and the flowers are crowded distally. Particularly short, wiry branches (or branchlets) bearing just one to three flowers each characterize the *I. capillaris* group (series *Capillares*), series *Brevitubae* (*I. linearifolia*, *I. marginifolia, I. pavonia*) and a few species of other series, notably *I. namaquana*, *I. ramulosa* and several more species. In *I. ecklonii* the branches of the several specimens of the only known collection consistently have a single flower each.

The bracts and prophylls subtending the branches are sometimes distinctive and provide valuable taxonomic characters. They range from short and subacute, obtuse or truncate and 1–2 mm long (e.g, in *Ixia namaquana*, *I. rapunculoides* and *I. robusta* in series *Rapunculoides* and *I. latifolia* in series *Morphixia*), to attenuate and significantly longer, notably in series *Capillares*, a few species of series *Rapunculoides*, notably *I. oxalidiflora* and *I. sobolifera*, and are particularly pronounced in *I. lacerata* in which the long, thread-like apices of the bracts and prophylls are spreading to recurved, a feature that makes this species unmistakable. Care should be taken to note this feature, for in the absence of corms, it can be useful in separating otherwise similar species.

*Leaves*: the bladeless basal cataphylls provide few important characters but in a few species they persist as a collar of fibres around the base of the stem, a feature particularly well developed in *Ixia cochlearis* and *I. robusta*, but weakly expressed in *I. capillaris*, *I. pauciflora* and in some of the southern populations of *I. rapunculoides*. In most populations of *I. capillaris* and *I. pauciflora* the cataphylls are dry and a distinctive, chestnut-brown.

Foliage leaves range in number from several (4–10) in what we consider the less specialized sect. *Hyalis*, to just three, less often four in sect. *Morphixia* with the uppermost leaf sheathing the stem for virtually its entire length. The sharp distinction between the basal leaves with expanded blades and the entirely sheathing upper leaf or leaves is clearly derived. Particularly specialized are the narrow, linear leaf blades of series *Capillares*. When fresh, the blades in the series are leathery to almost fleshy and lack evident veins and margins, though these are visible as areas of paler green when held up to the light. The midvein is usually the only vein present and is always displaced to the adaxial side of

the blade. When dry, the veins and margins often appear raised due to the differential drying of the leaf tissue. *Ixia stenophylla* has superficially similar narrow leaves, but the midvein is ± central and prominently thickened and raised.

Plane leaf blades are almost universal, occasionally with moderately to heavily thickened margins, notably in *Ixia latifolia* and *I. robusta*. Two species, *I. alata* and *I. thomasiae* stand out in the genus in having winged leaf margins, a specialization not uncommon in some other genera of Crocoideae, especially *Geissorhiza* (Goldblatt 1985) and *Gladiolus* (Goldblatt & Manning 1998). In such leaves the margins are raised at right angles to the blade. The unusual, long, narrow leaves of *I. linearifolia* also stand out in their almost fleshy texture and prominently raised but thick, fleshy margins.

Leaves are usually narrowly sword-shaped to lanceolate and 4–15 mm wide. *Ixia latifolia*, *I. marginifolia* and *I. rapunculoides* typically have broad, falcate leaf blades, sometimes over 20 mm wide. Leaves are often weakly twisted above but strikingly so in *I. aurea.* The narrow, linear leaves of series *Capillares* are mostly 1.0–1.5 mm wide, and always less that 2 mm wide.

*Spike*: the number of flowers per spike is always variable, but a range is usually constant for a species. The main or terminal spike usually has more flowers than the branches. Particularly robust individuals, usually the result of a good growing season, always have more flowers per spike and confound the taxonomic utility of the character. Consistently few flowers per spike characterize *I. linearifolia, I. marginifolia*, *I. ramulosa*, all members of series *Capillares* and most species of series *Rapunculoides*. The several known specimens of *I. ecklonii* have a single-flowered main and lateral spikes.

Floral bracts are membranous and more or less translucent and have one or more prominent veins, often dark in colour. The outer bracts provide several taxonomic characters. They are most often three-veined and terminate in three subequal teeth or lobes. *Ixia lacerata* stands out in having bracts with five ± equal veins and five attenuate teeth. Most species of sect. *Hyalis* have outer bracts with a single prominent vein and with a single terminal tooth or lobe, or when 3-veined, the central tooth or lobe is more prominent than the laterals. *Ixia paniculata* has obscurely 3-dentate outer bracts with the central tooth vestigial and *I. splendida* and *I. linderi* have ± truncate outer bracts minutely serrate at the tips. Inner floral bracts are always 2-veined and forked at the tips.

*Flowers*: shape, always constant in a species, ranges from salver- to bell-shaped and flowers may be held vertically (i.e. erect), ascending (half nodding) or horizontally oriented (nodding). Species of series *Capillares* typically have nodding flowers as do *Ixia namaquana*, *I. rapunculoides*, *I. oxalidiflora* and several more of series *Rapunculoides*. *Ixia sobolifera* has nodding to ± pendent flowers. An important aspect of the flower is the perianth tube, which ranges from narrowly (most species of series *Hyalis*) to broadly funnel-shaped (series *Morphixia*, most species of series *Capillares*) or ± cylindric or gradually and uniformly flared from the base (e.g. series *Paucifoliae*, *Ixia ecklonii*, *I. longituba*, *I. paniculata*). The perianth is always radially symmetric with subequal tepals, those of the outer whorl slightly broader than those of the inner. The stamens are usually symmetrically arranged around the style, but are unilateral and declinate, with the anthers facing the dorsal tepal in *I. declinata* and at least some populations (possibly all, but this is impossible to determine from pressed specimens) of *I. fucata* and *I. pauciflora.*

Flowers are seldom brightly coloured, more often being muted shades of blue-grey, mauve-pink, or white and only rarely have weakly developed markings. *Ixia tenuifolia* stands out in its yellow to orange perianth often with a dark centre, *I. esterhuyseniae* and most populations of *I. odorata* in their uniformly yellow flowers, and *I. pumilio* in its attractive red perianth. Flowers of *I. leipoldtii* are unique in being pure white with deep purple markings on the lower parts of the tepals and those of *I. pavonia* in their dark red centre on a blue-mauve background.

Floral scent is common and usually reminiscent of rose to violet. Scent is sometimes quite strong, notably in *Ixia odorata* and *I. rivulicola* in which the rich floral scent has notes of passion fruit and pineapple. Flowers of *I. parva* have a strong scent of sweet peas, surprising in so small a bloom.

Shortly exserted filaments are most likely the ancestral condition for stamens, as for example in *Ixia capillaris*, but *I. latifolia* has filaments exserted up to 10 mm, rendering the anthers particularly prominent. We infer that this is a specialized state. All members of series *Rapunculoides* and scattered species of other sections (e.g. *I. dieramoides*, *I. leipoldtii*, *I. stohriae*) have the filaments and the bases of the anthers included in the perianth tube, an unusual specialization. The stamens are fully included in the tube in *I. linderi*, *I. oxalidiflora* and *I. recondita*, and usually so in *I. paniculata* and *I. splendida*. In the last-named two species the tips of the anthers often extend beyond the mouth of the tube and in *I. paniculata* the anthers are occasionally fully exserted.

The subglobose ovary itself offers no variation except size, and is not useful taxonomically. The point of division of the style is somewhat variable within species but nevertheless constitutes a useful character, as does length of the style branches. The style divides between the bases and apices of the filaments in *I. reclinata* and *I. odorata* but in other species, usually opposite the middle to upper third of the anthers, and in a few species it exceeds them. The direct contact between pollen in dehisced anthers and style branches, common in *Hyalis* and *Morphixia*, does not indicate autogamy: several species with flowers of this type that we have examined (*I. lacerata*, *I. namaquana*, *I. rapunculoides*, *I. sobolifera*) do not produce seeds with their own pollen and we infer that they are self-incompatible. Horn (1962) reported self-incompatibility in *I. odorata* but several species of sect. *Ixia* produced reduced amounts of seed if self-pollinated by hand.

*Fruit and seeds*: capsules and seeds show little variation in the few species in which they are known. In those in which fruits have been recorded, the capsule walls

are cartilaginous and smooth but show the outline of the seeds. Capsules are loculicidally dehiscent and the seeds are hard, smooth and shiny. Both the ovary and the capsule of *Ixia alata* and *I. thomasiae* of series *Brevitubae* have a conspicuously warty surface. An unusual feature of the seeds is exclusion of the vascular trace to the ovule from the seed body during development (Goldblatt & Manning 1995). The trace persists in the mature seed as a fine thread lying above the raphe. Such seeds are shared with the *Dierama–Duthieastrum–Sparaxis–Tritonia* clade of tribe Ixieae and are derived in Crocoideae (Goldblatt *et al*. 2006).

*Chromosome cytology*

The relatively few chromosome counts for *Ixia* (Table 2) consistently indicate a basic chromosome number of $n = 10$ (Goldblatt 1971; Goldblatt & Takei 1997). Just 16 species have been counted, but include at least two for each of the four sections of the genus. Sect. *Morphixia* is least sampled and we note that no species of the *I. capillaris* or *I. paucifolia* groups of the section have been counted. The karyotype is uniform across the species examined; *I. orientalis* stands out in being tetraploid, $2n = 40$ and a diploid number of $2n = \pm 42$ [probably $2n = 40$] was noted on a collection of *I. calendulacea*. There are thus single counts for these two relatively widespread species, making it premature to conclude that either is uniformly tetraploid.

The basic karyotype for *Ixia*, described by Goldblatt (1971), consists of two substantially larger, acrocentric chromosome pairs, 3.0–3.3 µm long, one of which bears a terminal satellite in some species. The remaining eight pairs are ± 1.5–2.5 µm long and range from acrocentric to submetacentric. Using a different method for chromosome preparation, Goldblatt & Manning (1993) reported a similar karyotype but smaller chromosomes in *I. acaulis*. Species of *Dierama* have a virtually identical karyotype, which has been considered independent evidence for the belief that the two genera are immediately allied. *Sparaxis* (including *Synnotia*) also has $x = 10$ and a comparable karyotype but, as noted by Goldblatt (1971), the chromosome complement is slightly smaller and the distinction between large and small chromosome pairs less pronounced. Among closely related genera, *Duthieastrum* also has $x = 10$ (De Vos 1974), but *Tritonia* has $x = 11$, and most species are diploid with $2n = 22$; three species, however, have $2n = 20$, presumably a derived number.

TABLE 2.—Chromosome counts in *Ixia*, with taxonomy corrected. In addition, a collection of *I. calendulacea* (*De Wet 00903* PRE) has an annotation indicating a diploid chromosome number of $2n = 42$ [probably $2n = 40$], which is tetraploid and is included below

| Species | Diploid chromosome no. $2n$ | Reference |
|---|---|---|
| Sect. ***Hyalis*** | | |
| *acaulis* | 20 | Goldblatt & Manning 1993 |
| *longituba* | 20 | Goldblatt 1971 |
| *odorata* | 20 | Goldblatt 1971 |
| *orientalis* | 40 | Goldblatt 1971 |
| *paniculata* | 20 | Goldblatt & Takei 1997 |
| Sect. ***Morphixia*** | | |
| *ramulosa* | 20 | Goldblatt & Takei 1997 (as *I. latifolia* var. *ramulosa*) |
| *rapunculoides* | 20 | Goldblatt 1971 |
| Sect. ***Ixia*** | | |
| *calendulacea* | ± 42 | De Wet, unpublished |
| *campanulata* | 20 | Goldblatt 1971 |
| *dubia* | 20 | Goldblatt 1971 |
| *flexuosa* | 20 | Goldblatt 1971 |
| *polystachya* | 20 | Goldblatt 1971 |
| *viridiflora* | 20 | Goldblatt 1971 |
| Sect. ***Dichone*** | | |
| *trifolia* | 20 | Goldblatt & Takei 1997 (as *I. brevituba*) |
| *erubescens* | 20 | Goldblatt 1971 |
| *scillaris* | 20 | Goldblatt 1971 |

*Pollination*

The hollow-tubed flowers of sects *Hyalis* and *Morphixia*, with the exception of *Ixia pavonia*, contain nectar, secreted from septal nectaries through minute pores at the top of the ovary directly into the perianth tube. Nectar is most likely the main reward for pollinating insects, particularly in species in which the anthers are held within the perianth tube or at its mouth, largely concealing the pollen. Pollen on the prominently displayed anthers of *I. latifolia* and its allies, as well as *I. marginifolia*, most likely serve as a pollinator attractant, and pollen is the reward in these species. Nectar is sucrose-dominant in all species examined for the nectar chemistry (Table 3, from Goldblatt *et al*. 2000). Nectar concentrations range from mean values of 23.7 % to 29 % sucrose equivalents except in *I. lacerata*, in which we recorded 43.2 %, an unusually high concentration.

Diurnal, long-proboscid, nectarivorous insects are the recorded pollinators of most species of subgen. *Morphixia* (Goldblatt *et al*. 2000). Pollinators include large-bodied, long-tongued anthophorine bees (Apidae: Anthophorinae) and the native *Apis mellifera* for species with perianth tubes 5–15 mm long. Anthophorine bees visiting *I. capillaris*, *I. latifolia*, *I. odorata*, *I. rapunculoides* and *I. thomasiae* include *Anthophora diversipes*, *A. schulzei*, *Amegilla spilostoma* and *Pachymelus peringueyi.* Observations we report here for *I. divaricata* and *I. rivulicola* expand this pattern. *Ixia rivulicola* is visited by a wide range of female and male bees, including *Amegilla spilostoma* (Apidae), *Melitta capensis* (Melittidae), *Megachile* sp. (Megachilidae), *Plesanthidium calvini* and *Patellapis* sp. (both Halictidae), as well as *Apis mellifera* workers. *Ixia divaricata* exhibits a similar pattern: *Lasioglossum* sp. (Halictidae), *Anthophora diversipes* and *Amegilla spilostoma* have been captured on flowers of this species. The range of long- and short-tongued bees indicates that nectar, as well as pollen, are rewards to floral visitors.

Little is known about pollination by empidid flies (Empididae) but they are reported to be effective pollinators of some northern hemisphere plant species (Proctor *et al*. 1996). We have been struck repeatedly by the presence of these small insects, ± 3 mm long, in flowers of *Ixia rapunculoides*. The flies frequently carried pollen on the frons and dorsal part of the head and thorax, which passively accumulates as they crawl into the nar-

TABLE 3.—Nectar properties of selected *Ixia* flowers. Nectar sugars analysed by B.-E. van Wyk. Sample size indicates no. different individuals examined at study site (data from Goldblatt *et al*. 2000)

| Species | Sample size | Nectar vol. µl (n) | % different sugars | | | Mean suc/glu | |
|---|---|---|---|---|---|---|---|
| | | | % sugar (±SD) | fru | glu | suc | + fru (*n*) |
| Sect. *Hyalis* | | | | | | | |
| leipoldtii | | – | – | 29 | 30 | 41 | 0.69 (1) |
| *longituba* | | | | | | | |
| subsp. *macrosiphon* | 6 | 2.0–2.4 | 23.7(3.3) | 14–19 | 12–22 | 60–75 | 1.94 (3) |
| subsp. *longituba* | 2 | 1.1–2.8 | 27.0(1.4) | 23–31 | 24–27 | 45–50 | 0.90 (2) |
| *paniculata* | 8 | 3.9–5.7 | 26.1(2.7) | 16–19 | 17–23 | 58–66 | 1.66 (3) |
| *stohriae* | 5 | 0.4–0.9 | 26.2(1.7) | – | – | – | – |
| Sect. *Morphixia* | | | | | | | |
| *lacerata* | 5 | 1.8–2.6 | 43.2(4.6) | – | – | – | – |
| *latifolia* | 5 | 1.7–2.9 | 27.6(2.5) | – | – | – | – |
| *paucifolia* | 5 | 1.1–1.6 | 29.8(1.8) | 17–21 | 20–25 | 54–63 | 1.41 (2) |
| *rapunculoides* | 3 | 1.1–1.5 | 28.0(1.0) | 27–28 | 29–37 | 35–44 | 0.69 (3) |

fru, fructose; glu, glucose; suc, sucrose

row part of the tube in which the anthers are held. For the empidids to be significant pollinators they would need to move from flowers of one plant to another and we have not recorded information on this aspect of their behaviour. As noted above we have often seen large anthophorine bees also visiting *I. rapunculoides* flowers and in the past we considered the species adapted for pollination by large-bodied bees (Goldblatt *et al*. 2000 and unpublished data).

Long-tubed species, including *Ixia dolichosiphon, I. longituba* and *I. paucifolia*, are pollinated by long-proboscid horseflies (Tabanidae), *Philoliche gulosa* and *P. rostrata* (Goldblatt *et al*. 2000), and a third long-tubed species, *I. paniculata*, by *Moegistorhynchus longirostris* (Nemestrinidae) (Manning & Goldblatt 1997). *Ixia paniculata* has a perianth tube as long as 75 mm and its pollinator has a proboscis almost as long. The southern and shorter-tubed populations of *I. paniculata* are probably pollinated by *Philoliche rostrata*, the most common long-proboscid fly in the southern Cape Peninsula and nearby. Other likely long-proboscid fly-pollinated species are *I. bellendenii* and *I. splendida*.

Exceptional in *Ixia, I. cedarmontana* has white or pale pink, long-tubed flowers with a carnation-like scent that is particularly strong in the evening. The flowers remain open and scented thoughout the night. We infer moth pollination for this species.

Another exception, *Ixia acaulis*, which although acaulescent, also has a long perianth tube, is evidently pollinated by the large butterfly, *Cynthia cardui*. These butterflies have been noted by N. Helme (pers. comm. 2010) actively visiting the small yellow flowers of this winter-blooming species.

Other exceptions to the general pattern are *Ixia aurea* and *I. tenuifolia* (both sect. *Hyalis*), which have large, bright yellow (or orange in the latter) flowers. Both are visited by hopliine beetles and nectarivorous tabanid flies with short probosces; *Mesomyia edentula* in the former; and *Philoliche atricornis* in the latter (Goldblatt *et al*. 2000). The only pollinating insect species recorded on *I. esterhuyseniae* is also *P. atricornis*. Unique in sect. *Morphixia*, *I. pavonia* has dark purple-black filaments and style, and a perianth with an almost black centre edged with bright red, stereotypical adaptations for pollination by hopliine scarabs. One species of the hopliine genus *Kubousa* has been noted visiting flowers of the species (N. Helme pers. comm. 2008); the bodies of several of the dark-coloured beetles visibly carried pollen.

Lastly, *Ixia orientalis* has been reported as being visited by the butterfly *Colias electo* (Goldblatt *et al*. 2000) but subsequent observations, reported here, show that it is also visited by hopliines or a combination of hopliines and large anthophorid bees. *Ixia orientalis* is evidently a generalist, but *I. aurea* and *I. tenuifolia* fit the criteria of a bimodal pollination system (Manning & Goldblatt 2005). Bright yellow to orange perianth colour, and in *I. tenuifolia* a dark central eye, are characteristics of hopliine pollination (Goldblatt *et al*. 1998), but presence of nectar signifies a nectarivorous pollinator as well, in this case species of Tabanidae. We have also noted *Apis mellifera* visiting flowers of *I. marginifolia* to forage for pollen, but these bees also probe the short tube (2–4 mm long) for nectar, traces of which are produced. Both large anthophorine bees, *Anthophora* species, and the fly *Prosoeca* sp. (Goldblatt & Manning 2007, 2008a) visit flowers of *Ixia lacerata*, which has a perianth tube 10–12 mm long. Both bees and flies carry pollen of the species after visiting flowers and thus seem legitimate pollinators. This in turn suggests the species has a functionally bimodal pollination system derived from the ancestral bee pollination system of the series.

### *Relationships of* Ixia

A member of Crocoideae, largest of seven subfamilies of the Iridaceae (Goldblatt *et al*. 2008), *Ixia* is currently assigned to Ixieae, a tribe of 14 genera, mostly of southern Africa (Goldblatt *et al*. 2006, as Croceae). Notably *Crocus* L. is restricted to Eurasia and North Africa and *Romulea* Maratti extends through highland tropical Africa to Eurasia. Within the tribe the immediate relationships of *Ixia* are with the southern African genera *Dierama* K.Koch, *Tritonia* and perhaps *Sparaxis* Ker. Gawl. (Lewis 1954, 1962; Hilliard *et al*. 1991; Goldblatt *et al*. 2006). These genera, together with

*Duthieastrum*, share derived membranous to dry floral bracts and hard shiny seeds with excluded ovular vasculature, but only *Dierama* and *Ixia* (and the acaulescent *Duthieastrum*) have radially symmetric flowers, a specialized condition in this lineage of Ixieae (a few species of *Ixia* have independently evolved zygomorphic flowers, then usually with declinate stamens).

Among these genera only *Dierama*, *Ixia* and *Tritonia delpierrei* and *T. marlothii* have leaves with a strand of submarginal sclerenchyma (possibly a reversal to an ancestral state for the subfamily), but except in *Ixia* the strand is associated with a marginal vein rendering the condition in *Ixia* unique. In contrast, *Duthieastrum*, *Sparaxis* and all but the two species of *Tritonia* mentioned above have leaves without submarginal sclerenchyma or a marginal vein and instead have derived columnar marginal epidermal cells with thickened anticlinal walls. The condition in *Ixia* series *Capillares* (Goldblatt & Manning 2008b), in which the marginal sclerenchyma strand is not associated with a marginal vein (in fact there is no marginal vein in the upper part of the leaf) is an apparently specialized, secondary condition.

Chromosome number in *Ixia*, $x = 10$, is shared with *Dierama*, *Duthieastrum* and *Sparaxis* but *Tritonia* has $x = 11$. Lewis (1954, 1962) and Hilliard *et al*. (1991) regarded *Dierama* as most closely related to *Ixia* on the grounds of similar floral morphology (assuming the ancestral flower in the genus was of the *Morphixia* type with a funnel-shaped tube and decurrent stamens) and the characteristic thin, wiry flowering stem, often nodding above, again with the unstated assumption that the habit of the *Morphixia* group is ancestral. As pointed out by Hilliard *et al*. (1991) the bracts of *Dierama* are quite different from those of *Ixia*, being dry and without the discrete veins of most species of *Ixia*.

Preliminary molecular studies, using just one species each of the genera of Crocoideae, however, show *Ixia* to be immediately related to *Tritonia* (Reeves *et al*. 2001; Goldblatt *et al*. 2006). This pair constitutes a clade sister to *Dierama* (bootstrap support 81 %) in turn related to *Sparaxis* plus *Duthieastrum* (BS 63 %). The *Sparaxis*–*Duthieastrum* clade has no bootstrap support. This topology is difficult to reconcile with morphology and cytology: *Tritonia* and *Ixia* have similar (and evidently derived) floral bracts; *Dierama* and *Ixia* have radially symmetric flowers (most likely derived) and share a chromosome number (also probably derived) different from that in *Tritonia*; and the leaf margin anatomy of *Ixia* and *Dierama* is similar and unlike that in *Tritonia*. Additional molecular studies of this alliance and using species of all the major morphological types are needed to better understand their relationships and evolution.

## SYSTEMATICS

For the sake of brevity we do not mention capsules and seeds in descriptions unless they are known. In most species they are not. Currently we believe that capsules and seeds are remarkably uniform across the genus, vary only slightly in dimensions and have no features of taxonomic significance, except for the warty capsule walls of *Ixia alata* and *I. thomasiae*.

Specimens cited for each species are a selected sample covering its geographical range. For new or rare species we cite all specimens that we examined.

## KEY TO SECTIONS AND SPECIES

*Notes*: care must be taken in measuring floral parts of preserved specimens: depending on the method of drying, the perianth can shrink as much as 30 %. Presence of stolons is difficult to establish as they are often left behind during collection unless corms are removed from the ground with particular care.

Measure filaments from point of insertion on perianth tube to base of anther, not to point of insertion above the anther base. For bracts measure those in the middle portion of the main spike (those at the base and near the apex of the spike are often longer or shorter than normal).

### Key to sections of *Ixia*

1a Style branches tubular with margins involute and stigmatic surfaces confined to tips of style branches; perianth tube filiform throughout and blocked by style; anthers ovoid and short, sometimes dehiscing incompletely from base; flowers pink to mauve, pale violet (or white) . . . . . sect. *Dichone*

1b Style branches channelled with margins conduplicate below and stigmatic surfaces extending along distal half of style branches; perianth tube either filiform throughout and blocked by style or funnel-shaped to cylindric and hollow above or throughout; anthers ± linear, dehiscing completely; flowers variously coloured:

2a Perianth tube filiform throughout with filaments inserted at mouth of tube; filament bases often expanded (tepals sometimes connate basally for a short distance); perianth brightly coloured, usually with dark centre . . . . . sect. *Ixia*

2b Perianth tube funnel-shaped to cylindric and hollow throughout or filiform in lower part with filaments inserted within tube and decurrent; filament bases not expanded; perianth usually shades of pink or pale blue to white, occasionally brilliantly coloured and rarely with dark centre:

3a Leaves 4–6(–10), with upper leaves partly sheathing stem and not sharply differentiated from lower leaves; plants sometimes acaulescent; perianth tube sometimes blocked by style in lower part . . . . . 1. sect. *Hyalis*

3b Leaves mostly 3 (sometimes 4 or 5, rarely only 2), with upper 1 (or 2) leaves almost or entirely sheathing and usually clearly differentiated from lower leaves; plants never acaulescent; perianth tube always hollow to base . . . . . 2. sect. *Morphixia*

### Key to species of sect. *Hyalis*

1a Plants acaulescent with flowers borne at ground level; leaves falcate or prostrate, without evident midrib; flowers bright yellow, salver-shaped with tube 15–20 mm long . . . . . 7. *I. acaulis*

1b Plants with an aerial stem; leaves falcate to upright, usually with evident midrib; flowers usually shades of white or pink to orange, rarely red or yellow but then not as above:

2a Floral bracts with 3(–5) subequal major veins and ± equally 3-lobed to 3-dentate:

3a Anthers and style branches included in lower half of perianth tube; style dividing below or opposite filament bases . . . . . 12. *I. recondita*
3b Anthers and style branches exserted or partly included, tips of anthers usually emerging from tube or at least reaching beyond upper third of tube; style dividing above filament bases:
4a Corm tunics extending upward in a short collar of fibres around base; leaves ± linear and firm-textured; bracts 4–5 mm long; filaments exserted ± 6 mm from tube . . . . . 9. *I. cochlearis*
4b Corm tunics not extending upward in a short collar of fibres around base; leaves sublinear to sword-shaped and relatively soft-textured; bracts 5–8 mm long; filaments exserted up to 5 mm or included:
5a Filaments exserted 2–5 mm from tube; style branches 2.0–2.5 mm long; flowers white with red reverse or pink; stamens (?always) unilateral . . . . . 10. *I. fucata*
5b Filaments included or exserted up to 1 mm; style branches 1.0–2.3 mm long; flowers pink; stamens symmetrically disposed . . . . . 11. *I. stohriae*
2b Floral bracts with one major vein (or no dark veins evident) and either with one prominent lobe or tooth, or 3-toothed with central tooth smaller than lateral teeth, or ± truncate with apex minutely serrated:
6a Perianth tube ± cylindric, usually elongate, 12–70 mm long:
7a Anthers fully exserted from tube:
8a Perianth tube 12–33(–35) mm long; flowers pink (rarely white sports present in pink-flowered populations); filaments 4–9 mm long, exserted up to 5 mm from tube . . . . . 3. *I. longituba*
8b Perianth tube 35–40 mm long; flowers beige, flushed pink outside; filaments ± 15 mm long, exserted 10–11 mm from tube . . . . . 4. *I. bellendenii*
7b Anthers fully to partly included in tube:
9a Anthers dark purple-black (rarely pale yellow); perianth tube 35–70 mm long; style dividing between lower third and apex of anthers, rarely shortly beyond anther tips . . . . . 8. *I. paniculata*
9b Anthers yellow to white; perianth tube 18–30 mm long; style dividing below or opposite lower third of anthers:
10a Perianth pink to brick-red; perianth tube 27–30 mm long; tepals 15–18 mm long; anthers 5–6 mm long . . . . . 5. *I. splendida*
10b Perianth white or flushed pale pink; perianth tube 18–20 mm long; tepals ± 10 mm long; anthers ± 4 mm long . . . . . 6. *I. linderi*
6b Perianth tube widely to narrowly funnel-shaped, narrow and cylindric below, obviously widening at ± middle or upper third into a flared upper part:
11a Filaments and bases of anthers included in perianth tube; flowers white with large purple blotch on lower part of each tepal; bracts large, 7–10 mm long, pellucid, flushed pink or brownish . . . . . 2. *I. leipoldtii*
11b Filament apices exserted from tube; flowers and bracts not as above:
12a Perianth tube (12–)15–19 mm long; flowers light purple or yellow to orange or brick-red with dark centre:
13a Flowers yellow to orange or brick-red, with a dark centre; bracts dark rust-brown in distal half . . . . . 17. *I. tenuifolia*
13b Flowers light purple; bracts pale-translucent . . . . . 18. *I. purpureorosea*
12b Perianth tube 4–12 mm long; flowers white, pink to brick-red or yellow, without a dark central mark:
14a Plants 100–250 mm tall; flowers brick-red, facing ± to side; bracts opaque, brownish, 7–9 mm long . . . . . 1. *I. pumilio*
14b Plants 100–650 mm tall; flowers yellow to orange or white to pink, suberect; bracts pellucid, 5–7 mm long:
15a Flowers white or pink to mauve; filaments 5–6 mm long; stem usually 1–4-branched . . . . . 13. *I. orientalis*
15b Flowers yellow to orange, rarely white but then filaments < 3.5 mm long; stem usually unbranched:
16a Plants 100–150(–350) mm tall; perianth tube 4.5–6.0 mm long; style dividing between base and middle of anthers . . . . . 15. *I. esterhuyseniae*
16b Plants 180–550 mm tall; perianth tube 7–15 mm long; style dividing below base of anthers:
18a Tepals yellow or white, 9–11 × ± 5 mm; leaves often linear, barely, if at all twisted distally, 2–10 mm wide; filaments relatively short, up to 3 mm long . . . . . 14. *I. odorata*
18b Tepals orange, 16–23 × 7–9 mm; leaves ± lanceolate and loosely twisted distally, (8–)10–16 mm wide; filaments longer, 5–6 mm long . . . . . 16. *I. aurea*

## Key to species of sect. *Morphixia*

1a Foliage leaves 2, blades linear-filiform, < 2 mm (and usually < 1.5 mm) wide when alive:
2a Leaves with a slightly to prominently thickened main vein ± in centre of blade:
3a Flowers with perianth tube cylindrical throughout, (12–)15–20 mm long and uniformly ± 2 mm diam.; leaf margins not raised . . . . . 35. *I. stenophylla*
3b Flowers with perianth tube funnel-shaped, ± 5 mm long; leaf margins raised and fleshy . . . . . 29. *I. linearifolia*
2b Leaves with main vein not evident when alive unless held to the light, lying closer to abaxial margin, when dry, main vein and margins become evident and appear thickened due to collapse of mesophyll between them:
4a Perianth tube 4–10 mm long; filaments included or exserted up to 2 mm from tube; anthers symmetrically arranged in a column enclosing style:
5a Perianth tube 4–8 mm long; tepals 11–15 mm long, thus ± twice as long as tube; filaments exserted 1–2 mm and anthers fully exserted; anthers (3–)4–5 mm long . . . . . 45. *I. capillaris*
5b Perianth tube 8–10 mm long; tepals 8–10 mm long, thus ± as long or slightly longer than tube; filaments included and bases of anthers held within tube; anthers 3.5–4.0 mm long . . . . . 46. *I. exiliflora*
4b Perianth tube 12–22 mm long; filaments included or well exserted from tube; anthers symmetrically arranged or unilateral and facing upward, then style lying below anthers:
6a Stamens symmetrically arranged; filaments included, 3–6 mm long; anthers 2.5–3.5 mm long, bases usually included in tube . . . . . 47. *I. dieramoides*
6b Stamens usually (?always) unilateral and horizontal to declinate; filaments 12–15 mm long, exserted 2–10 mm from tube; anthers 4–5 mm long, fully exserted from tube:
7a Filaments exserted 2–6 mm from tube; stem simple or with 1 or 2(3) lateral branches, branches subtended by attenuate bracts and prophylls; cataphylls chestnut-brown above ground . . . . . 48. *I. pauciflora*
7b Filaments exserted 8–10 mm from tube; stem with 1–3 lateral branches, branches subtended by truncate bracts and prophylls; cataphylls green with ± membranous margins . . . . . 49. *I. reclinata*
1b Foliage leaves 1–4, blades linear to lanceolate or falcate, rarely linear-filiform but then with a moderately to prominently thickened central vein, usually > 2 mm wide in mature plants; midvein evident when alive, ± central or slightly displaced toward abaxial margin:
8a Foliage leaves with margins broadly winged, thus H-shaped in cross section; ovary and capsules warty:
9a Flowers pale pink with white to pale yellow throat; perianth tube 5–6 mm long; anthers ± 5 mm long . . . . . 30. *I. alata*
9b Flowers pale blue-mauve, white in throat; perianth tube 8–10 mm long; anthers ± 6 mm long . . . . . 31. *I. thomasiae*
8b Foliage leaves plane, sometimes with margins heavily thickened but never winged; ovary and capsules smooth, rarely surface obscurely roughened:
10a Perianth tube cylindric or subcylindric; tepals usually shorter than tube:

