

# Studies in *Trichaleurina* (Pezizales). Type studies of *Trichaleurina polytricha* and *Urnula philippinarum*. The status of *Sarcosoma javanicum*, *Bulgaria celebica*, and *Trichaleurina tenuispora* sp. nov., with notes on the anamorphic genus *Kumanasamuha*

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**Summary:** The original material of *Trichaleurina polytricha* and *Urnula philippinarum* housed in the Herbarium of the Swedish Museum of Natural History (S) was examined. The results of the morphological study prove they are synonyms of *Trichaleurina javanica*. The status of *Sarcosoma javanicum* and *Bulgaria celebica* are investigated, and a new species, *Trichaleurina tenuispora*, is proposed to replace one of the different interpretations of *B. celebica*. The anamorphic genus *Kumanasamuha* is discussed as well. Color pictures of dried and fresh specimens and microscopic characters are provided.

**Keywords:** Ascomycota, Chorioactidaceae, *Galiella*, *Galiella javanica*, *Galiella celebica*, Sarcosomataceae, type studies.

## Introduction

The first occurrence of the name *Trichaleurina* was in REHM (1903) as an infrageneric rank within *Aleurina* Masee. It remained an invalid name until REHM (1914a) raised it at genus level, validating it with the new (and only) species *Trichaleurina polytricha*, collected by M.B. Raimundo in the Philippines.

CARBONE *et al.* (2013) proved that *Galiella* is an independent genus in the family Sarcosomataceae Kobayasi and they maintained that at least two species formerly included in the genus, i.e. *G. javanica* and *G. celebica*, constitute an independent lineage within the Chorioactidaceae Pfister being definitely unrelated to the type species *G. rufa*. The old generic name *Trichaleurina* Rehm was thus restored for these two tropical taxa.

*Trichaleurina* was completely forgotten by all mycologists who treated the paleotropical “*Galiella*” or “*Sarcosoma*-like” species. In fact, neither the ones supporting the genus *Galiella* Nannf. & Korf for the paleotropical collections (e.g. KORF, 1957, 1972, 1973; OTANI, 1980; MORAVEC, 1983; CAO *et al.*, 1992; ZHUANG & WANG, 1998; PANT & PRASAD, 2008) nor those in favour of *Sarcosoma* Casp. (e.g. LE GAL, 1958, 1960; BOEDIJN, 1959), did ever make any mention on this old and legitimate genus, thus proving they were unaware about its existence.

According to the unpublished notes of Nannfeldt present in the online database of the herbarium of the Swedish Museum of Natural History (S), he examined in 1947 the type specimens of *Trichaleurina polytricha* and *Urnula philippinarum* Rehm, and considered both as synonyms of *Galiella javanica* (Rehm) Nannf. & Korf. (≡ *Sarcosoma javanicum* Rehm).

*Sarcosoma javanicum* was described by REHM (*in* HENNINGS, 1893) upon material collected by O. H. Warburg in Celebes (i.e. Sulawesi Island, Indonesia). The description is accompanied by a b/w plate showing two sub-cylindrical fruitbodies in different stages of maturity, plus one in section, three fusoid spores and some asci mixed with paraphyses (see Plate 7). Due to the lack of type material, the first try to circumscribe the species concept has been conducted by BOEDIJN (1932) and subsequently by LE GAL (1953, 1959, 1960 with a colored drawing). These authors' concept remained the same till today because it fits very well with the protologue, although probably more than one species has been covered with this name (see discussion below).

Another species seemingly to belong to the genus *Trichaleurina* could be *Bulgaria celebica* Henn. It was described by HENNINGS (1900) from material collected by Sarasin in Celebes (i.e. Sulawesi Island, Indonesia). Also in this case, because of the lack of original material, its modern concept has been based only on the protologue and the b/w iconotype consisting in a fleshy fruiting body, a section, some fusoid spores, asci and paraphyses (see Plate 12). However, although CARBONE *et al.* (2013) transferred it into the genus *Trichaleurina*, judging from all the available relevant literature, it is quite obvious that its original concept is not as clear as it has been interpreted by many authors (e.g. BOEDIJN, 1932; LE GAL, 1953; CAO *et al.*, 1992; ZHUANG & WANG, 1998; PANT & PRASAD, 2008). The epithet *celebica* seems to be commonly used in Japan and India, mainly due to the studies published by OTANI (1980) and PANT (2001).

For all the reasons above, the aims of the present work are: i) to revise the holotype of *Trichaleurina polytricha* in order to delineate the morphological concepts of genus and species; ii) to revise the holotype of *Urnula philippinarum*, also described by REHM (1914b) from Philippines, in order to delineate its species concept; iii) to investigate and discuss the names *Sarcosoma javanicum* and *Bulgaria celebica* trying to define their original concepts.

## Materials and methods

**Morphological study.** — Microscopic characters were studied on specimens rehydrated in water or on fresh ascocarps, 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. At least 30 spores were measured. Photographs of ascospores and conidia were also made by scanning electron microscopy (SEM, Hitachi SU-1500). Single-spore cultures were processed by following WANG (2011) from fresh ascocarps of *Trichaleurina javanica* and *T. tenuispora*.

**DNA extraction, amplification and sequencing.** — DNA was extracted and amplified from dried specimens or the freshly cultured mycelia that were incubated on plates of malt extract agar (MEA) according to the methods published by HUANG & WANG (2011) and ALVARADO *et al.* (2012). We amplified and sequenced two loci: the nuclear internal transcribed spacer region (ITS) with primer pairs ITS1F or ITS1/ITS4 (WHITE *et al.*, 1990; GARDES & BRUNS, 1993), and the 28S

nuclear large ribosomal region (nrLSU) with two primer pairs, LR1/LR7 (VILGALYS & HESTER, 1990; TUINEN *et al.*, 1998) or LROR/LR5 (MONCALVO *et al.*, 2000). Sequences were assembled and edited with the software Geneious 6.1.2 (Biomatters Ltd., <http://www.geneious.com>). The GenBank accession nos. in this study are KF418243~KF418271 (Table 1).

**Phylogenetic analyses.**—The sequences obtained were aligned with the closest relatives in the *Chorioactidaceae*. Sequences contigs were assembled using Geneious 6.1.2. The sequences were first aligned with MUSCLE (EDGAR, 2004), then adjusted manually and trimmed at the end. The substitution models for two loci matrices were inferred using jModelTest v.2.1.3 (POSADA, 2008). The models were selected according to the Akaike information criterion (AIC) and Bayesian information criterion (BIC). If the two criteria did not agree in the best choice, the model with the higher average likelihood (lnL) between the two criteria was chosen. The models selected were GTR+G (28S) and HKY+I+G (ITS). The selected models and parameters estimated were then used for tree searches from the respective data partitions.

Phylogenetic trees were performed using maximum likelihood (ML) and Bayesian inference (BI). ML analysis was conducted using GARLI v.2.0 (ZWICKL, 2006). The branch supports of the tree with highest likelihood score were estimated based on the consensus of 1,000 bootstrap pseudoreplicates. The phylogenetic reconstruction by BI was obtained using MrBayes v.3.2.1 (RONQUIST & HUELSENBECK, 2003). The Markov chain Monte Carlo (MCMC) simulation was run for 2,000,000 generations with two runs and four chains, sampling trees and parameters every 1,000 generations. After checking that the average standard deviation of split frequencies remains below 0.01 for last 10,000 generations, and discarded 25% of the sampled trees as burn-in, a 50% majority-rule consensus tree was built and plotted using FigTree v.1.4.0 (RAMBAUT & DRUMMOND, 2010). Significance thresholds were above 70% for bootstrap (BP) and 90% for posterior probability (PP).

## Phylogenetic results

Two major clades diverge in the *Trichaleurina* lineage. *Wolfina aurantiopsis* represents the sister taxon to the *Trichaleurina* spp. in the *Chorioactidaceae* (Fig 1). The topology of the tree suggests a division of *Trichaleurina* into two major groups, corresponding to morphological taxonomy. *T. javanica* is well supported as monophyletic (PP = 1.0, BP = 100), as is the monophyly of *T. tenuispora* (PP = 0.97, BP = 90). In contrast to the wide geographic distribution, comprising Southeast Asia and the tropical islands in the Indian Ocean, *T. javanica* has lower genetic variation compared to its sister taxon *T. tenuispora*.

## Types revision and taxonomy

*Trichaleurina polytricha* Rehm, *Leaflets Philipp. Bot.*, 6: 2234 (1914).

### Original diagnosis

*Apothecia sessilia, caespitose aggregata, breviter stipitata, primitus urceolata, dein disco orbiculaliter -7 cm explanato, crenulato-marginato, demum vario modo complicata, disco fuscidulo. Excipulo fusco, subcoriaceo contexto, versus basim costato-rugoso, ceterum pilis rectis, filiformibus, septatis ex cellulis 12-18 micro. longis, obtusis, scabris, -1 mm longis, ad basim circ. 15 micro. latis, intermixtis hyphis simplicibus, longioribus, pallide fuscidulis, septatis, 3-4 micro. latis densissime obtecto. Asci cylindranei, apice rotundati, 8-spori, -300 × 20 micro. Sporae oblongae vel oblongo-fusiformes, 1-cellulares, rectae, hyalinae, 2-3-guttatae, postremo fuscidulae, 25-33 × 12-15 micro., 1-stichae. Paraphyses filiformes, 3 micro., ad apicem -5 micro. latae et*

*subfuscae. Ad ligna putrescentia: Luzon, Prov. Laguna, Los Baños, 5/1913, leg. M. B. Raimundo, comm. C. F. Baker, no. 1470. Eximia species et magnitudine villositateque apotheciorum et sporis demum fuscis.*

### Revision of the holotype F2943 (S)

The collection is in good condition and comprises seven fruitbodies. They are discoid or turbinate, up to 4 cm in diameter, the hymenium is brown to greyish-brown and the external surface is brown, wrinkled and velvety.

