

A revision of *Ornithogalum* subgenus *Aspasia* section *Aspasia*, the chinchinchees (Hyacinthaceae)

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ABSTRACT

The species of *Ornithogalum* L. subgenus *Aspasia* section *Aspasia* are revised. Section *Aspasia* is defined by a rosette of lanceolate to oblong leaves; large, boat-shaped, ± petaloid bracts; moderately-sized white, yellow or orange flowers, sometimes with dark central markings; thin-textured, ellipsoid capsules that are enclosed by and concealed within the persistent, papery perianth; and angular, colliculate to echinulate seeds. Twelve species are recognized in the section, separable into three series based on seed morphology. *O. conicum* is redefined to exclude specimens from the Eastern Cape, which are recognized as *O. synanthifolium*, and *O. conicum* subsp. *strictum* is raised to species status as *O. strictum*. The circumscription of *O. dubium* is expanded to include *O. fimbrimarginatum* and *O. subcoriaceum*, previously distinguished on account of their longer styles. Collections from the Roggeveld Escarpment and Klein Roggeveld that were previously included in *O. fimbrimarginatum* are recognized as the new species *O. corticatum* Mart.-Azorin, on the basis of their unusual, thick, cartilaginous outer tunics and puberulous adaxial leaf surface. *O. ceresianum* is removed from the synonymy of *O. thyrsoides* and recognized as a distinct species on account of its extensive glossy black tepal markings, winged inner filaments, and glossy black ovary. The poorly known *O. puberulum* is more fully described based on several recent collections, and *O. leeuportense* is neotypified in the absence of any original type material. *O. rupestre* and *O. multifolium* are regarded as colour forms of the same species, for which *O. rupestre* is the older name. Similarly, *O. roussouwii* is a depauperate, pale form of *O. maculatum* and is thus included in the synonymy of that species. The circumscription of *O. pruinatum* remains unchanged. The species *O. haurii*, *O. diphyllum* and *O. septonii* from the Drakensberg Mountains of Eastern Cape and KwaZulu-Natal are excluded from section *Aspasia* on the basis of their turbinate capsules that are exposed by the reflexed tepals. Each species is fully described, with accompanying discussion of variation and relationships, a distribution map, and an illustration.

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INTRODUCTION

Hyacinthaceae, a predominantly Old World family, is distributed throughout Africa and the Mediterranean, extending through central to eastern Asia, with a single, small genus in the Andes Mountains in South America (Speta 1998). Around 400 of an estimated total of 700–900 species are endemic to southern Africa, making it one of the most important geophyte families in southern Africa, exceeded in numbers only by the Iridaceae. Hyacinthaceae are especially numerous in the southwestern winter rainfall region, which is one of the main centres of diversity for the family.

Among the more common and conspicuous members here are the large-flowered species of *Ornithogalum* L. subgenus *Aspasia* (Salisb.) Oberm., known colloquially as chinchinchees, an onomatopoeic sobriquet derived from the sound produced when the stems are rubbed together (Smith 1966). Several species in this group, especially *O. thyrsoides*, are a characteristic part of the southwestern Cape spring, occurring in enormous populations in lowland areas around Cape Town and further north into Namaqualand. Their extreme toxicity (Van Wyk *et al.* 2002) enables them to colonize overgrazed lands with impunity, and their ease of cultivation and long vase-life have made them important horticulturally. Several selections of *O. dubium* and *O. thyrsoides* are available commercially as cut-flowers and further breeding programmes are ongoing. The taxonomy of this group, however, is far from fully understood and several of the species are notoriously difficult to identify.

The southern African species of *Ornithogalum* have been revised three times in the last sixty years, beginning with the work of Leighton (1944, 1945). This review was the first complete regional treatment of the genus since Baker's (1897) account for the *Flora capensis*, with the

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apparently significant advantage gained from examination of living material collected in the wild. Leighton, like Baker before her, was impressed by the great variability among populations in the form of the inner filaments, which may be slender and awl-like, lanceolate, with or without small basal expansions, or conspicuously winged. Flower colour is another source of variation, ranging from pure white through various milky-white or buff shades to yellow, orange or reddish orange, with or without small to large dark central markings. Defining her taxa very narrowly, Leighton (1944, 1945) described numerous species to accommodate the different combinations of these characteristics, ultimately recognizing 21 species and many forms in the group (Leighton 1945). With further study, however, it became clear that many of these species represented nothing more than local populations. Obermeyer (1978), who was the first to propose a more formal recognition of the chinchinchees, as the *Aspasiae* group of subgenus *Aspasia*, adopted a much broader view of the species in her monograph on the genus, reducing their number to 10, with two subspecies recognized in *O. conicum*. *Ornithogalum diphyllum* Baker from the KwaZulu-Natal Drakensberg, unaccountably left out of Leighton's treatment, was included as the eleventh member of the group. This treatment was largely followed by Müller-Doblies & Müller-Doblies (1996), who formalized the group as section *Aspasia*. The section was expanded slightly to include two additional species, *O. constrictum* F.M.Leight. and *O. inclusum* F.M.Leight., which had been placed by Obermeyer in the *Hispidaspasiae* group, and was subdivided into two subsections and six series. The species in Obermeyer's *Aspasiae* group were dispersed among four series in two subsections: *Aspasia*, *Leeupoortensia* U.Müll.-Doblies & D.Müll.-Doblies and *Maculata* U.Müll.-Doblies & D.Müll.-Doblies of subsection *Aspasia*, and series *Ruspes-tria* U.Müll.-Doblies & D.Müll.-Doblies of subsection *Teretaspasia* U.Müll.-Doblies & D.Müll.-Doblies. A total of 13 species was recognized, two of which, *O. leeupoortense* and *O. roussouwi*, were newly described and another two resuscitated from synonymy.

Despite the relatively high level of taxonomic study to which it has been exposed, the taxonomy of the group remains unclear, and the identification of specimens is often problematical. Although some of the species are well circumscribed and may be identified without much difficulty, the boundaries of others, especially those around *O. dubium*, remain poorly defined. Increased collecting over the past decades has greatly improved our appreciation of the natural variation among wild populations, indicating the need for another review of the species in this group. A comprehensive, illustrated account of the species is presented here for the first time.

It is evident that many of the characters that have traditionally been used to separate species in the group are much more variable than has been realized. This is particularly true of flower colour, the degree of basal expansion of the inner filaments, the length of the style relative to the ovary, and the surface sculpturing of the seeds. Most species are reliably diagnosed by a combination of characters, supplemented with distribution and ecological data. A previously underappreciated character, the size of the seeds, appears to be a useful indicator of relationships among the species. Three seed size classes can be distinguished: large (2.0–3.5 mm long), in *O. conicum*,

O. corticatum and *O. synanthifolium*; medium (1–2 mm long), in *O. ceresianum*, *O. strictum* and *O. thyrsoides*; and small (0.5–1.0 mm long), in the remaining species. The species are arranged in three series according to these size classes.

MATERIALS AND METHODS

This study is based on an examination of dried herbarium specimens as well as living plants studied during extensive field work undertaken throughout the southwestern Cape. The herbarium specimens studied include the complete collections in BOL, K, NBG and SAM, the types of all names, and selected specimens from PRE. Specimens examined are listed at the end. Seeds were examined with both light and scanning electron microscopy.

TAXONOMY

Ornithogalum L., Species plantarum: 306 (1753).
Type: *O. umbellatum* L. (vide Stearn 1983).

Deciduous or rarely evergreen perennials. *Bulb* subterranean or epigeal, subglobose or rarely poorly developed and rootstock rhizomatous, tunics sometimes scale-like or loosely overlapping, usually white but rarely pinkish; outer bulb tunics membranous, papery, or leathery. *Leaves* 1–several, green or dry at flowering, erect or spreading, linear to oblong or filiform, sometimes very succulent, usually glabrous but sometimes pubescent or glandular-pubescent, margins smooth, ciliate, fringed, or hyaline, sheaths sometimes persistent and forming a papery or weakly to strongly fibrous, sometimes horizontally barred sheath around base of stem. *Inflorescence* a several- to many-flowered raceme, sometimes subcorymbose with shortened axis, or secund, usually solitary but sometimes more than one; peduncle rarely papillate; bracts membranous, leafy or petaloid, small or large, not spurred; bracteoles usually lacking but sometimes thread-like and borne on alternate sides of pedicels at base; pedicels short or long. *Flowers* white, yellow, orange, or yellowish green, without darker keels, scented or unscented, sometimes closing at night or more rarely nocturnal, suberect or patent, rotate or campanulate; tepals ovate to narrowly lanceolate, persistent, ± shortly united at base or rarely united into a short tube, spreading to erect, sometimes with tips reflexed. *Stamens* suberect or slightly spreading; filaments free or rarely united below, fused to base of tepals or inserted at top of tube, filiform to lanceolate, all similar or inner usually broader, both whorls or more usually only inner variously expanded or toothed below. *Ovary* ovoid to globose or turbinate, sometimes shortly stipitate; ovules few to many per locule; style vestigial to long, subcylindrical, erect or sometimes slightly deflexed; stigma small and 3-lobed or -angled. *Capsule* fusiform, ovoid to subglobose, ± 3-angled or -lobed, membranous or leathery, enclosed in dry perianth or exposed, dehiscing loculicidally. *Seeds* few to many per chamber, flattened or angled, black, the testa tightly adhering, laevigate, rugulate, papillate or echinate. *Base chromosome number* $x = 9$.

About 250 species in Africa, Madagascar, Mediterranean, Saudi Arabia and India, mainly in the winter rainfall areas of southern Africa, including ± 40 species in Western Cape, South Africa.

Subgenus *Aspasia* (*Salisb.*) *Oberm.* in *Bothalia* 12: 333 (1978). Type: *O. conicum* Jacq.

Section *Aspasia*

Leaves radical, lanceolate to oblong, usually glabrous but sometimes partially or entirely pubescent, margins usually fringed or ciliate. *Inflorescence* sometimes subcorymbose; bracts large, boat-shaped, foliaceous or petaloid, margins entire or ciliate but not denticulate. *Flowers* medium-sized to large, white, yellow or orange, without darker keels but sometimes with dark centre, closing at night, shallowly bowl-shaped; tepals

free, ovate, persistent and papery in fruit. *Stamens* free; filaments filiform to lanceolate and all similar or inner broader, both whorls or more usually only inner variously expanded or winged basally. *Ovary* ovoid; style well-developed or vestigial. *Capsule* fusiform or ellipsoid, thin-walled, enclosed and concealed within dry perianth. *Seeds* many per chamber, pyriform, comma-shaped or cuneate, 1–3 mm long, testa papillate or echinulate. *Base chromosome number* $x = 6$.

Species 12, mainly endemic to the winter rainfall region of the southwestern Cape, with two species extending eastwards to the Eastern Cape.

Key to species

- 1a Style up to 2.5 mm long; leaves glaucous, margins smooth; flowers yellow to orange, rarely whitish or pinkish, sometimes with dark markings at tips of tepals; bracts brownish apically:
- 2a Leaves 2–5, narrowly lanceolate to oblong; outer tepals usually with pale or dark marks at tips; flowers larger, tepals 11–25 × 5–14 mm 9. *O. maculatum*
- 2b Leaves 3–10, subterete or linear-canaliculate; tepals never maculate; flowers smaller, tepals 6–12 × 3.5–5.0 mm 10. *O. rupestre*
- 1b Style usually more than 2.5 mm long but if shorter then leaf margins ciliate:
- 3a Leaves 2 or 3, soft-textured, glabrous or pubescent but margins always with soft cilia 1–2 mm long; lower leaf base clasping and inflated; plants from southern Namibia and Richtersveld 12. *O. puberulum*
- 3b Leaves usually more than 3, ± leathery or subsucculent, margins glabrous to densely ciliate with short, stiff cilia less than 0.7 mm long; plants from South Africa:
- 4a Robust plants 350–950 mm high, ± evergreen with leaves 200–400 mm long and glabrous or minutely ciliate on margins; lowermost pedicels 15–30 mm long in flower, lengthening up to 35–75 mm in fruit; capsules 12–15 mm long and seeds 2–3 mm long; plants from Eastern Cape, east of Grahamstown 2. *O. synanthifolium*
- 4b Not as above:
- 5a Filaments ± monomorphic, filiform to awl-shaped, rarely inner with small basal expansion in lower 1.5 mm; bulbs large, 25–35 mm diam., outer tunics pale and papery; plants restricted to southwestern Cape coastal districts; flowering from late November to January 1. *O. conicum*
- 5b Filaments ± dimorphic, awl-shaped to lanceolate, inner wider than outer and usually with ± prominent basal expansions:
- 6a Outer bulb tunics soft-textured or papery, pale grey or whitish; leaves suberect and clasping at base, lanceolate, bright green; seeds 1–2 mm long:
- 7a Raceme narrowly cylindrical, 70–150 mm long in flower; lowermost pedicels 5–15 mm long at flowering, scarcely elongating in fruit and then 15–25 mm long; flowers rarely with dark centre; inner filaments expanded only in lower third, expansion rhomboidal or inconspicuously toothed; style often deflexed. 4. *O. strictum*
- 7b Raceme conical to subcorymbose, 30–80 mm in flower; lowermost pedicels 14–37 mm long at flowering, elongating up to 20–70 mm long in fruit; flowers with darker centre, although this sometimes small; inner filaments expanded in lower half and clasping ovary, expansions with conspicuous apical wings that often cover top of ovary; style erect:
- 8a Inner filaments expanded and winged in lower half, outer filaments linear to subulate; flowers usually with small greenish or brownish centre; ovary dull brownish to black 5. *O. thyrsoides*
- 8b Both inner and outer filaments expanded and winged in lower half, inner more prominently so; flowers with large, dark centre covering lower half of tepals; ovary glossy dark green to black and conspicuously 3-lobed 6. *O. ceresianum*
- 6b Outer bulb tunics firm-textured and leathery or cartilaginous, grey or blackish; leaves elliptical or shortly lanceolate; seeds usually 0.5–1.0 mm long:
- 9a Leaf margins glabrous, minutely ciliate or obscurely papillate; plants from drier parts of Northern and Western Cape north of Klaver:
- 10a Leaves bright green, distichous, falcate, attenuate, as long as or longer than inflorescence; inflorescence usually laterally displaced and thus apparently axillary 11. *O. leeuportense*
- 10b Leaves glaucous, rosulate, oblong-lanceolate, leathery, usually less than half as long as inflorescence, margins sometimes crisped 8. *O. pruinosa*
- 9b Leaf margins densely ciliate; plants from Northern Cape south of Calvinia, Western and Eastern Cape:
- 11a Leaves shortly pubescent adaxially near apex, withered at flowering; bulbs relatively large, globose, outer tunics cartilaginous or thick and leathery, accumulating in thick layers; flowers white, without dark centre; inner filaments slightly keeled; plants from Roggeveld Escarpment in Northern Cape 3. *O. corticatum*
- 11b Leaves glabrous except along margins, often still green at flowering; tunics not accumulating in thick layers; flowers orange, yellow, cream-coloured or white, often with dark centre; bracts sometimes ciliate in upper half; plants from Western and Eastern Cape 7. *O. dubium*

Series 1 *Aspasia*

Flowers without dark centre; seeds 2.0–3.5 mm long.

1. *Ornithogalum conicum* Jacq., *Collectanea* 3: 232 (1791). *O. lacteum* var. *conicum* (Jacq.) Baker: 284 (1873). Type: South Africa, Cape, without precise locality, in Jacq., *Icones plantarum rariorum* 2, t. 428 (1789b)(icono!).

O. lacteum Jacq.: 76 (1797). Type: South Africa, Cape, without precise locality, in Jacq., *Icones plantarum rariorum* 2, t. 434 (1789b)(icono!).

O. aestivum L. Bolus: 55 (1934). Type: South Africa, [Western Cape], between Malmesbury and Mamre, *L. Bolus s.n. BOL20974* (BOL, holo!).

Plants 300–600(–900) mm high. *Bulb* subglobose, 25–45 mm diam., flesh sometimes pale pink, outer tunics whitish, papery. *Leaves* spreading or suberect, 5–10, one quarter to one third as long as flowering stem, partially or completely dry at flowering, oblong-lanceolate, 45–100(–120) × 6–25(–30) mm, glabrous but densely ciliate on margins. *Raceme* sub-

corymbose to conical-cylindrical, compact, 30–80 mm long at flowering, elongating to 60–100(–150) mm long in fruit, (11–)15–30(–35)-flowered; lowermost pedicels 10–17 mm long, elongating to 15–28 mm in fruit; bracts petaloid, whitish and papery, ovate, acute or acuminate, usually exceeding pedicels, lowermost 14–20 mm long. *Flowers* white with small greenish yellow centre, unscented or faintly honey-scented; outer tepals ovate-lanceolate, inner obovate,

14–17(–20) × 6–9(–12) mm. *Stamens* half as long as tepals; filaments filiform or subulate, white, 6–8 mm long, rarely inner widened at base. *Ovary* ovoid, 4–5 mm long, greenish yellow but brighter yellow at apex; style white, 2–3 mm long. *Capsule* fusiform to oblong-ovoid, 3-lobed, apiculate, 10–13 mm long. *Seeds* angular and irregularly folded, papillate to echinulate, 2–3 mm long. *Flowering time*: late November or December to mid-January. Figures 1A, 2.

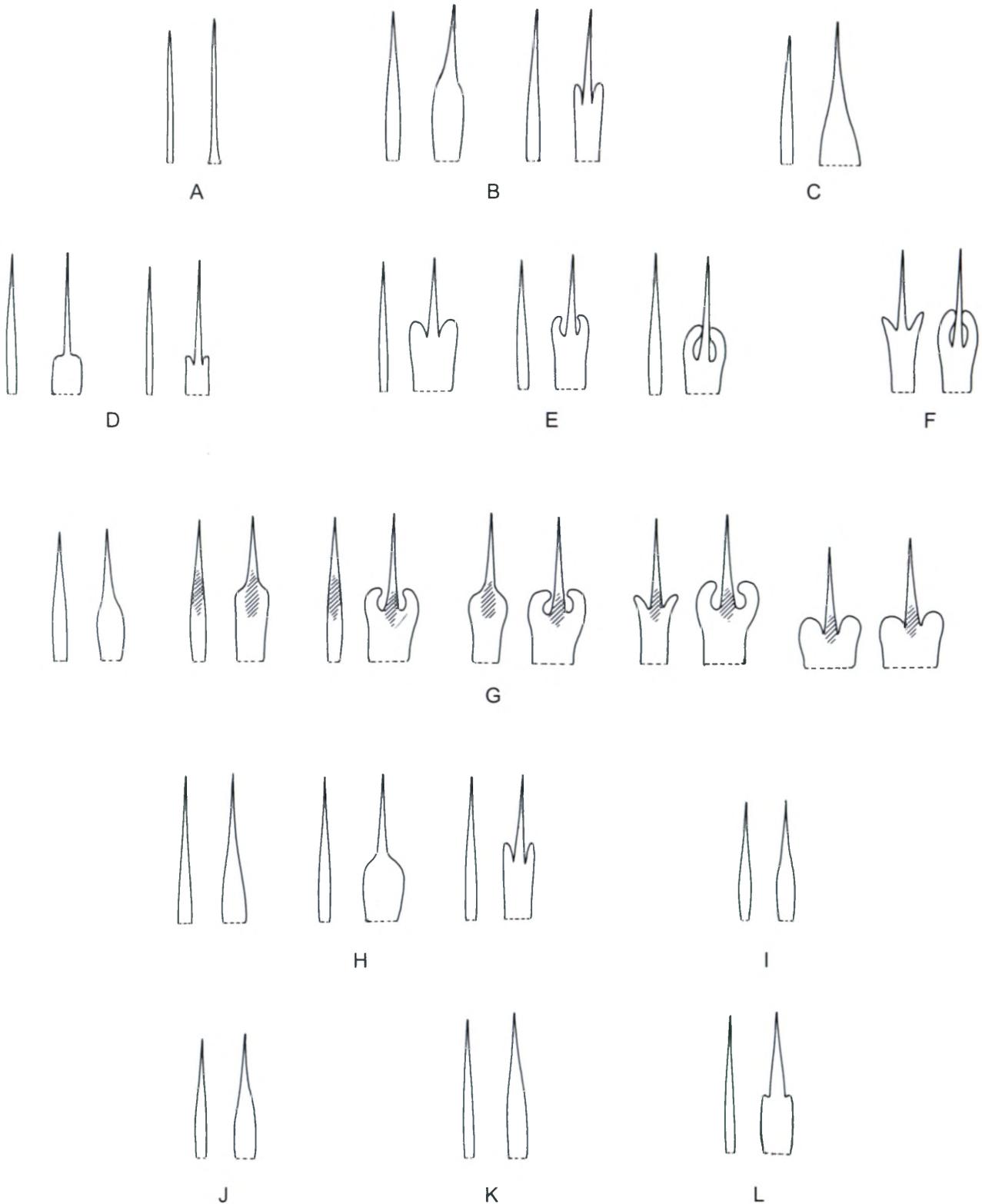


FIGURE 1.—Filament morphology in *Ornithogalum* section *Aspasia*. Filaments are shown in pairs from same flower, outer on left and inner on right. A, *Ornithogalum conicum*; B, *O. synanthifolium*; C, *O. corticatum*; D, *O. strictum*; E, *O. thyrsoides*; F, *O. cerasianum*; G, *O. dubium*; H, *O. pruinsum*; I, *O. maculatum*; J, *O. rupestre*; K, *O. leeuportense*; L, *O. puberulum*. Not to scale.