11a Perianth tube 15–18 mm long; flowers pale lilac to white flushed lilac . . . . . 33. *I. dolichosiphon*
11b Perianth tube (18–)22–34 mm long; flowers pale beige (also described as pale yellow) or white usually flushed mauve to pink outside:
12a Corm tunics of coarse, woody fibres; flowers pale beige; tepals oblong, 11–15 × 3.0–4.5 mm . . . . . 32. *I. paucifolia*
12b Corm tunics of fine, pale fibres; flowers white, sometimes flushed mauve to pink outside, or pale pink; tepals ovate, 10–12 × 5–7 mm . . . . . 34. *I. cedarmontana*
10b Perianth tube broadly or narrowly funnel-shaped; tepals usually as long as or longer than tube:
13a Filaments reaching mouth of perianth tube or exserted (sometimes for only 1 mm); anthers always completely exserted:
14a Foliage leaf solitary, linear; stem usually unbranched . . . . . 20. *I. saundersiana*
14b Foliage leaves 2–4, linear to lanceolate; stem simple or branched:
15a Perianth tube (2.5–)3.0–5.0 mm long; lateral branches usually several and always short, bearing 1–3(4) flowers:
16a Filaments pale blue to white, 5–7 mm long; lateral branches mostly 2- or 3-flowered . . . . . 27. *I. marginifolia*
16b Filaments purple-black, ± 4 mm long; lateral branches mostly 1-flowered . . . . . 28. *I. pavonia*
15b Perianth tube 6–18 mm long; lateral branches various:
17a Lateral branches mostly 3–6, short and thread-like, each bearing 1 or 2(3) flowers; perianth deep maroon-purple, magenta-pink, blue-mauve or white with yellow cup . . . . . 24. *I. ramulosa*
17b Lateral branches mostly 1–3, or plants unbranched, branches typically well developed, straight or twisted, bearing 1–6 or more flowers:
18a Branches straight and bearing 2–several flowers in distal half or plants unbranched:
19a Leaves (5–)10–18 mm wide, with moderately to heavily thickened margins; perianth tube 14–23 mm long; tepals 15–18 mm long; bracts 8–10 mm long; perianth usually deep pink to cherry-red . . . . . 21. *I. latifolia*
19b Leaves mostly narrowly sword-shaped to falcate, usually < 5 mm wide, with slightly thickened margins; perianth tube 8–11 mm long; tepals 11–14 mm long; bracts 5–7 mm long; perianth white, pale pink or purple:
20a Branches 0–2, short, wiry and suberect; corm with papery, onion-skin-like, pale brown tunics not persisting; perianth tube ± 10 mm long; tepals 12–17 mm long . . . . . 22. *I. monticola*
20b Branches nearly always present, diverging; corm with fibrous, medium to coarse fibres; perianth tube 8–11 mm long and tepals 11–14 mm long:
21a Branches mostly held at more than 45° from main axis, sometimes nearly horizontally; perianth tube 8–11 mm long; filaments exserted (1–)2 mm or included in tube; anthers 4.0–5.5 mm long . . . . . 19. *I. divaricata*
21b Branches ascending; perianth tube 12–14 mm long; filaments exserted ± 4 mm from tube; anthers ± 6 mm long . . . . . 34. *I. cedarmontana*
18b Branches and main spike always 1-flowered or branches twisted and flexuose, with flowers not obviously crowded in distal half:
22a Perianth tube 11–23 mm long; tepals 13–23 mm long; bracts pale and translucent with dark veins evident . . . . . 21. *I. latifolia*
22b Perianth tube (5–)6–11 mm long; tepals 10–15 mm long; bract veins ± obscured:
23a Bracts pale; stem with (1)2 or 3 short, wiry, twisted branches 5–8 mm long, each bearing a solitary flower . . . . 25. *I. ecklonii*
23b Bracts purple to glossy brown and veins obscured; stem branching not as above:
24a Plants mostly < 100 mm high; bracts 5–6 mm long, flushed purple; cormlets when present borne at base of corm . . . . . 23. *I. parva*
24b Plants mostly 250–450 mm high; bracts 7–10 mm long, glossy dark brown; cormlets borne on long, slender stolons . . . . . 26. *I. brunneobracteata*
13b Filaments not reaching mouth of perianth tube; anthers partly to entirely included in tube:
25a Main spike long, straight and erect, lateral spikes ascending to spreading, with upright flowers crowded in distal half . . . . . 19. *I. divaricata*
25b Inflorescence not as above:
26a Plants up to 150 mm high; flowers upright, purple with pale yellow cup; main spike and branchlets twisted and flexuose, inclined to nearly horizontal . . . . . 44. *I. contorta*
26b Plants usually taller; flowers not as above:
27a Perianth tube (12–)13–20 mm long; anthers partially or fully included in perianth tube:
28a Anthers half exserted from perianth tube; cormlets borne at base of main corm . . . . . 41. *I. namaquana*
28b Anthers fully included in perianth tube; cormlets borne at ends of flattened stolons . . . . . 42. *I. oxalidiflora*
27b Perianth tube 5–12(–14) mm long; anthers partly included in perianth tube:
29a Leaf blades of lower two or three leaves 8–15 mm wide (rarely 3–7 mm); filaments 2–4 mm long:
30a Bracts and prophylls subtending branches attenuate, up to 5 mm long, often deflexed distally; leaves 2(1) with well-developed blades; perianth tube (10–)12–14 mm long; outer bracts with (4)5 major veins, 5-toothed . . . . . 39. *I. lacerata*
30b Bracts and prophylls subtending branches short, obtuse to truncate, < 2 mm long; leaves 2 or 3(4) with well-developed blades; perianth tube 5.5–8.0(–10.2) mm long; outer bracts with 3 major veins, 3-toothed or 3-lobed:
31a Foliage leaves 2(3), blades usually falcate; base of stem rarely with fibrous collar; anthers 2.3–3.5 mm long . . . . . 36. *I. rapunculoides*
31b Foliage leaves 3(4); blades usually sword-shaped; base of stem covered by a collar of fibres; anthers 3.5–4.0 mm long . . . . . 37. *I. robusta*
29b Leaf blades mostly 2.0–3.5 mm wide; filaments 3–4 mm long:
32a Plants of streambanks and marshes, often growing in water; perianth tube 8–9 mm long; flowers white with yellow throat . . . . . 38. *I. rivulicola*
32b Plants of hillsides and flats; perianth tube 5–10 mm long; flowers white (rarely flushed pale blue), or pale pink, slate-blue with white or yellow throat, horizontal to nodding:
33a Corm tunics of firm, fine to medium-textured, netted fibres accumulating with age; corms bearing sessile cormlets at base (and rarely a slender stolon); perianth whitish or flushed palest blue with white throat; style dividing opposite middle of anthers, style branches extending between them . . . . . 40. *I. mollis*
33b Corm tunics of soft, ± papery (not fibrous) layers, not accumulating significantly; corms bearing flattened, ribbon-like stolons; perianth pink, blue-grey, slate-blue or white; style dividing opposite anther tips, rarely beyond them, style branches extending beyond anthers . . . . . 43. *I. sobolifera*

1. Sect. **Hyalis** *(Baker) Diels* in Engl. & Prantl, Die natürlichen Pflanzenfamilien edn 2, 15a: 486 (1930); Lewis: 149 (1962). Subgenus *Hyalis* Salisb. ex Baker: 161 (1892); Goldblatt & Manning: 63 (1999). Type: *Ixia paniculata* D.Delaroche, lecto., effectively designated by Lewis 1962: 149.

*Leaves* usually at least 4, sometimes up to 10, in a loose fan with uppermost leaves not sharply distinct from lower and usually not entirely sheathing but distal portion with a produced blade. *Spike* with outer bracts usually dry-membranous and opaque, outer with 1(or 3) prominent veins and with 1 or sometimes three teeth,

the central usually longest. *Flowers* variously coloured, rarely pale blue-mauve, usually erect or ascending; perianth tube hollow to base or walls of tube clasping style in proximal half, funnel-shaped to cylindric; tepals subequal, spreading. *Stamens* symmetrically arranged in a ring around central style and contiguous, rarely unilateral, then horizontal or declinate; filaments inserted at base of upper part of tube, decurrent, not expanded below, included to well-exserted; anthers splitting longitudinally, exserted, partly included or rarely fully included. *Ovary* and *capsules* smooth, rarely papillate (*Ixia pumilio*); style slender, central and straight, or when stamens unilateral then displaced to lie beneath filaments.

1.1. Series **Hyalis**

1. **Ixia pumilio** *Goldblatt & Snijman* in South African Journal of Botany 51: 68 (1985). Type: South Africa, [Western Cape], banks of the Breede River south of Worcester, Farm Reiersrus, 30 Aug. 1983, *Snijman 737* (NBG, holo.!; K!, MO!, PRE!, iso.).

Plants mostly 120–160 mm high, simple or with 1, rarely 2 or 3 short branches subtended by dry, attenuate, translucent bracts and prophylls ± 3 mm long. *Corm* 7–12 mm diam. with tunics of fine netted fibres. *Leaves* 3 or 4, upper 1 or 2 partly sheathing stem; blades narrowly sword-shaped to sublinear, reaching to base or middle of spike, 2–5 mm wide; midrib slightly thickened. *Spike* elongate, mostly 6–10-flowered, branches with fewer flowers; bracts dry-membranous, pale brown, mostly 8–9 mm long, outer with a prominent central vein, acute or obscurely 3-toothed, the inner 2-veined and forked apically, usually slightly exceeding outer. *Flowers* ± erect, old rose (brick-red), with conspicuously darker veins, unscented; perianth tube funnel-shaped, widening in upper half, 8–10 mm long; tepals subequal, ovate-oblong, 11–13(–16) × 5.5–6.0 mm, spreading horizontally. *Stamens* with filaments 5–6 mm long, exserted ± 3 mm from tube; anthers 4.0–5.5 mm long, yellow. *Style* dark purple, dividing opposite middle of anthers, style branches ± 1.5 mm long; ovary surface minutely warty. *Flowering time*: mid-August to mid-September.

*Distribution*: an extremely local endemic, *Ixia pumilio* is known only from the Farm Reiersrus, near Moordkuil south of Worcester (Figure 1). Plants grow in alluvial sand close to the Breede River. Because it is so hightly localized, the species must be regarded as endangered.

*Diagnosis and relationships*: discovered by Cape Town botanist Dee Snijman in 1983, this rare species is distinguished by its low stature (the feature for which the species is named), with plants seldom exceeding 150 mm, unusual dull reddish pink flowers and dry, pale brown, opaque bracts. The filaments of *Ixia pumilio* are exserted ± 4 mm from the perianth tube and the dark purple style divides opposite the middle of the anthers. The ovary and capsule are unusual in the genus in their minutely warty surface.

We offer no suggestions about the immediate relationships of the species. The fan of leaves and outer floral bract with a single prominent vein place the species in sect. *Hyalis* and with its lack of obvious floral specializations, apart from the unusual colour, we place it in the unspecialized series *Hyalis*. *Ixia pumilio* is an attractive plant and is a perfect subject for container culture.

*Additional specimens*

WESTERN CAPE.—3319 (Worcester): Aan-de-Doorns, Farm Reiersrus, alluvial sand along banks of Breede River, (–CB), 26 Sept. 1983 (fr.), *Goldblatt & Snijman 6960A* (MO, NBG).

2. **Ixia leipoldtii** *G.J.Lewis* in Annals of the South African Museum 40: 212 (1954); Lewis: 87 (1962). Type: South Africa, [Western Cape], Eikekraal, east of Prince Albert, 27 Sept. 1935, *Leipoldt s.n.* (*BOL21808*, holo.!; SAM, iso.!).

Plants mostly 150–200 mm high, simple or with 1 or 2 short branches subtended by dry, translucent brown, attenuate bracts and prophylls 3–5 mm long. *Corm* 1.0–1.4 mm diam., with tunics of medium-textured fibres. *Leaves* usually 3 or 4, lower 2 (or 3) with expanded blades, lanceolate to falcate, ± half as long as stem, upper leaf sheathing stem in lower two-thirds, free in upper third. *Spike* erect, 2–4(–6)-flowered; bracts dry-membranous, translucent brown with dark veins, 8–9 mm long, outer 3-veined, with 3 subacute teeth, central tooth longest, inner 2-veined and forked at apex, slightly shorter than outer. *Flowers* erect, white with a large dark red-purple centre, unscented; perianth tube funnel-shaped, ± 11 mm long; tepals ascending below, spreading above, ovate, (17–)20–22 × 11–13 mm. *Stamens* with filaments 3–4 mm long, included in tube; anthers 4–5 mm long, yellow, bases included in tube. *Style* dividing opposite lower third of anthers, style branches ± 2 mm long. *Flowering time*: September.

*Distribution*: *Ixia leipoldtii* is known with certainty only from the heights at the top of Op-de-Tradouw Pass, west of Barrydale in the Little Karoo (Figure 1); plants grow in stony clay loam. Just a few plants are currently known to exist, growing among rocky islands in ploughed land. The type collection is reputedly from the Farm Eikekraal, east of Prince Albert but that locality remains to be confirmed. Despite some searching at Eikekraal it has not been re-collected there (J.H.J. Vlok pers. comm.), a fair distance from Barrydale, and its

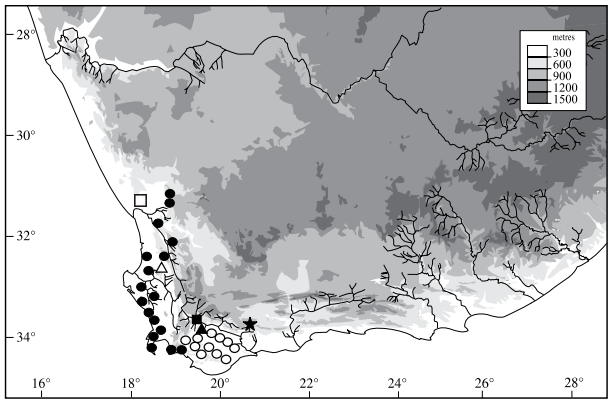


FIGURE 1.—Known distribution of *Ixia pumilio,* ■; *I. leipoldtii*, ★; *I. longituba*, ○; *I. bellendenii*, ▲; *I. splendida*, △; *I. acaulis*, □; and *I. paniculata*, ●.

occurrence near Prince Albert now seems doubtful. The species is, as far as we know, on the verge of extinction in the wild, but plants that we have introduced to cultivation at the South African National Botanic Gardens, Kirstenbosch, are thriving, and seem well suited to container and rock garden culture. It is one of the most seriously endangered species of the genus.

*Diagnosis and relationships*: a striking plant in full bloom, *Ixia leipoldtii* has large, white flowers with a dark purple central blotch that are eye-catching by themselves but in so small a plant appear remarkable. Apart from the unusual flower colour, *I. leipoldtii* is readily distinguished by the translucent brown bracts, broadly ovate to almost orbicular tepals, and filaments included in the perianth tube. We have no informed opinion about its relationships except that it appears to be an unspecialized member of series *Hyalis*, having a relatively short perianth tube, a weak distinction between lower and upper leaves, and outer floral bracts with a single or dominant central cusp.

*Selected specimens*

WESTERN CAPE.—3320 (Montagu): fields at top of Op-de-Tradouw Pass, (–CC), 12 Sept. 1994, *Goldblatt & Manning 9987* (MO, NBG); flats (*vlakte*) near Barrydale, 2300' [700 m], (–CC), Sept. 1923, *Levyns 545* (BOL).

3. **Ixia longituba** *N.E.Br.* in Journal of the Linnean Society, Botany 48: 44 (1928); Lewis: 156 (1962). Type: South Africa, without precise locality, illustration in Ker Gawler in Curtis's Botanical Magazine 16: t. 589 (1802a).

Plants (180–)250–450 mm high, simple or more often 1- or 2-, rarely 3-branched; branches subtended by pale, membranous, attenuate bracts and prophylls 3–5 mm long. *Corm* depressed-globose, with tunics of pale, fine fibres. *Leaves* mostly 4–8, ± sword-shaped to lanceolate, usually reaching to ± base of spike, 5–15 mm wide, firm-textured; margins moderately to heavily thickened, sometimes crisped. *Spike* densely 7–12-flowered, branches, when present, with fewer flowers; bracts pale and ± translucent, often flushed pink distally, outer with a single prominent vein and 1- or obscurely 3-toothed, inner forked at tips, 2-toothed, ± as long or slightly longer than outer. *Flowers* ± suberect to almost horizontal, pale to deep pink (except for rare white sports), darker pink at tepal bases, pale green to yellow in mouth of tube, unscented; perianth tube slender, widening slightly near mouth, (10–)12–33(–35) mm long, 3–4 mm wide at mouth; tepals subequal, spreading horizontally, 16–22 × 7–11 mm, inner narrower than outer. *Stamens* with filaments 5–10 mm long, inserted 2–3 mm below mouth of perianth tube, thus exserted 3–7 mm; anthers 4–6 mm long, yellow. *Style* mostly dividing opposite top of filaments or lower to middle third of anthers, rarely shortly beyond anther tips, style branches 3–5 mm long. *Flowering time*: mid-September to late October.

*Distribution*: *Ixia longituba* occurs widely across the Caledon District of Western Cape, extending from the Bot River in the west to Swellendam and Bredasdorp in the east and south (Figure 1). A relatively late-blooming species, it occurs at low elevations and usually on heavy clay soils, but the species has also been recorded on dry, stony, sandstone slopes.

*Diagnosis and relationships*: pink-flowered *Ixia longituba* is distinguished among the longer-tubed species of sect. *Hyalis* by flower colour combined with filaments exserted 5–7 mm, anthers 4–6 mm long and well-developed style branches 3–5 mm long. Perianth tube length is remarkably variable, mostly 12–33 mm long, but as short as 10 mm and occasionally as long as 35 mm.

The species first appeared in the botanical literature in 1802 as a painting in *Curtis's Botanical Magazine*, which John Ker Gawler (1802a) identified as *Ixia aristata* Thunb. Although the type of the latter species is now known to be *I. campanulata* Houtt. (Lewis 1962), the name *I. aristata* remained in use for *I. longituba* throughout the 19th century. Only after N.E. Brown (1929) examined the Iridaceae of the Thunberg herbarium, did the correct identity of *I. aristata* become established and Brown then provided the name *I. longituba* for the plant illustrated in *Curtis's Botanical Magazine.*

De Vos (1999) treated *Ixia bellendenii* as a synonym of *I. longituba*, reducing it to the rank of subspecies because she regarded the two as overlapping in their critical morphological features, especially perianth tube, filament and anther length, and point of division of style. After examining all the available specimens in South African herbaria, we have concluded that *I. bellendenii*, as typified by the white-flowered plant figured in *Curtis's Botanical Magazine* (Ker Gawler 1812b), must be treated as a separate species. It is readily distinguished from *I. longituba* by a perianth tube 35–40 mm long, filaments exserted up to 11 mm, and style branches, 1.5–2.0 mm long, shorter than in long- or short-tubed morphs of *I. longiflora*. Collections of *I. longituba* always have pink flowers (with the exception of white-flowered sports) with an unusually wide range of perianth tube lengths, 10–33(–35) mm. We provisionally recognize two subspecies in *I. longituba*, which we circumscribe slightly differently than De Vos (1999). We reserve subsp. *longituba* for plants with a perianth tube (10–)12–23 mm long and describe subsp. *macrosiphon* for those with a tube 25–35 mm long. With this circumscription, subsp. *macrosiphon* comprises the northern populations of the species, all close to the foot of the Riviersonderend Mtns. We note however, that plants from the south of its range near Bredasdorp, may have a perianth tube 22–23 mm long. This indicates that there is no cline in tube length across the range from south to north.

Observations on the pollination biology of a long-tubed population of *Ixia longituba* show the species is pollinated by the long-proboscid horsefly, *Philoliche gulosa* (Goldblatt *et al*. 2000).

Key to subspecies

1a Perianth tube (10–)12–23 mm long; filaments 5–9 mm long and exserted 3–6 mm from tube; anthers 4–5 mm long . . . . . 3a. subsp. *longituba*

1b Perianth tube 25–33(–35) mm long; filaments 8–10 mm long and exserted 6–7 mm from tube; anthers 5–6 mm long . . . . . 3b. subsp. *macrosiphon*

3a. subsp. **longituba**

Flowers with perianth tube (10–)12–23 mm long; tepals 14–18 × 6–9 mm. *Stamens* with filaments 5–9

mm long, exserted 3–6 mm from mouth of tube; anthers 4–5 mm. *Style* dividing opposite middle third to apex of anthers, rarely at apex of filaments.

*Distribution*: subsp. *longituba* extends from the Bot River in the west to Swellendam in the east, and as far south as Bredasdorp, thus in the central and southern part of the range of *Ixia longituba*.

*Selected specimens*

WESTERN CAPE.—3419 (Caledon): Van der Stel's Pass, Bot River to Villiersdorp, (–AA), Oct. 1983, *Paine s.n.* (MO); 7.5 miles [11 km] SSE of Eerstehoop, coastal renosterveld, 500' [152 m], (–AA), 15 Oct. 1969, *Acocks 24265* (PRE); Caledon, commonage east of town, (–AB), 9 Oct. 1995, *Goldblatt & Manning 10310* (MO); west of Riviersonderend, (–BB), flowers pink or white, Sept. 1969, *Goldblatt 452* (BOL); 1 km south of Jongensklip, (–BC), 18 Oct. 2001, *Helme 2230* (NBG); vlei between Bredasdorp and Elim, (–DB), 24 Sept. 1933, *Dymond s.n.* (BOL). 3420 (Bredasdorp): Swellendam, (–BB), 5 Oct. 1929, *Van der Merwe s.n.* (*Nat. Bot. Gard.1780/29* in BOL); The Poort, Bredasdorp, (–CA), 3 Sept. 1943, *Van Niekerk 322* (NBG).

3b. subsp. **macrosiphon** *Goldblatt & J.C.Manning*, subsp. nov.

Flores tubo perianthii 25–33(–35) mm longo, tepalis 16–22 × 8–11 mm, filamentis 8–10 mm longis ex tubo 6–7 mm exsertis, antheris 5–6 mm longis, stylo usitate inter basem et medium antherarum dividenti.

TYPE.—[Western Cape], 3419 (Caledon): hills 6 km SW of Greyton, (–BA), 8 Oct. 1995, *Goldblatt & Manning 10341* (NBG, holo., MO, iso.).

Flowers with perianth tube 25–33(–35) mm long, tepals 16–22 × 8–11 mm. *Stamens* with filaments 8–10 mm long, exserted 6–7 mm from mouth of tube; anthers 5–6 mm long. *Style* usually dividing between base and middle of anthers.

*Distribution*: subsp. *macrosiphon* is known from a few populations in heavy clay ground at the foot of the Riviersonderend Mtns, thus in the northernmost part of the range of *Ixia longituba*.

*Selected specimens*

WESTERN CAPE.—3419 (Caledon): Villiersdorp, (–AA), 2 Oct. 1940, *Leipoldt 3610* (BOL); near Genadendal '*Ixia paniculata* var. *tenuiflora*', (–BA), without date, *Drège 8375* (MO); foot of Riviersonderend Mtns between Stormsvlei and Bonnievale, stony sandstone, (–BB), 3 Oct. 1980, *Goldblatt 5912* (MO, NBG).

4. **Ixia bellendenii** *R.C.Foster* in Contributions of the Gray Herbarium, Harvard University 114: 47 (1936), as replacement name for *Tritonia rochensis* Ker Gawl.: t. 1503 (1812a); Lewis: 155 (1959). *T. rocheana* Sweet: 398 (1826), orth. var. pro *T. rochensis* Ker Gawl. *Waitzia rochensis* (Ker Gawl.) Heynh. 2: 855 (1841). *Montbretia rocheana* (Ker Gawl.) Heynh.: 418 (1847), orth. var. pro '*rochensis'*. *Crocosmia rochensis* (Ker Gawl.) Klatt in Peters: 516 (1864). *Morphixia paniculata* var. *rochensis* (Ker Gawl.) Baker: 97 (1877). *Ixia paniculata* var. *rochensis* (Ker Gawl.) Baker: 166 (1892). *I. rochensis* (Ker Gawl.) L.Bolus: 133 (1929a), illegit. homonym, not *I. rochensis* Ker Gawl. (1803c) (= *Geissorhiza radians* (Thunb.) Goldblatt. *I. longituba* var. *bellendenii* (R.C.Foster) M.P.de Vos: 63 (1999). Type: South Africa, without precise locality, illustration in Ker Gawler in Curtis's Botanical Magazine 37: t. 1503 (1812a).

Plants 400–550 mm high, simple or with 1–3 branchlets; branches subtended by translucent, deltoid-apiculate bracts 5–6 mm long and long-awned prophylls 7–8 mm long. *Corm* globose 18–22 mm diam., with tunics of fibrous layers. *Leaves* mostly 4 or 5, lower 3 or 4 with fully developed blades, firm-textured, ± sword-shaped to lanceolate, reaching to ± middle of stem, (2–)5–10 mm wide, dry at flowering; margins moderately to heavily thickened, sometimes crisped. *Spike* mostly 6–12-flowered; bracts ± opaque-whitish, tinged pink distally, 6–9 mm long, veins slightly darkened distally, outer with a single prominent vein, subacute or with a short apical tooth, inner forked at tips, 2-toothed, 1–2 mm longer than outer. *Flowers* spreading horizontally, ± white with pink to purple veins outside, veins becoming more pronounced with age, yellow in tube and greenish yellow at tepal bases, unscented; perianth tube slender, widening slightly toward mouth, 35–40 mm long, ± 2.5 mm wide at mouth; tepals subequal, spreading at right angles to tube, 18–22 × 6–10 mm. *Stamens* with filaments ± 15 mm long, exserted ± 11 mm; anthers 5–6 mm long. *Style* dividing opposite upper half of anthers, sometimes up to 6 mm beyond anthers, style branches 1.5–2.0 mm long. *Flowering time*: mid-November to early December. Figure 2.

*Distribution*: *Ixia bellendenii* is restricted to the northern slopes of the Riviersonderend Mtns. Plants grow in loamy sand among sandstone rocks on the lower and middle slopes, a relatively dry habitat, and flower late in the season by which time the leaves are dry and withered (Figure 1).

*Diagnosis and relationships*: the species is readily recognized by the almost white flowers suffused pale pink outside, an elongate perianth tube 35–40 mm long, and well-exserted filaments, 15 mm long, bearing prominent anthers 5–6 mm long.

*Ixia bellendenii* has been known since it was first illustrated in Curtis's Botanical Magazine in 1812 when Ker Gawler named the plant *Tritonia rochensis*. Much confusion has surrounded the species since then for it was not known in the wild, as far as we can determine, until specimens were collected by Worcester naturalist, I.B. Walters, in 1976. This and the few later collections were referred by M.P. de Vos to *I. longituba* subsp. *bellendenii*, in which she also included shorter-tubed, pink-flowered plants. Baker (1877) was the first to realize that *Tritonia rochensis* was misplaced in that genus and he referred it to *Morphixia* (the genus to which species of *Ixia* sects *Morphixia* and *Hyalis* were then referred) as a variety of *M. paniculata* (now *Ixia paniculata*). Even after the union of *Ixia* and *Morphixia* by Baker (1892), *I. bellendenii* remained a variety of the very different *I. paniculata* (which typically has dark-coloured, included anthers and usually a substantially longer perianth tube). H.M.L. Bolus (1929a) once again raised the plant to species rank, but under the combination *I. rochensis*, unfortunately a homonym. R.C. Foster provided the replacement name *I. bellendenii* in 1936.


FIGURE 2.—*Ixia bellendenii*, *Manning 3124* (NBG): A, plant; B, half-flower; C, outer bract; D, inner bract. Scale bar: 10 mm. Artist: J.C. Manning.

G.J. Lewis (1962) recognized the species but included shorter-tubed, pink-flowered plants (tube 25–32 mm long) in her circumscription that we believe are better referred to *Ixia longituba*. Her account is easy to understand for at the time, no white-flowered *I. bellendenii* was known in the wild and it was not possible to accurately measure floral parts in the type painting. In De Vos's (1999) account of the genus, *I. bellendenii* was treated as a subspecies of *I. longituba*, distinguished in her key by the longer style (directly correlated with the longer perianth tube (20–)25–35(–45) mm long) and cream-coloured or sometimes pink perianth. We have examined all available collections of *I. longituba* and find a nearly continuous range of perianth tube length, 10–33 mm, among plants with pink flowers. These plants, without exception, flower from September to mid-October, occur on clay soils south of the Riviersonderend Mtns, and have green leaves at flowering. Details of the flowers include: tepals 16–22 mm long, filaments exserted 5–7 mm, anthers 4–6 mm, and style branches 3.0–4.5 mm long. The four collections of *I. bellendenii* now available, have flowers with tepals 18–22 mm long, filaments ± 15 mm long and exserted ± 11 mm, anthers 5–6 mm and style branches 1.5–2.0 mm long. The longer filaments and shorter style branches compared with *I. longituba*, combined with a perianth tube 35–40

mm long and white perianth in plants that are isolated geographically, favour a different substrate (sandy loam vs clay) and flower at least a month or even two months later, indicate to us that a narrowly circumscribed *I. bellendenii* should be regarded as separate from *I. longituba*, to which it is, nevertheless, almost certainly immediately related.

Pollination biology of *Ixia bellendenii* is unknown but the flowers exhibit the hallmarks of long-proboscid fly pollination. The most likely pollinator is the tabanid fly, *Philoliche rostrata*.

*Selected specimens*

WESTERN CAPE.—3319 (Worcester): near Jonas Kop TV aerial, nearest beacon 44, (–DC), 30 Nov. 1976, *Walters 1596* (NBG); Jonaskop, among sandstone rocks on lower slopes, (–DC), 26 Nov. 1989, *Snijman 1243* (NBG, PRE); Jonaskop, between 2nd and 3rd gate, (–DC), 9 Dec. 1987, *De Vos 2700* (NBG, PRE); Jonaskop, 2nd gate near bottom of mountain (–DC), 30 Nov 2007, *Manning 3124* (MO, NBG).

5. **Ixia splendida** *G.J.Lewis* in Journal of South African Botany 4: 9 (1938); Lewis: 153 (1962). Type: South Africa, [Western Cape], 3218 (Clanwilliam): Piketberg, Zebrakop, near stream, (–DA), 10 Nov. 1934, *Pillans 7183* (BOL, lecto.! [as 'holo.'], designated by De Vos 1999: 65; BOL!, PRE!, SAM!, iso.).

Plants 300–600 mm high, simple or with a single short branch subtended by acute, translucent bracts and prophylls ± 1 mm long. *Corm* 14–18 mm diam., with tunics of fine, netted fibres. *Leaves* 5–7, all with expanded blades, narrowly sword-shaped to sublinear, 2–5 mm wide, reaching to ± middle of stem, upper 2 leaves sheathing stem for half to two thirds their length. *Spike* densely 5–7-flowered; bracts membranous and translucent, evidently dry and turning brown near tips, 6–7 mm long, outer weakly 3-veined, truncate or obscurely 3-lobed, inner 2-veined and forked apically, ± as long as outer. *Flowers* pale brick-red or pink, evidently unscented; perianth tube subcylindric, slightly expanding from base to apex, 27–30 mm long; tepals subequal, oblong, obtuse to emarginate, 15–18 × 6–8 mm, spreading horizontally. *Stamens* with filaments 4–5 mm long, included in tube; anthers 5–6 mm long, included or tips exserted. *Style* dividing opposite lower third of anthers, style branches ± 1.5 mm long. *Flowering time*: mid-October and November.

*Distribution*: *Ixia splendida* remains known from just two collections from along a stream on the upper slopes of Zebrakop, highest peak of the Piketberg (Figure 1). We assume the habitat is the stony sandstone soil, typical of the Cape Fold Mountains but this remains to be established.

*Diagnosis and relationships*: *Ixia splendida* was discovered in 1934 by the Cape Town botanist, N.S. Pillans, and was described in 1938 by G.J. Lewis. It has been re-collected only once, close to the type locality, in 1973 by botanist H.P. Linder. The species is readily recognized by its slender perianth tube 27–30 mm long, expanding gradually and uniformly from base to apex, dull reddish or deep pink perianth, and fully included stamens. The floral bracts are also unusual: the outer of the pair is truncate and obscurely three-veined, whereas the inner is fairly typical in having 2 veins and is shallowly forked at the tip. Lewis assumed that *I. splendida* was most closely related to the more widespread *I. paniculata*, which also has a long perianth tube and included stamens. Like the latter, the flowers are very likely adapted for pollination by long-proboscid nemestrinid and tabanid flies (Goldblatt *et al*. 2000). The flowers of *I. paniculata* are pale yellow to beige, sometimes almost white, and also have partly to fully included stamens, but the anthers are usually dark-coloured, almost black, and the perianth tube is cylindric and usually longer, up to 75 mm but only 35–50 mm at the southern end of its range, compared to the gradually flared tube 27–30 mm long and yellow anthers of *I. splendida*. In addition, the outer floral bracts of the two differ substantially. Whereas those of *I. paniculata* are elongate and attenuate, with a single prominent vein, those of *I. splendida* have 3 veins and are truncate or obscurely 3-lobed apically. The bract differences suggest to us that the two species may not be immediately related. The flowers of *I. splendida* resemble those of other species of *Ixia* that are adapted for pollination by long-proboscid flies and we assume that it has the same pollination system.

Also from Zebrakop are two collections of a long-tubed, white-flowered species, the perianth flushed pink on the outside, which like *I. splendida*, have included anthers. The tube, 18–20 mm long, and a fairly slender habit, makes it seem very different from *I. splendida*, but it also has short, truncate floral bracts, such a distinctive feature that this plant must be seen as immediately allied to *I. splendida*. Differences in flower colour, perianth tube and bract length, plus small differences in the length of the stamens and style branches suggest that the collections represent a novel taxon, which we describe below as *I. linderi*.

*Additional specimens*

WESTERN CAPE.—3218 (Clanwilliam): Piketberg, Zebrakop, gentle south-facing slopes in moist sand, often near water, ± 1 100 m, (–DA), 7 Nov. 1973, *Linder 105* (BOL).

6. **Ixia linderi** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 300–450 mm altae, foliis 3–4 linearibus 1.3–3.0 mm latis, caule eramoso, spica 2–6-flora, bracteis ± 5 mm longis bractea exteriore truncata sine venis fuscatis, floribus albis extra carneis suffusis, tubo perianthii subcylindrico 18–20 mm longo, tepalis ± 10 × 4 mm patentibus, staminibus inclusis filamentis ± 1.5 mm longis antheris ± 4 mm longis, ramis styli ± 1 mm longis.

TYPE.—Western Cape, 3218 (Clanwilliam): Piketberg, Zebrakop, east-facing ledges near water, ± 1 100 m, (–DA), 7 Nov. 1973, *Linder 103* (BOL, holo.).

Plants 300–450 mm high, unbranched, base surrounded by persistent cataphylls forming a poorly developed collar around stem base. *Corm* 8–10 mm diam., with tunics of fine fibres. *Leaves* 3 or 4, ± linear, 1.5–3.0 mm wide, central vein prominent; margins slightly thickened. *Spike* 2–6-flowered; bracts membranous, evidently dry near tips, ± 5 mm long, outer without dark veins, truncate, inner 2-veined, veins pale, forked apically, slightly longer than outer. *Flowers* suberect, white

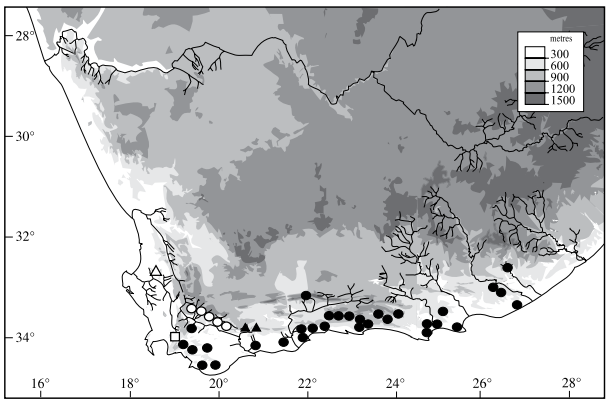


FIGURE 3.—Known distribution of *Ixia stohriae*, ▲; *I. linderi*, △; *I. cochlearis*, □; *I. fucata*, ○; and *I. orientalis*, ●.

or faintly pink, tepals flushed pale pink outside, presence of scent unknown; perianth tube subcylindric, gradually expanding from base to apex, 18–20 mm long; tepals subequal, oblong, obtuse, ± 10 × 4 mm, spreading horizontally. *Stamens* with filaments ± 1.5 mm long, inserted ± 6 mm below mouth of tube; anthers ± 4 mm long, apices just reaching mouth of tube. *Style* dividing shortly below anther bases, style branches ± 1 mm long, reaching lower third of anthers. *Flowering time*: November.

