

Studies in *Galiella* (Ascomycota, Pezizales). II.

The identity of *Galiella thwaitesii* and *Sarcosoma leratii*

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Summary: The original material of *Rhizina thwaitesii* and *Sarcosoma leratii* was revised. Their identities and taxonomic positions in the genus *Galiella* are discussed. Color pictures of dried specimens and microscopic characters are also provided.

Keywords: *Sarcosomataceae*, type studies.

Riassunto: Viene revisionato il materiale originale di *Rhizina thwaitesii* e *Sarcosoma leratii*. Vengono discusse le loro identità e la posizione tassonomica in seno al genere *Galiella*. Vengono inoltre proposte foto a colori del materiale secco e del quadro microscopico.

Parole chiave: *Sarcosomataceae*, studio dei tipi.

Introduction

CARBONE *et al.* (2015) described in depth the identity of *Galiella rufa* (Schwein.) Nannf. & Korf and summarized the history and taxonomical features of the genus *Galiella* Nannf. & Korf. In this second part we present the study of the original material of *Rhizina thwaitesii* and *Sarcosoma leratii* in order to have a complete and better view of their microscopic features. Because it seems they have not been collected again, the main goal of the present work is to delineate their species concepts for future topotypical findings and, in the meantime, to discuss their taxonomical position from a morphological point of view.

Rhizina thwaitesii Berk. & Broome was originally described from Sri Lanka (BERKELEY & BROOME, 1875) and transferred into the genera *Sarcosoma* Casp. by PETCH (1910), *Bulgaria* Fr. by SEAVER & WATERSTON (1946) and finally *Galiella* by NANNFELDT (*in Korf*, 1957). PETCH (*op. cit.*) made a good description of his material but failed in describing the disposition of the spores ornaments and the type of hairs on the external surface. According to Petch's description, his material could be very likely belonging to the genus *Trichaleurina* Rehm (see CARBONE *et al.*, 2013). The same could be said for SEAVER & WATERSTON'S (1946) description. LE GAL (1953) studied some Malagasy collections and revised the original material of *Rhizina thwaitesii* and *Sarcosoma fibula* Pat. (PATOILLARD, 1928). She concluded all that material refers to the single species "*thwaitesii*" belonging to her concept of *Sarcosoma*. According to LE GAL (*op. cit.*), *R. thwaitesii* (as *Sarcosoma t.*) is characterized by the following features: warted ascospores, 31.5–51 × 12–20.5 µm, with warts up to 1–2 µm high and more crowded and distributed on one side, medullary excipulum consisting of a gelatinized loose *textura intricata* with hyphae heavily encrusted in place, a not well developed and differentiated ectal excipulum with brown, smooth, septate, thick-walled hairs. Finally *Rhizina thwaitesii* has been put by MASSEE (1896) in synonymy with *Rhizina spongiosa* Berk. & M.A. Curtis but this synonymy has been largely rejected (PETCH, 1910; LE GAL, 1953; CARBONE & AGNELLO, *in press*).

Sarcosoma leratii Pat. is a very poorly known species. It was described by PATOILLARD (1915) upon material collected by Le Rat in New Caledonia. LE GAL (1953) concluded that *Sarcosoma leratii* could be a darker form of *Galiella thwaitesii*, but also that further studies on fresh material are required in order to establish it.

Material and methods

Microscopic characters were studied on specimens rehydrated in water, using an optical microscope Olympus CX41 trinocular. Microscopic pictures were made using a Nikon Coolpix. Primary mounting

media was Congo red. Water mounts were used for all measurements and observations of pigments. 30 ascospores were measured.

Taxonomy

Galiella thwaitesii (Berk. & Broome) Nannf., *in Korf, Mycologia*, 49 (1): 108 (1957).

Basionym: *Rhizina thwaitesii* Berk. & Broome, *J. Linn. Soc., Bot.*, 14: 102 (1875).

