

Corticolous species of the genus *Rinodina* (lichenized Ascomycetes, Physciaceae) in southern Africa

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Abstract: MAYRHOFER, H., OBERMAYER, W. & WETSCHNIG, W. 2014. Corticolous species of the genus *Rinodina* (lichenized Ascomycetes, Physciaceae) in southern Africa. – *Herzogia* 27: 1–12.

Four corticolous species of *Rinodina* are recorded from southern Africa: *Rinodina albocincta*, *R. australiensis*, *R. capensis* and *R. ficta*. *Rinodina boleana* is regarded as a synonym of *R. ficta*. A key to the species is provided. Characters, distribution and habitats are discussed.

Zusammenfassung: MAYRHOFER, H., OBERMAYER, W. & WETSCHNIG, W. 2014. Borkenbewohnende Arten der Gattung *Rinodina* (lichenisierte Ascomyceten, Physciaceae) in Südafrika. – *Herzogia* 27: 1–12.

Vier borkenbewohnende Arten der Gattung *Rinodina* werden aus Südafrika gemeldet: *Rinodina albocincta*, *R. australiensis*, *R. capensis* und *R. ficta*. *Rinodina boleana* wird als Synonym von *R. ficta* erkannt. Die Arten werden geschlüsselt und ihre Merkmale, die Gesamtverbreitung sowie die Lebensräume diskutiert.

Key words: Biodiversity, taxonomy, lichenized fungi, Africa.

Introduction

The lichen biota of South Africa is still poorly known. DOIDGE (1950) gave a valuable and thorough compilation of the existing knowledge of the region up until 1945, recording more than 1150 species. ALMBORN (1988) subsequently estimated the total number of taxa as ranging from 1500 to 1800. Fifteen saxicolous species of *Rinodina* from southern Africa were treated by MATZER & MAYRHOFER (1994, 1996). In this paper, we confirm and treat four corticolous species and include one further species reported in literature (*R. sophodes*) which may also occur there. Three species (*Rinodina albocincta*, *R. capensis* and *R. ficta*) have been described from South Africa.

Material and methods

The present study is based on collections from the herbaria GZU, M, PRE and ZT. All samples have been identified with routine microscopic techniques. The type specimen of *Rinodina albocincta* has been examined by TLC according to the methods of WHITE et al. (1985).

The identification and delimitation of *Rinodina* species depends heavily on their ascospores, in particularly on their characteristic apical and median wall thickenings (POELT & MAYRHOFER 1979, revised compilations by HAFELLNER et al. 1979, MAYRHOFER & POELT 1979, MAYRHOFER 1982, 1984a, and modified by MATZER & MAYRHOFER 1996, GIRALT 2001, SHEARD & MAYRHOFER 2002, and SHEARD 2010). An important character is the mode of ascospore devel-

opment (GIRALT & MAYRHOFFER 1994a, 1994b, 1995): Type A, where apical internal spore wall thickenings appear after the insertion of the septum (Figs 1A–C, 1E), and type B, where apical internal wall thickenings appear before the insertion of the septum (Fig. 1D).

