Short Communications

Preliminary investigation of *Cyanella hyacinthoides* (Tecophilaeaceae) as an edible crop plant

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The literature search, herbarium studies and field work associated with revision of the southern African genus *Cyanella* Royen ex L. suggest that *C. hyacinthoides* Royen ex L. may have potential as an edible crop. Preliminary investigations of seed germination in various soil types and under different temperatures régimes, coupled with plant counts in disturbed areas indicate that it may be possible to grow this species in high-density plots as a supplementary food crop. However, the economic viability of such a venture would depend on the time taken for corms to reach marketable size and information as to this aspect is at present lacking.

Die literatuurondersoeke, herbariumstudie en veldwerk wat gepaard gaan met hersiening van die Suider-Afrikaanse genus *Cyanella* Royen ex L. stel voor dat *C. hyacinthoides* Royen ex L. moontlik as 'n eetbare plantsoort benut kan word. Voorlopige ondersoek van saadontkieming in verskeie grondtipes en temperature, asook opnames van plantgetalle wat in versteurde gebeide voorkom, gee 'n aanduiding van die moontlikheid dat die spesie as aanvullende eetbare plantsoort benut kan word. Die ekonomiese lewensvatbaarheid van so 'n onderneming sal grootliks afhang van die tydsverloop benodig vir vorming van knolle van bemarkbare grootte. Inligting aangaande hierdie aspek is egter nie beskikbaar nie.

Keywords: *Cyanella hyacinthoides*, edible crop, Tecophilaeaceae

Cyanella is a southern African monocot genus with a distribution confined to the southern and western Cape Province and southern Namibia. All the species possess deep-seated tunicated corms which are presumed to be an adaptation for survival under arid conditions. Historical records indicate that the underground parts of many southern African geophytes constituted an important item in the diet of the indigenous Khoisan, Tswana and Nguni peoples and were utilized to some extent by European settlers. This implies a fairly extensive knowledge of practical pharmacology, in view of the known presence of toxic alkaloids or glycosides in e.g. *Homeria, Moraea*, (Iridaceae), *Ornithogalum* and *Urginea* (Hyacinthaceae) (Watt & Breyer-Brandwijk 1962). *Cyanella* spp. appear to lack toxins, *C. lutea* L. being listed by Burchell (1824) as one of the edible plants utilized by the Bachapin in Botswana and *C. hyacinthoides* by Thunberg (1795) as 'roasted for the table of the farmers in the Piketberg district'.

Archer (1982), in an ethnobotanical survey of the plant species utilized by the Nama peoples of the Kamiesberg, noted that *C. hyacinthoides* (raap, wilde raap) was highly prized as a dietary staple. The corms were removed by means of a short crowbar or digging stick and prepared by roasting or boiling in milk, the taste being reminiscent of mashed potatoes (Archer 1982). If consumed raw, the corms were said to cause flatulence, while the previous year's growth remaining beneath the new corm was reputed to be toxic. The mass of an edible corm, without tunic, was in the region of 14 g (Archer 1982). Analysis for dietary value (Archer 1982) gave the following results, comparable figures for potato (*Solanum tuberosum*) being given in parentheses: fibre content 3.86% (2.5%); protein content 6.88% (10.4%); kilojoule g^{-1} value 16.36 (15.73).