Synonyms: *Sarcosoma thwaitesii* (Berk. & Broome) Petch, *Ann. Royal Bot. Gardens (Peradeniya)*, 4 (6): 420 (1910); *Bulgaria thwaitesii* (Berk. & Broome) Seaver & Waterston, *Mycologia*, 38 (2): 182 (1946).

Further synonymy fide LE GAL (1953): *Sarcosoma fibula* Pat., *Mém. Acad. Malgache*, 6: 36 (1928).

Original diagnosis

920. *R. Thwaitesii*, B. & Br. *Orbicularis, sessilis, extus velutina, fusca; hymenio pallido; sporidiis fusiformibus verruculosus* (no. 1). On twigs covered with lichen. Closely resembling *R. spongiosa*, but not positively villous, besides having the sporidia rough and in general far less pointed.

Revision of the type specimen K(M) 181592

All the notes present on this collection lead us to consider it as the holotype of *Rhizina thwaitesii*. It consists of two well preserved specimens (see plate 1), one of which shows all the macroscopic features reported in the short original diagnosis.

Microscopic characters

Asci on average 700 × 19–22 µm, cylindrical, operculate, inamyloid, eight-spored, with a tapered, flexuous, aporhynchous base. **Paraphyses** not exceeding the asci, 1.5–2 µm wide, cylindrical, septate, sometimes anastomosing, branched below, with apex simple to slightly undulated or lobed; among the paraphyses many yellow crystals have been observed. **Hymenial hairs** rare and very difficult to find but based on the few seen, cylindrical, as long as the paraphyses, ca. 4 µm wide, with a simple apex, and a single septum at the very base. **Ascospores** ellipsoid-subfusoid, warted, sometimes slightly inequilateral, thick-walled, (31–) 35–43 × 16–20 µm, Q = (1.6–) 2.3–2.5 (–2.7), hyaline; warts up to 3 µm wide and 2 µm high, rounded to irregular, mostly isolated but sometimes connected, more distributed on one side of the ascospore wall. **Subhymenium** composed by a dense *textura intricata* of cylindrical, frequently septate hyphae. **Medullary excipulum** very gelatinous, of *textura intri-*

K(M): 181592 HERB. HORT. BOT. REG. KEW

Sri Lanka :

Sarcosoma thwaitesii (Berk. & Broome) Petch

Peradeniya

Alt.(m):

Date: Nov 1867

Coll. G.H.K. Thwaites 1/185 (ex herb. Berkeley)

Add. info. Type:

Det.

1.1.1.7

HERBARIUM MYCOLOGICUM BERKELEYANUM.
Presented by the Rev. M. J. BERKELEY, 1879.

HERB. HORT. BOT. REG. KEW. 185

1. *Rhizina Thwaitesii*, Berk.
Peradenia G.H.K.T.
Nov. 1867.



Rhizina Thwaitesii Berk.
Peradenia G.H.K.T.
Nov. 1867
Type



Plate 1 — *Rhizina thwaitesii*. Original material with annotations
Scale bar = 1 cm (for dried specimens only). Photo M. Carbone.

