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Striatula (*Hyacinthaceae, Urgineoideae*), a new genus from South Africa and southern Namibia

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with 1 figure and 1 table

Key words: *Drimia oliverorum, D. platyphylla, Rhadamanthus, R. platyphyllus, Asparagaceae, Hyacinthaceae, Urgineoideae, Urgineeae,* flora of southern Africa, taxonomy.

Summary

Pinter M., Martínez-Azorín M., Crespo M. B., Alonso-Vargas M. Á. & Wetschnig W. 2019. *Striatula* (*Hyacinthaceae*, *Urgineoideae*), a new genus from South Africa and southern Namibia. – Phyton (Horn, Austria) 59 (1–2): 91–98, with 1 figure and 1 table.*

Within the framework of the taxonomic revision of subfamily *Urgineoideae* of *Hyacinthaceae*, we here describe the new genus *Striatula* from South Africa and southern Namibia. *Striatula* is at first sight related to *Rhadamanthus* species, but can be easily distinguished by the one or two flat, ovate to elliptic, sulcate leaves which are appressed to the ground. This genus includes *Rhadamanthus platyphyllus*, a species native to the Western, Eastern and Northern Cape Province of South Africa, and the more recently described *Drimia oliverorum* from Namibia. A morphological description for *Striatula* is presented, including the most important characteristics and the necessary new combinations.

1. Introduction

The family *Hyacinthaceae* includes about 1000 species, with their distribution range in Africa, Europe and Asia. Only a single small genus, *Oziroë* Raf. (Rafinesque 1837: 53), is native to South America (Speta 1998a, 1998b, APG 2003). The four subfamilies *Hyacinthoideae*, *Ornithogaloideae*, *Oziroëoideae* and *Urgineoideae* in which the family can be subdivided, correspond to four monophyletic clades (Speta 1998a, Pfosser & Speta 1999, Manning & al. 2004). Alternatively, *Hyacinthaceae* are treated as *Asparagaceae* subfamily *Scilloideae*. In this case, the subfamilies are consequently reduced to the tribes *Hyacintheae*, *Ornithogaleae*, *Oziroëeae* and *Urgineeae* (APG 2009, 2016, Chase & al. 2009).

Subfamily *Urgineoideae* is mainly distributed in Africa and Europe, but it is also found in western Asia, with one representative as far east as Thailand.

Within the framework of a taxonomic revision of the subfamily *Urgineoideae*, we realized that the conventional treatment in some groups is not satisfactory, as several of the genera are still para- or polyphyletic (see Pfosser & Speta 2001, 2004, Manning & al. 2004, Pfosser & al. 2012, Martínez-Azorín & al. unpubl.). Speta 1998a already commented on the unsatisfactory state in this subfamily. As it was shown in the sister subfamily *Ornithogaloideae*, when a sufficient selection of DNA regions is included in the phylogenetic analyses, clear morphological features are congruent with the clades, which are acceptable at generic rank (Martínez-Azorín & al. 2011).

A similar study evaluating alternative and more consistent generic concepts is still lacking in *Urgineoideae*. This is the aim of our ongoing research, which so far clearly supports the recognition of several genera in the subfamily (Martínez-Azorín & al. unpubl.).

The treatments of *Urgineoideae* at generic level are still controversial. More detailed information on generic circumscriptions within *Urgineoideae* can

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be found in Martínez-Azorín & al. 2013a, 2013b, 2015, 2019b and Pinter & al. 2013. Some studies in the last decades accept only c. 100 species within the subfamily (compare Manning & al. 2004, 2009), but due to the lack of detailed comprehensive taxonomic revisions and our current knowledge of this subfamily across its broad distribution range, we consider the number of species to be at least double (compare Martínez-Azorín & al. 2019b).

In the last years, as a first attempt to better accommodate species showing clear differences in morphology, ecology and biogeography correlated with solid genetic distinctions, seven new genera were described in *Urgineoideae* (Martínez-Azorín & al. 2013a, 2017, 2018, 2019a, Pinter & al. 2013, Speta 2016, Crouch & al. 2018). Those genera are *Sagittanthera* Martínez-Azorín & al. 2013b: 46, *Mucinaea* M. Pinter & al. 2013: 296, *Vera-duthiea* Speta 2016: 154, *Aulostemon* Martínez-Azorín & al. 2017: 288, *Austronea* Martínez-Azorín & al. 2018: 105, *Iosanthus* Martínez-Azorín & al. 2019a: 584, and *Zingela* N. R. Crouch & al. 2018: 36. The addition of these new genera has facilitated a better understanding of *Urgineoideae* and a more homogeneous circumscription of genera. Continuing with this tendency, we here describe a new genus (*Striatula*) to accommodate two species with a unique combination of morphological characters and a distribution restricted to southern Africa, which also form an isolated and well-supported clade in the phylogenetic analyses (Pfosser & al. 2012).