*Distribution*: *Ixia linderi* is known from just two collections from Zebrakop, highest peak in the Piketberg Range. Plants grow on moist sandstone slopes and rock ledges near water (Figure 3).

*Diagnosis and relationships*: the white flowers with a relatively long perianth tube, 18–20 mm long, with the stamens and style included in the tube, immediately set *Ixia linderi* apart in sect. *Morphixia*. The filaments, only 1.5 mm long, are inserted ± 6 mm below the mouth of the tube and the anthers, ± 4 mm long, just reach the mouth of the tube. The style divides just below the anther bases and the short style branches ± 1 mm long are retained within the tube. The species most closely resembles a second Piketberg endemic, *I. splendida*, but this species is a more robust plant with leaves up to 5 mm wide and larger, brick-red to pink flowers with a perianth tube 27–30 mm long. Like *I. linderi*, the flowers of *I. splendida* have the stamens and style included in the tube. Both species have distinctive, translucent, ± truncate floral bracts with minute terminal teeth.

*Additional specimens*

WESTERN CAPE.—3218 (Clanwilliam): Piketberg, Zebrakop, south slopes often near water, 3600' [ ± 1 200 m], (–DA), 7 Nov. 1973, *Linder 105* (BOL).

7. **Ixia acaulis** *Goldblatt & J.C.Manning* in Novon 3: 152 (1993). Type: South Africa, [Western Cape]: 3118 (Vanrhynsdorp): Knersvlakte, Farm Rooiberg, low limestone ridge, (–BC), 19 May 1992, *Snijman & Manning 1249* (NBG, holo.!; MO!, PRE!, iso.).

Plants acaulescent, leaves and flowers reaching 20–30 mm above ground, often in small clumps, occasionally branched. *Corm* narrowly cone-shaped, ± 3–4 mm wide near base, tapering above, ± 15 mm long, tunics moderately to finely fibrous, accumulating with age in a dense covering. *Leaves* 3–5; blades linear to narrowly lanceolate, 1.5–2.0 mm wide, prostrate or inclined, leathery, without thickened margins or midrib. *Spike* 1- or 2-flowered; bracts membranous, ± 10 mm long, reaching up to 5 mm above ground, outer with upper margin slightly fringed, inner 2-veined and shallowly forked apically. *Flowers* yellow, whitish in tube, unscented or faintly sweet-scented; perianth tube 15–20 mm long, arising below ground level, extending ± 10 mm above ground, cylindric; tepals subequal, obtuse to emarginate, 6–7 × 3 mm, spreading horizontally. *Stamens* with filaments arising at top of tube, ± 1.5 mm long, decurrent; anthers ± 2 mm long. *Style* dividing at or just beyond mouth of tube, style branches short, ± 1 mm long, apices emerging between filaments. *Flowering time*: May and June, rarely in April. Figure 4.

*Distribution*: *Ixia acaulis* is restricted to the arid Knersvlakte of southern Namaqualand (Figure 1). Until 2009, just a single population is known from limestone ridges on the Farm Rooiberg. Then in 2010, during a survery of limestone outcrops in the Knersvlakte, Nick Helme found three more populations, one of them extensive, 20 km to the northwest of the type locality at Wolwenes. Corms are wedged in rock crevices and are very difficult to extract undamaged. Other limestone outcrops in the Knersvlakte, an area of predominantly fine clay soils often covered by a superficial layer of white quartz pebbles, remain to be examined for the presence of the species. The Knersvlakte has extremely low rainfall, less than 100 mm annually, normally falling in the late autumn and winter months, and is known for its diversity of habitats and extreme local endemism, particularly among Aizoaceae–Mesembryanthemoideae. Iridaceae are not well represented here, but other Knersvlakte endemics in the family include *Babiana carminea*, which grows at the same site as *I. acaulis*, *Moraea deserticola* and *M. knersvlaktensis* (both Iridoideae), and *Lapeirousia angustifolia* (if this is regarded as distinct from the related *L. pyramidalis*). Helme noted that at the Wolwenes site, flowers were being visited by numbers of *Cynthia cardui* butterflies, and butterflies, not exclusively *C. cardui*, are likely pollinators, as they have probosces long enough to access nectar in the base of the perianth tube.

*Diagnosis and relationships*: when first collected, the appropriate genus for the tiny, acaulescent species was in doubt. The smooth, red-brown seeds with an excluded ovular vascular trace placed the species in tribe Ixieae (sensu Goldblatt *et al*. 2006, as Croceae) which included genera such as *Ixia*, *Sparaxis*, and *Tritonia.* Leaf anatomy and pollen morphology provided the primary evidence for its assignment to *Ixia*: this is the only genus among several in the tribe that has leaf margins with unmodified marginal epidermis and a submarginal sclerenchyma trace associated with marginal veins and pollen grains with a single band of exine in the aperture. The immediate relationships of *I. acaulis* within *Ixia* are uncertain, but it obviously belongs either in sects *Hyalis* or *Morphixia* because of the decurrent filaments. We favour sect. *Hyalis* because of the membranous bracts without prominent veins. Similar fringed outer bracts are found in *I. linderi* and *I. splendida*, both of which also have an elongate perianth tube but have well-devel-


FIGURE 4.—*Ixia acaulis*, *Perry 3732* (NBG): A, flowering plants; B, flower and bracts; C, detail of stamen insertion; D, c/s floral tube showing decurrent filaments; E, outer bract; F, inner bract. Scale bar: A, B, E, F, 10 mm; C, D, 2.5 mm. Artist: J.C. Manning.

oped aerial stems and anthers included in the perianth tube. The capsules, described by Goldblatt & Manning (1993), are typical of the genus, but are borne at ground level.

*Selected specimens*

WESTERN CAPE.—3118 (Vanrhynsdorp): Knersvlakte, Farm Rooiberg, low limestone ridge, (–BC), June 1991, *Perry s.n.* (NBG); 27 Aug. 1991 (fr.), *Goldblatt & Manning 9132* (MO, NBG, PRE); Wolwenes, 20 km NW of Kwaggaskop, (–BC), 24 June 2010, *Helme 6550, 6551* (BOL, NBG); Rooiberg, 2 km west of Kwaggaskop, (–BC), 23 June 2010, *Helme 6552* (BOL, NBG).

8. **Ixia paniculata** *D.Delaroche*, Descriptiones plantarum aliquot novarum: 26, t. 1 (1766); Lewis: 149 (1962). *Morphixia paniculata* (D.Delaroche) Baker: 97 (1877). *Tritonia paniculata* (D.Delaroche) Klatt: 358 (1882). Type: South Africa, without precise locality or collector, Herb. Burman (G-DEL, holo.!).

*I. longiflora* P.J.Bergius: 7, 360 (1767), illegit. superfl. name for *I. paniculata* D.Delaroche. *Tritonia longiflora* (P.J.Bergius) Ker Gawl.: 228 (1804). *Gladiolus longiflorus* (P.J.Bergius) Jacq. (1794), illegit. homonym, not L.f. (1782). *Hyalis longiflora* (P.J.Bergius) Salisb.: 318 (1812). *Babiana longiflora* (P.J.Bergius) Steud.: 683 (1821). Type: South Africa, without precise locality, cultivated in Holland, *Kallstrom s.n.* (HBT, holo.–scanned image!).

*Houttuynia capensis* Houtt.: 448 (1780). *Tritonia capensis* (Houtt.) Ker Gawl.: t. 618 (1803b). *Montbretia capensis* (Houtt.) Voigt: 611 (1845). *Waitzia capensis* (Houtt.) Reichb.: 6 (1856). *Acidanthera capensis* (Houtt.) Benth. ex Baker: 187 (1892). Type: South Africa, without precise locality, cultivated in Holland, illustration in Houttuyn, Naturlijke historie 12: t. 85, f. 3 (1780).

*I. longiflora* Lam.: 342 (1789), hom. illegit. non P.J.Bergius. Type: uncertain, P (Herb. Lamarck or Herb. Jussieu).

*I. tenuiflora* Vahl: 66 (1805). *Tritonia tenuiflora* (Vahl) Ker Gawl.: sub t. 1275 (1810). *Waitzia tenuiflora* (Ker Gawl.) Heynh. 2: 855 (1841). *Montbretia tenuiflora* (Ker Gawl.) Voigt: 611 (1845). *Crocosmia tenuiflora* (Ker Gawl.) Klatt in Peters: 516 (1864). *Morphixia paniculata* var. *tenuiflora* (Vahl) Baker: 97 (1877). *Ixia paniculata* var. *tenuiflora* (Vahl) Baker: 166 (1892). Type: evidently unknown, possibly Herb. Vahl: C.

*Gladiolus ixioides* Thunb.: 208 (1811). Type: South Africa, without precise locality, *Thunberg s.n.* (*UPS-THUNB 1035*, holo.!).

*Tritonia concolor* Sweet: 398 (1826). *Waitzia concolor* (Sweet) Heynh. 2: 854 (1841). *Montbretia concolor* (Sweet) Voigt: 611 (1845). Type: South Africa, without precise locality or collector, illustration in Ker Gawler in Curtis's Botanical Magazine 37: t. 1502, var. γ, *corolla ochroleuca concolor* (1812b).

Plants 500–650 mm high, simple or often with 1 or 2 ascending to horizontal branches, these subtended by dry, cuspidate, brown-flecked bracts and prophylls 1.5–3.0 mm long. *Corm* 15–20 mm diam., with tunics of medium-textured, wiry netted fibres, often bearing cormlets on short, thick stolons. *Leaves* 5 or 6 in a loose fan, lower leaves becoming dry and brown at flowering; blades lanceolate, often slightly twisted in upper half, mostly 4–7 mm wide, reaching to middle or to near top of stem; margins and midrib slightly thickened. *Spike* crowded, 8–16-flowered, branches mostly 3–8-flowered; bracts membranous, translucent below but sparsely to closely flecked with rust-brown distally, (7–)9–15 mm long, outer with 1 prominent vein, acute or obscurely 3-lobed with a prominent central tooth, inner 2-veined, ± as long as outer or slightly longer or shorter, 2-veined, forked apically. *Flowers* pale yellow to creamy beige, lower fifth of tepals sometimes darker coloured, unscented; perianth tube cylindrical, 35–65(–75) mm long, widened in upper 3–5 mm; tepals oblong-elliptic, 16–25 mm long, outer ± 6 mm, inner ± 4 mm wide. *Stamens* with filaments 5–6 mm long, included, inserted 8–10 mm below mouth of tube, rarely fully exserted; anthers 4.5–7.0 mm long, dark purple (rarely pale), half to fully included with tips ± 1 mm below mouth of tube, rarely fully exserted. *Style* dividing opposite lower to upper third of anthers, rarely opposite anther tips or up to 3 mm beyond them, style branches ± 2 mm long. *Flowering time*: mid-November to early December.

*Distribution*: *Ixia paniculata* extends from the Bokkeveld Mtns, north of Nieuwoudtville in Northern Cape, to the coast of Western Cape near Kleinmond, thus throughout the western half of Western Cape (Figure 3). Plants occur both in montane habitats and on the coastal plain and favour sandy or stony sandstone ground in seasonally wet situations, either in seeps, drainage lines or along streams. In habitats that become overgrown with scrub and reeds, plants flower only after fire or when the surrounding vegetation has been cleared. Numerous records (e.g. Lewis 1962) indicate that the species was once common on the Cape Peninsula and Cape Flats, where it is rare today, a reflection of rapid urban development and growth of the human population in the vicinity of Cape Town. The species is naturalized as a weed of damp places and roadside ditches in parts of Western Australia.

*Diagnosis and relationships*: *Ixia paniculata* is distinctive in its fairly tall habit and remarkably long-tubed flowers, the tube usually 40–65 mm long, with the darkly coloured anthers at least half included in the tube (very rarely just exserted). The perianth is pale yellow to pale beige, the undersides of the tepals often flushed with pink or red.

The species is moderately variable in floral features, most obviously in perianth tube length, which shows a weak geographic pattern. Plants from inland areas in the north of the range, from Piketberg to the Bokkeveld Mtns have tubes 45–65 mm long, but those from the coast north of Cape Town are consistently long-tubed, 65–75 mm (*Goldblatt & Manning 10051*, from Modder River south of Darling). Plants from the Cape Peninsula and the False Bay coast have shorter tubes 35–55 mm long. Collections from the Cape Flats (*Esterhuysen 32349*) stand out in their pale anthers and style dividing ± 2 mm beyond the anther tips. In other collections we have examined the style divides between the lower and upper third of the anthers, exceptionally opposite the anther tips. The anthers, usually dark brown or almost black, are typically 5.0–6.5 mm long and half exserted, but are fully included in *Porter s.n.* from Hangklip Estates. The plants of the Cape Flats are particularly unusual, not only in the short tube and long style but the pale anthers are only 4.5 mm long. We have seen no examples of the style dividing below the base of the anthers, as mentioned by Lewis (1962) and suspect she may have examined immature flowers. The style elongates late during floral maturation and only reaches its full length on the second day of anthesis. Lewis discussed the floral variation in her account of the species and reached much the same conclusions as we have, that no infraspecific taxa merit recognition.

The flowers are adapted for pollination by long-proboscid flies (Manning & Goldblatt 1997) and along the west coast are pollinated by *Moegistorhynchus longirostris*. The species, at least in the Bokkeveld Mtns, sets seed in the absence of its pollinator, and is thus facultatively autogamous. Several other species pollinated by *M. longirostris* also have this adaptation, including *Babiana tubiflora* and *Lapeirousia anceps*, both of which co-occur with *Ixia paniculata* along the Cape west coast (Goldblatt & Manning 1997). We lack information on self-compatibility in other populations of the species.

A surprising hybrid, represented by a single clump of plants (*Mostert 393* NBG; *Manning 3122* NBG), was discovered by local plant enthusuast, Mr Louis Mostert, near Kleinmond. It represents a cross between *Ixia paniculata* and *I. dubia*, a short-tubed species of sect. *Ixia*. Hybrids in *Ixia* are rare in the wild and we know of no other records of intersectional hybrids in the genus.

*History*: described by D. Delaroche in 1766, *Ixia paniculata* was nevertheless known for the next 50 odd years as *I. longiflora*, a plant described by P.J. Bergius in 1767. Bergius himself realized that *I. paniculata* was the same species and included it as a synonym in the Addendum to his *Descriptiones plantarum ex capite bonae spei* but later authors, including Jacquin, Ker Gawler and Steudel, ignored this action. The species, transferred to *Gladiolus* by Jacquin (1794), to *Tritonia* by Ker Gawler (1812a) and to *Babiana* by Steudel (1821),

consistently bore the epithet *longiflora*. Additional synonyms in the early literature include *Houttuynia capensis* (Houttuyn 1780), *Ixia tenuiflora* (Vahl 1805) and *Gladiolus ixioides* (Thunberg 1811). The epithet *paniculata* was finally revived by Baker (1877) in the genus *Morphixia*, who treated Vahl's *Ixia tenuiflora* as var. *tenuiflora* of *Morphixia paniculata*. The species was returned to *Ixia* by Baker (1892, 1896) when he united *Ixia* and *Morphixia*. Variants of *I. paniculata* were illustrated together as early as 1812, in *Curtis's Botanical Magazine* under the name *Tritonia longiflora.* In this account, Ker Gawler regarded the form with included stamens and dark purple anthers as the 'typical' var. α, while treating a smaller-flowered plant with sulphur-coloured flowers as var. β and a plant with yellow anthers, partly included in the tube and a long style with the style branches remote from the anthers as var. γ. Robert Sweet named var. γ as *I. concolor* in 1826. These named taxa represent nothing but minor variants of *I. paniculata*.

*Selected specimens*

NORTHERN CAPE.—3119 (Calvinia): river bank close to Nieuwoudtville waterfall, (–AC), 18 Nov. 1995, *Goldblatt & Manning 10429* (MO); Bokkeveld Mtns, Keyserfontein, in marsh, (–AC), 20 Nov. 1992, *Bean & Trinder-Smith 2854* (BOL).

WESTERN CAPE.—3218 (Clanwilliam): St Helena Fontein, (–BB), Nov. 1943, *L. Bolus 22298* (BOL); roadside N of Citrusdal turnoff on Clanwilliam road, (–DB), 14 Nov. 1979, *Goldblatt 5117* (MO); Piketberg, Zuurvlakte, wet to swampy stream bank in sand, 2400' [730 m], (–DC), 3 Dec. 1973, *Linder 138* (BOL). 3318 (Cape Town): Hopefield, (–AA), Oct. 1912, *Pattison s.n.* (*BOL13674*); Bokbaai, vlei ground, (–AD), 19 Sept. 1986, *De Vos 2664* (PRE); 13 Oct. 1960, *Thomas s.n.* (*NBG61139*); ± 10 km N of Malmesbury, local in wet site, (–BC), 6 Nov. 1982, *Goldblatt 6715* (MO); Wynberg, Cape Town, below 100' [30 m], (–CD), Nov. 1904, *Bolus 4513* (BOL, MO); Kenilworth Race Course, (–CD), 4 Dec. 1969, *Esterhuysen 32349* (BOL, MO). 3319 (Simonstown): Cape Peninsula, west of Buffels Bay and south of Groot Blaauberg, (–AD), 22 Nov. 1921, *Pillans 4565* (BOL); Hangklip Estate, (–BD), Oct. 1942, *Porter s.n.* (*BOL26897*). 3419 (Caledon): Kleinmond, 5 km E of town on edge of Botrivier Lagoon, (–AC), 6 Nov. 2003, *Manning & Mostert 2911* (NBG); Kleinmond, Rooisand parking ground near Bot River vlei, floodplain in fynbos, (–AC), 15 Nov. 2007, *Manning 3120* (NBG).

*I. paniculata* × *I. dubia* hybrid

WESTERN CAPE.—3419 (Caledon): Kleinmond, Rooisand parking, Bot River vlei, (–AC), 3 Dec. 2002, *Mostert 393* (NBG); 15 Nov. 2007, *Manning 3122* (NBG).

### 1.2. Series **Fucatae**

9. **Ixia cochlearis** *G.J.Lewis* in The Flowering Plants of Africa 25: t. 969 (1945); Lewis: 90 (1962). Type: South Africa, [Western Cape], Jonkershoek, Nov. 1943, *Wicht s.n.* (*PRE27196*, holo.!; *BOL39125*, iso.!).

Plants mostly 200–300 mm high, unbranched, remains of old cataphylls and leaf bases persisting as a collar of fibres around base. *Corm* 14–20 mm diam., with tunics of fine netted fibres. *Leaves* 4–7, upper 1–3 partly sheathing; blades narrowly sword-shaped to sublinear, reaching at least to base, or sometimes exceeding spike, 1.5–3.0 mm wide; midrib slightly thickened. *Spike* elongate, mostly 6–12-flowered; bracts membranous with dark veins, 4–6 mm long, outer 3-veined and 3-toothed, inner 2-veined and forked apically, slightly exceeding outer. *Flowers* deep pink, presence of scent unknown; perianth tube narrowly funnel-shaped, widening in upper third, (10–)12–18 mm long, ± 3 mm wide at mouth; tepals subequal, oblong, 14–17 × 6–8 mm, spreading horizontally but remaining concave. *Stamens* with filaments ± 10 mm long, usually exserted ± 6 mm; anthers ± 4 mm long, yellow. *Style* dividing opposite anther tips, style branches ± 1.5 mm long. *Flowering time*: November, sometimes lasting into early December.

*Distribution*: restricted to the mountains immediately east of Stellenbosch in Western Cape, *Ixia cochlearis* occurs at elevations of 305–550 m (Figure 3). Plants grow on rocky slopes, at least sometimes on granite substrate. Some records indicate that plants were flowering well after a burn the preceeding summer, and it is likely that flowering is stimulated by fire and that blooming occurs rarely if at all except in the years immediately after wildfires.

*Diagnosis and relationships*: *Ixia cochlearis* is distinctive in sect. *Hyalis* in the deep pink flowers with a narrowly funnel-shaped perianth tube mostly 12–18 mm long, at least four, and up to seven, narrow, fairly firm leaves, and in the presence of a fibrous collar around the stem base. The relatively long and narrow perianth tube is reminiscent of *I. fucata* and *I. stohriae*, also montane species, but occurring to the east, in the Langeberg. These two species have broader, soft-textured leaves and shorter stamens, the filaments exserted only 2–5 mm in *I. fucata* and up to 1 mm in *I. stohriae*, compared with the longer filaments of *I. cochlearis*, which are exserted up to 6 mm. Although she did not say so explicitly, Lewis (1962) evidently named the species for the concave, more or less spooned tepals, a feature shown in the painting accompanying the protologue. The first record of this rare and very localized endemic was made by C.L. Wicht in 1938 in the mountains at Jonkershoek near Stellenbosch.

*Selected specimens*

WESTERN CAPE.—3318 (Cape Town): Stellenbosch, Banhoek, burnt ground, (–DD), 24 Nov. 1938, *Martley s.n.* (*BOL39127*, *SAM53175*); Jonkershoek, Biesiesvlei, granite slope, 1100' [335 m], (–DD), 30 Nov. 1938, *Wicht s.n.* (PRE), 8 Nov. 1940, *Levyns 7505* (BOL); Jonkershoek, Tierkloof, (–DD), Nov. 1944, *Wicht s.n.* (PRE, *SAM55837*); Jonkershoek, dry stony ridge, (–DD), 18 Nov. 1943, *Borchardt s.n.* (*BOL39128*).

10. **Ixia fucata** *Ker Gawl.* in Curtis's Botanical Magazine 34: t. 1379 (1811); Lewis: 98 (1962). Type: South Africa, without precise locality, illustration in Curtis's Botanical Magazine 34: t. 1379 (1811); epitype, here designated, [Western Cape], Worcester Dist., Hex River Mtns, Milner Ridge Peak, west slopes, 5000–6000' [1 525–1 830 m], (–AD), 11 Nov. 1943, *Esterhuysen 9326* (BOL).

Plants (150–)250–400 mm high, usually with a weakly developed collar around base, usually unbranched, sometimes with a single short, erect branch subtended by translucent, membranous, attenuate bracts and prophylls 2–3 mm long, these present even when branch not produced. *Corm* globose, 7–9 mm diam., with tunics of fine, soft, netted fibres. *Leaves* (3)4 or 5, narrowly sword-shaped to sublinear, 1.5–3.0 mm wide, central vein and margins usually slightly thickened, uppermost (1)2 leaves largely or entirely sheathing. *Spike* flexuose, (2–)4–7(–14)-flowered; bracts 5–8 mm long, outer 5-veined and acutely 3-toothed,

inner bracts as long or slightly longer than outer, 2-veined and forked apically. *Flowers* suberect, sometimes with unilateral stamens, white to pale or deep pink, darker at mouth of tube and lined or uniformly pink or red outside; perianth tube 10–15 mm long, straight, slightly flared, ± 2 mm diam.; tepals subequal, 12–14 × ± 6 mm, spreading at right angles to tube. *Stamens* with filaments 3–6 mm long, exserted ± 2–5 mm from tube; anthers 3.5–4.0 mm long, shortly tailed, often purple; pollen yellow (brown). *Style* dividing opposite lower third to middle of anthers, style branches 2.0–2.5 mm long, gently recurved. *Flowering time*: mainly late September to early November, occasionally in early September.

*Distribution*: a plant of mountain slopes and rock outcrops, *Ixia fucata* extends from the higher elevations of the Hex River Mtns through the Keeromsberg to the western Langeberg as far east as Montagu (Figure 3). It is likely that plants flower well only in the years immediately following a wildfire, but this has not been documented to date. The Saunders & Saunders sub Manning collection cited below was made in unburned veld.

*Diagnosis and relationships*: based on a plant of unknown provenance grown in Great Britain, *Ixia fucata* was described by John Ker Gawler in 1811 in *Curtis's Botanical Magazine*. The accompanying illustration shows what appears to be an *Ixia* with a white flower, pink on the outside and with small red streaks at the base of the tepals. The yellowish tube is narrow, but well developed, and there are five narrowly sword-shaped (± sublinear) leaves, the uppermost of which sheaths the stem for about two thirds of its length. Unfortunately, no associated preserved material is known. Ker Gawler thought the plant might be an accidental garden hybrid but Lewis (1962) unequivocally associated the illustration with plants from the western Langeberg and Hex River Mtns, most of them collected in the decades before her revision was published. We accept Lewis's conclusion about the identity of *I. fucata* but in order to stabilize the nomenclature we designate an epitype, thus fixing the application of the name.

*Ixia fucata* is still relatively poorly known but it is, nevertheless, obvious that plants referred by Lewis (1962) to *I. fucata* var. *filifolia*, do not belong here. This plant, from the Riviersonderend Mtns and nearby, to the south of the main range of *I. fucata*, consistently has only three leaves, the lower two with filiform blades no more than 1.2 mm wide, a straight and unusually wide perianth tube, ± 2 mm in diameter. We regard var. *filifolia* as a separate species, *I. stenophylla*, possibly most closely allied to the *I. paucifolia* group of sect. *Morphixia*.

Even with the removal of var. *filifolia*, *Ixia fucata* remains somewhat variable: plants from the Langeberg have pink flowers, with the bases of the tepals red, the outside of the tube and tepals are dark pink, and unusual for *Ixia*, the stamens are unilateral and declinate. The parallel anthers thus lie in one plane and face upward toward the top of the spike. This feature was first mentioned by De Vos (1999) for specimens from the Montagu and Robertson Districts and we noted unilateral stamens in a population from Orangeberg near Koo (M. Hansford pers. comm.). The feature is evident in *Levyns 4374* and *Esterhuysen 29110*, for example. In contrast, plants from the Hex River Mtns have white flowers and evidently do not have declinate stamens, nor do those from the Du Toitskloof Mtns. The type plant is presumably also from here because it too has symmetrically arranged stamens.

Plants from further north in the Great Winterhoek Mtns, sometimes identified as *Ixia fucata* in herbaria (e.g. *Marloth 1725*), are not this species, but *I. cedarmontana*, the flowers of which have a substantially longer tube.

*Selected specimens*

WESTERN CAPE.—3319 (Worcester): Hex River Mtns, Mt Brodie, rocky north slopes, (–AD), 1 Nov. 1953, *Esterhuysen 22229A* (BOL); Hex River Mtns, traverse west of Milner Peak, north-facing slopes of Shale Peaks, (–AD), 19 Oct. 2009, *Saunders & Saunders sub Manning 3234* (NBG) (fls pale pink with dark red markings); Worcester, Keeromsberg, (–DA), 7 Nov. 1943, *Esterhuysen 9248* (BOL, K, NBG) (fls pink with dark maroon markings); Robertson Dist., Langeberg, Dassieshoek, shallow soils in damp places, rocky south slope near kloof, 1000–2000' [305–610 m], (–DD), 2 Sept. 1961, *Esterhuysen 29110* (BOL, MO) (fls pink, red outside); Robertson, Langeberg, near stream in kloof, (–DD), 6 Oct. 1929, *Levyns 4374* (*BOL39137*). 3320 (Montagu): Montagu, Donkerkloof, (–CA), 26 Sept 1946, *Compton 18477* (NBG, SAM) (fls white, pink outside).

11. **Ixia stohriae** *L.Bolus* in South African Gardening 21: 281 (1931a); Lewis: 96 (1962). Type: South Africa, [Western Cape], Swellendam, Tradouw Pass, 14 Sept. 1931, *Smith s.n.* (*BOL19879*, lecto.!, designated by Lewis 1962: 97; K, iso.!).

*Tritonixia conferta* Klatt: 356 (1882), non *I. conferta* R.C.Foster (1936). Type: South Africa, [Western Cape], Voormansbosch, Oct. ± 1830, *Zeyher 4014* (SAM, lecto.!, designated by De Vos 1999: 29; K!, PRE!, Z, iso.).

Plants 180–400 mm high, usually 1–3-branched, sometimes simple; branches subtended by pale, membranous, darkly keeled bracts and prophylls 2–4 mm long. *Corm* globose, 9–12 mm diam., with tunics of fine, netted fibres, bearing small cormlets at base. *Leaves* (4)5 or 6(–8), lower with well-developed blades grading to partly to almost entirely sheathing above; blades narrowly sword-shaped to sublinear, usually reaching to ± base of spike, (2–)3–5(–6) mm wide, relatively firm-textured, central vein slightly raised, when dry a pair of secondary veins evident. *Spike* usually erect, spiral, 5–10-flowered; bracts membranous, pale and translucent, ± 5 mm long, outer 3-veined and shortly 3-toothed, inner 2-veined and 2-toothed, slightly shorter than outer. *Flowers* erect, pale pink, dark pink on reverse of tepals, tube dark red-purple outside, unscented; perianth tube widening very gradually from base to apex, (12–)14–22 mm long; tepals subequal, ovate, 12–14 mm long, spreading at right angles to tube. *Stamens* symmetrically arranged; filaments 1.5–3.0 mm long, inserted 2–4 mm below mouth of tube, included or exserted up to 1 mm; anthers 2–3 mm long, exserted or partly to entirely included in tube; pollen yellow. *Style* dividing 0.5–1.0 mm below anther bases or reaching to mid-anther level, style branches 1.0–2.3 mm long, tips reaching at least to anther bases, rarely shortly exceeding anther tips (*Ruiters 19*). *Flowering time*: late August to mid-September.

*Distribution*: the species is evidently a narrow endemic of the central Langeberg, and has been recorded from

Protea Valley above Swellendam and at Voormansbosch nearby, as well as in Tradouw Pass and in Grootvadersbos to the east (Figure 3) but it almost certainly occurs between these sites, and possibly even more widely. There are surprisingly few collections of this conspicuous species, which grows among other places, along the roadside in the well-travelled Tradouw Pass, south of Barrydale. The reason for this became clear in the spring of 2000 when mass flowering occurred there after a wildfire the previous summer. Plants were found in full bloom from one end of the pass to the other, in many places so plentiful that they coloured the rocky slopes pink. The following year the species seemed rare, no more than a handful of plants were found in bloom; in fact very few plants were evident even in leaf. Like a fair number of geophytes of the Cape sandstone mountains, *I. stohriae* is a true pyrophyte. Plants flower well only the season after a fire and then disappear until another fire stimulates their flowering response.

*Diagnosis and relationships*: the first collection of the species was made by C.L. Zeyher in the 1820s at Voormansbosch, near Swellendam. The collection was described by F.W. Klatt as *Tritonixia conferta*, the identity of which was only determined by Lewis (1962). The name cannot be transferred to *Ixia* as the epithet *conferta* is preoccupied: *I. conferta* R.C.Foster is now regarded as a synonym of *I. abbreviata* Houtt. (Goldblatt & Manning 2010).

Well-grown specimens of *Ixia stohriae* can reach up to 400 mm in height and produce masses of flowers on spikes of up to 8 flowers on the main stem. The pale pink blooms have a slightly darker ring around the base of the tepals, and the yellow anthers are barely exserted or are partly to fully included in the tube, thus occluding the mouth, features clearly illustrated in the protologue (Bolus 1931a).

*Ixia stohriae* appears to be most closely allied to *I. fucata* of the western Langeberg and Hex River Mtns to the west and they are virtually identical vegetatively. *Ixia fucata* has either white or pink flowers, the filaments are exserted 2–5 mm from the tube, and the style branches are consistently longer than in most collections of *I. stohriae*, 2.0–2.5 mm long. The stamens are reported to be unilateral and declinate in some populations, a condition we have confirmed in living plants from Dassieshoek above Robertson. Unilateral stamens are not shown in the type illustration and the species may be polymorphic for the condition. Nevertheless, the longer, well-exserted filaments and consistently exserted anthers readily separate *I. stohriae* from *I. fucata*. De Vos (1999) included the only known collection of the new *I. recondita* in *I. stohriae* but we regard this as a separate species, easily distinguished by the stamens and style branches included well within the perianth tube (see more detailed discussion under that species).

*Selected specimens*

WESTERN CAPE.—3320 (Montagu): Swellendam hiking trail, below *Protea* valley, (–CD), 30 Dec. 1987, *Esterhuysen 36684* (K, MO, NBG); Swellendam, forest path below 10 O'Clock Mtn, (–CD), 20 Sept. 1952, *Wurts 357* (NBG); Langeberg Mtns, Tradouw Pass, after fire, sandstone rocks, (–DC), 26 Aug. 2000, *Goldblatt & Nänni 11438A* (K, MO, NBG, PRE); 7 miles [10.5 km] from Barrydale into Tradouw Pass, ± 1000' [305 m], (–DC), 18 Sept. 1968, *Marsh 686* (K); Grootvadersbos, Oskloof, east of tar road, 2 years after fire, 500 m, (–DD), 20 Sept. 1988, *Ruiters 19* (NBG, PRE).

12. **Ixia recondita** *Goldblatt & J.C.Manning*, sp. nov.

Plantae *Ixiae fucatae* et *I. stohriae* similes sed caule usitate eramoso, foliis ± mollibus, antheris styloque in tubo inclusis, filamentis ± 3 mm longis, antheris 2.0–2.5 mm longis, stylo ± 1–2 mm longo, ramis styli 1.5–2.0 mm longis.

TYPE.—[Western Cape], 3320 (Montagu): kloof at base of Leeuriviersberg [Grootberg], on sparsely vegetated sloping ledges, pale pink, (–DD), 1 Sept. 1958, *Esterhuysen 27870* (BOL, holo.; K, MO, iso.).

Plants 250–750 mm high, erect or inclined, rarely with 1 branch subtended by membranous, darkly keeled attentuate bracts and prophylls 2–4 mm long. *Corm* globose, 10–12 mm diam., with tunics of fine, netted fibres, bearing small cormlets at base. *Leaves* 4, rarely 3, lower 3 with well-developed blades, uppermost partly to almost entirely sheathing; blades narrowly sword-shaped to sublinear, usually longer than stem but trailing above, (2–)3–4(–6) mm wide, soft-textured; midrib slightly raised, when dry a pair of secondary veins evident; margins not thickened. *Spike* subsecund, crowded, suberect or inclined, 4–8-flowered, branches with fewer flowers; bracts membranous, pale translucent with dark veins, flushed pink distally, 5–6 mm long, outer 3-veined and 3-toothed, inner 2-veined and 2-toothed, ± as long to slightly longer or shorter than outer. *Flowers* salver-shaped, pale pink, with a small, dark purple mark at tube apex between tepal bases, flushed red outside, unscented; perianth tube 10–12 mm long, subcylindric, widening gradually from base to apex, ± 1.5 mm diam. at mouth; tepals subequal, oblong-elliptic, 10–13 × 4–5 mm, spreading at right angles to tube. *Stamens* included in tube; filaments 2–3 mm long, inserted ± 3 mm above tube base, shortly decurrent; anthers 2.0–2.5 mm long, tips reaching 3.5–5.0 mm below tube mouth, white; pollen yellow. *Style* 1–2 mm long, dividing shortly below or opposite filament bases, style branches 1.5–2.0 mm long, reaching to base or middle of filaments. *Flowering time*: late August to mid-October. Figure 5.

