

IRIDACEAE

REAPPRAISAL OF *IXIA MACULATA* WITH *I. CALENDULACEA* SP. NOV., AND AN EARLIER NAME FOR *I. LUTEA*

A serendipitous discovery of two varieties of *Ixia maculata* L., *I. maculata* var. *fusco-citrina* (Desf. ex DC.) G.J.Lewis and *I. maculata* var. *intermedia* G.J. Lewis, growing and flowering in close proximity in

September 2007, led us to review the taxonomy of the species, which was treated by Lewis (1962) and De Vos (1999) as comprising three varieties. *Ixia maculata* is a member of section *Ixia* of the genus, which is endemic to

the winter rainfall zone of southern Africa and comprises over 70 species at the latest count (Goldblatt & Manning 2008a, b). Section *Ixia* includes 19 species with brightly coloured flowers with a narrow, subfiliform perianth tube, non-decurrent filaments inserted at or close to the top of the tube, and conduplicate style branches (Lewis 1962). Most species of the section have flowers with contrasting dark central marks, now believed to represent beetle marks, and indications are that most species are pollinated by hopliine beetles (Scarabaeidae: Hopliini) (Goldblatt *et al.* 2000).

Ixia maculata sensu G.J.Lewis stands out in sect. *Ixia* in its bright orange or yellow perianth with a dark central eye, dry and crinkly floral bracts that are usually partly or entirely brown, basally to completely united filaments, and the style dividing opposite or above the base of the anthers. These features are shared in the section only with *I. curta* Ker Gawl., which differs from *I. maculata* in its strongly dark-cuspidate bracts and its corms. The corms of *I. maculata* were described by Lewis (1962) as typically having submembranous or rarely fibrous tunics and producing stolons from the base, whereas corms of *I. curta* have persistent, fibrous, netted tunics, and cormlets, when present, are borne at the base of the corm, which is the more common condition in *Ixia*. Only *I. dubia* Vent., *I. lutea* Eckl. and *I. polystachya* L. of sect. *Ixia* also have yellow or orange flowers, but none have corms producing stolons, and all three have free filaments and a style usually dividing below the level of the anthers, except in *I. polystachya* var. *lutea*, which may prove to be a separate species. *Ixia lutea* and *I. polystachya* more often have white or pink flowers and *I. dubia*, which is the taxon most often confused with *I. maculata*, has pale, translucent floral bracts, sometimes suffused with pink. All these species share a range in Western Cape, and were once common from Cape Town northward to the Olifants River.

Lewis (1962) and De Vos (1999) distinguished three taxa within *Ixia maculata* primarily using features of the floral bracts, degree of filament union, and perianth tube length but a degree of overlap in these characters led to segregation of the known populations as varieties, rather than as distinct species. Our observations show that the nature of the stolons, corm tunics, colour of the filaments, and the shape and markings of the tepals are equally, if not

more important in distinguishing populations (Table 2). Some of these features are correlated with ecological differences and have convinced us that the present taxonomy does not adequately represent the biology of the *I. maculata* complex. We present a revised taxonomy in which we recognize var. *intermedia* as a separate species, *I. calendulacea*. Whereas vars. *maculata* and *fusco-citrina* have yellow filaments, and tepals with a concave base to which the dark brown or black pigmentation is restricted, *I. calendulacea* has dark brown filaments (drying violet), and the tepals are plane, thus lacking a concave base, and the brown to dull red centre is edged with a halo of translucent red. In addition, populations of *I. calendulacea* grow in deep, well-drained sandy soils, whereas typical *I. maculata* grows in sandy or granitic habitats that are always waterlogged in the growing season.

The differences between *Ixia maculata* var. *maculata* and var. *fusco-citrina* remain more or less as described by Lewis (1962) but the two taxa are insufficiently resolved. We note the potential taxonomic significance of the short stolons bearing up to three small cormlets that are produced in var. *maculata* and the long stolons of var. *fusco-citrina* which bear a single cormlet but additional field work is needed to assess the status of these two taxa.