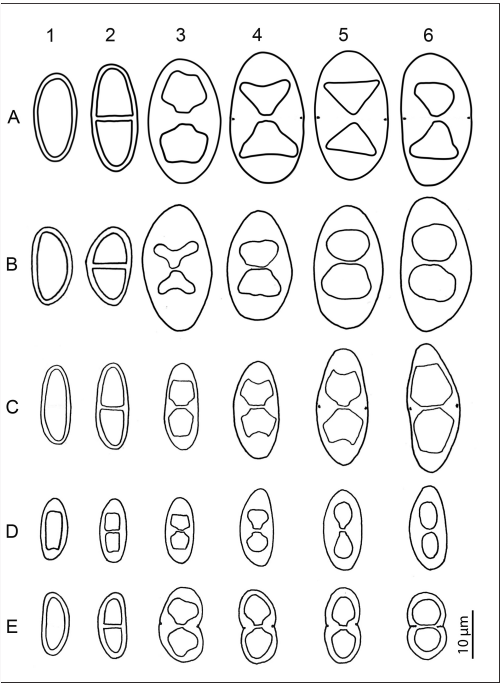


Fig. 1: Ascospore ontogenies of southern African corticolous *Rinodina* species. **A** – *Rinodina albocincta* (lectotype). **B** – *Rinodina australiensis* (lectotype). **C** – *Rinodina capensis* (modified after GIRALT & MAYRHOFFER 1994). **D** – *Rinodina ficta* (modified after GIRALT & MAYRHOFFER 1995, as *R. boleana*). **E** – *Rinodina sophodes* (modified after GIRALT & MAYRHOFFER 1995).

Within the species investigated or treated in the present study, the following ascospore types were observed:

- (i) *Teichophila*-type: septal and apical wall thickenings with variable lumina shape and spore size during development (Figs 1A, 1B, 3B); found in *R. albocincta* and *R. australiensis*.
- (ii) *Physcia*-type: septal and apical wall thickenings resulting in very symmetric lumina with concave or flat apices (Fig. 1C); found in *R. capensis*.
- (iii) *Pachysporaria*-type II: septal and apical wall thickenings with irregularly rounded lumina and type B ontogeny (Fig. 1D); found in *R. ficta*.
- (iv) *Milvina*-type: similar to the *Physcia*-type but with less pronounced septal and apical wall thickenings and more broadly ellipsoid spores that are often constricted at the septum at maturity (Fig. 1E); found in *R. sophodes*.

Key to the species

- 1 Thallus K+ yellow or red 2
- 1* Thallus K– 3
- 2 Thallus K+ yellow turning to red (atranorin and norstictic acid present). Ascospores of the *Teichophila*-type *R. albocincta*
- 2* Thallus K+ yellow (atranorin present). Ascospores of the *Physcia*-type *R. capensis*

- 3 Ascospores large, averaging $> 20.0\mu\text{m}$ in length, of the *Teichophila*-type *R. australiensis*
 3* Ascospores small, averaging $< 20.0\mu\text{m}$ in length, belonging to another spore type 4
 4 Ascospores of the *Pachysporaria*-type II with type B development *R. ficta*
 4* Ascospores of the *Milvina*-type with type A development *R. sophodes*

The species

Rinodina albocincta Zahlbr., Annal. Mycol. **34**: 178 (1936). Figs 1A, 2A, 2B, 3A and 3B

Type: [South Africa:] Kapland, distr. Knysna, on bark, leg. P. A. van der Byl (W-lectotype!).

Note: The type consists of three specimens (Fig. 2A). The right specimen is selected as the lectotype here! Associated species of the left specimen include a *Buellia* sp. and *Caloplaca crocea*.

Description: Thallus (Figs 2B and 3A) crustose, thin, whitish gray, minutely areolate to locally continuous, surface plane to convex; prothallus prominent, dark brown. Apothecia (Figs 1B, 2A) lecanorine, abundant, scattered, narrowly attached, to 0.8–1.0 mm diameter; disc brown, castaneous brown to dark brown or almost black, plane; apothecial margin thick, sometimes slightly crenulate, proper exciple narrow, apothecial cortex prominent, expanded to $100\mu\text{m}$ in the lower part, composed of intricate hyphae, crystals present in cortex and medulla; hypothecium hyaline, to $50\mu\text{m}$ thick; hymenium 150–180 μm thick; paraphyses strongly confluent, apices 2.5–3.5 μm wide, pigmented, forming a red-brown epihymenium. Ascospores (Figs 1A and 3B) eight per ascus, showing type A development, of the *Teichophila*-type, 24–30 \times 13–16 μm , torus indistinct to distinct. Pycnidia not seen.

Chemistry: spot tests: K+ yellow, turning red, C–, KC–, P+ orange-red; secondary metabolites: atranorin (chloroatranorin not checked for) and norstictic acid.

Distribution and ecology: The species is known only from the type locality. The Knysna area is renowned for the occurrence of the largest complex of the vegetation types of Southern African Forest (MUCINA & RUTHERFORD 2006), formerly also known as Knysna Forests (ACOCKS 1988).