*Distribution*: *Ixia recondita* is a narrow endemic of the Leeuriviersberg, now Grootberg, section of the Langeberg west of Swellendam (Figure 6). The species was first collected in 1958 by Elsie Esterhuysen and again only in 2007 when Di Turner and fellow CREW (Custodians of Rare and Endangered Wildflowers) members rediscovered plants at our prompting after an extended exploration of the southern slopes of the Langeberg from Grootvadersbos to Grootberg. Plants were found on stony, well-vegetated, south-facing slopes that had not been burned for many years. Nothing is known of the floral biology of the species but the salver-shaped, unscented, pink flowers with dark marks at the mouth of the tube are the hallmarks of long-proboscid fly pollination (Goldblatt & Manning 2006).

*Diagnosis and relationships*: distinctive in having not only the filaments but also the anthers, style and style branches included within the narrow perianth tube,

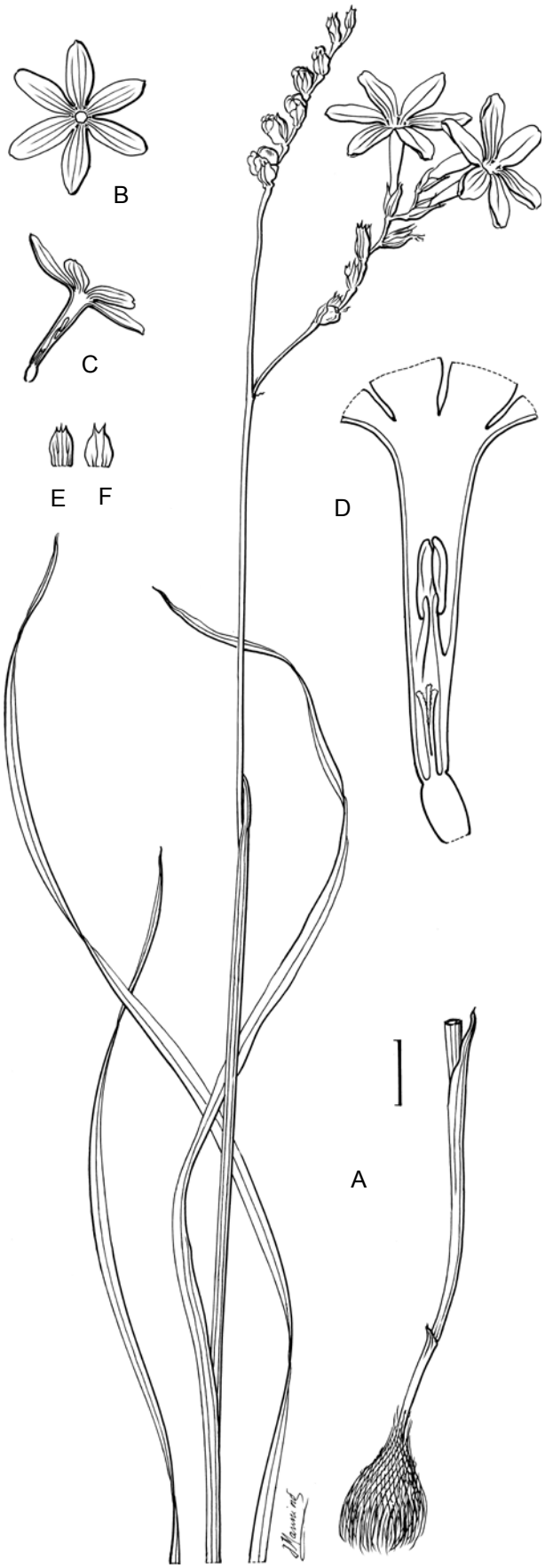


FIGURE 5.—*Ixia recondita*, *Turner s.n.* (NBG): A, plant; B, flower from above; C, half-flower; D, l/s perianth tube; E, outer bract; F, inner bract. Scale bar: A–C, E, F, 10 mm; D, 2.5 mm. Artist: J.C. Manning.

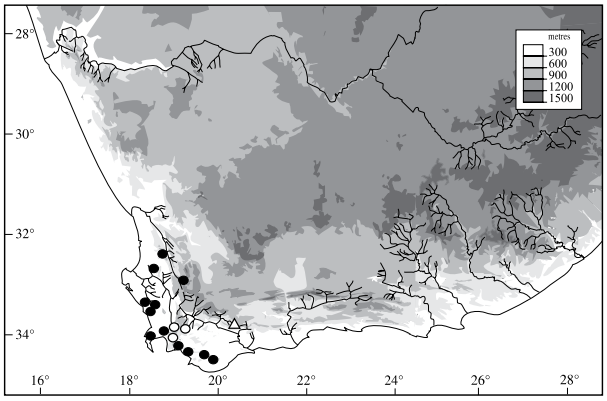


FIGURE 6.—Known distribution of *Ixia recondita*, △; *I. odorata*, ●; and *I. esterhuyseniae*, ○.

that is additionally unusual in the soft-textured leaves, *Ixia recondita* is a remarkable species. It was evidently unknown to Lewis although it was collected in 1958, thus before her monograph of *Ixia* was published (Lewis 1962). De Vos (1999) referred the specimen at the Bolus Herbarium to *I. stohriae*, which it broadly resembles, treating it simply as an unusual population of that species with included anthers. *Ixia stohriae* does have short filaments, either included in the perianth tube, or shortly exserted up to 1 mm, and the bases of the anthers are sometimes partly included in the tube but it is otherwise a more robust plant and most collections consist of plants with sturdy, erect stems with at least one branch (rarely up to five branches). The style in *I. stohriae* reaches at least to the middle of the anthers and sometimes exceeds them, thus always reaching the mouth of the perianth tube. This contrasts starkly with the condition in *I. recondita*, in which the style, just 2–3 mm long, divides opposite the filament bases in the lower half of the perianth tube and the style branches barely reach the middle of the filaments.

Like *Ixia stohriae* and closely related *I. fucata*, *I. recondita* usually has four leaves, sometimes three or five, the lower two or three with well-developed blades and the upper one or two partly to almost entirely sheathing. In the length of the perianth tube, ± 12 mm long, *I. recondita* is intermediate between its two relatives: the tube of *I. stohriae* is (12–)14–22 mm long, and that of *I. fucata* 10–15 mm long. Both *Ixia fucata* and *I. stohriae* are Langeberg endemics, the latter recorded from the mountains between Grootvadersbos and Swellendam, while *I. fucata* occurs further west from Montagu to Keeromsberg, as well as in the Hex River Mtns. The range of *I. recondita* thus lies between that of its two relatives.

*Selected specimens*

WESTERN CAPE.—3320 (Montagu): Swellendam hiking trail, base of Leeuriviersberg just past 9.5 km footbridge, rocky sandstone slope, 441 m, (–CD), 10 Oct. 2007, *Turner s.n.* (NBG).

### 1.3 Series **Angustisiphon**

13. **Ixia orientalis** *L.Bolus* in South African Gardening 19: 27 (1929); Lewis: 100 (1962). Type: South Africa, [Eastern Cape], Albany, between Seven Foun-

tains and Sidbury, Nov. 1928, *Dyer 1684* (BOL, holo.!; GRA, K!, PRE!, iso.).

*I. alba* Eckl.: 27 (1827), illegit. homonym not *I. alba* L. [= *Sparaxis bulbifera* (L.) Ker Gawl.]. Type: South Africa, [Western Cape], *Ecklon & Zeyher 70.10* (PRE!, S, syn.).

*I. scariosa* var. *longifolia* Baker: 165 (1892). Type: South Africa, [Western Cape,] mountains at Avontuur, Nov. 1870, *H. Bolus 2487* (K, lecto.!, designated by De Vos 1999: 33; BOL, iso.!).

Plants usually 400–600 mm high, rarely up to 80 mm, 1–3(4)-branched, occasionally unbranched; branches subtended by membranous, attenuate bracts and prophylls mostly 3–5 mm long. *Corm* with tunics of fine to medium-textured fibres, with sessile cormlets at base. *Leaves* (3)4–6, narrowly sword-shaped to sublinear, 1.5–6.5(–8.0) mm wide, upper 1 or 2 leaves partly sheathing. *Main spike* erect, flexuose, (2–)7–12(–16)-flowered, lateral spikes 2–8-flowered; bracts membranous, 5–8 mm long, usually about 1 internode long, occasionally longer, outer with 1 prominent vein and prominent central cusp, sometimes with a shorter tooth either side of central cusp, inner bract 2-veined and forked apically, slightly shorter to slightly longer than outer. *Flowers* upright, pink or white, presence of scent unknown; perianth tube narrowly funnel-shaped, (8–)9–12 mm long, proximal half filiform; tepals ovate, 10–14(–16) × 5–8 mm, spreading horizontally. *Stamens* with filaments 5–6 mm long, exserted 2–4 mm; anthers 4–5 mm long. *Style* dividing opposite base to lower third of anthers, rarely shortly below apex of filaments, style branches mostly 4–5 mm long, ascending, emerging between anthers. *Flowering time*: mainly mid-September to late October, but as late as early December at high elevations.

*Distribution*: the most widespread species of the genus, *Ixia orientalis* has a geographic range that extends from Caledon in Western Cape to Bathurst and the Amatola Mtns in Eastern Cape (Figure 3); it is one of only two species of the genus that extend outside the Greater Cape Floristic Region (Born *et al.* 2006), the other being *I. marginifolia*. Plants occur in a remarkably varied range of habitats, including seasonally marshy sites, stony coastal grassland, clay hills, and fairly dry sandstone slopes. Typically late flowering, *I. orientalis* is seldom seen before the middle of September, although there are some records of plants in flower as early as August.

*Diagnosis and relationships*: a relatively unspecialized species, *Ixia orientalis* lacks any outstanding features, making it somewhat difficult to diagnose. It can be identified by the combination of branched stems, spikes often with seven or more flowers, four to six leaves (rarely only three), none of them completely sheathing the stem, and moderate-sized, pink or white flowers. The perianth tube, 8–12 mm long, is narrowly funnel-shaped with the proximal half to two thirds always extremely narrow and filiform. Well-grown specimens have stems with 2–4 branches and the main spike usually bears 7–12, rarely up to 16 flowers, although in plants from the mountains of the southern Cape the stems may be unbranched and the spikes have fewer flowers. Typical plants from Eastern Cape have the largest flowers, with the tube 12 mm and tepals ± 14 mm long, but to the west, particularly in the Caledon District, flowers are smaller, sometimes with a tube only 8 mm long and tepals ± 10 mm long (e.g. *Goldblatt & Manning 9789*), but we see no other differences and the pattern of variation lacks clear discontinuities so that it is impossible to recognize infraspecific taxa.

We suspect that the closest allies of *Ixia orientalis* are the largely montane Western Cape species, *I. odorata*, and *I. tenuifolia* of the Malmesbury District north of Cape Town. *Ixia odorata* typically has slightly smaller flowers, usually yellow, rarely white, with a strong sweet scent. It is also distinctive in the relatively short filaments up to 3 mm long (measured to the base of the anthers), and the style divides between the base and apex of the filaments. This contrasts with longer filaments, up to 6 mm long, and a style usually dividing between the base and middle of the anthers (rarely shortly below the filaments) in *I. orientalis*. *Ixia tenuifolia* differs in the slightly longer perianth tube, (12–)15–19 mm long, yellow to orange or brick-red perianth, frequently with a dark central mark, and consistently narrow, very firm-textured leaves, and the stem is seldom branched. Curiously, we have found it difficult to distinguish *I. orientalis* from *I. flexuosa* (sect. *Ixia*) without careful dissection. Both may have a perianth tube of similar length [4–6 mm in *I. flexuosa* according to Lewis (1962)], with a relatively short, wider distal portion, a style dividing opposite the bases of the anthers, and many-flowered spikes. The filaments, inserted at the base of the wider part of the tube are uniformly narrow and shortly decurrent in *I. orientalis* and although similarly positioned in *I. flexuosa*, its filaments are flattened and broader toward the bases, the feature that confirms its place in sect. *Ixia* rather than sect. *Hyalis*.

Although *Ixia orientalis* was only formally recognized in 1929, it was known long before this, but was confused with one of several other species. Ecklon (1827) named specimens of the species *I. alba*, but the name is a homonym for *I. alba* L. [a synonym of *Sparaxis bulbifera* (L.) Ker Gawl.]. Lewis regarded Ecklon's name as invalid, lacking a description or diagnosis, but Nordenstam (1972) maintained that the brief diagnosis was sufficient to validate the name. We concur. *Ixia scariosa* var. *longifolia* Baker (1892), based on a collection each of *I. orientalis* and *I. divaricata*, is now a synonym of *I. orientalis* following designation of the specimen of the latter species as the lectotype (De Vos 1999). De Vos also suggested that *I. schlechteri* (Baker 1904) may be conspecific with *I. orientalis* and, if so, it would be an earlier name. The type, *Schlechter 5609* from the Swartberg at Caledon, is in the Zurich Herbarium but currently cannot be found. Images of the types (there are two sheets, only one with flowers) on the worldwide web are insufficient for firm identification. The species is alternatively *I. flexuosa*.

Our observations on the pollination of *Ixia orientalis* indicate that it is a generalist. The first published study recorded the butterfly, *Colias electo*, as sole visitor (Goldblatt *et al*. 2000). Subsequently we have noted hopliine beetles in the flowers (*Goldblatt & Porter 12577*), and at another site both hopliines and large anthophorine bees (*Goldblatt & Porter 12366A*). In all cases the insects' bodies brushed against anthers and style branches, effecting pollen transfer.

*Selected specimens*

EASTERN CAPE.—3226 (Grahamstown): Amatola Mtns, below Gaika's Kop, roadside next to waterfall marsh, (–DB), 3 Dec. 1982, *Furness & Phillipson 88* (MO, PRE). 3323 (Willowmore): Lauterwater, (–DC), Oct. 1933, *Fourcade 5025* (PRE); grassland near Plettenberg Bay, (–DD), 11 Sept. 2003, *Goldblatt & Porter 12270* (MO). 3324 (Steytlerville): poort between Patensie and Cambria, (–DA), 11 Sept. 1973, *Oliver 4511* (PRE); 5.5 km N of Hankey, cleared bush on clay loam, (–DD), *Goldblatt 4936* (MO). 3325 (Port Elizabeth): Cape Golf Course, (–DC), 12 Oct. 1932, *Long 811* (PRE). 3326 (Grahamstown): Alicedale road west of Grahamstown, (–AD), 28 Sept. 1974, *Bayliss 6812* (MO); Southwell, Bathurst Dist., (–DB), 25 Oct. 1961, *Bayliss 5007* (MO). 3423 (Plettenberg Bay): west end of Robberg, (–AB), 12 Aug. 1960, *Acocks 21496* (PRE). 3424 (Humansdorp): Humansdorp, Pietersgat, well-drained calcrete sand, (–BB), 2 Oct. 2001, *Brand 409* (MO).

WESTERN CAPE.—3319 (Worcester): between Worcester and Villiersdorp, (–CC), *Lewis 2902* (*SAM63500*). 1921 (Ladismith): Swartberg Mtns, burnt slope on road to Gamkakloof near Kliphuisvlei, (–BD), 22 Oct. 1986, *Goldblatt 7972* (MO). 3322 (Oudtshoorn): Perdepoort north of Kamfer, burned sandstone slope, (–CD), 28 Sept. 2004, *Goldblatt & Porter 12577* (MO, NBG); burned slope 34.5 km from Dysseldorp on Laudina road, (–DA), *Goldblatt & Porter 12290* (MO). 3419 (Caledon): Mr du Toit's farm, Elgin, (–AA), 27 Sept. 1966, *Dahlstrand 1159* (MO, NBG); Caledon, east end of Caledon Swartberg in marsh, (–BA), 11 Oct. 1993, *Goldblatt & Manning 9789* (MO); between Stanford and Baardscheerdersbos on Elim road, (–DA), 5 Sept. 1985, *De Vos 2597* (PRE). 3420 (Bredasdorp): Bontebok National Park, Swellendam, (–AB), Sept 1962, *Liebenberg 6479* (PRE). 3421 (Riversdale): Albertinia commonage, (–BA), Oct. 1911, *Muir 5481* PRE); burnt slopes between Mossel Bay and Herbertsdale, (–BB), 26 Sept. 2003, *Goldblatt & Porter 12371* (MO). 3422 (Mossel Bay): 6.4 km E of Great Brak River, (–AB), 21 Sept. 1959, *Lewis 5579* (PRE).

14. **Ixia odorata** *Ker Gawl.* in The botanists register 7: Notes [3] (1821) and Iridearum generum 101 (1827); Lewis: 92 (1962). *Morphixia odorata* (Ker Gawl.) Baker: 97 (1877). *Ixia erecta* var. *lutea odorata* Ker Gawl.: t. 1173 (1809). Type: South Africa, without precise locality or collector, cultivated in Britain, illustration in Curtis's Botanical Magazine 29: t. 1173 (1809).

*I. erecta* Thunb.: 16 (1783), illegit. homonym not P.J.Bergius (1767). *I. avellana* R.C.Foster: 47 (1936), as replacement name for *I. erecta* Thunb. Type: South Africa, without precise locality, *Thunberg s.n.* (S, UPS-THUNB, syn.).

*I. flavescens* Eckl.: 26 (1827), nom. nud. *I. polystachya* var. *flavescens* (Eckl.) Baker: 90 (1877).

*Agretta pallidiflavens* Eckl.: 24 (1827), genus invalid.

*I. odorata* var. *hesperanthoides* G.J.Lewis: 96 (1962). Type: South Africa, [Western Cape], Piketberg, top of ridge south of Zebrakop, 9 Nov. 1934, *Pillans 7184* (BOL!, (two sheets), PRE!, SAM!, syn.).

Plants (200–)400–550 mm high, usually tall and slender, simple, rarely 1-branched; branches subtended by short, acute bracts and prophylls ± 1 mm long. *Corm* 6–8 mm diam. with tunics of fine netted fibres. *Leaves* (3)4–6(–10), lower 2–4 with expanded blades, reaching to ± middle of stem, narrowly sword-shaped to lanceolate, often slightly twisted distally, 2–10 mm wide, upper 1 or 2 partly sheathing. *Spike* erect, crowded, mostly 10–16-flowered; bracts membranous, translucent, rarely flushed pink, 6–7 mm long, usually 1.5–2.0 internodes long, sometimes longer, outer usually with a single prominent vein and 1 central cusp, or obscurely 3-lobed with central cusp prominent, inner ± as long as outer, 2-veined and shallowly forked at apex. *Flowers* clear yellow (often appearing whitish when dry), rarely white, outer tepals sometimes flushed red to brown outside, sweetly scented; perianth tube filiform below, flared in upper third, (7–)8–12 mm long, 3–5 mm wide at mouth; tepals subequal, 9–11 × ± 5 mm, spreading horizontally. *Stamens* with filaments 2.5–3.0 mm long, exserted 1.5–2.0 mm; anthers 5–6 mm long, yellow. *Style* dividing between base and apex of filaments, thus within tube up to ± 2 mm above mouth of tube, style branches (3–)4–6 mm long, arching outward below or between bases of anthers. *Flowering time*: mid-September to early November.

*Distribution*: a largely montane species, *Ixia odorata* extends from the Piketberg and Olifants River Mtns near Citrusdal to the Cape Peninsula and thence eastward to Hermanus and Elim (Figure 6). Plants are usually found on sandstone slopes but also grow on granite-derived soils in the vicinity of Darling.

*Diagnosis and relationships*: *Ixia odorata* has been known to science since at least 1809 when it was illustrated in Curtis's Botanical Magazine, named therein *I. erecta* var. *lutea odorata* by John Ker Gawler. Later Ker Gawler (1821, 1827) reconsidered his decision and renamed the plant *I. odorata*. The species is well named for its particularly sweetly scented, yellow flowers crowded at the top of the short spike, a strong scent being unusual in *Ixia*. Typical *I. odorata* has the following characteristics: bracts 6–7 mm; perianth tube 7–12 mm long; tepals 9–11 × ± 5 mm; filaments 2.5–3.0 mm long, exserted 1–2 mm; anthers 5–6 mm long; and style branches 3–5 mm long.

As circumscribed by Lewis (1962), *Ixia odorata* included populations of short, few-flowered plants from middle and upper elevations in the Hottentots Holland-Jonkershoek Mtn complex that are now treated as a separate species, *I. esterhuyseniae* (De Vos 1988, 1999). This montane species is very different in stature from the taller, fairly small-flowered *I. odorata* but they share outer floral bracts with a single main vein and usually a single tooth, in contrast to the more common 3-veined and 3-dentate outer bracts of the genus. Apart from its low stature, *I. esterhuyseniae* has style branches dividing above the bases of the anthers, usually opposite the middle third of the anthers, thus unlike *I. odorata* in which the style divides below the anthers, sometimes within the tube and opposite the bases of the filaments. We include *I. odorata* in sect. *Hyalis* because of the leaf number, usually 4–6, with no obvious differentiation between the lower and upper, partly sheathing leaves. The single-veined outer bracts are likewise consistent with sect. *Hyalis*.

*Ixia odorata* is sometimes mistaken for the southern Western Cape and Eastern Cape *I. orientalis* and the two can be confused when flower colour is not known, although the latter is almost always branched, whereas *I. odorata* is rarely so. White- or pink-flowered *I. orientalis* has a perianth tube of similar dimensions, and with a filiform lower portion but the style typically divides opposite the base of the anthers (rarely just below them), and it has longer filaments 5–6 mm long (vs 2.5–3.0 mm) exserted 2–4 mm (vs 1–2 mm), and only weakly scented flowers. The flowers are pollinated by

large anthophorine bees (Goldblatt *et al*. 2000) that are believed to visit the flowers to forage for nectar.

Plants treated as *Ixia odorata* var. *hesperanthoides* by Lewis (1962) and De Vos (1999), including *Barker 7561*, *Pillans 7184* and *Ecklon* 438, remain puzzling to us. The type collection, *Pillans 7184*, has white flowers with a perianth tube only ± 5 mm long, tepals ± 8 mm long, and anthers, 3.5–4.5 mm long, all smaller than in typical *I. odorata*. The style dividing at the base of the anthers and style branches ± 3 mm long conform reasonably well to typical *I. odorata*, although the length of the style branches is also shorter than the normal 4–5 mm that we find in other collections of the species. The observation by Pillans on his collection that the flowers open in the late afternoon, unlike ± 11:00 for typical, yellow-flowered *I. odorata*, suggests that some white-flowered populations, at least the Pillans collection, represent a separate race, possibly even a separate species. Before an informed decision can be made about its status, we need additional collections of the small-flowered, evening blooming plants. Other collections included in var. *hesperanthoides* could equally well be included in *I. odorata* as other white-flowered populations are known. Typical, yellow-flowered *I. odorata* also occurs in the Piketberg, providing support for separate species status for var. *hesperanthoides*. Provisionally, however, we include the Pillans collection in *I. odorata* but have not expanded our description to include measurements of the floral parts of the population.

*Selected specimens*

WESTERN CAPE.—3218 (Clanwilliam): Olifants River and Villa Brakfontein (76.10), (–BD?), Oct. 1830, *Ecklon & Zeyher s.n.* (*Ixia albo-flavens* Eckl.) (PRE); Piketberg, clay slopes at east base of Kapteinskloof Mtn, (–DC), 20 Oct. 1935, *Pillans 7801* (BOL); Piketberg Mtn, (–DC), 3 Nov. 1951, *Barker 7561* (NBG). 3219 (Wuppertal): Olifants River Mtns, Grootfontein, pass down from Dasklip, dry west slope on shale, (–CC), 27 Oct. 1972, *Oliver 4068* (MO, PRE). 3318 (Cape Town): Darling, (–AD), Sept. 1929, *Letty 127* (PRE); near Riebeek-Kasteel, (–BD), 26 Oct. 1941, *Leipoldt 3818* (BOL); Mamre, (–CB), 17 Sept. 1959, *Lewis 5541* (PRE); Constantia Nek, (–CD), Oct. 1950, *Pillans 10506* (MO); Farm Joostenbergkloof, near Oostenberg, sandstone ridge, (–DD), 4 Nov. 1996, *Goldblatt 10585* (MO). 3418 (Simonstown): Cape Peninsula, near Hout Bay, (–BA), 14 Oct. 1941, *Salter 8686* (BOL); Rooi Els, (–BD), 2 Oct. 1945, *Leipoldt 4157* (BOL); Palmiet River mouth, sandy soil, after fire, (–BD), 18 Sept. 1969, *Boucher 700* (PRE), 29 Sept. 2001, *Goldblatt & Nanni 11935* (MO, NBG). 3419 (Caledon): Hermanus, rocky mountainside, (–AD), 6 Oct. 1955, *Van Niekerk 660* (BOL); Farm Paardeberg, near Papiesvlei, (–BC), 25 Sept. 1962, *Taylor 4052* (PRE)*;* ± 6 km NW of Elim, wet, sandy ground, (–DA), 3 Oct. 1986, *Vlok 1636* (MO, PRE).

15. **Ixia esterhuyseniae** *M.P.de Vos* in South African Journal of Botany 54: 600 (1988). Type: South Africa, [Western Cape], 3418 (Simonstown): peaty slope along Panorama trail, after fire, 3000' [915 m], (–BB), 9 Jan. 1973, *Esterhuysen 33089* (BOL, holo.!; MO, iso.!).

Plants mostly 100–150(–200) mm high, rarely with 1 short, suberect branch subtended by attenuate, brown-tipped bracts and prophylls; bracts 4–8 mm long and prophylls 2–3 times longer, up to 18 mm long. *Corm* depressed-globose, 8–10 mm diam., with tunics of fine fibres. *Leaves* 5 or 6, all with expanded blades or uppermost largely sheathing, sword-shaped, reaching to between middle and top of stem, 4–6 mm wide; midrib slightly raised. *Spike* crowded, closely 2–4(–6)-flowered; bracts membranous, ± 4.5 mm long, outer with a prominent central vein, inner 2-veined and bidentate. *Flowers* erect, yellow; tepals flushed red to purple outside, lily-scented; perianth tube funnel-shaped, flared in upper half, 4.5–6.0 mm long, ± 4.5 mm wide at mouth; tepals subequal, 10–11 × 5–6 mm, spreading horizontally. *Stamens* with filaments ± 3.5 mm long, exserted ± 1.5 mm; anthers 3.5–4.0 mm long, yellow. *Style* dividing opposite lower to middle third of anthers, style branches 2.0–2.5 mm long, extending between upper third of anthers. *Flowering time*: December and January.

*Distribution*: *Ixia esterhuyseniae* is a montane species, restricted to the Jonkershoek-Hollentots Holland Mtn complex (Figure 6). Plants occur at relatively high elevations, usually over 1 000 m, in seeps and along drainage lines and flower in mid-summer, only in the years following a fire.

*Diagnosis and relationships*: until 1988 when it was described by M.P. de Vos, *Ixia esterhuyseniae* was included in a second Western Cape species, *I. odorata*, normally a taller plant with multi-flowered spikes. As noted by De Vos, *I. esterhuyseniae* has a shorter and sometimes wider perianth tube, 4–5 mm long and ± 4.5 mm wide at the mouth (vs (7–)8–12 mm long and 3–5 mm wide at the mouth in *I. odorata*), the tepals thus about twice as long as the tube. The style divides opposite the middle of the anthers into branches ± 2.5 mm long, another difference with *I. odorata* in which the style divides below the anther bases (sometimes opposite the bases of the filaments), and the style branches are up to 5 mm long.

Preliminary observations of the pollination of *Ixia esterhuyseniae* (Goldblatt *et al*. 2000) indicate that the only insect visitors are the short-proboscid horsefly, *Philoliche atricornis*, which is the presumed pollinator. The reward for these insects is nectar held within the short perianth tube.

*Selected specimens*

WESTERN CAPE.—3418 (Simonstown): Hottentots Holland Mtns, Pic Sans Nom, (–BB), 6 Jan. 1944, *Esterhuysen 9957* (BOL); Nuweberg Reserve, slopes of Sneeuberg, (–BB), 17 Jan. 2000, *Manning 564* (NBG); Somerset Sneeukop, shale band, (–BB), Dec. 1940, *Stokoe 8093* (BOL); Hottentots Holland, Landrostkop, 1 340 m, (–BB), 6 Jan. 2000, *Oliver & Oliver 11461* (NBG, PRE). 3419 (Caledon): Jonkershoek, Dwarsberg, contour path, ± 4000' [1 220 m], (–AA), 9 Jan. 1973, *Kerfoot 6613* (PRE).

16. **Ixia aurea** *J.C.Manning & Goldblatt* in Goldblatt & Manning in Bothalia 29: 61 (1999). Type: South Africa, [Western Cape], Farm Wolwefontein west of Darling, rocky slope among granite boulders, 22 Sept. 1998, *Goldblatt & Manning 11029* (NBG, holo.!; K!, MO!, PRE!, S!, WAG!, iso.).

For description see *Bothalia* 29: 61 (1999).

*Distribution*: apparently rare, *Ixia aurea* occurs in granitic, sandy gravel at isolated sites between Darling, Piketberg and Porterville (Figure 7).

*Diagnosis and relationships*: striking when in flower, *Ixia aurea* has bright yellow-orange flowers in crowded spikes that make a bright splash among the late spring flora. Yet it has rarely been collected. Plants have been

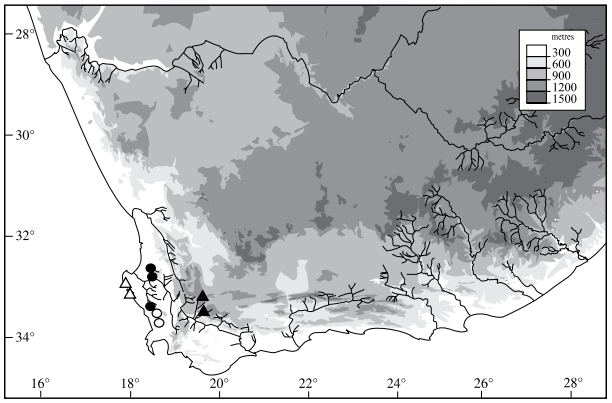


FIGURE 7.—Known distribution of *Ixia aurea*, ●; *I. tenuifolia*, ○; *I. purpureorosea*, △; and *I. saundersiana*, ▲.

confused with *I. dubia* (sect. *Ixia*), (e.g. Goldblatt *et al*. 1998) because of the general resemblance to that species, despite the lack of a dark central mark to the flowers. Careful examination has shown that *I. aurea* does not belong in sect. *Ixia* as it has flowers with a narrowly funnel-shaped tube, tightly enclosing the style in the cylindrical lower half, but containing nectar in the upper third, unlike sect. *Ixia* in which the perianth tube is cylindrical and closely clasping the style almost to the apex, does not contain more than minute traces of nectar, and the filaments are basally coherent or connate, thus occluding the mouth of the tube. In *I. aurea* the filaments diverge from the base and do not block the tube. We suspect that records of this species are seldom made because even from a short distance the plants may be confused with *I. maculata* or *I. dubia*, both common species in the rolling wheatlands between Darling and the Olifants River Mtns, and hence not collected. The relationships of *I. aurea* lie with the short-tubed species, in particular *I. odorata*, flowers of which are sweetly scented, smaller, pale yellow or white and have tepals up to 15 mm long (vs 16–23 mm in *I. aurea*).

The flowers of *Ixia aurea* are pollinated by a range of insects, mainly hopliine beetles (Scarabaeidae: Hopliini). At the type locality, Goldblatt & Manning (1999) recorded the hopliines *Heterochelus arthriticus*, *Lepithrix ornatella* and *Pachycnema crassipes*, and the horsefly *Mesomyia edentula* (Tabanidae). At a second site, Steiner (*Steiner 3022*) recorded the hopliine, *Lepithrix gentilis* visiting the flowers. The beetles use the flowers as sites for assembly and mating, and the horsefly as a source of nectar. Both the beetle species and the horsefly become covered in pollen after visiting several flowers. *Ixia aurea* is thus another example of a species with a bimodal pollination system (Goldblatt *et al*. 1998).

*Selected specimens*

WESTERN CAPE.—3218 (Clanwilliam): Piketberg, sandy slope near Farm Weltevrede near Kapteinskloof road, (–DA), 19 Sept. 2007, *Goldblatt & Manning 13081* (MO, NBG, PRE); Farm Modderfontein, edge or parking area along N7, 4.2 km N of turn-off to Paleisheuwel, clay-loam, (–DB), 29 Sept. 1995, *Steiner 3022* (NBG); Farm Groenvlei, flats at eastern base of Piketberg, 150 m, (–DD), 15 Oct. 1972, *Bremer 338* (BOL). 3318 (Cape Town): Porterville, (–BB?), Oct. 1956, *Loubser 412* (BOL).

17. **Ixia tenuifolia** *Vahl*, Enumeratio plantarum 2: 62 (1805). Type: South Africa, without locality or collector, (C-Herb. Vahl, holo.–scanned image!).

*I. pulcherrima* Eckl.: 25 (1827). Type: none known but *Zeyher s.n.*, from near Klipfontein (PRE), annotated '*Ixia* sp. (*I. pulcherrima* Ecklon)', possibly by P. MacOwan, appears to authenticate the identity of the species; *Ecklon & Zeyher Irid 81* (SAM) '*Ixia pulcherrima'* Groenekloof, and '*Ixia pulcherrima* Eckl.' from Klipfontein, Zwartland likewise authenticate the name.

*Freesea mineatolateritia* Eckl.: 30 (1827), genus illegit.

*I. framesii* L.Bolus: 368 (1931b); Lewis: 91 (1962). Type: South Africa, [Western Cape], near Darling, Sept. 1928, flowered in Cape Town, Sept.–Oct. 1931, *Ross-Frames s.n.* (*BOL19896*, holo.!; K, iso.).

Plants 120–240 mm high, unbranched. *Corm* 10–18 mm diam.; tunics of fine, soft netted fibres. *Leaves* mostly 3(4), reaching or shortly exceeding spike, firm-textured, linear, 1.3–2.0 mm wide, main vein ± central or displaced abaxially, uppermost leaf sheathing in lower half. *Spike* densely 3–8(–14)-flowered; bracts dry-membranous, 6–8 mm long, opaque, pale below, rust-brown distally, outer with 1 prominent vein, acute, inner 2-veined and 2-toothed, ± as long as outer. *Flowers* salmon-pink or yellow to orange, dark red-brown in centre, unscented; perianth tube filiform below, narrowly funnel-shaped in upper third, (12–)15–19 mm long, 3–5 mm wide at mouth; tepals subequal, 15–19 × 8–10 mm, spreading horizontally. *Stamens* with filaments 4–5 mm long, exserted 1.0–1.5 mm; anthers ± 5 mm long, yellow. *Style* dividing just below or shortly above anther bases, style branches 2.5–3.0 mm long. *Flowering time*: mainly mid-September to mid-October.