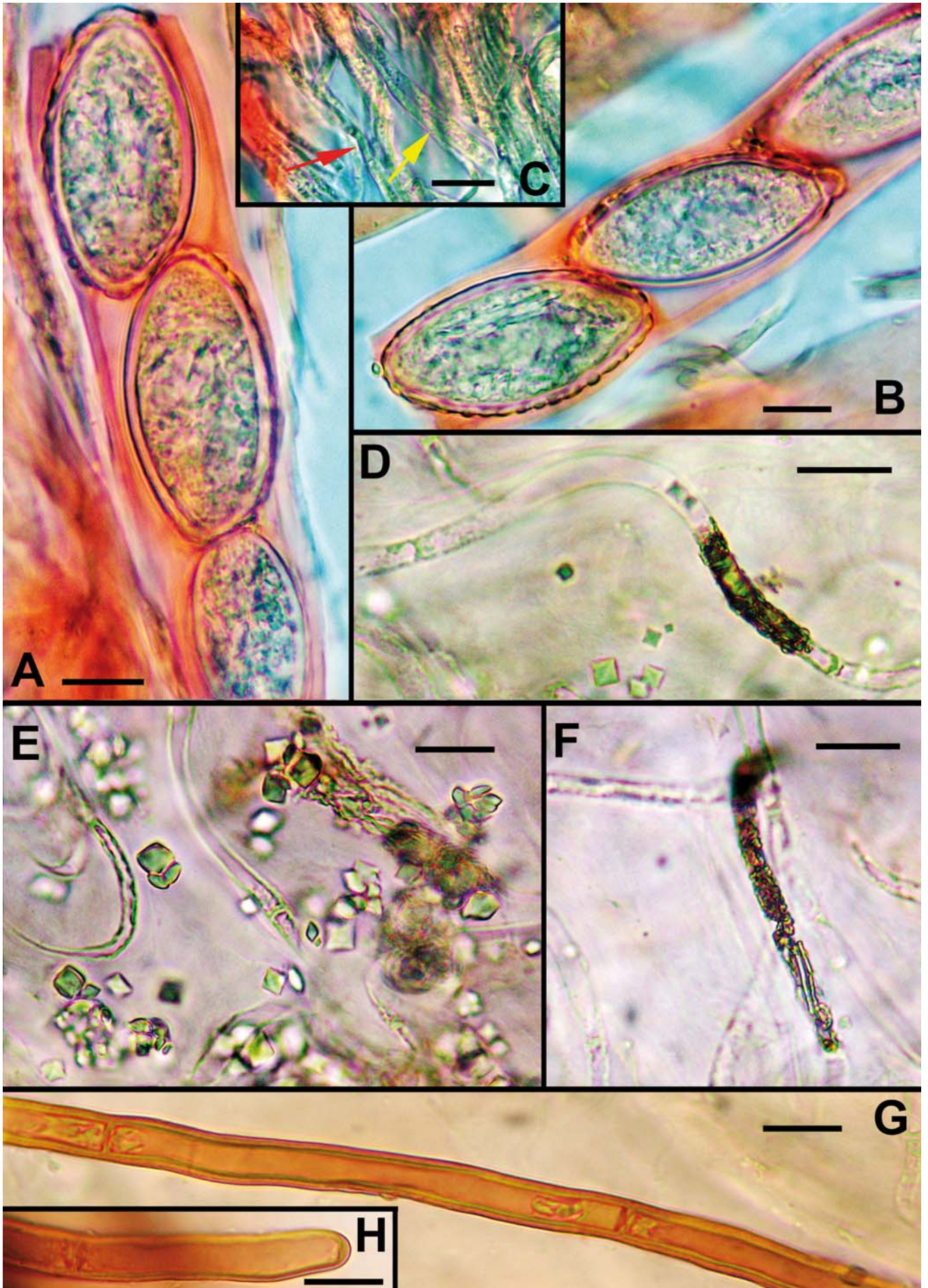


Plate 2 — *Rhizina thwaitesii*. Microscopic characters

A-B: Ascospores in Congo red; C: Paraphyses (red arrow) and hymenial hair (yellow arrow); D-F: Incrustated hyphae and crystals of the medullary excipulum; G-H: External hair. Scale bars = 10 μm . Photos M. Carbone.