Discussion: *Rinodina albocincta* is characterized by large *Teichophila*-type ascospores and a thin whitish, granular thallus containing atranorin and norstictic acid. This combination of secondary metabolites is not known from any other species of *Rinodina*. The only species with a similar chemistry is *Rinodina stictica* Sheard & Tønsberg containing atranorin, chloroatranorin, zeorin and stictic acid with traces of satellites including cryptostictic, constictic, and norstictic acids (SHEARD & TØNSBERG 1995). *Rinodina stictica* is characterized by a sorediate thallus and *Pachysporaria*-type I ascospores (SHEARD 2010) and is known from humid western North America (SHEARD 2010) and from one locality in Norway (TØNSBERG 1998).

Rinodina australiensis Müll.Arg., Hedwigia **32**: 123 (1893).

Figs 1B and 4

Short description: This species is characterized by a rather thick, olive-gray to brownish gray thallus without secondary lichen compounds, and large (20–30 \times 10–15 μm) *Teichophila*-type ascospores (MAYRHOFFER & WIRTH 2011). MAYRHOFFER et al. (1999) classified the ascospores as belonging first to the *Mischoblastia*-type and then corresponding to the *Pachysporaria*-type. However, SHEARD & MAYRHOFFER (2002) introduced the term “*Teichophila*-type” for such variable ascospores. A detailed description with photographs of ascospores and notes on the distribution in Australia are provided by MAYRHOFFER et al. (1999). Photographs of the morphology and the habitat, and an extended description of the specimens from Namibia are given in MAYRHOFFER & WIRTH (2011).



Fig. 2: *Rinodina albocincta* (W – type). **A** – The black arrow points at the selected lectotype; **B** – lectotype; whitish gray thallus with abundant lecanorine apothecia.



Fig. 3: *Rinodina albocincta* (W – lectotype). **A** – Closeup of the roundish apothecia with almost black discs and slightly crenulate, white margin; **B** – large ascospores of the *Teichophila*-type with triangular lumina and narrow, or poorly developed tori.

Distribution and ecology: This species was described from Australia by MÜLLER (1893), where it is a lowland species, found in mangroves and sclerophyllous woodland and heathland, usually near the coast (MAYRHOFFER et al. 1999). All localities in southern Africa (Fig. 4) are likewise close to the sea within their specific types of vegetation. The Vredenburg locality is situated in the Saldanha Limestone Strandveld vegetation unit, belonging to the Fynbos biome. The Alexanderbay site belongs to the Desert Biome. Groot Derm 10 lies in the Northern Richtersveld Yellow Duneveld. All the other localities belong to azonal vegetation units of Seashore Vegetation. The Holgat River Mouth locality lies in an area with Namaqualand Seashore Vegetation, Roscherpan belongs to the Langebaan Dune Strandveld, whereas the locality SW of Swellendam and the Natures Valley locality are situated in areas with Cape Seashore Vegetation (MUCINA & RUTHERFORD 2006).

All specimens examined from South Africa and the samples from Namibia treated in MAYRHOFFER & WIRTH (2011) occur on the bark of small dead twigs of various woody shrub species (e.g. *Stoeberia* sp., *Sarcocaulon* sp.).

The record of *Rinodina roboris* (Nyl.) Arnold in NYLANDER (1869, as *Lecanora roboris*) refers to *R. australiensis*.