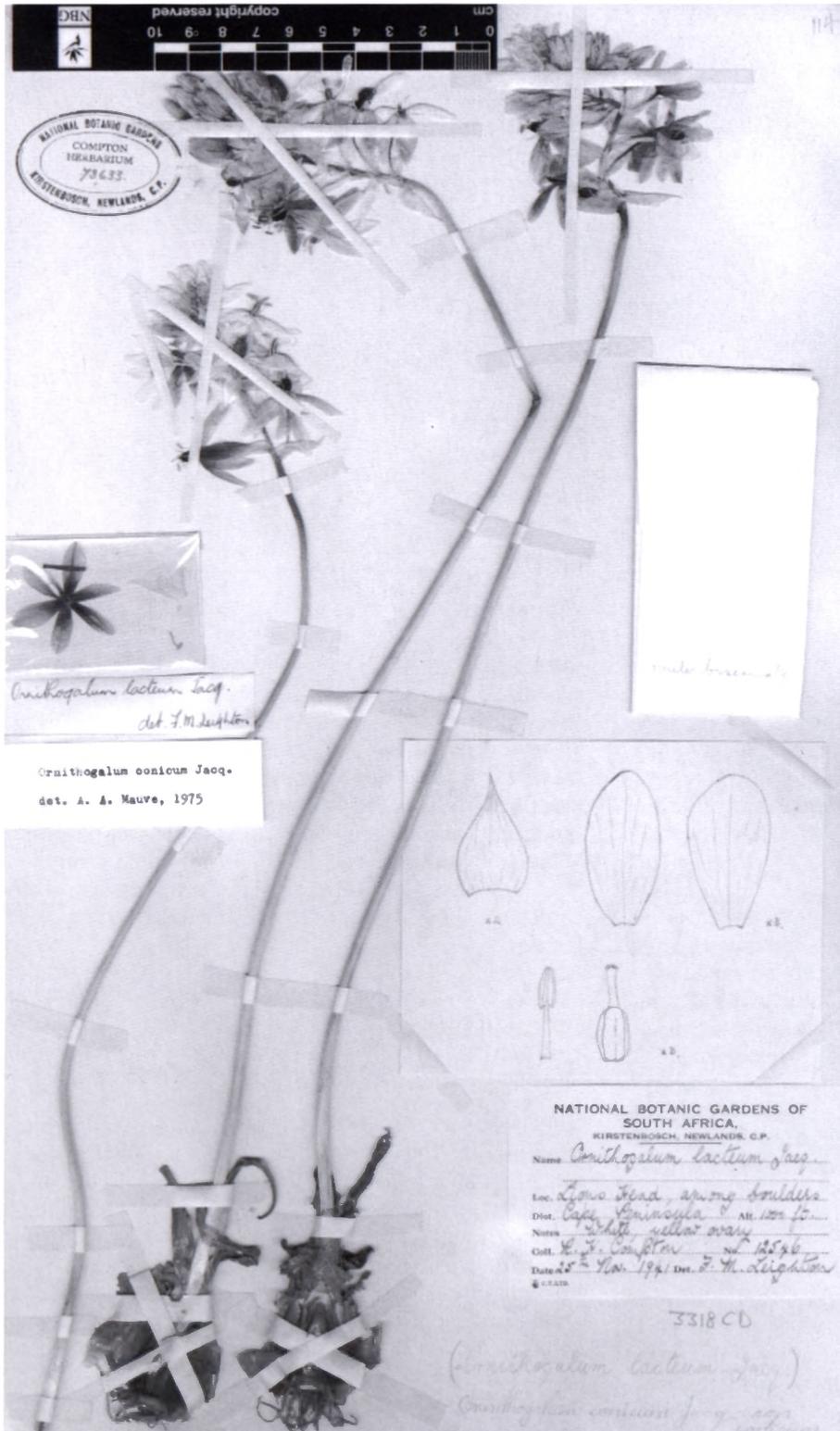


FIGURE 2.—*Ornithogalum conicum* Jacq.

Distribution and ecology: restricted to coastal areas in the southwestern Cape, from Graafwater southwards along the west coast to the Cape Peninsula and Gordon's Bay (Figure 3), occurring on coastal limestone pavement, stony hills and granitic outcrops, typically in coarse-grained sandy or gravelly soils but also shale.

Discussion: *Ornithogalum conicum* is a summer-flowering species from coastal areas in the extreme southwestern Cape. It is characterized by its very large bulb, sometimes with pale pink flesh, whitish to light grey, papery tunics, and a rosette of short, densely ciliate leaves less

than one third as long as the inflorescence and partially or completely dry at flowering. Both whorls of filaments are typically filiform or awl-shaped, or the inner may rarely be slightly widened at the base but never into the apically lobed, oblong expansions that occur in other species in the group. The species is variable in stature and size with the largest plants, up to 900 mm high, recorded from Paleisheuvel. Plants from the Cape Peninsula are shorter, never more than 500 mm high.

Both *Ornithogalum thyrsoides* and *O. dubium* occur with *O. conicum* on the Cape Peninsula. *O. thyrsoides*,

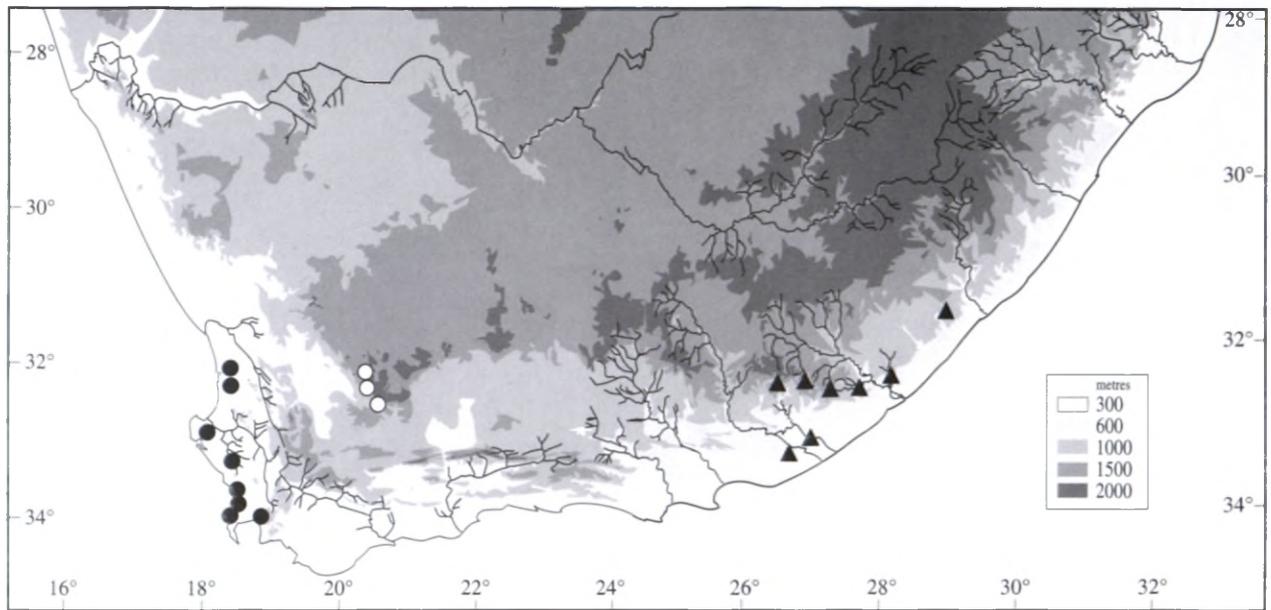


FIGURE 3.—Known distribution of *Ornithogalum conicum*, ●; *O. corticatum*, ○; *O. synanthifolium*, ▲.

which often forms large colonies along road verges and in waste ground, differs in its much smaller bulb, seldom more than 20 mm in diameter, longer, suberect, \pm synanthous leaves, and conspicuously winged inner filaments. It also flowers earlier in the season, in September and October, and is in fruit by the time that *O. conicum* begins to bloom in early November. White-flowered forms of *O. dubium* that occur on Table Mountain are distinguished by their smaller bulb with dark tunics, mostly subcorymbose inflorescence, and basally expanded or winged inner filaments. In addition, the ovary in *O. dubium* is typically blackish, unlike the yellow ovary in *O. conicum*, and the seeds are much smaller (\pm 1 mm vs 2–3 mm long). On the Peninsula, *O. dubium* is restricted to sheltered places on sandstone cliffs, whereas *O. conicum* is found at lower altitudes on exposed granite or shale slopes. The flowers in the populations of *O. conicum* on Lions Head on the Cape Peninsula are open throughout the day from early morning, and are slightly scented, unlike those of *O. dubium*, which only open around mid-morning and lack fragrance.

Although the species has been documented as toxic, the actual identity of the specimens tested is uncertain in view of the much broader circumscription of the species that was current in the past. Given its relatively restricted geographic range, however, it seems more likely that these results were based on tests of *O. strictum* rather than true *O. conicum*.

History: *Ornithogalum conicum* was illustrated and described by Jacquin from cultivated plants that were almost certainly originally collected on the Cape Peninsula, where the species is still found on the slopes of Signal Hill and the foot of Lions Head. At the same time, Jacquin illustrated and named *O. lacteum* but this appears to be nothing more than a luxuriant form with the bases of the inner filaments slightly expanded. This form was reduced to synonymy by Baker (1897), whose concept of *O. conicum*, later followed by Obermeyer (1978), included not only plants from the Eastern Cape

with narrow filaments, which are segregated here as *O. synanthifolium*, but also collections from the Olifants River Valley that are treated here as a distinct species *O. strictum*. Both of these taxa have relatively long leaves that are still green at flowering, leading Louisa Bolus to describe *O. aestivum* for plants from the West Coast that produced a rosette of short leaves which were dry and withered by the time that the plants flowered in summer. It is now clear that these populations represent true *O. conicum*, which is more narrowly defined here than in the past.

2. *Ornithogalum synanthifolium* F.M.Leight. in *Journal of South African Botany* 10: 176 (1945). Type: South Africa, [Eastern Cape], King William's Town District, Perie [Pirie] Mtns, *Galpin* 2528 (PRE, holo!).

Plants (200–)350–950 mm high. *Bulb* ovoid, sometimes not well developed, (20–)25–35 mm diam., outer tunics not always persisting but then greyish to blackish, leathery. *Leaves* suberect, 5–11, synanthous, oblong-lanceolate, \pm half as long as inflorescence, (150–)200–400 \times (8–)10–25(–30) mm, dark green, soft-textured, glabrous or ciliolate on margins. *Raceme* subcorymbose or cylindrical, compact, (50–)70–150 mm long but elongating to 100–150 mm long in fruit, (10–)15–40(–50)-flowered, sometimes two per bulb; lowermost pedicels 15–30 mm long, elongating to 35–72 mm in fruit; bracts pale and papery, ovate, acuminate, lowermost (12–)15–40 mm long, longer or shorter than lower pedicels in flower and shorter in fruit. *Flowers* white; outer tepals ovate-lanceolate, inner obovate-lanceolate, 13–18(–20) \times 6–8(–10) mm. *Stamens* half as long as tepals; filaments 5–7 mm long, white, outer linear to narrowly subulate, inner either subulate or expanded and oblong in lower half, rarely winged. *Ovary* ovoid, 3–5 mm long, greenish; style erect, 2–3 mm long. *Capsule* oblong-ovoid to obovoid, 3-lobed, obtuse-apiculate, 12–15 mm long. *Seeds* angular, irregularly folded, 2.5–3.5 mm long, colliculate to papillate, especially along margins. *Chromosomes:* $2n = 12$ (De Wet 1957; Pienaar 1963). *Flowering time:* September to January. Figures 1B, 4.



FIGURE 4.—*Ornithogalum synanthifolium* F.M.Leight.

Distribution and ecology: endemic to the Eastern Cape, where it is scattered along the higher ground fringing the coast, from Umtata in the north to Grahamstown in the south (Figure 3), occurring in moist or marshy grassland along streams and in damp valleys, sometimes in dense colonies. The species is typically evergreen and flowers throughout the wet summer season.

Discussion: *Ornithogalum synanthifolium* is typically a large, often evergreen species 350–950 mm high with relatively long leaves, usually at least half as long as the inflorescence. The leaves are soft-textured and bright

green, with the margins glabrous or at most ciliate. The plants produce a subcorymbose to cylindrical raceme of pure white flowers with elongate lower pedicels, 15–30 mm long in flower but lengthening to 35–72 mm in fruit. It is not uncommon for the plants to produce two inflorescences in a single season (e.g. *Pienaar 8*) or for the inflorescence of the previous season to persist alongside that of the current year due to the ± continuous vegetative growth in the species.

The bulb in *O. synanthifolium* may not be well developed as a result of both its evergreen habit and its pref-

erence for moist habitats, and the outer bulb tunics may not persist for the same reasons. When present, the outer tunics are greyish or blackish and somewhat leathery in texture. The inner filaments, like those of most species in the section, are rather variable in shape, ranging from lanceolate to basally expanded or winged, sometimes (Taylor 4212) to the degree that they resemble those of *O. thyrsoides*. The large capsules, 12–15 mm long and large seeds, 2–3 mm long, are shared with *O. conicum*. Other members in the section have smaller capsules, and seeds less than 2 mm long.

There is no doubt that the Eastern Cape plants are quite distinct from *O. conicum*, which occurs in seasonally dry situations on the Cape Peninsula and adjacent parts of the southwestern Cape. The climate here is Mediterranean and summer-dry, unlike the summer rainfall climate in which *O. synanthifolium* occurs. True *O. conicum* invariably produces a well-developed, subglobose bulb and a rosette of short, spreading, densely ciliate leaves that are dry and withered at flowering, which takes place in early summer after the rainy season.

In the wild, *Ornithogalum synanthifolium* may be confused with *O. dubium*, the only other species of section *Aspasia* to occur in the Eastern Cape, but the latter is deciduous, grows in more rocky situations, and produces a rosette of spreading leaves that are densely ciliate on the margins and usually shorter than half the length of the inflorescence. The raceme in *O. dubium* is also typically shorter and more densely corymbose than in *O. synanthifolium*, and the seeds are much smaller, ± 1 mm long.

History: *Ornithogalum synanthifolium* has been much misunderstood in the past. The first collection of the species appears to have been made by the Rev. F. Baur near Baziya in Eastern Cape. It was identified as *O. lacteum* Jacq. (now regarded as a synonym of *O. conicum* Jacq.) by Baker (1897) on account of its awl-shaped inner filaments. Another early collection made by Ernest Galpin, a local businessman with an intense interest in botany, probably around the turn of the century, formed the basis of *O. synanthifolium*, which was described by Leighton (1944) for several collections of plants from the Eastern Cape that have the inner filaments expanded at the base but which otherwise closely match those collected by Baur. The latter she retained in *O. lacteum*, albeit as a distinct form restricted to the Eastern Cape.

Ornithogalum synanthifolium was subsequently included in *O. conicum* by Obermeyer (1978), despite the fact that the latter species was otherwise restricted to the extreme southwestern Cape, creating an extraordinary and inexplicable disjunction of some 800 km between the two areas of occurrence. This decision was based largely on the large stature of the plants and their lanceolate or minutely expanded inner filaments. Specimens from the Eastern Cape with more prominently expanded inner filaments were referred to *O. fimbri-marginatum*, here included within *O. dubium*. The inner filaments of *O. synanthifolium*, like so many of the species in this group, are now known to be variable in shape, either lanceolate without basal lobes or with an apically lobed, oblong expansion in the lower portion.

3. *Ornithogalum corticatum* Mart.-Azorin, sp. nov.

Planta habitu cum *O. conico* congruens, sed valde dif-
fert tunicis bulbi incrassatis corticem fuscum formanti-
bus facile discedentibus, foliis brevibus ad adaxialem
apicem pilosis marginibus dense ciliatis per anthesin
omnino emarcidis, et staminibus internis filamentis
linearibus basi triangularibus carinatis valde dilatatis.
Nomen *O. corticatum* a characteribus peculiaribus tuni-
corum bulbi corticem formatum proveniens.

TYPE.—Northern Cape, 3220 (Sutherland): Klein Roggeveld, Skaapberg, (–DC), 12 November 2005, *M. Martínez-Azorin & J. Manning* 96 (NBG, holo.; K, MO, iso.).

Plants (250–)300–450 mm high. *Bulb* depressed-globose, 20–30(–35) mm diam., outer tunics thick, hard and leathery or cartilaginous, pale greyish, brownish or black, accumulating in loose layers. *Leaves* spreading, 5–7, dry at flowering, oblong-lanceolate, up to one quarter as long as inflorescence, 30–60 × (5–)10–15 mm, densely puberulous adaxially in distal half and densely ciliate on margins. *Raceme* conical to cylindrical, compact, 30–90 mm long at flowering, elongating to (35–)70–160 mm in fruit, (6–)16–35-flowered; lowermost pedicels 10–12 mm long, elongating up to 15 mm in fruit; bracts white, petaloid, pale and papery, ovate, acute or acuminate, usually exceeding pedicels, lowermost 13–20 mm long. *Flowers* white; outer tepals ovate-lanceolate, inner tepals obovate-lanceolate, (13–)14–18(–19) × (3–)5–7 mm. *Stamens* ± half as long as tepals; filaments (6–)7.0–8.5 mm long, white, outer subulate, inner triangular and keeled, slightly incurved over ovary. *Ovary* oblong, obtuse or truncate, (3–)4.0–5.5 mm long, greenish below but yellow in upper part; style 3–4 mm long, white. *Capsule* oblong-ovoid, 8–11 mm long, 3-lobed, apiculate. *Seeds* angular-pyriform and irregularly folded, 2.0–2.5 mm long, papillate-echinulate but echinate on margins. *Chromosomes*: 2n = 10 (Pienaar 1963 [as *O. lacteum* forma nov., Sutherland]). *Flowering time*: November. Figures 1C, 5, 6.

Distribution and ecology: endemic to the Roggeveld and Klein Roggeveld near Sutherland in Northern Cape (Figure 3), where it favours heavy clay soils derived from dolerite, growing in open renosterveld shrubland. On the Roggeveld Escarpment, the species may occur in dense colonies numbering thousands of plants that cover large swathes of country. This suggests that it may be toxic to stock. On the more rocky slopes of the Klein Roggeveld, plants tend to be more scattered, sometimes on sandstone pavement along drainage lines.

The old bulb tunics of *Ornithogalum corticatum* are exceptionally firm, accumulating around the bulb in thick, rigid layers. Cartilaginous or thickly matted tunics are a feature of other geophytes from the Roggeveld Escarpment, including *Lachenalia comptonii* (Hyacinthaceae) and *Devia xeromorpha* (Iridaceae). The region experiences extreme climatic conditions through the year, with bitterly cold winters, during which temperatures fall below freezing, contrasting with hot summers when temperatures reach the high thirties, and the thickened covering of the underground parts may act as insulation.