C. hyacinthoides has an extensive distribution range, centered in the SW Cape but reaching north as far as the Richtersveld and eastwards to Riversdale (Figure 1). An outlying population has recently been recorded in the Outeniqua Mountains. The species is therefore confined to the winter-rainfall region as defined by Goldblatt (1976) (Figure 2) within which annual precipitation may vary from less than 100 mm in the NW Cape to more that 2 500 mm in the SW Cape (Venter *et al.* 1986; Fuggle & Ashton 1979). *C. hyacinthoides* does not appear to be confined to a particular veld type nor are its edaphic requirements very specific. It is recorded as occurring in Renosterveld, Succulent Karoo and Mountain Fynbos i.e. veld types 46, 31 and 69 (Acocks 1975) in Table Mountain Sandstone, poorly drained clay, weathered granitic soils and loam, over an altitudinal range of 0–900 m. Observations in the field supported the apparent lack of edaphic specificity of *C. hyacinthoides* suggested by herbarium records. It was frequently seen in disturbed areas such as old lands, beside farm roads and on sites cleared of aliens, that this species tended to become almost weedy, springing up in dense stands. The impression gained is that *C. hyacinthoides* may be easy to grow in a wide range of field conditions. It appears to be nutritious and capable of cultivation in high-density plots, suggesting potential as an edible crop. Botanists and conservationists worldwide have drawn attention to the small number of plant species that constitute the staple diet of the world's peoples and have highlighted the necessity for investigating new edible crop plants (Eloff 1986). The suitability of *C. hyacinthoides* as such a crop could only be assessed by means of extensive field trials, but it was felt that an investigation of the following aspects would provide a rough guide:

1. Viability of seeds of different age classes;
2. Success or otherwise of seed germination and seedling growth in different soil types;
3. The most suitable sowing season;
4. The number of plants that might be grown per unit area of land.

Seed collected during 1986 and 1987 from plants growing in the nursery and the field was pooled and treated as follows:

1. One-kg batches of sand, loam and clay soils, determined according to the Bouyoucos test (Day

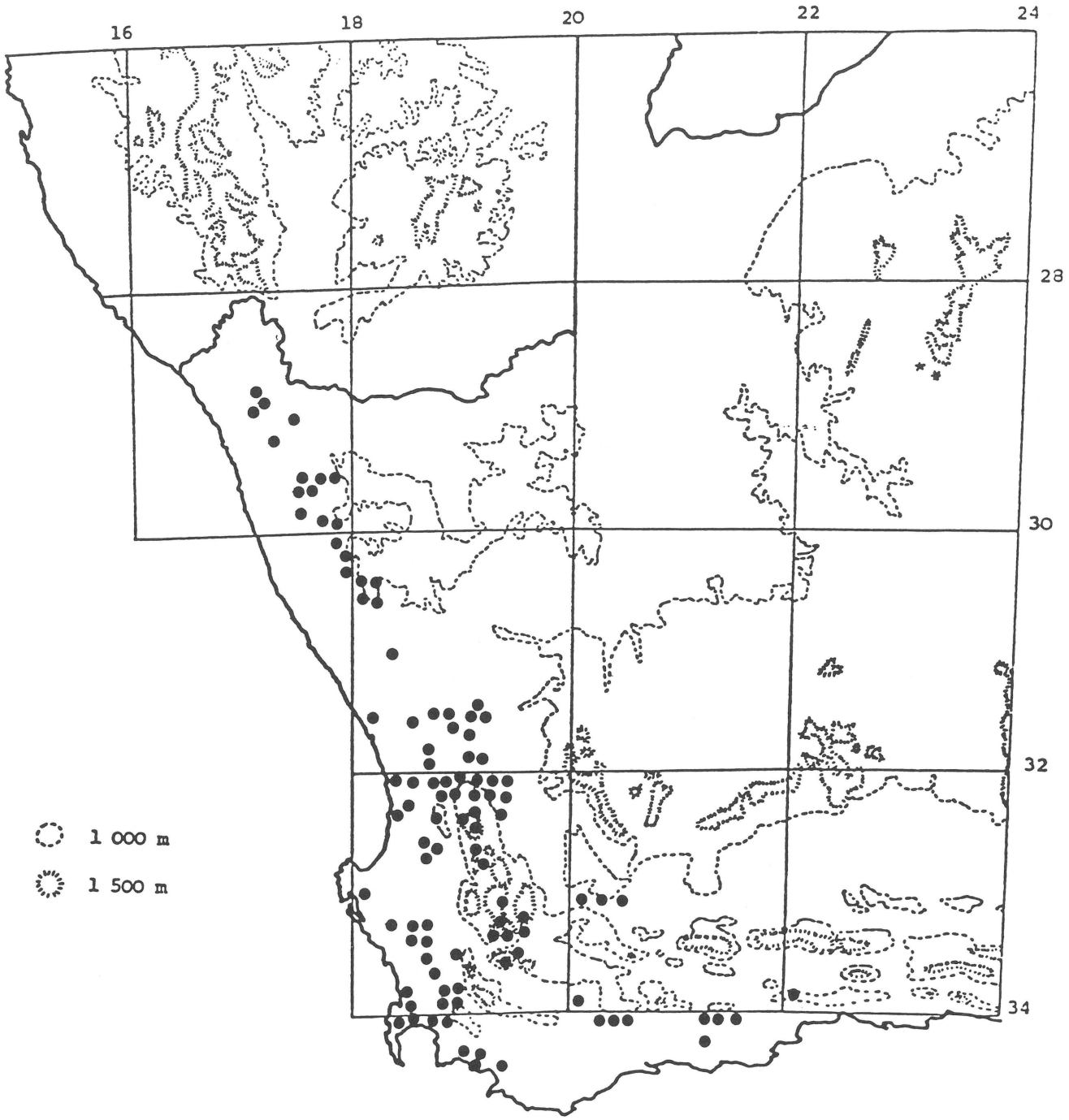

Figure 1 Distribution of *Cyanella hyacinthoides*.

1965), were sterilized in an autoclave and transferred to seed trays. Thirty seeds from the 1986 and 1987 collections were planted in each of the three soil types and the trays placed outside under cover. Water was given at 3-day intervals.

2. Three replicates of 10 seeds each of the 1986 and 1987 collections were placed in petri dishes on filter paper discs moistened with 8 cm^3 of distilled water. The petri dishes were wrapped in aluminium foil and placed in incubators at the following temperatures: 0°, 25°, 30° and one batch at an alternating cycle of 12 h each at 18°/10°C. Petri dishes were checked every 3 days and the filter paper discs kept moist with distilled water.

In addition, numbers of *C. hyacinthoides* plants growing in 1-m^2 plots were counted at three separate sites where human activity had disturbed the original vegetation. This would provide an indication of the plant density per unit area theoretically attainable in cultivation. Sites 1 and 2 were situated on a pavement at the junction of Bishopscourt Road and Kirstenbosch Drive, Newlands, Cape (site 1) and adjacent vacant land belonging to the City Council, planted with *Pinus pinea* (site 2). Site 3 was situated on the farm Hillcrest, 10 km south of Malmesbury in the south-western Cape Province. The area chosen lay between fallow land and farm buildings.

Germination of 1-year-old seed (Table 1) was better in loam and clay and similar in sand to that of 2-year-old

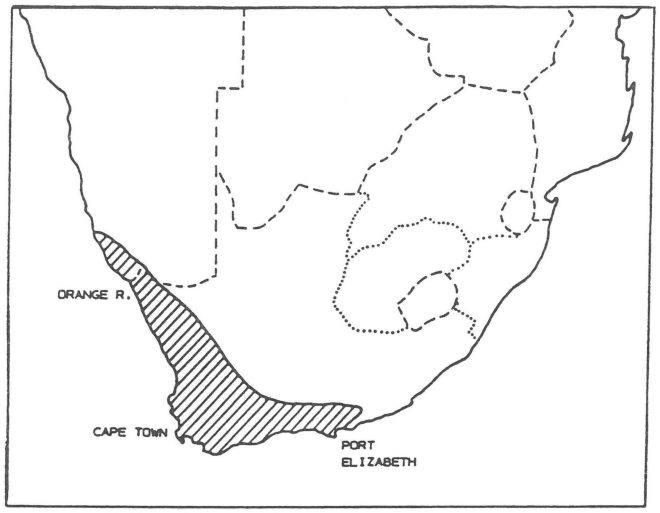

Figure 2 The winter rainfall area of southern Africa (after Goldblatt 1976).

seed. Germination of 1-year-old seed was similar in sand, loam and clay, while that of 2-year-old seed was best in sand, slightly lower in clay and much lower in loam soil.