***Ixia calendulacea* Goldblatt & J.C.Manning, sp. nov.**

I. maculata var. *intermedia* G.J.Lewis in Journal of South African Botany 27: 142 (1962). Type: Western Cape, 3218 (Clanwilliam): Redelinghuys, 29 September 1943, W.F. Barker 2591 (NBG, holo.!).

Plantae 200–500 mm altae usitate eramosae, cormo depresso-globoso 12–16 mm diam. tunics fibrosis sobolis horizontalibus ± 1.5 mm diam., ad 120 mm longis praedito, foliis usitate 4–6 raro 3, usitate (8–)12–20 mm latis lanceolatis saepe supra torsivis, spica flexuosa usitate 5–8-flora, bracteae siccae albo-transparentibus infra brunneis supra, bractea externa ± 8 mm longa ± truncata vel biloba cuspi brevi centrali, interna ad apicem furcata in dua cuspidibus attenuata 2 mm longa, floribus vadosis cupulatis calendulaceis centro brunneo vel rubro ± 15 mm diam., usitate margini rubro-translucenti, tubo perianthii 5–8(–10) mm longo cylindrico, tepalis subequalibus ascendentibus pauciter imbricatis (18–)22–25 × 12–14 mm, externis ± 2 mm

TABLE 2.—Characteristics of *Ixia calendulacea* compared with those of *I. maculata* var. *maculata* and var. *fusco-citrina*. Because there is doubt about the status of cultivated plants referred in herbaria to var. *fusco-citrina*, we have not included measurements from these specimens. Observations for taxonomically important features are taken only from well-preserved specimens, bearing in mind that floral features may shrink up to 20 % of original size, depending on the care with which specimens are prepared. We did not use Lewis's (1962) or De Vos's (1999) measures for any taxa because we apply some names in different ways

Character	<i>I. maculata</i> var. <i>maculata</i>	<i>I. maculata</i> var. <i>fusco-citrina</i>	<i>I. calendulacea</i> (= <i>I. maculata</i> var. <i>intermedia</i>)
Stolons	short, with multiple small cormlets	long, with single cormlet	long, single cormlet
Corm tunics	papery-membranous	papery-membranous	fibrous
Perianth tube length (mm)	5–8	10–13	6–8
Outer tepals (mm)	15–22 × 8–12	21–27(–30) × 7–14	15–30 × 9–12
Perianth colour	orange or yellow, centre brown often with star mark	pale yellow, solid dark brown-black centre	orange, brown eye edged red
Stamens			
filaments (mm)	2.5–5.5; united 1–3	3.5–5.0; united 1.0–1.5	± 4–6; united 0.5–6.0
anthers (mm)	8–11	9–11	8–10
Style branch length (mm)	3.5–4.0	2.5–4.0	± 4
No. flowers per spike	5–10	8–15	5–8
Outer bract length (mm) and colour	8–15; entirely brown or lower half pale	8–13; brown, lower half pale	7–12; brown, lower half pale

latur quam internis, filamentis \pm 4 mm longis connatis in pars dimidio vel omnino raro liberis atrobrunneis, antheris 9–11 mm longis, stylo inter basem et inferiori tertio antherarum diviso, ramis 3–4 mm longis.

TYPE.—Western Cape, 3318 (Cape Town): granite-topped hill east of Langebaan, in deep sand, (–AA), 19 September 2008, *Goldblatt & Porter 13152* (NBG, holo., K, MO, PRE, iso.).

