Bulbinella

in South Africa

Pauline L. Perry

STRELITZIA 8

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by

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STRELITZIA

This series has replaced *Memoirs of the Botanical Survey of South Africa* and *Annals of Kirstenbosch Botanic Gardens* which the NBI inherited from its predecessor organisations.

The genus *Strelitzia* occurs naturally in the eastern parts of southern Africa. It comprises three arborescent species, known as wild bananas, and two acaulescent species, known as crane flowers or bird-of-paradise flowers. The logo of the National Botanical Institute is based on the striking inflorescence of *Strelitzia reginae*, a native of the Eastern Cape and KwaZulu-Natal that has become a garden favourite worldwide. It symbolises the commitment of the National Botanical Institute to promote the sustainable use, conservation, appreciation and enjoyment of the exceptionally rich plant life of South Africa, for the benefit of all its people.

Cover design by Sandra Turck,
incorporating drawings by Jeanette Loedolff

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The author

Pauline Lesley Perry was born in London in 1927. She trained as a horticulturist at Wye College, University of London, graduating with a B.Sc. in horticulture. After teaching in Britain, she came to South Africa in 1972. In 1976 she joined the National Botanic Gardens of South Africa as a horticulturist, stationed at the Karoo Garden in Worcester where she specialised in geophytes from the winter-rainfall region of the Cape, especially Namaqualand. Combining horticultural and taxonomic interests, Pauline built up outstanding collections of geophytes, especially *Bulbinella* and *Eriospermum* from which phenologically complete sets of herbarium specimens were prepared. A 320-page monograph of the difficult genus *Eriospermum* resulted from these studies: A revision of the genus *Eriospermum* (Eriospermaceae) in *Contributions from the Bolus Herbarium*, No. 17, October 1994. After transferring from the Karoo Garden to the Compton Herbarium in October 1982, Pauline was occupied largely with taxonomic research until her retirement in 1989.

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Pauline L. Perry
September 1999

Abstract

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Bulbinella Kunth is a comparatively small genus of the family Asphodelaceae or Liliaceae *sensu lato*, with distributions in the Northern, Western and Eastern Cape Provinces of South Africa, and in the main islands comprising New Zealand. A revision is provided of Baker's 1896 systematic treatment of the genus in *Flora capensis*. The data sources for the revision include a detailed morphological study based on living material, seedling development, leaf anatomy, geographical distribution and ecology. Previous work on breeding biology is reviewed. For the taxonomic treatment, existing type material as well as herbarium material from the main collections in South Africa and Europe was examined. Of the 21 names originally referred to the genus, as enumerated in *Index kewensis*, seven had previously been transferred to other genera, six have been placed in synonymy, and eight have been upheld. One variety was raised to specific rank. Eight new species and two new varieties were described by the present author in 1987. One new species and two new subspecies are described and four varieties are raised to subspecies.

NEW TAXA AND NEW STATUSES
PUBLISHED IN *STRELITZIA* 8 (1999)

Bulbinella latifolia *Kunth* subsp. **denticulata** *P.L.Perry*, subsp. nov., p. 28
Bulbinella latifolia *Kunth* subsp. **doleritica** (*P.L.Perry*) *P.L.Perry*, stat. nov., p. 28
Bulbinella latifolia *Kunth* subsp. **toximontana** *P.L.Perry*, subsp. nov., p. 31
Bulbinella nutans *(Thunb.) T.Durand & Schinz* subsp. **turfosicola** *(P.L.Perry) P.L.Perry*, stat. nov., p. 23
Bulbinella potbergensis *P.L.Perry*, sp. nov., p. 36

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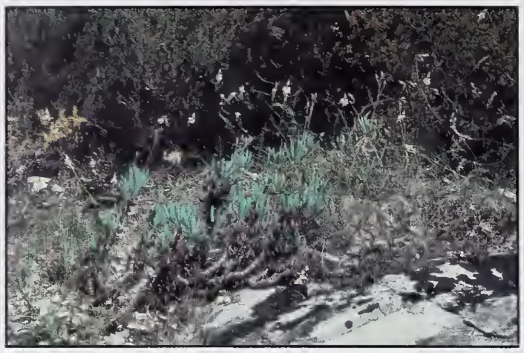

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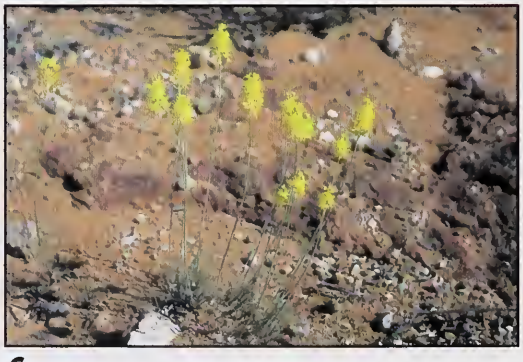

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***Bulbinella* in habitat**: 1. *B. nutans* subsp. *nutans*, Worcester Commonage, Western Cape; 2. *B. latifolia* subsp. *doleritica*, Nieuwoudtville, Northern Cape; 3. *B. elata*, Witteklip, Western Cape; 4. *B. trinervis*, Vogelgat, Western Cape; 5. *B. divaginata*, Nieuwoudtville, Northern Cape; 6. *B. nana*, Ratelpoort, Northern Cape. Photographs by Colin Paterson-Jones (1–3, 5), Pauline Perry (4) and Graham Williamson (6).

Introduction

Bulbinella Kunth is a small to moderate-sized genus of the family Asphodelaceae or Liliaceae *sensu lato*. The genus has two widely disjunct centres of distribution: one in the winter-rainfall region of the Western Cape of South Africa and the other in New Zealand. Within its distribution range in the Cape the genus is widespread and several species are comparatively common, often found in large stands in damp vleis or seepage areas.

A revision of the New Zealand members of *Bulbinella* was undertaken by Moore (1964) who described six species, one with two varieties. Two of the species and one variety had not previously been described. A preliminary investigation into the history and nomenclature of the genus by the present author revealed that systematic studies in South Africa were incomplete. No new species had been described this century and all published work prior to that had been carried out on herbarium material or in the case of one new species, the description was made from plants cultivated in Europe. Many of the early herbarium specimens lacked root systems and sheaths, both of which show important diagnostic characters. Descriptions were largely based on flower structure, which shows very little variation between the different species. Identifications were therefore frequently unreliable.

Prior to 1987, only four species of *Bulbinella* were recognised in South Africa (Gibbs Russell *et al.* 1985). However, *Bulbinella* names for South African species extracted from volumes of *Index kewensis* up to 1900, totalled 21. Of these, two have since been placed in *Ornithogalum* L., four in *Trachyandra* Kunth and one has been identified as *Caesia contorta* (L.f.) T.Durand & Schinz. With these taxa removed, 14 *Bulbinella* names remained. Various placings were given to these remnant names by authors such as Kunth (1843), Baker (1872, 1876, 1896) and Durand & Schinz (1894). In the present work seven are shown to be synonyms, superfluous or illegitimate names and seven are retained. The latter, together with one variety raised to specific rank, nine new species and six new subspecies form the 17 species and six subspecies are recognised here.

The genus has little known economic value. However, the fact that breeding research was initiated in the early 1960s (Horn 1962) indicated that the genus was considered to have potential for the cut-flower trade. In fact, in South Africa, the common yellow *Bulbinella* now identified as *B. nutans* var. *nutans* is popularly referred to as the 'Florist's Bulbinella'. Unfortunately, Horn's account is partly inaccurate, because of evident unreliable naming of taxa. It does, however, give some insight into breeding behaviour in the genus and more detailed research in this direction could be of considerable interest. Some species have more recently been used in gardens in climates not susceptible to hard frost.

Materials and methods

Extensive field studies on *Bulbinella* were carried out in the winter-rainfall area of South Africa from 1977 and intensively between 1984 and 1986. In addition to the preparation of herbarium material, in most cases live plants were brought back for cultivation at the Kirstenbosch and Karoo National Botanical Gardens. When seed was available, it was collected both for examination of structure and for germination to study stages of development. For one species only, *B. potbergensis*, it has not been possible to obtain seed.

Herbarium material was borrowed from the main herbaria in South Africa (BOL, NBG, PRE, SAM, STE) and also from the herbarium of the *Conservatoire et Jardin botaniques* in Geneva (G) and studied in detail. During an overseas visit it was possible to examine material in the chief British herbaria (the Royal Botanic Gardens in Kew, the British Museum and the Linnean Society of London—K, BM, LINN respectively) and in the herbarium of the *Muséum National d'Histoire Naturelle* in Paris (P). Specimens were sent from the herbarium of the *Botanischer Garten und Botanisches Museum* in Berlin (B) to Kew for study during this visit. It has also been possible to study high-quality colour prints of the Thunberg specimens at the Botanical Musuem of the Uppsala University (UPS) and a monochrome print of *Anthericum setosum* from the Willdenow Herbarium. Thus it has been possible to examine all existing type material for the names of South African species of *Bulbinella*.

Historical background

The genus *Bulbinella* was established by Kunth (1843) when he discarded the genus *Anthericum* L. and divided the taxa then known among the three genera *Phalangium* Mill., *Trachyandra* Kunth and *Bulbinella* Kunth.

The first bulbinellas to be described under the genus *Anthericum* were those published by the younger Linnaeus in 1781: *A. cauda-felis* from material collected by Thunberg without definite locality other than *Cap. Bon. Spei* and *A. triquetrum* collected by Sparrman, also with locality information limited to *Cap. Bon. Spei*. The types of these two names are housed in the Linnean Herbarium in London. Thunberg made three long journeys in the Cape in the spring and summer months of 1772, 1773 and 1774 (Gunn & Codd 1981). *Bulbinella cauda-felis* could have been collected on any of these trips. Sparrman arrived in the Cape in 1772 and botanised mainly in the vicinity of Cape Town where *B. triquetra* is known from a number of localities.

In 1794 Thunberg named another of his collections *Anthericum nutans*. The type in Uppsala has also been given the locality *Cap. Bon. Spei*. This species still occurs on the Tygerberg Hills near Cape Town and it could well have been the locality of Thunberg's specimen.

Prior to this, in 1789, Aiton described a plant from the Cape of Good Hope, collected by Masson and introduced in 1774. It flowered in cultivation at Kew and was named *Anthericum floribundum*. No type specimen for this name has been traced and it seems likely that the description was made from a living plant and that no herbarium material was prepared either at the time of collection or from the cultivated material. Since then, the epithet *floribundum* has been applied in a number of publications to a variety of different taxa. Kunth (1843) included it under his *Trachyandra* but with a question mark. In Baker's (1876) account of *Anthericum floribundum*, he quotes no Masson specimen but places it in subgenus *Chrysobactron* quoting *Drège 2667a*, the type of *Bulbinella latifolia*. Durand & Schinz (1894),

who validated the name *Bulbinella floribunda*, gave no reason for doing so but merely listed citations for *Anthericum floribundum* and included as a synonym *B. latifolia*, also quoting *Drège 2667a*. In *Flora capensis*, Baker (1896) dropped the epithet *floribundum* in favour of Kunth's *B. latifolia*.

Masson embarked on his second Cape journey in September 1773 in the company of Thunberg. To begin with, they headed north reaching the Saldanha and St Helena Bay areas towards the end of the month. At the foot of large granite boulders near Vredenburg, known as Witteklip, two species of *Bulbinella* may still be found. One, *B. cauda-felis*, would have been in flower when Masson and Thunberg were there. Thunberg's herbarium specimen of this species may have been made from this locality. The other species recently named as *B. elata* flowers earlier and would have been in seed at the time of Masson and Thunberg's visit. No herbarium material appears to have been made of this species but, as Masson was more interested in plants for cultivation, it seems likely that he collected seed and sent it to Kew where it was grown to flowering size. The flowering time of March and April would indicate the months of flowering at Kew.

In addition to a detailed generic account of *Bulbinella*, Kunth (1843) named 12 species, with a thirteenth in the addendum. For six of these he gave new names and detailed descriptions. The remaining seven came under the heading 'Species decidedly dubious to me', each with a question mark before the specific name. These were previously described species which Kunth possibly knew only from the brief descriptions previously given to them. One of the seven, *B. ?ornithogaloides* Kunth, has been identified by Obermeyer (1967) as an *Ornithogalum*. Another, *B. ?capillaris* Kunth, originally named *Phalangium capillare* by Poiret (1804), is clearly a *Bulbinella*, judging from the type specimen in the Lamarck Herbarium in Paris.

The remaining five species had previously been placed in *Anthericum* by Linnaeus the younger and Thunberg. Of these, three have been identified by Obermeyer (1962, 1967) as species of *Trachyandra*. The other two clearly fall under *Bulbinella*: *B. ?caudata* (Thunb.) Kunth and *B. ?triquetra* (L.f.) Kunth.

Two years after Kunth had erected the genus *Bulbinella*, J.D. Hooker (1845), in his *Flora antarctica*, described plants he collected from islands to the south of New Zealand under a new genus *Chrysobactron*. Subsequently, a second species of *Chrysobactron* from New Zealand was described. In his *Handbook of the New Zealand flora*, J.D. Hooker (1864) placed both species in *Anthericum*.

In 1876 Baker returned Kunth's *Phalangium*, *Bulbinella* and *Trachyandra* to *Anthericum*. Included among his subgenera of *Anthericum* were *Bulbinella*, with descriptions of nine South African species, and *Chrysobactron*, with two South African species (*A. carnosum* and *A. floribundum*) added to the two New Zealand species. Later, in his account for the *Flora capensis*, Baker (1896) reinstated the genus *Bulbinella*, with descriptions of eight species and three varieties.

Apart from the description of one new species, *Bulbinella punctulata*, by Zahlbruckner (1900), no further work had been published on the South Africa species of *Bulbinella* until 1987 when eight new species and two varieties were described by the present author (Perry 1987). In a revision of the New Zealand species Moore (1964) states that 'no clear reasons have emerged for dissociating the New Zealand plants from *Bulbinella*'.

Family and generic relationships of Bulbinella

Bulbinella has long been regarded as a member of the large and heterogeneous family Liliaceae of the order Liliales. Liliaceae *sensu lato* is one of the largest families of flowering plants, with approximately 250 genera and 3 700 species worldwide (Willis 1973). Recent research into affinities of the numerous genera in this unwieldy family has resulted in several modern classifications. The most recent and detailed works, those of Dahlgren & Clifford (1982) and Dahlgren, Clifford & Yeo (1985), give an integrated and comparative account of the monocotyledons. The classification presented in these works combines 11 orders in a superorder Liliiflorae. Among the orders are Asparagales and Liliales. The division of the former Liliales into the two orders Asparagales and Liliales was first introduced by Huber (1969). This was based on a number of differences such as seed characters, endosperm formation, and nectaries (Dahlgren & Clifford 1982). Families placed under Asparagales included Asphodelaceae, with the three subfamilies Astelioideae, Asphodeloideae and Anthericoideae (Dahlgren & Clifford 1982). In a more recent publication (Dahlgren *et al.* 1985), Asteliaceae and Anthericaceae are treated as families whereas Asphodelaceae is divided into the subfamilies Asphodeloideae and Alooideae. Asphodelaceae subfamily Asphodeloideae is a small homogeneous grouping consisting of the eight genera *Asphodelus* L., *Asphodeline* Rchb., *Bulbine* Wolf, *Bulbinella* Kunth, *Eremurus* M.Bieb., *Jodrellia* Baijnath, *Kniphofia* Moench and *Trachyandra* Kunth. Of these, *Asphodelus*, *Asphodeline* and *Eremurus* are northern hemisphere genera distributed in Europe and Asia, whereas *Bulbine*, *Bulbinella, Kniphofia* and *Trachyandra* are centred in South Africa. *Kniphofia*, *Bulbine* and *Trachyandra* each have a few representatives in tropical Africa and *Bulbine* has a second centre in Australia. *Bulbinella* has a second and smaller centre in New Zealand. *Jodrellia* is a recently described genus from central Africa closely related to *Bulbine*.

General morphology

All *Bulbinella* species are deciduous geophytes ranging in height above ground from about 0.2–1.2 m. The underground stem is a compact corm-like structure with an apical shoot surrounded by membranous or fibrous sheaths extended to form a neck. Numerous swollen roots arise basally and laterally from the stem. A new stem disc and swollen roots are formed annually towards the end of the growing season. Plants remain largely dormant through the dry summer.

Roots

A dense fascicle of some 10–100 roots emerges from the base of the condensed stem, in most cases penetrating through a thick mat of fibres surrounding the stem and leaf bases. As the roots perform the function of food storage and assist in perennation for the plant, they become swollen or tuberous for part of their length. In some species such as *Bulbinella chartacea* and *B. divaginata* the roots are fusiform with a swollen region proximal to the stem, gradually tapering to a thinner absorptive portion at the ends. In other species, for example *B. cauda-felis* and *B. elegans*, the tuberous part is frequently terminal and forms about one-third of the length of the root, with a narrow basal part. Sometimes, as in *B. triquetra*, swollen regions may be seen in both positions, but the proximal ones may only be a preliminary growth phase. In a third group, including *B. nutans*, the roots are thickened more or less evenly for the whole length of 300 mm or more. These roots are orange but are interspersed with many greyish brown remains of roots in which food stores have been used up.

Three stages in root growth, covering three seasons, may clearly be seen towards the end of the growth period. The newly forming swollen roots arise on the upper part of the sheath; they are light in colour and may appear woolly from a dense covering of root hairs. The previous season's swollen roots become darker-skinned and numerous thin flexuose laterals arise from them. In between are the remaining empty skins of roots from the year before in which food stores have been used up. Rudimentary swollen roots sometimes grow erectly on the inside of the leaf base where they are protected in the early stages of growth.

Stem

This is reduced to a small, solid subglobose structure resembling a miniature corm, at most 10 mm across. It appears to last for one year only and at the end of the growing season a new stem is formed on top of the old one. This leaves the old stem disintegrating and forming a spongy mass underneath. A bud on the upper part of the stem develops into the new aerial part of the plant. Sometimes a lateral bud may develop, the plant gradually forming a clump.

Fibrous sheathing neck

When the foliage leaves die at the end of the growing season, the basal vascular strands remain and gradually become hardened, forming a brown, fibrous or bristle-like neck, which makes a tough protective cover for young roots and shoots. These layers remain for a number of years and possibly protect the delicate primordia and stem from desiccation during dormancy in the dry summer season and from being eaten by animals.

These sheaths present a useful diagnostic character as their nature appears to be constant within a species—they may be tough, straight and bristle-like or fine, soft and reticulate, for example. The greatest part of the fibrous sheaths is hidden below ground and is frequently missing, together with the roots, from herbarium specimens.

Zahlbruckner (1900), in his description of *Bulbinella punctulata*, noted that the sheaths were 'basally purple-violet dyed'. A similar purple stain has been observed in other species, in particular *B. cauda-felis* and *B. graminifolia*. Although it is a character seldom discernible on herbarium specimens, from a study of living collections it appears to be confined to a few species and could therefore have some diagnostic significance.

Leaves

Leaves are produced annually, dying down at the end of the growing season. Few to several erect, linear leaves arise directly from the upper side of the reduced stem. In the more narrow-leaved species, leaves tend to be of a similar length and width, whereas in the broader-leaved species there is a range in size, the outermost leaf usually short, the second and third leaves the longest and broadest, and the innermost each in turn becoming shorter and narrower. In the latter group, the broader leaves are normally canaliculate and the inner leaves are sometimes more semiterete.

The bases of the leaves and peduncle are held together by a hyaline sheath formed in one of two ways that are characteristic of the species. The leaf bases themselves may be expanded to form membranous wings, which completely encircle the peduncle and other leaf bases. Sometimes all the leaves of the plant are basally sheathing or only the outer bases are completely encircling and the inner leaves have wing extensions, which become gradually smaller towards the inside. In other species, a completely separate tubular membrane is formed and the bases of foliage leaves are not sheathing. The term cataphyll is applied to these sheaths.

Glabrous leaves are the most common but very occasionally leaves may be sparsely and irregularly covered with fine, longish hairs. More frequently the margins of leaves produce irregularly spaced, tiny, transparent teeth giving a rough feel to the sides of the leaf. This is found mainly in the narrower semiterete leaves, but the degree of denticulation does not always appear constant within a species. A degree of succulence is found in some species, in particular in *Bulbinella gracilis* with its fleshy, terete leaves and in *B. nutans* and *B. latifolia* (and their subspecies).

Inflorescence

The simple, unbranched and dense raceme is situated at the end of a comparatively long, erect peduncle. Some variations in size and shape due to the varying numbers of flowers and length of pedicels may be observed and are of some value in identification. The peduncle is always terete and naked. Normally only one scape appears to be produced per plant each season, but in cultivation with plentiful watering two or three inflorescences have been seen per plant in some species and this may be normal in the wild in good seasons. The 50–500 flowers are frequently tightly packed and mature progressively up the inflorescence. In a very floriferous raceme buds, flowers and fruits may be observed at the same time. Buds are held erect and close to the rachis, but pedicels become spreading in the flower stage so that the open flowers face outwards. As the fruit develops in most species, the pedicel returns to the more erect position so that the capsule is held upright. *Bulbinella gracilis* and *B. nana* are exceptions in which the pedicels remain patent.

Bracts

Some variation in size and shape of bracts occurs in different species, presenting a possible character for identification in the reproductive stage. The smallest bracts, about 1 mm long, occur in *Bulbinella gracilis* and the longest, up to 12 mm long, in *B. nutans* and *B. cauda-felis* in which the attenuate apex is very conspicuous in the bud stage. In species such as *B. trinervis*, the distinctive truncate bract appears to be quite consistent in all collections and is therefore a useful character for identification purposes. In other species such as *B. triquetra*, the length of the attenuate apex and therefore the length of the whole bract is very erratic and consequently a poor character for identification. No distributional clines have been observed in this variation. In several species such as *B. gracilis*, *B. divaginata* and *B. nutans*, the margin of the bract is entire, but in others it is variously and irregularly serrate.

Pedicels

Each bract supports only one pedicel and pedicels are articulated only with the tepals. If a flower is not fertilised, it normally falls off completely at the apex of the pedicel. Pedicels vary in length from 5–25 mm. They are always very narrowly terete and in flower the colour is similar to that of the tepals, later turning green as the fruits develop.

Flowers

Species differences in flowers are largely limited to colour and a slight range in size. The perianth in all species has an open stellate shape, the six tepals joined at the extreme base. The six stamens are joined to the base of the tepals and regularly arranged, half spreading and central to each tepal. The superior ovary is centrally placed between tepals and stamens with the style extending erectly. Size of flowers ranges from 8–13 mm in diameter, but this

variation may be seen within one species depending on the prevailing growing conditions. The tepals and other flower parts are most commonly yellow, but white tepals with a pale pink midrib and pink buds are also frequent. Cream-coloured flowers with brownish or greenish buds and, more rarely, orange flowers are also found. Although most species have flowers of one colour only, in a few such as *Bulbinella elegans* and *B. nutans*, two or more different colour forms occur. The colour forms apparently have distinctive allopatric distribution ranges. Mixed populations of different colour forms have not been observed. Tepals are equal to subequal in size and shape and are commonly elliptic. The greatest length the tepals reach is 6 mm. Tepals frequently have a glittering appearance caused by large, turgid epidermal cells. Both sets of tepals are single-veined. The vein usually shows up clearly, either as a slight variation in colour, such as pale pink on white, or as a distinct thickened area.

Androecium

The six stamens show very little variation, always being adnate to the base of the tepals and held in an equidistant erecto-patent position around the ovary. Filaments are glabrous, narrowly subulate or filiform and about two-thirds the length of the tepals. The filaments are usually the same colour as the tepals. The anthers are small, subrotund, dorsifixed and versatile.