### Microscopic features

**Ascospores** ellipsoid-subfusoid to fusoid, 29–43 × 13–17 µm (Q=2–3), very variable in size mainly because the lower 1–3 spores are longer and narrower than the upper ones (e.g. lower ones measure 38–43 × 13–14 µm, whilst the upper ones 29–32 × 15–17 µm), hyaline to slightly yellowish, walls up to 1 µm thick, external surface covered by round, isolated warts, up to 0.5 µm wide and high. **Asci** cylindrical, 470–500 × 15–16 µm, inamyloid, operculate, 8-spored, with walls thickened up to 1.8(–2) µm and with a flexuous, tapered and long base. **Paraphyses** cylindrical, 3–4(–5) µm wide in the medium part but up to 8 µm at their tips, septate, subhyaline, light yellow to very pale brownish if observed at low magnification. **Subhymenium** of thick *textura intricata* with hyphae cylindrical, septate; uniformly brownish at low magnification. **Medullary excipulum** of loose *textura intricata* with hyaline hyphae, cylindrical, septate, 3–5 µm wide, very slightly thick-walled, immersed in an abundant gelatinous matrix. **Ectal excipulum** of *textura subglobulosa* to *angularis*, thin, not easy to detect, with cells up to ca. 20 µm long or wide, with thickened walls; dark brown mainly for an epimembraneous and extracellular pigment. **External hairs** emerging from the external layer, two main types have been found, although some intermediate forms can be present; 1) subhyaline to yellowish, cylindrical, up to 5–6 µm in diam., smooth, walls up to 0.5 µm thick, septate, straight to flexuous; 2) pale to dark brown, cylindrical, slightly tapering upward, apex blunt, 10–14 µm wide, finely warted throughout or at least in the lower part, walls up to 1 µm thick, closely septate in the lower part where the cells can be 20 µm high whilst they reach ca. 80 µm in the upper part; many 1-celled hairs of this second, warted type are also present.

### Brief note

The handwriting on the herbarium label reporting “on rotten sticks, Los Baños, P.I.<sup>1</sup>, Aug. 5/13, M.B. Raimundo” and almost all of the macro- and microfeatures recognized from the original diagnosis confirm undoubtedly the presence of the holotype.

*Urnulla philippinarum* Rehm, *Leaflets Philipp. Bot.*, 6: 2281 (1914).

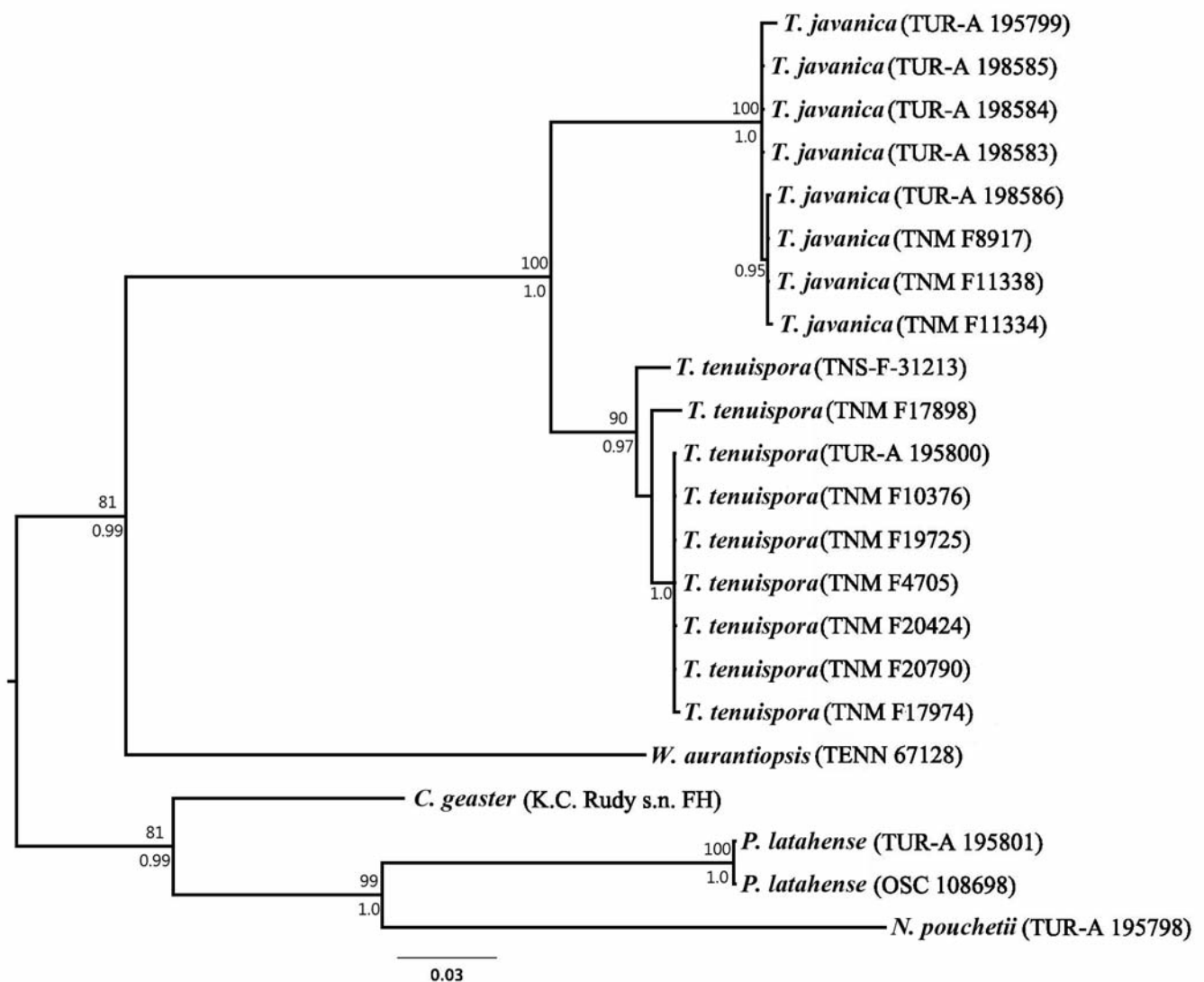
### Original diagnosis

*Apothecia primitus urceolata, dein campanulaeformia, late expansa, ad basim contracta, non stipitata, disco orbiculari, crasse integre marginato, -5 cm lato, nigra, excipulo demum transverse corrugato, fuscidulo, tomento flocculoso dense obtecto hypharum simplicium, rectorum, obtusarum, septatarum, fuscarum, aequaliter 5-7 micro. latorum, -400 micro. longarum, modo ad basim cellula -12 micro. lata instructarum. Asci cylindranei, apice rotundati, 8-spori, -250 × 20 micro. Sporae ellipsoideae, utrinque subacutatae, 1-cellulares, plerumque guttulatae, interdum 1-2 magniguttatae, hyalinae, glabrae 25-30 × 12-15 micro., 1-stichae. Paraphyses filiformes, septatae, 3 micro., ad apicem 8-10 micro. latae, late fuscae. Ad ligna emortua, Los Baños, Philipp., 12/1313, leg. C.F. Baker, no. 2365. Pulcherrima species, appropinquans ad *Sarcoscypham melastoma* (Low.), quam Boud. Hist. et Class. Disc. d'Europe p. 55, ad genus *Urnulla* posuit, inprimis propter hymenium nigrum a *Sarcoscypha distinguendam*.*

<sup>1</sup> Philippine Islands.

**Table 1** – GenBank accession numbers and voucher information for phylogenetic examination in this study.

Species	Location	Voucher/Strain	ITS	28S nrLSU
<i>Trichaleurina tenuispora</i>	Taitung, Taiwan	TNM F4705	KF418243	KF418258
<i>Trichaleurina tenuispora</i>	Kaohsiung, Taiwan	TNM F10376	KF418244	KF418259
<i>Trichaleurina tenuispora</i>	Nantou, Taiwan	TNM F17898	KF418245	KF418260
<i>Trichaleurina tenuispora</i>	Miaoli, Taiwan	TNM F17974	KF418246	KF418261
<i>Trichaleurina tenuispora</i>	Miaoli, Taiwan	TNM F19725	KF418247	KF418262
<i>Trichaleurina tenuispora</i>	Nantou, Taiwan	TNM F20790	KF418248	KF418263
<i>Trichaleurina tenuispora</i>	Yunan, China	TNM F20424	KF418249	KF418264
<i>Trichaleurina tenuispora</i>	Chiba, Japan	TNS-F-31213	KF418250	KF418265
<i>Trichaleurina tenuispora</i>	Yokohama, Japan	TUR-A 195800	JX669839	JX669876
<i>Trichaleurina javanica</i>	Taitung, Taiwan	TNM F8917	KF418251	KF418266
<i>Trichaleurina javanica</i>	Taitung, Taiwan	TNM F11334	KF418252	KF418267
<i>Trichaleurina javanica</i>	Pintung, Taiwan	TNM F11338	KF418253	KF418268
<i>Trichaleurina javanica</i>	Phuket, Thailand	TUR-A 198583	KF418254	KF418269
<i>Trichaleurina javanica</i>	Praslin, Seychelles	TUR-A 198584	KF418255	KF418270
<i>Trichaleurina javanica</i>	Praslin, Seychelles	TUR-A 198585	KF418256	KF418271
<i>Trichaleurina javanica</i>	Mahe, Seychelles	TUR-A 198586	KF418257	—
<i>Trichaleurina javanica</i>	Praslin, Seychelles	TUR-A 195799	JX669838	JX669861
<i>Pseudosarcosoma latahense</i>	Canada	TUR-A 195801	JX669819	JX669856
<i>Pseudosarcosoma latahense</i>	USA	OSC 108698	EU652357	EU652392
<i>Chorioactis geaster</i>	USA	K.C. Rudy s.n. (FH)	AY307934	AY307942
<i>Neournula pouchetii</i>	Italy	TUR-A 195798	JX669837	JX669875
<i>Wolfina aurantiopsis</i>	USA	TENN 67128	KC306744	KC306743



**Fig. 1** – Majority-rule consensus tree of the Bayesian inference obtained from the analysis of the partitioned matrix for the loci 28S (GTR+G) and ITS (HKY+I+G). Bayesian posterior probabilities (PP) are shown below branches, and bootstrap (BP) values for maximum likelihood above branches. Support values of PP < 0.9 and BP < 70 are not shown. Tree generated by C.-L. Huang.