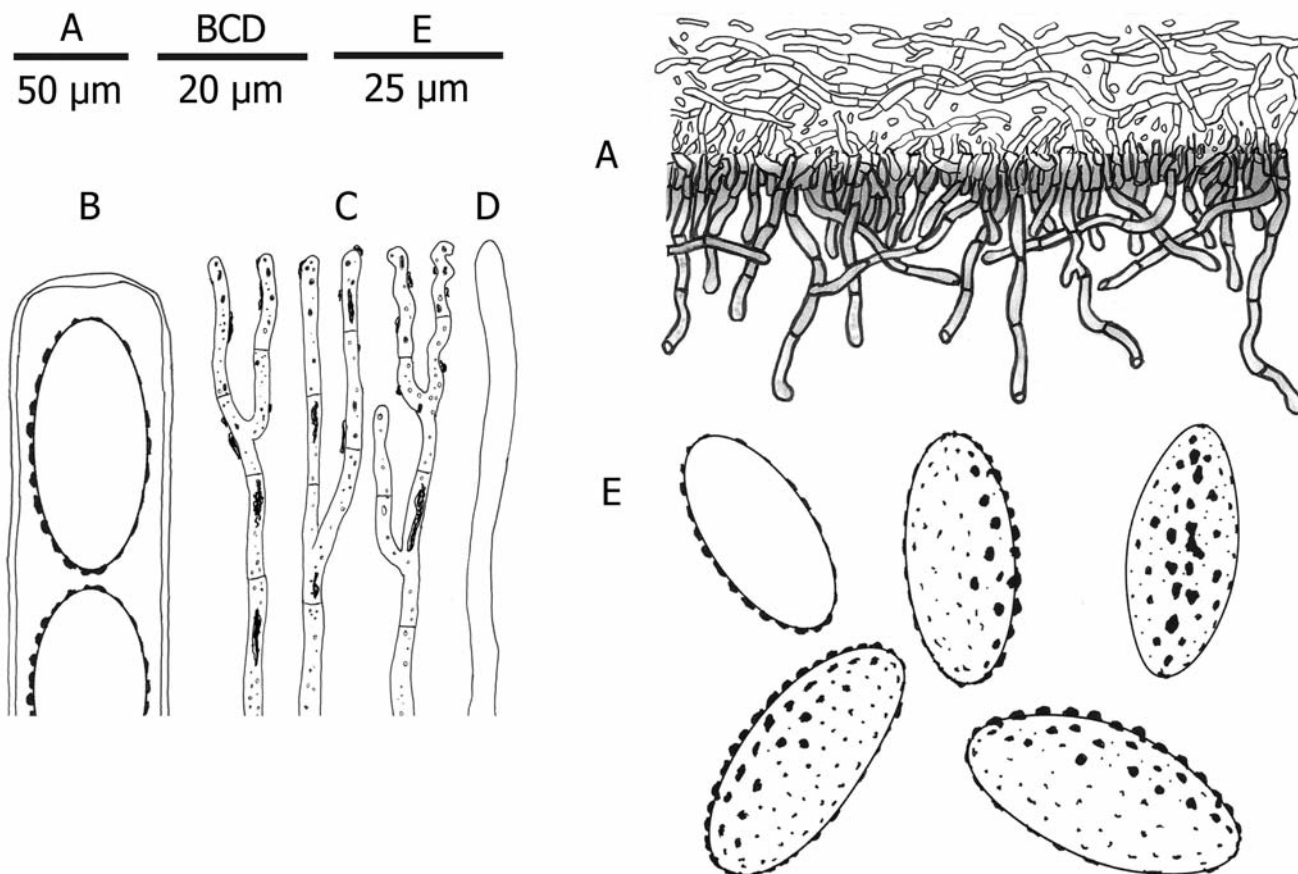


Plate 3 — *Rhizina thwaitesii*. Microscopic characters

A: Medullary and ectal excipulum; B: Ascus tip with spores; C: Paraphyses; D: Hyphenal hair; E: Ascospores. Drawing C. Agnello.

cata with hyphae cylindrical, septate, hyaline, 2–4 μm wide and walls up to 0.8 μm thick; an encrusting brownish extracellular pigment is present in places on the external surface of the hyphae, and cuboid crystals up to 4 μm wide are commonly seen among the hyphae. **Ectal excipulum** absent or at least a simple extension of the medullary excipulum where darker hyphae are mixed with basal part of the external hairs. **External hairs** cylindrical, septate, smooth, up to 6 μm wide, up to 220 μm long, straight to slightly wavy, with blunt tips. They are light brown due to an epimembraneous pigmentation, with wall thickened up to 1 μm .