Gynoecium

The trilocular ovary is very characteristic of the genus, always containing two ovules lying side by side lengthways. The ovary wall is normally green, sometimes with a reddish brown tinge. The ovary is globose to ovoid but the small size of 1–1.5 mm makes clear definition of shape difficult. The style is narrowly terete and erect; the stigma is apical, minutely papillate and of the dry type (Dahlgren & Clifford 1982), i.e. without copious fluid secretion.

Fruit

The fruit is a dry subglobose or ovoid capsule, brittle or more papery and loculicidally dehiscent. Length varies around 4–7 mm in the different species and shape may be more or less globose or distinctly ovoid, according to species. The texture and colour of the outer walls may be of taxonomic significance. The fruit may be chestnut-brown, quite thick and brittle in some species such as *Bulbinella nutans*, or a light fawn colour, more papery thin and not so freely dehiscent in other species such as *B. cauda-felis*. Tepals are persistent, usually fitting closely around the capsule, but sometimes becoming more shrivelled and pendent. In all South African species the capsule is clearly sessile. After a few days, unfertilised flowers wither and fall off completely from the apex of the pedicel.

Seed

The three or six seeds lie collaterally and are shaped to fit neatly into the capsule, the outer edge being rounded and the two inner edges straight. Seeds are thus three-angled. Each seed may form a sixth or a third sector of a circle, depending on whether both seeds or only one seed in the locule develops. The shape is very similar in the different species but length may vary from 1.5–7 mm. The surface is slightly rugose and the colour may be mat black or greyish black. A membranous extension formed from an extra covering layer which is easily removed, leaving the black testa, is obvious in some taxa and the width of the wing-like extension could be diagnostic. Although the covering is usually dark brown to greyish black, it is yellowish orange in *Bulbinella divaginata*.

Vegetative reproduction

This does not appear to be an important method of reproduction. In several species lateral buds develop, older specimens eventually consisting of a cluster of up to seven loosely attached complete plants each with roots, leaves and inflorescence. It is not clear whether clumps later form separate plants. Species in which clump formation is most commonly found are *Bulbinella nutans, B. caudafelis* and *B. triquetra.*

Seedling development

Germination is of the hypogeal type in which the cotyledon does not become green. It forms a tubular elongation of the cotyledonary sheath referred to as a coleoptile. The primary leaf appears through the coleoptile. In some species of *Bulbinella* the coleoptile appears to be very short, whereas in others it becomes elongated. Coleoptile length may be correlated with the formation of separate cataphylls as opposed to leaf bases. The hyperphyll forms a haustorium or sucker which is surrounded by the seed coat.

After two to three months, the primary root is replaced by shoot-borne roots and at about the same time two or three foliage leaves may have appeared. The outer foliage leaf may have a clearly developed sheathing base. By the end of the first growing season swollen roots have developed and the first layer of sheathing fibres is clearly visible.

Pollination biology

Pollination has been observed in plants in cultivation, especially in the orange-flowered *Bulbinella latifolia* subsp. *doleritica*—by honey-bees which visit flowers on sunny days for pollen. No nectar has been found in any member of the genus. A variety of crawling insects which visit the inflorescences could also be responsible for pollination. Scent may be connected with pollination in some species that produce a distinctive, somewhat unpleasant, musty odour. This is particularly noticeable in *B. eburniflora* and *B. barkerae*. Although a similar somewhat musty odour has been noticed in some collections of some other species, it was not possible to detect any odour in most collections. The scent also appears somewhat ephemeral and may be connected with time of day or stage of development.

Blue scarab beetles and striped black-and-yellow beetles have been seen in considerable numbers on several occasions on *Bulbinella eburniflora*. Although they were observed to have been eating the flowers, it is possible that they were also effective in pollination. Faegri & Van der Pijl (1979) describe beetle-pollinated flowers as having few visual attractions, with no special shape, being generally large and flat or shallowly bowl-shaped, and with dull colours, frequently greenish or off-white, a strong fruity or aminoid odour, easily accessible pollen and exposed sexual organs. These features are exhibited by many species of *Bulbinella*, especially *B. eburniflora* with ivory-coloured flowers and *B. barkerae* with off-white flowers.

Geographical distribution and ecology

Bulbinella is essentially a genus of cold or cool, wet habitats. In New Zealand it is found in the southerly parts of North Island and the islands to the south where plants are summer-growing with flowers produced from December to March.

In South Africa *Bulbinella* is confined to the winter-rainfall area of the Cape where it is concentrated towards the west coast, becoming less frequent northwards and eastwards. Its growing season is the coolest and wettest time of the year from April to September. Although flowers of a few species are produced in the summer months, they appear either after or before leaf growth.

The species closest to the New Zealand species, *Bulbinella nutans* and *B. latifolia*, are frequently found in large stands in wet seepage areas or sticky, wet clay soils. Speciation appears to have tended towards an adaptation to drier habitats, but even in Namaqualand a species with succulent leaves such as *B. gracilis* is found only in damp, shaded areas or dry river beds.

In the Cape the northern limits of *Bulbinella* are in the drier areas of northern Namaqualand (28°S). In the southern Cape one species occurs sporadically eastwards as far as Baviaanskloof (23°E). The genus is generally widespread within this distribution range occupying the main spectrum of habitats with the exception of Afro-montane forest.

The greatest concentration of species occurs in the phytogeographical region that Goldblatt (1976) refers to as the Western Coastal Belt. This area extends from the Cape Peninsula northwards to Nieuwoudtville and includes the Cederberg Mountain range. The area receives over 60% of its rainfall in winter. This is the growing season for all South African species of *Bulbinella*. The average annual rainfall in the mountainous areas is 300–600 mm and in the lower lying areas it is mainly more than 250 mm per annum. Within this region the highest concentration of species is in the Nieuwoudtville area (31°S 19°E), which has eight species with two neighbouring grid areas Wuppertal (32°S 19°E) and Clanwilliam (32°S 18°E) each having seven species. Those of Cape Town (33°S 18°E), Worcester (33°S 19°E) and Caledon (34°S 19°E) each have six species. The number of species tends to decrease eastwards and northwards towards areas of less winter rain.

The Springbok grid area (29°S 17°E) also has a comparatively high concentration of five species. This is an arid area of erratic rainfall seldom exceeding 100 mm per annum. In the more arid regions the genus tends to appear in the moister local habitats, thus beside seasonal streams, in seepage areas or on shaded south-facing slopes of clayey soil, which retain moisture from the more limited rains. In seasons when moisture is minimal, growth is restricted and plants may be stunted; in extreme cases there may be very limited flower production.

A few species such as *Bulbinella cauda-felis*, *B. divaginata* and *B. triquetra* are widespread over a large part of the distribution range. They are found in a variety of habitats with different soils and vegetation types. *B. triquetra,* for instance, is found in damp depressions on sandy flats sometimes at altitudes only a little above sea level, and also on upper slopes of mountains of the Table Mountain Group to an altitude of around 1 500 m. It also occurs on shaded slopes of clayey soils derived from Malmesbury shale, among karroid shrubs. *B. divaginata* is also found on both clayey soils among karroid vegetation as well as on Table Mountain Group-derived sandy soils among fynbos vegetation. *B. cauda-felis* is found mainly on clayey soils, often on shady

slopes among karroid vegetation or renosterveld. Because of the greater water-holding capacity of these soils, this species is able to grow in areas of low rainfall. Several good populations occur in the West Coast Strandveld among broad-leaved shrubs both on granitic soils and on the coastal calcareous sands where they are enriched by quantities of humus, which also helps to retain moisture.

Some other species appear more particular in their requirements and have limited distributions on a specific soil type. This is the case with *Bulbinella eburniflora*, found only among renosterveld vegetation on fine loamy soils, and *B. latifolia* subsp. *doleritica* growing only on the red doleritic soils of the Nieuwoudtville area.

Cultivation

In spite of many of the South African species of *Bulbinella* having showy inflorescences consisting of numerous small flowers, making them worthy of garden or pot culture, there appear to be few records of them in cultivation. General garden dictionaries and encyclopedias in the past have mainly mentioned only the two most common New Zealand species, *B. hookeri* (Hook.) Cheeseman and *B. rossii* (Hook.f.) Cheeseman. Where South African species are included, the information is often inadequate and inaccurate. Much of the present information has been gained from growing plants at the Karoo National Botanical Garden in a semi-arid area of the Cape where the clay soils favour several of the species.

Most of the 17 South African species are worth growing and with six subspecies and three species with two distinct colour forms, together with a range in size of plants, there is scope for selecting a plant for a variety of situations. Because all the South African species are winter-growers, they are not suitable for outdoor situations in frost-prone areas, but could do well in the cool greenhouse. No studies are known that have ascertained the lowest temperatures at which they can survive and it is possible that *Bulbinella nutans* subsp. *turfosicola*, which grows on mountain plateaus at altitudes of 500–1 000 m, could withstand low temperatures, but as yet this subspecies is not known in cultivation.

As hybridisation between species is not known to occur, plants come true from seed. In the orange bulbinella (*Bulbinella latifolia* subsp. *doleritica*) a certain amount of gradation in colour may be produced in a batch of seedlings and selection of better colour forms may prove worthwhile.

Propagation

This is best accomplished by seed although, with well-grown clumps, division may be satisfactory. Seed should be sown in early autumn of the year of collection as it appears to lose viability after about six months. Especially with the larger species, deep pots or seed beds are advisable to allow room for the storage roots to develop well by the end of the first growing period. A well-drained medium and a temperature of 10–20°C are recommended. Towards the end of the dormant summer period the seedlings may be separated into larger containers or planted into a garden bed. If seedlings have had the space and suitable conditions to develop well in their first season, they may produce flowers in the second year, certainly by the third year.

After a number of years some plants may have developed into good-sized clumps and then division is possible. This is best car-

ried out towards the end of the dormant period. Plants should be lifted carefully to ensure that the important storage roots are not damaged and the clump may then be prised apart. The separated plants should be planted without delay because, if roots are stored out of the ground or unprotected for any length of time, they soon wither and survival is then doubtful. Digging around plants should also be done with great care to avoid damage to the roots.

In nature some species are confined to heavy clay soils, some are found on both clayey and sandy soils, whereas a few are confined to the nutrient-poor sandy soils of the southwestern Cape. These last-named species appear to be the most difficult in cultivation. Examples are *Bulbinella punctulata*, *B. latifolia* subsp. *toximontana* and *B. chartacea*; no record is known of them in cultivation, but they are certainly worth trying. *B. nutans* subsp. *turfosicola,* which grows in peaty seepage areas in the Cape mountains, has frustrated limited attempts to keep it in growth for more than two years from seed or mature plants taken from habitat. All the remaining species should grow satisfactorily in a clayey or sandy medium provided they receive plenty of moisture in winter and a dry period in summer.

Species recommended for cultivation

The taller species of *Bulbinella* are most suitable for garden cultivation where they may be included in a herbaceous or mixed border. They are also the most useful species for cut-flowers. The tallest and most spectacular is *B. elata*, which has an off-white and a rarer yellow-coloured form and is the earliest to flower in midwinter. Apart from plants growing at the Karoo National Botanical Garden, this species is not known in cultivation.

The tall species most commonly seen in cultivation in various parts of the world are *Bulbinella latifolia* subsp. *latifolia* and the yellow-flowered form of *B. nutans* subsp. *nutans*. These were more commonly seen in gardens in New Zealand than their indigenous species, although more interest in their native species has been evident in recent years. The orange bulbinella (*B. latifolia* subsp. *doleritica*) received much publicity some years ago and has since proved popular in cultivation in Israel and the United States of America, especially in California where the Mediterranean type climate may be especially suitable. The cream-flowered form of *B. nutans* subsp. *nutans* is apparently not yet known in cultivation, but is as attractive as the yellow-flowered form.

Of the medium-sized species *Bulbinella cauda-felis*, with its long, narrow inflorescence of pink-tinged white flowers, can make fine plants. It is, however, a widespread species and very variable in the different areas in which it is found and seed may therefore not always produce the best inflorescences. The similar but slightly smaller white-flowered *B. graminifolia* may be worth trying, but it is not known in cultivation. *B. eburniflora* with a broader inflorescence of ivory-white flowers is a more impressive plant. Both the lemon-yellow and the cream-coloured forms of *B. elegans* are well worth growing. They make neat plants and the venation on the leaf sheath adds to their interest. All these medium-sized plants have swollen torpedo-shaped roots at the end of a narrow stalk-like portion and when transplanting it is very important to make sure that these are not damaged or lost.

The smallest of the species could be grown in a rock garden, but are also the most suitable for container culture. Of these, the only species known to be in cultivation is the spring-flowering *Bulbinella triquetra*

with yellow flowers. Of a similar size and also with yellow flowers is *B. divaginata*, but this species flowers in autumn when the leaves are just beginning to appear. *B. gracilis* with its slightly succulent leaves requires somewhat less water in winter than other species. As the name implies, it is a graceful plant and no doubt would make a charming pot plant. The smallest and daintiest species is the rare *B. nana*. It also makes a good pot plant but, although it has multiplied vegetatively in cultivation, so far seed has not been produced and it is therefore not likely to be readily available.

Taxonomic treatment

Bulbinella *Kunth*, Enumeratio plantarum 4: 569 (1843); Benth. & Hook.f.: 784 (1883); Baker: 355 (1896); E.Phillips: 182–183 (1951); Moore & Edgar: 21–22 (1970); R.A.Dyer: 924 (1976). Type: *B. triquetra* (L.f.) Kunth (lectotype, see E.Phillips 1951).

Chrysobactron Hook.f: 72 (1845); Baker: 293 (1876). Type: *C. rossii* Hook.f. (K!, lectotype).

Medium-sized, deciduous, perennial geophytes. *Rhizome* a compact, subterranean, annually replaced stem surrounded by membranous cataphylls or basal leaf sheaths and frequently with fibrous remains. *Roots* many, fascicled, swollen evenly the whole length, fusiform, or with tuberous swellings at apices. *Leaves* few to many, inserted on upper part of stem and crowded over a short distance, filiform to linear and tapering to an acuminate tip, somewhat fleshy, triquetrous to subterete or canaliculate, parallel veins prominent or masked; margin smooth, finely denticulate or ciliate. *Inflorescence* a simple, many-flowered, cylindrical, conical or subcorymbose raceme, dense to somewhat lax; peduncle erect, unbranched, naked, terete; bracts solitary, basal, subtending a single flower. *Flowers* actinomorphic; pedicels wiry, articulated at apex. *Perianth* stellate, yellow, orange, white or cream-coloured, 6–12 mm in diameter; tepals 6, equal to subequal, free or connate at extreme base only, oblong, single-veined, persistent. *Stamens* 6, hypogynous, adnate to base of tepals; filaments subulate or filiform, apiculate, glabrous; anthers small, subglobose, dorsifixed, versatile. *Ovary* superior, subglobose to ovoid, 3-locular, ovules 2 in each locule, collateral; style terete; stigma small, apical. *Capsule* subglobose to ovoid, becoming dry, sessile or stipitate, dehiscent, topped with a persistent style, loculicidally 3-valved. *Seeds* 1 or 2 per locule, narrowly or broadly triangular with sharp inner angle and curved outer angle, black, sometimes with a silvery to yellow outer integument, narrowly or distinctly winged. *Basic chromosome number* $x = 7$; diploid number $2n = 14$.

There are 17 species in South Africa and six in New Zealand. Found in the Northern, Western and Eastern Cape Provinces of South Africa and on three main islands of New Zealand and Auckland and Campbell Islands.

Key to the South African species

The construction of a satisfactory key to the South African species of *Bulbinella* is handicapped by the lack of clear diagnostic characters separating the different species. In particular, there is the similarity of floral structure in all species, yet with subtle differences in properties such as proportions, colour and scents that are not easily definable. Vegetative differences are often dependent on growing conditions, which may vary according to habitat or the often erratic rainfall over much of the *Bulbinella* distribution range. Differences in

PLATE 1.—*Bulbinella nutans* subsp. *nutans*, *Perry 3045* (Soutpan): 1, plant in vegetative stage, × 1; 2, inflorescence, × 1; 3, flower and bract, side view, × 6; 4, ripe fruit with bract and separate seed, × 6. Artist: Jeanette Loedolff.

the structure of tuberous roots are frequently not easily seen because of the difficulty in extracting the complete system from hard ground or the entanglement with root systems of surrounding plants. The structure of the fibrous sheath has proved useful in most cases, but is variable in the widespread *B. cauda-felis* species complex.

1a Leaves of different sizes, largest towards the outside, smallest inside; plants mostly higher than 0.5 m; flowers yellow, orange, cream-coloured or white:
2a Roots orange-yellow, thickened the whole length; leaves broad, up to 65 mm wide, bright green, somewhat fleshy; flowers yellow, cream-coloured or orange:
3a Leaf blade flat, not canaliculate; raceme long and slender; flowers yellow or cream-coloured; fruits globose . . . . . 3. *B. elata*
3b Leaf blade canaliculate; raceme broadly conical; flowers yellow, orange or cream-coloured; fruits ovoid:
4a Largest leaves 10–30 mm wide; raceme up to 55 mm wide; flowers bright yellow or cream-coloured . . . . . 1. *B. nutans*
4b Largest leaves 20–65 mm wide; raceme up to 40 mm wide; flowers yellow, white or reddish orange . . . . . 2. *B. latifolia*
2b Roots white, distally swollen, basally wiry; leaves narrow, up to 9 mm wide, dark green to glaucous, somewhat coriaceous; flowers yellow or white:
5a Leaves few (1–4), leaf bases not sheathing; flowers yellow:
6a Leaves 2 or 3, rarely 4; distribution Cederberg Mountains . . . . . 4. *B. punctulata*
6b Leaf 1; distribution Potberg range only . . . . . 5. *B. potbergensis*
5b Leaves 5 to 14, leaf bases sheathing; flowers not yellow:
7a Leaf margins ciliate or hispido-ciliate:
8a Leaf margins distinctly ciliate; raceme narrowly cylindrical, ± 20 mm wide, with pointed apex; flowers off-white . . . . . 9. *B. barkerae*
8b Leaf margins hispido-ciliate; raceme broadly cylindrical, ± 30 mm wide, with rounded apex; flowers pale straw-coloured . . . . 6. *B. eburniflora*
7b Leaf margins not ciliate, lacking small teeth, rarely with long wispy hairs:
9a Raceme narrowly conical in bud and flower, up to 30 mm wide; flowers white with pink midrib; capsule 5 mm long; seeds ± 5 mm long . . . . . 7. *B. cauda-felis*
9b Raceme narrowly cylindrical, up to 15 mm wide; flowers white, not pink-veined; capsule small, up to 3.5 mm long; seeds up to 2.5 mm long . . . . . 8. *B. graminifolia*
1b Leaves all equal to subequal; plants mostly lower than 0.5 m; flowers yellow or white:
10a Membranous cataphylls with fibrous sheath absent or poorly developed, with few short fibres; pedicels remaining patent in fruit:
11a Fibrous sheath absent or vestigial; leaves 4–8, up to 4 mm wide, succulent . . . . . 16. *B. gracilis*
11b Fibrous sheath poorly developed, fibres up to 10 mm long; leaves 10–20, up to 0.5 mm wide, filiform . . . . . 17. *B. nana*
10b Membranous cataphylls or sheathing leaf bases surrounded by well-developed fibrous sheath, with tough, protective fibres; pedicels becoming erect in fruit:
12a Sheathing fibres 1–2 mm wide, chartaceous, shiny brown to silvery shades. . . . . 15. *B. chartacea*
12b Sheathing fibres narrower than 0.5 mm, not chartaceous, dull brown or grey:
13a Vagina two-layered, inner white membranous cataphyll showing above outer brown fibres; flowers yellow in autumn with young developing leaves . . . . . 14. *B. divaginata*
13b Vagina showing only outer brown fibres, inner cataphyll not showing above outer fibres; flowers yellow or white:
14a Leaves terete, up to 7, margin seldom toothed; flowers white in autumn with young developing leaves . . . . . 13. *B. trinervis*
14b Leaves triquetrous or semiterete, more than 7, margin toothed; flowers yellow or white in spring:
15a Sheathing fibres coarse, straight, bristle-like; flowers white . . . . . 11. *B. ciliolata*
15b Sheathing fibres not course and straight; flowers yellow or white:
16a Sheathing fibres soft, fine, straight to somewhat reticulate; leaves narrower than 1.5 mm . . . . . 10. *B. triquetra*
16b Sheathing fibres regularly, compactly reticulate; leaves 2–3 mm wide . . . . . 12. *B. elegans*

Species descriptions

1. **Bulbinella nutans** *(Thunb.) T.Durand & Schinz*, Conspectus florae africae 5: 335 (1894). Type: Cap. Bon. Spei, *Thunberg s.n.* (UPS, lectotype, photo.!).

Plants medium-sized to large, 0.3–0.8 m high, solitary or in clumps of 2–several plants joined together. *Roots* numerous in a dense fascicle, young roots yellow, up to 300 mm long and thickened throughout, up to 4 mm in diameter at end of season; skin becoming dark orange and flesh lighter orange, lateral roots developing in second season; many dead and withered greyish brown pieces of old roots remaining. *Stem disc* up to 12 mm high, 15 mm in diameter, orange-coloured internally. *Fibrous sheathing neck* up to 100 mm long, 70 mm wide at base; fibres fine to medium, partly reticulate to straight. *Leaves* rosette-forming, erect, 5–13; base of all leaves expanded to form a sheath up to 90 mm long, whitish with green longitudinal veins prominent; lamina narrowly subulate, size varying, largest towards the outside up to 700 × 25 mm, inner becoming gradually shorter and narrower, bright green, fleshy, glabrous, canaliculate; margin smooth. *Raceme* broadly conical in flower and bud, up to 170 mm long, 55 mm wide, becoming more cylindrical and up to 300 mm long in flower and fruit, with 100–250 flowers; peduncle up to 650 mm long, 8 mm in diameter, terete, bright green basally, sometimes becoming reddish above; bracts narrowly triangular, 6–12 mm long, 1.5–2.0 mm wide at base, membranous, becoming brown with age, with a brown midrib. *Flowers* stellate, up to 12 mm in diameter; pedicels up to 25 mm long, wiry. *Tepals* connate at extreme base only, equal to subequal, 4.25 × 2.5 mm, elliptic, bright yellow or cream-coloured, with a raised vein showing well in pressed material, green or pale yellow. *Filaments* adnate to base of tepals, filiform, apiculate, 3–4 mm long, 1.5 mm wide, yellow or cream-coloured. *Ovary* subglobose to ovoid, up to 1.5 mm long, 1.5 mm wide; style cylindrical, 2.5 mm long. *Capsule* ovoid, up to 6.5 mm long, 3.5 mm wide, chestnut-brown becoming darker with age, hard, seeds freely released. *Seeds* up to 7 mm long, 3.25 mm wide, silvery black with lighter wings or wings not obvious. *Flowering time*: late July to December.

Distribution and habitat

Bulbinella nutans is found from the Nieuwoudtville/Calvinia plateau to the Cape Peninsula and eastwards to the Caledon District, from near sea level to 1 200 m. It is often seen in large stands, inhabiting damp areas on clayey or peaty soils, but also among karoo vegetation or renosterveld on clayey flats or hillsides.

Diagnostic features

Bulbinella nutans is not always readily distinguished from *B. latifolia* from which it is separated largely on size. Apart from the leaves of *B. latifolia* being considerably broader than those of *B. nutans*, in living plants they are arched and spreading, whereas those of *B. nutans* are erect. The inflorescence is broader and shorter in *B. nutans*.

This species is divided into two subspecies, mainly on account of different habitat preference, but also the size of the leaves. The subspecies have been raised in rank from variety because, as a result of extensive field work and further study, it was felt that the differences warranted subspecies rather than varietal rank.

