

Drimia cochlearis (Hyacinthaceae), a New Species from South Africa

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Abstract—A new species of *Drimia* is here described from South Africa. *Drimia cochlearis* sp. nov. is at first sight closely related to both *Drimia ciliata* and *D. sclerophylla*, but it differs in a number of floral and vegetative characters that clearly support its recognition as a distinct species. Here we provide a detailed morphological description for this species, including ecological and chorological data. Affinities and divergences with close allies are also discussed.

Keywords—Distribution, *Drimia ciliata*, *Drimia sclerophylla*, ecology, taxonomy, Urgineoideae.

The family Hyacinthaceae subfamily Urgineoideae includes about 100 species (Manning et al. 2004), but the number of taxa is likely to be considerably higher due to the poor knowledge of this plant group throughout its wide geographic range. Species of this subfamily are distributed in Africa, Europe, and western Asia, reaching India to the east. As in other subfamilies of Hyacinthaceae, generic circumscription in Urgineoideae has been a matter of controversy in the last decades. On the one hand, broad treatments have been recently proposed based on phylogenetic studies (Manning et al. 2004), where only two genera are accepted for the whole subfamily: *Bowiea* Harv. ex Hook. f. with two species (Reid et al. 1990), and *Drimia* Jacq. with about 100 species. The resulting expanded concept of *Drimia* is very variable in flower and vegetative morphology, and includes several traditionally accepted genera, such as *Litanthus* Harv., *Rhadamanthus* Salisb., *Rhodocodon* Baker, *Schizobasis* Baker, *Tenicroa* Raf., *Thuranthos* C. H. Wright, and *Urginea* Steinh. On the other hand, other authors favoured more analytical approaches based on morphology (Speta 1998), in which up to 10 different genera (excluding *Igidia* Speta that belongs to Ornithogaloideae) were accepted. However, several of these genera have proven to be para- or polyphyletic (Manning et al. 2004; Pfosser and Speta 2001, 2004; Pfosser et al. 2012). Speta (1998) himself commented that “the definition of genera in this subfamily is often unsatisfactory.” This scenario is similar in Ornithogaloideae, where contrasting taxonomic treatments were recently proposed based on different approaches (Speta 1998; Manning et al. 2004, 2009; Martínez-Azorín et al. 2011). However, as shown by Martínez-Azorín et al. (2011), where sufficient plastid and nuclear DNA regions are included in the phylogenetic analyses, consistent morphologic syndromes are fully congruent with clades, and these can be satisfactorily accepted at the generic rank. A similar study is still needed in Urgineoideae to evaluate possible alternatives to render more consistent generic circumscriptions.

Drimia is characterized in general terms by the short-lived flowers (living from several hours to up to a day), with the tepals more or less united at the base, spurred floral bracts, and the caducous and circumscissile perianth, abscising at the base and withering as a cup on the developing capsule (cf., Manning and Goldblatt 2007), which is nearly congruent with the characters shared in general terms by most taxa in the subfamily Urgineoideae. However, several groups within Urgineoideae do not agree with this definition, e.g. the perianth almost free at the base (cf., *Urginea*), not persistent on top

of the capsule after withering (cf., *Rhodocodon*), or the flowers lasting more than one day (van Jaarsveld and van Wyk 2003). All these facts make *Drimia* s. l. very difficult to understand and to work with. Moreover, in an even more undefined genus concept within Hyacinthaceae, *Drimia* is characterized by the short-lived, caducous flowers, mostly rather inconspicuously colored dull cream, grey or brownish (cf., Manning et al. 2002; Manning and Oliver 2009). This broader and unclear genus concept is here provisionally accepted until a comprehensive study in the subfamily is undertaken allowing re-evaluation of alternative multigeneric treatments.

In the frame of taxonomic work on Urgineoideae in southern Africa, we have recently found plants at first sight similar to both *Drimia ciliata* (L. f.) J. C. Manning & Goldblatt and *D. sclerophylla* J. C. Manning & Goldblatt (= *Urginea rigidifolia* Baker, non *Drimia rigidifolia* Baker). However, they show a peculiar syndrome of characters that are not found in any of the described taxa of the group (cf., Jessop 1977; Nordenstam 1970; Müller-Doblies et al. 2001). Based on our observations, and according to morphological characters that have been used to differentiate taxa in the genus (e.g. color and morphology of tepals, and morphology of leaves and bulbs), the new species *D. cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold is here described.