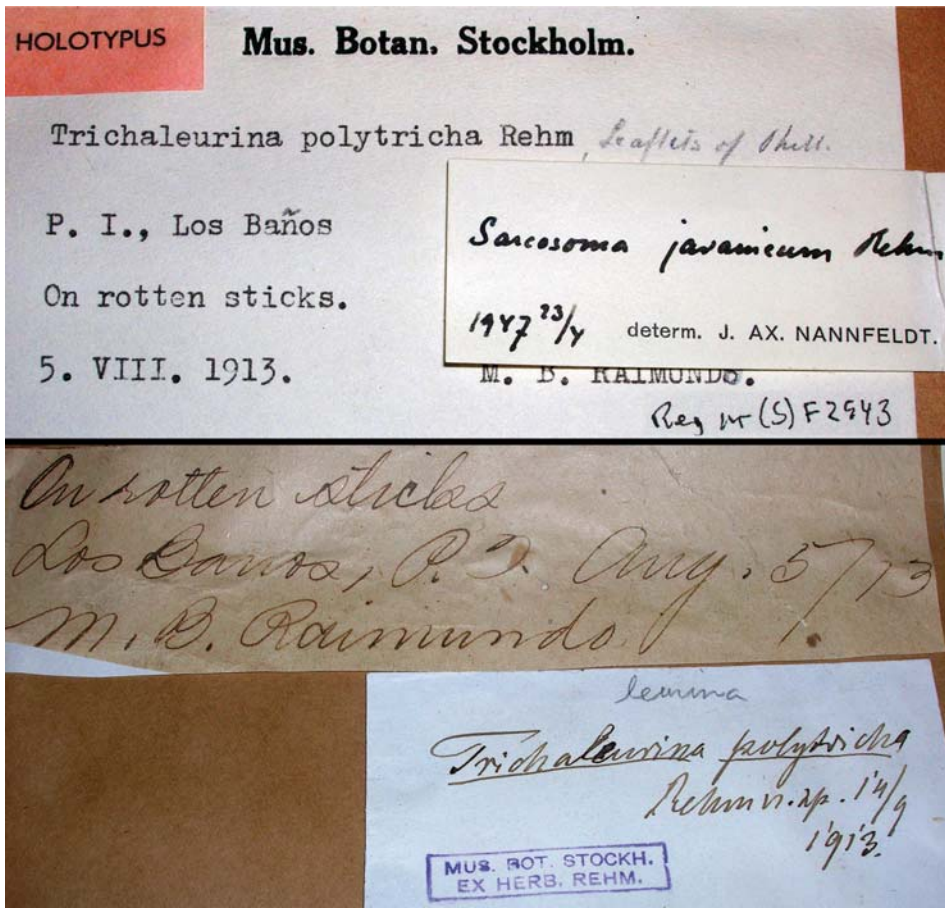
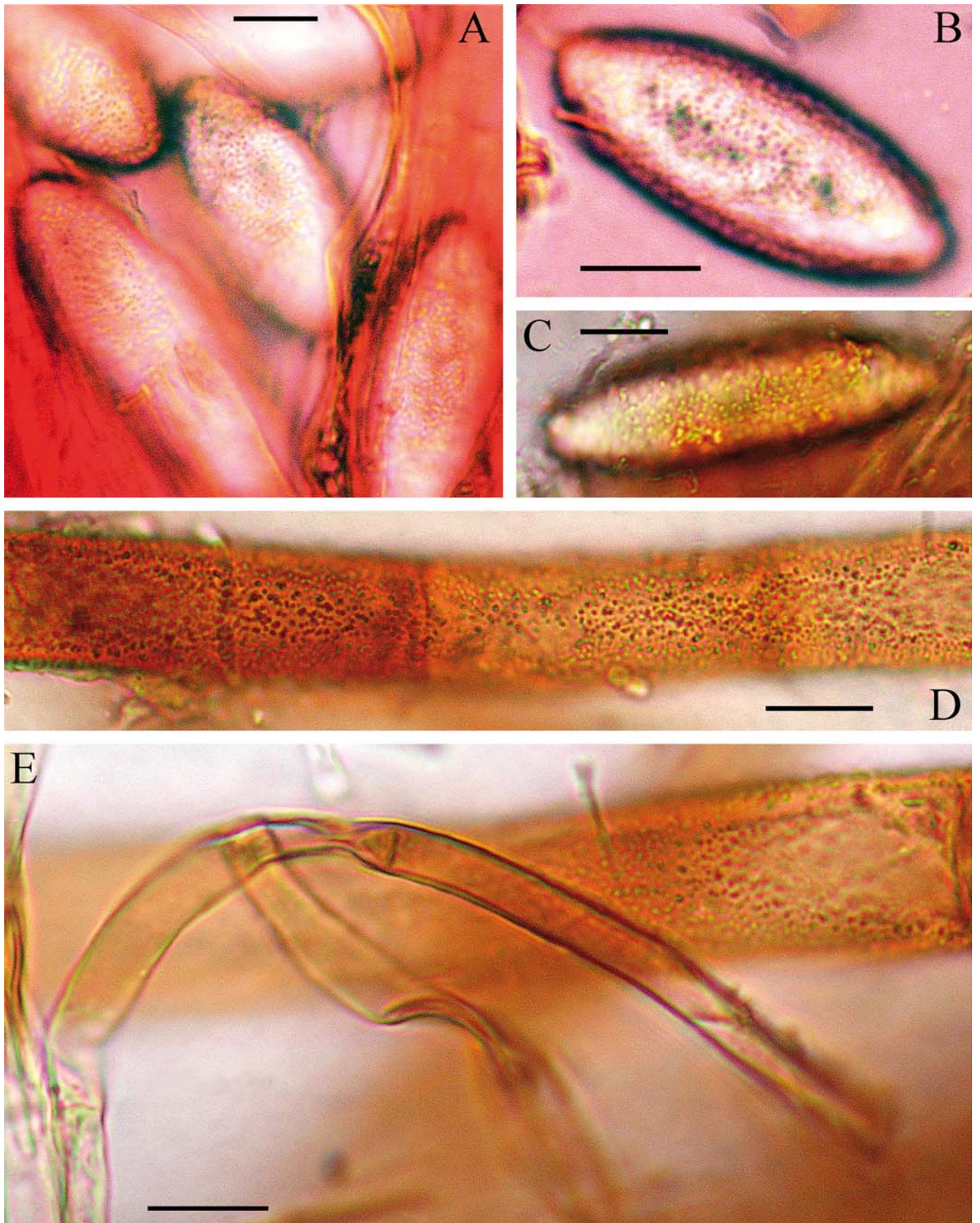


Plate 1 – Annotations on the *Trichaleurina polytricha* holotype. Photo: M. Carbone



Plate 2 – Holotype of *Trichaleurina polytricha*. Scale bar = 1 cm. Photo: M. Carbone





**Plate 3** – Microcharacters of the holotype of *Trichaleurina polytricha*.  
A-B: spores in Congo red. C: spores in water. D-E: external hairs of the two different types. Scale bars = 10  $\mu\text{m}$ .  
Photos: M. Carbone.



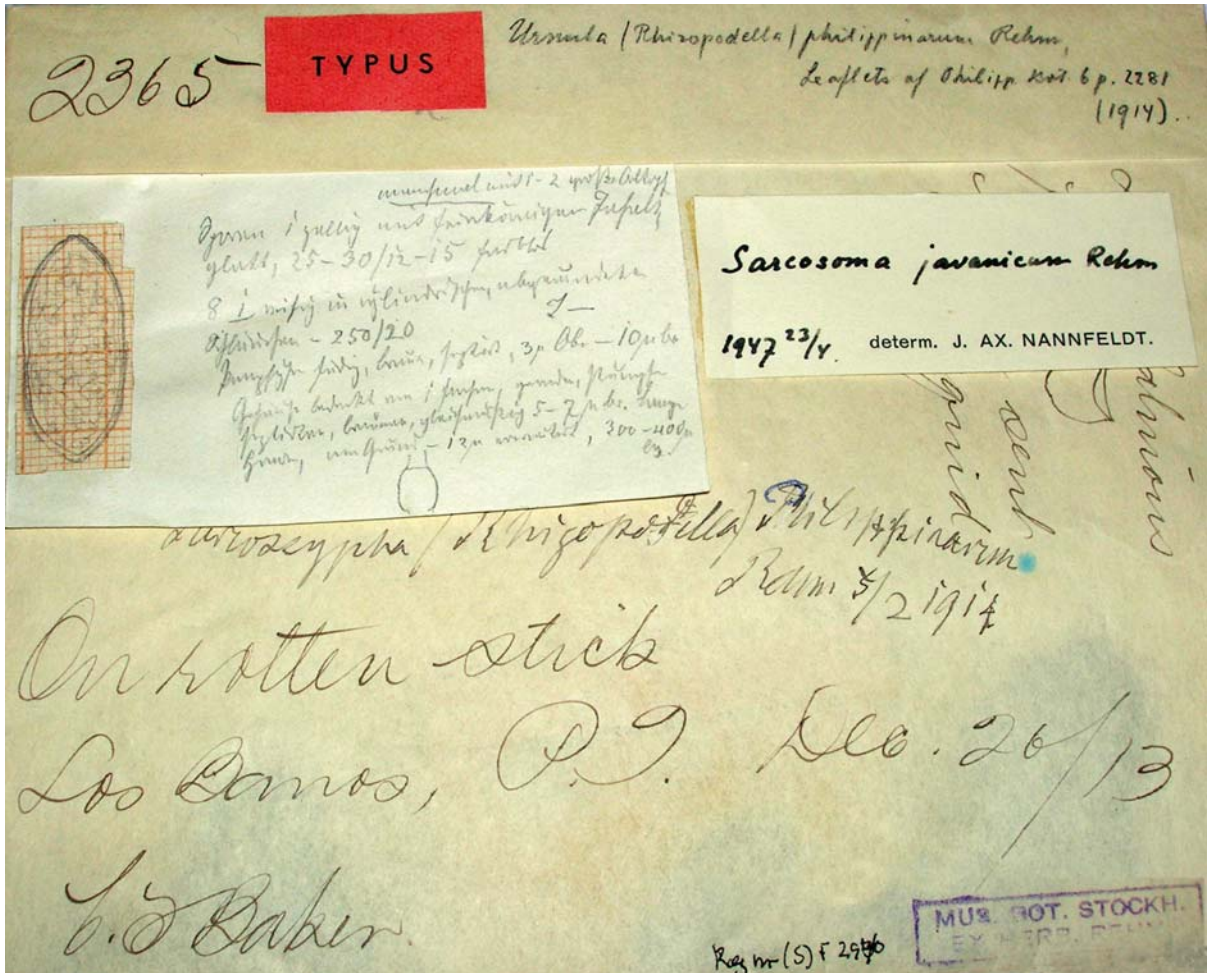
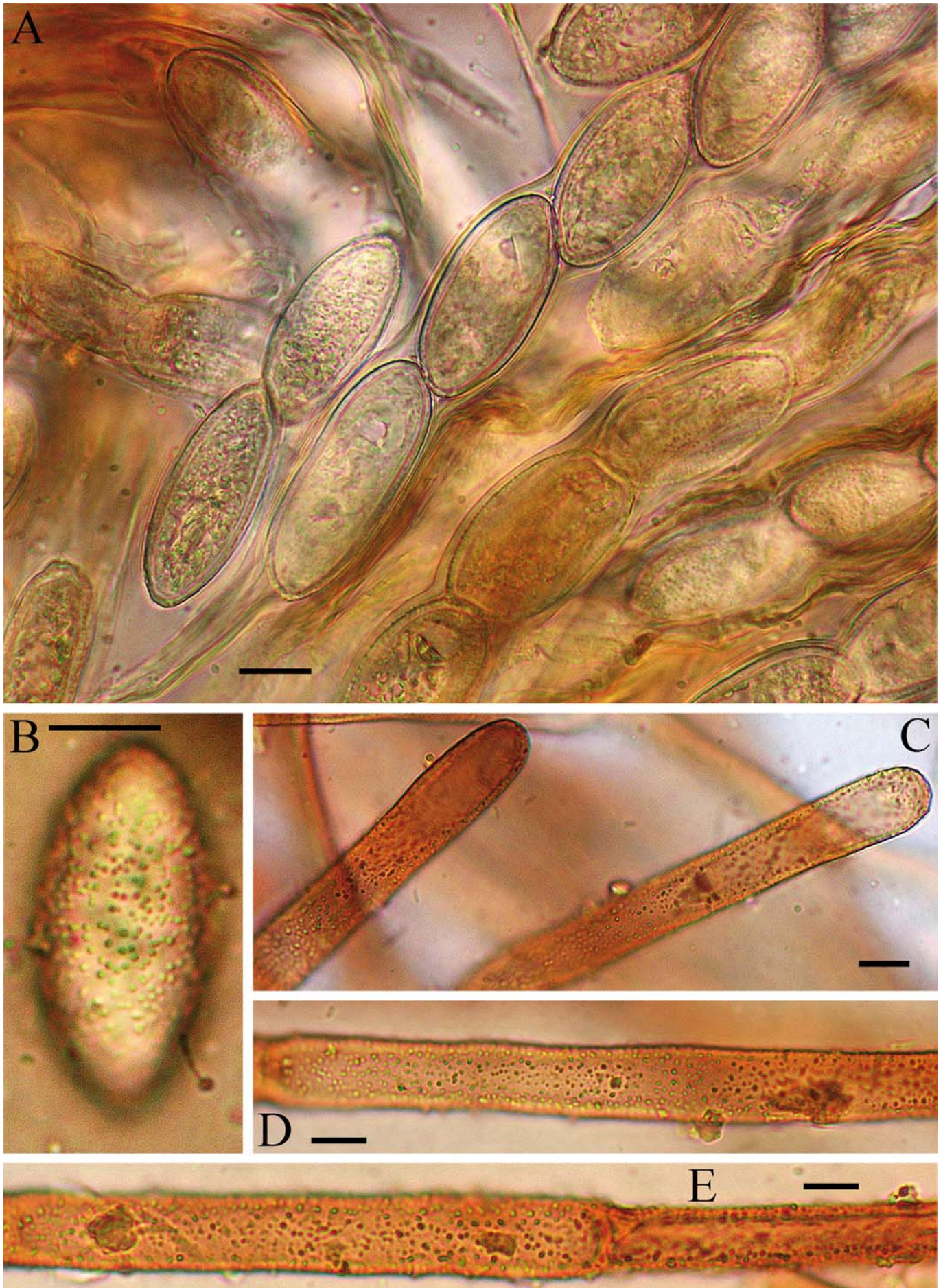