*Distribution*: *Ixia tenuifolia* is a plant of seasonally moist, loamy flats on the rolling plain between Cape Town and Malmesbury (Figure 7), where it was common until the 1950s. Intense agricultural development since the 1960s has eliminated it from almost its entire range. The only viable population occurs in the Nature Reserve at Riverlands, near Mamre Road Station where we hope it will remain protected from both agriculture and invasive alien plants, especially Australian *Acacia* species, that thrive in its sandy habitat. A 1916 collection from the Cape Town Wild Flower Show, and said to be from Vredenburg, expands the range of the species substantially if that locality is correct, but as it has not otherwise been re-collected in the area, this seems unlikely.

*Diagnosis and relationships*: long known as *Ixia framesii*, a species described by H.M.L. Bolus in 1931, *I. tenuifolia* must have been encountered repeatedly by botanical explorers travelling between Cape Town and Malmesbury into the southern African interior. Nevertheless, it seems largely to have been overlooked or confused with other species. It is not at all surprising that the species was known in Holland in the 18th century, and was likely cultivated there. A specimen from the Van Royen collection at Leiden found its way to Copenhagen where, in 1805, Martin Vahl described it as *I. tenuifolia* (De Vos 1988), the identity of which was unknown to Lewis. Later, in 1827, C.F. Ecklon provided a brief diagnosis for a plant he called *I. pulcherrima* (flowers bright red, glistening), that has remained unidentified. Lewis (1962) regarded the name as invalid, attributing it to either *I. framesii* or *I. campanulata*. Nordenstam (1972),

however, considered the diagnosis to be sufficient for legitimate publication, but did not know of any type material. A specimen in PRE, collected by C.L. Zeyher near Klipfontein (now Malmesbury) and annotated in an unknown hand (not Zeyher's) '*Ixia* sp. (*I. pulcherrima* Eckl.)' appears to authenticate the name, although it is not a type. On this basis, we provisionally treat *I. pulcherrima* as a synonym of *I. tenuifolia*.

*Ixia tenuifolia* is readily identified not only by the relatively long perianth tube, (12–)15–19 mm, particularly narrow in the lower half, and short floral bracts, 6–8 mm long, but by the unbranched stem and firm, leathery, straight leaves. The floral bracts are distinctive in being ± opaque, pale in the lower half and rust-brown in the upper half. The flowers, either deep salmon-pink (also described brick-red) or yellow to orange, usually have a dark brown or reddish centre. We have not seen plants with mature capsules, but partly developed capsules appear unusually short, 2.5–3.0 mm long (*Lewis Grant 3426*).

Pollination studies have shown that *Ixia tenuifolia* has a bimodal pollination system (Goldblatt *et al*. 1998, 2000). Flowers are visited by the hopliine beetle, *Lepithrix ornatella* (Scarabaeidae: Hopliini), which use the flowers for sites of assembly and also by the horsefly *Philoliche atricornis* (Tabanidae), which we presume feeds on nectar retained in the perianth tube.

*Selected specimens*

WESTERN CAPE.—3318 (Cape Town): Riverlands Reserve, sandy soil, (–BC), 28 Sept. 2005, *Snijman 2028* (NBG); between Darling and Malmesbury, (–BC), 23 Sept. 1932, *Salter 2711* (SAM); Malmesbury, (–DA), 26 Sept. 1927, *Lewis Grant 3426* (MO); N7 at turn-off to Camphill Village south of Malmesbury, (–DA), 13 Oct. 1974, *Goldblatt 3022* (MO), 27 Sept. 1995, *Goldblatt & Manning 10333* (MO, NBG); near Green River, ± 42 km N of Cape Town, sandy flats, (–DA), 30 Sept. 1961, *Lewis 5749* (NBG, PRE); near Klipfontein, (–DA), October, *Zeyher s.n.* (PRE, SAM); Kalabaskraal, (–DA), 29 Sept. 1958, *Werdermann & Oberdieck 293* (PRE). Without precise locality: Vredenburg, ex Cape Town Wild Flower Show, Oct. 1916, *Anon.* (*BOL13918*).

18. **Ixia purpureorosea** *G.J.Lewis* in Journal of South African Botany 28: 126 (1962). Type: South Africa, [Western Cape], Saldanha Bay, Postberg, 8 Sept. 1957, *Lewis 5243* (NBG, holo.!).

Plants mostly 400 to 600 mm high, simple or with 1 short branch subtended by acute bracts and prophylls. *Corm* up to 20 mm diam., with broad, fasciated stolons up to 60 mm long, branching distally and each branch with a small terminal cormlet. *Leaves* 4 or 5, sword-shaped, often laxly twisted distally, main vein thickened, margins not raised, upper 2 leaves sheathing stem, uppermost often entirely sheathing. *Spike* fairly crowded, mostly 15–20-flowered; bracts translucent white turning pale straw-coloured above with age, mostly ± 8 mm long, ± reaching node above, outer obscurely 3-veined, central vein more prominent, 3-lobed, central lobe longest, acute, outer lobes ± obtuse, inner 2-veined and 2-cusped. *Flowers* pink-purple, dark purple in throat, bases of tepals white sometimes edged with pale pink, tube dark red-purple to brown outside, unscented; perianth tube ± filiform, 13–15 mm long, flaring in upper 3 mm, with nectar held in upper part; tepals ovate, 20–22 × 10 mm long, spreading but remaining ± spooned. *Stamens*: filaments erect, contiguous, white, ± 4 mm long, exserted ± 2.5 mm from tube; anthers diverging, 6–8 mm long, yellow. *Style* dividing opposite or shortly above base of anthers, branches arching outward, between anthers, white, ± 5.5 mm long. *Capsules* and *seeds* unknown. *Flowering time*: September to early October. Figure 8.

*Distribution*: *Ixia purpureorosea* is a true edaphic endemic, restricted to areas of limestone and calcrete in the vicinity of Saldanha Bay (Figure 7). Plants grow in pockets of peaty sand in crevices in rocky pavement. Plants were only known to Lewis from Postberg on the Langebaan Peninsula but the species has since been collected at Jakobsbaai, north of Saldanha, and on the limestone hills east of Saldanha.

*Diagnosis and relationships*: according to Lewis (1962) who described the species, *Ixia purpureorosea* was first collected by C.P. Thunberg, and a collection in the Van Royen collection at Leiden likewise attests to its early discovery. Lewis considered the species as intermediate between sects *Ixia* and *Morphixia* but believed its affinity lay with the former. We disagree, not only is the perianth tube expanded in the upper quarter but the tube contains nectar, not normally present in species of sect. *Ixia*, the filaments are decurrent, and the perianth does not have a dark central area of pigmentation, almost universal in the section. The flowers are purple-pink with the tepals white, sometimes edged with pale pink, at base, not dark at base as described by Lewis. The perianth tube is dark red-purple to brown outside and this imparts to the mouth of the tube a dark colour when viewed from above.

*Ixia purpureorosea* is most likely allied to species of sect. *Hyalis* such as *I. tenuifolia* and *I. aurea*, which have a similarly narrow perianth tube, clasping the style in the lower half to two thirds. The broad leaves, somewhat twisted in the distal half are particularly reminiscent of *I. aurea.* A feature of *I. purpureorosea* not before recorded is the presence of one or more stolons produced from the corm base. The stolons, unique in the genus, are broad and fasciated, up to 60 mm long, branching distally with each branch bearing a small terminal cormlet.

*Selected specimens*

WESTERN CAPE.—3217 (Vredenburg): Saldanha, Farm Holvlei, shallow sand with calcrete rocks, (–DD), 2 Oct. 1996, *Rode 665* (NBG); Trekossenkraal Farm, exposed limestone and shallow sand, (–DD), 28 Sept. 2002, *Boucher 6988* (NBG); Jakobsbaai, limestone pavement, (–DD), 30 Sept. 2009, *Goldblatt & Porter 13481* (MO, NBG). 3317 (Saldanha): Saldanha, Prospect Hill, (–BB), 18 Sept. 2005, *Raimondo CR1698* (NBG); Saldanha, limestone hill east of the town, sandy slope among limestone rocks, (–BB), 5 Sept. 2009, *Goldblatt & Porter 13261* (MO, NBG). 3318 (Cape Town): Postberg, (–AA), 12 Sept. 1988, *De Vos 2707* (NBG).

2. Sect. **Morphixia** *(Ker Gawl.) Pax* in Die natürlichen Pflanzenfamilien 2,5: 154 (1888); Lewis: 66 (1962), as *Morphixia* (Ker Gawl.) Diels. Subgenus *Morphixia* (Ker Gawl.) Goldblatt & J.C.Manning: 63 (1999). Type species: *Morphixia aulica* (Aiton) Ker Gawl., here designated (= *Ixia latifolia* D.Delaroche).

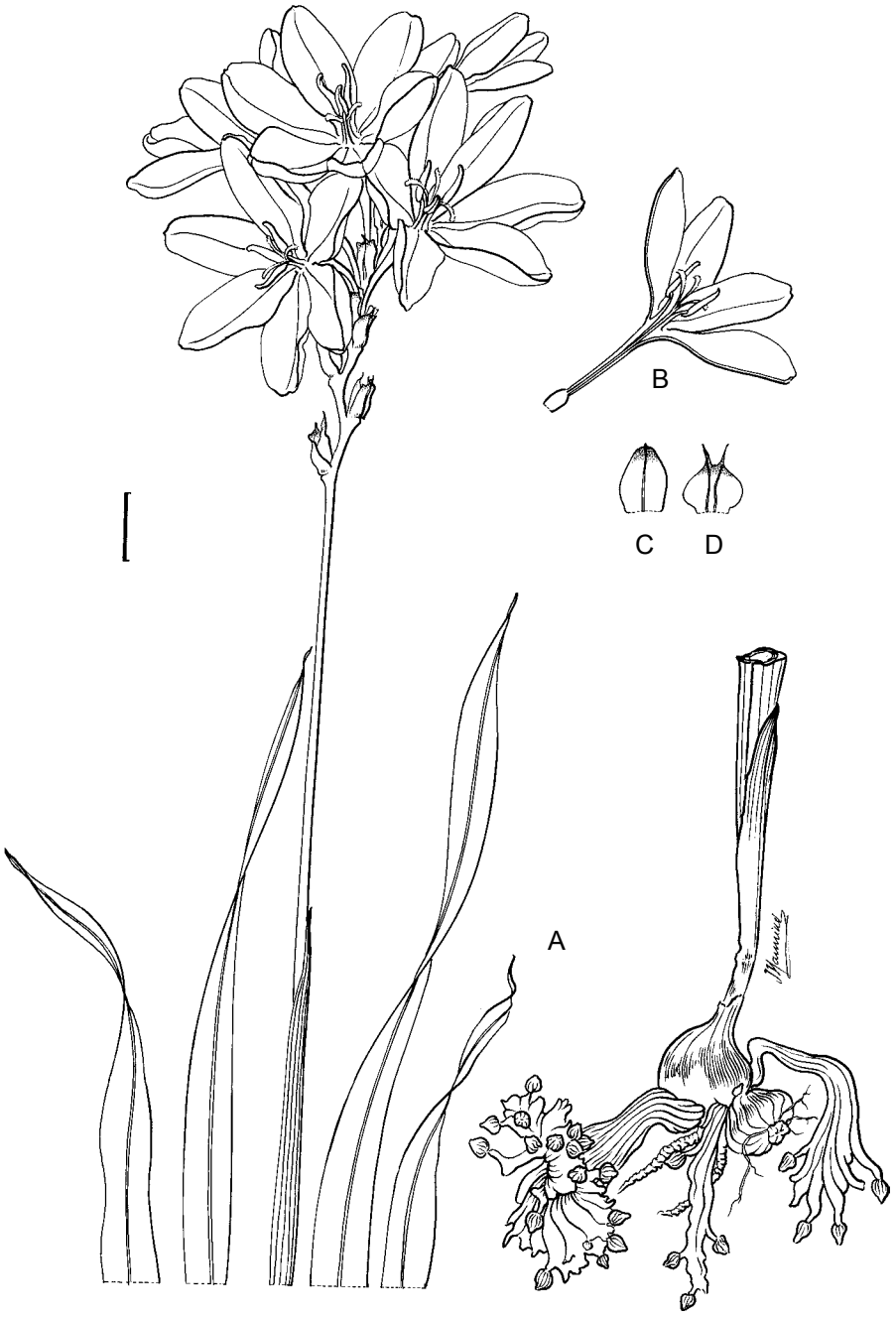


FIGURE 8.—*Ixia purpureorosea*, *Goldblatt & Porter 13261* (NBG): A, plant with corm showing fasciated stolons; B, l/s flower; C, outer bract; D, inner bract. Scale bar: 10 mm. Artist: J.C. Manning.

*Leaves* usually 3, sometimes up to 5, but always dimorphic, lower foliage leaves with well-developed blades and uppermost 1 (rarely 2 when basal foliage leaves more than 2) entirely sheathing. *Spike* with bracts usually membranous and translucent, rarely flushed with purple and opaque, outer with 3(5) prominent veins and 3-lobed to 3-toothed (or 5-toothed when 5-veined). *Flowers* usually actinomorphic, rarely bilateral, mostly pale blue-mauve, sometimes pink or white, occasionally deep purple, white to yellow in throat, erect, ascending or nodding, often scented; perianth tube alway hollow to base, funnel-shaped to cylindric; tepals subequal, spreading. *Stamens* symmetrically arranged around central style and contiguous, rarely unilateral and then horizontal or declinate; filaments inserted at base of upper part of tube, decurrent, not expanded below, included to well exserted; anthers dehiscing longitudinally, exserted, partly included or rarely fully included. *Ovary* and capsules usually smooth, rarely warty (*Ixia alata* and *I. thomasiae*); style slender, central and straight, or when stamens unilateral then displaced to lie beneath filaments.

The first listing of a type for *Morphixia* at any rank is Lewis's (1962: 66) designation of *Ixia latifolia* as the type of sect. *Morphixia*. That species was never included in *Morphixia* by name and is thus not available as a type. To preserve the current circumscription of *Morphixia* we designate *M. aulica* as the type, a later synonym of *I. latifolia*.

2.1. Series **Morphixia**

19. **Ixia divaricata** *Goldblatt & J.C.Manning* in Bothalia 38: 18 (2008a) as nom. nov. pro *I. latifolia* var. *angustifolia* G.J.Lewis: 86 (1962). Type: South Africa, [Western Cape] Witzenberg, middle east face opposite Farm Rosendal, 26 Nov. 1941, *Pillans 9790* (BOL, holo.!).

*I. rapunculoides* var. *rigida* G.J.Lewis: 77 (1962). Type: South Africa, [Western Cape], Hex River Valley, 1 Oct. 1893, *P. MacOwan* in Herbario Normale Austro-Africana 1653 (BOL! [as Hex River Pass, *Bolus s.n.* in *Guthrie 3077*], G, K! [as near Hex River East, 1500 ft (± 460 m)], MO! [as Hex River Valley, De Doorns, Oct. 1893, *H. Bolus s.n.*], SAM!, Z, syn.).

*I. rapunculoides* var. *subpendula* G.J.Lewis: 77 (1962). Type: South Africa, [Western Cape], between Groot River and Elands Kloof, Oct. 1939, *Leipoldt 3026* (BOL, holo.!).

?*Ixia capitata* var. *stellata* Andrews, The botanist's repository 4: t. 232 (1802). *I. stellata* (Andrews) Klatt: 396 (1882). *I. ovata* var. *stellata* (Andrews) Baker: 164 (1892). Type: South Africa, without precise locality or collector, illustration in Andrews l.c. (1802).

See Goldblatt & Manning (2008a) in Bothalia 38 for description and illustration.

*Distribution*: *Ixia divaricata* is scattered through the mountains of the southwestern Cape, from Elandskloof, east of Citrusdal, through the Cold Bokkeveld to Tulbagh and the Hex River Valley, where it most likely no longer occurs (Goldblatt & Manning 2008a: fig. 10). Plants favour seasonally wet, stony sandstone flats and rocky sites. *Ixia divaricata* is still common in the Cold Bokkeveld, where it is found in sites presently protected from agriculture. Below Gydo Pass in the Warm Bokkeveld it is now actively threatened by the expansion of orchards that extend from Ceres and Prince Alfred Hamlet to the foot of the pass.

*Diagnosis and variation*: *Ixia divaricata* is unmistakable in its unusual branching pattern; the distinctive, stiff, straight lateral branches are held at angles of 30–50° to the main axis and bear mostly 3–5 flowers crowded in the distal half. The white or pale pink (rarely deep pink or purple) flowers are held erect, with the tepals spreading but not fully patent. That this plant was treated as var. *subpendula* of *I. rapunculoides* is puzzling, for not only is it distinctive in its branching pattern but the flowers are upright, not inclined or drooping, and the anthers, 4.0–5.5 mm long, are usually fully exserted from the tube or rarely with the bases included. Specimens with anthers exserted 1–2 mm were often included in *I. latifolia* by De Vos (1999) but typical *I. latifolia* has larger, deep pink flowers with a perianth tube 14–17 mm long, filaments ± 10 mm long, and broad basal leaves, mostly 10–18 mm wide. The reason for the adoption of a new name at species rank and the synonymy of *I. divaricata* are explained elsewhere (Goldblatt & Manning 2008a).

The immediate relationships of *Ixia divaricata* are most likely with *I. latifolia*. Confusion with that species is due in part to some collections with a longer tube, 12–14 mm (e.g. *De Vos 2693* and *Leipoldt 4070*), that also have relatively short, broad leaves, up to 18 mm wide (also found in *I. latifolia*) but fairly slender branches (characteristic of *I. divaricata*). These are almost certainly hybrids between the two species, which sometimes grow within sight of one another, although on different soils, *I. latifolia* favouring heavy clay or loam.

*Ixia divaricata* was associated historically with *I. latifolia*, and one of the two specimens cited by Baker (1892) under var. *longifolia* of *I. scariosa*, the name by which *I. latifolia* was then known, is *I. divaricata* (the other specimen is *I. orientalis* and is the lectotype of the name). The type of *I. latifolia* var. *angustifolia*, from the Witzenberg is also *I. divaricata*, but several other specimens assigned here by Lewis (1962) and De Vos (1999) are a different species, *I. monticola*, described here. Although these two taxa have been confused in the literature, they may not be particularly closely allied. The most important differences are that *I. monticola* has a corm with membranous, non-accumulating tunics, few or no branches, and four or five leaves. *I. divaricata*, in contrast, has fibrous tunics of medium texture and a distinctive branching pattern, and plants from high elevations typically have two or three leaves in most specimens, although sometimes more in those from middle elevations.

Plants from upper Moraine Kloof in the Hex River Mtns (*Helme 2864*), flowering in January, were provisionally included in *Ixia divaricata* by Goldblatt & Manning (2008a). They have a similar branching pattern but somewhat smaller, purple flowers with a tube ± 5 mm long, tepals ± 10 mm long, and anthers ± 3.2 mm long. The style divides at the top of the anthers and has branches ± 1.3 mm long that extend above the anther tips, whereas in typical *I. divaricata* the style divides opposite the middle of the anthers. The specimens lack corms and leaves without which a fair decision about the status of this late-flowering population cannot be made.

Pollination of *Ixia divaricata* accords with that for other species of series *Rapunculoides*. Plants are pollinated by a range of medium-sized and large bees including *Lasioglossum* sp. (Halictidae) and *Anthophora diversipes* and *Amegilla spilostoma* (Apidae) (Goldblatt & Manning 2008a).

*Selected specimens*

WESTERN CAPE.—3219 (Wuppertal): Cedarberg, valley between Sneeuberg and Tafelberg, wet sandy flats, (–AC), 19 Oct. 1923, *Pocock 408* (NBG); Elandskloof, Ceres, (–CA), 30 Sept. 1944, *Barker 3094* (BOL, NBG); Cold Bokkeveld, Waboomsrivier, sandy flats (*vlakte*), (–CC), 4 Oct. 1966, *Hanekom 776* (K, PRE); Cold Bokkeveld, 3 miles [4.8 km] S of Leeurivier, (–CD), Sept. 1952, *Lewis 2512* (PRE, SAM). 3319 (Worcester): Great Winterhoek, Sneeugat, (–AA), Nov. 1916, *Phillips 1874* (NBG); Steindaal, Tulbagh, Oct.–Nov. 1858, *Pappe s.n. SAM20937* (NBG); Tulbaghskloof (Nieuwekloof), Tulbaghsthal, foot of Winterhoeksberg, Witsenberg and Vogelvalei, (–AA), Nov. 1830, *Ecklon & Zeyher Irid. 94* (BOL, K, PRE); Cold Bokkeveld, roadside at Farm Wadrif, in rocky sandstone ground, (–AB), 30 Sept. 2004, *Goldblatt & Porter 12604* (MO, NBG); stony flats at foot of Gydo Pass, (–AB), 4 Oct. 2004, *Goldblatt & Porter 12610* (MO, NBG, PRE); Witzenberg Mtns, Visgat Valley, Farm Wakkerstroom, (–AC), 5 Nov. 2003, *Low 9376* (NBG); near Ceres Nature Reserve in wet ground, (–AD), 8 Oct. 1986, *De Vos 2675* (NBG, PRE) Matroosberg, near Lakenvlei, (–AD), without date, *Phillips s.n. SAM11876* (NBG); Hex River Mtns, upper Moraine Kloof Amphitheatre south of Milner Peak, 1 050 m, (–AD), 4 Jan. 2004, *Helme 2864* (NBG).

Putative hybrids with *Ixia latifolia* are listed by Goldblatt & Manning (2008a).

20. **Ixia saundersiana** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 150–200 mm altae, eramosae, cormo ovoideo-conico ± 8 mm diam., tunicis fibris tenuibus, foliis 2 folio inferiori basali lineari 1.0–2.5 mm lato, spica 2- vel 3-flora, floribus caeruleo-malvinis fauce flavo, tubo perianthii infundibuliforme ± 5 mm longo, tepalis ovatis ±

11 × 5.5 mm, filamentis ± 3 mm longis, antheris ± 4 mm longis ex tubo exsertis, ramis styli ± 1.5 mm longis.

TYPE.—Western Cape: 3319 (Worcester): Milner Peak, rock cracks in humus with restios (–CD), 7 Dec. 2008, *Saunders & Saunders sub Manning 3237* (NBG, holo.).

Plants 150–200 mm high, usually unbranched, rarely with up to three short, ascending branches. *Corm* ovoid-conic, ± 8 mm diam., with tunics of fine netted fibres. *Leaves* 2, lower basal, linear, 1.0–2.5 mm wide, sometimes shortly exceeding stem, central vein strongly and margins slightly thickened, pale when dry, upper sheathing the lower half to two thirds of stem, with a short free blade. *Spike* 2- or 3(–5)-flowered; bracts membranous, translucent, outer with 3 main veins and 2 smaller lateral veins, shortly 3-toothed, inner 2-veined and 2-toothed. *Flowers* blue-mauve, yellow in throat; perianth tube funnel-shaped, ± 5 mm long; tepals ovate, ± 11 × 5.5 mm. *Stamens* with filaments ± 3 mm long, reaching mouth of tube; anthers ± 4 mm long, yellow; pollen yellow. *Style* dividing opposite base to lower third of anthers, style branches ± 1.5 mm long. *Flowering time*: late October to December.

*Distribution*: *Ixia saundersiana* is known from just two collections, the first made in December 2008 at high elevation on Milner Peak in the Hex River Mtns, where plants were found growing in rock cracks in damp humus among restios. A second collection extends the range of the species to the Swartruggens, some distance to the northeast. Figure 7.

*Diagnosis and relationships*: a recent and surprising discovery, the high altitude *Ixia saundersiana* is immediately recognized by the single linear foliage leaf and a second, largely sheathing leaf, together with a mostly unbranched stem and spike of 2 or 3(–5) small, blue-mauve flowers yellow in the throat. Well-grown plants may have up to three, short, straight, ascending branches with up to four flowers per branch. The flowers are unremarkable and have a funnel-shaped perianth tube ± 5 mm long, spreading tepals, and relatively short filaments only 3 mm long, that reach only to the mouth of the perianth tube. We suspect that the species is most closely allied to *I. divaricata* but that species has a longer perianth tube, 8–11 mm long, filaments 4.0–5.5 mm long, usually exserted 1–2 mm from the tube and the stem is typically branched, with the long, straight branches diverging strongly from the main axis.

*Additional specimen*

WESTERN CAPE.—3319 (Worcester): Swartruggens, Farm Knolfontein, 1 220 m, (–AB), 22 Oct. 2009, *Jardine & Jardine 1219* (NBG).

21. **Ixia latifolia** *D.Delaroche*, Descriptiones plantarum aliquot novarum: 22 (1766); Lewis: 81 (1962). *Hyalis latifolia* (D.Delaroche) Salisb.: 317 (1812), genus invalid. *Geissorhiza latifolia* (D.Delaroche) Baker: 94 (1877). *Tritonia latifolia* (D.Delaroche) N.E.Br.: 135 (1929). Type: South Africa, without precise locality or collector (G-DEL, holo.!).

*I. aulica* [Soland, in] Aiton: 57 (1789). *Ixia capillaris* var. *aulica* (Aiton) Ker Gawl.: t. 1013 (1807). *Hyalis aulica* (Aiton) Salisb.: 318 (1812), genus invalid. *Morphixia aulica* (Aiton) Ker Gawl.: 107 (1827). Type: South Africa, 'Cape of Good Hope', cultivated in Britain, without precise locality, illustration in Curtis's Botanical Magazine 25: t. 1013 (1807).

*I. incarnata* Jacq.: t. 282 (1795b); Jacq.: 13 (1796). *Ixia capillaris* var. *incarnata* (Jacq.) Ker Gawl.: t. 617 (1803a). *Morphixia incarnata* (Jacq.) Ker Gawl.: 107 (1827). *M. capillaris* var. *incarnata* (Jacq.) Baker: 97 (1877). Types: South Africa, without precise locality or collector, illustration in Jacq. (1795b); South Africa, [Western Cape], Ceres, Theronsberg Pass, 20 Oct. 1983, *Snijman 779* (NBG, epitype!, here designated; PRE, iso.!).

*I. scariosa* Thunb.: 243 (1811). Type: South Africa, [Western Cape], probably in the Cold Bokkeveld, Sept. 1773, but not stated, *C.P. Thunberg s.n. UPS-THUNB990* (UPS-THUN–digitally scanned image!, specimen on right of sheet, lecto., here designated).

*I. phlogiflora* Delile in Redouté: t. 432 (1814a). Type: South Africa, [Western Cape], without precise locality or collector, illustration in Delile in Redouté, Les Liliacées 8: t. 432 (1814a).

*I. latifolia* var. *curviramosa* G.J.Lewis: 86 (1962), syn. nov. Type: South Africa, [Western Cape], 3320 (Montagu): Laingsburg Div., Tweedside, on flats, (–BB), 27 Sept. 1951, *Barker 7469* (NBG, holo.!; NBG!, PRE!, iso.).

Plants mostly 150–350 mm high, usually 1–3-branched, rarely simple; branches either ascending, fairly long and straight or shorter and ± twisted, subtended by obscure, obtuse bracts and prophylls ± 1 mm long. *Corm* subglobose, mostly 15–25 mm diam., with tunics of firm, often coarsely wiry, netted fibres, bearing small cormlets at base. *Leaves* usually 3, lower 2 lanceolate to sword-shaped, oblong or falcate, (5–)10–18 mm wide, ± one third as long as stem; margins moderately to strongly thickened, sometimes slightly crisped; uppermost leaf sheathing lower half to two thirds of stem. *Main spike* mostly 3–7-flowered, lateral spikes (1–)3–6-flowered, either ± straight or twisted; bracts translucent sometimes tinged brown, especially in fruit, outer with three dark veins, mostly 7–11 mm long, acutely 3-toothed, inner ± as long or slightly longer, with two dark veins, 2-toothed at apex. *Flowers* facing to the side, deep pink, pale mauve or blue-mauve, white or yellow in throat, sometimes edged darker pink or purple, unscented or with a faint rose or sour odour; perianth tube (7–)10–18(–23) mm long, narrowly funnel-shaped, flaring in upper third, slightly curved near base; tepals subequal, ovate, 13–20(–23) × (6–)7–10 mm, spreading at right angles to tube distally. *Stamens* with filaments 8–12 long, exserted 6–8 mm; anthers 3–5 mm long before splitting. *Style* dividing between base and middle of anthers, style branches 1.8–3.0 mm long, extending between anthers. *Flowering time*: mainly mid-September to mid-October. Figure 9.

*Distribution*: as circumscribed here, *Ixia latifolia* is a species of clay, clay loam and sandy soils in renosterveld, or occasionally dry fynbos habitats. The species is fairly common at higher elevations in the interior southwestern part of Western Cape. It extends from the Cold Bokkeveld and Worcester eastward to Karoo Poort at the edge of the Tanqua Karoo and southeast through the Witteberg Karoo and northern foothills of the Klein Swartberg. Isolated populations also occur locally in the Little Karoo on the southern slopes of the Gamkaberg, a small but surprising disjunction (Figure 10). Lewis's (1962) vague description of the habitat of *I. latifolia* as sandy flats and slopes must then be extended to include clay soils as well.

*Diagnosis and relationships*: in our revised and narrower circumscription, *Ixia latifolia* is recognized by the relatively large, deep pink, purple, mauve-pink, blue-mauve or violet flower usually with a relatively


FIGURE 9.—A, B, *Ixia latifolia, Goldblatt & Porter 12969*: A, plant; B, l/s flower. C, D, *Ixia latifolia, Goldblatt & Porter 12813*: C, plant; D, half-flower. Scale bar: 10 mm. Artist: J.C. Manning.

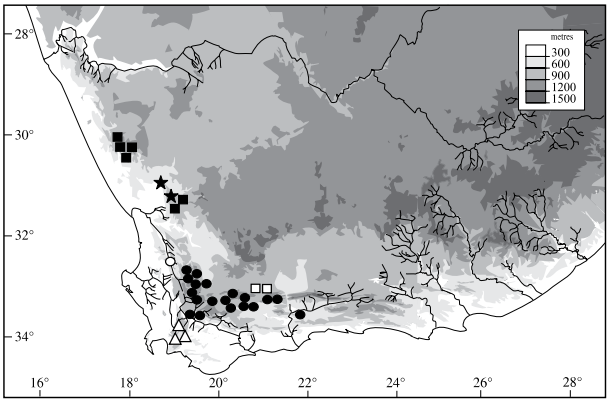


FIGURE 10.—Known distribution of *Ixia latifolia*, ●; *I. ecklonii*, ○; and *I. monticola*, △; *I. parva*, □; *I. ramulosa*, ■; and *I. brunneobractea*, ★.

well-developed perianth tube, (7–)10–18(–23) mm long that gradually widens toward the mouth, and spreading tepals 13–20(–23) long. The long stamens have filaments exserted 6–8 mm from the tube and anthers 3–5 mm long. The floral bracts are mostly 8–10 mm long and distinctive in having narrowly acute teeth. The two broad basal leaves are usually fairly broad, 10–18 mm, but occasionally only 5 mm wide. The third leaf sheathes the stem for its entire length, as is typical of sect. *Morphixia.*

Lewis (1962) recognized five varieties of *Ixia latifolia*, three of which are here treated as four separate species. Small-flowered var. *parviflora*, now *I. parva*, is a plant of low stature, a twisted spike, purple floral bracts, and filaments exserted 5–6 mm. Var. *ramulosa*, from Namaqualand, now *I. ramulosa*, comprises plants with several, short lateral branches bearing one or two, rarely three, flowers. Lastly, var. *angustifolia* included two species, one of them is now *I. divaricata* and the other is a high elevation species, described here as *I. monticola*, and distinguished by soft-textured leaves and dry-membranous, brown, onion-skin-like corm tunics. The remaining var. *curviramosa* was distinguished by Lewis by the short, somewhat twisted, rather than straight, lateral branches and slightly smaller flower. The ample material of *Ixia latifolia* collected since Lewis's revision has made the distinction between var. *curviramosa* and var. *latifolia* arbitrary and we do not recognize var. *curviramosa*. The degree of twisting and length of the branches is not consistently correlated with any other character, and is often difficult to determine because plants with shorter, ± straight branches, conform to neither taxon.

Flower size in *Ixia latifolia* is unsually variable. Both the northernmost populations of *I. latifolia* in the arid Tanqua Basin and the easternmost near Oudtshoorn are exceptional and we considered that they possibly represented separate species. The Tanqua populations (*Goldblatt & Porter 12969*), growing in perhaps the most arid habitat for the species, have the largest flowers with a tube 20–23 mm long and tepals up to 21 × 10.5 mm. In contrast, the Gamkaberg populations have flowers with a tube 7–8 mm long and tepals 13–15 × ± 7 mm, among the smallest in the species. But plants from several other localities, e.g. *Goldblatt & Nänni 11184* from the Voetpadsberg near Touws River and *Oliver 5104* from Long Acres in the Cold Bokkeveld have flowers almost as small. The plants from the Tanqua Karoo reverse the usual trend for smaller stature and flower size in the driest habitats and merit further study. We prefer not to formally recognize any of these variants because of the existence of populations intermediate between these extremes.

*Ixia latifolia* is probably most closely related to *I. divaricata*, a plant of wet, sandstone habitats in the Cold Bokkeveld and surrounding mountains, which has long, slender, straight lateral branches with flowers crowded in the upper half, a feature sometimes found in *I. latifolia*, but always a smaller perianth with a tube 8–11 mm long, tepals 11–14 mm long, and filaments 4–5 mm long reaching 1–2 mm beyond the mouth of the perianth tube or sometimes only to the mouth of the tube. *Ixia divaricata* typically has pale pink or white flowers and narrow leaves, thus very different from the larger, deep pink mauve or purple flowers with well-exserted filaments, and broad, fairly short leaves of *I. latifolia*. Plants with broader leaves may be the result of crossing with *I. latifolia*, and plants of that species with particularly long branches may be the result of occasional crosses with *I. divaricata* at sites where the habitats of the two are close together.

*Taxonomic history and typification*: *Ixia latifolia*, described by Daniel Delaroche in 1766, has a complex synonymy. It was long known as *I. scariosa*, described by Thunberg in 1811, and both this and the earlier *I. aulica* Aiton (1789), which was based on a plant cultivated in England and evidently preserved only as a painting, match the straight-branched form of *I. latifolia* from the Cold Bokkeveld. The type sheet of *I. scariosa* in the Thunberg Herbarium (*UPS-THUNB990*), is actually a mixture of two species. There are two tall specimens of *I. latifolia* and one short plant in the centre of the sheet, which may be *I. contorta* (but with a flower of *I. latifolia* mounted at the top of the main spike). Our identification of this specimen as *I. contorta* is provisional, because the included filaments in the single flower that belongs to the plant, are not visible in the digital image we have available. Because of the mixture on the sheet, we designate as lectotype the single plant on the right-hand side.