Specimens examined: Namaqualand: Holgat River Mouth, 15 m; Grid Ref. 2816 DC; 14.10.1980, Le Roux & Parsons CH 4506 (PRE, as *Rinodina albocincta*). – Northern Cape Province: Alexanderbay (Lichen field). In diamond area close to the town of Alexanderbay, 28.3.2001, L. Zedda 5541 (M-0039912). Northern Cape Province: Groot Derm 10 (Richtersveld Yellow Dunes), about 20km south of Brandkaros (BIOTA Observatory no. 21), 28°36'44.5"S/16°39'52.4"E, about 200 m, on Asteraceae shrubs, 31.3.2001, L. Zedda 5037 (M-0038487). Ibidem, on *Stoeberia* sp., L. Zedda 5014 (M-0038483). Ibidem, on *Stoeberia* sp., L. Zedda 5017 (M-0038485). Ibidem, on

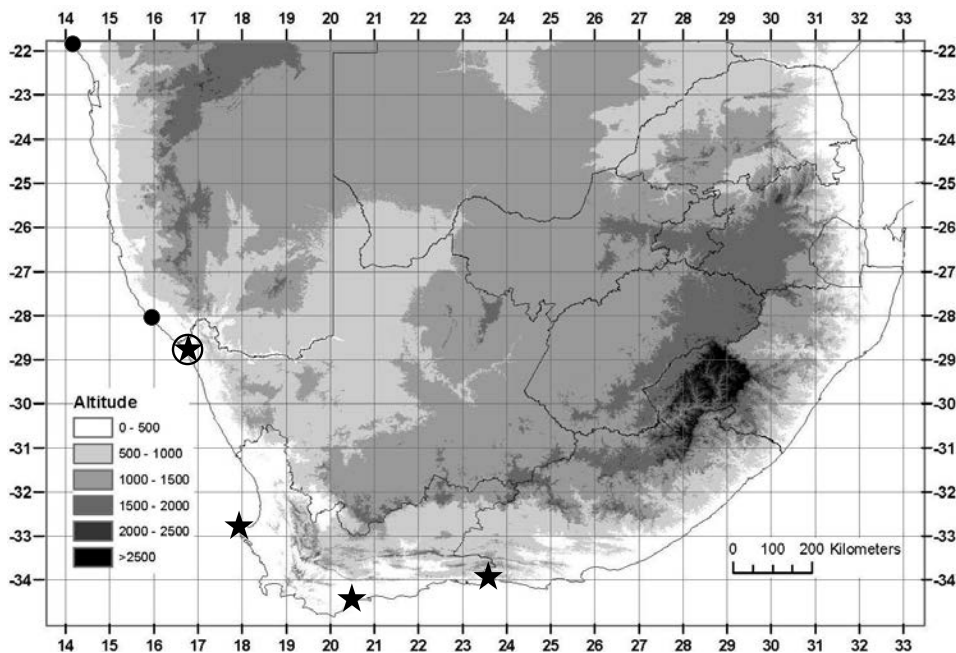


Fig. 4: *Rinodina australiensis*: Localities of the studied specimens in South Africa are indicated with a star. The circles refer to the specimens cited in MAYRHOFFER & WIRTH (2011) from Namibia. The star with a circle refers to three localities which are very close.

dead wood, L. Zedda 5071 (M-0038484). Ibidem, L. Zedda 5075 (M-0038486). Ibidem, on *Sarcocaulon* sp., L. Zedda 5054 (M-0038488). – Western Cape Province: Roscherpan Nature Reserve, along road between Velddrif and Elandsbaai, c. 15 km north of Dwaarskroos (BIOTA Observatory no. 29), 32°36'03.1''S/18°18'20''E, 35 m, 20.3.2001, L. Zedda 6120 (M-0039430). – Cape Province: west coast, about 15 km NW of Vredenburg, Paternoster, about 2 km SW of the hotel Paternoster in Cape Columbine direction, 32°49'S/17°53'E, near the beach; 22.9.1987, W. & U. Wetschnig (GZU). – SW Cape Province: About 46 km southwest of Swellendam, near the road R 316; 34°21'S/20°09'E; 25.9.1987, W. & U. Wetschnig (GZU, associated with *Teloschistes chrysophthalmus*). – S Cape Region: Natures Valley, first stabilized dune, on dead twigs, Grid Ref. 3323 DC, 26.12.1980, E. Retief 572 (PRE, as *Rinodina roboris*). – Südafrika, com. Breutel (M, as *Lecanora roboris* – mounted on paper with the handwriting of W. Nylander).