Plate 4 – Annotations on the *Urnula philippinarum* holotype. Photo: M. Carbone



Plate 5 – Holotype of *Urnula philippinarum*. Scale bar = 1 cm. Photo: M. Carbone





**Plate 6** – Microcharacters of the holotype of *Urnula philippinarum*.

A-B: spores in water. C: external hairs tips. D-E: external hairs of the second type. Scale bars = 10  $\mu$ m.

Photos: M. Carbone.



### Revision of the holotype F2940 (S)

The collection is in good condition and comprises five fruitbodies. They are discoid and turbinate, up to 4 cm in diameter, the hymenium is brown and cracked, the external surface is brown, wrinkled and velvety.

On the envelope there are many notes (see Plate 4).

The microscopic features are definitely identical to the ones of *Trichaleurina polytricha* and so we decided not to report them again. The only small differences detected, that we think not to be taxonomically relevant, consist in: the length of the spores (up to 47  $\mu\text{m}$  in length vs. 43  $\mu\text{m}$ ) and the width of paraphyses in the middle part (up to 4  $\mu\text{m}$  wide vs. up to 5  $\mu\text{m}$ ).

### Brief note

According to the holotype label "Dec. 26/13", it is obvious that "12/1313" written in the original diagnosis is a typographical error and must be corrected in 1913. Probably the number "12" refers to the month (December) and not to the day (which is 26<sup>th</sup>). The no. 2365 is written on the left top, and thus we believe there are no doubts this is the holotype of *Urnula philippinarum*. In addition almost all the features of the original diagnosis are here confirmed.

*Trichaleurina javanica* (Rehm) M. Carbone, Agnello & P. Alvarado, *Ascomycete.org*, 5(1): 6 (2013).

### Basionym

*Sarcosoma javanicum* Rehm, in Hennings, *Hedwigia*, 32: 226 (1893).

### Synonyms

*Galiella javanica* (Rehm) Nannf. & Korf, in Korf, *Mycologia*, 49 (1): 108 (1957).

*Trichaleurina polytricha* Rehm, *Leaflets Philipp. Bot.*, 6: 2234 (1914). (See discussion).

*Urnula philippinarum* Rehm, *Leaflets Philipp. Bot.*, 6: 2281 (1914). (See discussion).

*Sarcosoma decaryi* Pat., *Mém. Acad. Malgache*, 6: 37 (1928), fide LE GAL (1953).

*Sarcosoma novoguineense* Ramsb., *Contr. Phytogeogr. Arfak. Mount.*: 186 (1917), fide BOEDIJN (1932) and LE GAL (1959).

= ? *Bulgaria celebica* Henn., *Monunia*, 1: 30 (1900). (See discussion).

### Holotype

Selected ex art. 9.1 (Note 1) I.C.N.: Pl. VIII, figs. 6a–e, in HENNINGS, *Hedwigia*, 32 (1893).

### Original diagnosis

*Apothecia sessilia, primitus irregulariter globosa, gelatinosa, extus et intus castaneo-nigra, 2–3 cm, disco cinereo, rotunde aperto, saepe laceratim marginato, urceolato nigro, dein patelliformi, plano, tenuissimo margine cincto, subtus perpendiculariter –3 cm longo elongato, denique lateraliter subcompresso –5 mm crasso, inde laminaeiformi –stipitato, disco apothecii –3 cm lato; asci cylindraceo-clavati, apice rotundati, teneri, –300  $\mu$  longi, 18–21  $\mu$  lati, octospori; sporidia elliptica, recta, glabra, episporio crasso, hyalina, denum fuscidula 27–30  $\times$  12–14  $\mu$ , monosticha; asci senescentis crebri –15  $\mu$  lati, superne sporis 8, subfuscis, corrugatis praediti. Paraphyses filiformes, septatae, 3  $\mu$  –, versus apicem –6  $\mu$  lati et granuloso-fuscidulae. Celebes auf Holz. Die Schlauchschicht wird durch Jod nicht gefärbt.*

### Macroscopical features

**Apothecia** scattered, at first closed and subglobose with a very small hairy orifice at the top, then opening, turbinate to discoid, 2.5–8 cm diam., 2–6 cm high; fleshy and rubbery due to the highly gelatinized flesh. **Hymenium** ochre brown, reddish brown, orangish and finally black in overmature specimens. **Margin** strigose. **External surface** dark brown to blackish, rugulose, tomentose.

### Microscopic features

**Ascospores** ellipsoid-subfusoid, upper ones (22–)25–32  $\times$  15–17(–17.5)  $\mu\text{m}$ , lower ones 32–42(–44)  $\times$  (13–)14–16  $\mu\text{m}$ , hyaline to pale brown, with 2–4 large oil globules, walls up to 1  $\mu\text{m}$  thick, external surface covered by round, isolated warts, up to 0.5  $\mu\text{m}$  wide and high. **Asci** 8-spored, inamyloid, cylindrical, operculate, 425–525(–590)  $\times$  19–22  $\mu\text{m}$ , with walls up to 1.8  $\mu\text{m}$  thick and with a flexuous, long tapered base. **Paraphyses** filiform, septate, slightly enlarged at the tips, 4–7  $\mu\text{m}$  wide, subhyaline, light yellow to very pale brownish if observed at low magnification. **Subhymenium** 50–150  $\mu\text{m}$  thick, of a thick *textura intricata* with cylindrical, septate hyphae, 2.5–7.5  $\mu\text{m}$  wide; uniformly brownish at low magnification. **Medullary excipulum** thick, yellowish, gelatinous, of loose *textura intricata* with hyaline, cylindrical, septate hyphae, 4–6  $\mu\text{m}$  wide, very slightly thick-walled. **Ectal excipulum** 50–55  $\mu\text{m}$  thick, of *textura subglobulosa to angularis*, with globose to polygonal cells, 15–25  $\mu\text{m}$  diam., with thickened walls; dark brown mainly by an epimembranaceous and extracellular pigment. **External hairs** emerging from the external layer; two main types have been found, although some intermediate forms can be present; 1) subhyaline to yellowish, cylindrical, up to 5–9  $\mu\text{m}$  in diam., smooth, walls up to 0.5  $\mu\text{m}$  thick, septate, more or less straight to flexuous, and difficult to measure; 2) 100–1200  $\times$  7–14  $\mu\text{m}$ , mainly dark brown, cylindrical, slightly tapering upward, apical blunt, finely warted throughout or sometimes in the lower part only and then smooth above, walls up to 1  $\mu\text{m}$  thick.

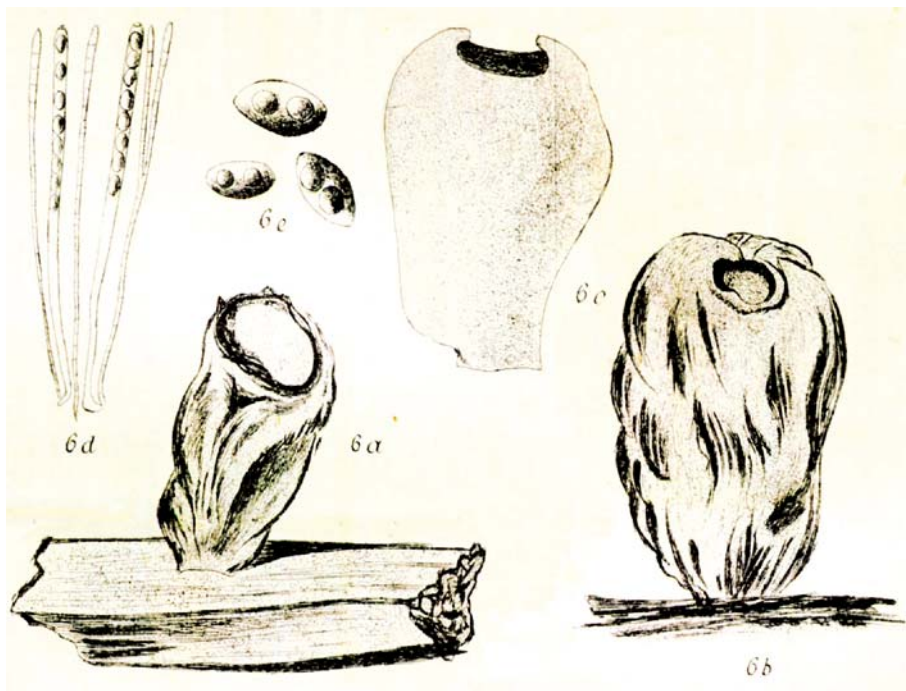


Plate 7 – Original plate of *Sarcosoma javanicum* in HENNINGS (1893).

