



A new and threatened species of *Trichaptum* (Basidiomycota, Hymenochaetales) from urban mangroves of Santa Catarina Island, Southern Brazil

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Abstract

Trichaptum comprises around 36 polypore species, with variable morphology and worldwide distribution. During polypore surveys in Santa Catarina Island (Southern Brazil), specimens of a remarkable species, with large, mostly resupinate basidiomata, large (6–11 µm long) spores and two kinds of cystidia, were collected in mangrove forests and their vicinities. Morphological and phylogenetic analysis (rDNA ITS) revealed it as new, and is described herein as *T. fissile* sp. nov. Moreover, the species is proposed as Vulnerable according to the IUCN criteria. The taxonomic placement and delimitation of *Trichaptum* are also discussed.

Keywords: Taxonomy, Polypores, Nigrofomitaceae, IUCN

Introduction

Trichaptum Murrill (1904: 608) is a genus of polypores with mostly annual and pileate basidiomata, typically presenting purplish to brownish colors with a tomentose to hirsute upper surface. Microscopically, the apically encrusted cystidia, dimitic to trimitic hyphal system and cylindrical spores are diagnostic features of this group (Gilbertson & Ryvarden 1987, Ryvarden 1991, Gibertoni *et al.* 2011, Ryvarden 2016, Vlasák & Vlasák Jr. 2017).

The genus currently comprises 36 species (mycobank.org 2019) worldwide, of which 14 have been recorded in the Neotropical Region (Ryvarden 2016, Vlasák & Vlasák Jr. 2017, GBIF.org 2019). Despite being home of more than a third of the species in the genus, few taxonomic studies were conducted on the group in the Neotropics, leaving a gap of knowledge. Almost all of the recent taxonomic studies regarding species in the genus on the region were conducted in the tropical areas of North and Central America (Ryvarden 2014, Vlasák & Vlasák Jr. 2017), and four new species were described in the last decade, but none of them from Brazil.

Regarding phylogenetic relationships, recent works showed that *Trichaptum* is closely related to *Nigrofomes* Murrill (1904: 425) within Hymenochaetales Oberw. (1977: 89), but not accommodated in any family. The genus has also been shown to be polyphyletic, with at least two clades, *Trichaptum* s.s. sister to *Nigrofomes*, and *Trichaptum* s.l. sister to the *Trichaptum* s.s. and *Nigrofomes* assemblage (Vlasák & Vlasák Jr. 2017, Zhou *et al.* 2018).

Efforts to document fungal diversity in urban areas are crucial, as they present potential for discoveries (Bittencourt *et al.* 2018), especially in areas threatened by growing occupation, such as Mangrove forests (Sovernigo 2009, Ferreira & Lacerda 2016). In this case, during polypore surveys in urban Mangrove areas of Santa Catarina Island, some *Trichaptum* specimens were collected, which, at a first glance, did not seem to belong to any described species in the genus. This work aims to describe the new species based on morphological and molecular data, proposing it as threatened, as well as presenting insights about the taxonomic placement and delimitation of *Trichaptum*.

Material and methods

Study area:—Collections were performed in Santa Catarina Island, municipality of Florianópolis, Santa Catarina State, Brazil, at the borders of Mangrove areas of the Atlantic Rainforest and at the Federal University of Santa Catarina Campus.

Morphological analyses:—Macro-morphological analyses of the basidiomata (shape, color, and number of pores per mm) were made with Leica EZ4 stereomicroscope. Color names and codes were obtained from dried basidiomata, following Watling (1969). Microscopical observations were made by cutting sections of the tubes and context using a razor and mounted on microscopy slides using KOH 5% with Phloxin 1% and Melzer's reagent and observed using Leica DM500 optical microscope. Measurements were made from pictures made on 1000× magnification on KOH + Phloxin preparations, using ImageJ (Schneider *et al.* 2012). For each structure, 40 measurements were made per specimen. Maximum and minimum values under 5% occurrence on the inferior and superior limits are shown between parentheses. Basidiospore shape was determined by the ratio of length/width (Q), following the terminology of Tulloss (2019). Additional specimens kept at FLOR and FURB Herbaria (Thiers 2019) were analyzed.