Sarcosoma leratii Pat., *Bull. Soc. mycol. Fr.*, 31: 34 (1915) [as “*Le Rati*”]

Original diagnosis

Ascomatibus gelatinosis, sessilibus, hemisphericis, supra truncatis, 2-3 cm altis, 4-5 cm latis, brunneo-castaneis, corrugates, villosis, pilis simplicibus, septatis $\pm 100 \times 6-8 \mu$, sparsis vel dense approximatis, castaneis, obtusis, tectis; disco levi, plano, concolori, margine tumida cincto; contextu tremelloso brunneo; ascis cylindraceis $\pm 300 \times 15 \mu$, operculatis, 8 sporis; sporis monostichis, ellipsoideo-elongatis, fuscidulis, rugulosis, rectis, $33-40 \times 10-12 \mu$; paraphysibus filiformibus, fuscidulis, $3-5 \mu$ crassis, septatis, obtusis. Hab. Ad truncos “Mont Mou” Nova Caledoniae. Leg. Beat, Le Rat.

Analogue à *S. platydiscus* Casp., voisine de *S. javanicum* Rehm, et de *S. celebicum* (Henn.) Sacc.

Revision of the type specimen FH (barcode 00290378)

All the notes present on this collection lead us to regard it as the holotype of *Sarcosoma leratii*. It consists, most probably, of a single specimen split into two parts (see plate 4). Macroscopically it shows all the few features reported in the original diagnosis.

Microscopic characters

Asci mostly collapsed but the few seen measuring on average $600 \times 15 \mu\text{m}$, cylindrical, operculate, inamyloid, eight-spored, with a tapered, flexuous, aporhynchous base. **Paraphyses** not exceeding the asci, 2 μm wide, cylindrical, septate, sometimes anastomosing, branched below, with an apex simple to slightly undulated or lobed; among the paraphyses many yellow crystals have been observed. **Hymenial hairs** very difficult to find but based on the few seen, cylindrical, as long as the paraphyses, ca. 4 μm wide, with a simple apex, and a single septum at the very base. **Ascospores** ellipsoid, warty, sometimes slightly inequilateral, thick-walled, $33-39 \times (11-12-13 \mu\text{m})$, $Q = (2.5-2.7-3.2)$, hyaline; warts up to 3 μm wide and 1.5 μm high, rounded to flattened, mostly isolated and distributed on one side of the ascospore wall. **Subhymenium** composed by a dense *textura intricata* of cylindrical, frequently septate hyphae. **Medullary excipulum** very gelatinous, of *textura intricata* with hyphae cylindrical, septate, hyaline, 2–4 μm wide, thin-walled; an encrusting, crystalline, subhyaline, extracellular pigment is present in places on the wall of some hyphae. **Ectal excipulum** very thin, ca. 10–20 μm thick, of *textura subglobulosa* to *angularis*, made up of elements up to 12 μm wide, dark brown due to the colored thick walls. **External hairs** cylindrical, septate, smooth, up to 5 μm wide, straight to slightly wavy, with blunt tips. They are light brown due to an epimembraneous pigmentation, with wall thickened up to 1 μm .

Discussion

Rhizina thwaitesii and *Sarcosoma leratii* share many macro- and microscopic features with *Galiella rufa* and, at the same time, differ pretty much from the main features of the other genera in the family *Sarcosomataceae* Kobayasi. So, at least from a morphological point