MATERIALS AND METHODS

A detailed morphological study of wild living plants of *Drimia cochlearis* (47 plants in one population) as well as *D. ciliata* (64 in five populations) and *D. sclerophylla* (36 in four populations) was undertaken. Morphological studies included both qualitative and quantitative features of bulbs, leaves, flowers, fruits, and seeds, and have been described in detail for other related groups in Ornithogaloideae by Martínez-Azorín et al. (2007, 2010). Herbarium specimens from the following herbaria were studied: ABH, GRA, K, NBG, and PRE (acronyms according to Thiers 2012). Authorities of cited taxa follow the IPNI (2012).

RESULTS AND DISCUSSION

During the course of fieldwork, plants were found in the surroundings of Calitzdorp in the Little Karoo, Western Cape Province of South Africa, which resembled *D. ciliata*. However, a careful examination of relevant characters revealed that many differences existed between both taxa and other related ones, such as *D. sclerophylla*. A new species, *D. cochlearis* (Figs. 1–3; Table 1) is described herewith to accommodate these distinct plants.

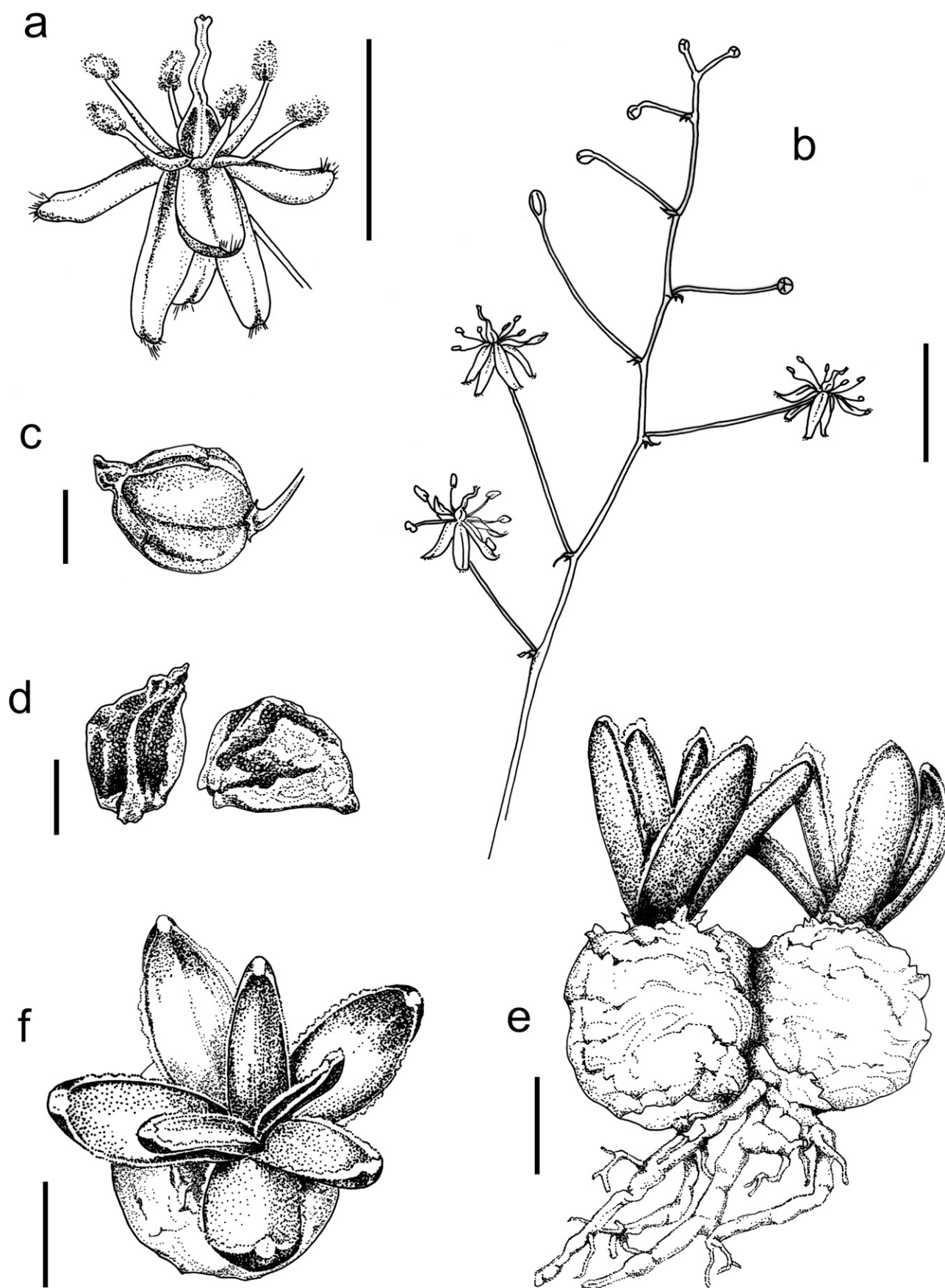


FIG. 1. *Drimia cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold. A. Flower. B. Inflorescence. C. Capsule. D. Seeds. E. Bulbs with leaves, lateral view. F. Bulb with leaves, apical view. Scales a: 5 mm; b: 1 cm; c: 2 mm; d: 1 mm; e–f: 1 cm.



FIG. 2. General view of *Drimia cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold at the type locality, Gamkaberg Nature Reserve, Western Cape, South Africa.

TAXONOMIC TREATMENT

Drimia cochlearis Mart.-Azorín, M. B. Crespo & A. P. Dold, sp. nov. —HOLOTYPE: SOUTH AFRICA. Western Cape, ca. 11 km SW of Calitzdorp, Gamkaberg Nature Reserve (former Groenfontein Nature Reserve), 408 m, 29/09/2011 (bulbs with leaves from wild plants), flowers ex hort. (28/01/2012 in Grahamstown), 33°37'16" S, 21°38'08" E, M. Martínez-Azorín, A. P. Dold, J. Vlok & A. Martínez-Soler MMA941 (holotype: GRA ; isotypes: ABH, K).