Rinodina capensis Hampe in A. Massal., Memor. R. Ist. Venet. **10**: 87 (1861). Figs 1C, 5A and 5B

Type: Africa meridionalis, Caput Bonae Spei, corticola, Wawra (VER–holotype).

Syn.: *Rinodina corticola* (Arnold) Arnold

Short description: This species is well characterized by thin, pale thalli, sessile and uniformly rounded apothecia (Fig. 5B) and, especially, by the thick and I+ blue apothecial cortex, the large *Physcia*-type ascospores (Fig. 1C) and the presence of atranorin, chloroatranorin and traces of zeorin. GIRALT & MAYRHOFFER (1994) and GIRALT (2001) provide detailed descriptions. VAN DEN BOOM et al. (2009) have found pannarin in the epihymenium of the type specimen and in many but not all European samples investigated.

Distribution: In South Africa, the species is known only from the type locality.

Discussion: GIRALT & MAYRHOFFER (1994) adopted the name *R. capensis* for the species previously known as *Rinodina corticola* which occurs in southern and central Europe, Macaronesia and on the island of Cyprus (GIRALT & MAYRHOFFER 1994). They have not observed any differences between the type specimen and the specimens from the Northern Hemisphere. This species is also recorded from New Zealand (MAYRHOFFER et al. 2007). VAN DEN BOOM et al. (2009) have suggested that *R. aurantiaca* Sheard from western North America is also conspecific.

Rinodina ficta (Stizenb.) Zahlbr., Cat. Lich. Univ. **7**: 518 (1931). Figs 1D, 6A and 6B
Bas. *Lecanora ficta* Stizenb., Lich. Afric. **I**: 210 (1890).

Type: Auf der Rinde einer Malvaceae, Durban, Südafrika, 02.1888, Wilms (ZT Myc 30506 – holotype!), associated with *Haematomma africanum*.

Note: Most of the small piece of bark (Fig. 6A) is covered by *Haematomma africanum* (J. Steiner) Dodge and two small foliose parmelioid thalli, and only very few apothecia of the *Rinodina* are present (Figs 6A and 6B). The protologue includes characters of the apothecia of *Haematomma africanum* but the features and measurements of the hymenium and the ascospores refer to *Rinodina ficta*.

Syn.: *Rinodina boleana* Giralt & H. Mayrhofer, Mycotaxon **40**: 435 (1991).

Short description: *Rinodina ficta* is characterized by a thin, pale gray to gray, rimose thallus, small sessile apothecia and small (12–16 × 5–8 µm) *Pachysporaria*-type II ascospores with type B development. SHEARD (2010) introduced the *Pachysporaria*-type II for such ascospores which were assigned to the *Pachysporaria*-type by GIRALT & MAYRHOFFER (1991). A torus is absent but a diffuse septal pigmentation is present. GIRALT & MAYRHOFFER (1991) provide a detailed description.