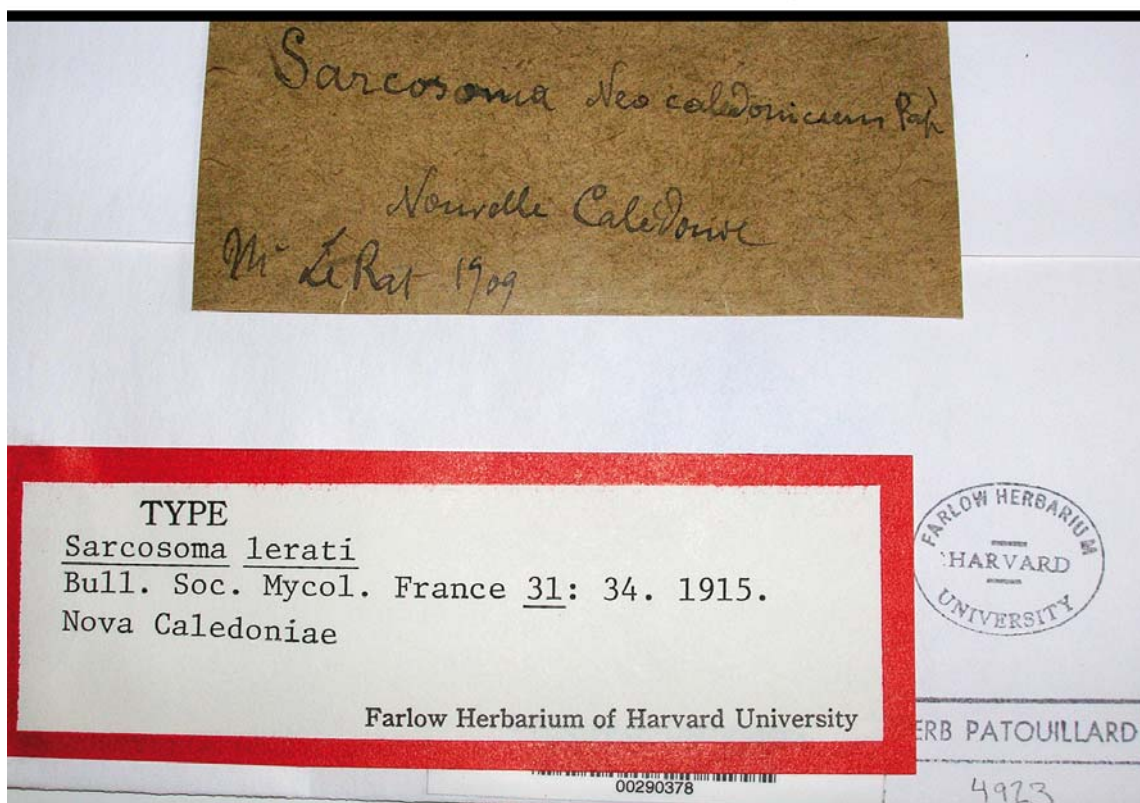


Plate 4 — *Sarcosoma leratii*. Original material with annotations
Scale bar = 1 cm (for dried specimens only). Photo M. Carbone.

of view, it seems that their right placement should be in the genus *Galiella*. This position must be evaluated with more precise and genetic techniques. The genus *Sarcosoma* is here excluded because it is microscopically characterized by typical moniloid external hairs and smooth ascospores (PADEN, 1983; CARBONE, 2009). For this reason, we believe that the name *Galiella thwaitesii* is definitely the best to use, whilst we avoid proposing a new combination for *Sarcosoma leratii* because our type studies (some in press and some in progress)

lead us to consider it as a possible synonym of an existing name having priority.

Regarding the synonymy proposed by LE GAL (1953) between the two species here treated, we do not accept it due to the microscopic differences and the geographical distance between the two type localities. *Sarcosoma leratii* share more features with *Wolfina papuana* Otani, which according to CARBONE & AGNELLO (2015) should be considered a synonym of *Sarcosoma orientale* Pat. or, at least, a species