Key to the subspecies

Widest leaves 8–16 mm wide, margin smooth; flowers yellow or cream-coloured; seeds silvery black, up to 5 mm long; on clay soils in renosterveld or karroid shrublands . . . . . 1a. subsp. *nutans*

Widest leaves 10–25 mm wide; flowers cream-coloured; seeds black, up to 7 mm long; on dark peaty soils of seepage areas in mountains of the Table Mountain Group; among fynbos vegetation . . . . . 1b. subsp. *turfosicola*

PLATE 2.—*Bulbinella nutans* subsp. *nutans*, *Perry 3157* (Springerskuil, Zwartberg, Caledon): 1, inflorescence, × 1. *B. latifolia* subsp. *latifolia*, *Bayer 2214* (Rooiberg, Kamiesberg): 2, inflorescence, × 1. *B. latifolia* subsp. *toximontana*, *Perry 3584* (Matzikammaberg): 3, inflorescence, × 1. Artist: Jeanette Loedolff.

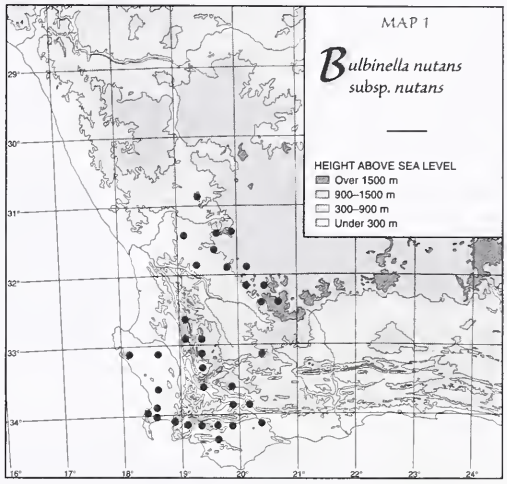
1a. **Bulbinella nutans** *(Thunb.) T.Durand & Schinz* subsp. **nutans**.

Anthericum nutans Thunb.: 63 (1794); Thunb.: 319 (1823); Baker: 294 (1876); non Jacq.: 86 (1796). *B. nutans* (Thunb.) T.Durand & Schinz var. *nutans*, P.L.Perry: 442 (1987). Type: Cap. Bon. Spei, *Thunberg s.n.* (UPS, lectotype, photo.!).

A. setosum Willd. ex Schult. & Schult.f.: 473 (1829); Baker: 295 (1876). *B. setosa* (Willd.) T.Durand & Schinz: 335 (1894); Baker: 358 (1896); I.Verd.: t. 930 (1944). *B. robusta* Kunth: 571 (1843) Baker: 358 (1896), nom. superfl. Type: In promont. b. spei, *Willdenow Herb. no. 6656* (B-W, photo.!).

Description as for species and see key. *Flowering time* late July to October. Plates 1 and 2: 1.

Distribution and habitat



This subspecies is found mainly on clayey soils that become seasonally wet with winter rains. A vivid yellow-flowered form is common in the Western Mountain Karoo shrublands of the Nieuwoudtville/Calvinia plateau and Sutherland District at altitudes of 600–1 200 m where it is often seen in large stands, especially in wet seepage areas. A cream- flowered form occurs at lower altitudes in the karroid broken veld of the Worcester/Robertson Karoo stretching to the remains of the Coastal Renosterveld of the Caledon District, and on clay flats or low hills in the vicinity of Cape Town where it may be only a little above sea level. Map 1.

Diagnostic features

Herbarium specimens of this subspecies may be confused with *Bulbinella cauda-felis* as the pressed leaves may be approximately the same size. They are easily separated when roots and fibrous sheaths are present. Also, the inflorescence is long and narrow in *B. cauda-felis* compared with the more broadly conical one of *B. nutans*. In living material the white tepals with pink midrib of *B. cauda-felis* are clearly different from the more cream-coloured tepals of that colour form of *B. nutans*.

Nomenclatural notes

The epithet *nutans* for a species of *Bulbinella* has been largely ignored in the naming of specimens in South Africa and some overseas herbaria, possibly because Kunth (1843) did not include it in his treatise of the genus and also because of confusion with *Anthericum nutans sensu* Jacquin (1786–93) which, from the plate illustrating his concept of the species (*Icones plantarum rariorum* 2: t. 407), is clearly a *Bulbine*. Jacquin's *Collectaneorum supplementum*, with his validating description of *A. nutans* on page 86, was published in 1796, two years after Thunberg's *Prodromus plantarum capensium* and therefore the latter takes precedence.

Although the specimen *Thunberg 8396* (IDC microfiche no. of type of *Anthericum nutans*) is smaller than normal for this subspecies, it

agrees well with a specimen in the Bolus Herbarium collected by Pillans from the lower southern slopes of the Tygerberg where the cream-flowered form still occurs. This seems a very likely locality for Thunberg's specimen as, according to his travels, he could have been in that vicinity at flowering time. Specimens of the yellow-flowered form collected in a dry season in the Nieuwoudtville area also look similar, but dates given for Thunberg's visit to that area, for example 4 November 1773, are too late for flowering of this subspecies. Although flowers on the Uppsala specimen appear to be yellow, this is also the case with the Pillans specimen from Tygerberg.

The type specimen for Willdenow's *Anthericum setosum*, no. *6656*, is a good match of Thunberg's *A. nutans*. As this was one of the specimens quoted by Kunth in his description of *Bulbinella robusta*, the latter must be regarded as a nomenclaturally superfluous name. The additional inclusion of *Drège 8763* (*B. nutans* var. *turfosicola*) in Kunth's circumscription of *B. robusta* indicates that he had a taxonomically confused concept of the species. Although stating that the Drège specimen differed in being larger and with longer pedicels, he lacked the detailed information of flower colour, seed structure and habitat to create a separate taxon.

Baker (1896) gave *Anthericum nutans* Thunb. as a synonym for *Bulbinella gracilis* Kunth, possibly because of the lack of fibrous sheath in Thunberg's specimen. However, fibres together with roots had clearly been removed prior to pressing. Baker's misconception emphasises the considerable difficulty in making correct identifications from pressed material in a genus in which flower structure is of no significance and important distinguishing characters are in the underground parts so frequently missing from herbarium sheets.

Specimens examined

—3019 (Loeriesfontein): (–CD), *Lombard 6* (PRE, STE).

—3119 (Calvinia): Glenridge farm near Nieuwoudtville, (–AC), *Pamphlett 111* (NBG, PRE); Glen Lyon, *Perry 3131* (NBG); *Mauve & Oliver 32* (K, PRE, STE); *Goldblatt 4037* (PRE); Nieuwoudtville Wild Flower Reserve, *Perry & Snijman 2146* (NBG); *Perry 3013* (NBG); Van Rhynspas, *Van der Schijff 7041* (PRE); Grasberg, *Herre BOL035230.* (BOL); between Nieuwoudtville and Calvinia, *Thompson 223* (K, PRE, STE); farm Papkuilsfontein, *Perry 3319* (NBG); Akkerdam, (–BC), *Barker 9309* (NBG); Hantamsberg, *Plowes NBG120390* (NBG); 5 miles SW of Calvinia, (–BD), *Davis SAM64565* (PRE, SAM); Botterkloof, (–CD), *Schlechter 10887* (BM, BOL, G, K, P, PRE); Ripjoeni Mountains, (–DA), *Marloth 10294* (PRE); 26 miles W by S of Calvinia, *Acocks 16888* (K, PRE); Karigaboschfontein, (–DD), *Thompson 2477* (PRE, STE).

—3120 (Williston): 24.5 miles NW of Middelpos, (–CC), *Leistner 306* (K, NBG, PRE); 6.2 km farm Blomfontein to Calvinia, *Perry 3329* (K, MO, NBG, PRE).

—3219 (Wuppertal): Olifants River Valley, (–CA), *Lavis BOL018384* (BOL); Koelfontein, Bo-Bokfontein, (–CC), *Hanekom 1303* (K, PRE, STE); 13.3 miles beyond Excelsior, (–CD), *Taylor 5894* (PRE, STE); Zoo ridge on the Zuurvlakte, *Stirton 6199A* (K, PRE).

—3220 (Sutherland): top of Gannaga Pass, (–AA), *Wisura 3477* (NBG); *Stayner NBG87573* (NBG); between Kruis Rivier Plaats and Sutherland, (–AB), *Levyns 1660* (BOL); Driefontein, W of Sutherland, (–AD), *Thompson 1779* (K, STE); farm Voëlfontein, *Perry 3333* (NBG, PRE); 13 miles N of Sutherland, (–BC), *Theron 1258* (BM, K, PRE); Geelhoek, *Acocks 17182* (K, PRE).

—3318 (Cape Town): 8 miles SE of Langebaan road, (–AA), *Theron 2018* (BOL, K, PRE); Lucasfontein, Malmesbury, (–BA), *Acocks 24310* (PRE); near Claremont, (–CD), *Schlechter 2959* (BOL, G); between Paarlberg and Paardeberg, (–DB), *Drège 486* (G, K, P); Tygerberg, (–DC), *Pillans 18307* (BOL); *Krauss 1431* (G); *Loubser 3069* (PRE).

—3319 (Worcester): farm Het Kruis, (–AB), *Marloth 10622* (PRE); Titus River Valley E of Eselfontein, (–AD), *Oliver 5094* (STE); near Ceres, *Bolus BOL035155* (BOL); Hex River Valley, (–BC), *Davidson 85* (SAM); Karoo Botanic Garden, *Leighton 1037A* (BOL, NBG.); *Bayer 89* (NBG); Langerug, *Perry 3118* (NBG); Worcester commonage, *Van Breda 579* (K, PRE); farm Reiersrus, *Walters 598* (NBG); 14.2 km from top Rooihoogte Pass towards N1, (–DB), *Perry 3204* (NBG); Koo, *Lewis 6038* (NBG); Vrolikheid Nature Reserve, (–DD), *Van der Merwe 2974* (PRE).

PLATE 3.—*Bulbinella nutans* subsp. *turfosicola*, *Perry 3075* (Zuurvlakte, Du Toits Kloof) & *3079* (Table Mountain): 1, inflorescence and single leaf, × 1; 2, plant in vegetative stage, × 1; 3, unripe fruit and bract, × 6; 4, single flower and bract, × 6; 5, gynoecium, × 12; 6, inner tepal and stamen, × 12; 7, outer tepal and stamen, × 12. Artist: Jeanette Loedolff.

—3320 (Montagu): Cobita, near Laingsburg, (–AB), *Compton 3760* (BOL); Bonnievale (–CC), *Marloth (Hurling & Neil) 11947* (PRE).

—3418 (Simonstown): Cape Flats, (–BA), *De Vasseldt SAM22729* (SAM); Harmony Flats, Gordon's Bay (–BB), *Perry 3151* (MO, NBG, PRE); flats between Strand and Gordon's Bay, *Esterhuysen 34611* (BOL).

—3419 (Caledon): Bot River, Langehoogde, (–AA), *Ecklon & Zeyher 132* (G, K, PRE, SAM); intersection of Caledon-Cape Town-Worcester roads, (–AB), *Walters 1491* (NBG); Dumghye Park, *Jordaan 202a* (STE); Caledon, *Perry 3224* (NBG); commonage S of Caledon, *Goldblatt 4092* (PRE); *Barker 52* (BOL, K.); Caledon, near the Baths, *Marloth 9220* (PRE); Zwartberg, (–BA), *Zeyher 4211* (G, K, P, PRE, SAM.); 6 miles W of Rietpoel river flats, (–BB), *Taylor 3749* (K, NBG, PRE, STE); Springerskuil, (–BC), *Perry 3157* (NBG, PRE).

— 3420 (Bredasdorp): Bontebok Park, (–AB), *Grobler 422* (PRE, STE.); Boesmanspad, Swellendam, *Joubert STEU10190* (STE, STEU).

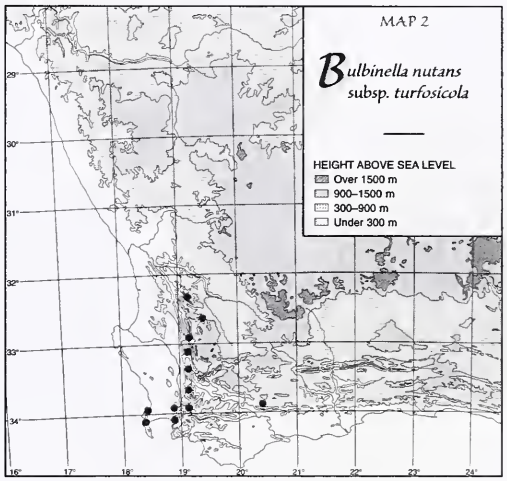
1b. **Bulbinella nutans** *(Thunb.) T.Durand & Schinz* subsp. **turfosicola** *(P.L.Perry) P.L.Perry*, stat. nov. Type: Western Cape, Zuurvlakte, Du Toitskloof, November 1983, *Perry 3075* (NBG, holotype; K, MO, PRE, isotypes).

B. nutans (Thunb.) T.Durand & Schinz var. *turfosicola* P.L.Perry: 442 (1987).

Description as for species and see key. *Flowering time* October to December. Plate 3.

Distribution and habitat

This subspecies usually forms dense stands in flat seepage areas in mountainous regions from the Cederberg to Table Mountain at an altitude of 500–1 000 m. It grows in black peaty soil among restionaceous species such as *Hypolaena crinalis* and *Elegia intermedia* or *Erica* species such as *E. parvifolia* and *E. mollis*. Map 2.



Diagnostic features

This subspecies is most easily separated from subsp. *nutans* by its locality and habitat, and its late spring- to summer-flowering time. Plants tend to be more robust than those of subsp. *nutans*, with generally wider leaves. When growing under good conditions, the inflorescence of the cream-flowered form of subsp. *nutans* is almost indistinguishable from that of subsp. *turfosicola*. Seeds of the two subspecies are distinctive, those of subsp. *turfosicola* being larger (up to 7 mm long) and black, not grey like those of subsp. *nutans*.

Cultivation

Attempts to cultivate this subspecies have so far met with little success. When given growing conditions similar to other species of *Bulbinella*, only two seedlings germinated but they did not survive beyond the first season. Complete plants taken from the veld also failed to settle in pots. Although one collection survived into a third

season, it did not produce flowers and the vegetative growth gradually diminished in size. As other plants of *B. nutans* and *B. latifolia* given similar conditions have grown satisfactorily, it may reasonably be assumed that subsp. *turfosicola* requires a very distinctive set of growing conditions as is provided by the wet peaty soil and lower temperatures at the altitude in which it is found.

Specimens examined

—3219 (Wuppertal): flats near near Moutons Klip vlei, (–AC), *Andrag 169* (STE); vlei 2 miles from top of Uitkyk Pass, *Gillett 4111* (K); Eikeboom, top of Uitkyk Pass, *Leighton BOL032682* (BOL); Uitkyk Pass, *Stokoe SAM55733* (SAM); Kromme River, (–CB), *Stokoe SAM64566* (PRE, SAM); Twenty-Four River Mountains, (–CC), *Esterhuysen 16202* & *21883* (BOL).

—3318 (Cape Town): Table Mountain, (–CD), *Compton 14050* (NBG); *Perry 3079* (K, MO, NBG, PRE); *Marloth 596* & *9406* (PRE); *Phillips SAM44614* (BM, SAM); *Bolus 4588* (BM, BOL, K, NBG); near Kasteel Poort, *Wolley-Dod 1470* (PRE); summit of Table Mountain, *MacOwan 1558* (BOL, G, K, PRE, SAM, STE); *MacOwan 2515* (G); above Skeleton Gorge, *Galpin 4743* (PRE); Fir Tree, *Andreae 547* (PRE, STE); swamp on lower plateau, *Esterhuysen 9011* (BOL); Kasteelberg, *Pappe SAM22727* (SAM); *Zeyher SAM22726* (SAM); Jonkershoek, (–DD), *Kerfoot 5555* (STE).

—3319 (Worcester): Porterville Mountains, (–AA), *Oliver 4093* (PRE); Winterhoek near Tulbagh, *Bolus 5269* (BOL); 5 km N of turn-off to Agterwitzenberg, (–AB), *Goldblatt 8032* (NBG); Witsenberg (–AC), *Pappe SAM22715* (SAM); Zuurvlakte, Du Toits Kloof, (–CA), *Perry 3075* (K, MO, NBG, PRE); *Perry 526* (NBG); *Thorne SAM46519* (SAM); Drakensteinbergen, (–CC), *Drège 8763* (B, BM, G, K, P).

—3320 (Montagu): Eleven o'clock Mountain, (–CD), *Wurts 491* (NBG).

—3418 (Simonstown): *vlakte* next to Grootkop, (–AB), *Jackson 43* (NBG); Hottentot Hollands near Somerset Sneeukop, (–BB), *Stokoe SAM64550* (SAM).

2. **Bulbinella latifolia** *Kunth*, Enumeratio plantarum 4: 572 (1843); P.L.Perry: 441 (1987). Type: Cape Province, Little Namaqualand, between Uitkomst and Geelbeks Kraal, *Drège 2667a* (G, lectotype; K!, P!, isolectotypes).

Plants up to 1 m high. *Roots* fascicled, numerous, thickened the whole length, up to 250 mm long, 6 mm in diameter, orange with many dead membranous remains interspersed. *Fibrous sheathing neck* up to 150 mm long, 70 mm wide, fibres fine to medium thick, partially reticulate. *Leaves* 5–10, bases expanded to form a sheath encircling peduncle and inner leaves; lamina spreading to arched, inner erect, ensiform to subulate, of varying size, largest up to 550 × 65 mm, bright green, fleshy, shallowly canaliculate; margin smooth or minutely denticulate. *Raceme* dense, conical in bud and flower, up to 250 mm long, 40 mm wide becoming cylindrical in flower and fruit, up to 400 mm long, 30 mm wide, with up to 500 flowers; peduncle up to 700 mm long, 12 mm in diameter at base, erect, terete, green to reddish green with a glaucous bloom; bracts narrowly triangular, up to 12 mm long, 3 mm wide at base, attenuate, membranous with a reddish brown midrib. *Flowers* stellate, 9–10 mm in diameter; pedicels up to 20 mm long, yellow in flower, green in fruit. *Tepals* bright or lemon-yellow, cream-coloured or reddish orange. *Filaments* filiform, apiculate, 2.5–3.0 mm long, yellow. *Ovary* ovoid, 1.5 mm long, 1 mm wide, yellow; style cylindrical, 2.75 mm long. *Capsule* ovoid, 7 mm long, 3 mm in diameter, light chestnut-brown. *Seeds* silvery to shiny black, membranous, wings not obvious, up to 6.5 mm long, 3.75 mm wide. *Flowering time*: August to October.

Distribution and habitat

This species is found in a variety of habitats. One is the seasonally damp areas such as annual streams or near dams on granitic soils in the Kamieskroon area. Another is the Table Mountain Group

PLATE 4.—*Bulbinella latifolia* subsp. *doleritica*, *Perry 3011* (Nieuwoudtville): 1, base of plant, × 1; 2, single leaf, × 1; 3, inflorescence, × 1. Artist: Jeanette Loedolff.

sandy and peaty soils of the Cederberg and Matzikammaberg, at altitudes of 500–1 000 m. It also occurs on flats of red doleritic soils in the Nieuwoudtville area, frequently in large stands, and on clayey soils of the Worcester area.

Diagnostic features

This species is closely related to *Bulbinella nutans* and is often difficult to separate from that species, especially pressed material. It is separated from it partly on the grounds of size, *B. latifolia* having broader and more spreading leaves. The inflorescences of the two species are different in shape, those of *B. latifolia* being considerably longer but narrower. The fact that subspecies of the two species, namely the yellow form of *B. nutans* subsp. *nutans* and *B. latifolia* subsp. *doleritica*, grow sympatrically at Nieuwoudtville and flower at the same time without showing any signs of hybridisation is regarded as further ground for separating the species. Living plants of these two taxa growing side by side show marked differences in habit and young cultivated plants of the two show consistent differences in length and width of roots.

Nomenclatural notes

Kunth's (1843) description of *Bulbinella latifolia* was based on *Drège*, herb. Cap. no. *2667a*, which was collected in August in Little Namaqualand between Uitkomst and Geelbeks Kraal (Drège 1843). Specimens of this collection seen in herbarium material from Kew, Geneva and Paris show clearly a broad-leaved taxon of *Bulbinella*. These specimens show leaves and inflorescence only, with leaves up to 400 mm long, 28 mm broad and inflorescence mostly in bud 100 mm long, 18 mm wide and with 100–200 flowers. Pedicels and bracts are shorter than typical in this species.

Bulbinella latifolia is here separated into four subspecies mainly on the grounds of distribution, flower colour and a distinct habitat preference. It will be noted that in the case of subsp. *doleritica* and the autonym subsp. *latifolia*, the ranks have been raised from variety for the same reasons as given under *B. nutans*.

Key to the subspecies

1a Flowers yellow; leaves with or without minute denticulations:
  2a Flowers bright yellow; leaves with smooth margins; sandy soils derived from granite or sandstone of the Table Mountain Group; often in large stands in damp seepage areas . . . . . 2a. subsp. *latifolia*
  2b Flowers lemon-yellow; leaves with minute denticulate margins; clay soils; plants scattered among bushes . . . . . 2c. subsp. *denticulata*
1b Flowers orange or cream-coloured; leaves without denticulations:
  3a Flowers reddish orange; restricted to sticky, red, doleritic clay soil on flats in the Nieuwoudtville area . . . . . 2b. subsp. *doleritica*
  3b Flowers cream-coloured; in humic sandy soil derived from sandstone of the Table Mountain Group, among rocks in damp seepage areas . . . . . 2d. subsp. *toximontana*

2a. **Bulbinella latifolia** *Kunth* subsp. **latifolia**.

B. robusta Kunth var. *latifolia* (Kunth) Baker: 358 (1896). *B. latifolia* Kunth var. *latifolia*, P.L.Perry: 441 (1987).

Description as for species and see key. *Flowers* bright yellow. *Flowering time* from August to October. Plate 2: 2.

Distribution and habitat

This subspecies often forms large stands in seasonally damp areas mainly in the Northern Cape, where in dry seasons flowering may be limited. Map 3.

Specimens examined

—2917 (Springbok): Spektakel Pass, (–DA), *Barker 7428* (NBG); Okiep, (–DB), *Marloth 12736* (PRE); 20 miles S of Springbok, (–DD), *Compton 20578* (NBG).

—3017 (Hondeklipbaai): Grootvlei, (–BB), *Leighton 1371* (BOL); *Van Jaarsveld 1410* (NBG); *Lewis 1455* (SAM); *Barker 3722* (BOL, NBG); 15 miles S of Kamieskroon, *Salter 3822* (BOL); near Grootvlei from Kamieskroon, *Barker 8408* (NBG).

—3018 (Kamiesberg): opposite Gamoep turn-off about 12 km from Kamieskroon, (–AA), *Perry 3169* (NBG); Leliefontein, (–AB), *Scheffler 262* (PRE, STE); *Rodin 1459* (BOL, K, PRE); S of Leliefontein, (–AC), *Wisura 2214* (NBG); *Schweickerdt 2545* (PRE); *Levyns 4028* (BOL); Eselkop, *Downing 317* (PRE, STE); Naras Ravine, *Pearson 6652* (BOL, K).

—3219 (Wuppertal): Algeria Forest Station, (–AC), *Viviers 622* (STE); Matjiesrivier, (–AD), *Wagener 152* (BOL, NBG).

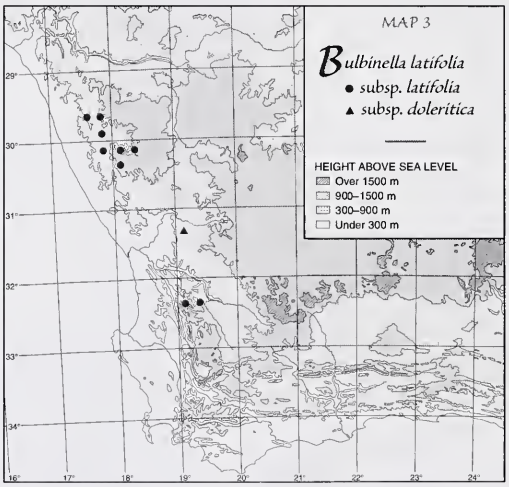
2b. **Bulbinella latifolia** *Kunth* subsp. **doleritica** *(P.L.Perry) P.L.Perry*, stat. nov. Type: Northern Cape, Nieuwoudtville, farm Glen Lyon, August 1986, *Perry 3472* (NBG, holotype; K, MO, PRE, isotypes).