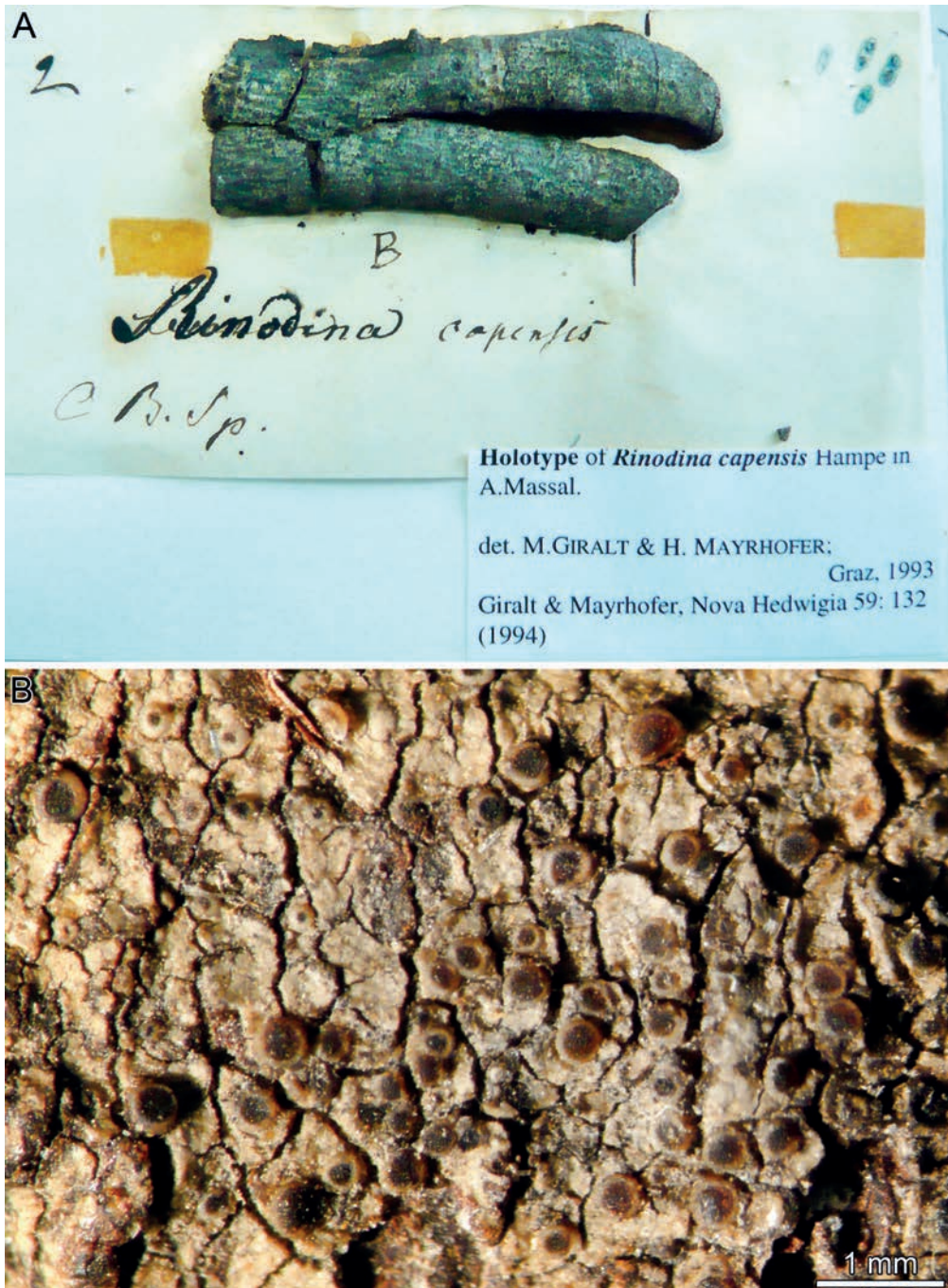


Fig. 5: *Rinodina capensis*. (VER – holotype). **A** – Specimen with spore drawings on the right side; **B** – rimose thallus and roundish, lecanorine apothecia.