Adapted by M. Carbone.



**Anamorph** (from TNM F8917): *Kumanasamuha* sp. (see discussion).

**Colonies** spreading slowly, 5–6 cm in diam. in MEA after two weeks at room temperature, floccose, white first, turning dark-brown, composed of intermingled conidiophores and sterile hyphae. **Hyphae** brown, septate, smooth, 3–4  $\mu\text{m}$  wide. **Conidiophores** erect, macronematous, septate, branched, brown, verrucose, 500–900  $\mu\text{m}$  long, 8–10  $\mu\text{m}$  wide. **Fertile lateral branches** very short, curved, 15–25  $\mu\text{m}$  long, 5–10  $\mu\text{m}$  wide, brown, verrucose. **Conidiogenous cells** polyblastic, clustered or arranged penicillately on the lateral branches, brown, globose to subglobose, 8–10  $\mu\text{m}$  diam., verrucose, with a short hyaline outgrowth bearing

several denticles. **Conidia** 4–6  $\times$  3–5  $\mu\text{m}$ , ellipsoid, solitary, dry, 1-celled, pale brown, with ridges arranged obliquely.

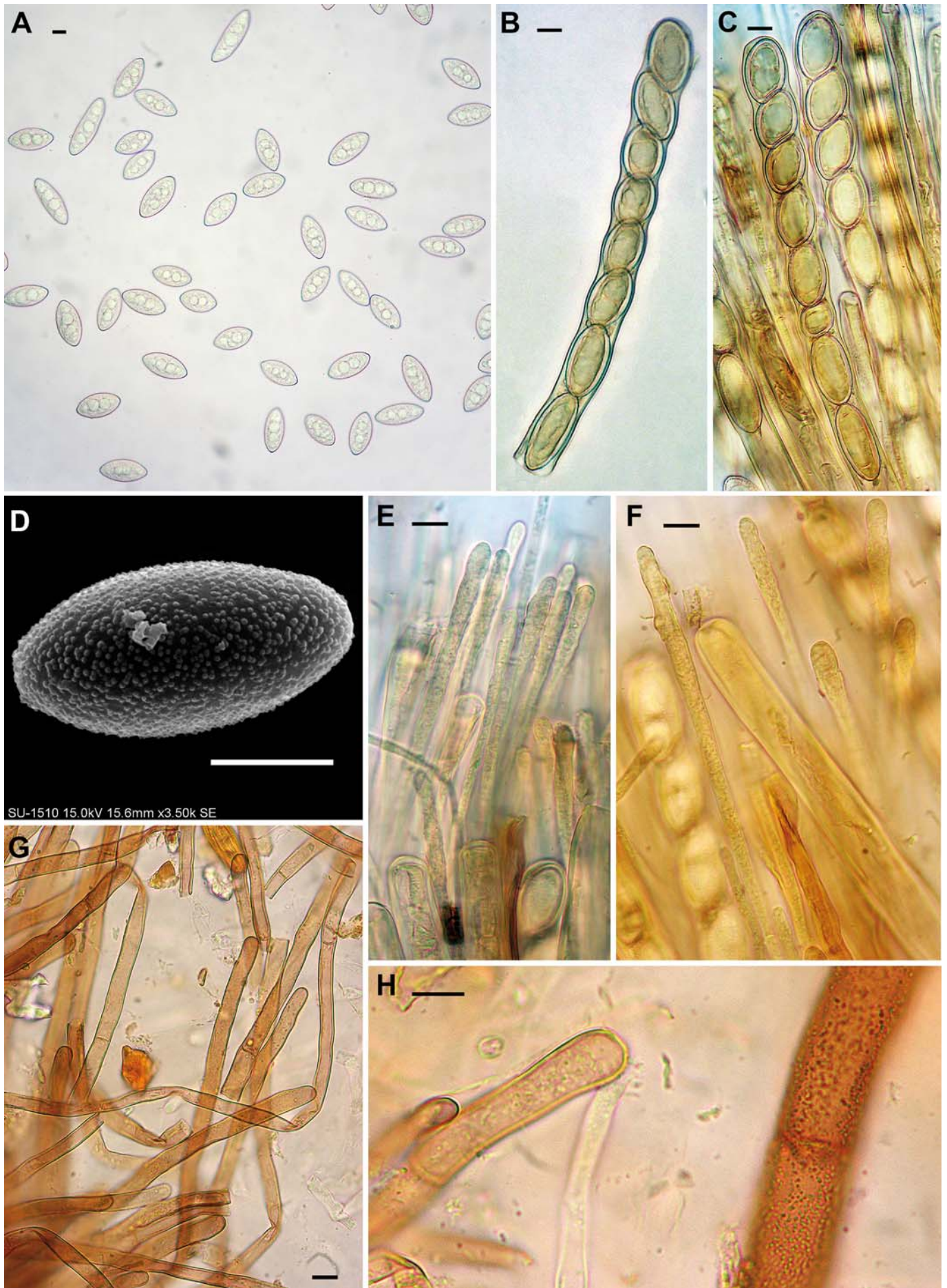
**Specimens examined**

CHINA. Hainan, *leg.* J.H. Yu & Y. Liu 1383, *det.* S.C. Teng, May 25, 1960 (HMAS 29564). Hainan, *leg.* X.K. Deng, *det.* S.C. Teng, Nov. 8, 1934 (HMAS 56524). Taiwan. Pingtung, Chufengshan, alt. 300 m; on rotten wood, *leg.* C.C. Wen, WAN 611, Sep. 09, 1998 (TNM F8917). Taitung, Orchid Island (Lanyu), alt. 10 m, on rotten wood, *leg.* S.Z. Chen, Chen1080, Jul. 18, 2000 (TNM F11334). Taitung, Orchid Island (Lanyu), on rotten wood, *leg.* S.Z. Chen, Chen1092, Jul. 18, 2000 (TNM F11338). THAILAND. Phuket island, on decaying wood, no date,



**Plate 8 – *Trichaleurina javanica*.** A: TUR-A 198585; B: TNM F8917; D: TUR-A 198584; E: TUR-A 195799; C-F-G: TUR-A 198583. Photos: M. Carbone and Y.-Z. Wang.

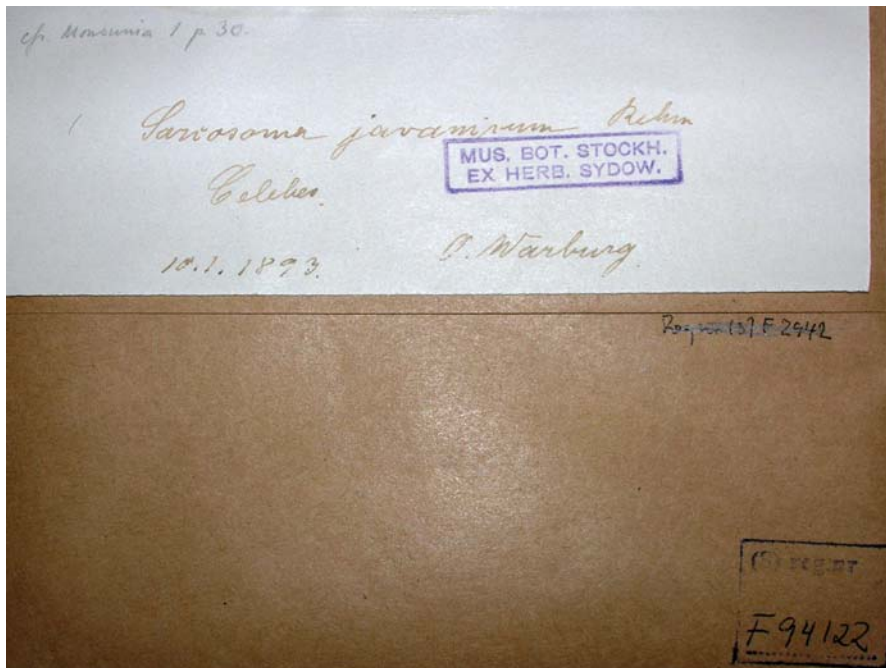




**Plate 9 – Microcharacters of *Trichaleurina javanica*.**

A: spores from sporeprint. B-C: spores inside the asci. D: spore SEM. E-F: paraphyses. G-H: external hairs of both types. Scale bars = 10  $\mu$ m. Photos: M. Carbone and Y.-Z. Wang.



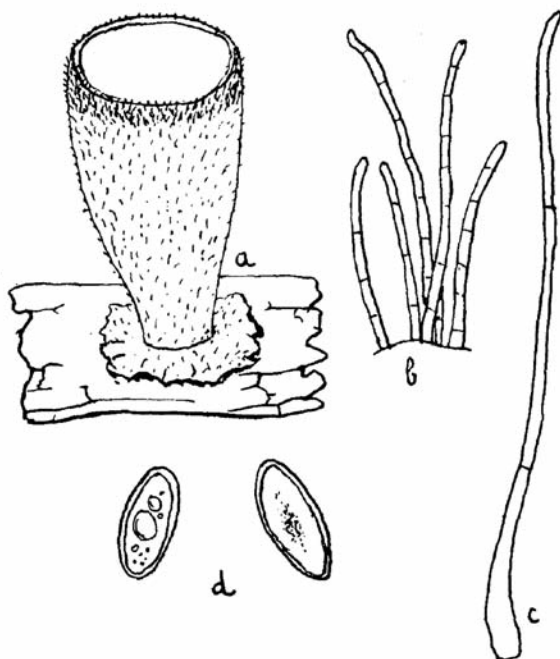


**Plate 10 – *Trichaleurina javanica*.** Left: herbarium packet from S herbarium. Right: dried specimen. Scale bar = 1 cm (valid for the dried sample only). Photos: M. Carbone.

leg. V. Verri, det. M. Carbone (TUR-A 198586). SEYCHELLES. Praslin, anse Lazio, on decaying wood, May 04, 2009, leg. and det. M. Carbone (TUR-A 195799). Praslin, vallée de Mai, in the ground on roots, Oct. 06, 2008, leg. and det. M. Carbone (TUR-A 198583). Praslin, vallée de Mai, in the ground on decaying wood, May 06, 2009, leg. and det. M. Carbone (TUR-A 198584). Mahe, Victoria, Botanical Gardens, on the roots at the base of a palm tree, May 08, 2009, leg. and det. M. Carbone (TUR-A 198585).