B. latifolia Kunth var. *doleritica* P.L.Perry: 441 (1987).

Description as for species and see key. *Flowers* dark reddish orange with yellow stamens, ovary and style. *Flowering time* from August to September. Plate 4.

Distribution and habitat

This subspecies occurs in large stands in the vicinity of Nieuwoudtville, restricted to the flat areas near the dolerite koppies where the hard red doleritic clay begins to merge into the greyish dwyka tillite clay. Map 3.



Specimens examined

—3119 (Calvinia): Loeriesfontein road 4 miles NW Nieuwoudtville, (–AC), *Bolus 19600* (BOL); Glen Lyon, *Oliver & Mauve 43* (PRE, STE); *Hardy 70* (PRE); *Perry 3011* (NBG); *Perry 3472* (K, MO, NBG, PRE); Klip Koppies, (–AC), *Barker 9367* (NBG); Oorlogskloof, *Schlechter 10970* (BM, BOL, K, P, PRE).

2c. **Bulbinella latifolia** *Kunth* subsp. **denticulata** *P.L.Perry*, subsp. nov., a ceteris subspeciebus margine folii denticulato usque ad ciliato discedit.

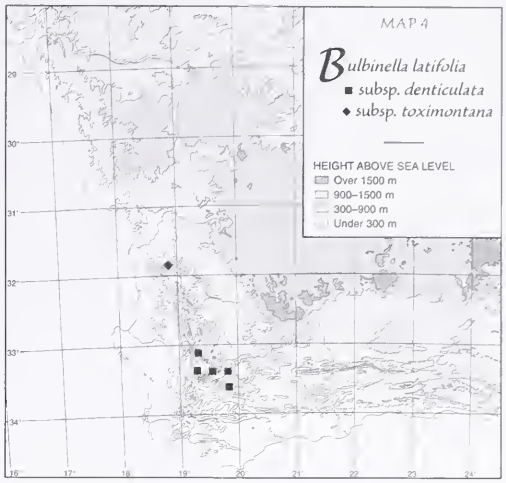
Type.—Western Cape, 4 km SW Kleinstraat, *Perry 3199* (NBG, holotype).

Description as for species and see key. *Flowers* more of a lemon-yellow than those of subsp. *latifolia*. *Leaf margin* distinct, finely denticulate, ciliate, clearly discernible without magnification. *Flowering time* is in September and October.

PLATE 5.—*Bulbinella elata, Perry 3132* (Biedouw): 1, plant in vegetative stage, × 0.5; 2, inflorescence, × 0.5; 3, unripe fruit, seed and bract, × 6. Artist: Jeanette Loedolff.

Distribution and habitat

This subspecies is distributed in the northern part of the Worcester District in an area stretching from the Koue Bokkeveld, east of Ceres, to the top of the Hex River Pass, mainly at an altitude between 900 and 1 200 m. It occurs in renosterveld or karoo vegetation, mainly as scattered plants among bushes. Map 4.



Specimens examined

—3319 (Worcester): 0.6 km S of Op die Berg turn-off on Gydo Pass to Citrusdal road, (–AB), *Perry 3521* (NBG); Theronsberg Pass, (–AD), *Perry 3207* (NBG); near Ceres, *H. Bolus BOL035155* (BOL); Leeuwfontein, (–BC); *Compton 16051* (NBG); Hottentots Kloof, *Compton 16132* (BOL, NBG); 4 km SW Kleinstrat towards Hex River Pass, (–BD) *Perry 3199* (NBG); 14.2 km from top of Rooiberg Pass towards the N1, (–DB), *Perry 3204* (NBG).

2d. **Bulbinella latifolia** *Kunth* subsp. **toximontana** *P.L.Perry*, subsp. nov., a ceteris subspeciebus tepalis cremicoloribus, ovario rubro et distributione a arena montis Matzikamma restricta differt.

Type.—Western Cape, 3.7 km along Matzikammaberg road from the top of Gifberg Pass, *Perry 3584* (NBG, holotype).

Description as for species and see key. *Leaves* slightly smaller than those of subsp. *latifolia*, being 500 × 45 mm. *Raceme* up to 40 mm wide; peduncle up to 7 mm in diameter, green with a reddish tinge. *Tepals* a creamy colour. *Ovary* red. *Flowering time* is in July and August. Plate 2: 3.

Distribution and habitat

This subspecies is separated from the others mainly on account of distribution, habitat and flower colour. It is so far known only from two collections on the top of the Gifberg near Vanrhynsdorp, where it occurs in damp areas of humic, sandy soil. Map 4.

Specimens examined

—3118 (Vanrhynsdorp): Gifberg near Ronderug Hoogte, (–DD), *Rourke 1068* (NBG); 3.7 km along Matzikammaberg road from the top of Gifberg Pass, *Perry 3584* (NBG).

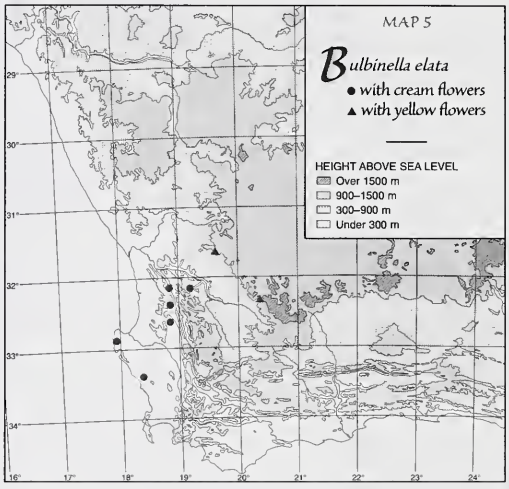
3. **Bulbinella elata** *P.L.Perry* in South African Journal Botany 53: 437 (1987). Type: Western Cape, near top of hill into Biedouw Valley from Pakhuis, August 1984, *Perry 3132* (NBG, holotype).

Plants up to 1 m tall. *Roots* fascicled, several thickened, up to 180 mm long, 2.5–3.0 mm in diameter, slightly more thickened near stem, orange, with some old shrivelled remains and separate thin absorptive roots. *Stem disc* solid, 10 mm in diameter, orange. *Fibrous sheathing neck* usually ± 40 mm long but up to 80 mm; fibres thin, loose, straight, becoming somewhat reticulate towards

inside. *Leaves* 6–8, of varying sizes, forming a rosette, outer spreading and inner suberect, bases expanded to form a sheath, up to 80 mm long; lamina ensiform, up to 450 × 70 mm, gradually tapering, inner leaves shorter and narrower, not canaliculate, thinly coriaceous with parallel veins prominent and close together, bright yellowish green, glabrous; margin entire to very minutely ciliate. *Raceme* cylindrical, up to 400 mm long in flower and fruit, 30 mm wide, with 200–500 flowers; peduncle up to 800 mm long, 7 mm in diameter, terete; bracts 6 mm long, broad-based, lanceolate, attenuate, colourless, with a faint brown midrib. *Flowers* stellate, 10 mm in diameter, faintly scented; pedicels up to 15 mm long but usually shorter, whitish in flower, reddish in fruit. *Tepals* subequal, cream-coloured or bright yellow, outer somewhat recurved, inner patent, oblong, 4.5 × 2 mm. *Filaments* filiform, apiculate, inner 4 mm long, outer 3 mm long. *Ovary* globose, 1.25 mm long and wide, pale green to yellow; style cylindrical, 1.75–2.0 mm long, off-white. *Capsule* subglobose, up to 4.5 mm long, 4 mm wide, chestnut-brown. *Seed* up to 4.5 mm long, 3 mm wide, greyish black, wings not obvious. *Flowering time* July and August. Plate 5.

Distribution and habitat

There are two colour variations of this species. A cream-flowered form is restricted to the Clanwilliam area where it has been found on shady south-facing slopes on clayey soil among karroid vegetation and to the Vredenburg area where it occurs in granitic sandy soil at the base of the large Witteklip granite boulders. A yellow-flowered form is known from two populations on the escarpment below the Roggeveld: one on Bloukrans Pass and the other in a shaded kloof near to the north of Ouberg Pass in the Sutherland District. Map 5.



Diagnostic features

Although this taxon is closely related to *Bulbinella latifolia* and *B. nutans* and plants on herbarium sheets are not always easy to separate from some larger specimens of the former, there are sufficiently good characters in living plants to make a distinct species. Among these are the flat, spreading, coriaceous, noncanaliculate leaf blades, which are thinner and more delicate when pressed than those of *B. latifolia*. The long narrow inflorescence and the small globose capsule are clearly different from the more conical inflorescence and larger ovoid capsules of *B. latifolia* and *B. nutans*. In nature, *B. elata* normally flowers earlier in the season than the forms of *B. latifolia* and *B. nutans*.

Specimens examined

—3119 (Calvinia): Bloukrans Pass, 19.5 km S of Calvinia, (–DA), *Perry 1937* (NBG).

—3217 (Vredenburg): Witteklip, near Vredenburg, (–DD), *Lewis 1456* (SAM); *Perry 3195* (NBG); *Leighton 598* (BOL).

—3218 (Clanwilliam): 4 miles south of Clanwilliam on old road, (–BB), *Kellerman 6* (STE); 11.5 km S of Algeria turn-off on old Clanwilliam to Citrusdal road, *Scott s.n.*

PLATE 6.—*Bulbinella punctulata, Perry 3312* (Gifberg Pass): 1, plant in vegetative stage, × 1; 2, inflorescence, × 1; 3, flower and bract, × 6; 4, dry fruit capsule and seeds, × 6. Artist: Jeanette Loedolff.

(NBG, PRE); 19 km S of Clanwilliam on old road, (–BD), *Perry 3311* (NBG); farm Witelsboskloof, foot of Faraoskop, *Steiner 1494a* (NBG, PRE); Olifantrivier, (–DB), *Schlechter 7997* (BM, BOL, G, K, P).

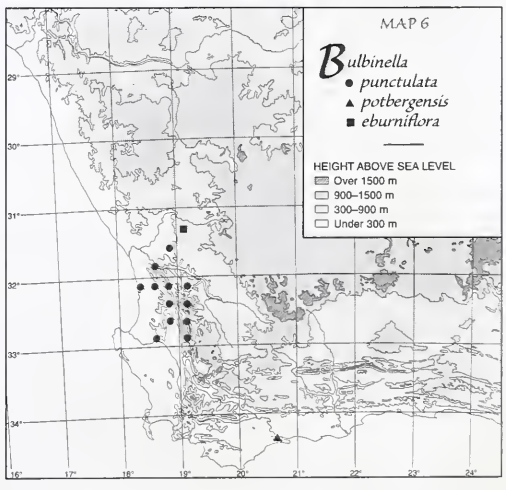
—3219 (Wuppertal): hill to Biedouw Valley, (–AA), *Perry 3019 & 3132* (NBG); Pakhuis, *Esterhuysen 5925* (BOL); road to Wuppertal from Pakhuis, *Leighton BOL 032639* (BOL).

—3220 (Sutherland): near Ouberg Pass, (–AD), *Perry & Bruyns 3641* (NBG).

—3318 (Cape Town): summit of Contreberg, (–AD), *Pillans 6905* (BOL).

4. **Bulbinella punctulata** *Zahlbr.* in Annalen des K.K. Naturhistorischen Hofmuseums 15,1: 16–17 (1900); P.L.Perry: 442 (1987). Type: Western Cape, Pikeniersbergen, Twenty-four River Mountains, *Penther 422, 517* (W, holotype lost in World War 2); Western Cape, top of Dasklip Pass, September 1985, *Perry 3350* (NBG, neotype; K, MO, PRE, W, isoneotypes).

Plants tall and slender, 0.5–1.0 m high, solitary. *Roots* densely fascicled, up to 120 mm long, with swollen regions proximal to stem disc up to 28 mm long, 8 mm in diameter, also some roots with swollen ends ± 28 mm long, 4 mm in diameter. *Fibrous sheathing neck* forming a thick layer at base up to 20 mm wide, 40 mm long, becoming progressively fewer-layered above, outer fibres greyish, very fine, distinctly reticulate, inner cataphylls up to 150 mm long, lacy, light golden fawn-coloured, basally internally violet-purple. *Leaves* 2, rarely 3 or 4 on older plants, base not expanded to form a sheath, subequal or inner considerably smaller, up to 600 × 6 mm, subulate with apex very gradually narrowing to a point, dark green, canaliculate, fleshy to coriaceous, glabrous; margin not denticulate. *Raceme* narrowly cylindrical, up to 120 mm long, 20 mm wide, moderately dense, with ± 75–150 flowers; peduncle up to 700 mm long, 3 mm in diameter, lightish green; bracts triangular, cuspidate, 3 mm long, base partly surrounding pedicel, colourless, membranous, with light brown midrib. *Flowers* stellate, spreading to somewhat recurved, ± 9 mm across; pedicels 4–8 mm long, green. *Tepals* yellow with a narrow green midrib, oblong, obtuse, subequal, outer more recurved and slightly longer and narrower, 5 × 2 mm, inner narrowly lanceolate, 4 × 2.5 mm. *Filaments* filiform, apiculate, 3 mm long, yellow; anthers subglobose. *Ovary* ovoid, shiny yellow, 1.5 mm in diameter; style cylindrical, 2 mm long. *Capsule* 6 mm long, 4 mm wide, light fawn, sections somewhat cymbiform, 3-veined. *Seed* 4.5–5.5 mm long, 3.5 mm wide, shiny black with dark brown wing ± 0.5 mm wide all round. *Flowering time* August to October. Plate 6.



Distribution and habitat

This species is confined to the Cederberg range, where it grows in Table Mountain Group-derived sandy soils in rocky areas among mountain fynbos or in large stands in damp flats of restio veld. Map 6.

Diagnostic features

This is a very distinctive species owing to the small number of leaves, normally only two, which are comparatively long and narrow. The loose net-like part of the sheath with the inner cataphyll extending for some distance up the leaves also clearly separates *Bulbinella punctulata* from other species. It may also be recognised by the long narrow inflorescence of yellow flowers.

Nomenclatural notes

Although Penther's type specimen is no longer in existence, Zahlbruckner's detailed description, together with flowering time and locality, leaves little doubt as to the identity of this species. The finely reticulate sheath and the small number of leaves are distinctive in the genus and are easily recognised on herbarium sheets. The epithet *punctulata* apparently refers to the minute whitish pellucid dots mentioned in Zahlbruckner's description. This is, however, a character that is seen in most species. On a number of herbarium specimens this species has been identified as *Bulbinella peronata*. However, Kunth's description for that species gives 'leaves about 13', whereas collections of *B. punctulata* studied show at most four leaves.

The neotype for this name has been collected from as near as possible to the locality of Penther's original collection in the southern Cederberg range above Porterville known as Twenty-four River Mountains.

Specimens examined

—3118 (Vanrhynsdorp): Matsikammaberg, N of farm Die Vlei, (–DB), *Snijman 961* (NBG); Gifberg, *Nordenstam 1374* (NBG); *Compton 20803* (NBG); *Perry 3312 & 3316* (NBG); *Phillips 7550* (NBG, PRE).

—3218 (Clanwilliam): 1 mile down Die Berg road from Lamberts Bay turn-off, (–AB), *Pamphlett 102* (NBG); Graafwater, (–BA), *Compton 24219* (NBG); *Schlechter 2445* (BOL, PRE); W side of Pakhuis Pass, (–BB), *Ornduff 7176* (PRE); Lamberts Hoek Berg, (–BD), *Maguire 416* (NBG); Piekeniers Pass, (–DB), *Pamphlett 103* (NBG, PRE); *Perry 3140* (NBG); Piketberg Mountain plateau, (–DC), *Esterhuysen 23112* (BOL); Kapteinskloof, *Van Niekerk 630* (BOL, PRE).

—3219 (Wuppertal): Pakhuis Pass, (–AA), *Barker 10721* (NBG, PRE); *Pamphlett 115* (NBG); *Esterhuysen 3169* (BOL); *Steyn 402* (NBG); *Stokoe SAM55732* (SAM); *Perry 3017 & 3173* (NBG); *Thompson 308* (K, PRE, STE); path between Heuningvlei and Koupoort, *Esterhuysen 5913* (BOL, PRE); Heuningvlei track, *Bean, Vlok & Viviers 1537* (NBG); Algeria Forest Station, (–AC), *Barnes 19290* (BOL); Nieuwoudt Pass, *Pococks 812* (STE); Duiwelskloof, (–CA), *Stokoe SAM64561* (PRE, SAM); Elandskloof, *Stokoe SAM 68265* (PRE, SAM); top of Dasklip Pass, (–CC), *Barker 10301* (NBG, PRE); *Perry 3350* (K, MO, NBG, PRE, W).

5. **Bulbinella potbergensis** *P.L.Perry*, sp. nov., species rarior, *B. punctulata* Zahlbr. tangit, folio unico et vagina compactiore fibrillosa ab ea removenda.

Type.—Western Cape, Diepkloof, north side of Potberg, September 1985, *Perry 3343* (NBG, holotype; MO, isotype).

Plants medium-sized, solitary. *Roots* many, fascicled, with slight proximal swellings and possibly also distal, with a wiry basal part, skin silvery brown. *Fibrous sheathing neck* formed from cataphylls; inner layer up to 150 mm long, compactly reticulate, light brown, basal 30 mm purple; outer older layers ± 30 mm long, 12 mm wide, reticulate, dark greyish brown. *Leaves* only 1 in all specimens examined, 500–800 × 2 mm, semiterete, base slightly winged to clasp peduncle but not sheathing, bright yellow immediately above stem disc; blade shallowly canaliculate towards base, bluish green, somewhat coriaceous, stiffly erect with tip dying back at anthesis; margin smooth. *Raceme* narrowly conical, 35–55 mm long in flower and bud,

PLATE 7.—*Bulbinella eburniflora, Perry 3462* (Nieuwoudtville): 1, plant in vegetative stage, × 1; 2, inflorescence, × 1; 3, ripe fruit, enclosed seed and bract, × 6. Artist: Jeanette Loedolff.

9–15 mm wide, with 40–50 flowers; peduncle terete, 340–500 mm long, 1.5 mm in diameter, light green becoming reddish brown towards inflorescence; bracts broad-based, cymbiform extending to inward curving attenuate apex, 1.75–2.00 mm long, membranous, hyaline with a reddish brown midrib, margin irregularly dentate. *Flowers* stellate, 6.5–7.0 mm in diameter; pedicels 5 mm long, pale green. *Tepals* equal to subequal, 4 × 1.5 mm, yellow with a faint green midrib, pale orange in bud. *Filaments* erecto-patent, filiform, apiculate, yellow. *Ovary* yellow; style yellow. *Capsule* and seeds not known. *Flowering time* September.

Distribution and habitat

Apparently a very rare species so far found only on the north side of the Potberg range. The few plants seen were at an altitude of about 150 m growing among clumps of the Cape reed, *Chondropetalum microcarpum*, on low koppies near the foot of the Potberg. The soil was a clayey silcrete with stones. Map 6.

Diagnostic features

Although so little material of this species has been seen, the single long leaf and neatly reticulate sheath make it distinctive but closely related to *Bulbinella punctulata*.

This species was recognised as distinct from the specimen *Acocks 22834* in the National Herbarium, Pretoria. According to Acocks's label, it was found growing occasionally in fynbos on the north side of the Potberg at 400 feet (122 m). A search in 1985 in one possible area on the north side of the Potberg was unsuccessful. However, a few scattered plants were found in a hilly area 0.5–1.0 km from the foot of the mountain range.

Specimens examined

—3420 (Bredasdorp): N side of Potberg, (–BC), *Acocks 22834* (K, PRE); Diepkloof, N side of Potberg, *Perry 3343* (NBG).

6. **Bulbinella eburniflora** *P.L.Perry* in South African Journal of Botany 53: 436 (1987). Type: Northern Cape, farm Biekos near Nieuwoudtville, September 1985, *Perry 3325* (NBG, holotype; K, MO, PRE, isotypes).

Plants up to 0.75 m above ground. *Roots* numerous, fascicled, white, mainly with distal swollen regions 20–50 mm long, 3–4 mm in diameter, on narrow bases 20–30 mm long, a few near stem ± 50 mm long, swollen for whole length, gradually tapering. *Fibrous sheathing neck* up to 70 mm long, 20 mm wide; fibres very fine, somewhat reticulate, light fawn; base of sheaths purple on adaxial side; inner membranous cataphyll becoming lacy above and extending up the leaves ± 30 mm beyond top of sheath. *Leaves* 3–7, erect; bases expanded, outer completely and inner partially sheathing; lamina linear, canaliculate, size varying, largest up to 880 × 8 mm, very gradually tapering to a point, dark green, coriaceous, parallel veins prominent; margin regularly and finely toothed. *Raceme* broadly cylindrical with rounded apex in flower, 40–100 mm long, up to 35 mm wide, with 50–200 flowers, in fruit up to 150 mm long, 18 mm wide; peduncle up to 450 mm long, 4 mm wide, terete; bracts 4 mm long, broad-based, attenuate, acuminate, membranous, white with light green or brown midrib. *Flowers* stellate, 9–10 mm in diameter, sometimes with a strong musty odour; pedicels 8–10 mm long, whitish in flower, becoming darker as fruits form. *Tepals* subequal, spreading, first green in bud becoming pale yellowish, then ivory-white when open. *Filaments* filiform, apiculate, 3.5 mm long, whitish. *Ovary* ovoid, 1.0–1.5 mm long, green. *Capsule*

valves up to 5 × 2.75 mm, light fawn. *Seeds* up to 3.5 mm long, 2.5 mm wide, shiny black, surface finely granular, with a wing ± 0.5 mm wide all round. *Flowering time* August and September. Plate 7.

Distribution and habitat Apparently confined to the Nieuwoudtville District, where it has been found in a number of localities on flats of soft fine silty loam soils mainly in renosterveld, but less often on a more sandy soil among Restionaceae. Map 6.

Diagnostic features This species is separated from closely resembling species by its hispido-ciliate, canaliculate leaves varying in size. In *Bulbinella elegans* and *B. ciliolata* the leaves are narrow, equal to subequal and semiterete. The fibrous sheath in *B. eburniflora* is fine, soft and somewhat reticulate, whereas in *B. ciliolata* it is straight and loose and in *B. elegans* intricately reticulate. Flowers in *B. eburniflora* are ivory-white and frequently have a strong musty odour, which makes them distinct from the other two species.

Specimens examined —3119 (Calvinia): Glen Lyon, (–AC), *Perry 3318* (NBG, PRE); between farms Glen Lyon and Oorlogskloof, *Perry 3324* (G, K, MO, NBG, PRE); near Grasberg, *Barker 9353* (NBG); 3 miles W of Nieuwoudtville, *Lewis SAM64560* (SAM); farm Biekos, *Perry 3325* (K, MO, NBG, PRE); 2 km N of Grasberg towards Perdekraal, *Perry 3469* (MO, NBG).

7. **Bulbinella cauda-felis** *(L.f.) T.Durand & Schinz,* Conspectus florae africae 5: 334 (1894). Type: Cap. Bon. Spei, *Thunberg s.n.* (LINN!, lectotype).

Anthericum cauda-felis L.f.: 202 (1782); Willd.:146 (1799); Baker: 137 (1872); Baker: 295 (1876). *Bulbine cauda-felis* (L.f.) Schult. & Schult.f.: 450 (1829).