Species insignis floribus primu adspectu ab *Drimia ciliata* et *D. sclerophylla* aemulans, sed multos characteribus sat distincta et facile distinguitur. A priore differt foliis cochleatis apice cucullatis margine scarioso-eroso non ciliato; inflorescentia et pedicellis pallide viridibus et longioribus; floribus erectis necnon tepalis albidis carina media viridi nunquam purpurascenti instructis, interioribus valde reflexis. A posteriore tamen discrepat foliis coriaceis obovatis multo latioribus brevioribusque, nunquam filiformibus subteretibus rigidioribusque.

Deciduous bulbous plants, up to 8–23 cm tall. Bulb ovoid to spherical, flattened at the top, 1.6–2.5 × 1.5–2.3 cm, usually proliferous, forming dense clumps, hypogaeal or slightly epigeal, with pale membranous outer tunics, not reaching the apex. Roots fleshy, thick, branched, up to 50 × 2 mm. Leaves 4–9 disposed in a basal rosette, mostly withered

at flowering time, suberect or spreading, 1.9–3.3(4.5 in cultivation) × 0.7–0.9 cm, obovate-oblong, firm, leathery, dark glossy green, with smooth surface, concave with cucullate apex, overlapping at the base, with a membranous, erose, translucent and sometimes undulate margin of ca. 0.7–1 mm width. Inflorescence an erect raceme, with 12–32(41) flowers, 4–11 cm long; peduncle 5–10 cm long, pale green, papillate in the basal part; pedicels (13)15–20 mm long, pale green, patent or suberect, slightly shortening from the base to the apex; bracts ovate-lanceolate to triangular, acuminate, very small and inconspicuous, much shorter than pedicels, up to 1 mm long, lowermost with an evident basal spur. Flowers erect or suberect; tepals white with a pale green median stripe, ovate-oblong, 4–6 × 1.5–2 mm, shortly fused at base (ca. 0.4 mm), with flat or slightly cucullate apex, bearing apical hairs of ca. 0.5 mm long; inners subpatent, outers strongly reflexed. Stamens monomorphic, subpatent and spreading; anthers 1 × 0.5 mm, fertile and dehiscing longitudinally along the whole length; filaments subcylindrical, white, smooth, 1.9–2.5 × 0.5 mm. Ovary ovate, white with pale green longitudinal stripes, 1.1–1.5 × 1–1.3 mm, sessile; style filiform, white, 2 × 0.5 mm, usually bent; stigma white, trigonous and inconspicuous. Capsule ovate, ca. 5 × 4 mm, trigonous to subspherical in section, pale-brown when mature; valves splitting completely from the base to the apex, with the withered perianth basally circumscissile and remaining attached