A third synonym, *Ixia incarnata* Jacq. (1795b), is today typified by an illustration not entirely representative of the species as the stem is unbranched. We have designated an epitype for the species so that the application of this name is fixed, should future doubt arise about its identity. Lastly, *I. phlogiflora* Delile (1814a), also based on a painting, testifies to the widespread cultivation of *I. latifolia* in Europe in the early 19th century. During the later 18th and early 19th centuries the species remained known as *I. scariosa*, even as late as 1896 in Baker's account of the genus in *Flora capensis*. The circumscription of *I. scariosa* remained fluid well into the 20th century and often included other species, such as *I. rapunculoides* Delile and its immediate relatives. The identity of Delaroche's *I. latifolia* remained uncertain throughout this period and was finally established by Lewis (1962) after she examined the type material at the Burman Herbarium in Geneva and then placed *I. scariosa* in synonymy.

Lewis also included *Ixia stellata* (Andrews) Klatt as a synonym of *I. latifolia*, a plant based on *I. capitata* var. *stellata* Andrews (1802). The only type material known is a painting in *The botanist's repository* and does not appear to us to represent *I. latifolia*, but possibly the related *I. divaricata* (Goldblatt & Manning 2008a). The correct identity of the plant is of secondary significance as the name *I. stellata* Roem. & Schult. (1817), probably a named hybrid of *Sparaxis* (Goldblatt 1969), renders use of Andrews's epithet at species rank in *Ixia* illegitimate.

*Selected specimens*

WESTERN CAPE.—3219 (Wuppertal): Cold Bokkeveld, Helpmekaar, red gravelly, stony loam, (–CC), 16 Oct. 1975, *Hanekom 2471* (K, MO, PRE); Cold Bokkeveld, NW of Tafelberg, dry shale slopes, 3100 ft [± 960 m], (–CD), 2 Oct. 1972, *Thompson 1550* (MO, PRE); summit of Tafelberg, (–CD), Oct. 1921, *Pillans s.n.* (*BOL14141*). 3319 (Worcester): Klip Koppies, north ridge of Gydoberg, dry sandy slope, 1 050 m, (–AB), 11 Oct. 1974, *Oliver 5096* (PRE); top of Gydo Pass, (–AB), 13 Oct. 1960, *Lewis 5750* (K, NBG, PRE); Long Acres, N of Gydoberg, on flats, 1 000 m, (–AB), 11 Oct. 1974, *Oliver 5104* (K, MO, NBG, PRE); Tanqua Karoo, north of Karoopoort near Inverdoorn, (–BB), 9 Sept. 2007, *Goldblatt & Porter 12969* (K, MO, NBG, PRE); Theronsberg Pass, east of Ceres, (–BC), 20 Oct. 1983, *Snijman 779* (NBG, PRE), 31 Oct. 1974, *Goldblatt 3227* (MO); Lakenvlei, (–BC), 19 Oct. 1941, *Compton 12061* (NBG); ± 2 km south of N1 on road to Montagu, sandstone cutting, (–BD), 9 Sept. 2006, *Goldblatt & Porter 12813* (MO, NBG, PRE); Worcester commonage, (–CB), 16 Sept. 1975, *Van Breda 4283* (K, PRE); Rabiesberg, Worcester, (–DA), 26 Sept. 1935, *Lewis s.n.* (*BOL26910*); Eendracht, Montagu, (–DB), 23 Sept. 1946, *Compton 15826* (NBG). 3320 (Montagu): between Konstabel and Tweedside, (–AB), 21 Sept. 1985, *De Vos 2602* (NBG, PRE); near Pietermeintjies Siding, (–AB), 2 Oct. 1999, *Goldblatt & Nänni 11184* (MO); foot of Voetpadsberg, 21.5 km E of Touws River, in sandy ground, (–AC), 3 Oct. 1999, *Goldblatt & Nänni 11202* (MO, PRE); Elandsfontein, Witteberg, (–AD), 21 Sept. 1931, *Compton 3810* (BOL, NBG); flats SW of Bantamskop, Witteberg, 980 m, (–BC), 23 Sept. 1990, *Oliver 9753* (NBG); between Ouberg Pass and Touws River, (–CA–CB), 29 Sept. 1933, *Dymond s.n.* (*Nat. Bot. Gard. 1965/33* in BOL, K, PRE). 3321 (Ladismith): northern foothills of Klein Swartberg, Farm Vleiland, (–AC), 10 Sept. 1983, *Vlok 668* (MO, NBG, PRE); road to Seweweekspoort, Farm Modderfontein, (–AC), 21 Sept. 2003, *Goldblatt & Porter 12329* (K, MO); Seven Weeks Poort, (–AD), Sept. 1912, *Phillips 1545* (BOL); southern foot of Gamkaberg, SW of Oudtshoorn, rocky ground in loamy clay among sandstone rocks, (–DB), 4 Sept. 2007, *Goldblatt & Porter* (NBG, K, MO, PRE, S).

22. **Ixia monticola** *Goldblatt & J.C. Manning*, sp. nov.

Plantae 80–250 mm altae, cormo ± 6 mm diametro, tunicis submembranaceis, foliis 2 vel 3(4) inferioribus 1, 2(3) anguste ensiformibus vel linearibus usitate 2.5–4.5 mm latis, caule saepe simplici vel 1(2)-ramoso, ramis filiformibus erectis saepe leviter contortis 10–15 mm longis, spica 2- vel 3-flora, bracteis 5–6 mm longis membranaceis vel scariosis, floribus carneis in fauce flavis, tubo perianthii infundibuliformi ± 10 mm longo, tepalis subequalibus 12–17 × 6–7 mm, filamentis ± 6 mm longis ex tubo 2–3 mm exsertis, antheris 3.5–4 mm longis flavis, stylo inter basem et medium antherarum dividenti ramis styli ± 1 mm longis.

TYPE.—[Western Cape], 3319 (Worcester): Du Toit's Peak, rocky upper slopes and ledges, west aspect, ± 6000' [1 820 m], (–CC), 21 Dec. 1975, *Esterhuyusen 34162* (BOL, holo.!; MO, iso.!).

Plants mostly 80–250 mm high, sheathed at base by pale brown cataphylls, usually simple or 1-, rarely 2-branched, branches thread-like, suberect, often slightly twisted, 10–15 mm long, subtended by obscure, membranous bracts and prophylls ± 1 mm long. *Corm* ± 6 mm diam., with rust-brown, submembranous tunics, not accumulating. *Leaves* 2, 3(4), lower 1, 2(3) with narrowly sword-shaped to linear blades, half as long to ± as long as stem, mostly 2.5–4.5 mm wide, uppermost leaf mostly sheathing but with a free unifacial distal portion. *Main spike* erect, slightly flexuose, 2- or 3-flowered, lateral spikes 1- or 2-flowered; bracts 5–6 mm long, membranous or becoming dry, flushed red-purple, outer bract shortly 3-cusped, inner forked apically. *Flowers* pink, yellow in throat, presence of scent unknown; perianth tube narrowly funnel-shaped, ± 10 mm long; tepals subequal, 12–17 × 6–7 mm. *Stamens* with filaments ± 6 mm long, exserted 2–3 mm from tube; anthers 3.5–4.0 mm long, yellow. *Style* dividing between base and middle of anthers, style branches ± 1 mm long. *Flowering time*: December to mid-January.

*Distribution*: *Ixia monticola* is a local endemic of the mountains of Western Cape between Victoria Peak and Wemmershoek Peak, on sandstone rocks and cliffs, above 1 200 m, this high mountain plant evidently flowers well only after fire, and with just a handful or collections known, it remains poorly understood (Figure 10).

*Diagnosis and relationships*: most specimens assigned by Lewis (1962) to *Ixia latifolia* var. *angustifolia*, including the type, *Pillans 9790* from the Witzenberg, are *I. divaricata* (syn. *I. rapunculoides* var. *subpendula*) (Goldblatt & Manning 2008a) but the few from the high elevations in the Paarl and Stellenbosch Divisions represent a second species, which we here describe as *I. monticola.* This new species can be recognized primarily by the small corm, ± 6 mm in diameter, with rust-brown, submembranous, non-accumulating, onion-skin-like tunics, often a fairly low stature and usually a simple, rarely 1(2)-branched stem. The moderate-sized pink flowers are unremarkable and have a perianth tube ± 10 mm long, tepals 12–17 mm long, and short filaments exserted 2–3 mm from the mouth of the tube. The leaves are ± straight, 2.5–4.5 mm wide, and the cataphylls are typically rust-brown. The species name indicates the high elevation distribution, all known collections being from above 1 400 m.

*Ixia monticola* is most easily confused with the relatively small-flowered *I. divaricata*, the higher elevation populations of which often have few-branched or unbranched stems, and similar narrow, erect leaves. *Ixia divaricata* more often has white or very pale pink flowers, and while the floral proportions are similar to those of *I. monticola*, *I. divaricata* always has well-developed fibrous corm tunics. It is not surprising that some collections of the latter have been confused with *I. monticola* given the similar appearance of *I. divaricata* from higher elevations. While they can best be distinguished by the corms, unfortunately often lacking in herbarium collections, the perianth tube length, 10–12 mm and usually unbranched stem of *I. monticola* contrasts with the perianth tube 8–11 mm in *I. divaricata*, and usually only 8–9 mm in the higher elevation populations. The distinctive divaricate branching pattern of *I. divaricata* with the branches straight, held at 45–90° to the main axis, and the flowers crowded in the distal half, contrast markedly

with the single short, suberect branches of *I. monticola*. Although we are fairly confident that *I. monticola* is correctly assigned to sect. *Morphixia* we note that the upper leaf is not completely sheathing, but has a short blade.

*Selected specimens*

WESTERN CAPE.—3418 (Simonstown): Victoria Peak, 4500' [± 1 450 m], (–AA), 2 Jan. 1944, *Esterhuysen 9763* (BOL). 3319 (Worcester): Wemmershoek Peak, south slopes, (–CC), 31 Dec. 1945, *Esterhuysen 11268* (BOL); mountains south of Wemmershoek, damp places, (–CC), Jan. 1921 (mostly fr.), *Andreae 736* (PRE); Adolph's Kop, Franschhoek Mtns, after fire, (–CC), 15 Dec. 1944, *Esterhuysen 11199* (BOL).

23. **Ixia parva** *Goldblatt & J.C.Manning*, nom. nov. pro *I. latifolia* var. *parviflora* G.J.Lewis in Journal of South African Botany 28: 86 (1962). Type: South Africa, [Western Cape], 3320 (Montagu): Laingsburg Div., Karoo Garden, Whitehill, (–BA), 9 Sept. 1935, *Compton 5592* (NBG, holo.!).

Plants mostly 70–120 mm high, usually 1- or 2-branched, branches short, twisted, subtended by membranous, attenuate bracts and prophylls 2–3 mm long. *Corm* 12–16 mm diam., with tunics of medium-textured, netted fibres, bearing medium-sized cormlets at base. *Leaves* 3, lower 2 with blades sword-shaped to falcate, 3–9 mm wide; margins and midrib slightly thickened; uppermost leaf sheathing lower half to two thirds of stem. *Main spike* mostly 3–6-flowered, markedly flexuose, branches (1–)3–5-flowered; bracts 5–7 mm long, membranous or papery, opaque-purple or rust-coloured and veins hardly evident, with short acute teeth, inner ± as long or slightly longer than outer. *Flowers* extending horizontally with tepals vertical, bright pinkish purple, yellow in throat with base of tepals edged with red, strongly scented of sweet pea; perianth tube funnel-shaped, 6–8 mm long; tepals subequal, oblong, 10–12 × ± 4 mm, spreading at right angles to tube. *Stamens* with filaments 6–7 mm long, ± 5 mm; anthers ± 4 mm long. *Style* dividing below or opposite bases of anthers, branches ± 3 mm long, spreading below anthers. *Flowering time*: mid-August to late September. Figure 11.

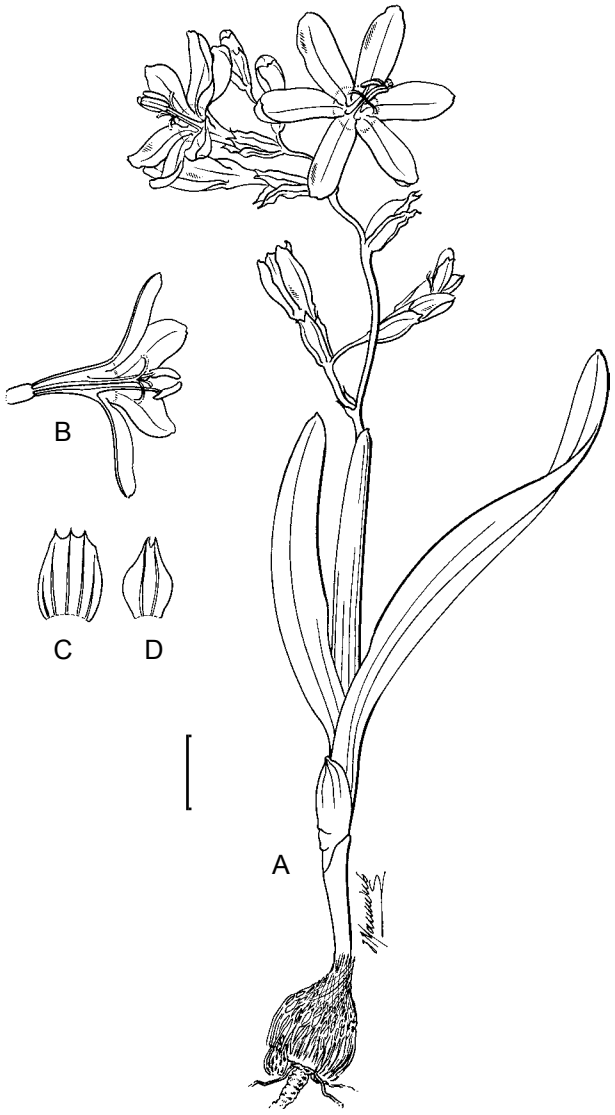


FIGURE 11.—*Ixia parva*, *Goldblatt & Porter 12709* (NBG). A, plant; B, half-flower; C, outer bract; D, inner bract. Scale bar: 10 mm. Artist: J.C. Manning.

*Distribution*: local in the Western Karoo, *Ixia parva* occurs between Laingsburg and Matjiesfontein, in decomposed shale on south-trending slopes (Figure 10).

*Diagnosis and relationships*: known from just two collections when first described by Lewis (1962), both from Whitehill near Laingsburg, *Ixia latifolia* var. *parviflora* was readily distinguished from other varieties of *I. latifolia* by its small, red-purple flowers and low stature. Additional collections now available confirm a fairly uniform morphology and complete separation in all quantitative features from the remaining varieties of *I. latifolia*. Neither Lewis (1962) nor De Vos (1999) in her *Flora of southern Africa* treatment of *Ixia* noted the distinctive dark purple bracts of the plant and confined themselves to comments on its smaller size. Not only do the bracts differ from those of other plants they included in *I. latifolia*, but the smaller flowers have unusually long style branches, ± 3 mm long, unexpected in such a small flower. The style divides at or slightly below the apices of the filaments and the style branches extend outward beneath the anthers where they are conspicuous. The flowers are also strongly scented of sweet pea, a feature unique among the species of the *I. latifolia* group where scent is lacking or weakly developed.

In view of its several differences from all variants of *Ixia latifolia*, we consider var. *parviflora* is best regarded as a separate species, here called *I. parva* because the name *I. parviflora* Salisb. (= *Romulea columnae* L.) prevents use of the varietal name at species rank. *Ixia parva* differs from *I. latifolia* in the very flexuose spike, twisted lateral branches, dark bracts and smaller flower with a perianth tube 6–8 mm long and tepals 10–12 mm long, versus straight lateral branches, a tube (7–)10–18(–23) mm long and tepals 13–20(–23) mm long in *I. latifolia*. The general appearance of *I. parva* most closely matches the eastern populations of *I. latifolia*, which also have twisted lateral branches, but these plants are usually taller and have larger, pale mauve to blue-mauve flowers. The shorter style branches, usually 1.8–2.3 (exceptionally 3) mm long, and style dividing opposite the middle third of anthers, of *I. latifolia* also stand in marked contrast to the style dividing below the anthers and relatively long style branches of *I. parva*. The delightful scent and bright red-purple colour of the

flowers make *I. parva* a particularly desirable plant for a container or rock garden.

*Representative specimens*

WESTERN CAPE.—3320 (Montagu): lower slopes of Ghaap Kop near Matjiesfontein, (–BA), 24 Sept. 1981, *Goldblatt 6388A* (MO, PRE); Karoo Garden, Whitehill, (–BA), 6 Aug. 1923, *Compton 2873* (BOL, NBG); gravel road to Sutherland from N1 west of Laingsburg, 2760 ft [± 910 m], (–BA), 27 Aug. 2006, *Goldblatt & Porter 12709* (K, MO, NBG, PRE, S).

24. **Ixia ramulosa** *(G.J.Lewis) Goldblatt & J.C.Manning*, stat. nov. *Ixia latifolia* var. *ramulosa* G.J.Lewis in Journal of South African Botany 28: 86 (1962). Type: South Africa, [Northern Cape], 3017 (Hondeklipbaai): Grootvlei, Kamieskroon, (–BB), Sept. 1945, *Lewis 1372* (SAM, holo.!; SAM, iso!, two sheets).

Plants mostly 150–400(–650) mm high, with 3–6(–8) short, slightly twisted branches subtended by minute, scale-like, ± truncate to obtuse bracts and prophylls 1(–2) mm long. *Corm* with tunics of coarse, netted fibres. *Leaves* 3, lower 2 sword-shaped to falcate, 4–10 mm wide; margins and midrib moderately or sometimes slightly thickened; uppermost leaf sheathing lower half to two thirds of stem. *Main spike* mostly 2- or 3-flowered, branchlets mostly 1- or 2(3)-flowered; bracts mostly 7–8 mm long, often rust-brown in distal half, with short acute teeth, inner bract ± as long or slightly longer than outer. *Flowers* deep purple, white in throat or mauve (also described as pink or blue) or white with a yellow throat, presence of scent unknown; perianth tube widely funnel-shaped, 7–9(–10) mm long; tepals subequal, ovate, 10–15 × 5–7 mm, spreading at right angles to tube. *Stamens* with filaments 4–6(–8) mm long, exserted 2–4(–6) mm from tube; anthers 4–5 mm long, slightly shorter to slightly longer than filaments. *Style* dividing between lower and middle third of anthers, style branches ± 1.0–1.8 mm long, apices emerging between anthers. *Flowering time*: mainly late August to early October, or early November at higher elevations.

*Distribution*: *Ixia ramulosa* is recorded from central Namaqualand in the Kamiesberg and along the Bokkeveld Escarpment in Northern Cape and adjacent Kobee Mtns in Western Cape, in granitic sand or light clay loam (Figure 10).

*Diagnosis and variation*: until now collections of *Ixia ramulosa* have been treated as var. *ramulosa* of *I. latifolia* (Lewis 1962; De Vos 1999). The taxon was associated with *I. latifolia* only because of the shared narrowly funnel-shaped perianth tube and moderately to well-exserted anthers, by no means an unusual feature and probably the ancestral condition for the genus. *Ixia ramulosa* can always be distinguished from other species with similarly exserted anthers, by the perianth tube 7–9(–10) mm long, several, short, wiry, lateral branchlets each bearing 1 or 2 or occasionally 3 flowers. Like other species of sect. *Morphixia*, *I. ramulosa* normally has just three leaves, the two lowermost with well-developed blades, and the upper one largely to entirely sheathing the stem.

*Ixia ramulosa* is best known from central Namaqualand where it has been repeatedly collected in the vicinity of Kamieskroon and the nearby farms, Grootvlei and Skilpad. Populations from these sites have brilliant, dark purple (also described as magenta) flowers with a white throat. Collections from higher elevations in the Kamiesberg east of Kamieskroon have pink or blue-mauve flowers with a yellow throat (e.g. *Esterhuysen 23700*; *Rodin 1474*) and also differ in perianth tube length, 7–8 mm long, versus 8–9(–10) mm for purple-flowered plants from lower elevations. Their later flowering, in October to early November, is probably explained by the higher elevation. Among these Kamiesberg populations, *Goldblatt 6697* consists of particularly tall, slender plants up to 650 mm high with long narrow leaves 5–6 mm wide. They appear very different to the short-leaved plants but this may be explained by marshy habitats in which the plants were found. Alternatively these plants represent a separate taxon.

Provisionally we also include plants from the Bokkeveld Mtns to the south in *Ixia ramulosa* (e.g. *Barker 10743*; *Helme 3567*; *Pretorius 556*). Like typical *I. ramulosa*, these plants have stems with several short, filiform, few-flowered lateral branches and bracts sometimes flushed rust-brown distally, but a perianth tube 8–9 mm long and filaments ± 8 mm long (longer than in typical *I. ramulosa*), exserted ± 5 mm from the tube. These southern populations have branchlets with one (*Pretorius 556*) or two (*Helme 3567*, *4240*) or three flowers (*Barker 10743*), and white or pale blue-mauve flowers with a yellow cup. The Barker collection stands out in consisting of exceptionally robust plants, up to 750 mm high. Despite the longer filaments and different perianth colour, we see no reason based on current information to regard the southern populations as a new taxon. Disjunctions between the Bokkeveld Mtns and the Kamiesberg are not common but are known. Examples from the Iridaceae include *Hesperantha pauciflora* G.J.Lewis and *Ixia namaquana* L.Bolus.

The Bokkeveld Mtn populations that we include in *Ixia ramulosa* have also been referred in herbaria to *I. brunneobracteata* but this is a species of wet sandstone habitats and it has uniformly brown bracts, not merely light brown in the upper half. *Ixia brunneobracteata* also differs in having corms bearing stolons, longer, narrower leaves (up to 3.5 mm wide), a main spike of 3–6 flowers, 1 to 2 fairly long lateral branchlets (stems are sometimes unbranched), each with 2–4(5) flowers, and a perianth tube 5–7 mm long. Bokkeveld populations of *I. ramulosa* consist of plants with up to 5 branchlets each with 1 to 3 flowers, as well as a slightly longer perianth tube, ± 8 mm long, and the corms do not bear stolons.

*Selected specimens*

NORTHERN CAPE.—3017 (Hondeklipbaai): Grootvlei near Kamieskroon, (–BB), 7 Sept. 1945, *Leighton 1216* (BOL, PRE); Grootvlei, rolling hills, 640 m, (–BB), 28 Aug. 1947, *Acocks 19459* (K, PRE); Kamieskroon, (–BB), 24 Aug. 1941, *Esterhuysen 5711* (BOL, PRE); Skilpad Nature Reserve, (–BB), 16 Aug. 1993, *Van Rooyen 2622* (PRE); Skilpad Farm, Wolwepoort, (–BB), 15 Aug. 1967, *McMurtry 287* (PRE); north of Darter's Grave, (–BD), 7 Sept. 1950, *Barker 6750* (NBG). 3018 (Kamiesberg): Leliefontein, (–AC), 2 Oct. 1947, *Rodin 1474* (BOL, K, MO, PRE); flats 1 km south of Leliefontein, local in marshy area, (–AC), 4 Nov. 1982, *Goldblatt 6697* (MO, PRE); Kamiesberg, De Kom, Farm Karas, (–AC), Oct. 1940, *Leipoldt 3606* (BOL); Kamiesberg, (–AC), 16 Oct. 1954, *Esterhuysen 23700* (BOL); between Garies and Leliefontein, top of pass, (–AC), Nov. 1939, *Leipoldt 3021* (BOL); lower north slopes of Rooiberg, jeep track to Damsland, 1 200 m, (–?), 14 Oct. 2004, *Helme 3308* (NBG). 3119 (Calvinia): Oorlogskloof Nature Reserve, Farm De Vondeling,

west bank of Oorlogskloof River at jeep track crossing, renosterveld in loam, 680 m, (–AC), 18 Sept. 2005, *Helme 3567* (NBG); Nieuwoudtville, Farm Groot Tuin, yellow clay, (–AC), 3 Oct. 2000, *Pretorius 556* (K, NBG, MO); Farm Uitkomst, SW of Nieuwoudtville, sandy slopes and floor of valley, (–AC), 29 Sept. 1970, *Barker 10734* (NBG, two sheets).

WESTERN CAPE.—3119 (Calvinia): Kobee, near Farm Klein Kobee, sandy loam along streams in shade of wild olives, (–CA), 4 Sept. 2006, *Helme 4240* (NBG).

25. **Ixia ecklonii** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 300–500 mm altae, caule ramis 1–3 brevibus filiformibus, foliis 3 folio superiori vaginanti inferioribus laminis lanceolatis 4–7 mm latis, spica axiali lateralique 1-flora, floribus horizontaliter extensis, tubo perianthii ± 10 mm longo, tepalis ± 10 × ± 4 mm, filamentis ± 1.5 mm exsertis, antheris 3–4 mm longis, ramis styli ± 2 mm longis.

TYPE.—[Western Cape], Olifants River Valley, without date, *Ecklon & Zeyher Irid. 271* (MO, holo.; B–Herb. Treviranus, iso.).

Plants 300–500 mm high, with (1)2 or 3 short, wiry twisted branches 5–8 mm long, subtended by short, subacute bracts and prophylls ± 1 mm long. *Corms* 7–12 mm diam., with tunics of matted, ± fibrous layers. *Leaves* 3, lower 2 with lanceolate blades reaching to ± middle of stem, 4–8 mm wide, uppermost leaf sheathing stem almost to base of spike. *Spike* half nodding, 1-flowered, branches also 1-flowered; bracts membranous, dark translucent brown, 7–9 mm long, outer 3-veined and 3-toothed, inner 2-veined and 2-toothed, about as long as outer. *Flowers* facing to the side, colour and presence of scent unknown; perianth tube narrow, flared uniformly from base, curving outward, 10–11 mm long, ± 4 mm wide at mouth; tepals ± 10 × ± 4 mm. *Stamens* with filaments exserted ± 1.5 mm from tube; anthers 3–4 mm long. *Style* dividing opposite lower third of anthers, style branches ± 2 mm long. *Flowering time*: not recorded.

*Distribution*: evidently extremely rare and local, *Ixia ecklonii* is known from just one early 19th century collection from the Olifants River Valley. This bears Ecklon & Zeyher's locality no. 76 which is their shorthand for Clanwilliam [District], along the Olifants River and at Villa Brakfontein [near present-day Citrusdal] (Figure 10). The area is well explored botanically and the fact that it has not been recollected is remarkable. The species must be a very local endemic.

*Diagnosis and relationships*: we have located nothing quite like the type collection of *Ixia ecklonii* and although we are reluctant to describe a species based on a single collection of several, poorly preserved specimens, scientific and conservation considerations are better served in this case by our describing the species formally than by waiting until plants are found in the wild. *Ixia ecklonii* is immediately recognized by the slender stem bearing up to three short, filiform branchlets, these as well as the main axis each bearing a single flower. The flowers have a slightly curved, narrow perianth tube 10–11 mm long, flaring uniformly from base to apex and they obviously face to the side but colour and other aspects of the perianth are not known. The filaments are exserted ± 1.5 mm from the tube and the comparatively large anthers 3–4 mm long and well-developed style branches place *I. ecklonii* among a poorly defined cluster of species we treat as series *Morphixia*. The three leaves, of which the uppermost is entirely sheathing, indicate this placement. The general appearance of the plants recalls *I. mollis* and *I. namaquana* but both have a funnel-shaped perianth tube and the filaments and bases of the anthers included in the tube. The translucent, brown floral bracts recall the Bokkeveld Mtn species, *I. brunneobracteata*, but this plant has a funnel-shaped perianth tube 5–7 mm long, the main axis bears 3–5 flowers and the branches are not particularly short and usually bear 2–4 flowers.

26. **Ixia brunneobracteata** *G.J.Lewis* in Journal of South African Botany 28: 80 (1962). Type: South Africa, [Northern Cape], 5 miles [8 km] from Nieuwoudtville on Grasberg road, 16 Sept. 1961, *Barker 9555* (NBG, holo.!; BOL!, NBG!, PRE!, iso.).

Plants 200–500 mm high, simple or 1 or 2(3)-branched; branches subtended by ± dry, translucent brown, acute to attenuate bracts and prophylls 1.5–4.0 mm long. *Corm* 7–10 mm diam., with tunics of medium-textured fibres, bearing short to long stolons up to 12 mm long, each with an ovoid terminal cormlet. *Leaves* 3, the lower 2 with blades expanded, ascending to falcate, up to 4 mm wide, uppermost leaf largely or entirely sheathing stem. *Main spike* 3–5-flowered, lateral spikes 2- or 3(–5)-flowered; bracts membranous, dark translucent brown, 6–11 mm long, outer 3-veined and 3-toothed, inner 2-veined and 2-toothed, ± as long as outer. *Flowers* pale pink or white, pale yellow in tube, tepals sometimes flushed pink or light purple outside, scented faintly of fresh coriander; perianth tube funnel-shaped, 5–7 mm long; tepals ascending below, spreading above, ovate, 10–15 × 5–8 mm. *Stamens* with filaments inserted in middle of tube, 6–8 mm long, exserted ± 3.5 mm from mouth of tube; anthers 4–5 mm long. *Style* dividing opposite middle third of anthers, style branches 1.5–2.0 mm long. *Flowering time*: mid-September to mid-October.

*Distribution*: an extremely narrow endemic, *Ixia brunneobracteata* is known only from seasonally wet or marshy sites in the sandstone belt between the top of Vanrhyns Pass and farms to the north along the Bokkeveld Escarpment (Figure 10). The rapid agricultural development in this area has all but eliminated the species from much of its range but it is, fortunately, protected in the new reserve, established on the Farm Avontuur, northwest of Nieuwoudtville, where it is common (N. Helme pers. comm. 2008).

*Diagnosis and relationships*: as its name suggests, *Ixia brunneobracteata* is immediately distinguished by its unusually dark floral bracts, which although membranous and semi-translucent, are a glossy dark chestnut-brown. A feature of the species not before recorded is the production of stolons from the base of the main corm. The flowers appear to be unspecialized, having a funnel-shaped perianth tube 5–7 mm long, spreading, subequal tepals, and filaments exserted ± 3.5 mm from the tube. Lewis (1962) suggested that the species might be most closely allied to *I. capillaris* from which it dif-

fered in the slightly wider leaves and usually more flowers per spike but we see no close relationship to *I. capillaris*, which has very specialized, linear leaves lacking the raised margins of the central vein, and wonder if *I. brunneobracteata* is not perhaps most closely related to *I. ramulosa* of the Kamiesberg and Bokkeveld Mtns. That species has a distinctively branched stem with up to five short, filiform branches bearing 1–3 flowers and a somewhat longer perianth tube, 7–9(–10) mm long. The floral bracts are translucent, or sometimes flushed light brown distally, and the flowers are magenta to blue-violet in Namaqualand, or in the Bokkeveld Mtns, pale yellow. In contrast, *I. brunneobracteata* has a spike of up to 5 flowers, only 1 or 2 branches or even an unbranched stem and white or sometimes pale pink flowers. The production of cormlets on long stolons is unusual in *Ixia*; the only other species of sect. *Morphixia* that has stolons, *I. oxalidiflora* and *I. sobolifera*, both series *Rapunculoides*, appear to have evolved this capacity independently and both favour heavier soils of clay or clay loam.

Although only described in 1962 by Lewis in her revision of the genus, *Ixia brunneobracteata* has been known at least since 1898 when plants were collected at sites in the vicinity of Nieuwoudtville by C.L. Leipoldt. His collections attracted no attention at the time, and were assigned in herbaria to the incertae or to *I. linearis* L.f., a name in the past often applied to *I. capillaris*, although the type is actually *Gladiolus quadrangulus* (D.Delaroche) Barnard (Goldblatt & Manning 2008a).

*Selected specimens*

NORTHERN CAPE.—3119 (Calvinia): Farm Avontuur, NW of Grasberg, sandy burned flats, (–AA), 21 Sept. 2008, *Helme 5837* (NBG); Nieuwoudtville, marshy places 'near the farm house', (–AC), Sept. 1898, *Leipoldt 790* (BOL); marshy slope south of top of Vanrhyns Pass, (–AC), 29 Sept. 1993, *Goldblatt & Manning 9781* (MO, NBG); Bokkeveld Escarpment between Meulsteenvlei and Cloudskraal, wet ground, (–AC), 15 Oct. 1976, *Goldblatt 4311* (MO); 2 miles [3 km] north of Nieuwoudtville, moist sandy places between restios, (–AC), 12 Oct. 1970, *Hall 3875* (NBG); Farm Biekoes, NW of Nieuwoudtville, wet sandy ground, (–AC), 29 Sept. 2008, *Goldblatt & Porter 13196* (K, MO, NBG, PRE).

### 2.2. Series **Brevitubae**

27. **Ixia marginifolia** *Salisb. ex G.J.Lewis* in Journal of South African Botany 28: 66 (1962) [as a combination based on *Hyalis marginifolia* Salisb.: 318 (1812), genus invalid]. *I. lancea* Jacq.: t. 218 (1795a), illegit. homonym not *I. lancea* Thunb. (1783). *I. capillaris* var. *lancea* Ker Gawl.: sub t. 570 (1802b) as a new name at varietal rank for *I. lancea* Jacq. *Morphixia capillaris* var. *lancea* (Ker Gawl.) Baker: 97 (1877). *Morphixia lancea* (Ker Gawl.) Klatt: 383 (1882). Type: South Africa, without precise locality or collector, illustration in Jacq., Icones plantarum 2: t. 281 (1795a).

*I. capillaris* var. *stricta* Ker Gawl.: t. 617 (1803a). Type: South Africa, without precise locality or collector, illustration in Curtis's Botanical Magazine 17: t. 617 of *I. capillaris* var. *stricta* (1803a).

Plants 200–500 mm high, often with a collar of fibres around base, usually with 4 to several (up to 10), short, filiform, straight or twisted branches, subtended by scale-like truncate bracts and prophylls ± 1 mm long. *Corm* 15–20 mm diam., with tunics of medium-textured to coarse fibres. *Leaves* (3–)5, lower (2–)4 with expanded blades, broadly lanceolate to falcate, one quarter to one third as long as stem, 8–15 mm wide; margins moderately to heavily thickened, pale, hyaline when dry; uppermost 1 or 2 leaves entirely sheathing. *Main spike* 1–3(–5)-flowered, lateral spikes (1)2–4-flowered; bracts membranous, translucent with dark veins, often dry; and brown distally, 6–7 mm long, outer 3-veined and obscurely 3-lobed, inner 2-veined and forked apically, ± as long as outer. *Flowers* facing to the side, blue-mauve, pink, or white, faintly freesia- or rose-scented, sometimes with an acrid odour or unscented; perianth tube funnel-shaped, (2.5–)3.0–4.0 mm long; tepals ascending below, spreading distally, ovate, (7–)10–13 × 5.5–8.0 mm. *Stamens* with filaments 5–7 mm long, exserted (1.5–)3.5–5.0 mm from mouth of tube; anthers 3.0–4.5 mm long, usually diverging at ± 30°, pale yellow. *Style* dividing opposite lower to middle third of anthers, style branches 1.5(–2.5) mm long. *Flowering time*: mostly mid-August to late September, but October at higher elevations.