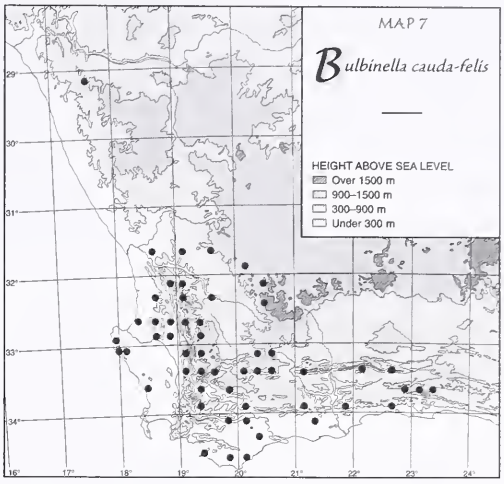
Anthericum caudatum Thunb.: 63 (1794); Thunb.: 321 (1823). *Bulbinella ?caudata* (Thunb.) Kunth: 572 (1843); Baker: 357 (1896). Type: Cap. Bon. Spei, *Thunberg s.n.* (UPS, lectotype, photo.!).

Plants medium-sized, from 0.4–0.8 m high. *Roots* numerous, fascicled, up to 140 mm long, swollen up to 6 mm in diameter the whole length or with a basal wiry part terminating in a thickened region ± 30 mm long, 4 mm in diameter, skin light fawn, flesh whitish. *Stem disc* ± 8 mm in diameter, 5 mm high, white to yellowish. *Fibrous sheathing neck* with fibres compactly reticulate or coarse, straight, loose, bristle-like. *Leaves* erect, 5–11, with dilated bases up to 60 mm long, membranous, cream-coloured, sometimes reddish above, outer completely sheathing, inner partly sheathing; lamina narrowly subulate, very gradually tapering to a point, size varying, largest towards outside up to 750 mm long, 9 mm at widest, innermost much shorter, barely 2 mm wide, sometimes all leaves ± 2 mm wide but length varying, canaliculate, dark to glaucous green, glabrous or rarely sparsely covered with long hairs; margin entire, or finely irregularly denticulate. *Raceme* narrowly conical in flower and bud up to 200 mm long, 30 mm wide, in fruit 280 mm long, 10 mm wide, with ± 50–150 flowers; peduncle terete, up to 500 mm long, 4 mm wide, bright green; bracts very conspicuous in bud, triangular with a broad base surrounding pedicel, acuminate, 4–6 mm long, margin irregularly serrate. *Flowers* stellate, up to 13 mm in diameter; pedicels 7–10 mm long, reddish pink, wiry. *Tepals* equal, elliptic, 5.5 × 2.75 mm, pink in bud, opening to pure white with a pink midrib. *Filaments* filiform, apiculate, 6 mm long, white. *Ovary* ovoid to globose, 1 mm long and wide, green sometimes tinged reddish; style 3 mm long, white. *Capsule* ovoid, 5–6 mm long, 2.5 mm wide,

PLATE 8.—*Bulbinella cauda-felis, Perry 3020* (Biedouw): 1, plant in vegetative stage, × 1; 2, separate leaf, × 1; 3, inflorescence, × 1; 4, flower and bract, × 6; 5, unripe fruit, × 6; 6, tepals and stamens, × 12; 7, gynoecium, × 12. Artist: Jeanette Loedolff.

light fawn, somewhat soft, not brittle when dry. *Seed* 5 mm long, 2–3 mm wide, black, wing extension not obvious, ripe seeds remaining in capsule for some time before dispersal. *Flowering time* August to December. Plate 8.

Distribution and habitat



This is a widespread species covering a large part of the distribution range of the genus and penetrating into the drier habitats on the northern and eastern margins, i.e. the Cape (*sensu lato*). In the Saldanha/Vredendal area plants are found in sandy soils derived from granite or in the coastal calcareous sands rich in humus. The surrounding mixed shrubby vegetation is of the coastal fynbos type. More frequently the species is found on shady hillsides or flats on clayey soils among renosterveld or karoo-type vegetation. Map 7.

Diagnostic features

Bulbinella cauda-felis is a very variable species complex in which it is difficult to find clear-cut distinguishing characters, yet it is not easy to find reliable characters for separation into more than one distinctive taxon. The narrow inflorescence of white flowers with a pink tinge is one of the main characters on which it may be recognised in flower. The leaves always have a dilated sheath and somewhat glaucous appearance, but in some cases they are so narrow that the plants could be confused with those of *B. triquetra*. In fact, in a number of herbarium collections, particularly from mountainous areas, it is difficult to decide whether their affinities are most strongly with *B. triquetra* or with *B. cauda-felis*. Sheath fibres also vary from straight and coarsely bristle-like to finer and somewhat reticulate. This may be a result of habitat conditions as the coarse, straight fibres are found in specimens from eastern areas of lower rainfall and clay soils. Many of these populations flower in November and December, which is later in the season than is normal. The somewhat thin-walled, pale fawn capsule and the large, dull black seeds are regarded as important diagnostic characters for the species.

Nomenclatural notes

The type specimen of the younger Linnaeus is housed in the herbarium of the Linnean Society in London and is clearly annotated '*cauda-felis*'. There is no information regarding the collector of the specimen, which consists of an inflorescence surrounded by five leaves and one separate leaf, but roots and fibrous sheath have been removed. There is a specimen of a similar plant in Thunberg's herbarium in Uppsala but this specimen, no. *8357*, has been annotated *Anthericum caudatum* and was published as such in *Prodromus plantarum capensium* and *Flora capensis*, edn 2. This has no doubt led to the confusion between the epithets *cauda-felis* and *caudatum* in the naming of this species. *Thunberg 8358* is annotated *Anthericum cauda-felis* with the 'felis' crossed out and 'tum' written in place of it and underneath 'nov. spec.' written apparently in dif-

ferent writing from the original. In any case, this specimen is not the same as that of the younger Linnaeus but has the broader leaf and inflorescence shape of the *Bulbinella nutans* group. The brief descriptions of *A. cauda-felis* L.f. and *A. caudatum* Thunb. are almost identical.

Willdenow (1799) correctly used the name *Anthericum cauda-felis*, but quoted *A. caudatum* Thunb. Schultes & Schultes (1829) used *Bulbine cauda-felis*, whereas Kunth used the epithet *caudata* quoting *A. cauda-felis* of Linnaeus and Willdenow and *A. caudatum* of Roemer & Schultes. Baker in the *Journal of the Linnean Society* (1876) seems to have been undecided using *A. cauda-felis*, but *Bulbinella caudata* in the *Flora capensis* (1896). The specific epithet *cauda-felis* consists of two words in the original description but, according to Article 23.1 of the *Code* (Stafleu 1983), these must be united or hyphenated. Durand & Schinz (1894) inserted the hyphen.

Specimens examined

—2917 (Springbok): 6.5 km west of Steinkopf towards Port Nolloth, (–BA), *Perry 3472* (NBG).

—3118 (Vanrhynsdorp): Vleikraal, east of Klawer, (–DA), *Walters 182* (STE); farm Aties, *Bayliss 6121* (K).

—3119 (Calvinia): Lokenburg, (–CA), *Acocks 19031* (K, PRE); Plaatberg, SW of Calvinia, (–DA), *Acocks 18614* (K, PRE).

—3120 (Williston): Middelpos to farm Blomfontein, (–CC), *Goldblatt NBG128824* (NBG); 17 km W of Middelpos to farm Blomfontein, *Perry 3371* (NBG).

—3217 (Vredenburg): Witteklip, S of Vredenburg, (–DD), *Perry 3194* (NBG); W of Saldanha housing development, *Perry 3196* (K, MO, NBG, PRE).

—3218 (Clanwilliam): Welbedacht, (–AC), *Barker 300* (NBG); Nieuwoudt Pass, *Esterhuysen NBG83576* (NBG); Clanwilliam, (–BB), *Leipoldt SAM22734* (SAM); Sandveld between Grey's Pass and Graafwater, (–BC), *Leipoldt 3136* (BOL); between Citrusdal and Piquetberg, (–CB), *Eliovson 168* (BOL); Grey's Pass, *Steyn 374* (NBG, PRE); Dassieklip, W foothills of Piketberg, (–DA), *Perry 3215* (NBG, PRE); Piekeniers Pass, (–DB), *Perry 3306* (NBG, PRE); Het Kruis near Piquetberg, *Stevens & Glover 8627* (BM, NBG); De Hoek, Piquetberg, (–DC), *Barker 2569* (NBG); slopes of Piketberg near the town, (–DD), *Hafström & Acocks 200* (PRE); between Piquetberg and Berg River Bridge, *Weintroub BOL032636* (BOL).

—3219 (Wuppertal): Biedouw Valley, (–AA), *Perry 3020* (NBG); *Perry 3172* (K, MO, PRE); *Thompson 354* (K, STE); *Van Breda 4278* (PRE); top of Biedouw Pass, *Mauve & Oliver 79* (K, PRE, STE); Matjiesrivier, (–AC), *Wagener 207* (NBG); Katbakkies, (–BC), *Bean & Viviers 1464* (K, MO, NBG); Middelberg Pass, (–CA), *Thompson 1534* (STE); 5 miles N of Citrusdal, *Compton 17121 & 20770* (NBG); Kromme River, (–CB), *Leighton 21614* (BOL, PRE); Kromrivier Pass, *Perry 3093 & 3136* (NBG); De Keur, (–CD), *Esterhuysen 13009* (BOL); Zoo Ridge, *Taylor 5914* (PRE).

—3220 (Sutherland): roadside by Quaggasfontein turn-off (–AB), *Perry 3377* (NBG); farm Voëlfontein (–AD), *Perry 3364* (NBG).

—3317 (Saldanha): Stony Head, on Donkergat Road, (–BB), *Pamphlett 118* (NBG, STE); near Hoetjies Bay, *Bolus 12860* (BOL); granite koppie near Saldanha, *Hugo 2937* (PRE, STE); promontory W of Saldanha Bay, *Salter 3926* (BOL); peninsula W of Langebaan, *Pillans 6958* (BOL).

—3318 (Cape Town): near Langebaan, (–AA), *Lewis BOL38839* (BOL); Olifants Kop, *Goldblatt 2707* (PRE); Groenekloof, (–CB), *MacOwan 2500* (SAM).

—3319 (Worcester): N Sneeugat Peaks, (–AA), *Esterhuysen 19802* (BOL, PRE); road from Citrusdal to Cold Bokkeveld, (–AB), *Leighton 1258* (BOL); Hansies Berg, *Compton 16698* (NBG); Boboskloof, *Rourke 681* (NBG, PRE); Tulbagh, (–AC), *Ecklon & Zeyher 139* (SAM); Montpelier, *Perry 3352* (NBG); Witsenberg, *Zeyher 4213* (SAM); *Pillans 9711* (BOL); Hex River Valley, *Tyson 656* (BOL, SAM.); *MacOwan 1662/3* (BM, G, K, P, SAM.); *Wolley-Dod 4016* (BOL); Mostert's Hoek Twins, *Esterhuysen 9888* (BOL); *Wasserfall 793* (NBG); Jackals Rest, (–AD), *Compton 16082* (NBG); NW of Prince Alfred's Hamlet, *Oliver 5131* (STE); Prospect Peak, (–BC), *Esterhuysen 15920* (BOL, NBG); Theronsberg Pass, *Perry 3058* (NBG); Stettynsberg, (–CB), *Esterhuysen 11166* (PRE); Vrolikheid, *Jooste 159* (STE); Karoo NBG Reserve, *Bayer 248* (NBG); Pokkraal, *Walters 902* (NBG); Worcester, *Theron STEU10012* (STEU); Bossiesveld, (–CD), *Walters*

PLATE 9.—*Bulbinella graminifolia, Perry 3025* (Clanwilliam): 1, plant in vegetative stage, × 1; 2, inflorescences, × 1; 3, flower and bract, × 6; 4, tepals and stamens, × 12; 5, gynoecium, × 12; 6, unripe fruit and separate bract. Artist: Jeanette Loedolff.

2306 (NBG); NW Lemoenpoort, *Bayer 2935* (NBG); Villiersdorp, *Esterhuysen 2944 & 3859* (BOL); Rooihoogte Pass, N Villiersdorp, *Bayer NBG130608* (NBG); Montagu to Matroosberg, Rooihoogte Pass, (–DB), *Mauve, Reid & Wikner 201* (STE); Matroosberg to Montagu Road, 1 km NW of farm Soutrivier, *Perry 3356* (NBG).

—3320 (Montagu): 2 km along track to Cabidu from N1, (–AB), *Perry 3200 & 3201* (NBG); Witteberg, near Tweedside, *Barker 7555* (NBG); 5 miles N of Touws River, (–AC), *Sidey 1890* (PRE); 6 km E of Elandsfontein, (–AD), *Perry 3203* (NBG); Elandsfontein, *Compton 3808* (BOL, NBG); Matjiesfontein, (–BA), *Marloth 10758* (PRE); Cabidu, *Compton 12092* (NBG); Bantams Karoo, *Compton 12169* (NBG); Whitehill Ridge, *Compton 13922 & 15184* (NBG); Matjiesfontein, *F. & L. Bolus 2108* (BOL); Witteberg, *Compton 2736* (BOL); Keurkloof, (–BC), *Lewis BOL035232* (BOL); Montagu Baths, (–CC), *Page BOL035131* (BOL).

—3321 (Ladismith): Klein Swartberg, (–AD), *Mauve, Reid & Wikner 111* (STE); Seven Weeks Poort, *Andreae 1300* (PRE); Garcia's Pass, (–CC), *Phillips 378* (SAM); between farms Bonniedale and Woeska, (–DD), *Vlok 1143* (NBG).

—3322 (Oudtshoorn): Swartberg, S of Blouberg, (–AC), *Thompson 2218* (STE); Zwartberg Pass, (–BC), *Bolus 11651* (BOL); Laudina, (–DB), *Fourcade 5452* (BOL, STE); *Esterhuysen 6516* (BOL); near Ganskraal, (–DC), *Perry 3255* (NBG).

—3323 (Willowmore): poort between Uniondale and Avontuur, (–CA), *James BOL334044* (BOL); Uniondale, *Bolus 2494* (K); pass N of Avontuur, *Theron 957* (PRE); 9 km Avontuur towards Haarlem, (–CB), *Perry 3253* (NBG); between Haarlem Drift and Avontuur, *Fourcade 6248* (STE).

—3419 (Caledon): Bushman's River, (–BB), *Lewis BOL135176* (BOL); Danger Point (–CB), *Stokoe PRE38798* (PRE); Geelrug, (–DB), *Albertyn 802* (NBG).

—3420 (Bredasdorp): Swellendam, (–AB), *Fries, Norlindh & Weimarck 1395* (PRE); Potberg, (–BC), *Burgers 1391* (PRE); Struys Bay, (–CA), *Leipoldt 3247* (BOL).

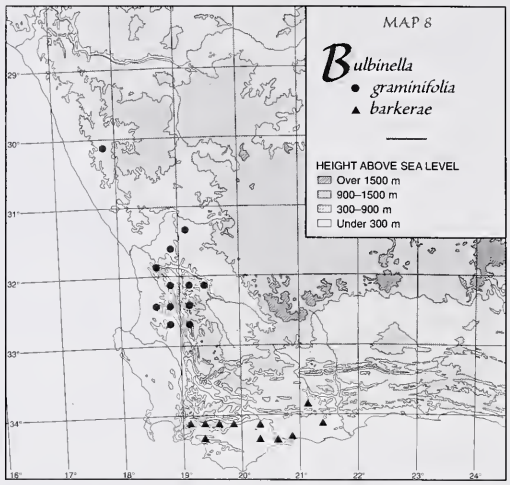
—3421 (Riversdale): SE Riversdale, (–AB), *Bayer 4870* (NBG).

8. **Bulbinella graminifolia** *P.L.Perry* in South African Journal of Botany 53: 440 (1987). Type: Western Cape, near Clanwilliam, opposite farm Remhoogte on road from N7 to Algeria, August 1954, *Perry 3139* (NBG, holotype; K, PRE, isotypes).

Plants medium-sized, up to 0.65 m above ground. *Roots* fascicled, with swellings proximal and distal, the distal up to 35 mm long, 3 mm in diameter, on a wiry basal part 30 mm long, the proximal ± 10 mm long, 5 mm wide, close together at base of stem with thinner laterals from the swollen part and with thin absorptive roots intertwined, skin light fawn, white internally. *Stem disc* 5 mm across, ± 3 mm high, pale yellowish. *Fibrous sheathing neck* up to 70 mm long, 18 mm wide at base, fibres soft, fine, somewhat reticulate, light fawn-coloured. *Leaves* erect, 4–9, outer broadening at base to form a complete sheath up to 65 mm long, innermost nonsheathing, membranous; lamina subulate, very gradually tapering, canaliculate to carinate, size varying from outermost ± 370 mm long, 6 mm wide, to innermost ± 290 mm long, 1.5 mm wide, light to glaucous green; margin with irregular minute transparent crenulations. *Raceme* narrowly cylindrical, up to 180 mm long, 15 mm wide, with 70–100 flowers; peduncle up to 350 mm long, 1.5 mm in diameter, light green, terete; bracts ovate, attenuate, 3–5 mm long, membranous, colourless, sometimes with a faint green midrib. *Flowers* stellate, up to 8 mm in diameter; pedicels 5–6 mm long, wiry, whitish. *Tepals* equal to subequal, 3.5–4.0 × 1.75 mm, white, pale salmon-pink in bud, elliptic, inner somewhat cymbiform. *Filaments* filiform, apiculate, adnate to base of tepals, 3 mm long, white. *Ovary* broadly ovoid to globose, ± 1 mm long, 1 mm wide, dark green to reddish brown; style cylindrical, nearly 2 mm long, white. *Capsule* valves 3.5 × 2.5 mm, light fawn-coloured. *Seeds*, 2.0–2.5 mm long, black, with narrow hyaline extension all round. *Flowering time* July and August. Plate 9.

Distribution and habitat

This species is confined largely to the Clanwilliam area, where it occurs on stony, clayey or loamy, damp, south-facing hillsides, in renosterveld or among karroid bushes such as *Eriocephalus africanus*. Map 8.



Diagnostic features

Bulbinella graminifolia is closely related to *B. cauda-felis*, but separated from that species by its considerably finer, reticulate, fibrous sheath, and its smaller more narrowly cylindrical inflorescence with flowers purer white and faintly salmon-coloured in bud, but tepals not pink-veined. The fruit and the seeds of *B. graminifolia* are barely half the size of those of *B. cauda-felis*.

Specimens examined

—3017 (Hondeklipbaai): Kamieskroon, (–BB), *Hall 547* & *548* (NBG).

—3118 (Vanrhynsdorp): mountain Pass to Kobee, (–DB), *Hall 4463* (NBG, PRE, STE); Gifberg, (–DC), *Phillips 7538* (SAM).

—3119 (Calvinia): Willemsrivier, (–AC), *Leipoldt 808* (SAM).

—3218 (Clanwilliam): Clanwilliam, near the Dam, (–BB), *Lewis 3259* (PRE , SAM); 7 km S of Clanwilliam, *Goldblatt 7131* (NBG); beyond Paleisheuwel, (–BC), *Levyns 10157* (BOL); 2.5 miles SE of Redelinghuys, *Pillans 7683* (BOL); 20 km S of Clanwilliam, (–BD), *Perry 3025* (NBG, PRE); opposite farm Remhoogte on road from N7 to Algeria, *Perry 3139* (K, NBG, PRE); Rondegat, *Hall 4532* (NBG, PRE, STE); 5–9 miles W of Clanwilliam, *Stokoe SAM64564* (SAM); Piekeniers Pass, (–DB), *Perry 3306* (NBG).

—3219 (Wuppertal): Biedouw to Wuppertal road, (–AA), *Bean, Vlok & Viviers 1538* (K, MO, NBG, PRE); near Brandewyns Rivier, *Lewis 2610* (SAM); Bidouwberg, (–AB), *Schlechter 8693* (BM, BOL, P, PRE); Koudeberg, near Wupperthal, (–AC), *Bolus BOL032606* (BOL); Citrusdal rocks (–CA), *Barker 3767* (NBG).

9. **Bulbinella barkerae** *P.L.Perry* in South African Journal of Botany 53: 431 (1987). Type: Western Cape, farm Klipfontein, NW end of Potberg, September 1985, *Perry 3344* (NBG, holotype; PRE, isotype).

Plants medium-sized, up to 0.6 m high, solitary. *Roots* numerous, fascicled, those immediately below stem disc swollen near base, with contractile rings, growing ± vertically downwards, more lateral roots spreading with distal swellings on wiry bases. *Fibrous sheathing neck* up to 50 mm high, 28 mm wide at base, fibres fine to medium coarse, ± straight, loose, untidy. *Leaves* 6–13, suberect to spreading, base dilated forming a complete sheath, cream-coloured with brownish veins; lamina subulate, canaliculate, size varying from up to 300 × 6 mm (outer) to up to 120 × 1 mm (innermost); margin with dense short cilia. *Raceme* narrowly cylindrical, dense, in flower up to 110 mm long, 20 mm wide, with 60–100 flowers, more compact in fruit, up to 95 mm long, 18 mm wide; peduncle up to 400 mm long, 3 mm in diameter; bracts 3–5 mm long, base broadly cymbiform, apex narrowly attenuate, membranous, white with a brownish midrib, margin somewhat irregularly serrate. *Flowers* stellate, up to 9 mm in diameter, with a

strong, rather unpleasant, musty odour; pedicels 5–6 mm long. *Tepals* whitish with a very faint pink midrib, sometimes pinkish in bud. *Filaments* filiform, apiculate, 2.5 mm long, white. *Ovary* ovoid, 1 mm long, narrower than 1 mm, yellowish green; style 2 mm long, white. *Capsule* ovoid, 4–5 mm long, 3 mm wide, light greenish grey. *Seed* grey-black, 3.5–4.0 mm long, 1.75–3.0 mm wide, with amber-coloured membranous wing extension up to 1 mm wide all round. *Flowering time* September and October.

Distribution and habitat

Bulbinella barkerae is confined to the Caledon, Bredasdorp and Riversdale Districts where it is found on shale flats or slight slopes mainly in renosterveld, or on stony, sandy ground at the foot of the Riviersonderend Mountains. It was possibly much more common before the renosterveld was cleared for agriculture. Map 8.

Diagnostic features

Bulbinella barkerae may be confused with *B. cauda-felis*, but is separated from that species by a number of features, especially the spreading leaves with regularly ciliate margins, the smaller greyish green fruits, the seeds with a broadish wing extension and also the strong-smelling flowers. *B. barkerae* is easily separated from the other species with ciliate margins, *B. ciliolata*, on locality and also on the broader and fewer leaves.

Eponymy

This species was named in honour of Miss W.F. Barker, former Curator of the Compton Herbarium. A specimen of this species in the herbarium was tentatively identified by her as *sp. nov.*

Specimens examined

—3321 (Ladismith): Garcia's Pass, (–CC), *Galpin 4742* (PRE).

—3419 (Caledon): Bot River, (–AA), *Wilman 799* (BOL); hillside near Caledon, (–AB), *Van Niekerk 262* (BOL); Caledon, *Van Niekerk 312* (NBG); *Prior PRE38802* (K, PRE); *Templeman SAM22735* (SAM); valley S of Shaw's Mountain, (–AD), *Gillett 4432* (BOL, PRE); Drayton siding, (–BA), *Perry 3219* (NBG); near Zandfontein, *Galpin 4741* (PRE); Riviersonderend, (–BB), *Matthie 5* (STEU); 5 miles NW of Riviersonderend, *Heginbotham 93* (NBG); Riviersonderend Mountains, *Stokoe SAM64563* (PRE, SAM).

—3420 (Bredasdorp): Bontebok Park, (–AB), *Mauve & Hugo 261* (STE); *Liebenberg 6460a* (PRE, STE); farm Spitzkop, N of De Hoop, (–AD), *Perry 3342* (NBG); farm Klipfontein, NW end of Potberg, (–BC), *Perry 3344* (NBG, PRE); NE Malgas, (–BD), *Bayer 4900* (NBG).