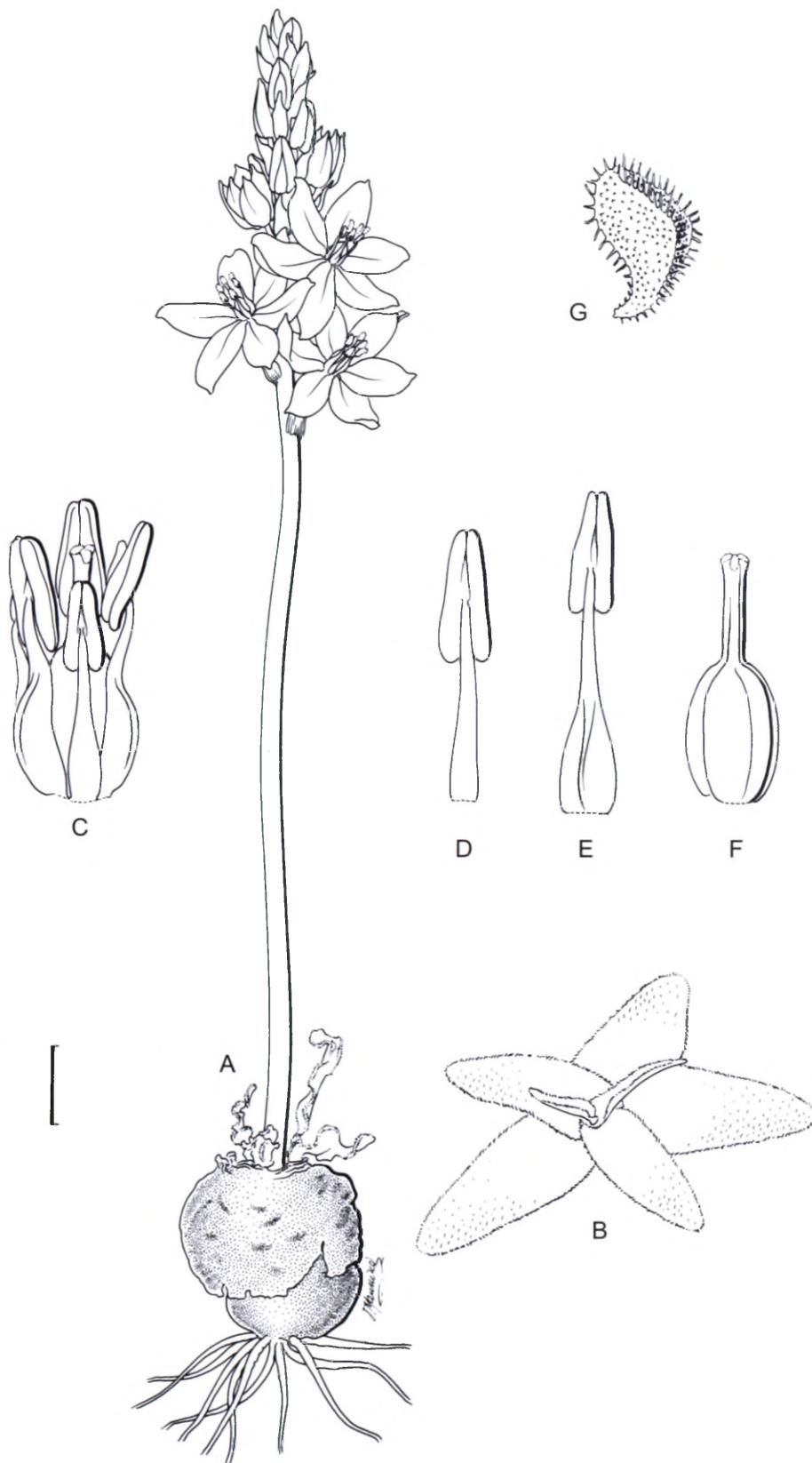


FIGURE 5.—*Ornithogalum corticatum* Mart.-Azorin, M. Martínez-Azorin & J. Manning 96 (NBG). A, whole plant. B, foliage; C, androecium and gynoecium; D, outer stamen; E, inner stamen; F, gynoecium; G, seed. Scale bar: A, B, 10 mm; C–F, 5 mm; G, 1 mm. Artist: John Manning.

Ornithogalum corticatum flowers in early summer, at which time the leaves are completely withered. Shrinkage of the bulb at this time results in the flesh pulling away from the stiff outer tunics, which form loose, easily detachable layers.

Discussion: *Ornithogalum corticatum* is readily distinguished by its depressed-globose bulb surrounded by firm, cartilaginous tunics, and rosette of short, spreading

leaves, less than one quarter the length of the inflorescence, that are shortly and densely hairy on the upper surface in the distal half, and thickly fringed on the margins. These are completely withered at flowering but the pubescence is still visible. The pure white flowers are borne in conical or narrowly cylindrical racemes on short pedicels up to 12 mm long. The relatively large, strongly echinate seeds are also distinctive. Additional support for its recognition as a distinct species comes

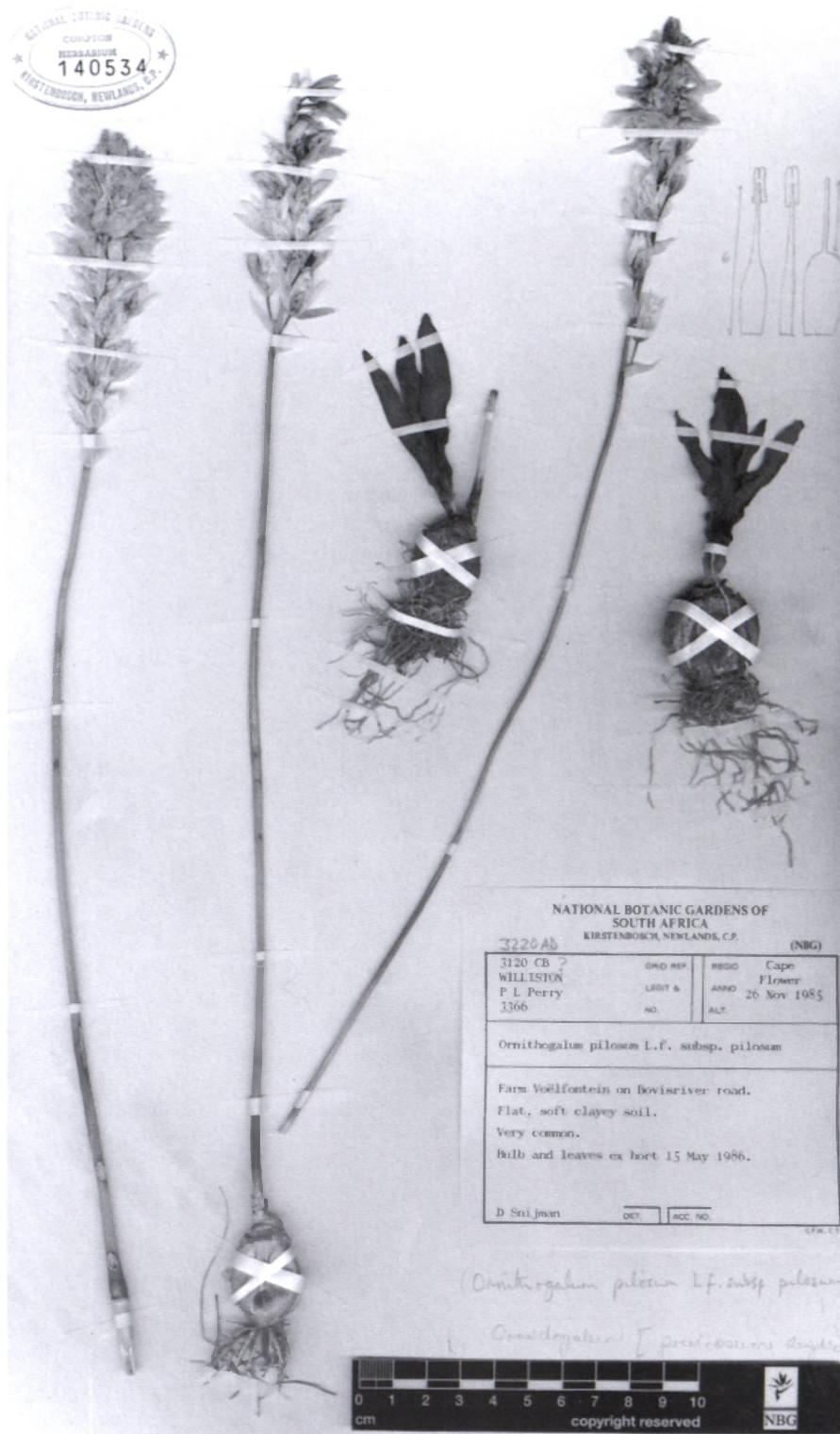


FIGURE 6.—*Ornithogalum corticatum* Mart.-Azorin.

from the cytological studies of Pienaar (1963) and Roos & Pienaar (1966), which identified these plants as a distinctive form of *O. lacteum* (a synonym of *O. conicum*) with the unusual chromosome number of $2n = 10$, other members of the section typically having $2n = 12$.

In its narrow raceme *Ornithogalum corticatum* resembles *O. strictum*, with which it has been recorded growing on the Klein Roggeveld, but the tunics in that species are pale and membranous, the leaves are green at flowering, much longer and glabrous, and the inner filaments are oblong in the lower half. The short, densely fringed

leaves of *O. corticatum* recall those of *O. conicum* and *O. dubium* but in both these species the leaf surface is glabrous (rarely apically pubescent in *O. dubium*) and the tunics, although leathery, are not as firm-textured as in *O. corticatum*. These two species also differ from *O. corticatum* in details of the flowers. The filaments in *O. conicum* are linear and erect, not curved over the ovary, and *O. dubium* is characterized by a subcorymbose inflorescence with longer, lower pedicels, and inner filaments that are typically expanded and oblong or winged in the lower part, not triangular. The small seeds of *O. dubium*, 0.5–1 mm long vs 2.5 mm also serve to distinguish the species.

History: although first gathered almost seventy years ago by Pauline Bond in 1939, the early collections of *Ornithogalum corticatum* lack the characteristic bulb and were thus referred to *O. conicum* on account of their narrow filaments. Later collections by the horticulturist Harry Hall were assigned to *O. fimbri-marginatum*, now included in *O. dubium*. It is now obvious that they represent a distinct species.

Series 2 *Thyrsoides*

Outer bulb tunics membranous, pale; flowers with or without dark centre; leaves suberect, stem-clasping below; seeds 1.5–2.5 mm long.

4. ***Ornithogalum strictum*** L.Bolus in Journal of Botany, London 71: 72 (1933a). *O. conicum* Jacq. var. *strictum* (L.Bolus) F.M.Leight.: 104 (1944). *O. conicum* Jacq. subsp. *strictum* (L.Bolus) Oberm.: 334 (1978). Type: South Africa, [Northern Cape], Vanrhyn's Pass, September 1931, *P. Ross Frames BOL20072* (BOL, holo.!).

Plants (300–)500–800(–1000) mm high. *Bulb* subglobose, (8–)11–25(–30) mm diam., outer tunics whitish, membranous. *Leaves* suberect to erect, 3–8, synanthous, reaching halfway or more up flowering stem, often to base of raceme, oblong-lanceolate, attenuate, clasping stem in lower part, (80–)130–300(–350) × (6–)8–25(–35) mm, glabrous but slightly to densely ciliate along margins. *Raceme* narrowly conical, compact, (50–)70–150 mm long at flowering, elongating to (70–)100–200(–300) mm in fruit, (9–)15–40(–65)-flowered; lowermost pedicels 5–14 mm long, elongating to 9–20 mm in fruit; bracts petaloid, pale and papery, ovate, acute or acuminate, usually exceeding pedicels, lowermost 15–30(–45) mm long. *Perianth* pure white, rarely with small brownish stain in centre; outer tepals ovate-lanceolate, inner obovate, (15–)16–22(–25) × 6–10 mm. *Stamens* half as long as tepals; filaments filiform to subulate, (5–)7–10 mm long, white, inner usually with square basal expansion in lower $\frac{1}{4}$ – $\frac{1}{3}$, sometimes bilobed or slightly winged above. *Ovary* oblong, 3–6 mm long, truncate, 3-lobed, usually yellow or greenish yellow, rarely dark greenish; style white, often deflexed, 3–6 mm long. *Capsule* fusiform to oblong-ovoid, apiculate, 10–12 mm long. *Seeds* angular-pyriform and irregularly folded, 1.5–2.0 mm long, colliculate to rugulose but echinulate on margins. *Chromosomes*: $2n = 12$ (Pienaar 1963 [as *O. conicum* var. *strictum*]). *Flowering time*: September–November. Figures 1D, 7.

Distribution and ecology: common along the Bokkeveld Mountains around Nieuwoudtville and through the Olifants River Valley, with outlying populations at the foot of the Piketberg and in the Ceres Valley in the south, and scattered collections from the Roggeveld and Klein Roggeveld in the east, from 100–800 m above sea level (Figure 8). The species occurs mainly on fine-grained clay or loam, typically on moist slopes or in drainage lines or vleis, where it can occur in large concentrations. On the Klein Roggeveld the species grows in washes along seasonal streams.

Ornithogalum strictum is the common white chincheerinchee in the Olifants River Valley, sometimes forming large swathes in seasonal vleis on the valley bottom.

Discussion: *Ornithogalum strictum* is recognized by its thin-textured, pale grey or whitish bulb tunics, long, erect leaves that often reach to the base of the raceme and are green at flowering, and by the narrowly conical raceme with short lower pedicels, typically less than 15 mm long. The flowers are usually pure white, although populations near Citrusdal may include individuals with a brownish centre. The ovary is mostly yellow or yellowish green and the style is typically deflexed in a highly characteristic manner unique to the species. The inner filaments are usually widened in the lower third into an oblong expansion, sometimes bilobed above but not distinctly winged. As in most species of section *Aspasia*, *O. strictum* shows some variation in the degree of expansion of the inner filaments. Plants from the Bokkeveld Escarpment have the inner filaments invariably expanded in the basal third but populations from further south, in the Olifants River Valley and around the Piketberg, may have almost linear or subulate inner filaments.

Ornithogalum strictum resembles *O. thyrsoides* in its pale outer tunics, slender leaves clasping the base of the stem, and expanded inner filaments, and both seem to occupy similar, seasonally moist habitats. *O. thyrsoides* can usually be distinguished by its subcorymbose to broadly cylindrical inflorescence with longer lower pedicels, especially in fruit, and inner filaments that are broadly expanded in the lower half (not third) and always conspicuously winged, with the wings curved over the ovary, which is typically dark greenish or blackish.

The distinction between the two is not always clear, however, especially in the Olifants River Valley, where occasional plants with the narrowly cylindrical raceme of *Ornithogalum strictum* have winged inner filaments like those of *O. thyrsoides*. A similar situation arises further north in Namaqualand. An alternative treatment would be to regard *O. strictum* as the northern subspecies of *O. thyrsoides* but intermediate types are rare and we prefer to maintain the two taxa as separate species, especially in view of the unusual declinate style that appears to characterize *O. strictum*.

History: described by Louisa Bolus in 1933 from plants collected on Vanrhyn's Pass on the Bokkeveld Escarpment, *Ornithogalum strictum* was included in *O. conicum* by subsequent authors (Leighton 1944; Obermeyer 1978), although it continued to be distinguished at an infraspecific level by its slender, narrowly conical raceme. The decision to include it in *O. conicum* was made on account of the relatively weakly expanded inner filaments, which are quite unlike the broadly winged filaments that are diagnostic of *O. thyrsoides*. It is now clear that *O. conicum*, with its large bulb, short, densely ciliate leaves, and larger seeds, is quite a different species, and on vegetative and seed characters it appears that *O. strictum* is actually more closely allied to *O. thyrsoides*.

5. ***Ornithogalum thyrsoides*** Jacq., Hortus botanicus vindobonensis 3: 17 (1776). Type: South Africa, Cape, without precise locality, in Jacq., Hortus botanicus vindobonensis 3: t. 28 (icono.!).

O. coarctatum Jacq. 2: t. 435 (1795). Type: South Africa, Cape, without precise locality, in Jacq., Icones plantarum rariorum 3: t. 435. (icono.!).

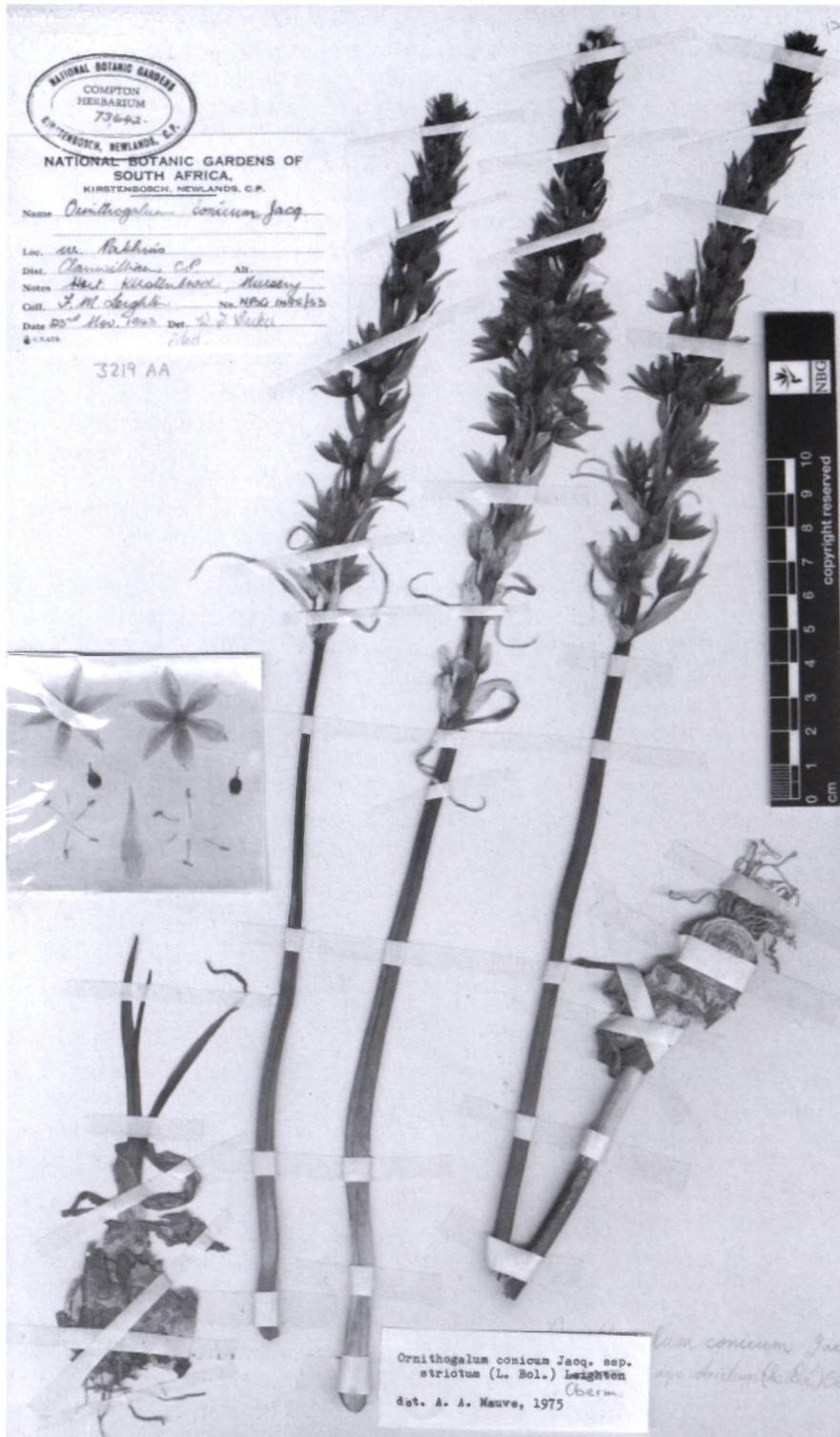


FIGURE 7.—*Ornithogalum strictum* L. Bolus.

O. bicolor Haw.: 177 (1803). Type: South Africa, [Western Cape], Cape of Good Hope, ex Whitley's Nursery (type not traced).

O. hermannii F.M.Leight.: 71 (1933b). Type: South Africa, [Western Cape], Clanwilliam Dist., 9 miles [14.4 km] N of Citrusdal, 1 October 1932, T.M. Salter 2806 (BOL, holo.!; K, iso!).