**Remarks**

Since the original material of *Sarcosoma javanicum* is not available, all the authors who tried to delineate its concept based their opinions only on the protologue.



**Plate 11 – Original plate of *Sarcosoma decaryi* in PATOUILARD (1928).** Adapted by M. Carbone.

The concept of *Sarcosoma javanicum* Rehm (in HENNINGS, 1893) has never been too much problematic, mainly due to the works of BOEDIJN (1932) and LE GAL (1953, 1959, 1960), even if it seems that the latter author was not aware of the existence of another very similar species which we here describe as *Trichaleurina tenuispora* (see below).

If we acknowledged that some features of the protologue does not fit perfectly with our data [and those of BOEDIJN (*op. cit.*) and LE GAL (*op. cit.*)], i.e. heterogeneous spores, spores size, lack of spores ornaments, lack of indications on hairs morphology, we still believe that the original plate shows definitely the macroscopical habit of this species, preventing any confusion with other species. However, it must be said that some Chinese authors like TENG (1963), CAO *et al.* (1992) and ZHUANG & WANG (1998) have surely treated also *T. tenuispora* under their "javanica" collections, but we believe that the epithet *javanica* must be retained due to its common usage for a species characterized by the turbinate apothecia, warty external hairs and finely punctate spores which are heterogeneous in shape and size (already within the same ascus). For this reason, we think that the collection cited by BOEDIJN (1932), i.e. "Selebes, Goenoeng Bonthain, on stems and little sticks, April 1921, Bünnemeyer", if still preserved in the Herbarium Bogoriense (BO), should be regarded as the epitype in the case of someone would regard the lectotype as ambiguous.

Regarding the lack of the holotype it must be noted that the Herbarium of the Swedish Museum of Natural History (S) houses the collection no. F94122, Celebes, 10.01.1893, legit O. Warburg, as *Sarcosoma javanicum* (see Plate 10). Unfortunately this Warburg's collection is not suitable for an epitypification because the hymenium is not yet developed at all. Anyway, external hairs are of two types: 1) subhyaline to yellowish, cylindrical, up to 5–6 µm in diam., smooth; 2) pale to dark brown, cylindrical, slightly tapering upward, 10–13 µm wide, finely warted throughout or in the lower part and then smooth; ectal and medullary excipulum are identical to those of the studied collections.

The specimens here studied have been all genetically confirmed to be the same species even if they have been collected in different geographical areas, this seems to indicate that *T. javanica* is widespread around the warmer areas of the Indian Ocean and also in the tropics (Fig. 1).

**Sarcosoma decaryi** Pat., described from Madagascar (PATOULLARD, 1928), was listed as synonym by LE GAL (1953, 1959) who seems to have examined the type specimen. The original diagnosis is here reported: "En forme de cône tronqué attaché par le sommet, pendant et haut de 3-4 centim. Disque plan rouge-gris, ferme, à peine marginé, 25 millim. de diamètre. Face externe d'un noir roussâtre, plus pâle près des bords, couverte de poils roux, septés, couchés, 10  $\mu$  d'épaisseur. Trame gélatineuse, incolore. Subiculum vilieux gélatineux-membraneux, étalé sur le support autour du point d'insertion. Asque  $\pm 250 \times 20 \mu$ , à 8 spores unisériées. Spores elliptiques, brun-pâle, 37-45  $\times$  15  $\mu$ . Paraphyses linéaires un peu épaissies vers l'extrémité".

**Sarcosoma novoguineense** Ramsb. was listed as synonym by BOEDIJN (1932) according to the original description (GIBBS, 1917: 186 as *S. novo-guineensis*) and LE GAL (1959) who examined the type specimen. The original diagnosis is here reported: "Ascomatibus gelatinosis, brunneis, discis pallidioribus, turbinatis, 8 cm. altis, 5 cm. latis, extus strigoso-hirsutis; setis simplicibus septatis, castaneis, 450-1200  $\mu \times$  10-17  $\mu$ ; ascis cylindraceo-clavatis, obtusis, ad 400  $\mu \times$  17-18  $\mu$ , partibus sporiferis c. 250  $\mu$ , octosporis, paraphysatis; paraphysibus subclavatis, fuscidulis, 4-6  $\mu$  crassis; sporis monostichis, ellipsoideis, 1-2 guttulatiss, 25-40  $\mu \times$  11-15  $\mu$ , hyalino-fuscidulis. Ad terram. Hab. Manokoeari, common in forest and sec. jungle. Jan. 6198".

We agree with these two synonymies because the descriptions fit well the *javanica*-concept and they are strictly tropical. *S. novoguineense*, in particular, has been collected from Manokwari (today in West Papua, Indonesia), not so far from the original locality of *T. javanica*.

**Bulgaria celebica** Henn., *Monsunia*, 1: 30 (1900).

$\equiv$  *Sarcosoma celebicum* (Henn.) Sacc. & P. Sydow, *Syll. fung.*, 16: 771 (1902); *Sarcosoma globosum* var. *celebicum* (Henn.) Kobayasi, *J. Jap. Bot.*, 13: 518 (1937); *Galiella celebica* (Henn.) Nannf., in Korf, *Mycologia*, 49 (1): 108 (1957); *Trichaleurina celebica* (Henn.) M. Carbone, Agnello & P. Alvarado, *Ascomycete.org*, 5 (1): 6 (2013).

$\equiv$  ? *Sarcosoma javanicum* Rehm, in Hennings, *Hedwigia*, 32: 226 (1893). (See discussion).

### Original diagnosis

*Ascomatibus gelatinosis sessilibus, cupuliformibus, hemisphaericis, 2 1/2 - 3 1/2 cm altis, 3-6 cm latis, extus tomentoso-vel strigoso-hirsutis atris, setis simplicibus, septatis, castaneis, obtusis ca. 300-600  $\mu$  longis, 13-15  $\mu$  crassis, disco laevi, glabro, atrobrunneo; ascis cylindraceo-clavatis, obtusis, 300-360  $\times$  12-16  $\mu$ , p. sp. 150-180  $\mu$  longis, 8-sporis, paraphysatis; sporis monostichis, ellipsoideis, guttulatiss, 23-27  $\times$  11-13  $\mu$*

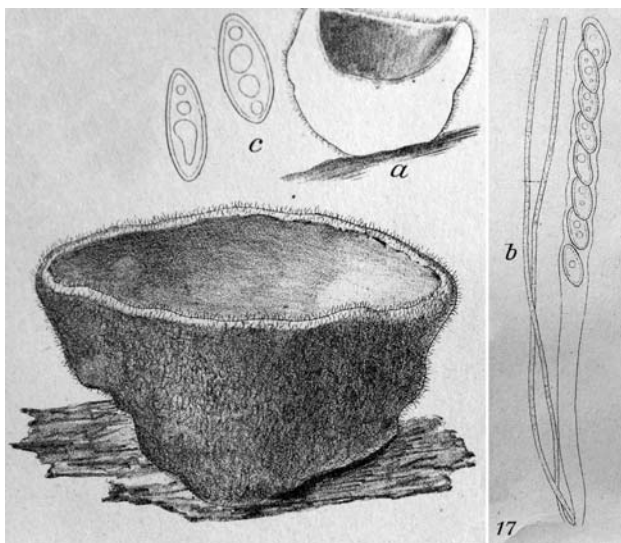


Plate 12 – Original plate of *Bulgaria celebica* in HENNINGS (1900). Adapted by M. Carbone.

*hyalino-fuscidulis; paraphysibus filiformibus, multiguttulatis, fuscidulis 3-4  $\mu$  crassis. Celebes, aus den Wäldern bei Tomohon: an einem alten Baumstamm. 13. Aug. 1893. (Sarasin). Eine sehr grosse, stattliche Art, die aussen sowie am Rand mit dichtem schwarzem Haarfilz bekleidet, von allen bisher bekannten Arten ganz verschieden ist, jedoch mit *B. platydiscus* (Casp.) gewisse Ähnlichkeit besitzt. Im Innern ist der Fruchtkörper gallertig-fleischig, graubräunlich. Von folgender Art [*B. javanica*] ist der Pilz völlig verschieden.*

### Remarks

Due to the lack of type material, BOEDIJN (1932), as he did for *Trichaleurina javanica*, applied the epithet *celebica* to a species that he believed to fit with Hennings' original plate (see Plate 12) and description. If we compare Boedijn's description with Hennings', we can find some differences: two types of hairs and inequilateral ascospores, above all due to the scarcity of details in the latter description (see above). LE GAL (1953) applied the epithet *celebica* (as *Sarcosoma celebicum*) to a species collected in Madagascar which seems to be quite different from the one described by BOEDIJN (*op. cit.*), due to the presence of short marginal hairs and smooth long hairs. Also in this case LE GAL (1953) has based her identification on Hennings protologue only. For this reason *Galiella celebica* as described by ZHUANG & WANG (1998) shows uniformly smooth external hairs, and thus differs from BOEDIJN's interpretation (1932).

The epithet *celebica* has been used also in Japan by OTANI (1980) and in India by PANT (2001) and PANT & PRASAD (2008). We have not examined all these collections but according to the descriptions or pictures, the Indian collections seem to recall more *Trichaleurina javanica*.

It is thus obvious that, judging from the available mycological literature, the *Bulgaria celebica* concept is not clear as it has surely been adopted by all these authors.

The only author who described a collection from a place close to the topotype was BOEDIJN (1932). The sample studied by him came in fact from Indonesia (Sumatra, Krakatau).

The main problem regarding the use of the epithet *celebica* is that, even if some features of the different interpretations match the protologue, many others definitely do not. We are convinced that this is mainly due to the ambiguous protologue that led to different interpretations. Thus we cannot take a solid position as we did for *T. javanica*. We consequently prefer to treat *Bulgaria celebica* as a *nomen dubium* or, at least, even as a possible synonym of *Sarcosoma javanicum*.

In fact, *Bulgaria celebica* has been described from the same place of origin as *Trichaleurina javanica*. The difference of spores size in the two protologues (i.e. 27–30  $\times$  12–14  $\mu$  in *javanica* and 23–27  $\times$  11–13  $\mu$  in *celebica*) seems not to be so significant if we consider that all the cited authors have found a larger range that could comprise both ranges. In the *B. celebica* protologue, a tendency to possess inequilateral shaped or ornamented spores is not indicated, we only know that they are subfusoid, and hence not different from those described for *javanica*. The morphological description of the external hairs is absent and thus we have no information whether they are smooth (thus more related to a real *Galiella* sp.) or warty (more related to *Trichaleurina*). Apothecia of *B. celebica* are reported as cupshaped or hemispherical (*cupuliformibus, hemisphaericis*) and black-brown (*atrobrunneo*). The black-brown and cupshaped apothecia are commonly found in old specimens of *T. javanica* that we have seen (see Plate 8, fig. C and F). In fact, the studied collections of *T. javanica* from Seychelles (all confirmed genetically to be the same species) have shown a very variable habit in shape and color depending respectively on the substrate and on the degree of maturity. Therefore some of them were identical by their appearance to the iconotype of *T. javanica* whilst others to that of *Bulgaria celebica*.