—3421 (Riversdale): near Riversdale, (–AB), *Muir 2685* (BOL, PRE).

10. **Bulbinella triquetra** *(L.f.) Kunth*, Enumeratio plantarum 4: 573 (1843); Baker: 356 (1896). Type: Cap. bonae Spei, *Sparrman s.n.* (LINN!).

Anthericum triquetrum L.f.: 202 (1782); Thunb.: 62 (1794); Willd.:146 (1799); Thunb.: 317 (1823); Baker: 293 (1876). *Bulbine triquetra* Schult. & Schult.f.: 451 (1829).

Phalangium capillare Poir.: 247 (1804). *Anthericum capillare* (Poir.) Schult. & Schult.f.: 457 (1829). *Bulbinella ?capillaris* (Poir.) Kunth: 572 (1843). Type: without collector or locality (P!, Lamarck Herb.).

Bulbinella setifolia Kunth: 569 (1843); T.Durand & Schinz: 335 (1894). Type: Cap. Bon. Spei, *Bergius, Lichtenstein* (?B, lost in World War 2).

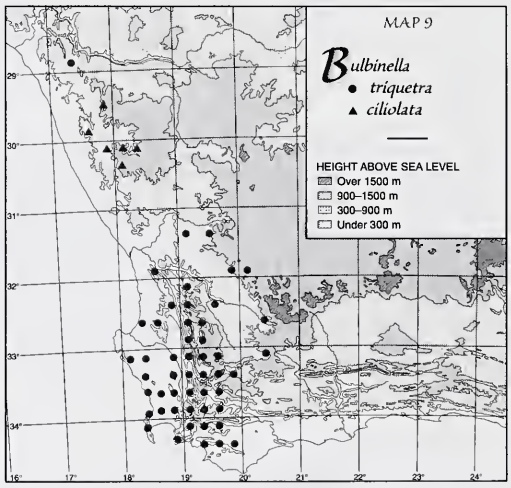
Bulbinella peronata Kunth: 570 (1843). Type: Roodezand between Nieuwekloof & Slangheuwel, *Drège 955* (G!).

Plants small, up to 350 mm high, solitary or in small clumps. *Roots* fascicled, either entirely thickened more or less evenly, up to 100

mm long, 2–3 mm in diameter or with wiry basal region and swollen spindle-shaped end, 20–30 mm long, 4 mm in diameter, pale yellow. *Stem disc* 4 mm high, 4 mm wide, pale yellow. *Fibrous sheathing neck* up to 65 mm high, 20 mm wide, fibres fine to medium coarse, straight, not reticulate, loose, untidy, bristle-like. *Leaves* 10–40, usually many, erect, subequal, basal part expanded to form a sheath, outer completely encircling inner leaves and scape, expanded part becoming progressively narrower on inner leaves, whitish, membranous, veins reddish; lamina filiform, trigonous, up to 180 × 1.0–1.5 mm, light green; margin very finely, irregularly toothed. *Raceme* subcorymbose to cylindrical with rounded apex, or narrowly conical, 20–80 mm long, 20–24 mm wide, becoming up to 150 mm long in bud and fruit together, with 50–80 flowers; peduncle 300 mm long, 2 mm in diameter, reddish to green; bracts triangular, 2–4 mm long, broad-based, apex acuminate, membranous, colourless with a brown midrib. *Flowers* stellate, 8–9 mm in diameter; pedicels up to 8 mm long, yellowish green. *Tepals* broadly elliptic, connate at extreme base, 3 × 2 mm, bright yellow. *Filaments* filiform, apiculate, 3.5–4.0 mm long, yellow, adnate to base of tepals. *Ovary* globose, ± 1 mm long, yellow; style 2.5 mm long, yellow. *Capsule* globose to ovoid, 4 mm long, 3.5–4.0 mm in diameter, bright green becoming fawn on drying. *Seeds* greyish black, 2.0–3.5 mm long, 1.75 mm in diameter, with indistinct wing extensions. *Flowering time* August to December, mainly September and October.

Distribution and habitat

Bulbinella triquetra is a common species which appears to favour damp depressions on flats of organic-rich sandy soils from the Cederberg to the Cape Town area and east to the Caledon area, but it also extends to damper shaded slopes on clayey soils in karroid vegetation. It has been collected from a little above sea level on the Cape flats to higher mountain plateaus at altitudes of up to 1 500 m. Map 9.



Diagnostic features

Two other species, *Bulbinella divaginata* and *B. trinervis*, are of similar size and have narrow leaves similar to those of *B. triquetra*, but their leaves are almost terete and without denticulations, not trigonous and with finely denticulate margins as in *B. triquetra*. They are both autumn-flowering species with leaves in an early stage of development at anthesis, whereas *B. triquetra* is spring- to early summer-flowering with the leaves having completed development at flowering. *B. trinervis* has white flowers, whereas *B. divaginata* and *B. triquetra* have yellow flowers, but the two last-named species are clearly separated by the sheathing leaf bases in *B. triquetra*, whereas in *B. divaginata* the fibrous sheath is formed from separate cataphylls.

Nomenclatural notes

Among the specimens of *Anthericum* in the Linnean Herbarium in London, is one annotated *triquetrum* by the younger Linnaeus. This specimen, apparently collected by Sparrman, shows a single complete

plant with small swollen roots, a fibrous sheath, several narrowly terete or triquetrous leaves with small teeth scattered along the margins and a small, almost corymbose inflorescence—all features leading to a clear identification of this species. This may be regarded as the specimen used by the younger Linnaeus for his description of *A. triquetrum*. Another specimen in the Linnean Herbarium is named *A. annuum*, although agreeing with the specimen of *triquetrum*. The name was, however, not published.

In the Thunberg Herbarium at the Botanical Museum in Uppsala, there are four specimens that have been annotated *Anthericum triquetrum*. These do not include roots and shoots and appear to belong to different taxa. Numbers *8415* & *8417* agree with the type of *A. triquetrum*. Number *8416* is more similar to the autumn-flowering species *Bulbinella divaginata* and the fourth specimen appears quite different, having much shorter and broader leaves and is difficult to relate to any known species.

The type specimen of *Phalangium capillare* examined in the Lamarck Herbarium in Paris clearly belonged to the same species as *Bulbinella triquetra* and so must be placed in synonymy with that species.

Kunth's description of another species, *Bulbinella setifolia*, seems to agree well with the type of *B. triquetra*. Unfortunately, the plants from which Kunth drew up his description have not been traced. He mentions specimens of Bergius and Lichtenstein from *Cap. b. spei*. Although Baker (1896) as well as Durand & Schinz (1894) included *B. setifolia* under *B. triquetra*, they cited no specimens as having been seen by them.

Kunth's description of *Bulbinella peronata* and the locality and date given for *Drège 955* as quoted are confusing as the description fits reasonably well the autumn-flowering species now described as *B. divaginata*. However, the flowering time given for number *955* is September (Drège 1843). The only specimen traced containing this number is at the herbarium of the *Conservatoire et Jardin botaniques* in Geneva and a clue to the confusion becomes evident as this specimen is clearly a mixed collection of *B. triquetra* and *B. divaginata*. Drège's original number has been cut out and pasted onto another piece of paper, so at some stage a specimen of *B. divaginata* from a different locality must have been added. Locality and flowering date clearly refer to the *B. triquetra* specimen.

Specimens examined

—2817 (Vioolsdrif): 3 miles NE of Stinkfontein, (–CD), *Percy Sladen Memorial Expedition 5638* (BOL).

—3118 (Vanrhynsdorp): Koudeberg, (–DC), *Schlechter 8730* (BOL, G, K, P, PRE).

—3119 (Calvinia): Nieuwoudtville Wild Flower Reserve, (–AC), *Perry & Snijman 2363* (NBG); Uitkomst farm, *Barker 10738* (NBG); 10 miles from Nieuwoudtville to Calvinia, *Bolus 19604* (BOL); 10 km along turn-off to Toren from Calvinia to Loeriesfontein road, (–BC), *Perry 3507* (NBG); 14 miles along old Middelpos to Calvinia road, (–DD), *Snijman 22* (NBG).

—3120 (Williston): 23 km Middelpos to farm Bloemfontein, (–CC), *Perry 3053* (K, MO, NBG, PRE).

—3218 (Clanwilliam): 23 miles N of Citrusdal, (–BD), *Hall 122* (NBG); Elandskloof Pass, *Hafström & Acocks 202* (PRE); *Lewis 22084* (BOL); opposite farm Remhoogte, *Perry 3138* (NBG); Papkuils Vlei, (–CB), *Barker 2637* (BOL, NBG); farm Het Kruis, (–DA), *Marloth 10623* (PRE).

—3219 (Wuppertal): Pakhuis Pass, (–AA), *Galpin 11121* (K, PRE); Boontjieskloof, *Esterhuysen 12201* (BOL, NBG, PRE); Middelberg, *Compton 12700* (NBG); *Pocock 156* (STE); *Esterhuysen 7188* (BOL, PRE); Heuningvlei, *Kruger 1704* (STE); Biedouw Hill, *Perry 3018* & *3144* (NBG); Krakadouwsberg, *Esterhuysen 7512* (BOL); Wuppertal, (–AC), *Bean 1539* (NBG); Heuningvlei Forest Station, *Viviers 6* (STE); Langberg,

Esterhuysen 7304 (BOL); Ezelband, *Thode A2092* (K, PRE); Koudeberg, *Bolus BOL03763* (BOL); between Rooiberg and Matroosberg, (–BC), *Esterhuysen 36279* (G, K, MO, NBG, PRE); Elandskloof, (–CA), *Lewis 1453* (SAM); Sneeuberg Peak, *Forsyth 148* (STE); Kromme River, (–CB), *Leighton 21615* (BOL); *Stokoe SAM64553* (SAM); Olifants River Valley, (–CC), *Thompson 1499* (STE); Dasklip Pass, *Liede 16071* (NBG, PRE); between Elandskloof and Ceres, (–CD), *Rycroft 2555* (NBG); Waboomsriver, *Hanekom 712* (K, PRE).

—3220 (Sutherland): Klipdrift, (–CB), *Acocks 17776* (K,PRE).

—3318 (Cape Town): Langebaan, (–AA), *Lewis PRE38804* (PRE); sandveld near Hopefield, (–AB), *Grant 4698* (PRE); near Darling, (–AD), *Bolus 12861* (BOL); Darling Flora Reserve, *Lewis 5071* (NBG); Heuningberg, (–BB), *Thomas NBG93795* (NBG); Riebeek Kasteel, (–BD), *Markötter STEU8539* (STE, STEU); Mamre Hills, (–CB), *Barker 1823* (BOL, NBG); Gansekraal, *Compton 9447* (NBG); Camp Ground, (–CD), *Wolley-Dod 532* (BM, BOL, K); beyond Milnerton, *Hutchinson 556* (BOL, K, PRE); Rondebosch Common, *Baker NBG 69572* (NBG); Kalbaskraal, (–DA), *Werdermann & Oberdieck 317* (K, PRE); Paarl, (–DB), *Smith STE31552* (STE); Zoutfontein Beacon hill, (–DC), *Acocks 24501* (K, PRE); Killarney, *Perry 3191* (NBG); near Joostenberg, (–DD), *Esterhuysen 16048* (BOL, NBG, PRE); between Klapmuts & Simondium, *Morrison STEU11112* (STE, STEU).

—3319 (Worcester): Sneeuwgat, (–AA), *Phillips 1882* (SAM); Great Winterhoek, *Esterhuysen 19797* (BOL); Sneeuwkop, *Leighton 21612* (BOL); Visgat, *Stokoe SAM63174* (SAM); Houtenberg Rivier, (–AB), *Lewis 1451* (SAM); Hansiesberg, *Lewis 1452* (SAM); Gydo Pass, *Compton 16747* (NBG); *Leipoldt 3891* (BOL); Boboskloof farm, *Rourke 674* (NBG, PRE); Romans River, (–AC), *Compton 11662* (NBG); near Tulbagh, *Leighton 1311* (BOL); Elandskloof, *Levyns 5795* (BOL); Darling Bridge, *Esterhuysen 6097* (BOL); Tulbagh road, *Herre BOL035171* (BOL); Baboon Peak, (–AD), *Estyerhuysen 33335* (BOL); Bokkerivier farms, *Booysen 76* (NBG); Waaihoek Mountain, *Esterhuysen 8281* (BOL); Milner Ridge Peak, *Esterhuysen 9343* (BOL); Roodeberg, (–BC), *Esterhuysen 1519* (BOL); Hottentots Kloof, *Compton 16080* (NBG); near Laaken Vlei, *Phillips 2089* & *2090* (SAM); Horseshoe Ridge Peak, (–BD), *Esterhuysen 22215* (BOL); Buffelshoek Peak, *Esterhuysen 24052* (BOL); Botha's Halt, (–CA), *Gillett 281* (STE); Rawsonville, *Walters 393* (NBG); Langerug, (–CB), *Walters 1246* (NBG); farm Groenrivier, *Walters 1902* (NBG); Sentinel Peak, *Esterhuysen 27429* (BOL); Karoo Botanic Garden, *Perry 436* (NBG); Goudini Road, *Levyns 4424* (BOL); Breede River flats, *Snijman 754* (NBG); Wemmershoek Peak, (–CC), *Esterhuysen 11283* (BOL); Du Toit's Peak, *Esterhuysen 16639* (BOL); farm Meerlust, (–CD), *Walters 1523* (NBG); Rabiesberg (–DA), *Lewis BOL 032669* (BOL); Wansbek, (–DC), *Van Breda & Joubert 2004* (PRE).

—3320 (Montagu): Tweedside, (–AB), *Marloth 10824* (PRE); Cabidu, *Barker 1897* (NBG); *Compton 22891* (NBG).

—3418 (Simonstown): Bergvliet farm, (–AB), *Purcell 10* (SAM); near Wynberg, *Schlechter 1685* (K, PRE); Diep River, *Marloth 7141* (PRE); De Klip, *Salter 8463* (BOL); Betty's Bay, (–BD), *Topper 153* (NBG).

—3419 (Caledon): Houw Hoek Pass, (–AA), *Werdermann & Oberdieck 156* (K, PRE); Bot River, *Wilman 796* (BOL); Caledon, (–AB), *Purcell 100* (SAM); *Radloff STEU12744* (STE, STEU); Caledon commonage, *Barker 2* (BOL, K, PRE); Dunghye Park, *Jordaan 202* (STE); 5.5 miles from Caledon to Shaw's Pass, (–AD), *Marsh 1434* (PRE, STE); valley S of Shaw's Mountain, *Gillett 4436* (BOL, K, PRE); Drayton siding, (–BA), *Perry 3220* (NBG); Springerskuil, (–BC), *Perry 3160* (NBG); Fairfield, (–BD), *Acocks 22642* (K, PRE); Napier, *Wackock STE31554* (STE).

11. **Bulbinella ciliolata** *Kunth,* Enumeratio plantarum 4: 570 (1843). Type: Northern Cape, between Pedroskloof & Leliefontein, *Drège s.n.* (G!, lectotype).

Anthericum ciliolatum Baker: 137 (1872); Baker: 294 (1876). *Bulbinella caudata* var. *ciliolata* (Kunth) Baker: 357 (1896).

Plants medium-sized, lower than 0.6 m. *Roots* numerous, fascicled, thickened the whole length up, to 120 mm long, 3 mm in diameter, or with swollen ends. *Fibrous sheathing neck* 60–80 mm long, up to 30 mm wide, fibres straight, coarse, loose to compact, bristly above. *Leaves* 12–40, erect to suberect, equal to subequal, base of outer

leaves dilated to form a membranous, colourless sheath up to 50 mm long, inner not sheathing; lamina filiform, semiterete, up to 700 × 1.5 mm, dark green; margin irregularly, shortly ciliate. *Raceme* dense, narrowly conical to subcylindrical, up to 100 mm long, 30 mm wide in flower and bud, elongating as fruits form, with ± 125 flowers; peduncle up to 350 mm long, 2–3 mm in diameter; bracts narrowly triangular, up to 7 mm long, white with a green midrib, membranous, margin irregularly serrate. *Flowers* stellate, 8–9 mm in diameter; pedicels 7–15 mm long, very pale pink in flower, becoming green in fruit. *Tepals* equal to subequal, elliptic, 5 mm long, 2 mm wide, white, faintly pink in bud. *Filaments* filiform, apiculate, 3.5–4.0 mm long, white. *Ovary* ovoid, 1.25 mm long, 1 mm wide, greenish yellow; style narrowly cylindrical, 2.5 mm long, white. *Capsule* valves 5.5–6.0 × 3.75 mm, fawn, with 3 wavy veins lengthwise, whole open capsule 5 mm across. *Seeds* 4.75 × 1.85–2.75 mm, black with flat, brown, hyaline extensions at each end up to 0.5 mm wide. *Flowering time* July to September.

Distribution and habitat

This species appears to be restricted to northern Namaqualand in the vicinity of Springbok and Kamieskroon. It occurs in Namaqualand broken veld on sandy loams of the granite hills, especially in damper depressions or by streamlets, but it is never common. Map 9.

Diagnostic features

Leaves of this species are similar to those of *Bulbinella elegans*, but tend to be narrower and more numerous. However, it is easily distinguished from that species by the fibrous sheath which is loose and straight in *B. ciliolata* but compactly reticulate in *B. elegans*. The inflorescence is similar to that of *B. cauda-felis* and in flower it may be confused with narrow-leaved forms of that species. Although fruits and seeds should help to distinguish the two species, further study of more living collections would help to clarify the situation.

Nomenclatural notes

Kunth quotes no number for the Drège specimen he cites for *Bulbinella ciliolata*, but adds the name *Bulbine caudata* as Drège's identification. On Drège's label for the specimen in the herbarium of the *Conservatoire et Jardin botaniques* in Geneva is written '*Bulbine caudata* Spr.e. P.B. Spei, *Drège 1839*'. Drège's *Zwei Pflanzengeographische Documente* (1843) gives the locality between Pedroskloof and Leliefontein. The specimen in Geneva is a complete plant and compares well with Kunth's description of *Bulbinella ciliolata*. Drège specimens at Kew and the British Museum and named *Bulbine caudata* have the leaves separated out and show no sheaths and so are not easily identified. Also, Drège's localities given for *Bulbine caudata* Spr. a, b, c and d, conform more to *Bulbinella cauda-felis* than to *B. ciliolata*. The specimen has therefore been chosen as the lectotype for *B. ciliolata*.

Specimens examined

—2917 (Springbok): near Okiep, (–DB), *Bolus 6586* (BOL); Nabapeep, *Barker 7432* (NBG); top of Messelpad Pass, (–DC), *Acocks 19363* (K, PRE).

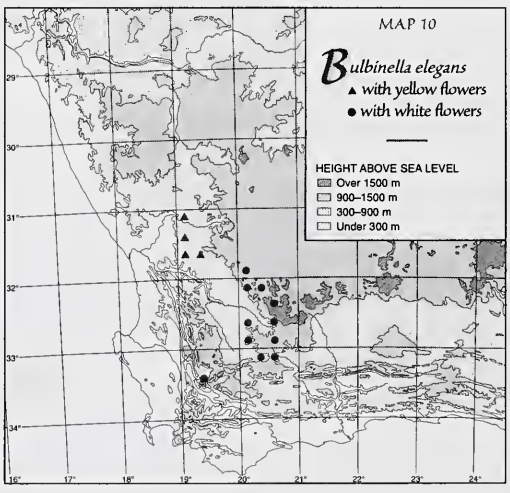
—3017 (Hondeklipbaai): Grootvlei Pass, (–BB), *Perry 1127* (NBG); *Acocks 19462* (PRE); Kamieskroon, *Compton 11315* (BOL , NBG); *Esterhuysen 5666* (BOL); between Kamieskroon and Grootvlei Pass, *Rösch & Le Roux 1445* (PRE); 1 mile S of Kamieskroon, *Lewis 1454* (SAM); 8 km E of Kamieskroon, *Hall 4238* (NBG); 3.5 km E of Grootvlei farmhouse, *Perry 3168* (NBG).

—3018 (Kamiesberg): 20.3 km from Kamieskroon to Leliefontein, (–AA), *Perry 3548* (NBG, PRE); De Kom, 3 miles from Leliefontein, (–AB), *Leipoldt 3138* (BOL); farm Welkom, (–AC), *Esterhuysen 23689a* (BOL).

12. **Bulbinella elegans** *Schltr.* ex *P.L.Perry* in South African Journal of Botany 53: 437 (1987). Type: Northern Cape, Matjiesfontein, Onder Bokkeveld, 20 August 1897, *Schlechter 10930*, (K!, holotype; BM!, BOL!, P!, PRE!, isotypes).

Plants up to 0.6 m tall. *Roots* many, fascicled, those directly below the stem disc swollen proximally, those from the sides basally wiry with swollen ends up to 50 mm long, 5 mm in diameter, with laterals arising from swollen region. *Fibrous sheathing neck* up to 65 mm long, 17 mm in diameter, forming several layers, fibres tough, reticulate, sometimes becoming loose and untidy in upper and outer parts especially in older plants, light to dark brown. *Leaves* 3–25, erect, subequal, basal 50–70 mm completely sheathing, white, with green reticulate veins prominent when visible above fibrous neck; lamina narrowly linear, up to 300 × 3 mm, innermost somewhat narrower and shorter, dark green on both surfaces, somewhat fleshy to coriaceous; margin irregularly denticulate. *Raceme* compact, cylindrical, ± 90 mm long, 25 mm wide, with 70–100 flowers; peduncle terete, up to 400 mm long, 4 mm in diameter, reddish green; bracts prominent in bud, up to 5 mm long, broadly lanceolate, attenuate, membranous, colourless with a reddish brown midrib. *Flowers* stellate, 7–8 mm in diameter; pedicels 7–8 mm long, colour dependent on flower colour. *Tepals* either lemon-yellow or pure white with a pinkish tinge, filaments, ovary and style the same colour as tepals. *Filaments* filiform, apiculate, 3.0–3.5 mm long. *Ovary* ovoid, 1.5 mm long, 1 mm wide; style cylindrical, ± 2.75 mm long. *Capsule* ovoid, up to 5.5 mm long, 3.5 mm in diameter, shiny green becoming light fawn on drying. *Seeds* up to 4.5 mm long, greyish black, shiny, with a light brown, membranous extension widest at each end. *Flowering time* July to October, mainly August (form with lemon-yellow flowers) and September (white-flowered form). Plate 10.

Distribution and habitat



This species is found from the flatter parts of the Nieuwoudtville/Calvinia plateau to the Sutherland and Laingsburg Districts, at an altitude of 600–1 000 m. It inhabits a variety of vegetation and soil types, but occurs mainly in the drier areas of the distribution range of the genus. There are two flower-colour forms, each having a distinct distribution range. The white form occurs in the Sutherland and Laingsburg Districts, mainly in mountain renosterveld on sandy or shale-derived soils. A lemon-yellow form appears to be confined to western mountain karoo vegetation of the doleritic and dwyka clays in the Nieuwoudtville/Calvinia area. Map 10.

Diagnostic features

Bulbinella elegans appears to be most closely related to *B. triquetra* being a larger form of that species in which the broader leaf has developed a more intricate system of conducting tissues, resulting in a basal sheath with more prominent reticulate veins and with the

PLATE 10.—*Bulbinella elegans, Perry 2324* (Nieuwoudtville): 1, inflorescence, × 1; 2, base of plant, × 1; 3, separate leaf, × 1; 4, flower and separate bract, × 6; 5, tepals and stamens × 12; 6, gynoecium, × 12; 7, transverse section of leaf, × 25; 8, portion of leaf showing denticulations, × 12; 9, unripe fruit, × 6. Artist: Jeanette Loedolff.

remaining dead fibres solidly compact and intertwined, whereas in *B. triquetra* the fibres are shorter, straighter and looser. The dense reticulate fibrous sheath is also the main distinction from *B. ciliolata*, which has a loose, straight fibrous sheath.