No germination occurred for seed incubated according to (2) above at 0°, 25° and 30°C. By contrast, seed incubated in an alternating 10°/18°C cycle germinated readily (Table 2), 90–100% success being recorded for all seed batches after 21 days. Germination of seed and growth of seedlings of 2-year-old seed was more rapid than that of 1-year-old seed. The fact that good results were obtained with this particular temperature regime suggests that spring or autumn would be the most suitable sowing season i.e. daytime temperatures below 20°C, and a fall in temperature to 10°C or below for part of the 24-h cycle.

The plant counts made at sites 1, 2 and 3 are recorded in Table 3. The lower number of plants found on site 1 compared with site 2 may be due to compaction of the soil of the former site, a public thoroughfare. Site 3, in spite of a more exposed situation and a much lower annual precipitation, supported a similar mean number of plants to site 2. This suggests that *C. hyacinthoides* does not require rainfall in excess of 450 mm per year, although no attempt was made to measure productivity under the two water régimes. The comparatively low numbers of plants recorded by Archer (1982) as occurring on 1-m^2 plots in the Kamiesberg (9 and 3 respectively on disturbed and undisturbed sites) may reflect lower annual rainfall (188–525 mm) or a reduced seed bank as a result of over-utilization.

Table 1 Germination of *C. hyacinthoides* seed in various soil types

Seed batch	1986	1987
Sand	73.3%	73.3%
Loam	33.3%	76.6%
Clay	70.0%	76.6%

Table 2 Germination of seed of *C. hyacinthoides* after incubation at a 12-h alternating cycle of 10°/18°C

	15 days			21 days		
	% germination	Mean radicle length (mm)	Mean plumule length (mm)	% germination	Mean radicle length (mm)	Mean plumule length (mm)
1986 A	80	7.5	1.5	90	8.55	7.0
B	90	7.5	1.5	90	7.44	7.7
C	90	6.0	0.5	100	6.0	5.2
1987 A	60	6.0	1.5	100	7.2	4.0
B	60	7.5	1.0	100	7.4	6.0
C	90	7.5	0.25	100	7.0	3.95
D	90	6.6	–	90	5.9	2.9

These preliminary investigations suggest that *C. hyacinthoides* may be amenable to cultivation in high-density plots of up to 50 plants m^{-2} in areas receiving an annual rainfall of 450 mm or more. Indications are that seed remains viable for at least 2 years without specialized storage conditions and that both seed germination and seedling establishment take place readily in different soil types. Data regarding the time taken for corms to reach marketable size are lacking and will determine the suitability of the species as a crop plant, unless an alternative propagation method can be found. At present, this appears to be limited to *in vitro* culture (J.H. de Lange, pers. comm.). It is hoped that agriculturalists may take up the question of utilization of this species as a crop plant.

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Table 3 Number of plants of *C. hyacinthoides* per square meter plot

Site	1	2	3
Grid ref.	3318 CD	3318 CD	3318 BC
Soil type	rich loam	rich loam	sand, little humus
Rainfall (mm per annum)	1 432.9	1 432.9	452.0
Mean no. of plants	38.33	61.33	57.66

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New and interesting records of South African fungi. IX. New Ascomycete records

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During the collection and study of the fungal flora of South Africa four new Ascomycete records were encountered: *Melomastia mastoidea* (Fr.) Schroeter (Sphaeriales: genus and species record); *Herpotrichia schiedermayeriana* Fckl., *Didymosphaeria striatula* P. *et* Sacc. and *Dothidea puccinioides* (DC.) Fr. (Dothideales: species records). The specimens are described and illustrated.

Vier nuwe Ascomycete-rekords is tydens die versameling en bestudering van die swamflora van verskillende habitatte in Suid-Afrika aangeteken: *Melomastia mastoidea* (Fr.) Schroeter (Sphaeriales: genus en spesie rekord); *Herpotrichia schiedermayeriana* Fckl., *Didymosphaeria striatula* P. *et* Sacc. en *Dothidea puccinioides* (DC.) Fr. (Dothideales: spesie-rekords). Die versamelde eksemplare word beskryf en geïllustreer.