In summary, if on one hand the *javanica* concept is definitely clear, on the other hand we are not certain whether *javanica* and *celebica* are really two different species (at least in their original sense).



ZHUANG & WANG (1998) considered *Galiella sinensis* J.Z. Cao as a synonym of *G. celebica*. We have examined the type (HMAS 29566) and observed smooth hairs, hence it should be more related to a real *Galiella* sp.

While working on ascomycetes in Taiwan, a large brown discomycete was occasionally collected by the second author. It was identified as *Galiella javanica* according to LE GAL (1953) and ZHUANG & WANG (1998). After thorough examination of the loaned specimens from China and Japan, we experienced that it also occurs in these countries, and the same discomycete was assigned to *G. javanica* in China (CAO *et al.*, 1992; ZHUANG & WANG, 1998) while to *G. celebica* in Japan (OTANI, 1980, 1989). It differs from *Trichaleurina javanica* by slender, inequilateral ascospores which are homogeneous in size within the asci and a distribution in more temperate regions. This distinction is also confirmed by molecular analysis (Fig. 1). For avoiding the confusions with *T. celebica* discussed above, we propose a new species.

*Trichaleurina tenuispora* sp. nov. – MB 804974

**Diagnosis**

It differs from *Trichaleurina javanica* in more slender, often inequilateral ascospores which are also more homogeneous in size within the ascus. It differs from the known *Galiella* species in having two kinds of external hairs, one of which is warted.

**Holotype**

TAIWAN, Miaoli County, Sanyi, on rotten wood, March 10, 2000, *leg.* W.T. Yang, *det.* Y.Z. Wang, WAN 767 (TNM F10376).

**Ascertained misapplied names**

*Sarcosoma celebicum sensu* BOEDIJN (1932).  
*Galiella javanica sensu* WANG (2011).  
*Trichaleurina celebica sensu* CARBONE *et al.* (2013).

*Macroscopical features*

**Apothecia** scattered, turbinate to discoid, 2–6 cm in diam., 1–3 cm high; fleshy and rubbery due to the highly gelatinized flesh. **Hymenium** greyish-brown to dark-brown, smooth. **Margin** hairy, usually paler than the external surface. **External surface** brown to black, tomentose.

*Microscopic features*

**Ascospores** ellipsoid to subfusoid, inequilateral, 27–35(–40) × 12–14(–15) μm, hyaline to pale-brown, with 2–4 large oil globules, walls up to 1 μm thick, external surface covered by round to sometimes ellipsoid, isolated warts, up to 0.5 μm wide and high. **Asci** 8-spored, inamyloid, cylindrical, operculate, 425–500 × 15–17 μm, with walls up to 1.5 μm thick and with a flexuous, tapered and long base. **Paraphyses** filiform, septate, slightly apically enlarged, 3–6 μm wide, subhyaline, light yellow to very pale brownish if observed at low



**Plate 13 – *Trichaleurina tenuispora*.**

A: TNM F8301. B: TNM F8286. C-D: TUR-A 195800. Photos: A-B by Y.-Z. Wang; C-D by K. Saitoh.



magnification. **Subhymenium** 50–150 µm thick, of a voluminous *textura intricata* with compact, cylindrical, septate hyphae, 2.5–7.5 µm wide; yellowish-brown at low magnification. **Medullary excipulum** very thick, yellowish, gelatinous, of a loose *textura intricata*, with hyaline, cylindrical, septate, smooth hyphae, 6–8(–11) µm wide, very slightly thick-walled up to 0.5 µm. **Ectal excipulum** very thin, of *textura subglobulosa* to *angularis*, with globose to polygonal cells, cells 17–25(–35) µm in diam., with thickened walls; brown mainly due to an epimembranaceous and extracellular pigment. **External hairs** emerging from the external layer, two main types have been found, although some intermediate forms can be present; 1) yellowish to brown, cylindrical, 5–10 µm in diam., flexuous, smooth, walls up to 0.5 µm thick, septate; 2) up to 2.5 mm long, 10–20 µm wide, mainly dark brown, cylindrical, apically blunt, densely verrucose throughout or at their base, walls up to 1 µm thick.

**Anamorph** from TNM F10376 (the type): *Kumanasamuha* sp. (see discussion)

**Colonies** spreading slowly, 5–6 cm in diam. in MEA after two weeks at room temperature, floccose, white first, turning dark-brown, composed of intermingled conidiophores and sterile hyphae. **Hyphae** brown, septate, smooth, 3–4 µm wide. **Conidiophores** erect, macronematous, septate, branched, brown, verrucose, 500–1500 µm long, 8–10 µm wide. **Fertile lateral branches** 20–75 µm long, 8–10 µm wide, with 1–2 septa, brown, verrucose, terminal cells enlarged, 10–17 µm diam. **Conidiogenous cells** polyblastic, clustered or arranged penicillately on the lateral branches, brown, globose to subglobose, 8–10 µm diam., verrucose, with a short hyaline outgrowth 6–7 × 4–5 µm bearing several denticles. **Conidia** 5–7 × 4–5 µm, ellipsoid, solitary, dry, 1-celled, pale-brown, with ridges arranged obliquely.

#### Specimens examined

CHINA, Anhui: Huangshan, on rotten wood, *leg.* S.C. Teng, 5139, Aug. 30, 1957 (TNM F19576). Yunnan, Longpa, on rotten wood, *leg.* S.H. Wu & S.Z. Chen, Wu 0606-23, Jun. 18, 2006 (TNM F20422). Longpa, on rotten wood, *leg.* S.H. Wu & S.Z. Chen, Wu 0606-26, Jun 18, 2006 (TNM F20424). TAIWAN, Hsinchu, Kuanwu, 1800 m alt., on rotten wood, Apr. 30, 2002, *leg.* Y.Z. Wang, WAN 893 (TNM F13898). Kaohsiung, Maolin, 1050 m alt., on buried rotten wood, Mar. 29, 2005, *leg.* S.Z. Chen, 1326 (TNM F17974). Kaohsiung, Tengchih, on humus, Apr. 30, 2005, *leg.* Y.C. Su (TNM F19382). Miaoli, Tahu, on dead branches, May 12, 1996, *leg.* S.Z. Chen, WAN 287 (TNM F4705). Nantou, Aowanta, on humus, Apr. 23, 2007, *leg.* W.N. Chou, WAN 1174 (TNM F20790). Nantou, Lienhuachih, on rotten wood, Feb. 26, 1998, *leg.* W.N. Chou, WAN 553 (TNM F8286). Nantou, Lienhuachih, on rotten wood, Apr. 14, 1995, *leg.* Y.Z. Wang, WAN 119 (TNM F3076). Nantou, Meifeng, on rotten wood, Apr. 18, 2006, *leg.* S.L. Yuan, WAN 1098 (TNM F19725). Nantou, Tungpu, 1600 m alt., on rotten wood, Mar. 21, 1998, *leg.* W.N. Chou, WAN 568 (TNM F8301). Taitung, Orchid Island (Lanyu), on rotten wood, Mar. 29, 2005, *leg.* C.L. Huang, WAN 1045 (TNM F17898). JAPAN, Chiba Pref., Kashiwa-shi, Konbukuro-ike pond, on wood, *leg.* T. Hosoya, *det.* K. Osaku, Oct. 15, 2006 (TNS-F-31213). Shizuoka Pref., Shimoda City, Suzaki Peninsula, on wood, *leg.* Y. Doi, May 27, 2003 (TNS-F-10492). Gunma Pref., Tonegun, Minakami-machi, Oana, on wood, *leg.* and *det.* T. Hosoya, Sep. 18, 2005 (TNS-F-31163). Tokyo, Chiyoda-ku, Fukiage Gardens, on rotten wood, *leg.* E. Nagasawa, *det.* T. Hosoya, Sep. 8, 2009 (TNS-F-27325). Hiroshima Pref., Yamagata-gun, Arita, *leg.* Y. Kawakami, Sep. 26, 2011 (TNS-F-45313). Ishikawa Pref., Kaga City, Jun. 15, 2003 (TNS-F-24168). Yokohama, Kanazawa, on log, Jun. 24, 2012, *leg.* and *det.* K. Saitoh, *rev.* M. Carbone (TUR-A 195800).

#### Remarks

*Trichaleurina tenuispora* has been treated by many Chinese authors (CAO *et al.*, 1992; ZHUANG & WANG, 1998) as *Galiella javanica* mainly due to the presence of long, warted external hairs. In fact, LE GAL (1953) treated *Sarcosoma javanicum* as the only species with

warted external hairs, and *Sarcosoma celebicum* lacking this kind of hairs. Although *T. tenuispora* shares the same kind of external warted hairs (thus it belongs to *Trichaleurina*), it was not regarded as an independent species from *G. javanica*.

The first who noticed its independence at species level was BOEDJIN (1932) who used the epithet *celebica* for it (see above the discussion for the use of *celebica*). From the examined collections it seems clear that it has been also treated as *Galiella celebica* in Japan, and surely as *Trichaleurina celebica* by CARBONE *et al.* (2013).

*T. tenuispora* is easily recognized under the microscope by its more slender and often inequilateral spores, which are not heterogeneous in shape and size inside the ascus as in *T. javanica* where the upper spores are shorter and wider whilst the lower ones are longer and slender.

*T. tenuispora* has a wider distribution than *T. javanica*. Most Chinese, Japanese and Taiwanese specimens we studied belong to *T. tenuispora* while only few collected from tropical islands as Hainan (China) and Lanyu (Taiwan) belong to *T. javanica*.

Based on the specimens examined in this study, the sympatric distribution of these two species in Taiwan, including the tropical island Lanyu, shows a unique biogeographical pattern. Because the similarity of the fauna of the Philippines and Lanyu, the northern end of neo-Wallace's Line was drawn between Taiwan and Lanyu (KANO, 1933). This line just defines the northern limit of *T. javanica*. As some plant seeds or fruits that can be found on distant beaches after having drifted thousands of miles through ocean currents, the long-distance distribution of *T. javanica* might be related to this same kind of dispersal ability which could explain the wide distribution and low genetic variance of this species.

In contrast, *T. tenuispora* adapts to a wider range of climate, from temperate to tropical areas. These two species are sympatrically distributed in the southern Asia.