Nomenclatural note

Specimens collected by Schlechter among hills on the farm Matjiesfontein, south of Nieuwoudtville, are housed in a number of herbaria. On the specimen at Kew, the inscription '*elegans* Schlechter *sp. nov.*' occurs and so that name was adopted.

Specimens examined

—3119 (Calvinia): 5.1 km along Theunisdrift road from Grasberg, (–AA), *Perry 3470* (NBG, PRE); farm Matjiesfontein, (–AC), *Schlechter 10930* (BM, BOL, G, K, P, PRE); Nieuwoudtville Wild Flower Reserve, *Perry & Snijman 2362* (NBG); Glen Lyon, *Perry 3336* (NBG); *Hardy 71* (K, PRE); 4 km W of Nieuwoudtville, *Hall 4225* (PRE); 34 km S of farm Oorlogskloof towards Botterkloof, (–CA), *Perry 3479* (NBG); Augustfontein Mountain, (–CB), *Acocks 18981* (K, PRE).

—3120 (Williston): farm Blomfontein,(–CC), *Barker 10780* (NBG); 16.8 km N of farm Blomfontein, *Perry 3327* (NBG); 14.2 miles on old road Middelpos to Calvinia, *Heimstra 592* (NBG).

—3220 (Sutherland): between two Bo-Visrivier turn-offs, (–AB), *Perry 3331* (NBG); Geelhoek, (–BC), *Acocks 17181* (K, PRE); *Perry 3332* (NBG, PRE); near farm Hottentotsfontein, *Perry 3334* (NBG); farm Rooikloof, *Steiner 799* (NBG); Houthoek, (–CA), *Hanekom 1548* (K, PRE); Koedoesberg, (–CC), *Thompson 1772* (STE); Verlaten Kloof, (–DA), *Levyns 1596* (BOL); 42 km from Matjiesfontein to Sutherland, (–DC), *Perry 3335* (G, K, MO, NBG, PRE).

—3319 (Worcester): Titus River Valley, (–AD), *Oliver 5095* (STE).

—3320 (Montagu): Tweedside, (–AB), *Barker 20640* (BOL); *Compton 3126* (BOL); 4 miles S of Matjiesfontein, *Hardy 2454* (K, PRE); Witteberg, (–BA), *Compton 3554* (BOL, NBG); Whitehill, *Archer 381* (BOL); Matjiesfontein, *F. & L. Bolus BOL035139* (BOL).

13. **Bulbinella trinervis** *(Baker) P.L.Perry* in South African Journal of Botany 53: 443 (1987). Type: Western Cape, Houw Hoek Mountains, *Burchell 8043* (K!, lectotype).

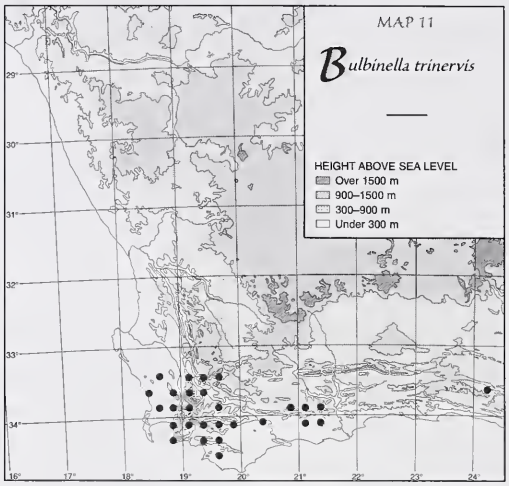
Anthericum triquetrum L.f. var. *trinervis* Baker: 294 (1876). *B. triquetra* (L.f.) Kunth var. *trinervis* Baker: 356 (1896).

Plants small, up to 0.4 m above ground. *Roots* ± 16, thickened along the whole length, 50–95 mm long, 4 mm wide, growing more or less vertically downwards, thin absorptive roots growing separately and as laterals from older swollen roots, skin very light fawn, internally white. *Stem disc* 4 mm high, 4 mm in diameter, internally whitish. *Fibrous sheathing neck* up to 120 mm long, 15 mm in diameter, fibres fine, straight to somewhat reticulate, compact, basally purple. *Leaves* 5–7, surrounded at base by a cataphyll, ± 25 mm high, pale cream-coloured, thinly membranous, supported by a few fine fibrous strands; new leaves scarcely developed at flowering, up to 400 × 1 mm when fully developed, semiterete, bright green; the two margins with minute, sparsely scattered teeth; old leaves turning brown and remaining for more than a year, becoming somewhat spiralled. *Raceme* narrowly conical in bud becoming narrowly cylindrical, up to 90 mm long, 17 mm in diameter in fruit and bud, with 30–60 flowers; peduncle terete, up to 350 mm long, 1 mm in diameter, glabrous, bright to reddish green; bracts 1.0–1.5 mm long, broadly bracket-shaped, surrounding pedicel at base, membranous, transparent, with a pinkish midrib. *Flowers* stellate, 6–7 mm in diameter; pedicels 5 mm long, whitish or pinkish in flower becoming green in fruit. *Tepals* subequal, inner slightly cymbiform, 3 × 1.5 mm, white with a pale pink midrib, pale pink in bud. *Filaments* adnate to base

of tepals, filiform, apiculate, 2.5–3.0 mm long, white. *Ovary* globose, 1 mm long, 1 mm wide, yellowish green; style cylindrical, 1.25 mm long, white. *Capsule* 4 mm long, light brown. *Seed* 3.5 mm long, 2 mm wide, black with lighter, narrow, marginal wings. *Flowering time* December to May, mainly March and April. Plate 11.

Distribution and habitat

This species is found in the western part of the southern Cape excluding the Peninsula, where it grows on rocky lower mountain slopes up to an altitude of about 500 m. It has been collected most frequently on sandy soils among fynbos vegetation but also on shales with clayey soils. In the northwestern part of its range it grows sympatrically with another common autumn-flowering species, *Bulbinella divaginata*. Map 11.



Although many of the collections come from the southwestern corner of the Cape, this may be a reflection of collecting pressures and the species may occur more commonly in the mountainous regions such as the Langeberg and Rooiberg. Time of flowering in the hotter months of summer and early autumn is a possible factor limiting accurate distribution records.

Diagnostic features

Bulbinella trinervis may be confused with *B. triquetra* because of the similar narrow leaves. However, the two species differ in several ways. The white flowers of *B. trinervis* are produced in autumn after a period of rest, with leaves just beginning to come into growth at anthesis, but frequently with long, loosely spiralled, brown remains of the previous year's leaves. *B. triquetra* has yellow flowers produced when leaves are fully developed in spring. In *B. trinervis*, bracts are very distinctive in the genus being broad and truncate without the more typical attenuate apex. *B. trinervis* may also be confused with narrow-leaved forms of *B. cauda-felis*, especially those populations flowering later in the season in November and December. The non-sheathing leaf bases, small bracts and also the smaller seeds are characters that most clearly separate *B. trinervis* in this case.

Nomenclatural notes

Baker (1876) described briefly a variety *trinervis* under *Anthericum triquetrum*. He cites two specimens: one is *Burchell 8043*, which is in the herbarium at Kew, and this specimen has the locality Houw Hoek Mountains and the date March 1818. This information helps to make certain of the identity of this specimen, which shows clearly identifiable characters. The other specimen Baker cites, was collected by Thunberg, but there is no number and the locality given, Cold Bokkeveld, is vague. None of the four specimens of Thunberg annotated *A. triquetrum* in the herbarium at Uppsala represent the same species as *Burchell 8043*.

Although Baker described this as a variety of *Bulbinella triquetra*, apart from the similarly very narrow filiform leaves, the two taxa

PLATE 11.—*Bulbinella trinervis*, *Perry 3107* (Hermanus): 1, plant in vegetative stage as seen in midwinter (July), × 1; 2, inflorescences as seen in April, × 1; 3, single flower and bract, × 6; 4, dorsal view of separate bract, × 10; 5, fruit and seeds, × 12. Artist: Jeanette Loedolff.

are not close and *B. trinervis* should be regarded as a separate species.

Specimens examined

—3318 (Cape Town): between Malmesbury and Morreesburg, (–BC), *Lewis 2611* (SAM); Mamre road, *Esterhuysen 34275* (BOL, K); Riverlands, *Esterhuysen 34924* (BOL, K); Melkbosch, (–CB), *Barker 5346* (NBG); Paarl, (–DB), *Compton 17984* (NBG); Kanonberg, (–DC), *Compton 15617* (NBG); Tygerberg Nature Reserve, *Loubser 3061* (PRE); Jonkershoek, (–DD), *Taylor 10115* (STE); Jonkershoek Twins, *Esterhuysen 18497* (BOL); Stellenbosch, *Duthie 449* (BOL); Jakkalsvlei, *Taylor 4664* (K, PRE, STE).

—3319 (Worcester): Slanghoek, (–AC), *Lewis 5713* (NBG, PRE); Waboomsrivier, *Stokoe SAM60607* (SAM); Tuesday's Peak, (–AD), *Galpin 12751* (K, PRE); Michell Peak, *Esterhuysen 15199* (BOL, NBG); Waaihoek Peak, *Esterhuysen 24295* (BOL); near De Doorns, (–BC), *Bolus 13204* (BOL); summit Klein Drakenstein Mountains, (–CA), *Galpin 10601* (PRE); *Galpin 11061* (K, PRE); Seven Sisters Mountains, *Esterhuysen 13739* (BOL); top of Bain's Kloof, *Stokoe 1613* (PRE); between Darling Bridge and Worcester, (–CB), *Leighton 1649* (BOL); Botha's Halt, *Van Breda 540* (PRE); Riverside, *Bayer 3617* (NBG); Franschhoek Pass, (–CC), *Levyns 11562B* (BOL); *Esterhuysen 11612* (BOL, K); *Smuts & Gillett STE31553* (STE); Zachariashoek, *Smith 118* (STE); Berg River Hoek, *Compton 15633* (NBG); Wemmershoek, *Esterhuysen 18595* (BOL, PRE); Klein Drakenstein, Leliefontein farm, *Lawyer NBG84059* (NBG); Ouklaarberg, (–DC), *Stokoe 1072* (PRE).

—3320 (Montagu): Kortfontein, Langeberg, (–DD), *Liede & Kotze NBG128820* (NBG).

—3321 (Ladismith): Langebergen, Riversdale, (–CC), *Schlechter 2200* (K, PRE); Ladismith, (–CD), *Haynes 1384* (STE).

—3324 (Steytlerville): Baviaanskloof, (–CA), *Bayliss 7999* (PRE).

—3418 (Simonstown): Steenbras Dam, (–BB), *Wilman 191* (NBG, BOL); Wesselgat, *Rycroft 2173* (NBG, STE); Palmiet River bank, *De Vos 890* (STE); Sir Lowry's Pass, *Stokoe SAM64555* (SAM); Kleinmond, (–BD), *Burman 1117* (BOL); Kogelberg Forest Reserve, *Boucher 1204* (K, PRE, STE).

—3419 (Caledon): Houw Hoek Mountains, (–AA), *Guthrie 2320* (NBG); Nieuwekloof, *Burchell 8043* (K); top of Viljoen's Pass, *Stokoe SAM64557* (SAM); Sandfontein, (–AB), *Schlechter 10356* (BM, K, P, PRE); Happy Valley, *Barker 1896* (NBG); Shaw's Pass, *Lewis 3256* (SAM); Caledon, *Purcell SAM46237* (SAM); Hermanus, (–AD), *Galpin 12831* (PRE); Vogelgat Kloof, above Dragonfly Pool, *Williams 2761* (NBG, PRE); *Perry 3107* (NBG); Fernkloof Nature Reserve, *Robertson 294* (K); Kleinriviermond, *Jordaan 789* (STE); Kanonkop, (–BA), *Perry 3259* (NBG); Greyton, *Bayliss 5698* (NBG); Riviersonderend Mountains, (–BB), *Wilman 1003* (BOL); Paardeberg, (–BC), *Stokoe SAM64554* (SAM); Elim, (–DA), *Frowein 15542* (PRE); N of Elim, *Oliver 3343* (K, PRE, STE).

—3420 (Bredasdorp): Ten o'clock Mountain, (–AB), *Wurts 15 & 549* (NBG); Swellendam, *Thode A2400* (K, PRE); National Bontebok Park, *Liebenberg 7202* (PRE).

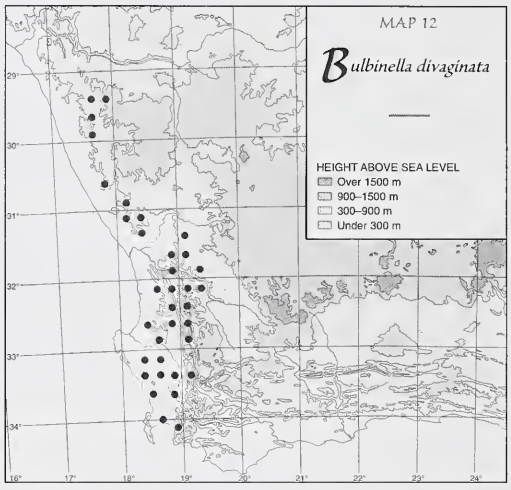
—3421 (Riversdale): Grootberg, Heidelberg, (–AA), *Linder 2782* (BOL); Riversdale (–AB), *Rourke 311* (N BG).

14. **Bulbinella divaginata** *P.L.Perry* in South African Journal of Botany 53: 433 (1987). Type: Western Cape, Boontjieskloof, near Pakhuis, May 1985, *Perry 3267* (NBG, holotype; G, K, MO, PRE, isotypes).

Plants small to medium-sized, up to 0.45 m above ground, solitary or clumps of up to 5 plants together. *Roots* fascicled, 5–20 fusiform up to 150 mm long, 8 mm at the widest, a few thin absorptive laterals arising towards apices, skin light to chestnut-brown, yellow internally; many withered remains of old roots remaining. *Stem disc* 7 mm long, 4 mm wide, orange internally. *Fibrous sheathing neck* showing two distinct regions, the outer consisting of old loose bristle-like fibres, up to 80 mm long, 14 mm wide, fine, straight or somewhat reticulate, light brown to greyish, inner region formed of several layers of membranous, white cataphylls up to 90 mm long and conspicuous beyond old outer fibres; upper part showing fine

reticulate strands as thin tissue between starts disintegrating; inner two cataphylls usually shorter than outer. *Leaves* usually numerous, up to 40, but may be as few as 4, only partly developed at anthesis; laminas fully developed some weeks after flowering, all ± the same size, filiform, semiterete, up to 500 × 1.0–1.5 mm, dark green, glabrous; margin without denticulations. *Raceme* narrowly cylindrical, 25–175 mm long, up to 20 mm wide, with 20–150 flowers; peduncle terete, 100–150 mm long, 1–2 mm in diameter; bracts somewhat variable, either small, ± 1 mm long and wide, ovate, attenuate, membranous, transparent and inconspicuous especially in bud stage, or becoming more attenuate and up to 3 mm long. *Flowers* stellate, 7–9 mm in diameter; pedicels up to 7 mm long, green. *Tepals* subequal, oval to elliptic, shallowly cymbiform, bright yellow. *Filaments* filiform, apiculate, ± 3 mm long, 0.5 mm at widest near base, yellow. *Ovary* ovoid to subglobose, a little more than 1 mm long, 1 mm wide, yellow; style cylindrical, 1.5 mm long, yellow. *Capsule* 5 mm long, 3.5 mm wide, light brown. *Seed* 3.5–4.0 mm long, 1.75–2.0 mm wide, with yellow to orange, thin, flaky covering over shiny black testa. *Flowering time* March to June. Plate 12.

Distribution and habitat



This species is common in the Northern and Western Cape from northern Namaqualand to the Paarl/Malmesbury area in the south. It occurs mostly in the more hilly or mountainous areas and apparently not in the sandveld of the coastal flats. It is found on a variety of soil types, from fine clay overlying shales where it is usually on south-facing stony slopes among karroid bushes such as *Pteronia incana*, *Rhus undulata* and *R. incisa*, to sandy Table Mountain Group-derived soils among fynbos vegetation and associated with plants such as *Protea nitida*, species of *Restio* and *Erica* and with *Metalasia muricata*. Map 12.

Plants collected in the Algeria area on Table Mountain Group-derived soils tended to be more sparsely distributed with smaller inflorescences, fewer flowers and fewer but thicker leaves, than plants from populations in the drier karroid Biedouw area.

Diagnostic features

Although this species shows some variation in certain characters such as size of plant and number of flowers and leaves, it is an easily recognised and distinctive autumn-flowering species. An important diagnostic feature is the membranous white cataphylls surrounding the base of the leaves, which show beyond the fibrous remains.

The narrow filiform leaves have resulted in this species being frequently identified as *Bulbinella triquetra*, but several features distinguish it from that species. In particular, the structure of roots is quite different, the distal swollen regions typical of *B. triquetra* not being found in *B. divaginata*. *Bulbinella divaginata* is a distinctly

PLATE 12.—*Bulbinella divaginata*, *Perry 3103* (Biedouw Hill): 1, plant in vegetative stage as seen in April, × 1; 2, inflorescence, × 1; 3, plant in vegetative stage as seen in July, × 1; 4, flower and separate bract, × 6; 5, tepals and stamens, × 12; 6, gynoecium, × 12; 7, ripe fruit with separate seed, × 6. Artist: Jeanette Loedolff.

autumn-flowering species normally appearing a few weeks after the first good winter rains when the leaves are still only in an early stage of development. June is the latest time of flowering of any of the more than 50 specimens identified as *B. divaginata*.

Bulbinella divaginata appears most closely related to *B. gracilis*, differing from that species in the more elongated inflorescence, narrower, more filiform and nonsucculent leaves and the well-developed fibrous sheath.

Specimens examined

—2917 (Springbok): 4 km from Sannagas farmhouse towards Kammagas, (–DC), *Van Jaarsveld 5370* (NBG).

—3017 (Hondeklipbaai): N bank of Groenrivier, (–DB), *Hall 4276* (NBG, PRE).

—3018 (Kamiesberg): between Bitterfontein and Eenkooker, (–CC), *Zeyher 1691* (K, SAM).

—3118 (Vanrhynsdorp): Meerhofkasteel, (–AA), *Perry 3143* (K, NBG, PRE); 2 km N of Nuwerus, (–AB), *Hall 3957* (NBG); Moedverloor, (–AD), *Hall 3932* (NBG); Vleikraal, E of Klawer, (–DA), *Walters 133* (STE); Sandkraal, (–DB), *Smith NBG83571* (NBG), Gifberg, (–DD), *Thompson 1178* (STE); *Perry 1808* & *3315* (NBG).

—3119 (Calvinia): near Nieuwoudtville, (–AC), *Compton 6620* (NBG); Lokenberg, (–CA), *Acocks 19195* (K, PRE); *Hall 3968* (NBG); near Botterkloof, (–CD), *Martin 1151* (NBG); top of Botterkloof Pass, *Perry 3287* (NBG).

—3218 (Clanwilliam): Die Berg road from Graafwater, (–BA), *Pamphlett 106* (NBG); Ramskop, (–BB), *Leipoldt 145* (BOL); Clanwilliam, *Leipoldt 430* (BOL, SAM); opposite farm Remhoogte, (–BD), *Perry 3309* (NBG); hills above Aurora, (–CB), *Pamphlett 105* (NBG); top of Grey's Pass (–DB), *Esterhuysen 21361* (BOL); Eendekuil, *Herre 3160* (BOL); De Hoek mountain slopes, Piquetberg, (–DC), *Lewis 2613* (SAM).

—3219 (Wuppertal): Boontjieskloof, (–AA), *Thompson 1162* (PRE, STE); *Perry 3267* (NBG); hillside near Brandewynriver, *Galpin 12950* (PRE); pass into Biedouw valley, *Perry 3103* (NBG); 5.5 km along Wuppertal road, *Perry 3101* (NBG); near Traveller's Rest, *Salter 4439* (BOL); NW of Algeria Forest Station, (–AC), *Perry 3105* (NBG); Nieuwoudt Pass, *Perry 3434* (NBG); Olifants River Valley (–CA), *Van Niekerk 15274* (K, PRE); Thee River, *Esterhuysen 15274* (BOL, K, NBG); Olifants River Dome, (–CC), *Esterhuysen 30177* (BOL, K).

—3318 (Cape Town): Geelkuil, (–AB), *Fisher 29* (NBG); Kapokberg, S of Darling, (–AD), *Liede NBG132622* (NBG); Swartberg, Moorreesburg, (–BA), *Jordaan 547* (STE); Malmesbury, (–BC), *Barker 4492* (NBG); N of Malmesbury, *Van der Merwe X9* (PRE); Riebeek Kasteel, (–BD), *Levyns 3103* (BOL); *Rourke 1852* (NBG); S foot of the Paardeberg, (–CB), *Van Niekerk 364* (BOL, PRE); mountain slope Paarl, (–DB), *Smuts STEU10654* (STE, STEU).

—3319 (Worcester): Elandskloof, (–AC), *Barker 4476* (NBG).

—3418 (Simonstown): Cape Flats (–BA), *Marloth 5663* (PRE); Hottentots Holland (–BB), *Ecklon & Zeyher 61.5* (G).

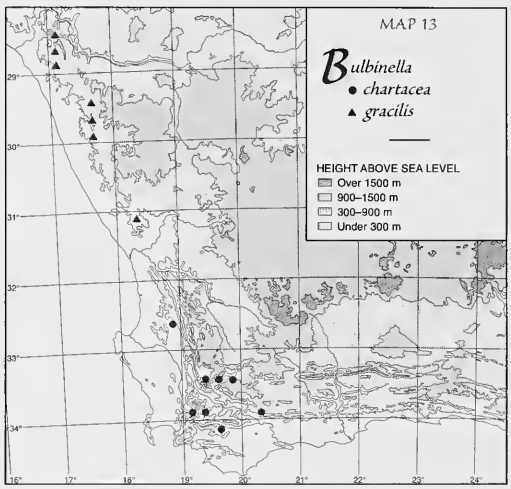
15. **Bulbinella chartacea** *P.L.Perry* in South African Journal of Botany 53: 433 (1987). Type: Western Cape, Kanonkop, Genadendal, March 1985, *Perry 3260* (NBG, holotype; K, MO, PRE, isotypes).

Plants small, up to 0.4 m above ground, solitary. *Roots* up to 10, fascicled, fusiform, up to 50 mm long, 5 mm in diameter near base of stem, gradually tapering to apex, skin light fawn, white internally; in the growing season also numerous longer thin absorptive roots and the shrivelled remains of many food-storing roots; new shoots noted growing from ends of some of the previous year's storage roots consisting of a sheath and beginnings of a single leaf. *Fibrous sheathing neck* 30–50 mm long, up to 15 mm wide, fibres loose, straight, flat, papery, inner almost transparent, outer darker. *Leaves* 3–5, erect, scarcely developed at flowering time, surrounded

at base by a thin, membranous, transparent cataphyll up to 30 mm long, entirely sheathing except top 5 mm, base of outer leaf dilated to form a sheath, remaining leaves not sheathing; laminas of differing lengths, longest up to 320 mm long, 4 mm wide at base, inner shorter and narrower, dark green, fleshy to succulent, canaliculate, glabrous. *Raceme* narrowly conical, up to 85 mm long, 16 mm wide, with 20–40 flowers; peduncle terete, ± 300 mm long, 1.5 mm in diameter, light green to reddish; bracts not conspicuous in bud, 2 mm long, broad at base and surrounding pedicel, attenuate, transparent with red midrib. *Flowers* stellate to recurved when fully open, ± 9 mm in diameter; pedicels wiry, ± 5 mm long, yellow-green. *Tepals* equal to subequal, elliptic, bright yellow with a narrow green midrib. *Filaments* adnate to base of tepals, filiform, apiculate, 2.0–2.5 mm long, yellow. *Ovary* ovoid, 1 mm long, narrower than 1 mm, yellow; style cylindrical, 2 mm long, yellow. *Capsule* ovoid, up to 5.5 mm long, chestnut-brown, shiny. *Seed* dullish black, up to 4.5 mm long, 3 mm in diameter, wings not pronounced. *Flowering time* February to April. Plate 13.