The genus *Rhadamanthus* Salisb. (Salisbury 1866: 37) is distributed in South Africa and southern Namibia (Nordenstam 1970, Manning & Oliver 2009, Manning & Goldblatt 2018). Salisbury l.c. described the genus to include a single species, *Hyacinthus convallarioides* L.f. (Linnaeus fil. 1782: 204), based on the nodding urceolate to campanulate flowers with tepals fused from the base up to their half, stamens connivent to the gynoecium, and anthers dehiscing by apical pore-like slits. However, the combination *Rhadamanthus convallarioides* was not validly published by Salisbury l.c., therefore it must be ascribed to Baker 1871: 434, as *R. convallarioides* (L.f.) Baker (see Nordenstam 1970).

Since then Baker 1897 and Dyer 1934 each added one further new species in *Rhadamanthus*, *R. cyanelloides* Baker 1897: 444 and *R. urantherus* R. A. Dyer 1934: t. 3247, sharing anther dehiscence. Nordenstam 1970 in a comprehensive revision of the genus accepted nine species of which six were new: *R. montanus* B. Nord. (Nordenstam 1970: 162), *R. arenicola* B. Nord. (l.c. 166), *R. secundus* B. Nord. (l.c. 168), *R. platyphyllus* B. Nord. (l.c. 172), *R. fasciatus* B. Nord. (l.c. 174), *R. albiflorus* B. Nord. (l.c. 177). Snijman & al. 1999: 113 added one more species to the genus, *R. involutus* J. C. Manning & Snijman. Nordenstam 1970 commented that the main difference of the genus "is found in the mode of anther dehiscence", as they "are said to open by apical pores". He further stated, "a more correct description is that the anthers dehisce incompletely by introrse longitudinal slits", but also that e.g. in *R. fasciatus* and *R. albiflorus* "the sutures reach down below the middle of the thecae". In his description of the genus, a high variability of morphological characters can be found, for instance: bulb scales sometimes loosely imbricated or even separate and stalked; leaves erect or spreading, 1 or 2 or several to numerous, filiform to linear or ovate to oblong, glabrous or pubescent; inflorescence a lax to subdense, few- to many-flowered raceme; perigone campanulate to subglobose, half-closed to almost spreading during anthesis; tepals subequal to somewhat unequal, connate basally or up to above the middle, seldom free from the base, or anthers free to connate.

The genus *Rhodocodon* Baker 1881: 280 was mainly based on the distinct flower morphology. It is characterized by urceolate to campanulate flowers, lasting for 3–7 days, the perigone segments fused for most of their length, usually persisting at the base after capsule dehiscence, the filaments adnate to the perigone and arising from the lower half of the tube (compare Knirsch & al. 2015, 2016). Baker stated in the description, that his new genus "Comes between *Muscari* and *Urginea*". This position has been commented by Speta 1998b: "… entspricht keinesfalls mehr neueren Erkenntnissen." ["… does not comply at all with recent findings."]. Based on the special configuration of the androecium (stamens convergent, anther dehiscence pore- to slit-like), Speta 1998b transferred nine *Rhodocodon* species into the genus *Rhadamanthus*. However, based on clear morphological as well as molecular differences, Knirsch & al. 2015 reinstated the genus *Rhodocodon*.

Obermeyer 1980 described two new species of *Rhadamanthus*, *R. namibensis* Oberm. (Obermeyer 1980: 137) and *R. karooicus* Oberm. (l.c. 138), as well as the subgenus *Rhadamanthopsis* Oberm. (l.c. 137). The subgenus, created to place these two species, was based on the loculicidal anther dehiscence instead of opening by apical pores. Speta 1998b: 74 raised this subgenus to generic rank, *Rhadamanthopsis* (Oberm.) Speta.