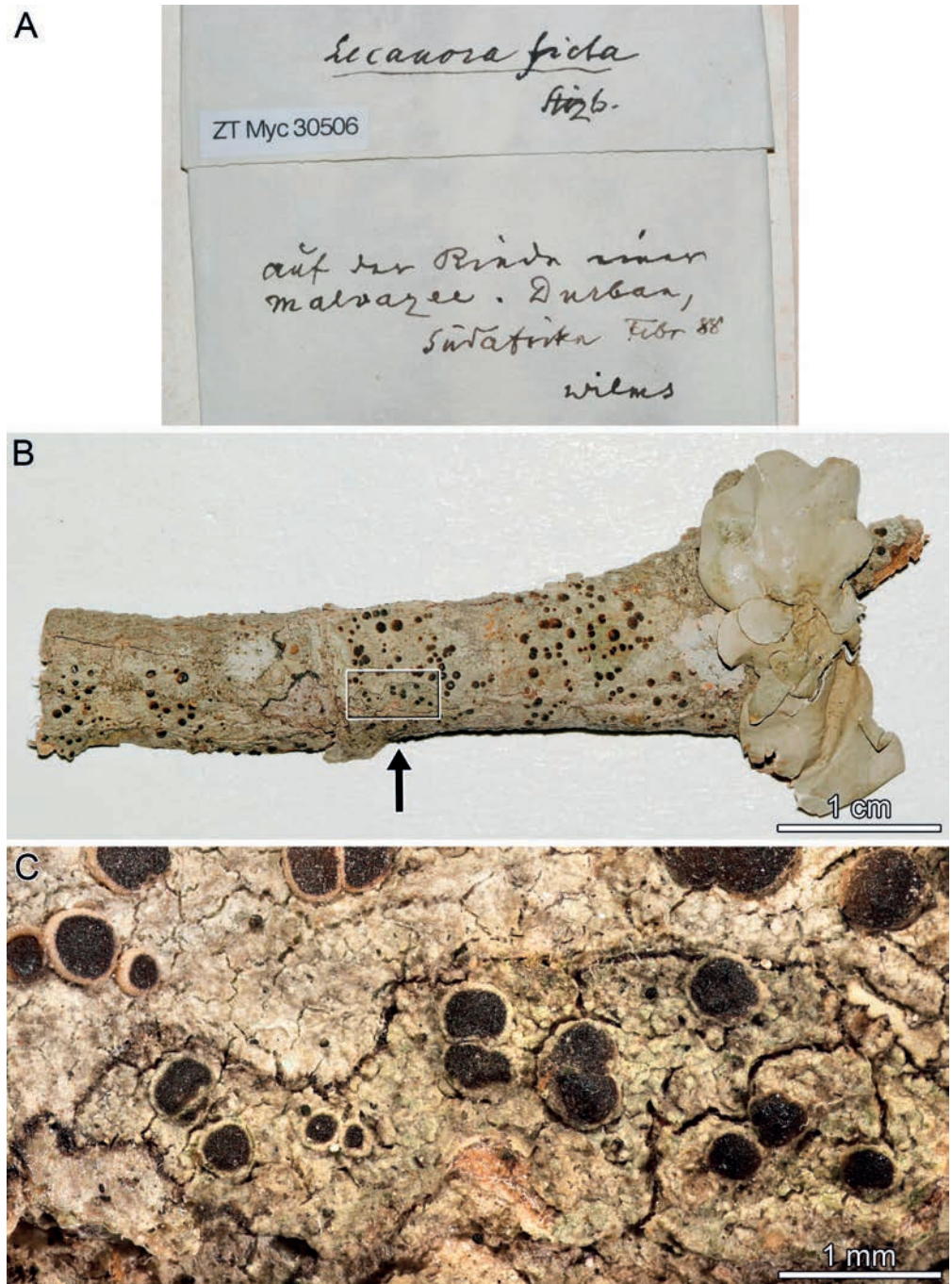


Fig. 6: *Rinodina ficta* (ZT – holotype). **A** – Label of the type specimen; **B** – whole piece of bark inside the envelope; the black arrow indicating the rectangle, where the thallus and apothecia of the type occur; most apothecia outside the rectangle belong to *Haematomma africanum*; **C** – enlargement of the rectangle drawn in B; the thallus of *R. ficta* in the center is well separated by a dark prothallus line from the paler thallus of *H. africanum* in the upper part with slightly brownish marginate apothecia.

Distribution and ecology: All specimens cited below come from localities within the Grassland Biome of Southern Africa (MUCINA & RUTHERFORD 2006). They often occur on bark of introduced trees. One specimen is from a planted pine tree near a house whereas two other specimens are from fruit trees. This pattern is in accordance with the observations by MAYRHOFFER et al. (2007) in New Zealand.