Keywords: Ascomycotina, descriptions, fungi, new records

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(Other papers in this series were published in *Bothalia*)

The compilation of a list on the fungal flora of South Africa collected until 1945 (Doidge 1950) signified an end of intensive study and collection of the South African Ascomycetes, whereas studies on other fungal groups continued. Taxonomic studies of this group were hereafter more coincidental than the deliberate search for new information and few new records have appeared since.

In the course of an ongoing survey of fungi occurring in South Africa, the following four species were encountered. They have not previously been recorded in South Africa and are presented as new records.

1. Melomastia mastoidea *(Fr.) Schroeter* in Kryptogamen Flora von Schlesien 3(2): 320 (1894).

Perithecia scattered, immersed, globose, black and carbonaceous with a thick, smooth opaque wall, 500–700 µm diam. Ostiole papillate, single and periphysate. Asci unitunicate, narrowly cylindrical, short-stalked, 8-spored, up to 150 × 7 µm. Paraphyses present, filiform, septate, hyaline, up to 180 µm × 1.5–2 µm. Ascospores oblong, hyaline, uniseriate, 3-celled with rounded ends, middle cell slightly larger than end cells, slightly constricted at the septa, 15–17 × 5–6 µm.

According to Munk (1957) *Melomastia mastoidea* is a very distinctive species and the fungus described here agrees well with the descriptions of Munk (1957) and Dennis (1968). Munk (1957) considers the genus *Melomastia* Nitschke *apud* Fuckel monotypic. The occurrence of this genus is therefore also a first record for South Africa. (Figures 1 & 5).

Trematosphaeria mastoidea (Fr.) Winter is considered a synonym (Cannon *et al.*, 1985).

Nelspruit: Collected on dead wood, Berlin Forest Station, Nov. 1987, PREM 49273.