DNA extraction, PCR amplification, and sequencing:—DNA was extracted from dried basidiomata following the protocol of Doyle & Doyle (1987) modified by Góes-Neto *et al.* (2005). Primer pairs ITS8-F/ITS6-R were used to amplify the internal transcribed spacer (ITS). Sanger Sequencing was performed with BigDye Terminator v. 3.1 Cycle Sequencing Kit (Applied Biosystems, California, USA) following manufacturer procedures. Sequencing was performed at Myleus Biotecnologia, Minas Gerais, Brazil. The resulting chromatograms and their respective sequences were manually inspected and edited using Geneious v4.8.5 (<https://www.geneious.com>). The obtained sequences were deposited into GenBank® (<http://www.ncbi.nlm.nih.gov>).

Phylogenetic analyses:—A total of 38 ITS sequences available in GenBank® were included in the dataset, including 30 *Trichaptum*, four *Nigrofomes* and two *Neoantrodia* Y.C Dai, B.K. Cui, Jia J. Chen & H.S. Yuan (2015: 202) sequences, as well as two Hymenochaetaceae Donk (1948: 474) sequences designated as outgroup [*Inonotus obliquus* (Fr.) Pilát (1942: 572) and *Tropicoporus drechsleri* Salvador-Montoya & Popoff (2018: 80)]. List of vouchers used is given in Table 1.

The datasets were aligned using MAFFT v. 7 (Katoh & Standley 2013), under the G-INS-i criteria. Then, they were manually inspected using MEGA v. 6 (Tamura *et al.* 2013). The ITS dataset was subdivided into three data partitions, ITS1, 5.8S, and ITS2. The best-fit model of nucleotide evolution to the datasets was selected by AIC (Akaike Information Criterion) using jModelTest2 v. 1.6 (Guindon & Gascuel 2003, Darriba *et al.* 2012). For the phylogenetic reconstruction, Maximum Likelihood (ML) and Bayesian Inference (BI) phylogenetic analyses were applied to the datasets. ML analyses were performed in RAxML v.8.2.12 (Stamatakis 2014) and BI in MrBayes v3.2.6 (Ronquist & Huelsenbeck 2003). The ML analysis first involved 100 searches, each one starting from one randomized stepwise addition parsimony tree, under a GTRGAMMA model, with all the other parameters estimated by the software. To assess the reliability of the nodes, multi-parametric bootstrapping replicates under the same model were computed, allowing the program to halt bootstrapping automatically by the autoMRE option. BI was performed with two independent runs, each one beginning from random trees with four simultaneous independent chains, performing 10.000.000 replications, sampling one tree every 1.000th generation. The first 25% of sampled trees were discarded as burnin, while the remaining ones were used to reconstruct a 50% majority rule consensus tree and calculate Bayesian posterior probabilities (BPP) of the clades. A node was considered to be strongly supported if it showed a BPP ≥ 0.95 and/or BS ≥ 70 %.

Conservation status assessment:—Conservation status was assessed following the IUCN Guidelines for Fungi (Dahlberg & Mueller 2010). Assessment was submitted to The Global Fungal Red List Initiative platform (<http://iucn.ekoo.se/en/iucn/welcome>) in order to be checked and approved by IUCN.

Results

Phylogenetic analyses:—Two ITS sequences were newly generated for the new species and deposited into GenBank. The ITS dataset with 40 sequences resulted in an alignment of 1295 characters with 497 variable characters, of which 326 were parsimony informative. The evolutionary models selected were GTR+I+G for ITS1, K80 for 5.8S and TrN+G for ITS2.

TABLE 1. List of taxa, vouchers and accession numbers used in the phylogenetic analyses.