Plants 200–500 mm high; corm depressed-globose, 12–16 mm diam., outer tunics fibrous with fibres mostly oriented vertically, sometimes accumulating, producing long horizontal stolons up to 120 mm long, \pm 1.5 mm diam., each bearing a terminal cormlet 8–9 mm diam.; stem usually unbranched, robust plants often with a node in upper third bearing a short branch or dry, attenuate scale, sheathing only at base and often curved back against stem. *Leaves* (3)4–6, lowermost largest, decreasing in size above, uppermost \pm entirely sheathing, $\frac{2}{3}$ to $\frac{3}{4}$ as long as stem, lanceolate, lowermost mostly (8–)12–20 mm wide, often twisted in one or two rotations. *Spike* flexuose, mostly 5–8-flowered; bracts dry, white-translucent below, brown in upper half or third, outer bract \pm truncate or bilobed with a short central tooth, (6–)8–12 mm long, becoming \pm lacerate, inner \pm as long as outer, forked in upper 2 mm into attenuate cusps. *Flowers* shallowly cupped when fully open, orange with brown or dull red central marking, 15–20 mm diam., usually with translucent reddish halo; perianth tube cylindric, 5–8(–10) mm long, \pm 2 mm diam. in lower part, expanded in upper 1 mm; tepals subequal, ascending and overlapping slightly when fully open, (18–)22–30 \times 11–15 mm, outer \pm 2 mm wider than inner. *Stamens* with filaments 3–4 mm long, united in lower half or entirely (rarely \pm free), dark red-brown (often drying violet but ultimately losing colour); anthers ascending, 9–11 mm long, yellow. *Style* dividing between base and lower third of anthers, branches (3–)4 mm long. *Capsules* and *seeds* unknown. Figure 4A–F.

Distribution and biology: largely a coastal species, *Ixia calendulacea* has a scattered distribution along the Western Cape Coast and near interior, from the Cape Peninsula and Saldanha Bay northwards to the Namaqualand coastal plain, as far north as the Groen River (Figure 5). Plants occur in sandy habitats, usually deep sands but also in areas of limestone substrate. Plants are most often associated with strandveld and sandveld vegetation but inland populations in the Olifants River Valley and the hills west of Piketberg, occur on stony sandstone slopes and flats in dry fynbos. When treated by Lewis (1962) and De Vos (1999) as *I. maculata* var. *intermedia*, its range was known from Saldanha to the Olifants River Valley. Later collections, notably *Reid 1291* from Namaqualand, near Kotzesrus, and from the Western Cape west coast northwest of Vredendal, *Goldblatt & Manning 12876* (not in bloom but with the characteristic long stolons and relatively broad leaves of *I. calendulacea*), document the presence of the species north of the Olifants River. A very recent collection from a remnant patch of Cape Flats Sand Fynbos in the southeastern suburbs of Cape Town, *Dorse sub Manning 3231*, is the first record of the species from the Cape Peninsula. There is no indication that this population, which has flowers with a large, translucent red centre and dark filaments connate to the tip, is not native to the Peninsula (Dorse pers. comm.). The population, which occurs in a military area inaccess-

sible to the public, is heavily infested with alien acacias, and flowered after a fire, six months earlier, burned off the canopy and woody undergrowth.

Observation of flowering plants from the type locality near Langebaan (*Goldblatt & Porter 13152*) confirm that *Ixia calendulacea* is visited by small brown hopliine beetles. These insects become covered in pollen as they crawl across the open perianth and readily transfer pollen as they fly from one open flower to another. This is consistent with what is known about pollination in several other species of section *Ixia* (*Goldblatt et al.* 2000).