Plants (110–)150–600(–700) mm high. *Bulb* subglobose, comparatively small, 7–20(–23) mm diam., outer tunics usually whitish, sometimes greyish or brownish, membranous. *Leaves* erect or suberect, 3–7(–9), synanthous or withered at anthesis, narrowly oblong-lanceolate, attenuate, 100–300(–380) × 5–20(–25) mm, clasping stem below, glabrous but minutely to densely ciliate

on margin. *Raceme* conical-cylindrical to subcorymbose, (40–)45–80(–95) mm long at flowering, elongating to 80–150(–200) mm in fruit, (6–)8–40-flowered, sometimes two per bulb; lowermost pedicels (8–)14–24 mm long, elongating to (8–)15–50(–70) mm in fruit; bracts pale, ovate, acute or acuminate, shorter or longer than pedicels, lowermost 15–40(–50) mm long. *Flowers* milky white or pure white, usually with small greenish or brownish centre; outer tepals ovate-lanceolate, inner obovate, 12–25(–27) × (6–)8–12(–15) mm. *Stamens* half as long as tepals, sometimes shorter; filaments (4–)5–8(–11) mm long, white, outer subulate and slightly broader at base, inner greatly expanded in lower two thirds

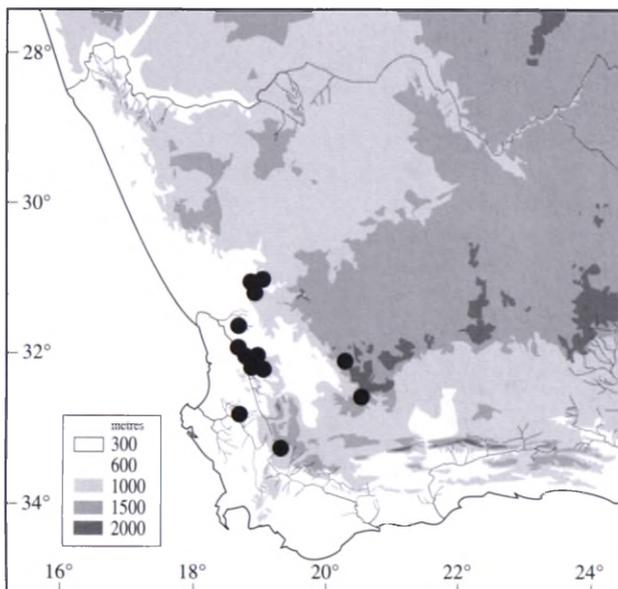


FIGURE 8.—Known distribution of *Ornithogalum strictum*.

with paired, wing-like outgrowths curved inwards over ovary. *Ovary* ovoid, obtuse, 3–6 mm long, grey, green or brown; style erect, 2.5–4.0 mm long, white or pale greenish. *Capsule* fusiform to oblong-ovoid, (9–)10–15(16) mm long, 3-lobed, apiculate. *Seeds* ovoid-angular and irregularly folded, 1.5–2.0 mm long, rugulose or colliculate and then echinulate on margins. *Chromosomes*: $2n = 12$ (Neves 1953; De Wet 1957; Pienaar 1963). *Flowering time*: late September to early November. Figures 1E, 9.

Distribution and ecology: widespread through the southwestern Cape, from Bredasdorp in the south to Vanrhynsdorp on the West Coast, with outlying populations recorded from further north on the higher ground in central Namaqualand, between Garies and Steinkopf (Figure 10). The species is typically found at lower altitudes and has not been recorded from the Bokkeveld, Cedarberg or Cold Bokkeveld Mountain ranges. We have not encountered it in the Warm Bokkeveld either, and the only known collection from Ceres (Walters 904) probably refers to the general region and not the town itself. The species is common on shale or loamy soils, especially in seasonally moist sites and ditches along roadsides. It appears to flourish under slight disturbance or overgrazing, and in such conditions may occur in dense colonies numbering hundreds or thousands of plants.

Ornithogalum thyrsooides is the most commonly encountered species in the southwestern Cape, especially along the west coast between Piketberg and Gordon's Bay, and is the original florists' chinchinchee.

It is known to be highly toxic to stock (Van Wyk *et al.* 2002), which may contribute to its rather weedy propensity. The toxic compound in the plants has been identified as prasinode G, a steroid glycoside (Van Wyk *et al.* 2002).

Discussion: *Ornithogalum thyrsooides* is characterized by its relatively small bulb with pale, membranous outer tunics, and slender, erect leaves that clasp the base of the stem. The outer filaments are slender and awl-shaped but the inner filaments are conspicuously expanded in the

lower two-thirds, the expansions with prominent apical wings that are curved over the dark greyish to brownish ovary. *O. thyrsooides* is usually readily distinguished from other species, including *O. conicum*, by the combination of thin-textured, pale tunics and winged filaments but may be difficult to differentiate from *O. strictum* in the Olifants River Valley where the two species co-occur. *O. strictum* typically has a longer, narrower raceme, inner filaments that are only expanded in the lower third and not winged, and an ovary that is usually yellow or pale greenish with a deflexed style.

Further south, in the Swartland and Boland, *Ornithogalum thyrsooides* occurs with *O. dubium* but that species is distinguished by its black outer tunics, shorter, more densely ciliate leaves and often shorter style. In addition, the filaments in *O. dubium* are often thicker-textured, and the outer may also be somewhat expanded rather than awl-shaped. Around Tulbagh, where the two species co-occur, *O. thyrsooides* favours moister, loamy soils while *O. dubium* prefers drier, stonier situations. Careful examination of mixed populations has failed to reveal a single hybrid plant. In the Warm Bokkeveld around Ceres, *O. thyrsooides* is replaced by *O. ceresianum*. Although vegetatively similar and occupying similar habitats, *O. ceresianum* is recognized by the very large, dark centre to the flower, covering the lower half of the tepals, and by having all six filaments winged, not just the inner three.

The species is rather variable in the shape of the inflorescence, which may range from narrowly cylindrical to subcorymbose, and in the size of the flowers. Many of these forms were accorded species status by Leighton (1944) but we prefer to treat them as part of the normal variation of the species. Among the more distinctive local forms are those from Langebaan and Saldanha (Boucher 6476, 6477; Craven 175), which are anomalous in their dark, brownish tunics. A particularly attractive form, with dense, subcorymbose racemes of flowers with distinctive, brownish centres occurs around Darling and Saldanha. In the Olifants River Valley some individuals have unusually long, narrowly cylindrical racemes (e.g. Boucher 2617), thus resembling *O. strictum*. The dark ovaries or bases to the tepals, strongly winged inner filaments, and erect styles, however, are more consistent with *O. thyrsooides*. Further north, populations between Klawer and Kamieskroon are robust, with arcuate, rather woody pedicels in fruit. Finally, Barker 3332 from Aries Kraal near Elgin includes plants with unusually short styles and scarcely winged inner filaments. Although resembling *O. dubium* in these features, the long, pointed leaves and small bulbs of these plants are more consistent with *O. thyrsooides*. It is possible that occasional hybridization may be the origin of some of these anomalous plants.

History: *Ornithogalum thyrsooides* was among the earliest species in the genus to be described from southern Africa and the first in section *Aspasia*. The winged inner filaments led Baker (1897) to conflate the species with *O. dubium*, and even Obermeyer (1978) was misled into treating *O. gilgianum* from Bainskloof (here included in *O. dubium*) as a synonym despite its dark tunics. Since the revision of Leighton (1944), however, the species has mostly been correctly understood.

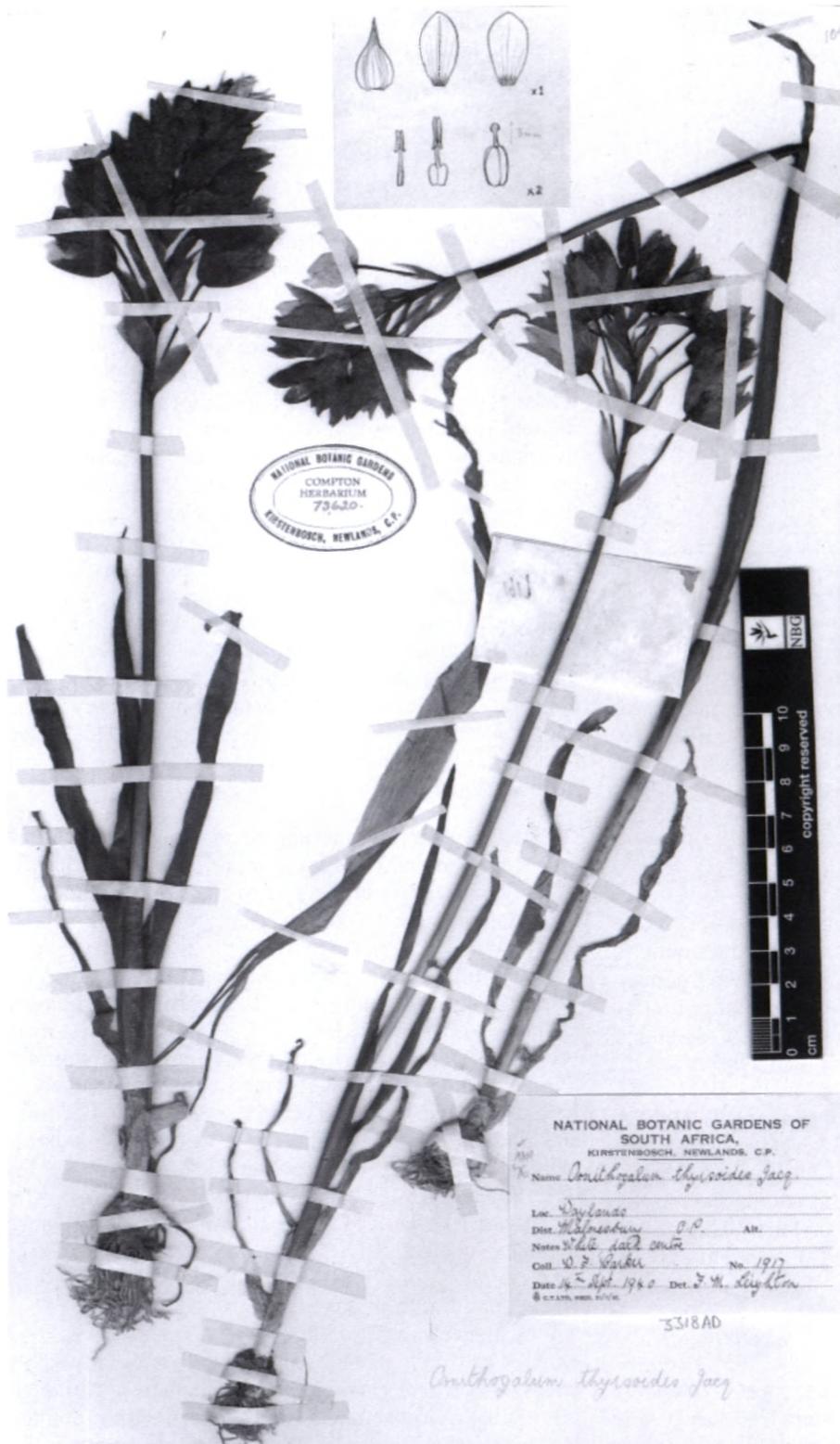


FIGURE 9.—*Ornithogalum thyrsoides* Jacq.

6. *Ornithogalum ceresianum* F.M.Leight. in Journal of Botany, London 71: 72 (1933a). Type: South Africa, [Western Cape], near Ceres, November 1931, Cook sub Nat.Bot.Gard.1756/25 (BOL, holo.!, K, iso.!).

Plants 200–350 mm high. Bulb subglobose, (11–)13–20 mm diam., outer tunics whitish, sometimes brownish grey, somewhat leathery or membranous. Leaves 3–7, suberect, more than half as long as inflorescence, sometimes reaching to base of raceme, partially or mostly dry at flowering, oblong-lanceolate, 40–90(120)

× 7–14(–18) mm, attenuate, clasping stem in lower part, glabrous. Raceme subcorymbose to conical, compact, 30–80 mm long at flowering, elongating to 60–100 mm long in fruit, 7–15(–20)-flowered, sometimes two per bulb; lowermost pedicels 27–37 mm long, elongating to 30–40 mm in fruit; bracts pale brownish and papery, ovate, acute or acuminate, lowermost 20–26 mm long, shorter than lowermost pedicels. Flowers creamy white with large, dark olive green central stain covering basal third of tepals, outer tepals ovate-lanceolate, inner obovate lanceolate, 16–21 × 7–11 mm. Stamens half as

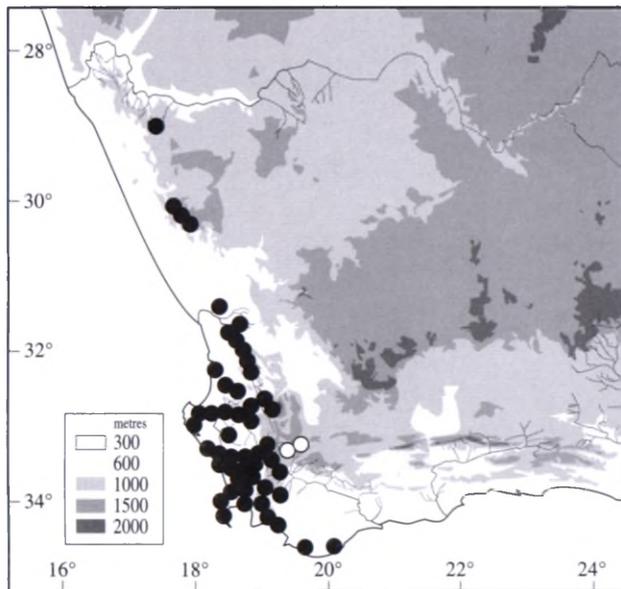


FIGURE 10.—Known distribution of *Ornithogalum thyrsooides*, ●; *O. ceresianum*, ○.

long as tepals; filaments 7–9 mm long, white, expanded and winged in lower two thirds, outer with shorter narrow wings, inner with longer wings. Ovary obovoid, 4–6 mm long, truncate, 3-lobed, glossy dark green to black in upper half, greyish below; style erect, 3.0–3.5 mm long, black. Capsule oblong-ellipsoid, 3-lobed, 10–12 mm long. Seeds angular-tetrahedral, 1.5–2.0 mm long, rugulose. Chromosomes: $2n = 12$ (Pienaar 1963). Flowering time: October, rarely November. Figures 1F, 11.

Distribution and ecology: a local endemic of the Warm Bokkeveld around the town of Ceres (Figure 10), where it occurs in loamy soils in seasonally moist vleis and along seasonal streams, usually in dense colonies.

Discussion: although vegetatively similar to *Ornithogalum thyrsooides* in its small bulb with pale, membranous tunics and slender, suberect leaves clasping the stem at the base, *O. ceresianum* is distinguished by the large, dark olive central eye that covers the basal third of the tepals, the glossy black ovary, and by having all six filaments expanded and winged in the lower two thirds. The inner filaments are more broadly winged than the outer and in some individuals may be petaloid with a dark base. In *O. thyrsooides* the outer filaments are at most slightly expanded, the dark centre of the flower is much smaller, covering no more than the base of the tepals, and the ovary is ovoid and matt. In addition the racemes are typically longer, with the lower pedicels shorter in fruit.

This striking species deserves to be in cultivation, and there is little doubt that it can be as easily grown as *Ornithogalum thyrsooides*.

History: first collected in the early years of the twentieth century, *Ornithogalum ceresianum* was described some twenty years later by Frances Leighton (1933a) but was subsequently treated as merely an unusual form of *O. thyrsooides* (Obermeyer 1978). Having seen the taxon in the wild, however, we are convinced that

it is sufficiently distinct from *O. thyrsooides* in several respects to warrant recognition as a distinct species.

Series 3 Maculata

Outer bulb tunics often dark; flowers white, yellow or orange, with or without dark centre; seeds 0.5–1.0 mm long.

7. ***Ornithogalum dubium* Houtt.** in *Natuurlijke historie* 2,12: 309, t. 82, fig.3 (1780). Type: South Africa, Cape of Good Hope, without precise locality, in Houttuyn herbarium (G, holo.–photo!).

O. flavissimum Jacq.: t. 436 (1789b). Type: South Africa, without precise locality, in Jacq., *Icones plantarum rariorum* 2: t. 436 (icono!).

O. flavescens Jacq.: 20, t. 437 (1789b). Type: South Africa, without precise locality, in Jacq., *Icones plantarum rariorum* 2: t. 437 (icono!).

O. miniatum Jacq.: t. 438 (1789b). Type: South Africa, without precise locality, in Jacq., *Icones plantarum rariorum* 2: t. 438 (icono!).

O. aureum Curtis: t. 190 (1792). Type: South Africa, without precise locality, in Curtis's *Botanical Magazine*: t. 190 (icono!).

O. vandermerwei Barnes: 14 (1931). *O. miniatum* var. *vandermerwei* (Barnes) F.M.Leight.: 89 (1944). Type: South Africa, [Western Cape], 8 miles [12.8 km] from Bonnievale on road to Swellendam, 8 October 1929, *N.J.S. van der Merwe BOL1814/29* (BOL, holo!).

O. vandermerwei Barnes var. *album* Barnes: 14 (1931). Type: South Africa, [Western Cape], between Worcester and Robertson, October 1930, *Hurling & McNeil BOL19296* (BOL, holo!).

O. fergusoniae L.Bolus: 57 (1932). Type: South Africa, [Western Cape], near Still Bay, November–December 1931, *E. Ferguson NBG45/31* (BOL!, lecto., designated in Obermeyer 1978; K, isolecto!).

O. brownleei F.M.Leight.: 62 (1933b). Type: South Africa, Eastern Cape, King William's Town Div., Middledrift, without date, *Brownlee BOL20366* (BOL, holo!).

O. leipoldtii L.Bolus: 71 (1933a). Type: South Africa, [Western Cape], Clanwilliam Div., between Klawer and Clanwilliam, Olifants River Valley, April 1929, *C.L. Leipoldt BOL19941* (BOL, holo!; K, iso!).

O. subcoriaceum L.Bolus: 55 (1934), syn. nov. Type: South Africa, [Northern Cape], near Nieuwoudtville, *L. Bolus BOL20090* (BOL, holo!).

O. alticolum F.M.Leight.: 93 (1944). Type: South Africa, [Western Cape], Paarl Div., top of Dutoitskloof, without date, *Pillans 8384* (BOL, holo!).

O. pillansii F.M.Leight.: 96 (1944). Type: South Africa, [Western Cape], Piketberg Div., near Het Kruis, 29 September 1943, *Leighton 134* (BOL, holo!; K!, PRE, iso.).

O. fimbrimarginatum F.M.Leight.: 105 (1944), syn. nov. Type: South Africa, [Western Cape], Montague, Whitehill Ridge, 25 October 1944, *F.M. Leighton 273* (BOL, holo!; K, iso!).

O. citrinum Schltr. ex Poelln.: 22 (1944). Type: South Africa, [Western Cape], Genadendal, without date, *Schlechter 9797* (B, holo.; GRA, K!, PRE, iso.).

O. gilgianum Schltr. ex Poelln.: 23 (1944), syn. nov. Type: South Africa, [Western Cape] Bainskloof, 3000' [915 m], 12 November 1896, without date, *Schlechter 9131* (B, holo.; BOL!, K!, PRE, iso.).

O. perpulchrum Schltr. ex Poelln.: 24 (1944), syn. nov. Type: South Africa, [Western Cape], Rietfonteinpoort (10 miles [16 km] SSE of Elim), 10 December 1896, *Schlechter 9681* (B, holo.; BM, BTU, GRA, K!, NSW, PRE, S, Z, iso.).