| Species | Voucher | Origin | GenBank® accession number |
|----------------------------------|---------------|----------------|---------------------------|
| <i>Inonotus obliquus</i> * | H51 | China | MK873442 |
| <i>Neoantrodiaella gypsea</i> | Yuan 5589 | Unknown | KT203292 |
| <i>Ne. thujae</i> | Dai 5065 | Unknown | KT203293 |
| <i>Nigrofomes melanoporus</i> | JV 1607/82 | Costa Rica | MF381027 |
| <i>N. melanoporus</i> | JV 1704/39 | Costa Rica | MF381028 |
| <i>N. sinomelanoporus</i> | Dai 16286 | China | MF629839 |
| <i>N. sinomelanoporus</i> | BJFC 020373 | China | NR158856 |
| <i>Trichaptum abietinum</i> | Dollinger-640 | USA | MF381022 |
| <i>T. abietinum</i> | JV 0907/9 | Czech Republic | MF381023 |
| <i>T. abietinum</i> | JV 1105/7-J | USA | MF381024 |
| <i>T. agricola</i> | JV 1407/97 | Costa Rica | MF380993 |
| <i>T. agricola</i> | PRM:945505 | Costa Rica | MF380995 |
| <i>T. byssogenum</i> | JV 0904/94 | USA | MF381012 |
| <i>T. byssogenum</i> | JV 1112/5-J | Puerto Rico | MF381013 |
| <i>T. byssogenum</i> | JV 1704/82 | Costa Rica | MF381014 |
| <i>T. byssogenum</i> | JV 0411/9 | Thailand | MF381015 |
| <i>T. confertum</i> | JV/ 1504/32 | Costa Rica | MF380990 |
| <i>T. confertum</i> | JV 1504/101 | Costa Rica | MF380992 |
| <i>T. confertum</i> | PRM:945506 | Costa Rica | MF380999 |
| <i>T. fissile</i> (H) | MTK09 | Brazil | MK973089 |
| <i>T. fissile</i> | MTK13 | Brazil | MK973088 |
| <i>T. fumosoavellaneum</i> | JV 1607/79-J | Costa Rica | MF381021 |
| <i>T. fuscoviolaceum</i> | JV 1610/3 | Czech Republic | MF381026 |
| <i>T. griseofuscum</i> | JV 0904/66-J | USA | MF381009 |
| <i>T. perrottetii</i> | JV 1012/2-J | USA | MF381011 |
| <i>T. resacarium</i> | JV 1109/57 | USA | MF381017 |
| <i>T. resacarium</i> | JV 1109/56 | USA | MF381019 |
| <i>T. sector</i> | RP 63 | Brazil | KP859296 |
| <i>T. sector</i> | RP 67 | Brazil | KP859297 |
| <i>T. sector</i> | JV 1006/14-J | Costa Rica | MF380997 |
| <i>T. sector</i> | Dollinger-897 | USA | MF380998 |
| <i>T. sector</i> | Dollinger-767 | USA | MF380999 |
| <i>T. sector</i> | JV 1408/8 | Costa Rica | MF381000 |
| <i>T. sector</i> | JV 1504/61 | Costa Rica | MF381002 |
| <i>T. sector</i> | JV 1704/50 | Costa Rica | MF381004 |
| <i>T. sector</i> | JV 1704/84 | Costa Rica | MF381005 |
| <i>T. sector</i> | JV 1704/100 | Costa Rica | MF381007 |
| <i>Trichaptum</i> sp. | JV 1109/56 | Costa Rica | MF380996 |
| <i>T. subchartaceum</i> | JV0509/146 | USA | MF381010 |
| <i>Tropicoporus drechsleri</i> * | CTES_570140 | Argentina | NR160489 |

* = outgroup; (H) = holotype.