Jessop 1977 began to lump genera of *Urgineoideae* but still regarded *Rhadamanthus* as a distinct genus based on its distinct flower morphology. Goldblatt & Manning 2000, however, lumped *Rhadamanthus* s.l. into *Drimia* Jacq. ex Willd. (Willdenow 1799: 165) and provided new combinations for the Cape species of *Urgineoideae*. Manning & al. 2002 gave an overview of their interpretation of the

genus *Drimia*, treating most of the traditionally accepted genera as "groups". Manning & al. 2004, based on their preliminary phylogenetic analyses covering an incomplete sampling of taxa and very limited plastid markers, opted to greatly expand the circumscription of the genus *Drimia* to nearly the whole *Urgineoideae*, only accepting *Bowiea* Harv. ex Hook.f. (Hooker 1867: t. 5619) as a different genus, but merging distinct genera like *Thuranthos* C. H. Wright (Wright 1916: 233), *Schizobasis* Baker (Baker 1873: 105), *Litanthus* Harv. (Harvey 1844: 314), *Rhadamanthus*, *Tenicroa* Raf. (Rafinesque 1837: 52), and several others.

Lately, Manning & Goldblatt 2018 included *Drimia platyphylla* and *D. oliverorum* in *Drimia* section *Rhadamanthus* (Salisb.) J. C. Manning & Goldblatt (Manning & Goldblatt 2018: 129), an assembly of nine species with variable morphology. According to our phylogenetic studies (Martínez-Azorín & al. unpubl.) as well as previously published results (e.g. Pfosser & al. 2012, Pinter & al. 2013 and Martínez-Azorín & al. 2019a), this group is polyphyletic.

The genus *Sagittanthera* Martínez-Azorín & al. 2013a: 46 was established to include *Rhadamanthus cyanelloides* Baker 1897: 444 (= *Drimia cremnophila* van Jaarsv., in van Jaarsveld & van Wyk 2005: 81) and *Drimia mzimvubuensis* van Jaarsv. (l.c. 83) as a first step to resolve the intricate situation within *Rhadamanthus* s.l. Subsequently, the genus *Aulostemon* Martínez-Azorín & al. 2017: 288 was segregated to include *Sagittanthera mzimvubuensis* (van Jaarsv.) Martínez-Azorín & al. 2013a: 51, based on clear morphological differences, such as the filaments forming a distinct tube and the free anthers, and different phylogenetic relationships between the two species originally included in *Sagittanthera*.

As *Rhadamanthus* is still polyphyletic (see Pfosser & al. 2012, Pinter & al. 2013, Martínez-Azorín & al. 2019a), we evaluated all available information and found out that two taxa in this alliance show distinct morphological features which coincide with a well-supported clade in our phylogenetic analyses (Pfosser & al. 2012, Martínez-Azorín & al. unpubl.). These species are *Rhadamanthus platyphyllus* B. Nord. (Nordenstam 1970: 172) and *Drimia oliverorum* J. C. Manning (in Manning & Oliver 2009: 225). They differ from *Rhadamanthus* s.str. by distinct morphological characters regarding the leaves, such as usually having only 1 or 2 (vs. usually more than 2), which are horizontally spreading, appressed to the ground (vs. erect to suberect or arcuate), (broadly) ovate to elliptic to elliptic-oblong (vs. filiform to terete), having 2 or 4 (i.e. solitary or paired) distinct longitudinal furrows (vs. longitudinal furrows lacking). In addition to the morphological differences mentioned, our phylogenetic analysis (Martínez-Azorín & al. unpubl.) as well as previously published ones (Pfosser & al. 2012, Pinter & al. 2013, Martínez-Azorín & al. 2019a) clearly place the latter two species in a well-supported clade located far from *Rhadamanthus* s.str. Due to the clear differences reported above, we here describe the new genus *Striatula*, to better accommodate these two remarkable species and provide the necessary combinations.

2. Materials and methods

Detailed morphological studies were undertaken on natural populations, cultivated specimens and herbarium vouchers, as elaborated upon in Martínez-Azorín & al. 2007, 2009. Specimens from the following herbaria were studied: ABH, BOL, GRA, GZU, K, NBG, P, PRE and WIND (acronyms according to Thiers 2019). Authors of cited taxa follow IPNI 2019. Orthography of geographical names and grid-number system follow Leistner & Morris 1976. Measurements of leaf length and width, as well as the size of tepals, stamens and ovary presented in the morphological descriptions were taken on fresh material. Measurements on dry specimens can show lower values.