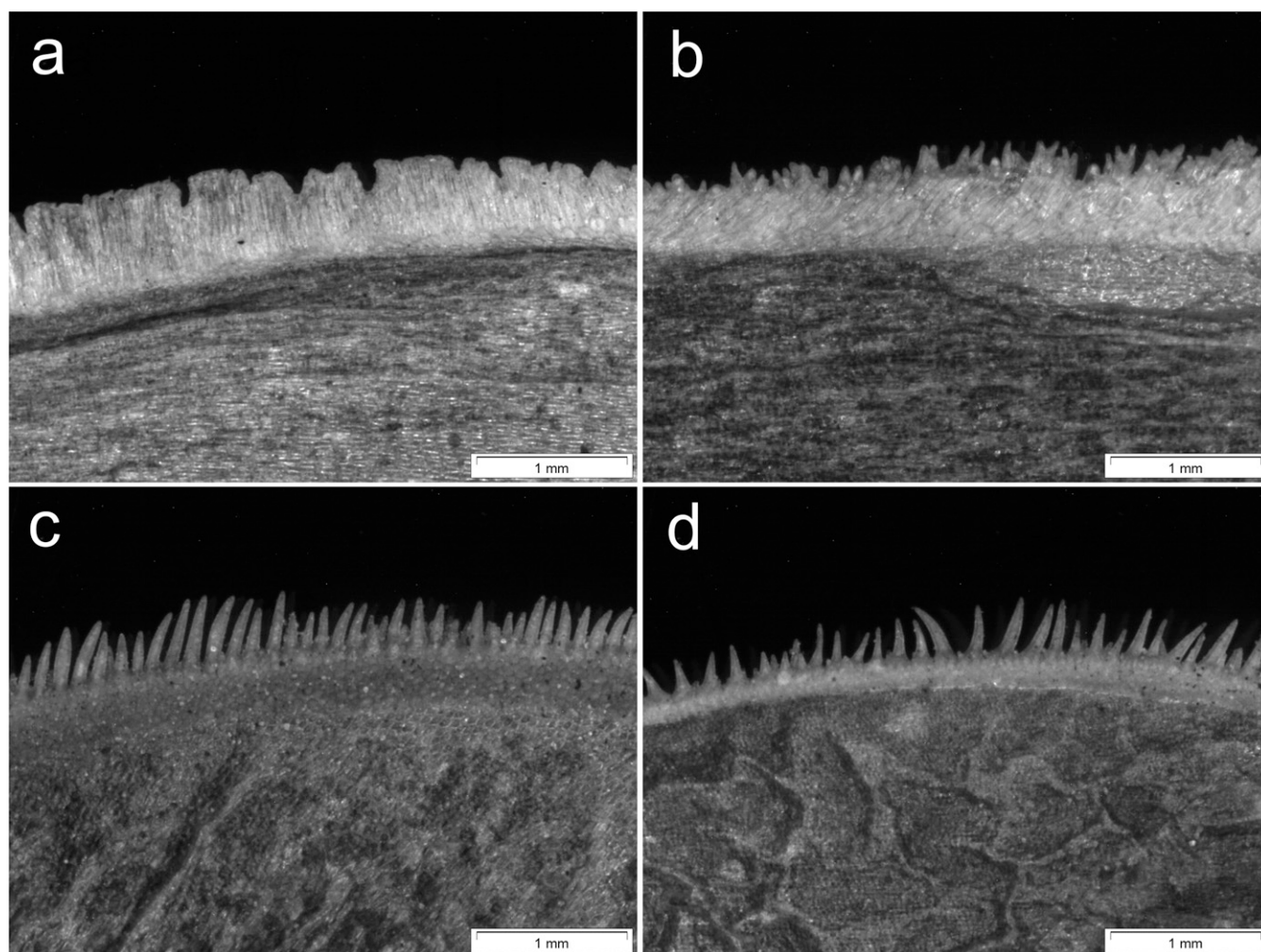


FIG. 3. Leaf margin details: (a–b) *Drimia cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold (Type specimen: Gamkaberg Nature Reserve, Western Cape, South Africa) and (c–d) *Drimia ciliata* (L. f.) J. C. Manning & Goldblatt (Baakens valley, Port Elizabeth, Eastern Cape, Martínez-Azorín 979 et al. GRA).

to the top of the capsule as an apical cup. Seeds semidiscoidal and irregularly compressed, angled, ca. $2\text{--}3 \times 1\text{--}2$ mm, dark brown to black. Figures 1–3, Table 1.