Plants (50–)100–450(–650) mm high. Bulb subglobose, (7–)10–20(–25) mm diam., outer tunics leathery to cartilaginous, dark brown or blackish. Leaves spreading, rarely suberect, (2)3–7(–9), green or dry at anthe-



FIGURE 11.—*Ornithogalum cerasianum* F.M. Leight.

sis, oblong-lanceolate to ovate, (20–)25–160(–200) × (3–)5–18(–20) mm, obtuse to acute, glabrous but thinly to densely ciliate on margins, rarely ciliae extending onto adaxial surface near apex and blade thus puberulous apically. *Raceme* corymbose to subcorymbose, rarely shortly cylindrical, (15–)20–60(–100) mm long at flowering, elongating to 30–100(–150) mm in fruit, (2)3–20(–30)-flowered; lowermost pedicels (8–)10–35 mm long, elongating to (12–)15–45(–55) mm in fruit; bracts greenish or whitish but dry and brown apically, ovate, acute or acuminate, usually shorter than pedicels,

sometimes ciliate along margins in upper third or near apex, lowermost (6–)10–30(–35) mm long. *Flowers* orange, yellow, cream-coloured or white with a brownish or greenish centre, or plain orange or yellow; outer tepals ovate-lanceolate, inner obovate, (7–)10–20(–23) × (3–)5–11(–13) mm. *Stamens* one third to half as long as tepals; filaments (3.5–)4.0–6.0(7.0) mm long, usually with brown or blackish stain in middle, or upper part orange, yellow or brownish, sometimes entirely white, often thick-textured, usually outer subulate and inner broader and winged but sometimes all subulate to trian-

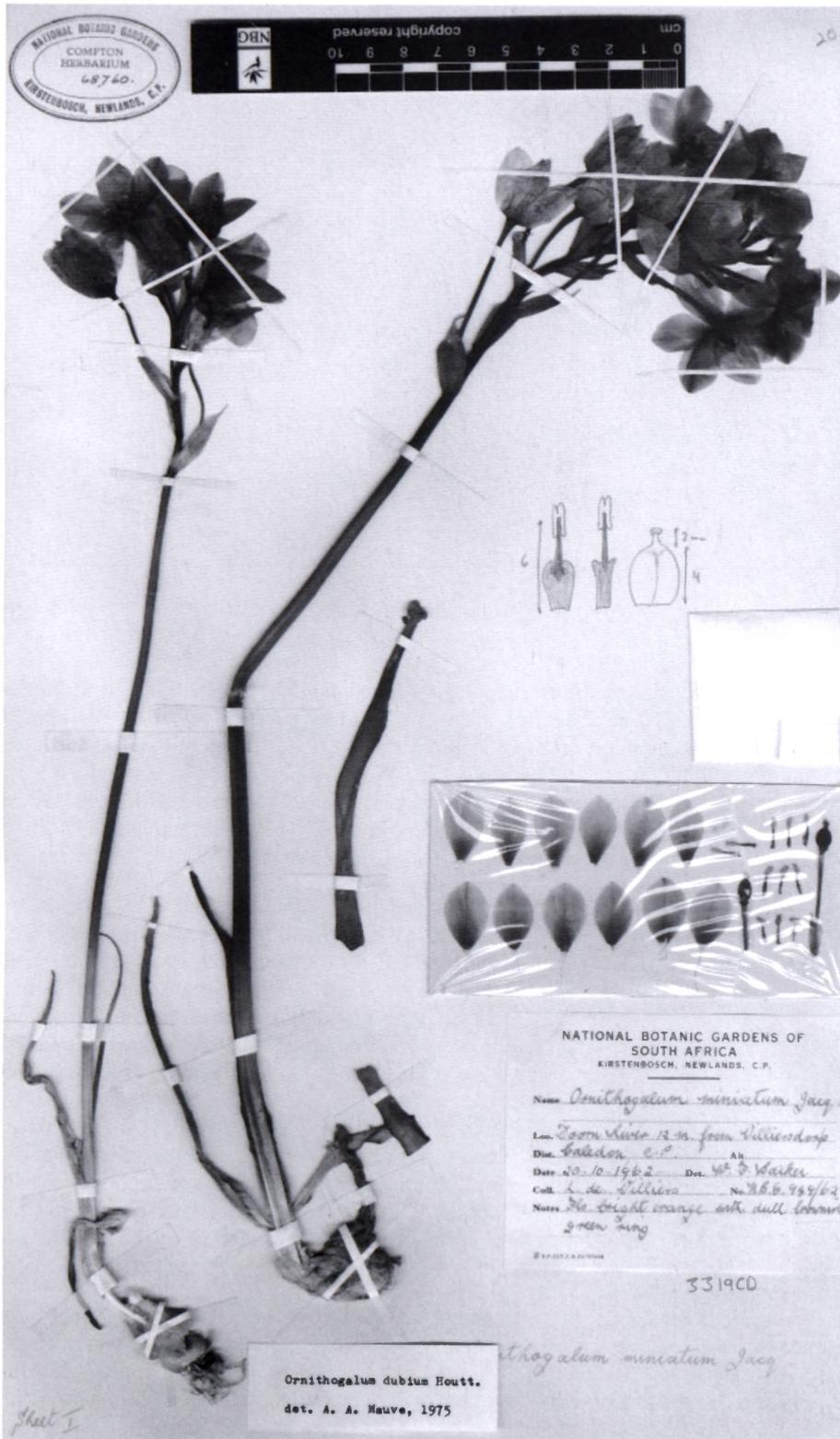


FIGURE 12.—*Ornithogalum dubium* Houtt.

gular or variously expanded and winged. Ovary ovoid, (2.5–)3.0–6.0 mm long, blue-greyish, greenish or yellow, usually narrowing into style, sometimes truncate; style short and thick or longer and slender, (1.5–)2.0–3.5(–4.0) mm long, white, yellow or blackish, erect. Capsule fusiform to oblong-ovoid, (5–)8–15 mm long, 3-lobed, apiculate. Seeds angular-pyriform, 0.5–1.0 mm long, echinulate to long-echinate. Chromosomes: $2n = 10, 12$ (De Wet 1957), $12, 12 + 5B, (18, 24)$ (Pienaar 1963). Flowering time: September–November at lower altitudes but December–January at higher altitudes. Figures 1G, 12.

Distribution and ecology: widespread through the southwestern and southern Cape, from the Bokkeveld escarpment southwards to the Cape Peninsula and thence eastwards along the coast and through the Little Karoo as far as Kentani and Stutterheim in the Eastern Cape (Figure 13). The species typically grows on stony flats or rocky slopes in pockets of shallow soil or humus in rock crevices, sometimes along rocky stream banks, in a wide variety of soils, from fine-grained clay to limestone or sandstone and in a range of vegetation types, including renosterveld and fynbos.

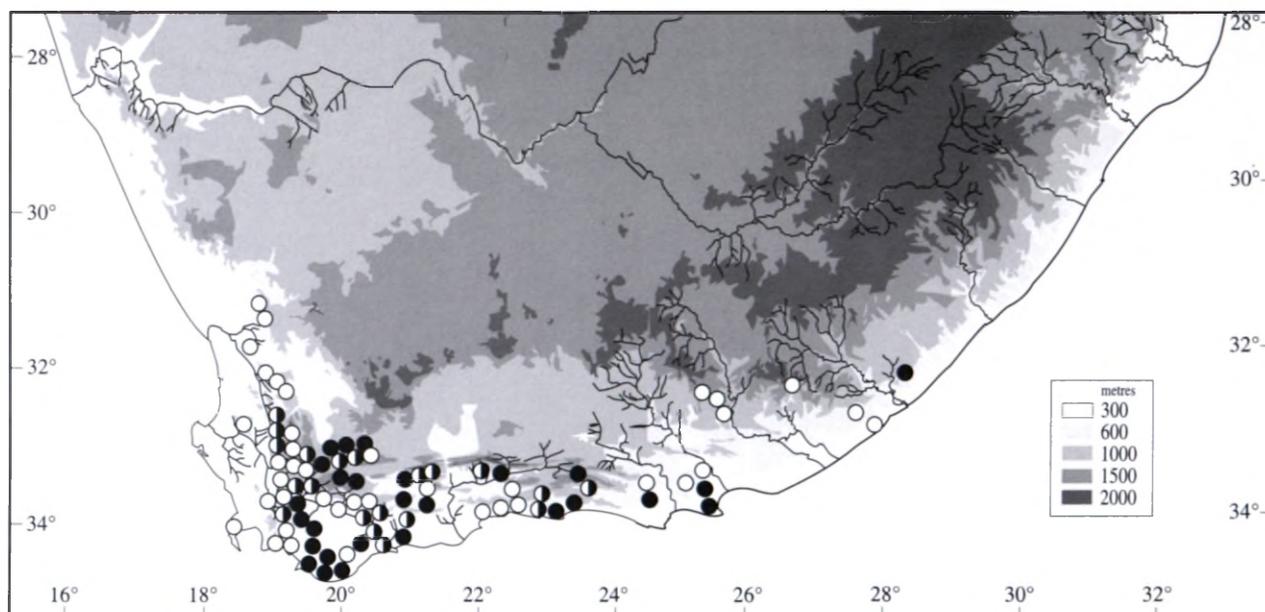


FIGURE 13.—Known distribution of *Ornithogalum dubium*: white-flowered populations, ○; yellow-flowered populations, ●; yellow- and orange-flowered populations, ◐.

Discussion: as circumscribed here, *Ornithogalum dubium* is defined by the firm-textured, dark brown to black bulb tunics, spreading, rather blunt leaves, seldom up to half as long as the inflorescence and typically densely ciliate on the margin, and corymbose to subcorymbose raceme of white, yellow or orange flowers, usually with a dark centre. The filaments are at least partially concolorous with the tepals, often with a dark zone in the middle or upper part, and the dark-coloured ovary typically narrows into the style, which may be shorter than or subequal to the ovary. The seeds are minute, 0.5–1.0 mm long, and echinulate. Similar small seeds are characteristic of all members of series *Maculata*.

Yellow- or orange-flowered plants with dark outer bulb tunics and ciliate leaves are readily assigned to *Ornithogalum dubium* but white-flowered individuals may pose some problems. The dark tunics, relatively short, spreading leaves and corymbose inflorescence serve to distinguish such plants from *O. thyrsooides* and *O. strictum*, which also have larger seeds, 1.5–2 mm long. *O. pruinatum*, from further north in Namaqualand, has similar dark tunics and small seeds but the leaves are distinctly glaucous and usually glabrous or minutely puberulous on the margins. *O. corticatum* from the Roggeveld Escarpment is distinguished by its thick, almost corky bulb tunics, leaves that are distinctly pubescent on the upper surface near the ends, plain white tepals and filaments, and yellow ovary. On the Cape Peninsula, *O. conicum* is recognized by its large bulb and linear-filiform filaments and larger seeds. In the Eastern Cape, white-flowered *O. dubium* is distinguished from *O. synanthifolium* by its deciduous habit, shorter leaves with ciliate margins, subcorymbose inflorescence and much smaller seeds (0.5–1.0 mm vs 2–3 mm).

Ornithogalum dubium is easily the most variable species in the section, displaying almost the entire range of flower colours and filament forms found among the species of sect. *Aspasia*. Populations are often constant in flower colour, comprising plants that are either white-flowered, or yellow- to orange-flowered, sometimes with less

than one kilometre separating populations of different colours. However, varicoloured populations are known from throughout the range of the species. We have seen a good example of such a population at Hottentotskloof, east of Ceres, comprising individuals displaying the entire range of different flower colours, from orange and yellow through cream-coloured to white with brownish centres.

Plants that match the type of *Ornithogalum dubium* and from which the original collections are most likely to have been made, occur around the town of Tulbagh at the head of the Breede River, on the original track into the interior. These populations have bright yellow or orange flowers and orange filaments, the inner expanded at the base and apically pointed but not winged, and short styles. Populations from the Swartland west of Tulbagh in contrast, are white-flowered with brownish orange centres. The filaments in these plants are darkly marked in the middle, and the inner are slightly winged. These populations often co-occur with *O. thyrsooides*, which is common on the coastal side of the mountains, but hybrids between them have not been seen.

Further down the Breede River Valley, between Worcester and Robertson, populations may be either white- or orange-flowered, and the inflorescences, although usually corymbose, may be longer and more conical. In some of these plants all six filaments are winged, the outer filaments with acute, divergent wings and the inner with longer, convergent wings. Both filament whorls are often stained dark in the middle or in the upper parts. A similar degree of variation is evident in the Little Karoo and southern Cape, where populations may be white- or yellow-, or sometimes orange-flowered, and the filaments vary from almost linear to winged.

Yellow-flowered populations are known from south of the Riviersonderend Mountains, between Caledon and Bredasdorp, and formed the basis of *Ornithogalum citrinum*, described by Von Poellnitz from plants collected by Rudolph Schlechter at Genadendal in the southern

foothills of the Riviersonderend Mountains. Plants from higher altitudes throughout the mountains of the southwestern and southern Cape are invariably white-flowered, typically with longer styles, and were previously segregated as *O. fimbriarginatum* and *O. subcoriaceum*.

Although white-flowered, longer-styled plants typically occur on sandstone soils throughout the mountains of the southwestern Cape, and short-styled plants on inter-montane shale soils east of the Bokkeveld-Hottentots Holland Mountain axis, this ecological-geographical differentiation is not absolute. Yellow- and orange-flowered plants occur, for instance, along the Tsitsikamma Mountains and in the Longkloof on sandstone substrates. Plants from the Witteberg near Laingsburg, including the type of *Ornithogalum fimbriarginatum*, are long-styled but otherwise match typical *O. dubium* perfectly in their dark centre, blackish green ovary, and filaments with the outer portion flushed olive-green. Apart from the length of the style there is nothing to separate these plants from white-flowered *O. dubium*.

It is now apparent that there are all transitions between short-styled and longer-styled plants, and that style length alone is an insufficient basis for distinguishing between species in the *O. dubium* complex. In the light of the extensive variation in flower colour and filament morphology that is now known to occur within even *O. dubium sensu stricto*, we therefore prefer to recognize a single, variable species in the complex pending more thorough investigation into the population genetics in the group.

The status of *Ornithogalum subcoriaceum* in particular deserves further study. This species was recognized for small plants, rarely up to 200 mm tall, from the interior mountains of the West Coast, typically bearing rather small flowers with tepals 8–14 mm long and bracts that are ciliate towards the apex. In addition, the seeds of collections that we have been able to examine are papillate rather than echinulate as is typical in *O. dubium/O. fimbriarginatum*. These distinctions, however, are not absolute and larger plants from the Cedarberg that are referable to *O. dubium/O. fimbriarginatum* on this basis may also have ciliate bracts and papillate seeds. We thus provisionally include the smaller plants within a broadly circumscribed *O. dubium*.

Ornithogalum dubium, unlike *O. thyrsoides*, has been shown to be non-toxic (Obermeyer 1978).

History: *Ornithogalum dubium*, described by Houttyn in 1780, was the second member of section *Aspasia* known to science after *O. thyrsoides*. Other yellow- and orange-flowered plants formed the basis of Jacquin's (1789b) *O. flavescens*, *O. flavissimum* and *O. miniatum*. All of these were treated as varieties of a very broadly defined *O. thyrsoides* by Baker (1897). The first modern treatment of the species is that of Leighton (1944) but the high degree of variation in flower colour and filament morphology evident in this widespread species led her to distinguish almost a dozen different taxa, based on small differences in the shape and size of the filaments and length of the style. Many of these species were reduced to synonymy under *O. dubium* by Obermeyer

(1978), who defined the species more broadly to include all plants with dark bulb tunics, ciliate leaves, and yellow, orange or white flowers with a dark centre and short style. Plants with dark tunics and white flowers with longer styles were excluded from this circumscription and treated as separate species, either *O. subcoriaceum* or *O. fimbriarginatum*.

Ornithogalum subcoriaceum was described by Louisa Bolus in 1934 from small plants collected on the Bokkeveld Escarpment near Nieuwoudtville that had ciliate bracts near the apex. Although maintaining the species in her treatment of the genus, Obermeyer (1978) recognized its similarity to *O. dubium*, and suggested that the dwarfing might be the result of the colder climate at high altitudes. Plants that match the type of *O. subcoriaceum* occur throughout the mountains of the southwestern Cape inland of the West Coast, from near Nieuwoudtville to Ceres. *Ornithogalum fimbriarginatum*, described by Leighton in 1944 from plants collected at Whitehill near Matjiesfontein, has never been well understood, and Obermeyer (1978) even considered the possibility that it was a hybrid between *O. dubium* and *O. conicum*, inheriting the dark tunics and expanded inner filaments from the former, and the white flowers and long style from the latter.

Ornithogalum dubium was separated from *O. fimbriarginatum* and *O. subcoriaceum* by Leighton (1944) and Obermeyer (1978) on the length of the style, which was taken to be less than 2 mm long in *O. dubium* and more than 2 mm long in *O. fimbriarginatum* and *O. subcoriaceum*. Long-styled plants with dark tunics and white flowers are scattered throughout the mountains of the southwestern and southern Cape, typically growing in moist, shallow soils in sandstone outcrops. Populations with the outer filaments variously broadened were referred by Leighton (1944) severally to *O. leipoldtii*, based on plants from Clanwilliam, *O. pillansii* from Piketberg, and *O. alticum* from Du Toitskloof, whereas those with the outer filaments linear or lanceolate were determined respectively as *O. fimbriarginatum* or *O. subcoriaceum*. The distinctly winged inner filaments of the plants referred to *O. leipoldtii* and *O. pillansii* have a dark zone in the middle, thus closely resembling white-flowered forms of *O. dubium*, and both were therefore reduced to synonymy under *O. dubium* by Obermeyer (1978), despite the fact that the length of their styles exceeds the upper limit accepted by her for that species.

There has been some confusion about the identity of *Ornithogalum perpulchrum*, described by Von Poellnitz (1944) from leafless plants collected by Rudolph Schlechter on 10 December 1896 near Elim in the Overberg. Obermeyer (1978) associated these plants with a collection of *O. dubium* made in the vicinity on the same day by Harry Bolus (*Bolus 8696*), who was collecting with Schlechter at the time, but Müller-Doblies & Müller-Doblies (1996) treated *O. perpulchrum* as a synonym of *O. rupestre* (as *O. multifolium*) on the basis that duplicates of both *Schlechter 9681* and *Bolus 8696* that they examined had the leaves of *O. multifolium*. This is, however, most definitely not the case with the Bolus collections in both the Bolus and Kew herbaria, which have the short, oblong, ciliate leaves and dark tunics of *O. dubium*. Similarly, we have no hesitation in identifying

the Kew isotype of Schlechter's collection as *O. dubium*, despite the rather small stature of the plants. There is no doubt that Schlechter's Rietfonteinkloof is correctly located near Elim (Jessop 1964), and *Ornithogalum rupestre* (= *O. multifolium*) is not known from south of the Langeberg, whereas *O. dubium* is common here. All evidence thus confirms that *Ornithogalum perpulchrum* is correctly placed in synonymy under *O. dubium*.

8. ***Ornithogalum pruinosum* F.M.Leight.** in Journal of South African Botany 10: 104 (1944). Type: South Africa, [Northern Cape], between Garies and Kamieskroon, September 1934, *L.Bolus BOL22781* (BOL, holo.!).

O. glaucophyllum Schltr. ex Poelln.: 23 (1944). Type: South Africa, [Northern Cape], Arakup [Arkoep, N of Kamieskroon], 14 September 1897, *R. Schlechter 11249* (Breslau, holo.; BOL!, GRA, K!, PRE, iso.).

Plants (40–)100–400(–650) mm high. *Bulb* sometimes epigeal or nearly so, subglobose, (8–)10–25(–27) mm diam., outer tunics dark brown to black, sometimes reddish apically, firm-textured or leathery. *Leaves* erect, (2)3–6(7), oblong-lanceolate to ovate-lanceolate, (20–)30–200(–300) × (5–)7–25(–35) mm, sometimes crisped, less than half as long as inflorescence, leathery, glaucous, glabrous or margins ciliolate. *Raceme* subcorymbose to cylindrical, (15–)20–50(–70) mm long at flowering, elongating to (30–)50–100(–150) mm in fruit, (4–)8–40(–60)-flowered; lowermost pedicels (5–)6–17(–20) mm long, elongating to (9–)12–25(–30) in fruit; bracts whitish or pale greenish, ovate, acuminate, shorter or longer than pedicels, lowermost (7–)10–30(–45) mm long. *Flowers* glossy white, sometimes with a small greenish or brownish centre; outer tepals ovate-lanceolate, inner tepals obovate, (8)9–15(–20) × (3)4–9(10) mm. *Stamens* half as long as tepals; filaments (3.5–)4.0–7.0(8.0) mm long, white, outer linear, sometimes slightly widened at base, inner either lanceolate or expanded and obovate (sometimes apically lobed) in lower half. *Ovary* ovoid, (2.5–)3.0–5.0(–5.5) mm long, green, yellow or brownish; style erect, (1.5–)2.0–3.0 mm long, yellow. *Capsule* ellipsoid to oblong-ovoid, (5)6–10 mm long, 3-lobed, apiculate. *Seeds* angular-pyriform, 0.5–1.0 mm long, papillate or echinulate. *Chromosomes*: 2n = 12 (Pienaar 1963). *Flowering time*: (July) late August to late September or mid October, rarely into early November. Figures 1H, 14.