3. Taxonomy

3.1. Description of the new genus

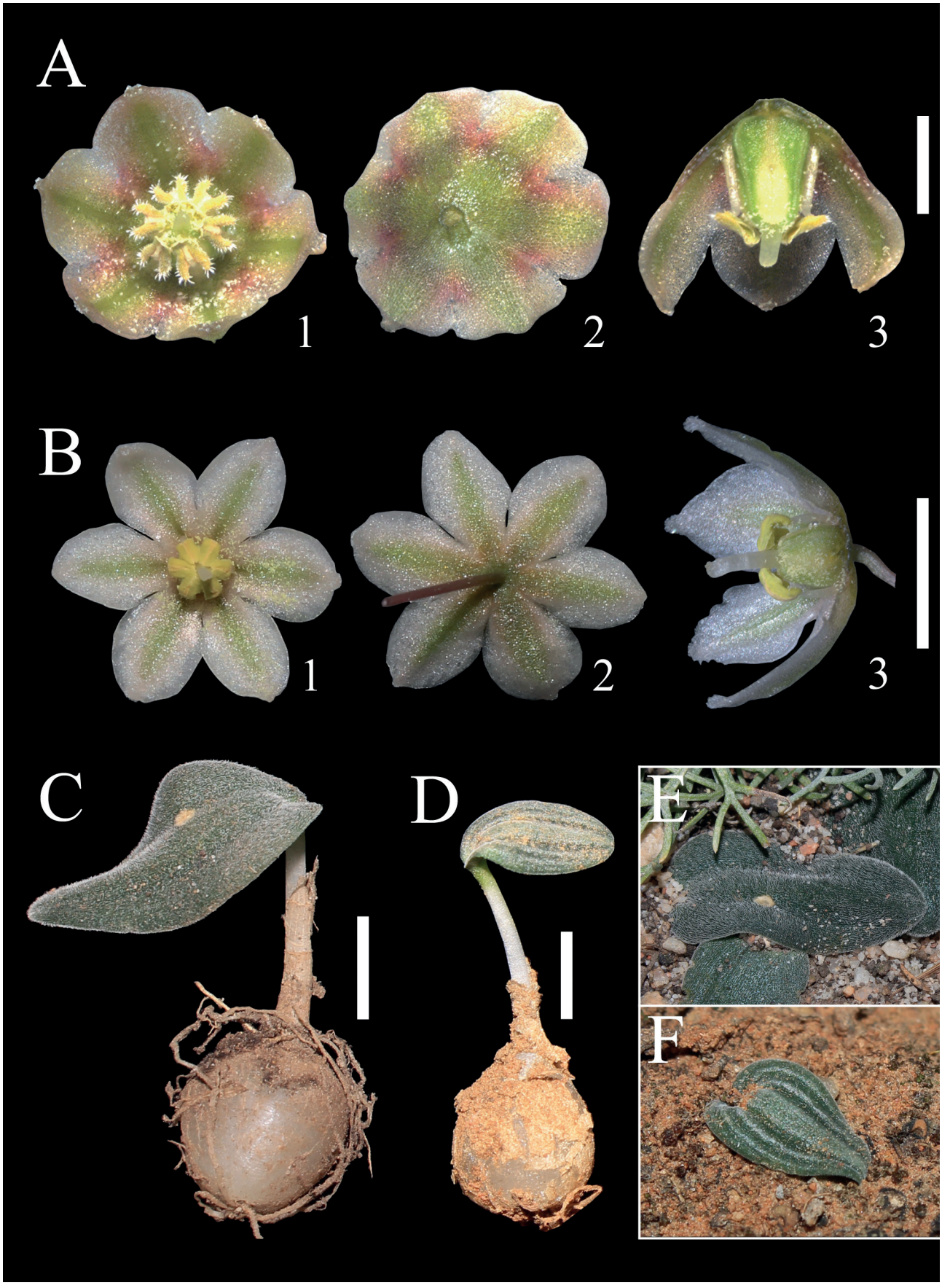
Striatula M. Pinter, Mart.-Azorín, M. B. Crespo & Wetschnig, **gen. nov**. (Fig. 1)

Diagnosis: Genus speciosum *Rhadamanthi* (s.str.) affine, a quo bene differt foliis praecipue 1–2 (in illo magis numerosis), planis, horizontaliter solo appressis (non erectis nec suberectis nec arcuatis), late ovatis, ellipticis vel elliptico-oblongis, apice rotundato vel obtuso (non filiformibus teretibusve acutisque), in facie adaxiali longitudinaliter 2- vel 4-sulcatis, i.e., duobus sulcis solitariis vel binatis instructis (in illo sulcis nullis).