## Discussion on the studied anamorphs and the genus *Kumanasamuha*

The genus *Kumanasamuha* P.Rag. Rao & D. Rao was described from India with *Kumanasamuha sundara* P.Rag. Rao & D. Rao as type species (RAO & RAO, 1964). Further four species have been described so far: *Kumanasamuha arakuensis* T. Raman, Ren. Rao & D. Rao (RAMAN *et al.*, 1978) and *K. kalakadensis* Subram. & Bhat (SUBRAMANIAN & BHAT, 1987) both from India; *K. novozelandica* L. Hunter & W.B. Kendr. (HUNTER & KENDRICK, 1977) from New Zealand; *K. geaster* Nagao, Sh. Kurogi & Kiyota (NAGAO *et al.*, 2009) from Japan [as anamorph of *Chorioactis geaster* (Peck) Kupfer ex Eckblad].

According to our morphological results, the anamorph of *Trichaleurina javanica* is morphologically close to *Kumanasamuha sundara*, but it is different by shorter conidiophores and fertile lateral branches, and smaller conidia.

The anamorph of *Trichaleurina tenuispora* is characterized by long fertile lateral branches with the terminal cells definitely enlarged or inflated. *Kumanasamuha kalakadensis* also has long fertile lateral branches, however it is different by longer ones and smaller conidia.

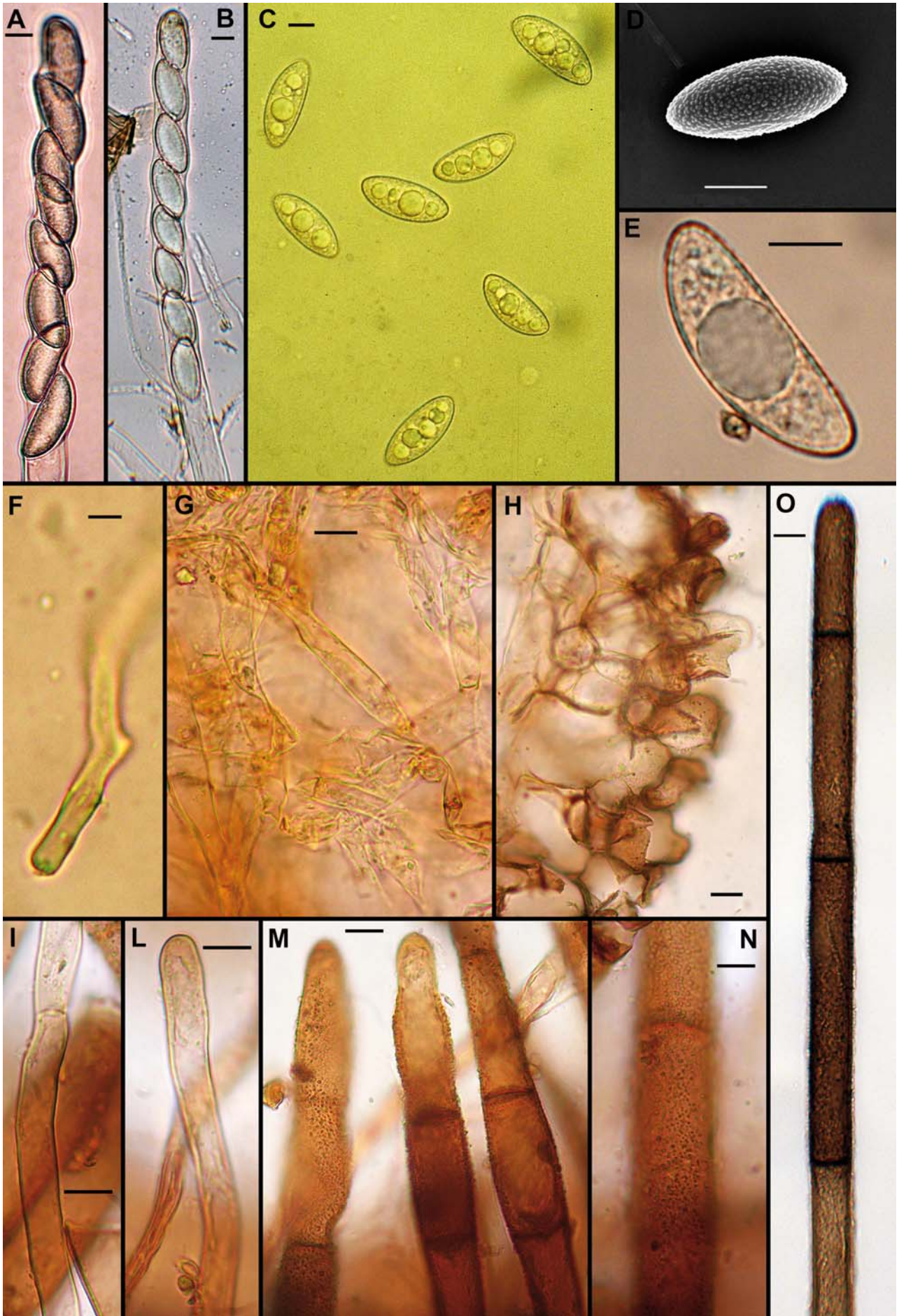
As *Kumanasamuha sundara* has been reported from Taiwan, the second author examined the specimens collected and cited by KIRSCHNER *et al.* (2001). They appeared to match more *K. kalakadensis* due to their long fertile lateral branches.

Both *Kumanasamuha* anamorphs examined in the present study definitely show affinities to the three Indian species and not to the two remaining ones. For this reason we have summarized their features in the Table 2.

## Final considerations

The present study confirms that *Trichaleurina polytricha* is definitely conspecific with *Sarcosoma javanicum* Rehm.





**Plate 14 – Microcharacters of *Trichaleurina tenuispora*.**

A-E: spores. F: ascus base. G: medullary excipulum. H: ectal excipulum. I-O: external hairs.  
Scale bars = 10 μm. Photos: Y.-Z. Wang and M. Carbone.



**Table 2** – Comparison between the main characters of *Kumanasamuha* species

	Length of main conidiophores	Length of fertile lateral branches	Conidiogenous cells	Conidia
<i>K. sundara</i>	160–1150 µm	10–45 µm	Globose, 5–12 µm	Oval to round, 5–7 × 4–6 µm
<i>K. arakuensis</i>	Up to 2000 µm	15–33µm, non septate	Flask-shaped, 9–12 × 6–12 µm	± spherical, 4–6 µm
<i>K. kalakadensis</i>	Over 2000 µm	Up to 125 µm	Globose, 6.7–9.8 µm	Oval to subspherical, 3.4–5.0 µm
Anamorph of <i>T. javanica</i>	500–900 µm	15–25 µm	Globose, 8–10 µm	Ellipsoid, 4–6 × 3–5 µm
Anamorph of <i>T. tenuispora</i>	500–1500 µm	20–75 µm	Globose, 8–10 µm	Ellipsoid, 5–7 × 4–5 µm

The same can be said for *Urnula philippinarum*, whose macroscopical, microscopic and biogeographical features are definitely identical to those of *T. polytricha*.

The epithet *javanica* is here retained and *T. javanica* is considered as a good independent species both morphologically and genetically after the examination of some tropical collections matching the protologue, its common use and the modern concept.

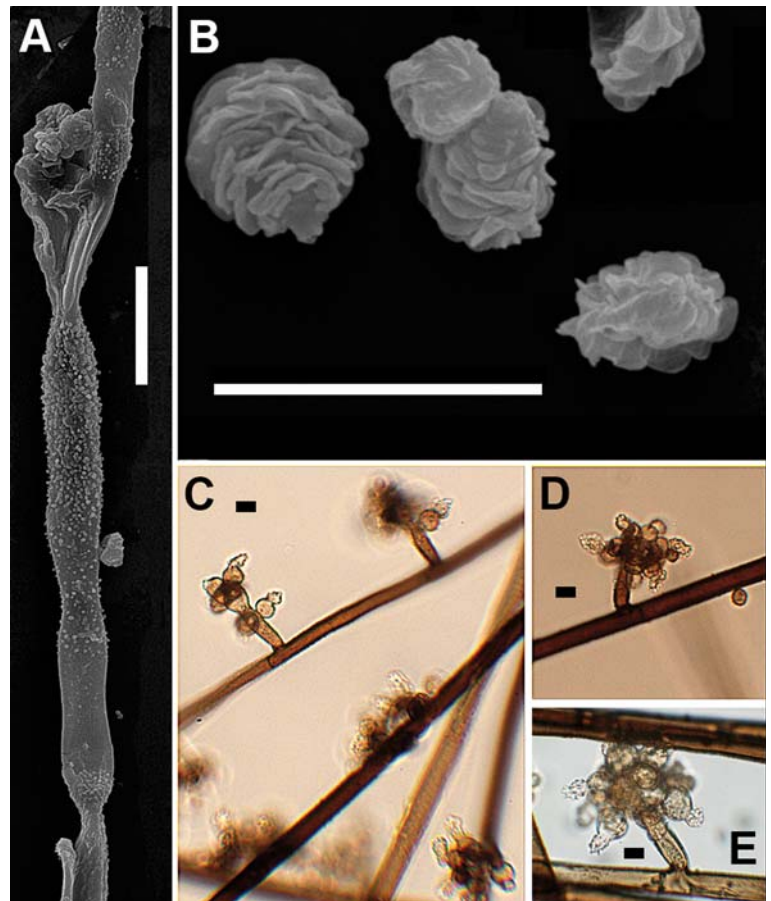
The epithet *celebica* is here suggested to be abandoned or, at least, to be regarded as a synonym of *T. javanica*. An epitypification could be the only way to save this name, but we believe that without the discovery of the type, all epitypifications could be too arbitrary. The choice to abandon the epithet *celebica* is a good way to avoid continuous misinterpretations in favour of a more nomenclatural stability. For this reason, *Trichaleurina tenuispora* is here described as new to science to replace one of the different interpretations of *Bulgaria celebica*. Its independence in the genus *Trichaleurina* is here confirmed both morphologically and genetically.

Both *T. javanica* and *T. tenuispora* have shown a *Kumanasamuha*-type anamorph, appearing morphologically different if compared to the nowadays known species of this genus. For this reason and due to recent changes in the International Code of Nomenclature and the new rule “one fungus, one name”, with the data in our hands, we have decided to describe *T. tenuispora* as a new species instead of making a new combination with an existing *Kumanasamuha* species epithet. An in-depth morphological and genetic study on the types of all *Kumanasamuha* species is definitely required to confirm (or not) our results, to ascertain their independence and to delineate their taxonomically relevant characters.

Finally, the present genetic study confirms the position of *Trichaleurina* in the family *Chorioactidaceae*, as a sister clade of *Wolfina*.

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**Plate 15** – Anamorph of *Trichaleurina tenuispora*.

A: conidiophores (SEM). B: conidia (SEM). C-D-E: conidiophores in water mount. Scale bars = 10 µm. Photos: Y.-Z. Wang.

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