Diagnosis and relationships: *Ixia calendulacea* is recognized by the relatively large, bright orange flower with a brown to dull red central eye with a translucent red halo, and brown filaments that are partly to entirely united, rarely \pm free (Figure 4A, C, D). Plants have fairly large corms, 12–16 mm diam., with fibrous tunics and bearing long, flattened stolons up to 120 mm long (Figure 4B). They typically have four to six basal leaves with lanceolate blades twisted in the upper half. As in *I. maculata*, the bracts are dry, firm and crinkled and brown at least in the upper part and the style divides above the base of the anthers. When compared directly with living *I. maculata*, the differences between the two come into sharp focus (Figure 4; Table 2). *Ixia maculata* has a particularly crowded spike, and the flower, viewed from the side, shows that the tepals form a shallow cup in the proximal third (the brown part of the tepals), whereas the distal, orange or yellow portions spread horizontally (Figure 4I, J). The tepals are \pm narrowly oblong-ovate with nearly parallel sides, \pm 22 \times 9 mm, do not overlap, and are tapered below so that the cup is narrowly windowed. In the southern form of the species the windows together with orange margins of the cupped portion of the tepals provides the star-like pattern in the brown cup. In typical *I. maculata* (as defined by Lewis 1962) the stolons are short and somewhat twisted and bear more than one (up to three) small cormlets (Figure 4H) and these contrast markedly with the long, flattened stolons of *I. calendulacea* (Figure 4B). Plants corresponding to var. *fusco-citrina* have similar long, flattened stolons and this feature may prove to be an important distinction between that and var. *maculata*. Unfortunately, too few collections have corms well enough preserved to allow examination of the stolons; indeed many collections lack corms altogether. As we noted above, *I. calendulacea* and *I. maculata* sometimes grow in close proximity but in different habitats, the latter always in seasonally wet sites. Their ranges, however, overlap very little (Figure 5), *I. maculata* being restricted to the southwestern Cape between Paarl and the western end of the Piketberg, whereas *I. calendulacea* extends from Langebaan and Porterville to central Namaqualand. An annotation on a collection from near Leipoldtville (*De Wet 00903*) indicates a diploid chromosome number of $2n = 42$, which suggests the species may be polyploid (*Goldblatt & Manning* in prep.). Basic chromosome number in *Ixia* is $x = 10$ (*Goldblatt & Takei* 1997). The count is unpublished.

A collection from near Porterville, *Goldblatt 2745*, is somewhat unusual in having narrow leaves (resembling those of *Ixia maculata*) but the flowers have united filaments and pale bracts, 9–10 mm long, with only the tips turning brown, thus corresponding with *I. calendulacea*. We regard this collection as best referred to the latter and it constitutes the southernmost record of the species.



FIGURE 4.—*Ixia calendulacea*: A, flowering stem; B, corm; C, two flowers; D, half-flower; E, outer (left) and inner (right) bracts; F, details of stamens and style. *Ixia maculata*: G, flowering stem; H, corm; I, flower; J, half-flower; K, outer (left) and inner (right) bracts; L, detail of stamens and style. Scale bar: A–E, G–K, 10 mm; F, L, 2 mm. Artist: John Manning.

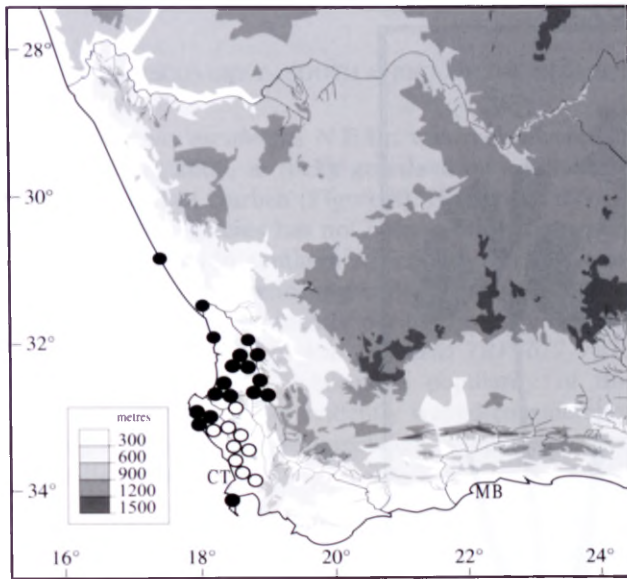


FIGURE 5.—Known distribution of *Ixia calendulacea*, ○; and *I. maculata* including var. *fusco-citrina*, ●.