2. Herpotrichia schiedermayeriana *Fckl.* in Müller & von Arx (1962).

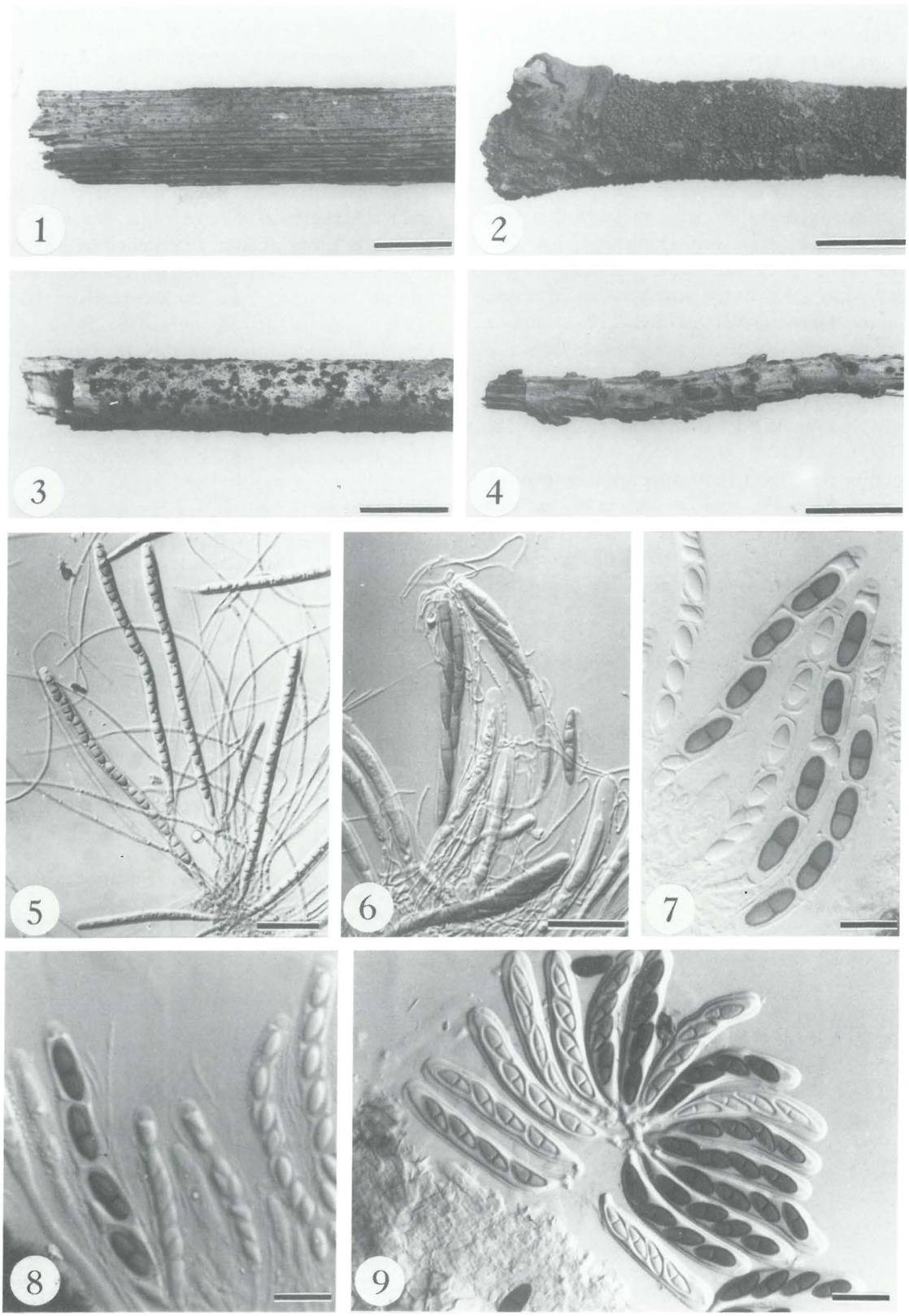
Pseudothecia gregarious, superficial on a mat of mycelium (subiculum) consisting of thick interwoven, septate, brown hyphae, subglobose, ostiolate, dark brown but orange-brown around the ostiole, 0.5–1.0 mm diam. Ostiole single, not papillate. Asci bitunicate, cylindrical, long-stalked, 8-spored, 120–130 × 10–15 µm. Pseudoparaphyses filiform, sometimes branched, hyaline, 140–160 µm × 1–2 µm. Ascospores fusiform, 2-celled, irregularly biseriate, no appendages observed, hyaline, becoming pale yellowish-brown, containing 4 oil globules and sometimes developing further septa between globules, 28–32 × 6–7 µm.

The size of the pseudothecia corresponds to that given by Müller & von Arx (1962), but the dimensions given for the asci and ascospores are slightly broader than those in this description.

This genus was recorded from South Africa once before when a new species, *H. striatispora* was described by Papendorf & von Arx (1966) from the leaf litter of *Acacia karroo* Hayne collected near Potchefstroom (PREM 44715). (Figures 2 & 6).

A thorough literature survey was done by Sivanesan (1971), who listed 24 synonyms.

Rabenh. Fung. Eur. 4060, PREM 4400;
Johannesburg: Collected on woody debris, Johannesburg Botanical Gardens, Sept. 1987, PREM 49270.



Figures 1–9 **1.** Immersed perithecia of *Melomastia mastoidea* (Fr.) Schroeter on dead wood. Bar = 10 mm. **2.** Superficial pseudothecia of *Herpotrichia schiedermayeriana* Fckl. on dead wood. Bar = 10 mm. **3.** Immersed pseudothecia of *Didymosphaeria striatula* P. *et* Sacc. Bar = 10 mm. **4.** Erumpent stromata of *Dothidea puccinioides* (DC.) Fr. on dead wood. Bar = 10 mm. **5.** Paraphyses and asci with ascospores of *Melomastia mastoidea* (Fr.) Schroeter. Bar = 30 μm. **6.** Pseudoparaphyses and asci with ascospores of *Herpotrichia schiedermayeriana* Fckl. Bar = 30 μm. **7.** Asci with ascospores of *Didymosphaeria striatula* P. *et* Sacc. Bar = 30 μm. **8.** Ascus of *Didymosphaeria striatula* P. *et* Sacc., focussed on ascospore surface. Bar = 30 μm. **9.** Asci of *Dothidea puccinioides* (DC.) Fr. containing 4 ascospores. Bar = 30 μm.