Distribution and ecology: widespread through Namaqualand, especially along the western edge of the escarpment between 500–1200 m, from the Richtersveld in the north to Klaver in the south, and extending eastwards to Calvinia on the Bokkeveld Plateau and Aggenys in Bushmanland, with two records from as far east as Kuruman and Augrabies in Gordonia (Figure 15). In the south of its range, in the Knersvlakte, the species occurs along the western foothills of the escarpment below the Bokkeveld plateau, and only extends onto the plateau itself, around Calvinia, from the more arid valleys of southern Bushmanland. Plants typically grow on dry, open stony flats and slopes, and on rocky hillsides, mostly in clay and granite.

Discussion: *Ornithogalum pruinosum* is recognized by its dark, blackish outer bulb tunics, characteristic glaucous, leathery, often undulate leaves that are seldom up to half as long as the inflorescence, and a subcorym-

bose inflorescence of pure white flowers (rarely with a small dark centre). The yellow ovary and style in many plants is also diagnostic. The small seeds ± 1 mm long, and dark, leathery tunics place the species in the group that includes *O. dubium*, *O. puberulum*, *O. maculatum* and *O. rupestre*.

Although centred south of the range of *Ornithogalum pruinosum*, in the southwestern Cape south of Klaver, outlying populations of *O. thyrsooides* have been recorded from the higher-lying parts of central Namaqualand, in the Kamiesberg and near Steinkopf. The two cannot be confused, however, as *O. thyrsooides* is readily distinguished from *O. pruinosum* by the slender, bright green leaves, small bulb with pale tunics, and inner filaments that are conspicuously winged in the lower half and partially obscuring the ovary. In the south, the distribution of *O. pruinosum* also approaches that of *O. strictum* and *O. dubium* but the species do not overlap and confusion between them is unlikely. *O. strictum*, which is common in seasonally damp sites along the Bokkeveld Mountains, has similar flowers but slender, bright green leaves and cylindrical racemes with short pedicels, and *O. dubium*, which has been recorded from similar habitats on the Gifberg, has bright green leaves that are densely ciliate on the margins.

Ornithogalum pruinosum is very variable in stature, ranging in size from small, few-flowered plants scarcely 50 mm high to robust individuals almost 700 mm tall. Plants from Aggenys in the arid eastern Bushmanland are especially dwarfed. This variation is to be expected in a species from arid environments with variable precipitation. Although usually lanceolate, the inner filaments are occasionally expanded at the base, the expansions with small, pointed apical wings. Plants with these winged filaments are scattered through the range of the species, and are known from the Richtersveld, central Namaqualand and Loeriesfontein. The range in form of the inner filaments in the species was evident to Leighton (1944), who noted that they varied in the same population or individual, even in the same flower.

History: *Ornithogalum pruinosum* appears to have been first collected in the late 19th century, first near Kamieskroon by R. Schlechter in the spring of 1897 and a year later at Okiep by W. Morris. Although Schlechter intended describing the species under the name *O. glaucophyllum*, it was only formally recognized in 1944, when it was independently described by both Leighton and Von Poellnitz, the latter using Schlechter's material and his proposed epithet. Since then it has been consistently recognized, and its characteristic glaucous, often undulate leaves have spared it the further taxonomic fragmentation on the basis of the shape of the inner filaments that has been the fate of other species from the southwestern Cape.

9. ***Ornithogalum maculatum* Jacq.**, Collectanea 3: 368 (1791). Type: South Africa, without precise locality or date, Jacq., Collectanea 3: t. 18, f. 3 (icono.!).

O. maculatum Thunb.: 62 (1794), illegitimate homonym. *O. thunbergianum* Baker: 269 (1873), new name for *O. maculatum* Thunb., not of Jacq. (1791). Type: South Africa, [Western Cape], Saldanha Bay, *Thunberg 8289* (UPS, holo.–microfiche!).



FIGURE 14.—*Ornithogalum pruinosum* F.M.Leight.

O. speciosum Baker: 72 (1891), illegitimate homonym. *O. insigne* F.M.Leight.: 113 (1933b), new name for *O. speciosum* Baker, not of Salisb. (1796) or Rafin. (1810). *O. magnificentum* Poelln.: 214 (1945), new name for *O. speciosum* Baker. *O. maculatum* Jacq. var. *speciosum* (Baker) F.M.Leight.: 110 (1944). Type: South Africa, [Northern Cape], Namaqualand, without precise locality or date, *W. Scully* 175 (K, holo., SAM, iso.!).

O. thunbergianum var. *concolor* Baker: 496 (1897). Type: South Africa, without precise locality or date, *Forster s.n.* (K, holo.!).

O. splendens L.Bolus: 14 (1931). *O. maculatum* Jacq. var. *splendens* (L.Bolus) F.M.Leight.: 110 (1944). Type: South Africa, [Northern Cape], near Nieuwoudtville, November 1930, *Buhr* 2654/30 (BOL, holo.!).

O. rossouwii U.Müll.-Doblies & D.Müll.-Doblies: 394 (1996), syn. nov. Type: South Africa, [Northern Cape], 2 km N of Buffelsrivier and 32 km N of Laingsburg on Sutherland road, \pm 800 m, 4 August 1986 (in leaf), *Müller-Doblies* 86037b (PRE, holo., not located; B, BTU, K, NBG, iso., not located).

Plants (40–)60–400(–550) mm high. *Bulb* subglobose, (7–)8–20(–25) mm diam., outer tunics whitish or grey-brownish, thin-textured. *Leaves* suberect, (1)2–5, linear-lanceolate to oblong-lanceolate, (15–)20–110(–170) \times 3–15(–20) mm, obtuse or acute, usually clasping at base, glaucous and entirely glabrous. *Raceme* corymbose to sub-corymbose or shortly cylindrical, (5–)10–30(–40) mm long

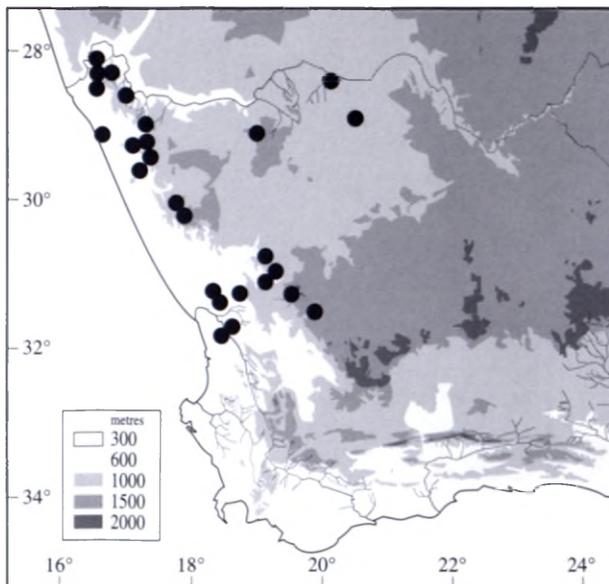


FIGURE 15.—Known distribution of *Ornithogalum pruinosum*.

at flowering, elongating to 25–55(–80) mm long in fruit, 1–6(–9)-flowered; lowermost pedicels 3–15 mm long, elongating to 5–27 mm in fruit; bracts whitish but brownish in outer part, ovate, acute or acuminate, longer than pedicels, lowermost (6–)10–20(–30) mm long. *Perianth* reddish, orange or yellow (rarely white), outer tepals usually with black spot or transverse bar near apex, sometimes unmarked; outer tepals obovate-lanceolate, inner obovate, tepals (10)11–25(–27) × 5–14(–18) mm. *Stamens* ± half as long as tepals; filaments (4–)5–8(–9) mm long, usually orange or yellow, subulate or inner lanceolate. *Ovary* ovoid, 4–8 mm long, yellow; style short and thick, 1.5–2.5 mm long. *Capsule* fusiform to oblong-ovoid, 8–10 mm long, 3-lobed, apiculate. *Seeds* angular-pyriform or comma-shaped, 1 mm long, rugulose. *Chromosomes*: $2n = 12$ (24) (Pienaar 1963), 14 (De Wet 1957). *Flowering time*: (late August) September to October. Figures 11, 16.

Distribution and ecology: localized to the higher-lying parts of central Namaqualand between Springbok and Garies, but widely scattered through the drier parts of the southwestern Cape, from the Bokkeveld Plateau southwards through the Cedarberg and Cold Bokkeveld to Langebaan and Malmesbury on the west coast, thence eastwards along the fringe of the Cape Floral Region to Prince Alfred (Figure 17). Plants are typically restricted to rock outcrops, typically in shallow humus on granite or sandstone pavements, but also outcroppings of shale.

Discussion: *Ornithogalum maculatum* is one of the most striking species in section *Aspasia*, readily recognized by its glaucous leaves lacking any marginal vestiture, orange or yellow flowers, usually with some dark marking at the tips of the outer tepals, and subulate or lanceolate filaments. Forms with pure yellow or orange flowers may be confused with *O. rupestre* but that species has narrow, subterete leaves. The minute seeds and orange flowers might lead to confusion with forms of *O. dubium*, but *O. maculatum* lacks the dark tunics and ciliate leaves that are characteristic of that species.

Ornithogalum maculatum is very variable in stature, flower size and in the development of markings on the flowers. Large forms, with pure orange flowers lacking markings and with broad filaments, originally segregated as *O. splendens*, occur around Calvinia and in Namaqualand between Kamieskroon and Hondeklipbaai. Plants of similar size but with well-marked outer tepals bearing triangular or diamond-shaped markings were distinguished as *O. speciosum* and have been recorded from Namaqualand, between Springbok and Garies, from the Olifants River Valley around Clanwilliam, and from the western Little Karoo, around Karoo Poort, Touws River and Montagu.

The presence and degree of marking may vary within a population, which can thus include both marked and unmarked individuals (e.g. *Van der Merwe 246*). Although typically blackish, the markings on the outer tepals range in colour from green to black, sometimes within a single population (e.g. *Horrocks 12*; *Hall s.n. NBG68697*). Occasional plants or populations from Karooport (*Viviers 1568*), Laingsburg (*Bayliss 736*) and near Steytlerville may lack yellow or orange pigment, producing whitish flowers with darker markings. Such plants formed the basis of *O. rossouwii*.

Anecdotal evidence suggests that the species is not toxic to animals since goats have been recorded as consuming it with impunity (Obermeyer 1978).

History: first described in 1791 by Nicolaas von Jacquin from plants grown in Vienna, *Ornithogalum maculatum* was redescribed a few years later by Thunberg from wild material gathered near Saldanha. Struck by the distinctive marks on the outer tepals, he chose the same epithet for his species. The species is now known to vary not only in flower colour but also in the degree of maculation. Some of the more distinctive of these forms were segregated as distinct species or varieties in the past. Well-marked forms from Namaqualand were segregated as *O. speciosum* by Baker (1891), and an attractive form with large, unmarked yellow or orange flowers from near Nieuwoudtville was named *O. splendens* by Bolus (1931). Both of these forms were later reduced to varietal status by Leighton (1944) but we are in accordance with Obermeyer (1978) in preferring to regard them as local forms within a much greater spectrum of variation and thus not deserving of taxonomic rank. Most recently, Müller-Doblies & Müller-Doblies (1996) described *O. rossouwii* from five greenhouse-grown plants collected between Laingsburg and Janseville, and distinguished from *O. maculatum* by their small size and whitish or pinkish flowers. Although the type material of this species has not been deposited in any herbaria, the accompanying illustrations make its identity clear. The differences between this material and typical *O. maculatum* are trivial when compared to the variation within the species. Several collections of depauperate plants with the yellow, spotted flowers of typical *O. maculatum* (e.g. *Pretorius 92*) are indistinguishable from *O. rossouwii* apart from the colour of the flowers, and these white or cream-coloured plants are most appropriately treated as colour forms of *O. maculatum*. A similar range in flower colour is com-

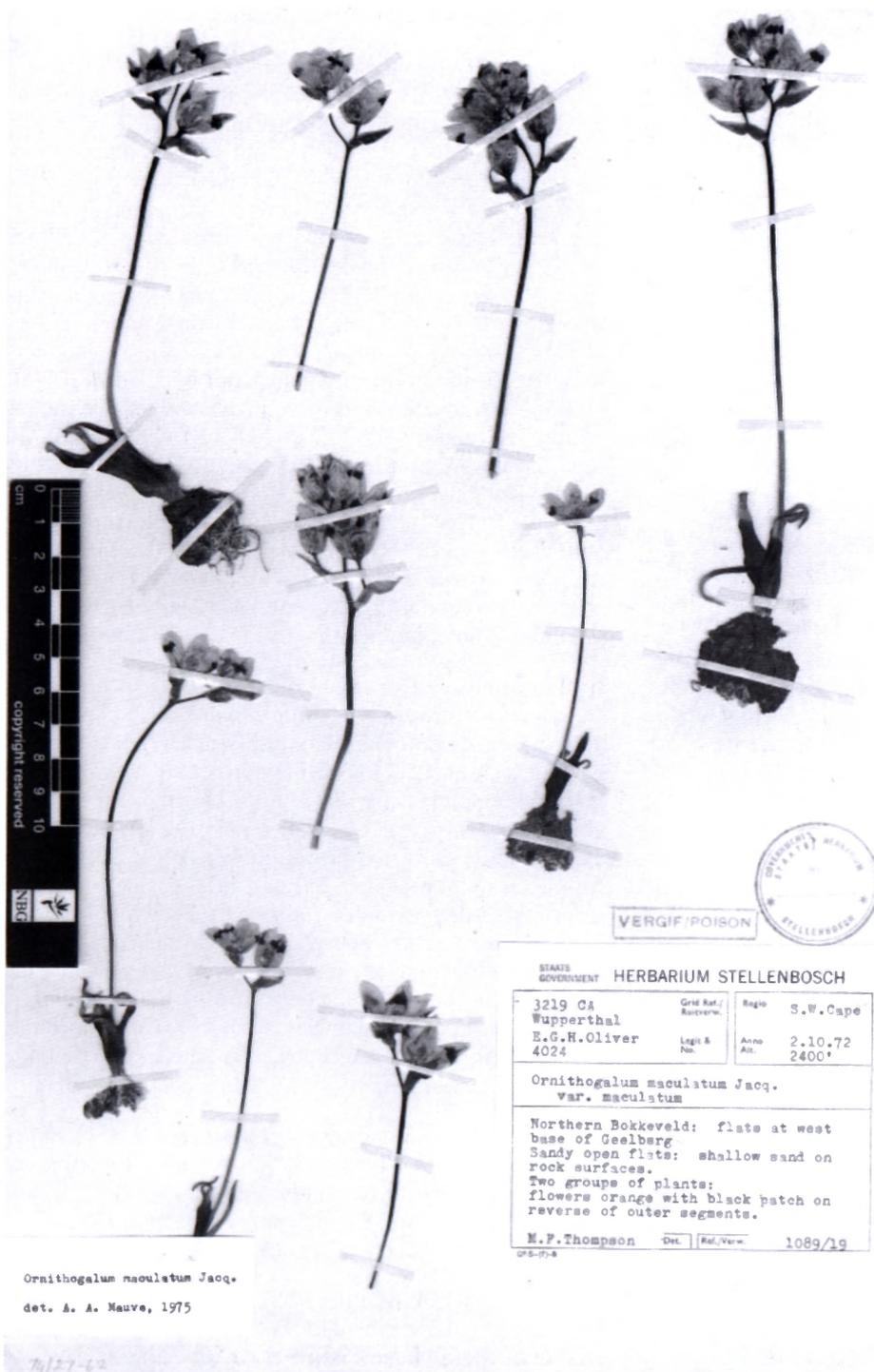


FIGURE 16.—*Ornithogalum maculatum* Jacq.

mon within *O. dubium* and it is now evident that it also occurs in *O. rupestre*.

10. *Ornithogalum rupestre* L.f., Supplementum plantarum: 199 (1782). Type: South Africa, [Western Cape], Malmesbury Division, Witteklip, *Thunberg 8302* (UPS, holo.–microfiche!).

O. multifolium Baker: 271 (1873), syn. nov. Type: South Africa, [Northern Cape], Namaqualand, Modderfontein, *Whitehead s.n.* (TCD, holo.!).

O. virgineum Soland. ex Baker: 271 (1873). Type: South Africa, without precise locality [probably Witteklip], *Masson s.n.* (BM, holo.!).

O. aurantiacum Baker: 748 (1878), syn. nov. Type: South Africa, [Western Cape], Malmesbury District, Groenekloof [Mamre], 1878, *H. Bolus s.n.* (K, holo.!).

O. ranunculoides L.Bolus: 71 (1933b), syn. nov. Type: South Africa, [Northern Cape], Steinkopf, *H. Herre STE3978* (BOL!, lecto., here designated).

O. witteklipense F.M.Leight.: 175 (1945). Type: South Africa, [Western Cape], Witteklip near Vredenburg, *Leighton 655* (BOL, holo.!).

O. saxatile Schltr. ms.

Plants (30–)50–150(–200) mm high. *Bulb* subglobose, (7–)10–15 mm diam., outer tunics whitish or brownish. *Leaves* (2)3–10, subterete or canaliculate, 20–110 × 1–3 mm, glabrous. *Raceme* corymbose to subcorymbose, 5–30 mm long at flowering, elongating to 10–50 mm in fruit, (1)2–10(–15)-flowered; lowermost pedicels 2–18 mm long, elongating to 6–25 mm in fruit; bracts ovate, whitish with upper part brownish, acute or acuminate,

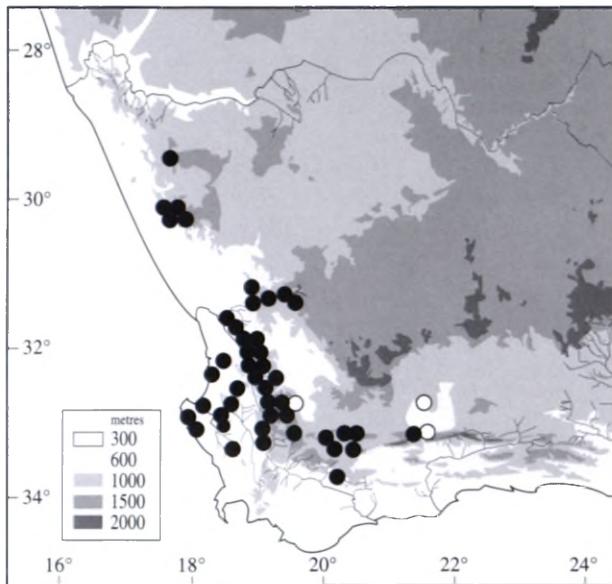


FIGURE 17.—Known distribution of *Ornithogalum maculatum*: white-flowered populations, ○; orange-flowered populations, ●.

usually shorter than pedicels but longer in small plants, lowermost (4–)6–15 mm long. *Flowers* usually yellow or orange, rarely white or pinkish; outer tepals ovate-lanceolate, inner obovate, 6–12 × 3.5–5.5 mm. *Stamens* ± half as long as tepals; filaments 3–5 mm long, whitish or yellowish, outer linear to subulate, inner lanceolate. *Ovary* ovoid, 3–4 mm long, yellowish; style short, erect, 1–2 mm long. *Capsule* fusiform to oblong-ovoid, 10 mm long, 3-lobed, apiculate. *Seeds* angular-pyriform or comma-shaped, 0.75 mm long, rugulose. *Chromosomes*: 2n = 12 (Pienaar 1963), 20 (Johnson & Brandham 1996). *Flowering time*: late August to early October. Figures 1J, 18.