Flowering Time—It flowers from late September to early January (March in cultivation in Grahamstown, Eastern Cape), and fruits appear from November to April.

Habitat—*Drimia cochlearis* grows occasionally singly or usually forming dense clumps in deep sandy soils, on rocky soils or ledges, in dry shrublands, mostly in the southern regions of the Succulent Karoo Biome (Fig. 4) (Mucina and Rutherford 2006), between 150 and 900 m altitude.

Distribution—The species is known from Bredasdorp (Western Cape Province) to Baviaanskloof mountains (Eastern Cape) in several localities about 400 km apart, which are located within a narrow latitudinal stripe ranging from ca. 33° to 34.5° S along the Cape Fold Belt (Fig. 5).

Diagnostic Characters and Relationships—*Drimia cochlearis* is easily recognized by the leaves that are dark glossy green, firm, leathery, obovate, concave and cucullate at the apex, with a membranous, translucent and sometimes undulate margin of ca. 0.7–1 mm width (Fig. 3 a–b), and mostly withered at flowering time; inflorescence in a long raceme with 12–32(41) flowers and patent long pedicels of (13)15–20 mm, about 4–5 times longer than tepals; flowers erect or suberect; tepals ovate-oblong, $4\text{--}6 \times 1.5\text{--}2$ mm; inners subpatent, outers

strongly reflexed (Fig. 1–3; Table 1). In cultivation, leaves usually are narrowly oblong to oblong-linear in outline, sometimes narrowing at the base in a pseudopetiole, a variation that has also been observed in *D. ciliata*.

Drimia cochlearis shares with *D. ciliata* the short and wide, glossy green, smooth leaves disposed in a spreading basal rosette, and the general flower morphology. However, leaves in the latter are appressed to the ground, flat, and even slightly convex when sprouting, with densely and long ciliate margins (Fig. 3 c–d). The inflorescence in *D. ciliata* has maroon pedicels and stem, its fertile part and pedicels are shorter, and the flowers are nodding with white tepals bearing a brown-reddish keel (cf. Linnaeus fil. 1782; Linnaeus 1784; Thunberg 1823; Kunth 1843; Baker 1872, 1897; Dold and Moberg 2000). Another remarkable difference between both species is found in the capsule dehiscence that begins from the base to the apex in *D. cochlearis* whereas it begins from the apex to the base in *D. ciliata* (Table 1). *Drimia sclerophylla* is also similar in terms of flower morphology to *D. cochlearis*, but its leaves are very long and narrow, terete, somewhat wiry, and rigid (cf. Baker 1878, 1897), which do not allow confusion at all with the new species. Furthermore, the former produces many-flowered inflorescences, with shorter reddish-brown pedicels and usually larger flowers (Table 1).

TABLE 1. Main diagnostic characters between *D. cochlearis*, *D. ciliata*, and *D. sclerophylla*.

	<i>Drimia cochlearis</i>	<i>Drimia ciliata</i>	<i>Drimia sclerophylla</i>
Bulb	1.6–2.5 × 1.5–2.3	2–2.5 × 2–2.5 cm	2.5–3 × 2.8–3.5 cm
Leaves	4–9 1.9–3.3(4.5 in cultivation) × 0.7–0.9 cm suberect or spreading obovate-oblong, firm, leathery, dark glossy green, with smooth surface concave with cucullate apex overlapping at the base membranous, erose, translucent, margin of c. 0.7–1 mm width, sometimes undulate withered at flowering time	10 0.8–3 × 0.3–1.9 cm prostrate ovate, ovate-elliptical or lorate, firm, leathery, dark glossy green, with smooth surface flat or slightly convex when sprouting overlapping at the base densely, long ciliate, straight margins withered at flowering time	3–5 9–17 × 0.1 cm erect narrowly linear, rigid, wiry, nervose, green, glabrous subterete not overlapping at base glabrous margin partially withered or green at flowering time
Inflorescence	12–32(41) flowers fertile part 4–11 cm long pedicels (13)15–20 mm long pedicels and stem pale green flowers erect at the anthesis	10–15 flowers fertile part 2–6 cm long pedicels 4–14 mm long pedicels and stem reddish-brown, glossy flowers nodding at the anthesis	30–56 flowers fertile part 10–15 cm long pedicels 5–13 mm long pedicels and stem reddish-brown flowers nodding at the anthesis
Tepals	4–6 × 1.5–2 mm white with a pale green keel inners subpatent, outers strongly reflexed	5–6 × 1.9–2.6 mm translucent white with a light brown to reddish keel inners patent, outers slightly reflexed	4–5 × 1.9–2.8 mm translucent white with a brown-purple to green keel inners subpatent, outers subpatent to slightly reflexed
Capsule	5 × 4 mm valves splitting completely from base to apex	3–7 × 2.5–5 mm valves splitting completely from apex to base	Not seen
Seeds	ca. 2–3 × 1–2 mm	2–2.5 × 2 mm	Not seen
Flowering time	late September to early January	January to February	November–January