Discussion: *Rinodina boleana* was described from northeastern Spain (GIRALT & MAYRHOFFER 1991) and is known from the Castellan, Tarragona and Valencia regions in Spain (GIRALT 2001, 2010), the Beira Litoral region in Portugal (PAZ-BERMÚDEZ & GIRALT 2010), the Isole Egadi of Sicilia in Italy (GIRALT & MAYRHOFFER 1995), the small strip of the Adriatic coast of Bosnia and Herzegovina (GIRALT & MAYRHOFFER 1995, filed under Croatia; BILOVITZ & MAYRHOFFER 2011), and the Cyclades island of Naxos in Greece (SIPMAN et al. 2005). Additionally it has been recorded from New Zealand (MAYRHOFFER et al. 2007), where it is presumed as been introduced on woody plants, and from the high Central Plains of northeastern Colorado, western Kansas and southwestern Nebraska in the USA (SHEARD et al. 2011). VAN DEN BOOM et al. (2009) has recorded a specimen with significantly larger ascospores from the island of Lanzarote in the Canary Islands as *R. aff. boleana*. This specimen needs further study.

ZEDDA et al. (2009) report the species as *Rinodina aff. boleana* from Namibia. The records of *Rinodina exigua* (Ach.) Gray (STIZENBERGER 1890, as *Lecanora exigua*) and *R. huefferiana* (STIZENBERGER 1890, as *Lecanora hüfferiana*) from South Africa refer to *R. ficta*.

Further specimens examined: Rep. South Africa: Pretoria distr.: Zwartdam, near Saltpan, on bark of *Acacia* sp., 20.6.1943, E. Schaefer 1804 (PRE). Transvaal: KwaNdebele Homeland, Gembokfontein, bark of pine tree at house, Grid Ref. 2528 BD, 17.3.1981, E. Retief 749 (PRE). Auf Obstbäumen bei Lydenburg in Transvaal, 1887, Wilms (ZT Myc 35525, as *Lecanora exigua*). An Obstbäumen bei Lydenburg, Transvaal, Wilms (ZT Myc 30509, as *Lecanora hüfferiana*). – Namibia: Sonop 903, Research Station (03), 19°04'58.3"S/18°54'48.3"E, 4.3.2001, L. Zedda 6243 (M-0039537, filed under *Hyperphyscia syncolla*). Otjozondjupa Province. Sonop 903, Research Station, about 80 km north-east of Grootfontein, along the B8 (BIOTA Observatory no. 03), 19°04'58.3"S/18°54'48.3"E, 1200 m, on *Acacia* sp. and *Terminalia* sp. in savannah sand dune vegetation, 24.10.2001, L. Zedda 5569 (M-0038811, filed under *Caloplaca citrina* and associated by *Candelaria concolor*). Ibidem, on *Acacia mellifera*, 24.10.2001, L. Zedda 5560 (M-0038813, filed under *Candelaria concolor*).

Rinodina sophodes (Ach.) A.Massal., Ric. Lich. Crost.: 14 (1852)

Short description: *Rinodina sophodes* is characterized by a reddish brown, areolate thallus on a black prothallus, crowded, immersed to subimmersed apothecia, a thick I+ bluish apothecial cortex and small *Milvina*-type ascospores, constricted at their septum. ROPIN & MAYRHOFFER (1993) provide a detailed description.

Distribution: *Rinodina sophodes* is the type species of the genus and is only known from the Northern Hemisphere. It is widely distributed in Europe and has also been reported from Macaronesia, North Africa and Asia Minor (MAGNUSSON 1947, ROPIN & MAYRHOFFER 1993, GIRALT & MAYRHOFFER 1995, GIRALT 2001, MAYRHOFFER & MOBERG 2002, VAN DEN BOOM et al. 2009). It is not known from North America (SHEARD 2010).

Discussion: *Rinodina sophodes* was recorded as *Lecanora sophodes* by DRÉGE (1843) from Paarlberg and by STIZENBERGER (1890) from Lydenburg. None of the reported specimens have been traced in the herbaria. Thus, its occurrence in southern Africa is highly doubtful. A saxicolous (!) herbarium specimen named *Lecanora sophodes* var. *atroalbida* (Transvaal, leg. Wilms, ZT) refers to *Rinodina huillensis* Vain., a widespread species in southern Africa (MATZER & MAYRHOFFER 1996).

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