Key distinctions between *Ixia calendulacea* and *I. maculata*

- 1a Tepals forming concave cup in central dark zone and spreading horizontally in distal part; tepals mostly 15–25 × 8–12 mm, not or hardly overlapping one another toward base; central eye 6–12 mm diam., dark brown, often with star-shaped mark within; filaments yellow; stolons either long, up to 100 mm long, bearing a single terminal cormlot or short, up to 20 mm long, usually more than one cormlot, each up to 3 mm diam. *I. maculata*
- 1b Tepals when fully open forming shallow cup and curved uniformly from base to apex; tepals mostly 16–28 × 9–14 mm, the inner obviously overlapping the outer in lower half; central eye of perianth ± 15 mm diam., glossy brown with pale reddish halo or dull, translucent red; filaments dark red-brown (violet when dry); stolons extending horizontally for up to 120 mm and bearing single terminal cormlot 7–9 mm diam. *I. calendulacea*

Representative specimens

NORTHERN CAPE.—3017 (Hondekliptbaai): Farm Hardekoppie NW of Kotzesrus, (–DC), 29 September 1987, Reid 1291 (PRE).

WESTERN CAPE.—3118 (Vanrhynsdorp): Farm Graafwater, W of Koekenaap, (–AC), August 2007 (sterile), *Goldblatt & Manning 12876* (NBG); Nardouw, (–DC/DD), 22 September 1937, *Barker 272* (NBG). 3217 (Vredenburg): Witteklip rocks, Vredenburg, (–DD), 18 September 1980, *Goldblatt 5845* (MO). 3218 (Clanwilliam): Lambert’s Bay road at Leipoldville turnoff, (–BA), 8 October 1965, *De Wet 00903* (PRE); Farm Sandberg, sandy slope burned two years ago, (–BC), 27 September 1995, *Goldblatt & Manning 10324* (MO, NBG); Farm Nootgedacht, N of Vredenburg, (–CC), 9 October 1985, *De Vos 2624* (PRE); Piketberg, Farm Weltevrede, sandy slope, (–DA), 19 September 2007, *Goldblatt & Manning 13011* (MO); sandveld between Porterville and Piekieniers Kloof Pass, (–DD), 24 September 1974, *Goldblatt 2745* (MO, NBG, PRE); ‘Posberg Reserve’ (ex Darling Flower Show), (?–AA), 19 September 1986, *De Vos 2665* (NBG). 3418 (Simonstown): Cape Town, Youngsfield Military Base, (–BA), 13 October 2009, *Dorse sub Manning 3231* (NBG).

AN EARLIER NAME FOR *IXIA LUTEA*

While examining the protologues of synonyms of *Ixia maculata* listed by Lewis (1962) in order to determine if any might apply to *I. calendulacea*, we found that *I. abbreviata* Houtt. (1780) (Figure 6) was misplaced in

the synonymy of this species. The type, an illustration (Figure 7), shows an *Ixia*-like plant with large flowers in which the style divides below the level of the anthers. The description, remarkably detailed for the time, emphasizes the short style, noting that this feature distinguishes the plant from most other species [of *Ixia*-like plants]. Houttuyn (1780) described the flowers as arising from transparent sheaths (i.e. bracts), sulphur yellow with a bluish central eye, anthers longer than the filaments and with a perianth tube almost half an inch long.

(35) *Ixia die getrostę Bloemen heeft, met zeer korte Stylen.* XXXV. *Abbreviata* KORTHYLL.
De korthheid van den Styl onderscheidt deeze van de voorgaande niet, als de langte van den Styl, waar van de lange dunne Stempels boven de Meelknopjes zig verheffen, De Bladen zyn Gras-
C 5
II. DEBL. XII. STUK.