Distribution and habitat

This species appears to have a comparatively limited distribution mainly in the Riviersonderend Mountains and ranges to the north of Worcester, where it occurs on the middle slopes at altitudes of 700–1 100 m in rocky areas in Table Mountain Group-derived soils among fynbos vegetation. Map 13.



Diagnostic features

The basal sheathing fibres clearly distinguish *Bulbinella chartacea* from all other species, being very loose, straight and papery. Specimens of this species have previously been identified as *B. triquetra,* but it is clearly separated from that species by the production of flowers at the beginning of the growing season and by the wider, glabrous, canaliculate, more fleshy leaves of different lengths together with the narrower inflorescence and shorter bracts. *B. trinervis*, which flowers at the same time of year often in similar areas, has white flowers and is found on lower slopes.

Specimens examined

—3218 (Clanwilliam): Olifants River mountains near Thee River, (–DB), *Esterhuysen 15353* (BOL); Old Elands Kloof, *Barker 7272* (NBG).

—3319 (Worcester): Milner Peak, (–AD), *Esterhuysen 14237* (BOL); Waaihoek Peak, *Esterhuysen 18333* (BOL); *Esterhuysen 22611* (BOL, K, PRE); Keeromsberg, (–BC), *Esterhuysen 26592* (BOL); Buffels Hoek, (–BD), *Compton 13181* (NBG); Milner Ridge Peak, *Esterhuysen 9332* (BOL); mountains S of Wemmershoek, (–CC), *Andreae 766* (STE); farm Jonas Plaats, 20 miles S of Worcester, (–CD), *Andreae 317* (PRE, STE).

—3320 (Montagu): Leeurivierberg, 20 km NW Swellendam, (–CD), *Liede & Esterhuysen NBG135011* (NBG).

—3419 (Caledon): Kanonkop, behind Genadendal, (–BA), *Perry 3260* (K, MO, NBG, PRE); Genadendal, S slopes of Kanonkop, *Rourke 329* (NBG); Galgeberg, McGregor, *Liede NBG130610* (NBG).

PLATE 13.—*Bulbinella chartacea, Perry 3260* (Kanonkop, Genadendal): 1, plant in vegetative stage, × 1; 2, inflorescences, × 1; 3, flower and bract, × 6; 4, ripe fruit and bract, × 6; 5 & 6, tepals and stamens, × 12; 7, gynoecium, × 12. Artist: Jeanette Loedolff.

16. **Bulbinella gracilis** *Kunth,* Enumeratio plantarum 4: 571 (1843); T.Durand & Schinz: 335 (1894). Type: Northern Cape, Mierenkasteel, *Drège 2670b* (G!, lectotype; BM!, K!, P!, isolectotypes).

Anthericum gracile (Kunth) Baker: 137 (1872); Baker: 295 (1876).

Plants small, up to 0.3 m high, normally solitary. *Roots* a fascicle of 15–20 fleshy, swollen, finger-like roots of varying lengths, from 5–50 mm, up to 3 mm wide, intermingled with fine, sparsely branched absorptive roots. *Sheathing neck* consisting of 1 or 2 membranous cataphylls up to 22 mm long, more frequently ± 10 mm long, up to 7 mm wide, whitish or fawn-coloured with thin, darker longitudinal lines lower down, fibrous remains lacking or vestigial. *Leaves* 4–8, encircling peduncle, erect, subequal, up to 240 mm long, 4 mm in diameter, terete or slightly flattened on inner side, tapering very gradually to acute apex, bright green, glabrous, succulent, somewhat flaccid, drying flat. *Raceme* broadly conical in bud and flower, becoming cylindrical with rounded apex, up to 60 mm long, 25 mm wide, with 20–80 flowers; peduncle terete, up to 300 mm long, 2 mm in diameter, glabrous, bright green; bracts triangular, 1 mm long, partly surrounding base of pedicel. *Flowers* stellate, up to 8 mm in diameter; pedicels wiry, up to 10 mm long in flower, yellow, remaining in the patent position after the flowers fade and fruits form. *Tepals* equal, elliptic, slightly cymbiform, 4 × 1.75 mm, rich bright yellow. *Filaments* filiform, apiculate, 2 mm long, bright yellow. *Ovary* ovoid to globose, little more than 1 mm long and wide, pale yellow; style cylindrical, 1.5 mm long, yellow. *Capsule* shorter than surrounding remains of tepals, valves 2.5 × 1.75 mm, light fawn-coloured. *Seeds* 1.5–2.0 mm long, 1 mm wide, black with narrow, amber-coloured, hyaline extension all round. *Flowering time* June to August. Plate 14.

Distribution and habitat

Bulbinella gracilis occurs in the Northern Cape from the Richtersveld as far south as Nuwerus. Rainfall in the area is usually low and erratic with an average of 100–150 mm per annum, but this species may be found in dampish areas either among the rocks of dried river beds and flood plain ravines or on shady, south-facing slopes mainly of shale or quartzitic rocks. Map 13.

Diagnostic features

This species is easily identified by a number of distinctive features. In particular, the absence of dead leaf remains forming a fibrous sheath around stem and leaf bases is not encountered in any other *Bulbinella* species in South Africa. The patent pedicels in the fruiting stage are unique to *B. gracilis* and *B. nana*. The almost terete leaves are considerably more succulent than those of other *Bulbinella* species and, as Kunth (1843) describes, dry flat. The small, inconspicuous, boat-shaped bracts are similar to but smaller than those of the two autumn-flowering species, *B. trinervis* and *B. divaginata*.

Nomenclatural notes

A search in August 1984 for this species at Mierenkasteel (Meerhofkasteel), one of the Drège localities quoted by Kunth (1843), was unproductive. It was, however, a very dry season and the possibility that the species has been grazed out from the locality should also be considered.

None of the type specimens of Drège seen at BM, G, K and P show a complete plant including roots and basal sheaths, two of the most distinctive characters in the identification of this species. But inflorescence and bract size and shape, together with size of leaves which have dried flat, help to confirm the identity. The absence of a fibrous

sheath is made clear in Kunth's (1843) description of the species when he says 'scarcely sheathed; no remains of the old leaves'.

Specimens examined

—2817 (Vioolsdrif): Cornellsberg, (–CA), *Oliver, Tölken & Venter 709* (PRE); SE slope of Jenkins Kop, (–CB), *Perry 1077* (NBG); Jenkins Kop, *Van der Westhuizen 149/80* (NBG); 6 miles W of Stinkfontein, (–CC), *Wisura 1651* (NBG).

—2917 (Springbok): Ezelsfontein, 14 miles W of Springbok, (–DA), *Hall 186 & 2910* (NBG); 14 miles W by S of Springbok, *Acocks 19266* (K, PRE); 15 miles from Springbok to Spektakel, *Nordenstam 621* (NBG); Spektakelberg, farm Naries between Kleinsee and Springbok, *Van Wyk 6456* (PRE); Keurboskloof in Komaggas Mountains, (–DC), *Herre 3360* (BOL); Komaggas Mountains, *Marloth (G.Meyer) 6964* (PRE); Messelpad Pass, *Rourke 802* (NBG).

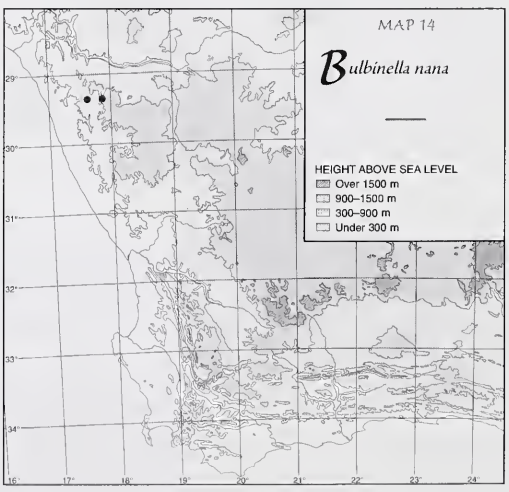
—3118 (Vanrhynsdorp): Karee Bergen, (–AB), *Schlechter 969* (BOL, K, PRE); Bitterfontein, *Salter 953* (K); Mierenkasteel, *Drège 2670b* (BM, G, K, P).

17. **Bulbinella nana** *P.L.Perry* in South African Journal of Botany 53: 441 (1987). Type: Northern Cape, Ratelpoort, April 1982, *Bayer 1637a* (NBG, holotype).

Plants small, up to 0.25 m above ground, solitary. *Roots* fascicled, 10–30, swollen, up to 60 mm long, 4 mm at widest near base of stem, gradually tapering. *Fibrous sheathing neck* of numerous short fibres up to 15 mm long, fine and straight. *Leaves* 10–20, equal, erect; base of leaves not sheathing but surrounded by two membranous, colourless cataphylls, longitudinaly dark veined; lamina narrowly filiform, ± 40 mm long at anthesis, later lengthening to 100 mm long, 0.5 mm wide, dark green. *Raceme* compact, rounded to somewhat lax and broadly cylindrical, up to 35 mm long, 16 mm wide, with 15–30 flowers; peduncle terete, up to 160 mm long, 1 mm in diameter, green; bracts closely adpressed to pedicel base and hard to distinguish, 1 mm long, ovate, almost colourless. *Flowers* stellate to somewhat recurved, 7 mm in diameter; pedicels up to 7 mm long very wiry, green. *Tepals* oval to elliptic, 3.5 × 1.75 mm, yellow. *Filaments* filiform, apiculate, up to 3 mm long, 0.5 mm at widest, yellow. *Ovary* ovoid to globose, barely 1 mm long, 1 mm wide; style cylindrical, 1.5 mm long. *Capsule* irregularly ovoid, valves 4 mm long, 1.75 mm at widest, pale fawn. *Seeds* 2.25 mm long, black, with pale orange outer covering forming a wing-like extension all round. *Flowering time* April to June.

Distribution and habitat

This species is known only from two collections from the Richtersveld area of the Northern Cape. The habitat of one collection is a south-facing rocky hillside where rainfall is low and erratic, averaging 100 mm or less per annum. Map 14.



Diagnostic features

This is the smallest of the *Bulbinella* species, forming dainty, delicate-looking plants. It has close affinities

PLATE 14.—*Bulbinella gracilis, Perry 1077* (Jenkins Kop, Vioolsdrif): 1, plant in vegetative stage, × 1; 2, inflorescences, × 1; 3, fruiting stem, × 1; 4, flower and bract, × 6; 5, ripe fruit, seeds and bract, × 6. Artist: Jeanette Loedolff.

with *B. gracilis*, which occurs in a similar area, but is separated from that species by the more numerous and very fine filiform leaves compared with the more succulent ones of *B. gracilis*. It also has more prominent basal sheath fibres and distinct veining in the cataphylls which is not so obvious in *B. gracilis*. The plants from Ratelpoort were at first thought to be a dwarfed form of *B. divaginata* as the fusiform roots and numerous filiform leaves are closer to that species. A few seeds formed in cultivation were markedly similar to the distinctive seeds of *B. divaginata*. However, seeing collections of the three species in flower together, it was noticed that *B. nana* had the patent pedicels of *B. gracilis* after the flowers had faded.

Specimens examined

—2917 (Springbok): Steinkopf, (–BC), *Meyer sub Marloth 6887* (PRE, STE); Ratelpoort, (–BD), *Bayer 1637a* (NBG).

Species insufficiently known

Bulbinella floribunda *(Aiton) T.Durand & Schinz*, Conspectus florae africae 5: 335 (1894).

Anthericum floribundum Aiton: 447 (1789); Baker: 296 (1876). *Trachyandra ?floribunda* (Aiton) Kunth: 583 (1843).

Anthericum floribundum was described by Aiton from material collected by Masson in the Cape of Good Hope. Presumably it was introduced in 1774. The flowering time given as March and April would presumably indicate the months of flowering at Kew. No Masson type specimen for this name has been traced in the British Museum or elsewhere, also Baker (1876) quotes no Masson specimen in his account of *Anthericum floribundum*. It seems likely that the original description was made from cultivated plants grown from seed collected by Masson and that no herbarium specimens were made at the time of collection or from the cultivated plants. This assumption is made from a study of Masson's travels and other material preserved at the British Museum. One of the places visited at the end of September by Masson and Thunberg together was Witteklip, south of Vredenburg. Two species of *Bulbinella* still exist in this locality. The one, *B. cauda-felis*, is in flower in September and both Masson and Thunberg made pressed material of this species, but with no locality given. The other has finished flowering and is in seed by the end of September and neither Masson nor Thunberg appears to have made herbarium material from this population, but it is possible that Masson collected seed.

The name *Bulbinella floribunda* has recently been applied to the large bulbinellas, in this account treated as *B. nutans* and *B. latifolia*. Unfortunately, Aiton's description is brief and includes no account of the underground parts of roots and sheaths, which are important diagnostic features for the genus. Furthermore, the descriptions 'folius planis glabris lineari-lanceolatis acutis' and 'racemo multifloro cylindrico compacto' do not accurately fit the plants erroneously identified as *B. floribunda* in which leaves are canaliculate and the raceme is conical. Although it could be assumed that plants of Aiton's *A. floribundum* were collected by Masson at Witteklip and the brief original description could apply better to the species described as *B. elata* P.L.Perry, the lack of good diagnostic characters for the genus *Bulbinella* makes the upholding of the name *B. floribunda* very tenuous.

Furthermore, Durand & Schinz (1894), who validated the name *Bulbinella floribunda*, gave no reason for doing so, but merely listed citations for *Anthericum floribundum* and also included as a synonym *B. latifolia* Kunth, quoting the latter's type for *B. latifolia* (namely *Drège 2667a*) as the type of *B. floribunda*. Baker (1896 in *Flora capensis*) dropped the epithet *floribunda* in favour of Kunth's *B. latifolia*, which he placed as a variety of *B. robusta* Kunth.

Bulbinella peronata *Kunth*, Enumeratio plantarum 4: 570 (1843). Type: Cap.b.spei, Roodezand, September, *Drège herb. Cap. no. 955* (G! right hand specimen, lectotype).

Kunth described this species from *Drège herb. Cap. no. 955*. No specimens with this number exist with other Drège *Bulbinella* material in the herbaria of the Royal Botanic Gardens at Kew, the British Museum, the *Muséum National d'Histoire Naturelle* in Paris or the *Botanischer Garten und Botanisches Museum* in Berlin, but a sheet in the herbarium of the *Conservatoire et Jardin botaniques* in Geneva has the number clearly cut out from the original typical Drège-annotated slip and glued to another piece of paper with the name Drège printed and affixed to a sheet with two *Bulbinella* specimens. These two specimens belong to different species and this accounts for the discrepancy between Kunth's description which appears to fit an April-flowering species, one of the specimens, and Drège's locality, Roodezand, and flowering time, September (Drège 1843), which fits the other specimen. The epithet '*peronata*' is not easily related to either specimen but could refer to the sheathed part of the latter specimen identifiable as *B. triquetra* (L.f.) T.Durand & Schinz. Because of Kunth's obvious confusion in his description of *B. peronata*, the former specimen is now described as *B. divaginata* P.L.Perry.

Excluded species

Bulbinella aitonii (Baker) T.Durand & Schinz: 335 (1894) = *Anthericum aitonii* Baker: 294 (1876) = **Trachyandra filiformis** (Aiton) Oberm.: 344 (1967).

B. brevifolia (Thunb.) Kunth: 573 (1843) = *Anthericum brevifolium* Thunb.: 62 (1794) = **Caesia contorta** (L.f.) T.Durand & Schinz: 353 (1894).

B. burkei (Baker) Benth.& Hook.f.: 784 (1883) = *Anthericum burkei* Baker: 140 (1872) = **Trachyandra burkei** (Baker) Oberm.: 721 (1962).

B. carnosum (Baker) Baker: 358 (1896) = *Anthericum carnosum* Baker: 296 (1876) = **Ornithogalum paludosum** Baker: 366 (1874).

B. ?filiformis (Aiton) Kunth: 572 (1843) = *Anthericum filiforme* Aiton: 451 (1789) = **Trachyandra filiformis** (Aiton) Oberm.: 344 (1967).

B. ?ornithogaloides Kunth: 693 (1843) = **Ornithogalum ornithogaloides** (Kunth) Oberm.: 344 (1967).

B. ?squamea (L.f.) Kunth: 573 (1843) = *Anthericum squameum* L.f.: 202 (1781) = **Trachyandra hispida** (L.) Kunth: 575 (1843); Oberm.: 732 (1962).

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Specimens examined (alphabetical according to collector)

The specimens are arranged alphabetically according to collector and numerically for each collector. The species number in the text is given in brackets.

Acocks 16888 (1a); *17181* (10); *17182* (1a); *17776* (10); *18614* (7); *18981* (12); *19031* (7); *19195* (14); *19266* (16); 19363 (11); *19462* (12); *19492* (12); *22642* (10); *22834* (5); *24310* (1a); *24501* (10). *Albertyn 802* (7). *Andreae 317* (15); *547* (1b); *766* (15); *1300* (7). *Andrag 169* (1b). *Archer 381* (12).

Baijnath NBG130611 (10); *NBG130612* (10). *Barker 2* (10); *52* (1a); *300* (7); *1823* (10); *1896* (13); *1897* (10); *1898* (1a); *2569* (7); *2637* (10); *3722* (2a); *3767* (8); *6447* (14); *4492* (14); *8408* (2a); *8647* (10); *9309* (1a); *9353* (6); *9363* (12); *9367* (2b); *9863* (14); *9906* (4); *10301* (4); *10721* (4); *10738* (10); *10780* (12); *20640* (12). Barnes *19290* (4). *Bayer 89* (1a); *248* (7); *1637a* (17); *2935* (7); *3617* (13); *4870* (7); *4900* (7); *NBG130608* (7). *Bayliss 1645* (7); *5698* (13); *6121* (7); *7999* (13). *Bean 1539* (10). *Bean & Viviers 1464* (7). *Bean, Vlok & Viviers 1537* (4); *1538* (8). *Bolus 2494* (7); *3762* (10); *4588* (16); *5269* (16); *6586* (11); *11651* (7); *12860* (7); *13204* (13); *19600* (2b); *19601* (12); *19604* (10); *BOL032606* (8); *BOL035155* (1a); *BOL03763* (10). *Bond 946* (13). *Boucher 1204* (13). *Booysen 76* (10). *Bruyns 2735* (12); *2843* (10); *2847* (10); *3749* (12); *2647* (16); *2629* (14). *Buhr NBG92537* (14). *Burchell 8043* (13). *Burgers 1391* (7). *Burman 772* (13); *1117* (13).

Cloete & Haselan 85 (1a); *239* (12). *Compton 2736* (7); *3126* (12); *3554* (12); *3618* (7); *3760* (1a); *5903* (7); *6620* (14); *9447* (10); *11315* (11); *11662* (10); *11776* (10); *12092* (7); *12169* (7); *12464* (10); *12700* (10); *13181* (15); *13922* (7); *14050* (16); *15184* (7); *15219* (12); *15617* (13); *15633* (13); *16032* (2c); *16051* (2c); *16080* (10); *16082* (7); *16698* (7); *16747* (10); *17121* (7); *17984* (13); *20578* (2a); *20770* (7); *20803* (4); *24219* (4).

Davidson 85 (1a). *Davis SAM64565* (1a). *De Vasseldt SAM22729* (1a). *De Vos 890* (13). *Downing 317* (2a). *Drège 486* (1a); *8763* (1b). *Duthie 449* (13).

Ecklon & Zeyher 61.5 (14); *132* (1a); *139* (7). *Edwards BOL135167. Eliovson 168* (7). *Esterhuysen 1519* (10); *2944* (7); *3169* (4); 3859 (7); *3940* (10); *4130* (10); *4833* (13); *5666* (11); *5913* (4); *5925* (3); *6089* (10); *6097* (10); *6516* (7); *7188* (10); *7304* (10); *7512* (10); *8281* (10); *9011* (1b); *9332* (15); *9343* (10); *9888* (7); *11166* (7); *11283* (10); *11612* (13); *12112* (4); *12201* (10); 13009 (7); *13739* (13); *14237* (15); *15199* (13); *15274* (14); *15353* (15); *15920* (7); *16048* (10); *16202* (1b); *16639* (10); *18056* (10); *18333* (15); *18497* (13); *18595* (13); *19797* (10); *19802* (7); *20564* (10); *21361* (14); *21883* (1b); *22215* (10); *22611* (15); *23112* (4); *23689*a (11); *24052* (10); *24295* (13); *26592* (15); *30177* (14); *33335* (10); *34274*(13); *34611* (1a); *34924* (13); *36279* (10); *NBG69871* (4); *NBG83576* (7).

Fellingham 1192 (1a); *1193* (12). *Fisher 29* (14). *Forsyth 148* (10). *Fourcade 5452* (7); *6248* (7). *Frowein 15542* (13).

Galpin 4741 (9); *4742* (9); *4743* (1b); *10601* (13); *11061* (13); *11121* (10); *12831* (13); *12950* (14). *Gillett 281* (10); *4111* (1b); *4432* (9); *4436* (10). *Goldblatt 2707* (7); *4037* (1a); *7131* (8); *8032* (1b); *NBG128824* (7). *Grant 4698* (10). *Guthrie, Hafström & Acocks 200* (7); *202* (10).

Hall 122 (10); *547* (8); *2910* (16); *3241* (1a); *3932* (14); *3957* (14); *3968* (14); *4225* (12); *4238* (11); *4276* (14); *4463* (8); *4532* (8). *Hanekom 712* (10); *1303* (1a); *1548* (12). *Hardy 70* (2b); *71* (12); *2454* (12). *Haynes 1384* (13); *1441* (13). *Heginbotham* 93 (9). *Heimstra 592* (12). *Herre 3160* (14); *3360* (1b); *BOL035230* (1a). *Hugo 2937* (7). *Hutchinson 556* (10).

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This systematic treatment of the 17 species of *Bulbinella*, a genus of deciduous geophytes belonging to the family Asphodelaceae or Liliaceae *sensu lato*, also contains most useful information on cultivation and propagation. Bulbinellas are about 0.2–1.2 m high, with a compact underground stem from which numerous swollen roots arise. Leaves are produced annually, dying down at the end of the growing season.

Usually only one simple, dense, unbranched raceme of flowers is produced each season, but with plentiful watering in cultivation two or three inflorescences are possible. The 50–500 flowers are usually tightly packed and mature progressively up the inflorescence. The flowers are most commonly yellow, but white tepals with a pale pink midrib and pink buds are also frequent. Cream-coloured flowers with brownish or greenish buds and, more rarely, orange flowers are also found.

In South Africa, *Bulbinella* is confined to the winter-rainfall area of the Cape where it is concentrated towards the west coast, becoming less frequent northwards and eastwards. The growing season of most species is the coolest and wettest time of the year from April to September. Plants remain largely dormant through the dry summer.

Most of the 17 South African species are worth cultivating. The six subspecies and three species with two distinct colour forms, together with a range in size of plants, give scope for selecting a plant for a variety of situations. Because all the South African species are winter-growers, they are not suitable for outdoor situations in frost-prone areas, but could do well in a cool greenhouse.

Propagation is best accomplished by seed. Seedlings that have had the space and suitable conditions to develop well in their first season, may produce flowers in the second year, certainly by the third year. After a number of years some plants may have developed into good-sized clumps and can then be divided.

The taller species of *Bulbinella* are most suitable for garden cultivation where they can be included in a herbaceous or mixed border. They are also the most useful species for cut-flowers. The smallest of the species could be grown in a rock garden or in containers.

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