*Distribution*: a widespread and often relatively common species of the western Karoo, *Ixia marginifolia* extends from the Kubiskou Range, west of Loeriesfontein, to Calvinia and then across the Bokkeveld Plateau south through the Roggeveld as far as Verlatekloof and east to Fraserburg and the Nuweveld Mtns near Beaufort West. The species has not been recorded in the Klein Roggeveld but further south, populations extend across the margins of the western Karoo and interior Cape flora region from Tweedside to Matjiesfontein (Figure 12). The record from near Beaufort West is a notable range extension of some 150 km from its next nearest recorded station near Fraserburg. Plants grow in renosterveld or karroid scrub on clay and loamy ground, usually the fine-grained, pale soils derived from Ecca or Beaufort shales and sandstones or occasionally loam in Witteberg Sandstone or even on the heavy red clays derived from dolerite.

*Diagnosis and variation*: distinctive in its short perianth tube, 2.5–4.0 mm long, and stem bearing several short, few-flowered wiry branches, *Ixia marginifolia* also has unusually broad, short, leathery leaves with strongly thickened, hyaline margins. It is sometimes confused in herbaria with *I. rapunculoides*, which is similar in general aspect, including flower colour and the falcate leaves with thickened margins, but the lat-

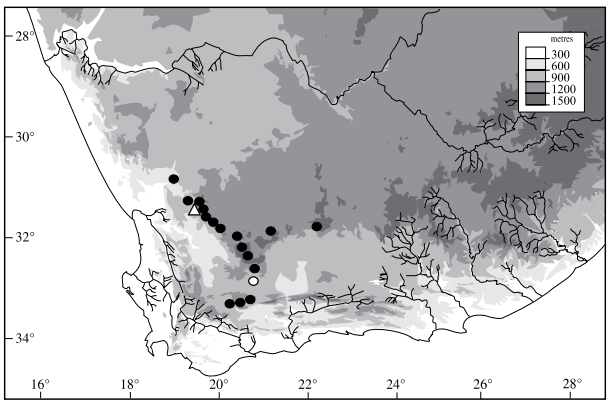


FIGURE 12.—Known distribution of *Ixia marginifolia*, ●; *I. linearifolia*, ○; and *I. pavonia*, △.

ter has short filaments included in the perianth tube, whereas *I. marginifolia* has the filaments exserted (1.5)3.5–4.0 mm so that the anthers are prominently displayed. The species displays a notable pattern of variation in flower colour. Plants in the northeast of its range have a pink perianth, but to the southeast in the Calvinia area, flower colour is pale blue-mauve, the same shade as equally common *I. rapunculoides* with which it is easily confused from a distance. On the northern and central Roggeveld Escarpment plants have either blue-mauve or white flowers, occasionally both colours occurring together (e.g. *Goldblatt & Porter 12789*), but at the southern end of the escarpment we have seen populations uniform for white flower colour, the same colour as reported for the Karoo National Park population (*Bengis 375*). Populations at the southern end of the range have violet flowers. White flowers remain open long after nightfall, whereas those of other colours close shortly after sunset. The variation in flower colour was not noted by Lewis (1962) or De Vos (1999), we suspect because they saw few plants in the wild and colour is soon lost in herbarium material.

*Ixia marginifolia* was poorly known to Lewis (1962), who cited just a handful of collections, mostly from the Sutherland area of the Roggeveld, but we now know the plant is quite common over a wide area across the western Karoo as far north as Loeriesfontein and east to the Nuweveld Mtns. Variation in number of flowers per branch is unusual: while 2 or 3 flowers are most common, plants with predominantly or only single-flowered branches occur throughout the range of the species (e.g. *Bengis 375*; *Hafström & Acocks 309*; *Marloth 9782*), most likely a reflection of poor growing conditions rather than an inherited feature. A few collections, e.g. from the base of the Voetpadsberg near Pietermeintjies Siding in Western Cape, consists of plants with smaller flowers than we consider typical for *I. marginifolia*, with tepals ± 7 × 5.5 mm (vs 10–12 × 6–8 mm), short filaments exserted ± 1.5 mm from the tube (vs 3.5–5.0 mm). These plants also have 1-flowered branches and we conclude that the smaller than normal floral features are the result of poor growing conditions that particular season. Plants from near Matjiesfontein a short distance to the east of the Pietermeintjies site and collected in another year have flowers typical in size for the species.

Despite being what we today consider a taxonomically isolated and distinctive species, *Ixia marginifolia* has been treated as a variety of *I. capillaris*, both as *I. capillaris* var. *lancea* and *Morphixia capillaris* var. *lancea* (Ker Gawler 1802b; Baker 1877). The immediate relationships of *I. marginifolia* are uncertain. The flowers, but not the leaves, closely resemble those of *I. linearifolia* and *I. pavonia* and we conclude that the three are closely related. The alliance may be allied to *I. latifolia*, although the latter has a much longer perianth tube. The overall similarity to *I. rapunculoides* is deceptive, for that species has short, included filaments and short, partly included anthers, very different from the longer and exserted filaments and long, prominent anthers of *I. marginifolia*.

*History*: the first record of *Ixia marginifolia* in the literature is the painting published in Jacquin's *Icones plantarum rariorum* (1795) under the name *I. lancea*. The provenance of the plant was not recorded except that it was from the Cape of Good Hope. The epithet *I. lancea* is an illegitimate homonym for the species so named by Thunberg (1783), which is *Tritonia lancea* (Thunb.) N.E.Br. Salisbury (1812) placed the species in his genus *Hyalis* with a new name *H. marginifolia*, citing Jacquin's *I. lancea* as a synonym. As *Hyalis* was a *nomen nudum*, and thus invalid, the name *H. marginifolia* is itself invalid. We accordingly treat the apparent combination *Ixia marginifolia* made by Lewis as a replacement name dating only from 1962 and attribute it to her alone.

*Selected specimens*

NORTHERN CAPE.—3019 (Loeriesfontein): lower clay slopes of Kubiskou Mtn, (–CD), 6 Sept. 2006, *Goldblatt & Porter 12777* (MO, NBG, PRE). 3119 (Calvinia): Holle River, 15 miles [24 km] from Calvinia, (–BC), 26 Sept. 1952, *Lewis 2513* (BOL, SAM); Bokkeveld plateau, shale flats near Bloukrans Pass, (–DB), 25 Aug. 1976, *Goldblatt 3935A* (MO); Perdekloof between Middelpos and Calvina near Farm Rooiwal, (–DD), 7 Sept. 2006, *Goldblatt & Porter 12789* (MO, NBG). 3120 (Williston): 28 km from Middelpos on road to Calvinia, (–CC), Sept. 1976, *Goldblatt 4270* (MO, NBG). 3121 (Fraserburg): hills near Fraserburg, (–DC), 20 Sept. 1938, *Hafström & Acocks 309* (PRE, S). 3220 (Sutherland): Roggeveld Escarpment, top of Ganagga Pass, (–AA), 1 Sept. 1993, *Goldblatt & Manning 9682* (MO, NBG); 14 miles [22.4 km] NNW of Sutherland, ± 5000' [1 535 m], (–BC), 27 Sept. 1957, *Acocks 19600* (NBG, PRE); Komsberg Flats, (–DB), Oct. 1920, *Marloth 9782* (NBG, PRE).

WESTERN CAPE.—3222 (Beaufort West): Karoo National Park, below FM tower, 2 000 m, (–BC), 30 Oct. 1984, *Bengis 375* (PRE). 3320 (Montagu): 3.9 km west of turn-off to Matjesfontein on N2, on recently burnt S-facing slope, (–BA), 29 Aug. 2007, *Goldblatt & Porter 12902* (MO, NBG, PRE); Memorial, stony south-facing slope above cemetery, (–BA), 31 Aug. 2007, *Goldblatt & Porter 12925* (K, MO, NBG, PRE).

### 28. **Ixia pavonia** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 150–500 mm altae, usitate 2 vel 3-ramosae, ramis 2–3 mm longis, cormo globoso tunicis fibrosis, caule usitate 3-ramoso ramis 2–6 mm longis, spicis 1–3-floris, bracteis membranosis translucentibus 8–9 mm longis, floribus suberectis caeruleo-malvinis centro nigribus rubrisque, tubo perianthii infundibuliforme ± 3.5 mm longo, tepalis ascendentibus ovatis 12–14 × 5–6 mm, filamentis atropurpureis ± 4 mm longis ex tubo ± 1.5 mm exsertis, antheris ± 4.5 mm longis, ramis styli ± 2 mm longis.

TYPE.—Northern Cape, 3119 (Calvinia): Roggeveld Escarpment, opposite entrance to Farm Vondelingsfontein on Vaalfontein–Nooiensrivier road, renosterveld, (–DD), 15 Sept. 2009, *Goldblatt, Manning & Porter 13355* (NBG, holo.; K, MO, PRE, S, iso.).

Plants 150–500 mm high, usually with 2–5(–12) short, filiform, branches 2–6 mm long, subtended by scale-like truncate bracts and prophylls ± 1 mm long. *Corm* 15–18 mm diam., with tunics of coarse fibres. *Leaves* usually 4 (or 3), lower 2 with expanded blades, broadly lanceolate to falcate, ± one quarter to half as long as stem, 8–15 mm wide; margins thickened, pale, hyaline when dry; upper two leaves partly to entirely sheathing, uppermost reaching to between upper third of stem and base of spike. *Main and lateral spikes* 1–3-flowered; bracts membranous, translucent, becoming brown and dry distally, 8–12 mm long, outer 3-veined and shortly 3-toothed apically, inner 2-veined and forked at tip. *Flowers* mostly half nodding,

blue-mauve, tepals dark red at base, black in wide part of tube, faintly acrid scented; perianth tube ± 3 mm long, funnel-shaped; tepals obovate, 12–15 × 6–8 mm, ascending to form a wide cup. *Stamens* with filaments purple, 4 mm long, exserted ± 1.5 mm; anthers 4.5 mm long, parallel, contiguous, yellow; pollen yellow. *Style* purple, dividing opposite middle of anthers, style branches ± 2 mm long, purple below, becoming pale blue distally. *Capsules* and *seeds* not known. *Flowering time*: September. Figure 13A–D.

*Distribution*: a narrow endemic, *Ixia pavonia* is known from a small area at the edge of the Roggeveld Escarpment south of Calvinia on the Farms Vondelingsfontein and Vaalfontein (Figure 12). Plants grow in clay ground in renosterveld.

*Diagnosis and relationships*: based on morphological similarity, *Ixia pavonia* must be regarded as most closely allied to the widespread Western Karoo species, *I. marginifolia*. Like that species, it has three leathery basal leaves with thickened margins and a main vein, a stem bearing three or more, short lateral branches, and a flower with a short perianth tube ± 3.5 mm long. Unlike the uniformly blue-mauve, white or pink flowers of *I. marginifolia*, *I. pavonia* has a blue-mauve perianth with a black centre surrounded by a broad red zone. Accompanying the colour difference in the perianth are purple-black filaments and style. Although the perianth tube and tepals are about the same dimensions as in *I. marginifolia*, the filaments in that species are 5–7 mm long and typically exserted 3.5–5.0 mm from the tube. The short filaments of *I. pavonia*, only 4 mm long and exserted ± 1.5 mm, stand in sharp contrast.

The small floral differences between *Ixia marginifolia* and *I. pavonia*, the dark central markings including short, dark filaments, a cupped, ± upright perianth, faint, not flowery scent and absence of nectar, are typical adaptations for hopliine beetle pollination and, indeed, beetles of the genus *Kubousa* have been seen and captured on flowers of the species (N. Helme pers. comm. 2009). *I. marginifolia* is pollinated by bees, often has a rose-like scent and produces trace amounts of nectar in the perianth tube.

*Selected specimens*

NORTHERN CAPE.—3119 (Calvinia): Roggeveld Escarpment, Vondelingsfontein, renosterveld, 31°46'59.9" S 19°50'27.9" E, 1 335 m, (–DD), 22 Sept. 2008, *Helme 5906* (NBG).

29. **Ixia linearifolia** *Goldblatt & J.C.Manning*, sp. nov.

Plantae usitate 450–900 mm altae, cormo globoso, tunicis fibrosis, caule 2–5-ramoso ramis ad 5 mm longis, spica 2- vel 3-flora, bracteis argenteo-membranosis 9–11 mm longis, floribus cernuis ex pallide caeruleo albis, tubo perianthii late infundibuliformi ± 5 mm longo, tepalis patentibus ovatis 15–16 × 6.5–7.5 mm, filamentis ± 5 mm longis ex tubo ± 2 mm exsertis, antheris 4.5–5 mm longis, ramis styli ± 2 mm longis.

TYPE.—Northern Cape, 3220 (Sutherland): Klein Roggeveld, Farm De Hoop, Smoushoogte, heights northeast of farm, in clay in stony ground, (–DC), 30 Aug. 2007, *Goldblatt & Porter 12921* (NBG, holo., K, MO, PRE, iso.).

Plants mostly 450–900 mm high, sheathed below by prominent, pale, dry-membranous, often irregularly torn cataphylls, usually with 2–5 short branches up to 5 mm long, branches subtended by pale, dry, attenuate scale-like bracts and prophylls 2–4 mm long. *Corm* 12–18 mm diam., with tunics of medium-textured fibres. *Leaves* 3, the lower 2 with long linear blades ± half as long as stem, mostly 1.5–2.0 mm wide (when alive), leathery succulent; midrib slightly raised; margins thickened and fleshy; uppermost leaf entirely sheathing. *Main spike* 2- or 3-flowered, lateral spikes 1- or 2(3)-flowered; bracts silvery membranous, translucent with darker veins, 9–11 mm long, outer 3-veined and 3-lobed to 3-toothed, inner 2-veined and shallowly forked at apex. *Flowers* facing to the side, white with a pale bluish cast, with pale green marks at tepal bases, faintly scented of rose; perianth tube broadly funnel-shaped, ± 5 mm long; tepals spreading at right angles to tube distally, ovate, 15–16 × 6.5–7.5 mm, outer tepals wider than inner. *Stamens* with filaments ± 5 mm long, exserted ± 2 mm from tube; anthers 4.5–5.0 mm long, parallel or slightly diverging when flower fully open. *Style* dividing opposite lower to middle third of anthers, style branches ± 2 mm long. *Flowering time*: mostly mid-August to mid-September. Figure 13G–H.

*Distribution*: rare and highly localized, *Ixia linearifolia* is known only from the upper, south-facing slopes of the Smoushoogte in the Klein Roggeveld, north of the Farm De Hoop (Figure 12). Plants grow in fairly dense Mountain Renosterveld vegetation often among tufts of *Merxmuellera* grasses, in light clay among rocks. Other geophytes in flower at the only known site include *I. lacerata* and *Geissorhiza cantharophila*, *Moraea* aff. *tripetala* and *Bulbine* sp.

*Diagnosis and relationships*: the short perianth tube, ± 5 mm long, flowers with outspread tepals and exserted filaments with prominently displayed anthers, and the several short lateral branchlets, at first suggest *Ixia marginifolia* but the leaves of *I. linearifolia* are quite unlike the short, broad, falcate leaves of that species. Instead the leaves are linear and about half as long as the stems, the latter mostly 45–90 mm high. The pale flowers have a faint blue cast and the tepals have pale green marks at the base of the tepals. Unlike *I. marginifolia* the leaf margins are not prominently thickened and hyaline but instead raised and fleshy without hyaline edges. The flowers of *I. linearifolia* are also slightly larger than those of *I. marginifolia* with tepals 15–16 × 6.5–7.5 mm compared with (7–)10–13 × 5.5–8.0 mm.

30. **Ixia alata** *Goldblatt & J.C.Manning*, sp. nov.

Plantae usitate 0.7–1.1 mm altae, cormo globoso 20–25 mm diam., tunicis fibrosis, caule 2–4-ramoso ramis ad 8 mm longis, spica 4–6-flora, bracteis membranoso-translucentibus 6–8 mm longis, floribus suberectis vel deminutantibus pallide carneis fauce albis, tubo perianthii late infundibuliformi 5–6 mm longo, tepalis subpatentibus ovatis 13–16 × 6–8 mm, filamentis ± 5 mm longis ± 2 mm ex tubo exsertis, antheris 4.5–5.0 mm longis, ramis styli ± 2 mm longis, ovario minute verrucoso.


FIGURE 13.—A–D, *Ixia pavonia*, *Goldblatt, Manning & Porter 13355* (NBG): A, plant; B, half-flower; C, outer bract; D, inner bract. E–H, *Ixia linearifolia*, *Goldblatt & Porter 12921* (NBG): E, plant with c/s leaf; F, half-flower; G, outer bract; H, inner bract. Scale bars: 10 mm. Artist: J.C. Manning.

TYPE.—Northern Cape, 3119 (Calvinia): southeastern foothills of Driefontein se Berg, SE of Calvinia, rocky, northeast-facing dolerite slope, (–DA), 15 Sept. 2009, *Goldblatt, Manning & Porter 13380* (NBG, holo., K, MO, PRE, iso.).

Plants mostly 0.7–1.1 m high, sheathed below by prominent, dry remains of cataphylls and leaf bases; cataphylls ± dry, pale chestnut-brown; usually with 2–4 short branches up to 8 mm long; branches subtended by pale, dry, attenuate scale-like bracts and prophylls 5–7 mm long; bracts sheathing in lower part. *Corm* 20–25 mm diam., with tunics of medium-textured fibres accumulating in a fairly dense mass. *Leaves* 3, lower 2 with linear blades ± one third to half as long as stem, mostly 3–4 mm wide (when alive), leathery; midrib strongly thickened; margins raised into wings held ± at right angles to blade, wings tilted to same side rendering one surface more exposed; uppermost leaf entirely sheathing. *Main spike* 4–6-flowered, lateral spikes mostly 3–5-flowered; bracts translucent with pale brown veins drying purple, 6–8 mm long, outer 3-veined and shallowly 3-lobed, often secondary veins not reaching bract apices, inner 2-veined, shallowly lobed at apex. *Flowers* suberect to half nodding, pale pink, white at base of tepals and in tube, with short vertical purple lines at tepal bases running into throat, unscented; perianth tube widely funnel-shaped, 5–6 mm long, narrow lower part ± 2.5 mm long; tepals laxly spreading distally but remaining slightly cupped, ovate, 13–16 × 5–8 mm, outer slightly wider than inner, indented abaxially along midline above filament insertion to a rounded median adaxial crest. *Stamens* with filaments ± 5 mm long, exserted ± 2 mm from wide part of tube, adaxial base with a flange decurrent on tepal midline; anthers 4–5 mm long, white, parallel or slightly diverging when flower fully open; pollen yellow. *Ovary* minutely warty; style dividing opposite middle to upper third of anthers, style branches ± 2 mm long, suberect and extending above anther tips. *Flowering time*: mostly mid-August to mid-September. Figure 14.

*Distribution*: highly localized but locally common, *Ixia alata* is known only from the northern edge of the Roggeveld Escarpment between the farms Vondelingsfontein and Driefontein in the western Karoo, south of Calvinia (Figure 15). Three large populations in the southern and northeastern foothills of Driefontein se Berg were restricted to heavy, red clay soils in dolerite outcrops but the plants at Vondelingsfontein grew in light sandy ground with ferricrete and dolerite fragments (C. Archer pers. comm.; N. Helme pers. comm.).

*Diagnosis and relationships*: the general appearance of *Ixia alata* is very much like *I. thomasiae* in the tall stature, stem with half nodding branches, suberect to half-nodding flowers, and the long narrow leaves with winged margins, are almost identical. The two differ, however, in flower size: the perianth tube of *I. alata* is just 5–6 mm long and the tepals 13–16 × 6–8 mm compared with a tube 8–10 mm long and tepals 14–20(–25) × 5.0–6.5(–8.0) mm. The perianth tube in particular is significantly shorter, and the tepals only slightly shorter but about as wide as those of *I. thomasiae*. Added to these differences are a main spike of 4–6 flowers and floral bracts 6–8(–10) mm long in *I. alata* compared with a spikes of 7–10 flowers and floral bracts 9–12 mm in *I. thomasiae*. These differences indicate to us that these are two distinct, albeit closely allied species. We also note that *I. alata* flowers from mid-September to early October, whereas *L. thomasiae* does not come into flower until the end of September and sometimes not until the second week of October. When we first encountered *I. alata* in mid-September 2009, plants of *I. thomasiae* were not in flower at its known stations only 30 km distant and at comparable elevation. Additional collections from the area between the known ranges of the two species may alter our decision but for the present, their populations show no overlap in critical floral characters, leading us to conclude that they represent separate species.

*Selected specimens*

WESTERN CAPE—3119 (Calvinia): Farm Vondelingsfontein, SE of Calvinia on Nooiensrivier road, E-facing shale slope, (–DD), 4 Oct. 1987, *Reid 1347* (PRE); Farm Driefontein, SSW of Calvinia, dolerite outcrop in red clay, (–DA), 23 Sept. 2009, *Goldblatt, Manning & Porter 13424* (K, MO, NBG, PRE, S, US).

31. **Ixia thomasiae** *Goldblatt* in Journal of South African Botany 45: 87 (1979). Type: South Africa, [Northern Cape], 3120 (Williston): Roggeveld Escarpment, Blomfontein Farm, between Middelpos and Calvinia, (–CC), 30 Sept. 1976, *Goldblatt 4268* (MO, holo.!; K!, NBG!, PRE!, S!, iso.).

Plants mostly 0.6–1.5 m high, with remains of old cataphylls and leaf bases persisting as a fibrous collar around stem base, usually with 1–3 short, twisted branches subtended by acute bracts and prophylls 4–10 mm long. *Corm* 15–20 mm diam., with tunics of coarse netted fibres. *Leaves* 3, lower 2 with expanded linear blades, reaching to upper third of stem, 3–5 mm wide; midrib and main vein thickened; margins forming wings held at right angles to blade, main vein with narrow wings parallel to blade; upper leaf sheathing stem. *Main spike* half nodding, 7–10-flowered, branches mostly 3–5-flowered; bracts membranous, translucent, becoming light brown distally, 9–12 mm long, outer 3-veined above with central vein more prominent, lateral veins paired in lower part and sometimes not reaching bract apex, obtuse to obscurely 3-lobed, inner 2-veined, forked apically, slightly shorter than outer. *Flowers* suberect or nodding, pale mauve, white in throat, presence of scent unknown; perianth tube funnel-shaped, widening in upper half, 8–10 mm long; tepals subequal, ovate-oblong, 14–20(–25) × 5.0–6.5(–8.0) mm, spreading ± at right angles to tube, indented abaxially along midline above filament insertion to form a rounded median adaxial crest. *Stamens* with filaments ± 6 mm long, included or exserted up to 2 mm from tube; anthers ± 6 mm long, yellow. *Ovary* slightly warty; style usually dividing opposite upper third of anthers, or just above anther tips, style branches ± 2.0 mm long. *Flowering time*: October, rarely late September.

*Distribution*: *Ixia thomasiae* occurs in the central Roggeveld Escarpment west of Middelpos (Figure 15). The species is rare, and has to date only been found on two farms in the area. Plants favour heavy clay ground and bloom relatively late in the season, mainly in Octo-

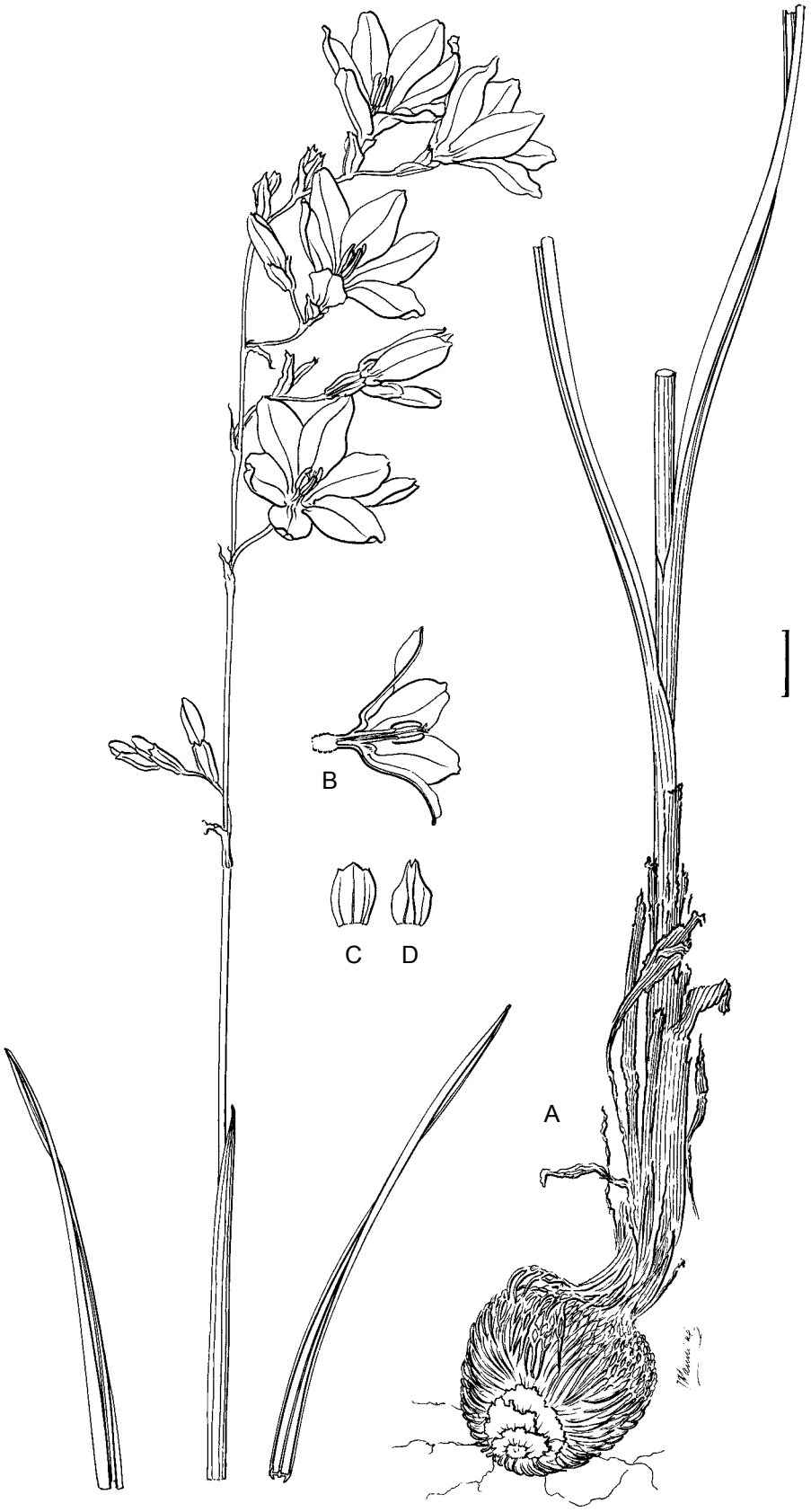


FIGURE 14.—*Ixia alata*, *Goldblatt, Manning & Porter 13380* (NBG). A, plant; B, half-flower; C, outer bract; D, inner bract. Scale bar: 10 mm. Artist: J.C. Manning.

ber. Further collecting in the area will likely yield additional sites for the species.

*Diagnosis and relationships*: remarkable leaves with raised and winged margins, thus ± H-shaped in cross section, combined with a perianth tube ± 6 mm long and the remarkable, warty ovary and capsules make *Ixia thomasiae* unmistakable. The leaf shape and warty ovary and capsules are not known elsewhere in *Ixia* except in *I. alata*. Its relationships most likely lie with the *I. marginifolia* group with which it shares a funnel-shaped perianth tube and exserted filaments and fully sheathing uppermost leaf, hence we place it in series *Brevitubae*.

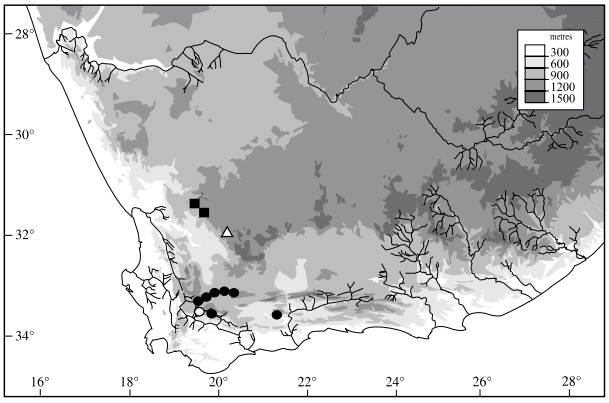


FIGURE 15.—Known distribution of *Ixia alata*, ■; *I. thomasiae*, △; *I. paucifolia*, ●; and *I. dolichosiphon*, ○.

The particularly large anthers, ± 6 mm long, and fairly long style branches, up to 2 mm long, are consistent with other species of the series.

Discovered in 1971, *Ixia thomasiae* was named for the Cape Town horticulturist, Margaret Thomas, who pioneered plant exploration in the Middelpos portion of the Roggeveld Escarpment. Her activities there resulted in the discovery of several novelties, including *Babiana virginea* and *Moraea virgata* subsp. *karooica*. Later collecting in the area has yielded more new species restricted to this area, notably in the Iridaceae: *Hesperantha teretifolia* (Goldblatt 1984) and *Romulea albiflora* (Manning & Goldblatt 2001). *Ixia brevituba* is also endemic there (Lewis 1962). It is now evident that the northern portion of the Roggeveld Escarpment is a minor but significant centre of endemism.

*Selected specimens*

NORTHERN CAPE.—3120 (Williston): Roggeveld Escarpment, west of Middelpos, Farm Blomfontein, (–CC), 19 Oct. 1995, *Goldblatt & Manning 10368* (MO, NBG); between farms Blomfontein and Matjiesfontein, west of Middelpos, (–CC), 28 Oct. 1983, *Snijman 769* (NBG); between Middelpos and Calvinia, (–CC), 29 Sept. 1971 (cult.), *Thomas s.n.* (*NBG93822*); 15 miles [24 km] along Blomfontein Road from Middelpos to Calvinia, (–CC), 12 Nov. 1975 (fr.), *Thomas s.n.* (*NBG104707*).

### 2.3. Series **Paucifolieae**

32. **Ixia paucifolia** *G.J.Lewis* in South African Gardening and Country Life 23: 213 (1933); Lewis: 153 (1962); De Vos: 65 (1999). Type: [Western Cape], Vanwyksdorp, 23 Oct. 1932, [*Compton &*] *Archer 534* (BOL, lecto.!, designated by De Vos 1999: 65).

*I. bolusii* G.J.Lewis: 10 (1938). Type: South Africa, [Western Cape], Hex River Valley near De Doorns, Oct. 1907, *Bolus s.n.* (*BOL13197*, holo.!; PRE, iso!).

Plants 120–300 mm high, simple or 1(2)-branched, branches ± straight, subtended by pale, membranous, subacute to attenuate bracts and prophylls 2–5 mm long. *Corm* 12–15 mm diam., with hard tunics of coarse, netted fibres. *Leaves* 3, lower 2 basal with expanded blades, falcate, mostly 3–5 mm wide; margins moderately thickened; lowermost leaf usually wider and longer than next, uppermost leaf sheathing lower half of stem. *Main spike* mostly 4–10-flowered, lateral spikes 2–4-flowered; bracts pale and membranous, (6–)8–9 mm long, outer 3-veined and 3-dentate, inner ± 1 mm longer than outer, with two veins and 2-dentate. *Flowers* beige to nearly white, unscented; perianth tube 24–34 mm long, slender and cylindric, divided inside into 3 compartments by decurrent filaments; tepals oblong, 11–15 × 3.0–4.5 mm, spreading at right angles to tube. *Stamens* with filaments ± 3 mm long, exserted ± 2 mm from tube; anthers ± 4 mm long. *Style* dividing shortly below or opposite anther tips, style branches ± 1 mm long, arching above anther tips, minutely bifurcate. *Flowering time*: late September and October.

*Distribution*: *Ixia paucifolia* extends from Hex River Pass and De Doorns eastward to the valleys of the Bonteberg, Vanwyksdorp near Ladismith and south to Koo (Figure 15). Plants are always associated with exposed, fairly dry shale slopes. They flower particularly well after fire when they are conspicuous among regenerating shrubby vegetation, which may later shade them out, but they continue to bloom for several years after fire. Near Pienaarspoort in the Bonteberg we have seen plants blooming in apparently mature renosterveld.

*Diagnosis and relationships*: as circumscribed here, *Ixia paucifolia* comprises plants with pale beige to almost white flowers (sometimes described as pale yellow), a cylindric perianth tube (22–)25–35 mm long, and narrow tepals 11–15 × 3.0–4.5 mm, spooned at the tips. The filaments are ± 3 mm long and exserted ± 2 mm from the tube, and the style divides close to or opposite the anther tips so that the style branches arch over the anthers. The species is readily distinguished from *I. dolichosiphon*, specimens of which have until now been included in *I. pauciflora* in herbaria by the very coarse-textured corm tunics, longer floral bracts, (6–)8–9 mm long, longer perianth tube (15–18 mm in *I. dolichosiphon*), beige (sometimes white) flower, and style dividing near the anther tips. In *I. dolichosiphon* the bracts are 5–6 mm long, the flowers white, flushed pale lilac, and veined purple outside, the style divides opposite the middle of the anthers and the style branches extend between them. The two species also differ in flowering time and habitat: *I. dolichosiphon* blooms in August and early September and favours south-facing sandstone slopes, whereas *I. paucifolia* grows on clay and shale slopes and blooms in late September and October.

*Ixia paucifolia* has in the past also included white- or pale pink-flowered plants from sandstone slopes in the Cold Bokkeveld and Cedarberg, here referred to the new species, *I. cedarmontana*. These plants have corm tunics of fine fibres, very different from the coarsely fibrous corm tunics of *I. paucifolia*. Other differences between these two species are discussed below under *I. cedarmontana*.

*Representative specimens*

WESTERN CAPE.—3319 (Worcester): upper slopes of Hex River Pass, south-trending shale slopes, (–BC), 10 Oct. 2004, *Goldblatt & Porter 12641* (K, MO, NBG, PRE); Bonteberg, (–BD), 3 Nov. 1940, *Compton 10002* (NBG); between Concordia and Eendracht, upper south slopes, (–CB), 12 Oct. 1922, *Tredgold 407* (PRE); Koo, 4000' [1 220 m], (–DB), 27 Oct. 1931, *Compton 3839* (BOL); rocky shale slopes of Burgers Pass, (–DB), 1 Oct. 2004, *Goldblatt & Porter 12604* (MO, NBG, PRE), 29 Sept. 1994, *Goldblatt & Manning 10012* (MO, NBG, PRE). 3320 (Montagu): Laingsburg Dist., Cabidu, (–AA), 20 Oct. 1941, *Olivier s.n.* (*NBG61209*), 27 Oct. 1950, *Hall 170* (NBG); Touws River to Pienaarskloof, Farm Karookop, renosterveld, ± 890

m, (–AA), 26 Sept. 2009, *Goldblatt & Porter 13450* (MO, NBG, PRE, S); Tweedside, quartzite hill, (–AB), Oct. 1921, *Marloth 10827* (PRE); Barrydale, 1200' [365 m], (–DC), 15 Oct. 1897, *Galpin 4709* (PRE, very depauperate specimen).