Distribution and ecology: widely distributed through Namaqualand and the more arid southwestern Cape, from the Richtersveld in the north through the higher-lying parts of Namaqualand to the Bokkeveld Plateau, southwards through the northern Cedarberg to Darling in the southwest, and through the Cold Bokkeveld to Barrydale and Laingsburg in the southeast, with isolated records from the Roggeveld Escarpment (Figure 19). Plants grow in shallow humus and soil on rock sheets, often on granite or sandstone, where they may occur in large numbers fringing depressions on the rocks that accumulate water in the rainy season.

Discussion: *Ornithogalum rupestre* is one of the most recognizable species in the section, identified by the few to many, subterete, glabrous leaves. Other species in section *Aspasia* have plane, oblong to lanceolate leaves. It is typically less than 100 mm high, with pure yellow or orange flowers with linear to lanceolate filaments and a very short style. *O. rupestre* shares glabrous leaves, mostly yellow or orange flowers with a rudimentary style, and minute, rugulose seeds with *O. maculatum* and it is likely that the two are immediately related. The flowers of *O. rupestre* are typically bright yellow or orange but populations from Langebaan and the Cold Bokkeveld have pale yellow flowers, and plants with cream-coloured flowers have been collected around Pakhuis Pass. The flowers of populations from the

Vredenburg Peninsula are uniformly white or pinkish.

History: *Ornithogalum rupestre* was described by Linnaeus f. (1782) from plants collected on Witteklip near Vredenburg by Carl Peter Thunberg. Although not mentioned in the original description, the plants from Witteklip are uniformly white-flowered, sometimes with a pinkish flush. Later collections of the more common and widespread yellow-flowered forms were described as *O. multifolium*, based on short, floriferous plants from Namaqualand (Baker 1873), and *O. aurantiacum*, from few-flowered plants collected near Mamre (Baker 1897). Yet another name, *O. ranunculoides*, was applied to taller forms from Namaqualand by Louisa Bolus (1933b). All of these forms were subsequently included within a single yellow-flowered taxon, *O. multifolium*, by both Obermeyer (1978) and Müller-Doblies & Müller-Doblies (1996). White-flowered *O. rupestre* from Vredenburg has until now been retained as distinct from yellow-flowered *O. multifolium*. The application of the name *O. rupestre* was confused by Leighton (1944), who used it for yellow-flowered plants (Obermeyer 1978), but there is no doubt that the type is white-flowered.

White-flowered *Ornithogalum rupestre* was separated from yellow-flowered *O. multifolium* on nothing more than flower colour, a minute difference in style length, and the smaller stature of the former. It is now clear that flower colour varies within the species in the group and is an insufficient basis for separating species. Even within yellow-flowered plants, flower colour may range from pale lemon-yellow through bright canary yellow to orange, whereas paler forms may be white, cream-coloured or pinkish. The purported differences in stature and style length are likewise trivial and we have no hesitation in including the various colour forms within a single species. It is unfortunate that *O. rupestre* is the earlier name for this taxon, which is better known under the name *O. multifolium*.

11. ***Ornithogalum leupoortense*** U.Müll.-Doblies & D.Müll.-Doblies in Feddes Repertorium 107: 396 (1996). Type: South Africa, Northern Cape, Bushmanland, Naip Mountains, (–AD), June 1988, E.J. van Jaarsveld 9478 (NBG!, neotype, here designated).

Plants 60–150 mm high. *Bulb* subglobose, 10–15 mm diam., outer tunics dark brown to black, somewhat leathery. *Leaves* falcate, distichous, (2–)5 or 6, lanceolate-attenuate, canaliculate, ± as long as inflorescence or longer, (25–)40–15 × (4–)5–10 mm, leathery, bright green, margins translucent and papillate, sometimes thickened. *Raceme* often laterally displaced by development of second inflorescence, corymbose, 20–50 mm long at flowering, (1–)4–15-flowered; lowermost pedicels (15–)20–30 mm long; bracts pale greenish, lanceolate-attenuate, shorter or longer than pedicels, lowermost (15–)20–25 mm long. *Flowers* glossy white; outer tepals elliptic-ovate, inner tepals elliptic-obovate, 13–20 × 5–8 mm. *Stamens* less than half as long as tepals; filaments 5.0–6.5 mm long, white, outer linear or subulate, inner linear-lanceolate. *Ovary* ovoid, 4–6 mm long, green; style erect, 2–3 mm long. *Capsule* ellipsoid to oblong-ovoid, 6–7 mm long, 3-lobed, apiculate. *Seeds* angular-pyriform, 0.5–1.0 mm long, echinulate. *Flowering time*: August to September. Figures 1K, 20.



FIGURE 18.—*Ornithogalum rupestre* L.f.

Distribution and ecology: currently known from the hills northeast of Springbok, with most of the collections from the inselberg Naip se Berg, and from further north on the higher mountains of the Richtersveld, between 800–1 000 m (Figure 21). Plants grow wedged in crevices and fissures in quartzite rock and scree on sheltered, south-facing slopes, where they may be locally abundant.

Discussion: still poorly collected and understood, *Ornithogalum leupoortense* is distinguished by the fan-like arrangement of its leaves, which are falcate, pointed and somewhat channelled. The leaf margins are obscurely

papillate and in the populations around Springbok they are also distinctly thickened. Plants typically produce a second inflorescence in a growing season and the older inflorescence is characteristically displaced, appearing to arise in the axil of one of the lower leaves. The relatively short inflorescence is characterized by large, often foliose, green bracts, the lowermost 15–25 mm long, with the tips drawn out and attenuate.

Collections from the Richtersveld, although lacking the thickened leaf margins of plants from around Springbok, match the southern populations in all other

essentials, including the falcate, glossy green leaves with attenuate tips, and lateral displacement of the primary inflorescence through development of a later one, and we have no hesitation in regarding them as conspecific.

The minute, echinulate seeds of *Ornithogalum leeuportense* indicate an alliance with the members of the *O. dubium* group but it is unlikely to be confused with any other species in series *Maculata* on account of the distinctive glossy green, distichous leaves. Most other species of the group from Namaqualand, particularly *O. pruinatum* and *O. maculatum*, have rosulate, glaucous leaves. Pressed specimens of *O. pruinatum* may be distinguished by their erect, proportionally broader leaves with ciliolate, often crisped margins. The leaves are also typically shorter, less than half as long as the inflorescence, and thick-textured.

History: the species was described by Müller-Doblies & Müller-Doblies (1996) from a collection of non-flowering plants made on 11 August 1988 on the Farm Leeupoort northeast of Springbok and subsequently grown on in the glasshouse. None of the cited material has been deposited in any herbarium but three collections of plants, all from Naip se Berg on the edge of Bushmanland northeast of Springbok, match the protologue in the diagnostic essentials, viz. the distichous leaves with thickened, obscurely papillate margins, and are accordingly referred to this species. Since no type material has been lodged in the cited herbaria, we select one of these specimens to act as a neotype. The earliest collection of the species that we have traced is that made by Margaret Thompson and Annelise le Roux in August 1977 in the Richtersveld and until now referred either to *O. subcoriaecum* (now a synonym of *O. dubium*) or *O. pruinatum*.

12. *Ornithogalum puberulum* Oberm. in *Bothalia* 12: 337 (1978). Type: Namibia, Kahanstal, 5 miles [8 km] N of Loreley [Lorelei], 30 August 1963, *H. Mueller & W. Giess 3365* (PRE, holo.!).

O. merxmuelleri Roessler: 389 (1979). Type: Namibia, Farm Namuskluft, 29 September 1977, *Merxmüller & Giess 32350* (M, holo.; PRE!, WIND, iso.).

O. puberulum subsp. *chris-bayeri* U.Müll.-Doblies & D.Müll.-Doblies: 390 (1996), syn. nov. Type: Namibia, mountain 2 km west of Rosh Pinah, ± 450 m, 26 September 1989, *Müller-Doblies 89120b* (WIND, holo., not deposited).

Plants 50–80(–90) mm tall. *Bulb* subglobose, 8–15 mm diam., outer tunics leathery or somewhat cartilaginous, whitish or dark grey, sometimes forming a short neck of narrow fragments. *Leaves* suberect or spreading, 2(3), synanthous, oblong to ovate-lanceolate, rarely lanceolate, uppermost usually only half as large as lower, 40–80 × 10–25 mm, soft-textured, glabrous or pubescent on both surfaces, margins with slender cilia 0.75–2.0 mm long, base shortly tubular, somewhat inflated and clasping scape. *Raceme* corymbose or racemose, 15–100(–130) mm long at flowering, 4–10(–25)-flowered; lowermost pedicels 10–20 mm long in flower, elongating to 30 mm; bracts whitish, ovate, acute or acuminate, glabrous or lowermost ciliate, shorter or longer than pedicels, lowermost 8–16 mm long. *Flowers* white; outer tepals

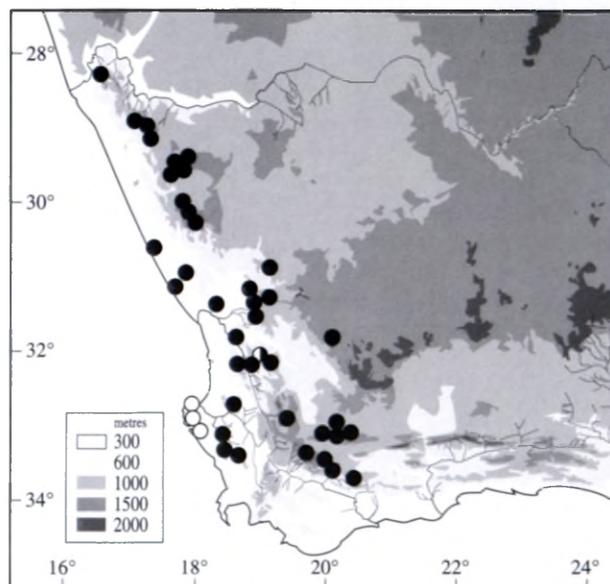


FIGURE 19.—Known distribution of *Ornithogalum rupestre*: white- or pale yellow-flowered populations, O; deep yellow- or orange-flowered populations, ●.

ovate-lanceolate, inner elliptical-ovate, 6–10 × 3–5 mm. *Stamens* ± half as long as tepals; filaments lanceolate, 4–5 mm long, white, sometimes marked with yellow, inner with quadrate or apically auriculate expansion in lower 2 mm. *Ovary* ovoid, ± 4 mm long, sometimes greenish black apically; style 1.5–3.0 mm long. *Capsule* ovoid, 6–8 mm long. *Seeds* angular, ± 1 mm long, colliculate to echinulate. *Flowering time*: August and September. Figures 1L, 21.

Distribution and ecology: largely restricted to a small area of high ground in southern Namibia, between 600–950 m, in the Klinghardt Mountains and nearby Huib Hoch Plateau (Figure 22), with a southward extension into the Richtersveld in Northern Cape, South Africa around Lekkering. This is an extremely arid region that is summer-dry, although coastal fogs supply some precipitation in the autumn.

The leaves of *Ornithogalum puberulum* are remarkably soft-textured for a species from such an arid area and plants are restricted to rock outcrops and crevices, on south-facing exposures or at the foot of boulders, where they are sheltered from the afternoon sun in winter and benefit from the cooler, moist conditions during the growing season. The species has been recorded as locally common where it occurs but leafing and flowering is dependent on adequate rain.

Discussion: this highly distinctive species is immediately recognizable by the two (rarely three) soft-textured, ovate to elliptical (rarely lanceolate) leaves that are either glabrous or pubescent but always with soft cilia 0.7–2.0 mm long on the margins. The leaves of *Ornithogalum puberulum* are typically rather tubular and inflated at the base where they clasp the stem, and the upper leaf is mostly only half the size of the lower one or two.

The species shows considerable variation in the pubescence of the leaves, sometimes within populations



COMPTON HERBARIUM (NBG)
NATIONAL BOTANICAL INSTITUTE, KERSTENBOSCH, CAPE TOWN

2912 FL	GRID REF.	REGIO
E J van Jaarsveld	LEGIT &	ANNO June 1988
9478	NO.	ALT.

Ornithogalum sp.

Voucher specimen for painting by Elaphie Ward-Hilhorst.

From Naip Mountains, Bushmanland.

Painting sold to Dr A C V Weeber.

DET ACC. NO.

Ornithogalum sp. (near *O. puberulum*)
leu-poortense
 Naip Mountains
 Bushmanland
 E. J. van Jaarsveld
 9478
 1988

Painting sold to Dr. A.C.V. Weeber.

E. Ward-Hilhorst Voucher specimen for painting June '88

FIGURE 20.—*Ornithogalum leu-poortense* U.Müll.-Doblies & D.Müll.-Doblies.

but more usually between them. The type collection comprises four plants, all of which have leaves that are entirely pubescent on both surfaces, apart from the upper leaf on one of the plants, which is pubescent only apically. The leaf and bract margins in all four plants are densely ciliate. The type of *Ornithogalum merxmuelleri* has similarly pubescent leaves but the bracts are entirely glabrous. All other collections that we have examined have leaves that are glabrous with sparsely pubescent margins. Although both the type and *Bruyns* 2668 have ciliate margins to the bracts, other populations from

near Rosh Pinah (*Bruyns* 8359, 8866) have entirely glabrous bracts.

Described from near Rosh Pinah in southern Namibia, *Ornithogalum puberulum* subsp. *chris-bayeri* Müll.-Doblies & Müll.-Doblies was distinguished from the typical subspecies by the shorter cilia on the leaf margins, hairy bracts, yellow-spotted filaments and shorter style (1.6 mm vs 2.5–3.0 mm). More recent collections of *O. puberulum*, with somewhat variably ciliate leaf margins, glabrous or ciliate bracts and short styles, that

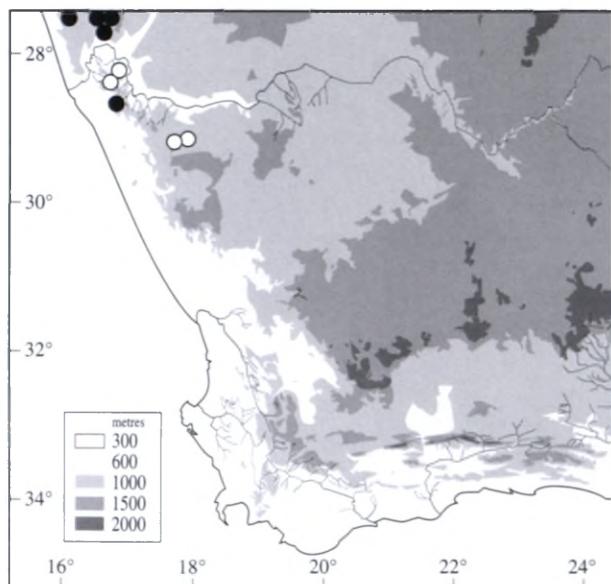


FIGURE 21.—Known distribution of *Ornithogalum leeuportense*, ○; *O. puberulum*, ●.

have subsequently been made near Rosh Pinah (Bruyns 2778, 8359, 8866) indicate that the species is more variable than was previously supposed and that the recognition of this subspecies is unwarranted.

Typical *Ornithogalum puberulum* from southern Namibia is characterized by a rather corymbose inflorescence with up to 15 flowers. Populations of vegetatively similar plants from near Lekkering in the Richtersveld (Oliver, Tölken & Venter 776; Thompson & Le Roux 85), however, have elongate, cylindrical inflorescences with up to 25 flowers, giving them a very different appearance. These plants were associated with *O. puberulum* without comment by Müller-Doblies & Müller-Doblies (1996). Although a similar range in inflorescence form is shown by other species in the group, including *O. prinosum*, the status of these populations requires further investigation.

The characteristic leaves of *Ornithogalum puberulum*, clasping at the base and with long-ciliate margins, have led to confusion with *O. hispidum* in the herbarium. The latter species, a member of section *Hispidaspasia*, is readily distinguished by its small bracts, and narrow raceme of smaller flowers with filiform filaments.

History: *Ornithogalum puberulum* was described by Obermeyer (1978) from plants collected fifteen years earlier in southern Namibia. *Ornithogalum merxmuel-leri*, described the following year by Roessler (1979) from fruiting material collected in the same area of southern Namibia, does not appear to differ in any significant way and was synonymized under *O. puberulum* by Müller-Doblies & Müller-Doblies (1996).

At the same time, Müller-Doblies & Müller-Doblies (1996) described *O. puberulum* subsp. *chris-bayeri* from plants that they had collected near Rosh Pinah in southern Namibia, distinguishing it by the shorter cilia on the leaf margins, hairy bracts, and yellow-spotted filaments and short style. These differences are, however, not significant in the light of more recent collections. We owe

much of our knowledge of the species to the recent collections made by the Cape Town succulent specialist, P.V. Bruyns.

Excluded species

1. *Ornithogalum baurii* Baker in Flora capensis 6: 504 (1897). Type: South Africa, Eastern Cape [Transkei], Baziya Mountain, 4000' [1 220 m], November without year, Baur 552 (K, holo.!, SAM, iso.!).

O. hygrophilum Hilliard & B.L.Burt: 195 (1988). Type: Eastern Cape [Transkei], NW of Umtata, hill above Mhlahlane Forest Station, 10 December 1985, Hilliard & Burt 19768 (E, holo.; K!, NU, PRE, iso.).

2. *Ornithogalum diphyllum* Baker in Kew Bulletin 1895: 153 (1895). Type: South Africa, [KwaZulu-Natal], Ntabamhlope Mountain, Evans 374 (K, holo.!, PRE-photo.!).

3. *Ornithogalum sephtonii* Hilliard & B.L.Burt in Notes from the Royal Botanic Garden Edinburgh 41: 308 (1983). Type: South Africa, Eastern Cape, Barkly East Dist., Ben Mcdhui, ± 8100' [± 2 466 m], 3 December 1981, Hilliard & Burt 14665 (E, holo.; NU, iso.).

These three taxa comprise a group of poorly understood species known from isolated localities along the mountains of the Eastern Cape and KwaZulu-Natal. They are all small or dwarf plants with two or three leaves and subcorymbose racemes of pure white flowers subtended by foliar bracts. The seeds of *Ornithogalum diphyllum* are club-shaped and echinulate (Obermeyer 1978) and those of *O. sephtonii* tetragonal and reticulate (Hilliard & Burt 1983). In the light of this, Obermeyer (1978) and Müller-Doblies & Müller-Doblies (1996) had little hesitation in associating this group of species with section *Aspasia* from the Western and Eastern Cape, despite the obvious anomaly in their distribution. They were interpreted by Obermeyer (1978) and others as isolated montane relics of the Cape section *Aspasia*.

At the same time Obermeyer (1978) included *O. baurii* and *O. synanthifolium*, both of which had been collected by Baur at Baziya in Eastern Cape, in a broadly circumscribed *O. conicum*. There is little doubt, however, that *O. baurii* and *O. synanthifolium* are distinct species (see Discussion under the latter), an opinion that was first aired by Hilliard & Burt (1988, 1989). What is not as evident, however, is where the affinities of *O. baurii*, *O. diphyllum* and *O. sephtonii* lie. While there is certainly a superficial similarity in vegetative and floral morphology between these three species and those of section *Aspasia*, particularly in their foliar bracts and moderate-sized, white flowers, and while the seeds of *O. diphyllum* at least have some resemblance to those of other species in the section, the capsules of this group are not at all like those that characterize section *Aspasia*. All three species have distinctly turbinate, 3-angled capsules that are exposed by the reflexing of the tepals. Such capsules are anomalous in section *Aspasia*, which is characterized by ellipsoid or ovoid, obscurely angled capsules that are concealed by the persistent, papery perianth. On this basis alone the three species of the *O. baurii* group should be excluded from section *Aspasia*.