42 DRIEMANNIGE LELIE-
V. van de meeste anderen. Haar Bladen zyn Liniiaal-Lancetvormig, bekleedende om laag de Stengel, die een Voet lang is, rond en dun, op ’t end een Trosje hebbende van zes Zwaavelgeele Bloemen, taamelyk groot. Zy komen voort uit Vliezige doorschynende tweekleppige Scheedjes, wier kortste of kleinste Lip twee lange punten heeft. Dunne Steeltjes van een half Duim lange, draagen deeze Bloemen; die byna een Duim lang zyn, bestaande uit zes ovaalachtige, fyn gaderde Blaadjes. De Meelknopjes, taamelyk dik, langer dan de Draadjes, Liniiaal of oyerall eeven breed, komen uit den Stiel der Bloem, die wat blaauwachtig is, voort; naby den oorsprong der drie Stempels; welke langwerpig, dik en omgekromd, naauwlyks eenigen Styl hebben, zittende op den bodem van de Bloem. Ik hebze ook die blaauw zyn van Kleur.

XXXVI. *Ixia Campanulata*, Klokblommig. PLAAAT LXXVIII. FIG. 4.
(36) *Ixia met getroste Bloemen, die Klokvormig zyn, en Grasaalrige Bladen.*
De figuur der Bloemen, welke naar die der Klokjes gelyken, onderscheidt deeze zo zeer van de voorgaande niet, als de langte van den Styl, waar van de lange dunne Stempels boven de Meelknopjes zig verheffen, De Bladen zyn Gras-
(36) *Ixia Floribus Racemosis, Campaniformibus, Fol. Gramineis.* HOUTT.

FIGURE 6.—Protologue of *Ixia abbreviata* Houtt.: 41, 42 (1780). Translated by J.P. Roux: (35) *Ixia* with flowers in bunches and with short styles / The short style separates this [species] from most others. The leaves are linear-lanceolate and form a sheath around the stem, which is one foot long, round and slender, and bears at the tip a single group of six, reasonably large, sulphur-yellow flowers. They [the flowers] arise from membranous, transparent, two-valved sheaths [bracts], of which the lip of the shortest or smallest has two long points. Slender stalks [tubes] half an inch long bear the flowers, which are nearly one inch long and consist of six elliptic, finely veined tepals. The relatively thick, linear or parallel-sided anthers are longer than the stamens and originate from the base of the flower [mouth of the tube], which is bluish, and near the origin of the three stigmas [style branches], which are elongated, thick and recurved. The blue style is almost absent and seated at the base of the flower.

PLAAT LXXVIII.



FIGURE 7.—Original illustration of *Ixia abbreviata*. Plate 78, fig. 3 (Houttuyn 1780).

There are few yellow-flowered species of *Ixia* section *Ixia* and the one that matches the description best is the plant currently called *I. lutea*. *Ixia polystachya* L. sometimes has pale yellow flowers, but typically has anthers shorter than, to as long as the filaments (rarely longer). Yellow-flowered *I. curta* and *I. maculata* have a very dark central eye, a style dividing above the anther base and brown rather than translucent floral bracts. Lastly, *I. dubia* Vent. has a small central dark eye and deep yellow to orange flowers usually red on the outside, and does not accord with Houttuyn's plant.

***Ixia abbreviata* Houtt.**, *Natuurlijke historie* 12: 41, t. 78 f. 3 (1780). Type: South Africa, without precise locality or collector, illustration in Houttuyn (1780).

I. lutea Eckl.: 24 (1827), syn. nov. Type: South Africa, without precise locality, cultivated in Cape Town, *Ecklon s.n.* (S, holo.).

We provisionally follow De Vos (1999) in recognizing a second variety of the species, providing the new combination for what she called var. *ovata* (Andrews) B.Nord.

***Ixia abbreviata* var. *ovata* (Andrews) Goldblatt & J.C.Manning**, comb. nov. *Ixia capitata* var. *ovata* Andrews, *The botanist's repository* 1: t. 23 (1798). *I. lutea* var. *ovata* (Andrews) B.Nord.: 284 (1972). Type: South Africa, without precise locality or collector, illustration in Andrews: t. 23 (1798).

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