33. **Ixia dolichosiphon** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 120–200 mm altae, (1–)3- vel 4-ramosae, cormo 10–16 mm diam., tunicis fibrosis, foliis 3 inferioribus 2 lanceolatis ad falcatis (5–)7–12 mm latis marginibus leviter incrassatis, spica principali flexuosa 4–10-flora spicis lateralibus ± contortis 2–8-floris, bracteis membranaceis translucentibus bractea externa 5–6 mm longa 3-nervosa leviter 3-dentata, interna 2-nervosa 2-dentataque, floribus albis vel ex lilacino albis extra purpureovenosis inodoris, tubo perianthii ± cylindrico 15–18 mm longo, tepalis obovatis patentibus subaequalibus 9–13 × 6–7 mm, filamentis ± 2 mm longis usitate ± 1 mm exsertis, antheris ± 3 mm longis, ramis styli ± 2 mm longis.

TYPE.—Western Cape, 3319 (Worcester): Hex River Kloof, SW-facing sandy mountain slopes of Keeromsberg above De Wet, Farm Rheboksfontein, (–DA), 9 Sept. 1993, *Goldblatt & Manning 9690* (NBG, holo.; K, MO, PRE, S, WAG, iso.).

Plants 120–200 mm high, (1–)3- or 4-branched, lowermost branches rarely also branched; branches twisted, diverging at 90° from main axis, subtended by pale, membranous, attenuate bracts and prophylls (1–)3–8 mm long. *Corm* 10–16 mm diam., with tunics of medium-textured, netted fibres. *Leaves* 3, lower 2 lanceolate to falcate, (5–)7–12 mm wide, usually reaching to ± base of or sometimes shortly exceeding spike; margins and midrib slightly thickened; uppermost leaf entirely sheathing, reaching at least to middle of stem or to base of spike. *Spike* flexuose, 4–10-flowered, lateral spikes somewhat contorted, 2–8-flowered, horizontal below first flower, then erect; bracts membranous and transparent, outer 5–6 mm long, 3-veined, slightly 3-dentate, inner slightly shorter to about as long as outer, 2-veined and 2-dentate. *Flowers* white or flushed pale lilac, tepals sometimes each with a purple basal mark, tepals and tube veined purple outside, scentless; perianth tube ± cylindric, tapering uniformly from ± 1 mm diam. at base to 2 mm diam. at apex, 15–18 mm long, internally divided into 3 compartments by decurrent filaments extending downward nearly to base; tepals obovate, spreading at right angles to tube, subequal, 9–13 × 6–7 mm. *Stamens* with filaments ± 2 mm long, inserted ± 1 mm below tube apex, decurrent nearly to base, mostly exserted ± 1 mm; anthers ± 3 mm long before anthesis, yellow. *Style* dividing between middle and upper third of anthers, branches extending between anthers, ± 2 mm long. *Flowering time*: late August to mid-September. Figure 16A, B.

*Distribution*: available records show that *Ixia dolichosiphon* is a narrow endemic of the lower slopes of the western end of the Langberg above De Wet (east of Worcester), close to the entrance to Hex River Kloof (Figure 15). Plants grow on stony, sandstone, south and southwest-trending slopes and have only been collected after fire. The species was discovered and collected only in 1993 after a fire on the Langeberg in the summer of that year. Occasional visits to the site where we first collected *I. dolichosiphon*, and which has not been burned since 1993, failed to reveal any sign of the species. Like its relative, *I. paucifolia*, *I. dolichosiphon* is adapted for pollination by long-proboscid flies. Goldblatt *et al*. (2000) captured the horsefly, *Philoliche gulosa* visiting the flowers of the species at the type locality (reported under the name *I. paucifolia*).

*Diagnosis and relationships*: *Ixia dolichosiphon* is distinguished in sect. *Morphixia* by its relatively long perianth tube, 15–18 mm long, white or pale lilac-flushed perianth and short filaments ± 2 mm long, included or exserted up to 1.5 mm from the tube. It is closely allied to, and most easily confused with beige-flowered *I. paucifolia*, a species of the dry interior valleys of the southwestern Cape. That species has flowers with a perianth tube (22–)25–34 mm long, slightly constricted at the apex, spreading tepals 12–15 × 5 mm, filaments ± 3 mm long, exserted 2–3 mm from the perianth tube and anthers ± 4 mm long. We have collected *I. paucifolia* at several sites in the past 15 years and found it growing on shale slopes in thin, gravelly clay, in bloom in late September and October. *Ixia dolichosiphon* by contrast is restricted to sandstone slopes where it grows on coarse sandy ground characteristic of the Cape mountains. Although confined to cooler, south-facing slopes, it flowers from late August to mid-September, earlier than any population of *I. paucifolia*. It differs from *I. paucifolia* not only in its white or pale lilac-flushed flowers, veined purple on the outside, and shorter perianth tube, but in the tepals, stamens and style. The tepals are 9–13 mm long, filaments ± 2 mm long that reach the mouth of the tube or are exserted up to 1.5 mm, and the anthers are ± 3 mm long. The style divides opposite the middle of the anthers and the style branches emerge between them in contrast to the longer style of *I. paucifolia*, which divides close to the anther tips so that the style branches arch above the anthers. As in *I. paucifolia*, the filaments of *I. dolichosiphon* are decurrent almost to the base of the tube, dividing the interior of the tube into three compartments.

Leaf number is consistently three in both species, typical of sect. *Morphixia*. While *I. dolichosiphon* and *I. paucifolia* appear to be immediately related, we have wondered whether they should be treated as separate species or merely divergent populations of a single species; nevertheless they differ consistently in several vegetative and floral features, have different bracts and branching patterns. These morphological differences are associated with different habitats and flowering times and they have separate geographic ranges. It seems appropriate to recognize the two sets of populations as separate species.

*Representative specimens*

WESTERN CAPE.—3319 (Worcester): Hex River Kloof, SW-facing mountain slopes above De Wet, Farm Rheboksfontein, (–DA), 21 Sept. 1993 (flower and fruit), *Goldblatt & Manning 9745* (K, MO, NBG, PRE, S, WAG).

34. **Ixia cedarmontana** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 150–300(–500) mm altae, usitate simplices raro 1- vel 2-ramosae, cormo subgloboso 7–12 mm


FIGURE 16.—A, B, *Ixia dolichosiphon*, *Goldblatt & Manning 9690* (NBG): A, plant; B, half-flower. C–F, *Ixia cedarmontana*, *Goldblatt & Porter 13477* (NBG): C, plant; D, half-flower; E, outer bract; F, inner bract. Scale bars: 10 mm. Artist: J.C. Manning.

diam., tunicis fibris tenuibus reticulatis, foliis 2 vel 3(4) inferioribus 3 anguste ensiformibus (1.5–)3.0–5.0(–8.0) mm latis folia superiore caulem vaginanti, spica (1–)3–5(–7)-flora, bracteis 6–9 mm longis, bractea externa 3-nervosa 3-dentataque vel 3-lobata, interna plusminusve aequilonga vel paulo longiore, floribus erectis albis vel pallide carneis, tubo perianthii (12–)18–25 mm longo anguste cylindrico, tepalis ovatis subaequalibus 10–12 × 5–7 mm externis quam internis paulo latioribus, filamentis 6–8 mm longis, antheris ± 4(5) mm longis, ramis styli ± 2 mm longis.

TYPE.—Western Cape, 3219 (Wuppertal): Heuningvlei, Groot Koupoort, 3200' [975 m], seasonally moist, (–AA), 11 Oct. 1975, *Kruger 1668* (PRE, holo.; NBG, iso.).

Plants 150–300(–500) mm high, slender, rarely with 1 or 2 branches, branches straight, diverging at 40–80° from axis, subtended by obscure, membranous acute bracts and prophylls 1–2 mm long. *Corm* globose, 7–12 mm diam., bearing cormlets at base, with tunics of fine netted fibres. *Leaves* 2 or 3(4), lower 1 or 2 (rarely 3 in

*Kruger 1668*) with expanded blades and ± basal, narrowly sword-shaped to ± linear, (1.5–)3.0–5.0 mm wide (up to 8 mm in *Marloth 2328*), with moderately thickened main vein and margins, uppermost leaf sheathing lower part of stem. *Spike* (1–)3–5(–7)-flowered, lateral spikes 1–5-flowered; bracts translucent, often flushed pink or purple distally, 6–9 mm long, outer 3-veined and 3-dentate or 3-lobed, inner ± as long or 1 mm longer than outer, 2-veined and 2-dentate. *Flowers* upright or half nodding, white to pink, flushed light purple to pink outside, yellow in throat, tube finely veined with purple, not closing at night, usually sweetly scented, especially in evening; perianth tube ± cylindric or slightly flaring, (12–)18–25 mm long; tepals subequal, ovate, outer slightly wider than inner, 10–16 × 5–8 mm. *Stamens* with filaments 6–10 mm long, reaching mouth of tube or exserted up to 4 mm; anthers ± 4(–5) mm long. *Style* dividing opposite middle to apex of anthers, style branches 1–2 mm long. *Flowering time*: October to early December, rarely in late September. Figure 16C–F.

*Distribution*: a poorly documented and probably fairly rare species of the north-south-trending mountains of northwestern Western Cape, *Ixia cedarmontana* is centred in the Cedarberg and Cold Bokkeveld Mtns, but there are also records from the Great Winterhoek Mtns, to the south (Figure 17). Plants grow in peaty sandstone-derived soils, usually in moist habitats such as wet, poorly drained flats, seeps and seasonal marshes.

*Diagnosis and variation*: *Ixia cedarmontana* is recognized by a combination of a relatively long perianth tube, 18–25 (rarely only 12) mm long, and small to moderate-sized corms with finely fibrous corm tunics. Most collections also have white flowers, pale yellow in the throat, but occasionally pink tepals. Several of the white-flowered collections that we assign here to *I. cedarmontana* were known to Lewis (1962), who included them in *I. paucifolia*, noting that these northwestern populations had fine corm tunics and straight rather than falcate leaves. De Vos (1999) likewise regarded them as belonging to *I. paucifolia*, which she treated as a single variable species, adding that the tepals were sometimes suborbicular in the northwestern plants. Both Lewis and De Vos thought that intermediates made it impossible to separate the two sets of populations taxonomically. We disagree. Not only do the corms of the two differ consistently in size and texture of the tunics, but flower colour and tepal shape do not overlap when carefully preserved flowers are measured. *Ixia cedarmontana* has white or pale pink, sweetly scented flowers with ovate tepals 10–16 × 5–8 mm, thus about twice as long as wide, and filaments reaching the apex or exserted up to 4 mm from the perianth tube. The almost white to light beige flowers of *I. paucifolia* are always unscented, have narrower tepals, 12–15 × 3.0–4.5 mm, thus about three to four times as long as wide, and the filaments are consistently exserted 2–3 mm.

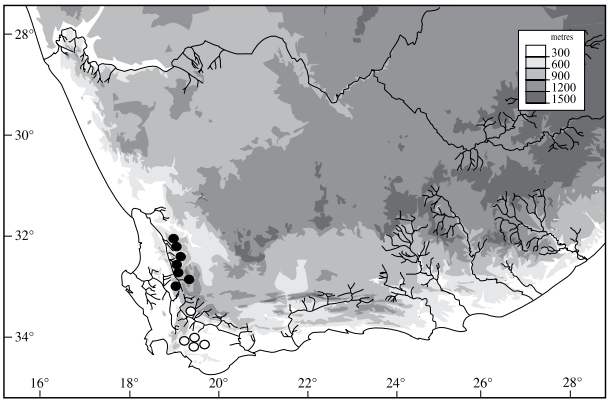


FIGURE 17.—Known distribution of *Ixia cedarmontana*, ●; and *I. stenophylla*, ○.

The two species also have a different ecology. *Ixia cedarmontana* grows in sandstone-derived soils and is associated with moist habitats, such as seeps and seasonal marshes, its flowers are richly scented, more so in the evening, and the flowers remain open all night. We infer moth pollination for the species. In contrast, *I. paucifolia* grows in relatively dry habitats, usually on exposed, well-drained open clay and shale slopes that are dry at flowering time. It is known to be pollinated by long-proboscid flies and the unscented flowers close at night.

*Ixia cedarmontana* is fairly variable in size and leaf dimensions. One collection from the Great Winterhoek Mtns (*Marloth 2328*) consists of tall plants, one specimen reaching 500 mm, and with leaves up to 8 mm wide. In contrast, plants from Bokkeveld Tafelberg (*Esterhuysen 3909*) are 150–250 mm high and have leaves only 3–4 mm wide. Most collections fall between these two extremes and have unbranched stems. The type collection from Heuningvlei (*Kruger 1668*) consists largely of plants with one or two, long, straight, lateral branches each bearing 3–5 flowers, and some have four leaves, the lower three with well-developed blades. We include here a single plant from Hexberg, southeast of Citrusdal (*Goldblatt 7116*), with linear leaves 1.5–2.0 mm wide, and two flowers on a slender, unbranched stem.

Some pink-flowered plants that we include in *Ixia cedarmontana* from the Cedarberg were referred by both Lewis and De Vos to *I. latifolia* var. *angustifolia*. Other specimens cited under this name are now *I. divaricata* and *I. monticola* but both have flowers with a shorter perianth tube, 8–11 mm long. *Ixia monticola* has, in addition, leaves of a softer texture and papery rather than fibrous corm tunics. *Ixia divaricata*, often a taller plant, has distinctive long lateral branches with the flowers crowded in the distal half, and the perianth tube is funnel-shaped rather than ± cylindric.

*Representative specimens*

WESTERN CAPE.—3219 (Wuppertal): Cedarberg, Middelberg Plateau, 4 000' [± 1 220 m], damp places, (–AA), Sept. 1927, *Levyns 2266* (BOL); northern Cedarberg, peak at Koupoort, 4000' [± 1 220 m], (–AC), 22 Oct. 1945, *Esterhuysen 12153* (BOL, PRE); Cedarberg, Cedarhoutkloof, 3 500' [1 110 m], (–AA), Oct. 1923, *Pocock 324* (NBG); Cedarberg, Matjies River Valley along road to Driehoek, wet restio flats, (–AC), 1 Oct. 2009, *Goldblatt & Porter 13477* (MO, NBG, PRE); Elandskloof, (–CA), 3 Oct. 1940, *Compton 9702* (NBG); Cedarberg, sandy flats near Sneeuberg Hut, in grassland with Restionaceae, 1 300 m, (–AC), 25 Oct. 1989, *Le Maitre 620* (NBG, PRE); Cedarberg, Slangvlei, moist sandy soil, ± 1 650 m, (–AC), 11 Nov. 1956, *Taylor 1850* (NBG); Hexberg, SE of Citrusdal, rare in rocky kloof, 4000'

[± 1 210 m], (–CA), 26 Oct. 1983, *Goldblatt 7116* (MO); Bokkeveld Tafelberg, Ceres, 5500' [± 1 720 m], (–CD), 8 Dec. 1940, *Bond 700* (NBG), *Esterhuysen 3909* (BOL). 3319 (Worcester): Grootwinterhoek, 1 200 m, (–AA), Nov. 1896, *Marloth 2328* (PRE); 31 Dec. 1951, *Esterhuysen 19878* (BOL).

35. **Ixia stenophylla** *Goldblatt & J.C.Manning*, nom. et stat. nov. pro *I. fucata* var. *filifolia* G.J.Lewis in Journal of South African Botany 28: 99 (1962). Type: [Western Cape], Riviersonderend Mtns, northern slopes (as Boschjesveld Mtns, Worcester side), 1 Oct. 1955, *Stokoe s.n.* [*SAM68608, 68609* (two sheets), syn.! (*SAM69608* was said by De Vos 1999 to be the holotype, but this is without foundation)].

Plants 200–400 mm high, without collar of fibres around base, simple or rarely with single branch subtended by silvery, attenuate bracts and prophylls up to 4 mm long, slightly curved at base of spike. *Corm* globose, 7–15 mm diam., with tunics of fine to medium-textured netted fibres, sometimes thickened and claw-like below. *Leaves* 3, lower 2 with linear-filiform blades 0.8–1.2 mm wide, central vein heavily thickened and raised above blade surface, thickened secondary veins sometimes present; margins not thickened; uppermost leaf usually entirely sheathing. *Spike* slightly flexuose, 1- or 2(–3)-flowered; bracts 6–8 mm long, outer 3-veined and 3-toothed, inner about as long as outer, 2-veined, forked apically. *Flowers* nodding, white or flushed pale mauve, with a ring of dark streaks at tube mouth, pale mauve outside, with dark veins on tube; perianth tube straight and cylindric, (12–)15–20 mm long, ± 2 mm diam.; tepals subequal, 12–15 × 6–8 mm, spreading at right angles to tube. *Stamens* with filaments 5–6 mm long, unilateral, arcuate, exserted ± 3 mm from tube; anthers 3–4 mm long, parallel and facing the lower tepals. *Style* dividing opposite middle to upper third of anthers, style branches ± 1.5 mm long, weakly recurved. *Flowering time*: late September and October, rarely in late August. Figure 18.

*Distribution*: *Ixia stenophylla* is a narrow endemic of the western end of the Riviersonderend Mtns and the Hex River Mtns; it extends from Boesmanskloof Pass above Greyton to the western end of the Riviersondered range near Villiersdorp (Figure 17). The one collection we have seen from the Hex River Mtns is from Brandwagberg. There is also a single record from the 'Frenchhoek Forest Reserve,' we assume from the eastern end of the Reserve, closest to the Riviersonderend Mtns. Plants grow in rocky sites, usually in low vegetation of the upper northern slopes, usually on sandy ground or in sandstone outcrops, but also on shale slopes.

*Diagnosis and relationships*: *Ixia stenophylla* was first recognized as a distinct taxon by Lewis (1962), who treated it as var. *filifolia* of the florally somewhat similar *I. fucata*. De Vos (1999), in her *Flora of southern Africa* account of *Ixia*, uncritically accepted that opinion. Lewis distinguished var. *filifolia* from var. *fucata* by its taller stem, three leaves, the basal two with filiform blades up to 1 mm wide, and the absence of a collar of fibres around the stem base, the latter characteristic of var. *fucata*. Lewis considered the spike, bracts and flowers virtually identical to those of var. *fucata*, particularly the wide, cylindrical perianth tube and well-exserted filaments. Our examination of the spike and flowers of the

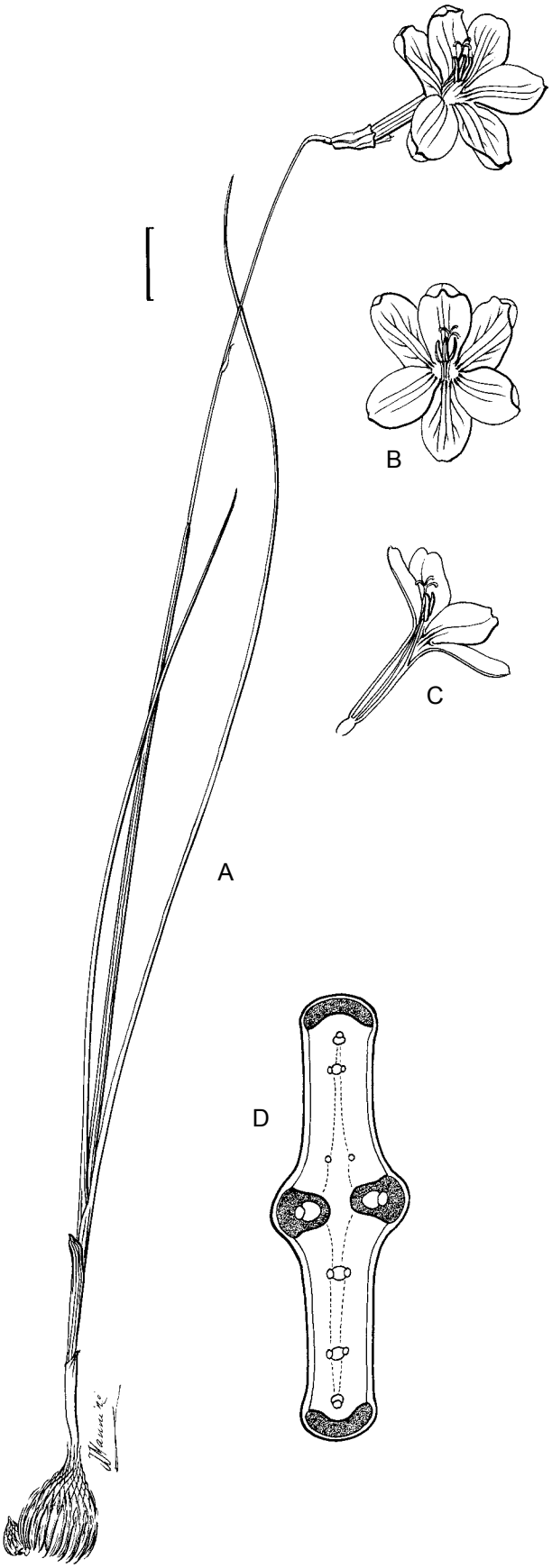


FIGURE 18.—*Ixia stenophylla*, *Snijman 2181* (NBG): A, plant; B, flower, front view; C, half-flower; D, anatomical section of leaf blade. Scale bar: A–C, 10 mm. Artist: J.C. Manning.

two taxa refutes Lewis's contention. Var. *filifolia* differs not only in the vegetative features noted by Lewis, the narrow leaf blades, up to 1.2 mm wide, with the margins not thickened, and without a collar of fibres around the stem base, but in floral features as well. The spike bears 1 or 2, rarely 3 flowers, and the stem is almost invariably unbranched (just three of 52 specimens in herbaria examined have a single short branch). The white flowers are flushed mauve outside and have dark veining on the perianth tube, which is fairly wide and (12–)15–20 mm long. Fresh flowers we examined (*Snijman 2181*) also have unilateral stamens, presumably typical of the species. Although extended horizontally, the unilateral stamens have parallel anthers facing the lower tepals, an orientation unique in *Ixia.* We have no hesitation in treating the plants as a separate species, *I. stenophylla*, so named for its particularly narrow leaves. Lewis's varietal name *filifolia* has already been used at species rank in the genus.

The immediate relationships of *Ixia stenophylla* are uncertain. The two linear and very narrow foliage leaves suggest it belongs to the *I. capillaris* complex, all species of which also have narrow leaves. Close examination of the leaves, however, shows that they differ significantly in having a strongly thickened and raised central vein and a thickened secondary vein, whereas the leaves of all species of the *I. capillaris* complex lack thickened veins.

Typical *Ixia fucata*, as we now circumscribe the species, usually has four leaves, the lower three with narrowly sword-shaped blades, 2–3 mm wide, of a thinner texture than in *I. stenophylla* and with a fairly well-developed central vein. The white to pink flowers are deeper pink to reddish on the outside, lack obvious dark veining, the stamens in at least some populations are unilateral and declinate, and the filaments are exserted ± 5 mm. The perianth tube is narrower than in *I. stenophylla* and expands gradually from base to apex, thus different from the wide tube of uniform diameter in *I. stenophylla*. The range of *I. fucata* extends from the western Langeberg near Montagu to Keeromsberg and the western end of the Hex River Mtns. We assume that the similarities in the flowers of *I. fucata* and *I. stenophylla* are due to convergence and that they are not closely allied. The immediate affinities of *I. fucata* are most likely with the central Langeberg species, *I. stohriae*, which is similar in vegetative morphology but has longer-tubed pink, radially symmetric flowers with shorter filaments, either exserted up to 1 mm or included in the perianth tube and then the anthers also partly to fully included.

*Selected specimens*

WESTERN CAPE.—3319 (Worcester): Hex River Mtns, Brandwagberg 186, Tierkloof on path to Thomas Hut, 828 m, partly shaded south slopes on shale soils, (–CB), 4 Oct. 2009, *Helme 6107* (NBG); NW end of Riviersonderend Mtns, road from Highlands to Paulsgat, in rocks along stream in fynbos, (–CD), 2 Oct. 2007, *Snijman 2181* (NBG); Jonaskop, Langberg, rocky koppie on north slopes, ± 1 050 m, (–DC), 19 Oct. 1971, *Esterhuysen 32696* (BOL, K, MO); Wolwen Kloof, Wildepaardeberg, ± 1050' [320 m], (–DC), 1931, *Stokoe 2507* (BOL); Jonaskop, halfway up FM tower road, among rocks, (–DC), 20 Oct. 1989, *Snijman 1239* (NBG, PRE). 3419 (Caledon): Silverstream, near Villiersdorp, moist rocky slope, (–AA), 5 Oct. 1985, *Esterhuysen 36235* (MO, PRE); 5 miles [8 km] N of Theewaterskloof Dam wall, (–AB), 21 Sept. 1975, *Burgers 115* (NBG); Riviersonderend Mtns, Boesmanskloof Pass, north slope on sandstone outcrop, (–BA), 19 Aug. 1993, *Bean & Trinder-Smith 2873* (BOL). Without precise locality: Franschhoek Forest Reserve, 28 Sept. 1935, *Lewis s.n.* (*BOL26938*).

2.4. Series **Rapunculoides**

36. **Ixia rapunculoides** *Delile* in Redouté, Les Liliacées 8: t. 431 (1814b); Goldblatt & Manning: 7 (2008a). Type: South Africa, without precise locality, collector unknown, illustration in Delile in Redouté, Les Liliacées 8: t. 431 (1814b). Epitype: South Africa, [Northern Cape], Klipkoppies, red clay, 9 Aug. 1961, *Lewis 5853* (NBG, epi.!, designated by Goldblatt & Manning 2008a: 7; K!, PRE!, iso.).

*Illustration*: Figure 1A–C in Goldblatt & Manning 2008a.

Since the publication of our account of the species (Goldblatt & Manning 2008a) one unusual variant has come to our attention. These are plants from the Keiskie Mtns south of Calvinia (*Goldblatt & Porter 13140*, MO, NBG). Very like *Ixia rapunculoides* in leaf and corm, and even general aspect, these plants differ from typical *I. rapunculoides*, which is common on flats and lower slopes both to the north and south, in the long narrow tepals ± 18 × 4 mm, perianth tube 8.5 mm long and filaments inserted ± 4 mm above the tube base and ± 4 mm long. Flowers of *I. rapunculoides* elsewhere have broader tepals 11–15 × 4.5–6.0 mm, a perianth tube rarely more than 8 mm long, and often less than 7 mm, filaments inserted 2–4 mm above the tube base and 2–3 mm long. The anthers of the Keiskie population are also longer, ± 4 mm, compared with 2.3–3.5 mm for *I. rapunculoides*. These plants need further investigation but we provisionally include them here without taxonomic recognition at any rank.

37. **Ixia robusta** *(G.J.Lewis) Goldblatt & J.C.Manning* in Bothalia 38: 9 (2008a). *Ixia rapunculoides* var. *robusta* G.J.Lewis: 74 (1962). Type: South Africa, [Northern Cape], Moordenaarspoort, 26 miles [41.6 km] NE of Calvinia, 26 Sept. 1952, *Lewis 2503* (SAM, holo.!; BOL!, PRE!, iso.).

*Illustration*: Figure 1D–F in Goldblatt & Manning 2008a.

38. **Ixia rivulicola** *Goldblatt & J.C.Manning* in Bothalia 38: 9 (2008a). Type: South Africa, Northern Cape, 3220 (Sutherland): Roggeveld Escarpment, drift across Bo-Vis River at Noudrif Farm, in muddy ground, (–AB), 11 Oct. 2004, *Goldblatt & Porter 12666* (NBG, holo.!; K!, MO!, PRE!, iso.).

*Illustration*: Figure 4A–C in Goldblatt & Manning 2008a.

39. **Ixia lacerata** *Goldblatt & J.C.Manning* in Bothalia 38: 10 (2008a). Type: South Africa, Western Cape, 3320 (Montagu): Klein Roggeveld, about 24 km north of N1 on road to Sutherland, dolerite slope, (–BA), 26 Aug. 2006, *Goldblatt & Porter 12702* (NBG, holo.!; K!, MO!, PRE!, iso.).

*Illustration*: Figure 4D–F in Goldblatt & Manning 2008a.

40. **Ixia mollis** *Goldblatt & J.C.Manning*, nom. nov. pro *I. flaccida* (G.J.Lewis) Goldblatt & J.C.Manning in Bothalia 38: 17 (2008a), illegit. homonym non *I. flaccida* Salisb.: 35 (1796), nom. illegit. superfl. pro *I. patens* Aiton: 59 (1789). Type: South Africa, [Western Cape], Boschkloof, 7 Aug. 1896, *Schlechter 8432* (BOL, holo.!; BM, G, K!, L, MO!, PRE (two sheets)!, S, Z, iso.).

41. **Ixia namaquana** *L.Bolus* in South African Gardening & Country Life 21: 368 (1931b); Goldblatt & Manning: 14 (2008a). *I. rapunculoides* var. *namaquana* (L.Bolus) G.J.Lewis: 76 (1962). Type: South Africa, [Northern Cape], Klipfontein, Sept. 1883, *H. Bolus* as Herbario Normale Austro-Africana 698 (BOL, lecto.!, designated by De Vos 1999: 15; B, G, K!, PRE!, SAM!, Z, iso.).

*Illustration*: Figure 6A–D in Goldblatt & Manning 2008a.

42. **Ixia oxalidiflora** *Goldblatt & J.C.Manning* in Bothalia 38: 17 (2008a). Type: South Africa, [Western Cape], 3319 (Worcester): Hex River Pass, south-facing clay slopes, (–BC), 2 Sept. 1992, *Goldblatt & Manning 9397* (NBG, holo.!; MO!, iso.).

*Illustration*: Figure 6E–G in Goldblatt & Manning 2008a.

43. **Ixia sobolifera** *Goldblatt & J.C.Manning* in Bothalia 38: 11 (2008a). Type: South Africa, Northern Cape, 3320 (Montagu): north of Matjiesfontein on road to Sutherland, (–BA), 9 Sept. 2006, *Goldblatt & Porter 12809* (NBG, holo.!; MO!, PRE!, iso.).

*Illustration*: Figure 4G–I in Goldblatt & Manning 2008a.

44. **Ixia contorta** *Goldblatt & J.C.Manning* in Bothalia 38: 21 (2008a). Type: South Africa, Western Cape, 3219 (Wuppertal): Cold Bokkeveld, low hill east of Farm Waboomsrivier, well-drained sandy ground, (–CD), 17 Sept. 2006, *Goldblatt & Porter 12854* (NBG, holo.!; MO!, PRE!, iso.).

*Illustration*: Figure 11 in Goldblatt & Manning 2008a.

2.5. Series **Capillares**

45. **Ixia capillaris** *L.f.*, Supplementum plantarum: 92 (1782); Lewis: 68 (1962); Goldblatt & Manning: 117 (2008b). *Morphixia capillaris* (L.f.) Ker Gawl.: 106 (1827). Type: South Africa, [Western Cape], without precise locality, collected circa 1773, *Thunberg s.n.* (*UPS-THUNB935 & 936*, syn.!).

*Illustration*: Figure 1A–C in Goldblatt & Manning 2008b.

46. **Ixia exiliflora** *Goldblatt & J.C.Manning* in Bothalia 38: 119 (2008b). Type: South Africa, Western Cape, 3319 (Worcester): ± 0.8 km S of turn-off to Montagu from N1, flat plateau, 3200' [± 1 050 m], (–BD), 25 Aug. 2006, *Goldblatt & Porter 12688* (NBG, holo.!; K!, MO!, PRE!, iso.).

*Illustration*: Figure 1D, E in Goldblatt & Manning 2008b.

47. **Ixia dieramoides** *Goldblatt & J.C.Manning* in Bothalia 38: 120 (2008b). Type: South Africa, Western Cape. 3320 (Montagu): north of N1 between Matjiesfontein and Touws River, sandstone outcrop, (–BA), 27 Aug. 2006, *Goldblatt & Porter 12713* (NBG, holo.!; K!, MO!, PRE!, BOL!, iso.).

*Illustration*: Figure 3 in Goldblatt & Manning 2008b.

48. **Ixia pauciflora** *G.J.Lewis* in Journal of South African Botany 27: 88 (1962); Goldblatt & Manning: 121 (2008b). Type: South Africa, [Western Cape], Cold Bokkeveld, north of Waboomsrivier, 2 Sept. 1956, *Barker 8635* (NBG, holo.!).

*Illustration*: Figure 5 in Goldblatt & Manning 2008b.

49. **Ixia reclinata** *Goldblatt & J.C.Manning* in Bothalia 38: 123 (2008b). Type: South Africa, Western Cape, 3419 (Caledon): hills south of Theewaterskloof Dam, Farm Cranesfield, north of Draaiberg road, stony shale outcrops, (–AA), 24 Aug. 2006, *Goldblatt*, *Manning & Porter 12686* (NBG, holo.!; K!, MO!, PRE!, S!, iso.).

*Illustration*: Figure 6 in Goldblatt & Manning 2008b.

## NOMENCLATURAL NOTE

In the course of our investigation of type material in European herbaria we located the type specimen of *Ixia striata* Vahl (1805) in the Copenhagen Herbarium. The species was excluded from *Ixia* in her account by Lewis (1962) who commented that it might be 'a form or variety' of *I. latifolia* based on the description. De Vos (1999) thought *I. striata* might be a species of *Tritonia* and although she saw and annotated the specimen at the Copenhagen Herbarium '*Tritonia strictifolia* (Klatt) Benth. & Hook.f.', she did not realize it was the type of *I. striata*. We have seen scanned images of the type and confirm that it is a species of *Tritonia* and are confident it is *T. gladiolaris* (Lam.) Goldblatt & J.C.Manning [= *T. lineata* (Salisb.) Ker Gawl.], of which it becomes a synonym. The basionym of *T. gladiolaris* is *Ixia gladiolaris* Lam. (1789) (see Goldblatt & Manning 2006), which predates *I. striata* by 16 years.

**Tritonia gladiolaris** *(Lam.) Goldblatt & J.C. Manning* in Bothalia 36: 57 (2006). *Ixia gladiolaris* Lam.: 341 (1789). Type: South Africa, Cape of Good Hope, cultivated in Paris, flowering March and April, original collector unknown (P–Herb. Lamarck, holo.!).

*Ixia striata* Vahl: 65 (1805), syn. nov. Type: South Africa, without precise locality or collector (C, holo.–scanned image!).

*Tritonia lineata* (Salisb.) Ker Gawl.: 228 (1804); M.P.de Vos: 369 (1983). *Gladiolus lineatus* Salisb.: 40 (1796). *Montbretia lineata* (Salisb.) Baker: 169 (1877). *Tritonixia lineata* (Salisb.) Klatt: 357 (1882). Type: South Africa, without precise locality, grown at the Royal Botanic Gardens, Kew in 1781 (BM, lecto., designated by M.P.de Vos 1983: 371).

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collection, not always present there: B, BM, BOL, C, GRA, K, PRE, S, UPS and Z.

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## INDEX