FIG. 4. Habitat of *Drimia cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold at the type locality, Gamkaberg Nature Reserve, Western Cape, South Africa.

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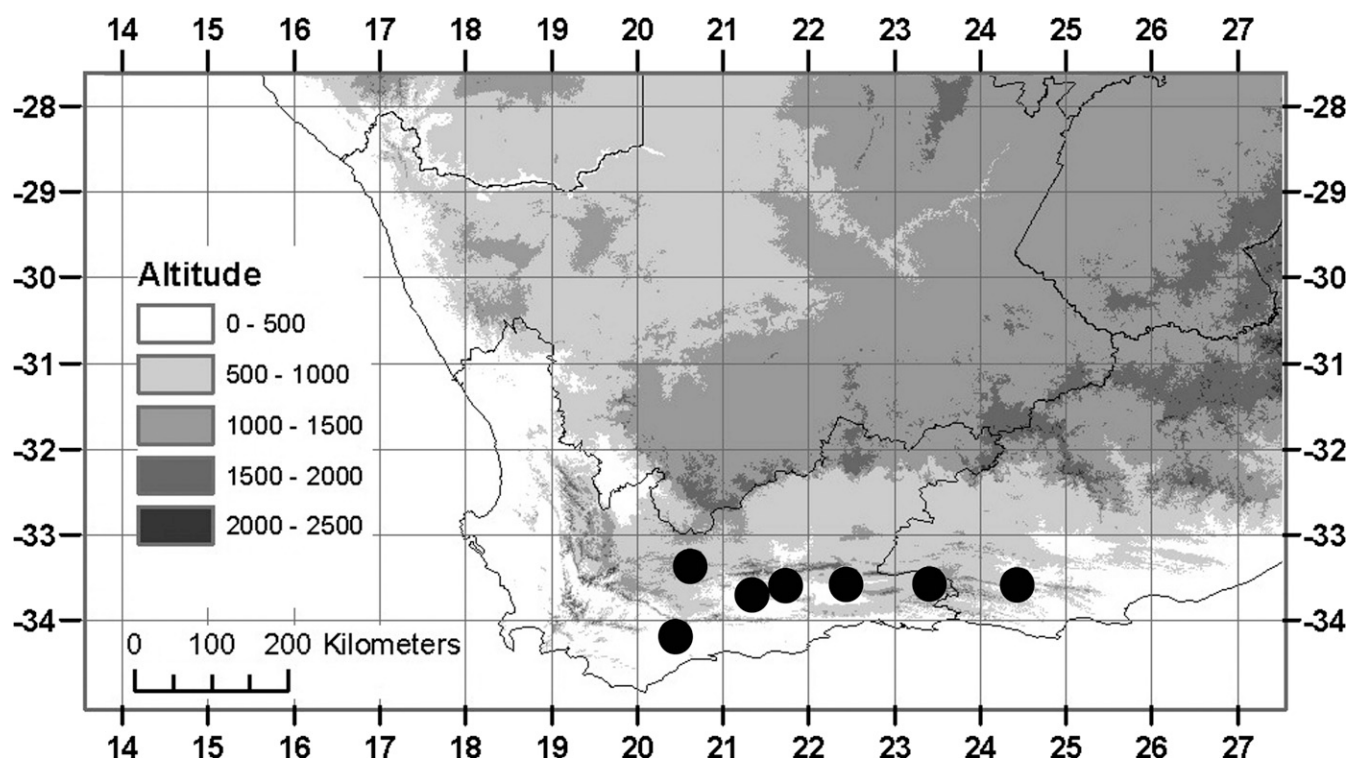


FIG. 5. Known distribution of *Drimia cochlearis* Mart.-Azorín, M. B. Crespo & A. P. Dold in southern South Africa. Axes show longitude and latitude in degrees.