3. Didymosphaeria striatula *Penz. et Sacc.*

Pseudothecia scattered, immersed, subglobose, black, 1–1.5 mm diam., associated with a slight development of a clypeus around the ostiole. Ostiole short, erumpent. Asci bitunicate, cylindrical, 8-spored, subsessile to short-stalked, arising from a basal cushion of hyaline hyphae, 190–200 × 15–20 μm. Pseudoparaphyses numerous, hyaline and filiform, 180–200 μm × 1–2 μm. Ascospores uniseriate, 2-celled, ellipsoid, dark brown, striate, slightly constricted at the septa, enclosed in a gelatinous sheath, 28–30 × 10–12 μm. (Figures 3, 7 & 8).

The genus *Roussoëlla* Sacc. was described in 1888 (Theissen & Sydow 1915) but is now considered a synonym of the genus *Didymosphaeria* Fuckel (Cannon *et al.* 1985). The type species of the genus *Roussoëlla* was *R. nitidula* Sacc. & Paol. which was, however, considered identical with *Didymosphaeria striatula* Penz & Sacc. (Theissen & Sydow 1915), described later in 1901 (Saccardo 1905).

The collection described here appears identical with *Didymosphaeria striatula* and is accepted as such. However, it could be argued that *D. striatula* should be renamed *D. nitidula*, taking *Roussoëlla nitidula* as basionym. As the original collections have not been examined, no formal change is proposed here.

Graskop: Collected on dead wood, The Bonnet, Graskop, Nov. 1987, PREM 49271.

4. Dothidea puccinioides *(DC.) Fr.* (fide Loeffler, 1957)

Stromata erumpent, attached over the entire base, pulvinate, black, smooth, carbonaceous, with several small, immersed ascogenous locules, 1.0–2.0 mm, stroma cells thick-walled. Asci bitunicate, cylindrical, short-stalked, 4-spored, 80–90 × 15 μm. Ascospores uniseriate, ellipsoid, 2-celled, slightly constricted at the septa, light-brown becoming dark-brown, 22–25 × 10–11 μm.

One species of *Dothidea* Fr., *D. aloicola* P. Henn. (Kew 1677, *v.d. Bijl 1164*) has been recorded on *Aloe* sp. (Doidge 1950). *Phyllachora kniphofiae* (Kalchbr. & Cooke) Sacc. was collected in South Africa as *Dothidea kniphofiae* Kalchbr. & Cooke (*Mac Owan 1311*, PREM 20820 & Rabenh. Fung. Eur. 3556) at Boschberg, Somerset East on *Kniphofiae aloides* Monch. (Doidge 1950).

Phyllachora perisporioides (Berk. & Curt.) Speg. was collected as *Dothidea perisporioides* Berk. & Curt. on several occasions on different hosts in the 1880's (Doidge 1950). An additional but doubtful species, *Auerswaldia scabies* (Kalchbr. & Cooke) Sacc. (Doidge 1950) was collected at Noodsberg, Natal as *Dothidea scabies* Kalchbr. & Cooke (*Mac Owan 48* and PREM 10436) on leaves of an undetermined tree. (Figures 4 & 9).

This collection is considered identical with *Dothidea puccinioides* (DC.) Fr. as accepted by Cannon *et al.* (1985) who quote *D. tetraspora* Berk. & Br. as a synonym in addition to the 18 synonyms listed by Loeffler (1957).

Drakensberg: Collected on dead wood, Royal Natal National Park, Drakensberg, Apr. 1988, PREM 49272.

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