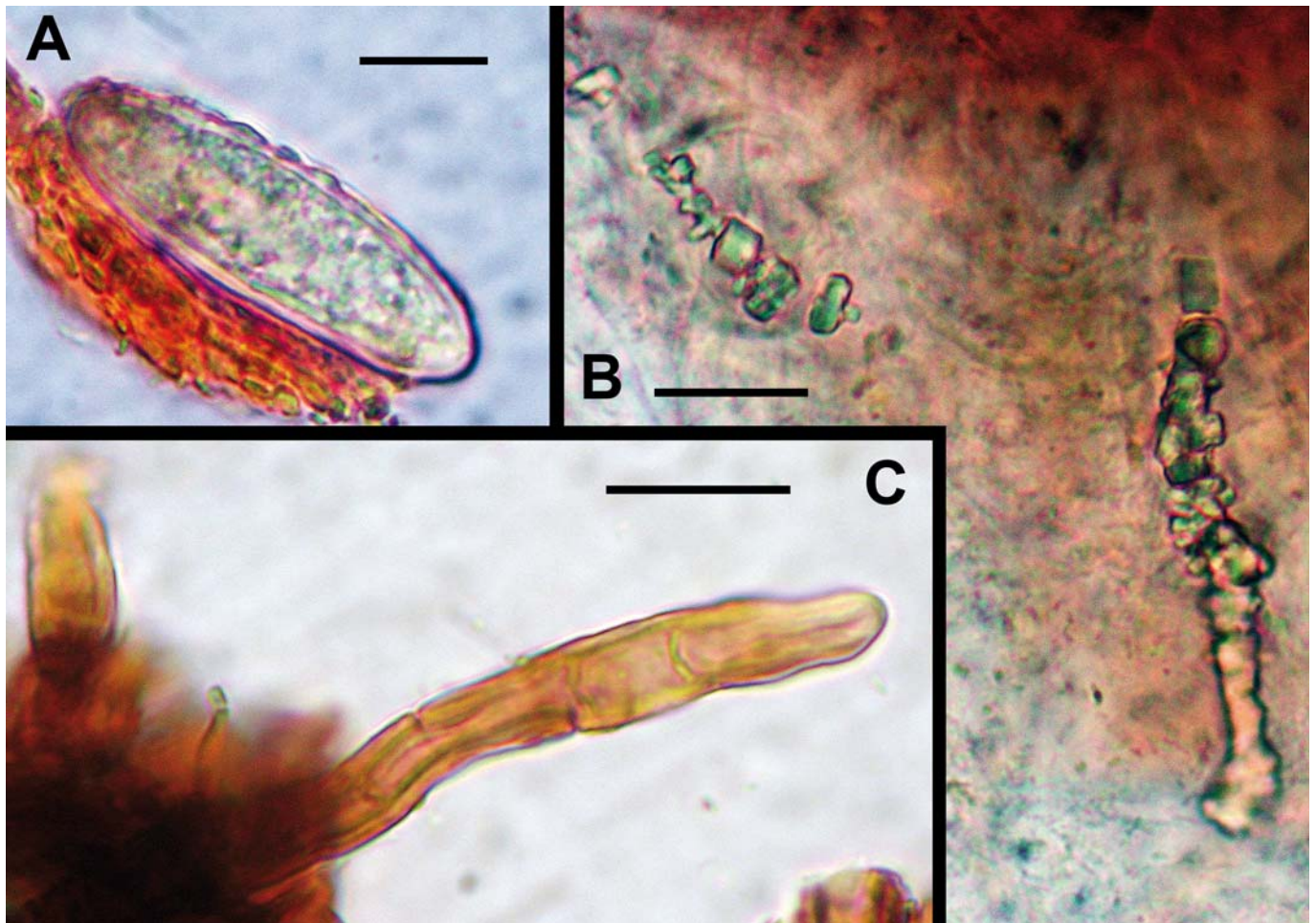


Plate 5 — *Sarcosoma leratii*. Microscopic characters

A: Ascospore; B: Encrusted hyphae of the medullary excipulum; C: External hair. Scale bars = 10 μ m. Photos M. Carbone.