Among the studied materials of *Drimia cochlearis* (see below), the collection *Oliver 9750* (NBG) bears an identification label as '*Urginea pulchellomarginata* U. & D. M.-D. msc' dated 17 December 1990. It includes only vegetative material of at least three different species, of which those having bulbs correspond to *D. cochlearis*.

It is remarkable that all three above mentioned species share very similar flower structure, but they differ in vegetative characters. These taxa form a distinct aggregate regarding flower structure, which is not found in other species of *Drimia* s. l., this evidencing close evolutionary relationships. Molecular work is being undertaken to clarify this point.

Etymology—The name refers to the concave shape of the leaves (*cochlearis* = spoon-like).

Other Representative Specimens Examined—SOUTH AFRICA. Western Cape: Bredasdorp (3420AB), 6 km SW of Swellendam, 09 May 1978, *Perry 720* (NBG); Ladismith District (3320BC), Anysberg area, valley on north side of Anysberg E of Vrede, 720 m, 23 Sep 1990, *Oliver 9750* (NBG); Blouhuis Farm, ca. 30 km south of Ladismith, on the Riversdale-Ladismith road (R323), ca. 18 km south the crossing with R62, 33°44'06" S 21°09'59" E, ca. 250 m, [pictures labelled as *Ornithogalum britteniae* aff. at both the Cok and Ine Grootsholten website (<http://public.fotki.com/Grootsholten/plant-collections/bulbs/britteniae.html>) and Panos and Stavros private collection website (http://www.bulbsociety.org/GALLERY_OF_THE_WORLD_BULBS/GRAPHICS/Ornithogalum/Ornithogalumlist.shtml); accessed 10–09–2012]; Oudtshoorn (3322CB), 18 km S of Oudtshoorn, 03 Dec 1985, *Vlok 869* (NBG); Willowmore (3323CB), Uniondale, De Hoop Farm, flowers ex hort. 13 Dec 1981, leaves ex NBG 07 Jul 1982, *Snijman 372* (NBG); Willowmore (3323CB), a few kilometres off Uniondale, Avontuur road towards De Hoop Farm, 30 Sep 1980, *Perry 1448* (NBG). Eastern Cape: Geelhoutbos, Baviaanskloof, on hill top behind managers house, Nov 1998, *Dold 4432*, *Clark & Cocks* (GRA); Steytlerville (3324CB), near the third gate up from the south side of the Enkeldoorn track, 28 Sep 1980, *Perry 1431* (NBG); Steytlerville (3324CB), along track from Enkeldoorn to Wilgerivier on north side of Baviaanskloof mountains, flowers ex hort. 13 Dec 1981 and flowers NBG 06/01/1982, leaves NBG 07/07/1982, *Snijman 375* (NBG).

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LITERATURE CITED

- Baker, J. G. 1872. Revision of the genera and species of Scilleae and Chlorogaleae. *Journal of the Linnean Society. Botany* 13: 209–292.
- Baker, J. G. 1878. Descriptions of new and little known Liliaceae. *Journal of Botany. British and Foreign* 16: 321–326.
- Baker, J. G. 1897. *Drimia*. Pp. 436–443 in *Flora Capensis* vol. 6, ed. W. T. Thistelton-Dyer. London: Reeve and Co.
- Dold, A. P. and R. Moberg. 2000. Correction of a historical error in the taxonomic description of *Urginea ciliata*. *Bothalia* 30: 46–48.
- IPNI. 2012. The international plant names index. <http://www.ipni.org> [accessed August 2012].
- Jessop, J. P. 1977. Studies in the bulbous Liliaceae in South Africa: 7. The taxonomy of *Drimia* and certain allied genera. *Journal of South African Botany* 43: 265–319.
- Kunth, C. S. 1843. *Enumeratio plantarum omnium hucusque cognitarum, secundum familias naturales disposita, adjectis characteribus, differentiis et synonymis. Tomus quartus*. Stutgardiae et Tubingae: J. G. Cotta.
- Linnaeus, C. 1784. *Systema vegetabilium secundum classes ordines genera species cum characteribus et differentiis*. Editio decima quarta. Gottingae: J. C. Dieterich.
- Linnaeus fil., C. 1782. *Supplementum plantarum*. Brunsvigae: Orphanotropei.
- Manning, J. C., P. Goldblatt, and D. Snijman. 2002. *The color encyclopedia of Cape Bulbs*. Portland: Timber Press.
- Manning, J. C., P. Goldblatt, and M. F. Fay. 2004. A revised generic synopsis of Hyacinthaceae in Sub-Saharan Africa, based on