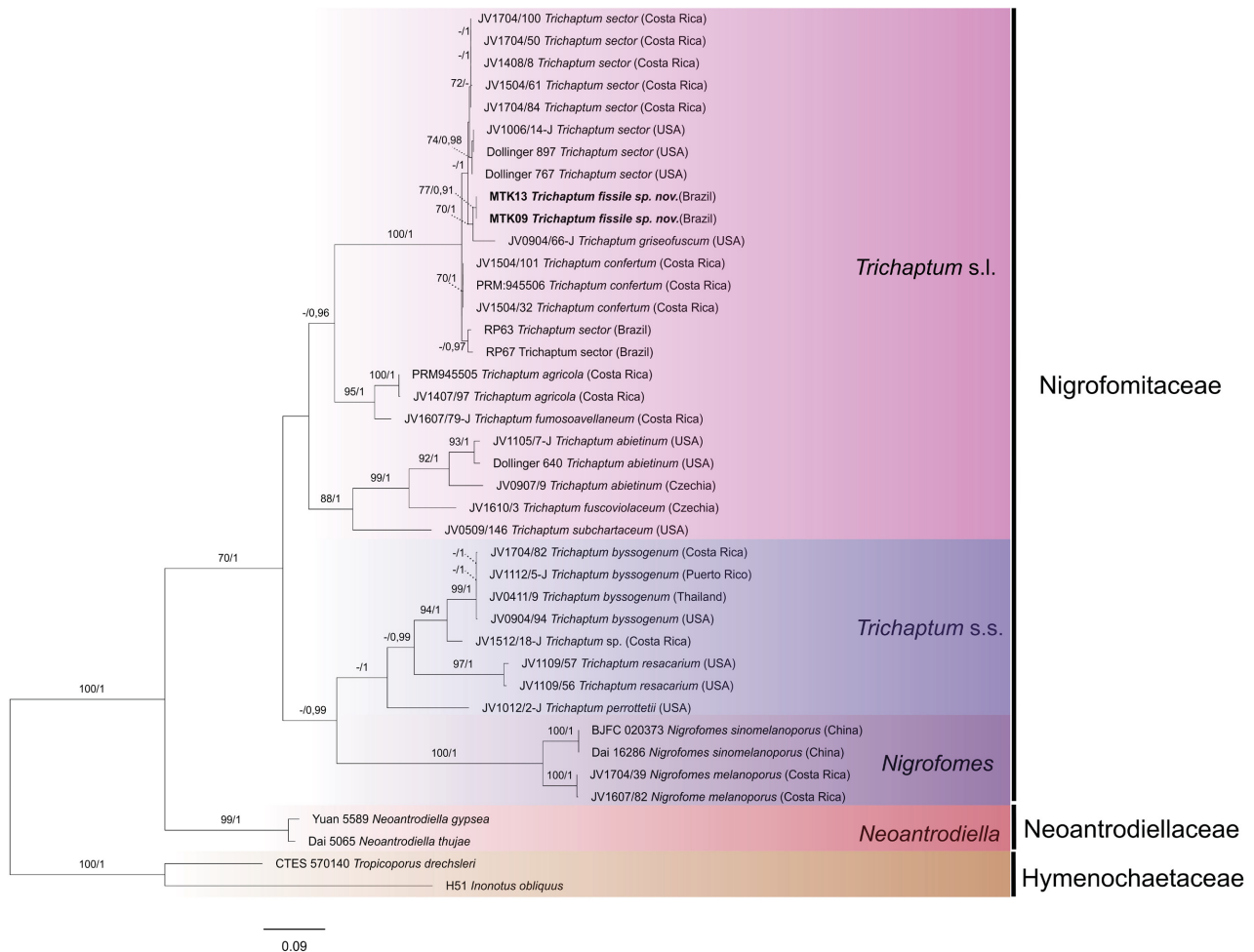


FIGURE 1. Best-scored tree from the ML analyses, showing the phylogenetic relationships of *Trichaptum* species inferred from ITS sequences. Values higher than 70% and 0.95 for Bootstrap and Posterior probability, respectively, are shown above the branches (BS/PP).

The topologies of both ML and BI analyses were identical, and the best-scored ML tree is presented with statistical values from both analyses (Fig. 1). The phylogeny shows the species usually classified in *Trichaptum* belonging to at least two distinct clades. One of them (1.0 PP) with the type species [*T. perrottetii* (Lév.) Ryvarden (1972: 237)], *T. byssogenum* (Jungh.) Ryvarden (1972: 237), *T. resacarium* Vlasák & Vlasák Jr (2017: 1221) and one unidentified specimen, considered by us as *Trichaptum s.s.* This clade was recovered as sister (0.99 PP) of *Nigrofomes*. The other clade (*Trichaptum s.l.*) is not supported and contains 10 phylogenetic species, among them, the new species, which is closely related to *T. griseofuscum* (Mont.) Ryvarden & Iturr. (2003: 1074) and *T. sector* (Ehnb.) Kreisell (1971: 84) (1.0 PP).

Taxonomy

Trichaptum fissile Kossmann & Drechsler-Santos *sp. nov.* (Fig. 2)

Mycobank: MB 834858.

Diagnosis:—Basidiomata resupinate to effused-reflexed, annual to biannual, resupinate up to 30cm in length, (3–)4–8(–9) pores/mm, hymenophore cracking, two kinds of cystidia and spores cylindrical measuring (6–)6.4–10(–11) × (2–)2.3–3.2(3.5) μm.

Etymology:—*fissile* (Lat.): meaning something that cracks or can be cracked, relating to the cracking portions of the hymenophore.

Type:—BRAZIL. Santa Catarina: Florianópolis, Santa Catarina Island, on living trunk of *Schinus terebinthifolius*, 27°34'56.5" S, 48°30'19.9" W, 8 march 2018, Kossmann, T. 99, Holotype (FLOR67488). GenBank accession number MK973089.