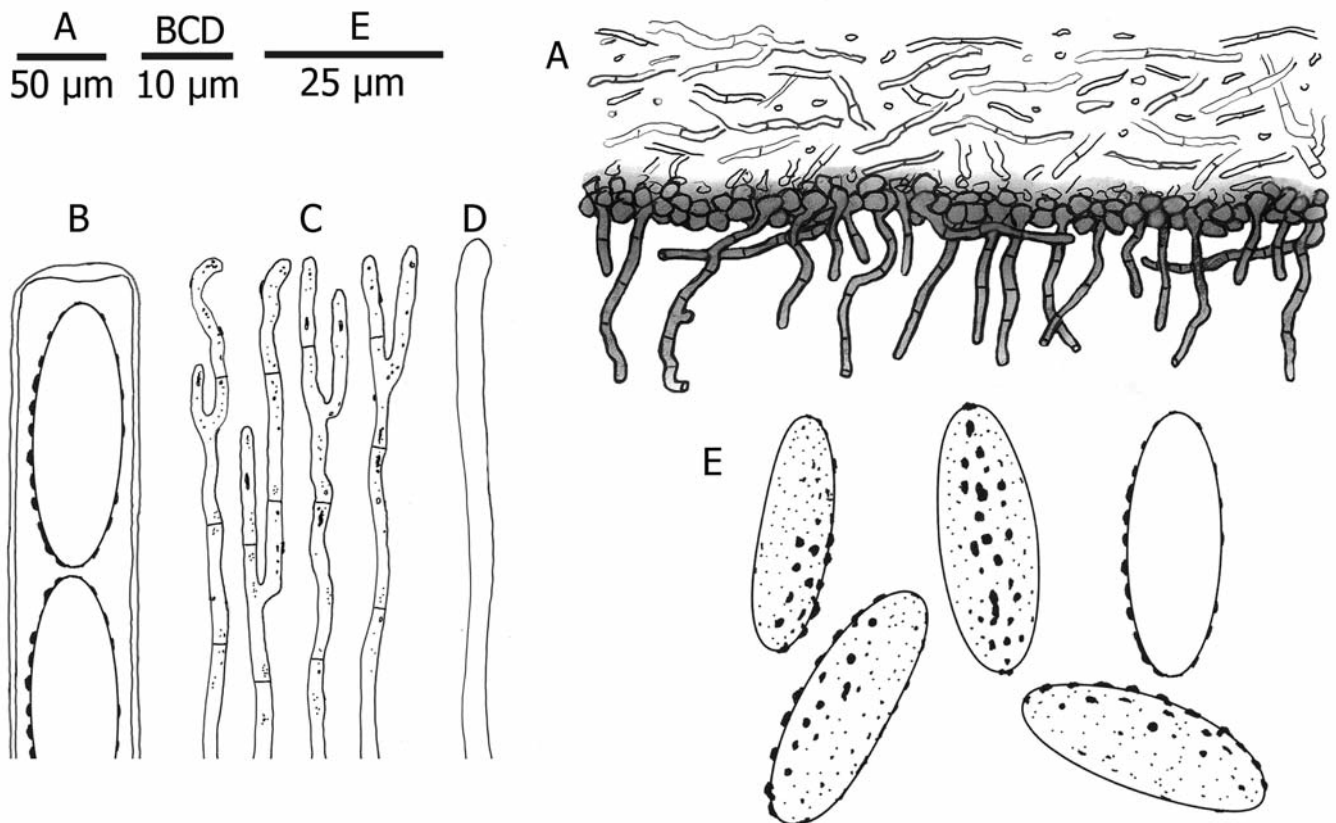


Plate 6 — *Sarcosoma leratii*. Microscopic characters

A: Medullary and ectal excipulum; B: Ascus tip with spores; C: Paraphyses; D: Hymenial hair; E: Ascospores. Drawing C. Agnello.

in the *orientale*-complex. A comparison of fresh material (matching the two species concepts) from New Caledonia and Sri Lanka is required.

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