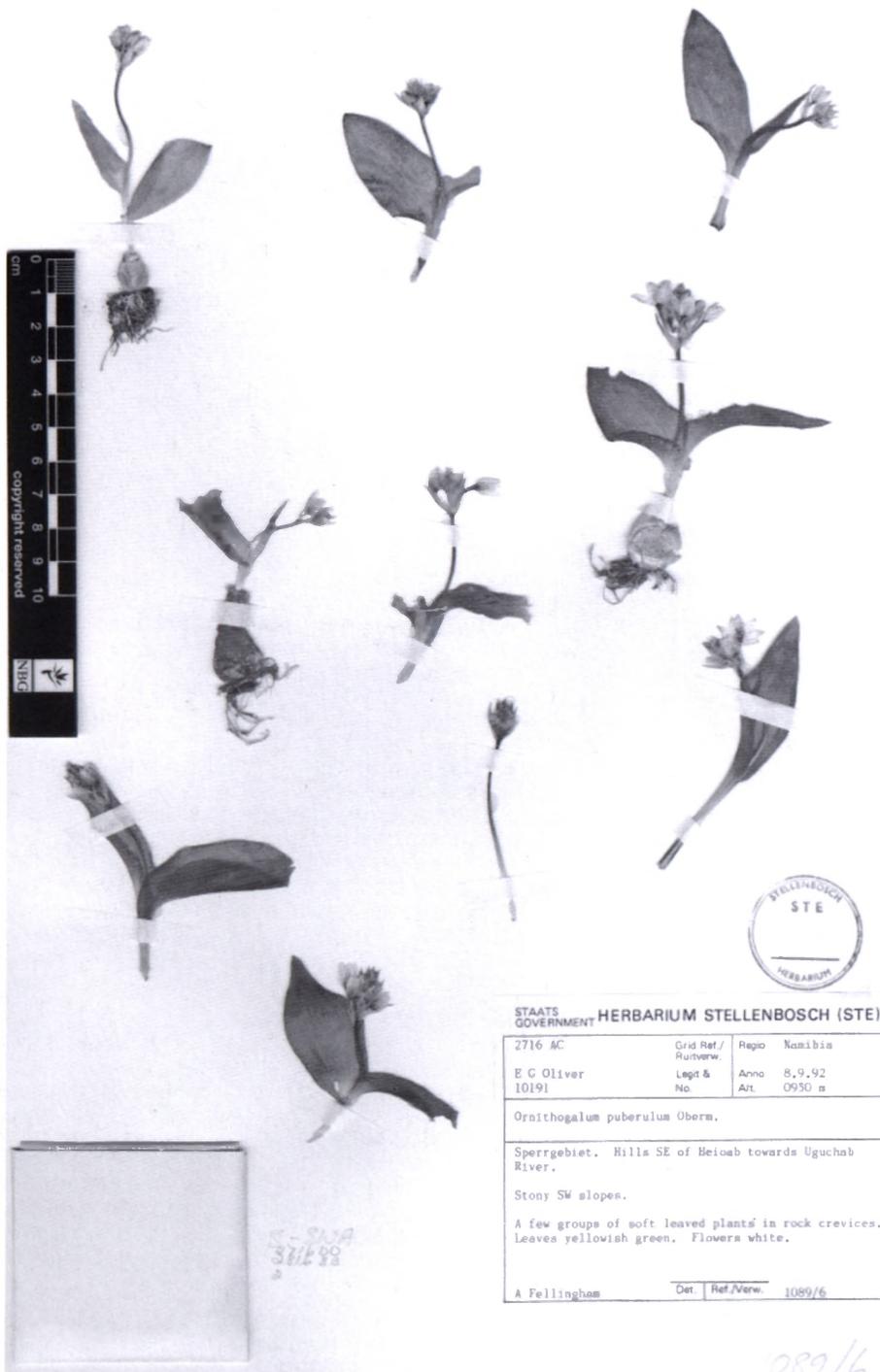


FIGURE 22.—*Ornithogalum puberulum* Oberm.

Support for this interpretation is provided by DNA sequence data (Manning *et al.* in prep.), which places *O. septonii* among the residue of species previously grouped within subgenus *Urophyllon*, where such turbinate capsules are common, and not among the species of subgenus *Aspasia*. We accordingly exclude these three species from section *Aspasia*. The differences between them are relatively minor and further study is likely to reduce the number of taxa.

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OTHER SPECIMENS EXAMINED

Acocks 14767 (8) K. *Andreae* 177, 764 NBG. *Axelson* 105, 359 (5) NBG.

Barker 9738 (1) NBG; 1916 (2) NBG; 295, 4766, 9478, 9796, 10330 (4) NBG; 1919 (5) BOL, NBG; 1917, 1923, 1935, 2570, 2606, 2646, 3332, 4198, 4858, 10534, 10801 (5) NBG; *BOL22845* (6) BOL; 87 (7) BOL, K; *BOL27865* (7) BOL; 292, 1576, 1922, 2406, 2581, 4259, 4266, 4898, 5347, 6035, 6814, 6859, 6879, 6994, 7292, 7579, 7605, 9106, 9135, 9585 (7) NBG; 1928, 5705, 7323, 7324, 7415, 9486, 9503 (8) NBG; 294, 1921, 1925, 2656, 2662, 3069, 4758, 6574, 7446, 9194, 10752 (9) NBG; 1079, 1932, 1933, 6761, 9024, 10310, 10763 (10) NBG. *Batten* 2.100.82 (2) NBG; 91 (7) NBG. *Baur* 508 (2) K, SAM. *Bayer* 3629 (7) NBG. *Bayliss* 6164 (7) NBG; 736 (9) NBG; 275, 276 (10) NBG. *Bohnen* 4733, 7052, 7536, 7537, 7966, 8732 (7) NBG. *Bolus* 4350 (5) BOL; *NBG73561* (5) BOL, NBG; 8696, *BOL410/33* (7) BOL; 1256/32 (7) NBG; 20349 (7) BOL, K; 6597 (8) BOL; 4346 (9) K; *BOL12892*, *BOL13065* (10) BOL. *Bond* 183 (3) BOL, NBG; *BOL22801* (3) BOL; 522 (5) NBG; 733 (7) NBG; 548 (9) NBG. *Botha* (3)109 (7) NBG. *Boucher* 2617 (5) K, NBG; 4117, 6361, 6476, 6477 (5) NBG; 2699, 3024 (7) NBG; 3136 (8) NBG; 2838, 6562 (9) NBG; 3338, 4717, 5687 (10) NBG. *Browne* *NBG123/37* (7) NBG. *Brownlee* *BOL* 22175, *BOL22714* (7) BOL. *Bruyns* 1848 (7) NBG; 9218 (10) NBG; 2771, 2778, 8359, 8866 (12) NBG. *Buhr* *STE119639* (9) NBG. *Burchell* 6198 (7) K. *Burgers* 1279, 1390 (7) NBG. *Buyts* 481 (7) NBG.

Cassidy 127 (1) BOL, NBG. *Compton* 12546, 16589 (1) NBG; 17769 (2) NBG; 3171/34, 9514, 11781, 12335, 15259, 15260, 15261, 15263, 16374, 18815 (5) NBG; 12082 (6) BOL, NBG; 3587, 9623, 9738, 9967, 11680, 12151, 12457, 12772, 13945, 15238, 16388, 16491, 16742, 16885, 17861, 18718, 18982, 21151, 21681, 21732, 22232, 23179, *NBG24/34*, *NBG261/44* (7) NBG; 5251, *BOL55470*, *NBG139/45* (7) BOL; 12058 (7) BOL, NBG; 22072 (8) NBG; 3565, 9571, 9692, 11700, 14846, 16138, 20839, 20876, 24200, 24302 (9) NBG; *BOL1528* (10) BOL; 3585, 14848 (10) BOL, NBG; 9288, 9611, 11773, 11891, 16301 (10) NBG. *Compton et al.* 2011/36 (4) NBG. *Cook* *BOL1766/25* (7) BOL. *Cowling* 1906, 1907A (7) NBG. *Craven* 179 (5) NBG. *Cross* 71, 72 (5) NBG. *Cruz* 98 (9) NBG.

Davison 32 (7) SAM. *De Villiers* 949/62 (7) NBG. *De Vos* 154 (5) NBG. *Desmet* 361 (8) NBG; 1941 (10) NBG; 3063 (11) NBG. *Dobay* 81 (7) NBG. *Drège* 1512, 2662 (10) K. *Du Plessis* 58, 59 (7) NBG.

Ebersohn 370 (5) NBG. *Ecklon* 569 (1) K. *Edwards* 93/29 (7) NBG. *Emdon* 174, 253 (7) NBG. *Esterhuysen* 11497 (1) BOL; 1433 (5) BOL; 71402 (5) NBG; 1771, 4390, 7278, 9317, 9392, 11207, 11280, 18327, *BOL7/42* (7) BOL; 2941, *NBG73514*, *NBG73568* (7) NBG; 3781, 14957 (7) BOL, NBG; 4384, 22100 (10) BOL.

Fellingham 474 (5) NBG; 1089/5 (7) NBG; 176 (9) NBG. *Flanagan* 788 (2) BOL; 2238 (7) BOL, K. *Forrester* 102, 931 (7) NBG. *Fourcade* 512 4175 (7) BOL, K, NBG; 5159A, 5866 (7) BOL.

Galpin 312 (2) K; 311 (7) K. *Germishuizen* 4063, 4156 (7) NBG. *Gillett* 1914, 4289 (7) BOL; 3384 (7) NBG; 380 (9) NBG. *Glass* 380 (2) NBG; 379, 381 (7) NBG. *Goatcher* *BOL13726* (6) BOL, K. *Goldblatt, Manning & Savolainen* 11526 (8) NBG. *Goulimis* *BOL22775* (1) BOL; *BOL22809* (7) BOL. *Grobler* 491 (7) NBG. *Guthrie* 2390, 2768 (7) NBG.

Hall 4542 (1) NBG; *NBG88092* (3) NBG; 3110 (4) K, NBG; 272, 1504, 4511, *NBG73519* (7) NBG; 325, 833, 4929 (8) NBG; 958, *NBG68697* (9) NBG; 475/52, 4930, 5195, 5217, *NBG73664* (10) NBG; 5062 (10) K, NBG. *Hanekom* 2616 (5) K, NBG; 3108 (5) NBG. *Harrower* 3001 (7) NBG. *Heathie* *BOL3710* (6) BOL. *Heese*

STE10173 (7) NBG. Heginbotham 164 (7) NBG; 43 (9) NBG. Herre BOL3966 (4) BOL; STE1235-4, STE17465 (8) NBG; STE17458, STE19638 (10) NBG. Hiemstra 470 (8) NBG. Hilton-Taylor 1990, 2036 (7) NBG; 1991 (9) NBG. Horrocks 12, 29 (9) NBG. Hugo 2061 (7) K, NBG; 2915 (8) NBG. Hurling NBG73531 (7) NBG. Hutchinson 1116 (7) BOL, K; 767 (10) BOL, K.

IBSA NBG207216 (3) NBG. Isaac 7234 (10) BOL.

James 134044, 233844, BOL 3277/32 (7) BOL. Jones STE30397 (7) NBG. Jordan STE25508 (5) NBG. Joubert (e) (7) NBG; (c.) (9) NBG.

Kellerman 11 (9) NBG. Kemper IPC740 (7) NBG. Kensit BOL22843 (7) BOL. Kerfoot 5907 (9) NBG. Kolbe BOL14312 (8) BOL. Kruger 44 (5) NBG. Kurzweil 1271 (5) NBG.

Lamb BOL1644/30 (4) BOL; BOL1619/30 (7) BOL. Laughton NBG22685 (7) NBG. Lavis BOL22152 (5) BOL; BOL22831 (7) BOL. Le Roux 2837 (5) NBG; 2505 (8) NBG; 2781A (8) BOL. Le Roux & Ramsey 326 (10) NBG. Lechmere-Oertel 355 (9) NBG. Leighton 175 (1) BOL; 1495/33 (4) NBG; BOL1492/33 (4) BOL; 135, 137 (5) K, NBG; 138, 163, 164, 170, 189, 195, 196 (5) NBG; 188 (5) BOL, NBG; BOL22700, BOL22701 (5) BOL; 134, 136, 1503/33 (7) NBG; 694, 717, 2200 (7) BOL; 275/45 (8) NBG; 3155 (8) BOL; 161, 655, 3159 (10) BOL; 1051 (10) BOL, NBG. Leipoldt 4374 (4) BOL; 4028 (8) BOL, NBG; BOL1048/36 (8) BOL; NBG73654 (8) NBG; 782 (9) NBG; 3357, 4090, 4379 (10) BOL. Levyns BOL1292 (4) BOL; 3470, 4795, BOL5763a, BOL7233 (7) BOL; 1776, BOL4631, BOL7232 (9) BOL; 11652, BOL7235 (10) BOL. Lewis 2185 (1) SAM; BOL22799 (4) BOL; 5070 (5) NBG; 5701 (7) NBG; BOL22088, BOL22853, NBG2696/32 (7) BOL; 279 (8) NBG; 1425, SAM55743, SAM62315, SAM62316 (8) SAM; 5899 (9) NBG; BOL22856, BOL22858 (10) BOL). Lombard s.n. (8) NBG. Louw 2689 (5) NBG. Low 8630 (9) NBG.

MacKinnon s.n. (7) NBG. MacOwan 2652 (1) K, SAM; 20 (2) BOL; 940 (5) BOL, K; 505, 1819 (7) BOL, K. Maguire 2004 (8) NBG; 238 (9) NBG. Malherbe STE30398 (7) NBG. Manning 2655 (4) NBG; 2654 (5) NBG; 2650 (7) NBG; 1036 (9) NBG. Manning & Martinez-Azorin 3 (4) NBG; 13, 63, 64, 83 (5) NBG; 1, 12 (6) NBG; 4, 5, 6, 8, 10, 60, 61, 62, 82 (7) NBG. Manning & Snijman 2722 (7) NBG. Marais 1 (1) NBG; BOL71519 (2) BOL. Marloth 11486 (5) NBG; 9572, 10781 (7) NBG; 12350, 12855 (8) NBG; 11497 (9) NBG; 11496 (10) NBG. Marsh 1043 (5) NBG; 462 (8) NBG; 479 (9) NBG; BOL1667/30 (9) BOL. Martin 836 (8) NBG; 69 (9) NBG. Martinez-Azorin 95 (4) NBG. Martley BOL22776, BOL22777 (1) BOL. Mathews BOL22704 (7) BOL; BOL27883 (9) BOL. Mauve & Hugo 19, 51 (5) NBG. Mauve, Reid & Wikner 91 (7) NBG. McDonald 1641 (7) NBG. Meyer STE9067 (9) NBG. Middlemost NBG73521 (7) NBG. Mitchell 1154 (10) NBG. Moffett 375, 451 (7) NBG. Montgomery 232 (5) NBG; 75 (7) NBG. Morley 230 (5) NBG; 325 (7) NBG. Morris BOL5805 (8) BOL, K. Mucina 080905/14 (11) NBG. Muir 1164, 4989 (7) NBG.

NBG Expedition 175/65 (4) NBG. Nieuwoudt s.n. (9) BOL, K. Nordenstam 2853 (10) NBG.

O'Callaghan 1303 (5) NBG. Oliver 3691, 5133 (5) NBG; 5179 (7) K, NBG; 4801, 5028, 5160, 5188, 5298, 5475, 5501, 9759 (7) NBG; 3868, 4024, 9567, 9711 (9) NBG; 10191 (12) NBG. Oliver, Tölken & Venter NBG169104 (8) NBG; 776 (12) NBG. Olivier 834, 874 (7) NBG. Orchard 323 (7) K, NBG.

Palmer 244 (7) NBG. Pappé SAM23321 (1) SAM. Paterson-Jones 663, 704 (5) NBG; 683, 719 (7) NBG. Peers BOL27889 (1) BOL; BOL27929 (5) BOL. Pegler 219 (2) BOL, K, SAM. Pells BOL22706 (7) BOL. Perry 3366 (3) NBG. Perry & Snijman 2423 (4) NBG. Phillips 1080 (7) BOL; 2084 (7) SAM; 7624 (7) NBG; 7543 (9) NBG. Pienaar 8 (2) NBG. Pillans 8370 (1) BOL; 8959, 9851 (5) BOL; 10890 (5) NBG; 8115 (7) BOL; 9566 (7) BOL, K, NBG; 4935, 5448 (8) BOL. Plowes NBG120374 (9) NBG. Pocock 467, 647 (7) NBG; 162 (9) NBG. Pond 117 (9) NBG. Pretorius 626 (4) NBG; 547 (7) NBG; 92 (9) NBG; 374 (10) NBG.

Rode & Boucher 0180 (5) NBG. Rogers 27540 (7) BOL, K; 28224 (6) BOL, K, SAM; BOL12941 (7) BOL; STE12770 (7) NBG. Rösch 273 (3) NBG; 664 (4) NBG. Ross-Frames 1241/26 (5) NBG; BOL1259/26 (8) BOL. Rouoc STE18987 (5) NBG. Rourke 617, 650 (7) NBG. Rycroft 2372, 2760, 3020 (7) NBG. Ryder 2272/30 (4) NBG; 3169/34 (7) NBG.

Salter BOL869/32 (1) BOL; 2755, 2805 (4) BOL, K; 590/32, 1213/33 (5) NBG; 4978 (5) BOL; BOL7816 (5) BOL, NBG; 2718 (7) BOL;

2779 (7) BOL, K; 2746, (10) BOL, K; 6226 (10) BOL. Schlechter 9131 (7) BOL; STE9011, STE10883 (8) NBG; 1421 (9) K; STE10882 (9) NBG; 11368, 11487 (10) BOL, K. Schonken 307 (7) NBG. Scott BOL2212/31 (7) BOL. Smith 6447 (4) NBG; 137, 2658 (5) NBG; 2659, 2869, 2870 (7) NBG; 6446 (8) NBG. Smuts s.n. (7) NBG. Snijman 376, 1370 (7) NBG; 1125 (9) NBG; 269, 1922 (10) NBG. Solomon 106 (5) NBG. Starke BOL17831 (9) BOL. Stayner NBG73547 (7) NBG. Steiner 2914, 3024 (7) NBG; 2917 (7) K, NBG. Stephens & Glover 8632 (9) K, NBG. Steyn 488 (9) NBG. Stobie 24, 38 (10) NBG. Stokoe 7605 (7) BOL; SAM63139, SAM64702 (7) SAM; SAM60648 (8) SAM. Story 4424 (4) K. Strauss 56 (8) NBG.

Taylor 3594, 4214 (2) NBG; 1202 (5) BOL; 3149/35, 4010 (5) NBG; 4325, 4348, 5171, 11137, 11887 (7) NBG; 3957, 5859, 5909, 10616, 11088 (9) NBG. Theron STE10181 (5) NBG. Thode STE6082 (5) NBG; 5460, A709, A1135, A2096, STE9494 (7) NBG. Thomas 27864 (7) BOL. Thompson 807 (9) NBG; 2894 (10) NBG. Thompson & Le Roux 224 (8) NBG; 105 (11) NBG; 85 (12) NBG. Thomson 2143, 3200, 3317, (7) NBG; 1288 (8) NBG; 303 (NBG) (9), 65, 2663 (10) NBG. Thorne SAM48847 (8) SAM. Thorns NBG73539 (7) NBG.

Van Berkel 445 (8) NBG; 259, 446 (9) NBG; 452 (10) NBG. Van der Merwe 278 (7) NBG; 246 (9) NBG. Van der Riet s.n. (5) NBG. Van der Westhuizen s.n. (10) NBG. Van Jaarsveld 8444 (8) NBG; 8189 (11) NBG. Van Niekerk s.n. (10) BOL. Van Rooyen, Steyn & de Villiers 497 (9) NBG. Van Wyk 344, 2059 (7) NBG. Van Zyl 2776/27 (5) NBG; 3101, 3150, 3191 (7) NBG; 3223, 3302, 3549 (9) NBG. Visser 44 (7) NBG. Viviers 3, 1176 (7) NBG; 1568 (9) BOL. Viviers & Vlok 45, 64 (7) NBG.

Wagener 208 (9) NBG. Walgate 328 (7) NBG; BOL22850 (7) BOL. Walters 2308 (5) NBG; 498, 1219, 1229, 1438, 1781, 2730 (7) NBG; 45 (10) NBG). Wasserfall 779 (1) NBG; 622, 792 (7). Wells 2804 (2) K. Werdermann & Oberdieck 1068 (2) K. Willems 81 (7) NBG. Williams 2913, 3343 (7) NBG. Williamson 3164 (8) BOL; 3795, 5451, 5453 (10) NBG. Williamson & Williamson 5825 (8) NBG. Wilman NBG405/37 (7) NBG. Winkler 152 (5) NBG. Wolfardt STE10788 (10) NBG. Woodvine 31 (7) NBG. Wurts 410, 417, 1204, 1584, 2266 (7) NBG.

Zeyher 5047 (1) BOL, K, NBG, SAM; 1065 (7) NBG. Zinn SAM62230 (7) SAM.

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