- molecular evidence, including new combinations and the new tribe Pseudoprosperaeae. *Edinburgh Journal of Botany* 60: 533–568.
- Manning, J. C., F. Forest, D. S. Devey, M. F. Fay, and P. Goldblatt. 2009. A molecular phylogeny and a revised classification of Ornithogaloideae (Hyacinthaceae) based on an analysis of four plastid DNA regions. *Taxon* 58: 77–107.
- Manning, J. C. and P. Goldblatt. 2007. New species of *Drimia* (Hyacinthaceae: Urgineoideae) allied to *Drimia marginata* from Western and Northern Cape, South Africa. *Bothalia* 37: 183–187.
- Manning, J. C. and E. G. H. Oliver. 2009. Hyacinthaceae: *Drimia oliverorum* (Urgineoideae), a new species from southern Namibia. *Bothalia* 39: 225–227.
- Martínez-Azorín, M., M. B. Crespo, and A. Juan. 2007. Taxonomic revision of *Ornithogalum* subg. *Cathissa* (Salisb.) Baker (Hyacinthaceae). *Anales del Jardín Botánico de Madrid* 64: 7–25.
- Martínez-Azorín, M., M. B. Crespo, and A. Juan. 2010. Taxonomic revision of *Ornithogalum* subg. *Beryllis* (Hyacinthaceae) in the Iberian Peninsula and the Balearic Islands. *Belgian Journal of Botany* 142: 140–162.
- Martínez-Azorín, M., M. B. Crespo, A. Juan, and M. F. Fay. 2011. Molecular phylogenetics of subfamily Ornithogaloideae (Hyacinthaceae) based on nuclear and plastid DNA regions, including a new taxonomic arrangement. *Annals of Botany* 107: 1–37.
- Mucina, L. and M. C. Rutherford (eds.). 2006. *The vegetation of South Africa, Lesotho and Swaziland*. Pretoria: South African National Biodiversity Institute.
- Müller-Doblies, U., J. Tang, and D. Müller-Doblies. 2001. A revision of the genus *Fusifilum* Raf. (1837) (Hyacinthaceae of Southern Africa). *Feddes Repertorium* 112: 473–497.
- Nordenstam, B. 1970. Studies in South African Liliaceae. III. The genus *Rhadamanthus*. *Botaniska Notiser* 123: 155–182.
- Pfossner, M. and F. Speta. 2001. Bufadienolides and DNA sequences: on lumping and smashing of subfamily Urgineoideae (Hyacinthaceae). *Stapfia* 75: 177–250.
- Pfossner, M. and F. Speta. 2004. From *Scilla* to *Charybdis* - is our voyage safer now? *Plant Systematics and Evolution* 246: 245–263.
- Pfossner, M., W. Knirsch, M. Pinter, S. Ali, S. Dutta, and W. Wetschnig. 2012. Phylogenetic relationships of Malagasy Hyacinthaceae. *Plant Ecology and Evolution* 145: 65–72.
- Reid, C., D. Müller-Doblies, and U. Müller-Doblies. 1990. *Bowiea gariensis*; southern Namibia and northern Cape; Liliaceae/Hyacinthaceae. *Flowering Plants of Africa* 51, plate 2007.
- Speta, F. 1998. Hyacinthaceae. Pp. 261–285 in *The families and genera of vascular plants* 3, ed. K. Kubitzki. Berlin: Springer.
- Thiers, B. 2012. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/> [continuously updated; accessed August 2012].
- Thunberg, C. P. 1823. *Flora Capensis*. Stutgardiae: J. G. Cotta.
- van Jaarsveld, E. J. and A. E. van Wyk. 2003. Two new succulent cliff-dwelling species of *Drimia* (Hyacinthaceae) from the Eastern Cape, South Africa. *Aloe* 42: 81–83.