Typus generis: *Striatula platyphylla* (B. Nord.) M. Pinter, Mart.-Azorín, M. B. Crespo & Wetschnig

Plants similar to those of *Rhadamanthus*, but different in leaf morphology having flat, broadly ovate to elliptic-oblong to elliptic leaves with obtuse to rounded apex, which are appressed to the ground and bearing 2 or 4 (i.e. solitary or paired) characteristic furrows on the adaxial side.

Deciduous bulbous plant. Bulb hypogeous, solitary, subglobose to ovoid, 1.5–3.5(–4) cm in diam., up to 4(–5) cm long, outer tunics pale-brownish to brownish when drying, membranous, adherent, forming a distinct neck, inner tunics whitish, compact, soft and fleshy. Leaves withered at flow-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ering time, usually 1 or 2, horizontally spreading, fleshy or subsucculent, appressed to the ground, (broadly) ovate to elliptic to elliptic-oblong, deciduous, 1–4 × 0.6–2.5 cm, flat, dull or dark green, with 2 or 4 (i.e. solitary or paired) distinct longitudinal furrows, minutely and densely velutinous on the adaxial side, glabrous on the abaxial side, with obtuse to rounded apex. Inflorescence erect, 1 (rarely 2) per bulb. Scape 3–15(–30) cm long, 0.5–1.5 mm in diam. at base, usually reddish brown or purplish red at base with dense and short to minute papillae or hairs disposed in straight vertical lines. Raceme moderately dense, 1.5–10(–12) cm long, (4–)5–50-flowered, all-sided. Bracts ovate-triangular to lanceolate, acute to acuminate, 1–2(–2.5) mm long, distinctly spurred; spur (0.5–) 1–1.5(–2) mm long. Pedicels filiform, patent or erecto-patent to spreading, 3–10 mm long, minutely scabrid-papillate or glabrate. Flowers slightly nodding to nodding. Perigone shallowly campanulate or urceolate to subglobose. Tepals 6, basally connate for ¼ to ½ of their length, obovate or ovate-oblong to narrowly elliptic-oblong, 3.5–6 × 1.2–2.5 mm, reddish brown to creamy pink or pinkish white with a broad purplish to green or greenish median stripe visible on both sides, with puberulous or penicillate, obtuse and sometimes subcucullate tips. Filaments 6, basally adnate to the perigone for < 1 mm; the free parts 1–1.5 mm long, whitish, laxly papillate-puberulous with spreading hairs or smooth. Anthers 6, yellow, ellipsoid or ovate-sagittate, 1–1.8 mm long, connivent, dehiscing with apical pore-like slits up to ½ of the theca length, basally glabrous or barbellate. Ovary ovoid to subquadrate, 1.8–2 × 1.2–1.5 mm, light green, glabrous. Style columnar, terete, c. 1–1.8 mm long, white to whitish. Capsules erect, triloculate, loculicidal to the base, 4.5–7 mm long and broad, broadly ovoid to subglobose, subtriquetrous, somewhat glossy golden green or purplish brown. Seeds compressed, unequally elliptic-oblong to reniform, 3–4 mm long, 1.2–1.5 mm wide, shiny black, irregularly folded and wrinkled and finely reticulate.

Etymology: The name *Striatula* refers to the distinct longitudinal furrows on the adaxial side of the leaf (lat. stria = streak, groove).

3.2. Taxonomic treatment of *Striatula* species

To date, the genus *Striatula* includes two species from the Western Cape, Eastern Cape and Northern Cape Provinces of South Africa and southern Namibia. For complete morphological descriptions of the two taxa see Nordenstam 1970 and Manning & Oliver 2009. The necessary new combinations are introduced below.

Striatula platyphylla (B. Nord.) M. Pinter, Mart.-Azorín, M. B.Crespo & Wetschnig, **comb. nova**

Basionym: *Rhadamanthus platyphyllus* B. Nord., in Martínez-Azorín & Crespo, Taxon 63(6): 1332 (2014). (*R. platyphyllus* B. Nord., Bot. Not. 123: 172 (1970); nom. inval.). — Type: SOUTH AFRICA. Western Cape. Wuppertal (3219): Clanwilliam Div., in stony or shallow sand on rocky slope below shale band below Cederberg Tafelberg (-AC), 3500–4000 ft. elevation, 16 December 1950, Esterhuysen 18135, leaves added April 1951 (BOL barcode BOL140333: the bulb with two leaves at the bottom left hand side corner of the sheet, holotype!).

= *Drimia platyphylla* (B. Nord.) J. C. Manning & Goldblatt, Strelitzia 40: 132 (2018). (*D. platyphylla* (B. Nord.) J. C. Manning & Goldblatt, in Goldblatt & Manning, Strelitzia 9: 712 (2000); nom. inval.).

Striatula oliverorum (J. C. Manning) M. Pinter, Mart.-Azorín, M. B. Crespo & Wetschnig, **comb. nova**

Basionym: *Drimia oliverorum* J. C. Manning, in Manning & Oliver, Bothalia 39(2): 225 (2009). — Type: NAMIBIA. Witputz (2716): Huib Hoch Plateau, Zebrasfontein (-DB), 1200 m elevation, 29 June 1989 [in leaf only], E. G. H. Oliver & I. M. Oliver 9164 (NBG, holotype!).

3.3. Identification key to the two species of *Striatula*

1 Leaves 2(–3), flowers nodding or pendent, perigone urceolate to subglobose, filaments laxly papillate-puberulous, anthers ovate-sagittate and basally barbellate, style shorter than the ovary ..... *S. platyphylla*

1* Leaf solitary, flowers slightly nodding, perigone shallowly campanulate, filaments smooth, anthers ellipsoid and basally glabrous, style equalling or longer than the ovary .....*S. oliverorum*

Fig. 1. ***Striatula platyphylla*** (B. Nord.) M. Pinter & al. (A1–3 corresponding to WW02597, ex cult.; C and E corresponding to MMA1160, top of Pakhuis Pass). (A) Flower: 1 apical view, 2 dorsal view, 3 dissection. – (C) Habitus of a whole plant. – (E) Plant in its habitat. – ***Striatula oliverorum*** (J. C. Manning) M. Pinter & al. (B1–3 corresponding to WW03930, S of Witputz; D and F corresponding to MMA1635 Zebrasfontein, type locality). (B) Flower: 1 apical view, 2 dorsal view, 3 dissection. – (D) Habitus of a whole plant. – (F) Plant in its habitat. – Scale bars: A 2 mm, B and D 5 mm, C 1 cm.

Table 1. Comparison of main characters of *Striatula platyphylla* and *S. oliverorum*.

	S. platyphylla	*S. oliverorum*
Bulb diameter	2–3.5(–4) cm	1.5 cm
Leaves number	2(–3)	1
Leaf shape	broadly ovate – elliptic – elliptic-oblong	elliptic – ovate
Leaf blade size (length × width)	1–4 × 0.6–2.5 cm	1.5–2 × 0.7–1 cm
Leaf adaxial surface (texture)	minutely and densely velutinous	densely velutinous
Scape length	3–15(–30) cm	up to 8 cm
Number of flowers	5–50	4–5
Pedicels	erecto-patent – spreading	patent
Flowers	nodding	slightly nodding
Perigone	urceolate – subglobose	shallowly campanulate
Tepals (length × width) shape colour indumentum	3.5–6 × 1.2–2.5 mm ovate-oblong – narrowly elliptic-oblong reddish brown – creamy pink with a broad purplish-green median stripe	5 × 2.5 mm obovate pinkish white with darker median stripe
Filaments	laxly papillate-puberulous with spreading hairs	smooth
Anthers shape base	1–1.8 mm ovate-sagittate basally barbellate	1.8 mm ellipsoid basally glabrous
Ovary (length × width) shape	1.8–2 × 1.2–1.5 mm ovoid–subquadrate	1.8 mm ovoid
Style length	c. 1 mm	1.8 mm
Distribution	South Africa (Western Cape, Eastern Cape and Northern Cape Provinces)	southern Namibia

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