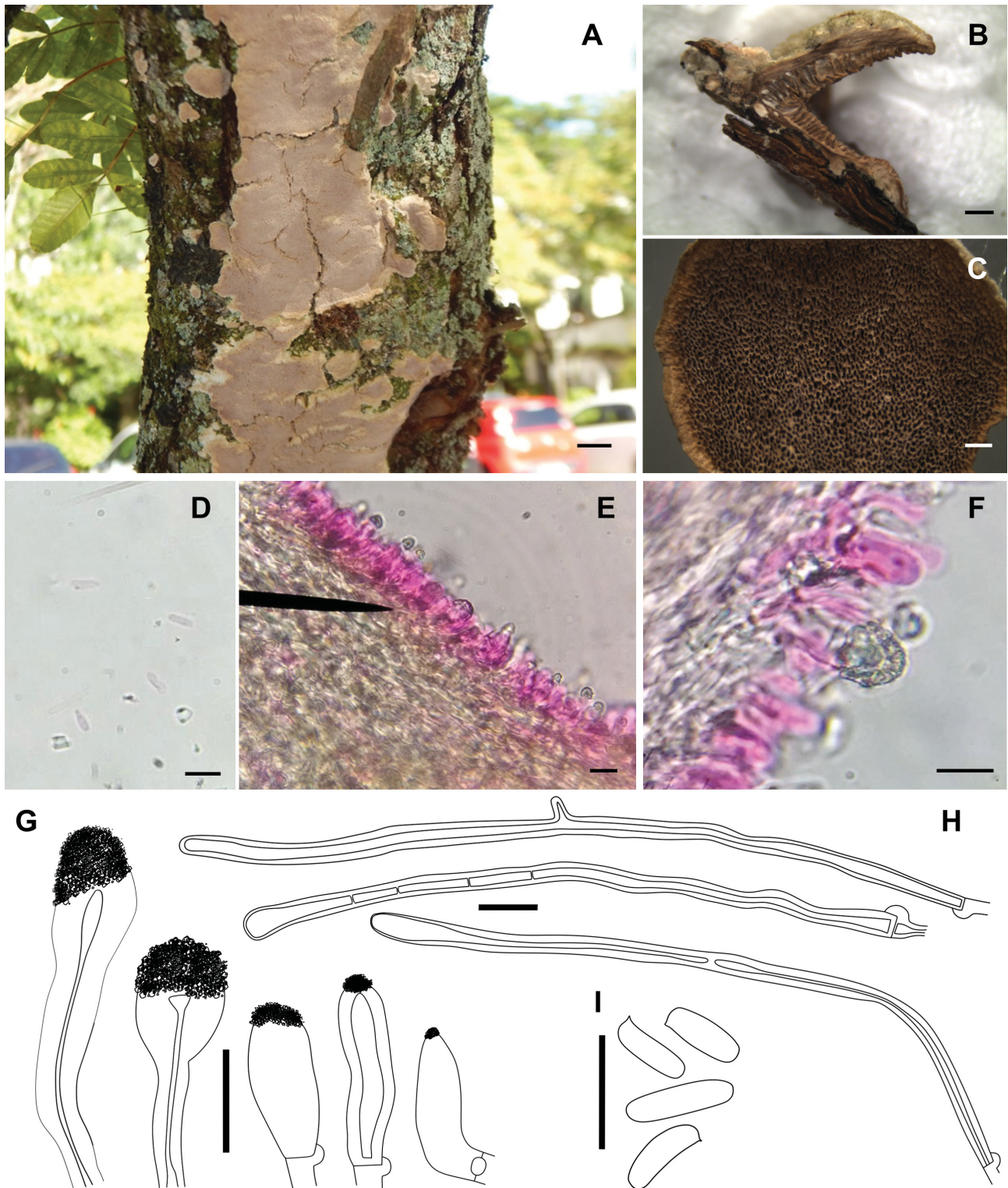


FIGURE 2. *Trichaptum fissile*. A. Basidioma *in situ* growing on *Schinus terebinthifolius* (FLOR67488 – Holotype); B. Cross-section of a basidioma (FLOR67490 – Paratype). C. Hymenophore. D. Thin-walled basidiospores. E. Hymenium. F. Detail of hymenium showing cystidia. G. Cystidia. H. Skeletal hyphae. I. Basidiospore. Bars: A = 10mm; B, C = 1mm; D, E, F, G, H, I = 10 μ m. Photos by T. Kossmann.

Description:—Basidiomata seasonal to biannual, resupinate to effused-reflexed, up to 300 mm long, 100 mm wide and 6 mm thick, generally thinner (2 mm), unusually pileate, up to 16 mm long, 26 mm wide and 4.5 mm thick. Pilear surface velutinate, whitish (2) to cream (4), concentrically zonate, zonations glabrous and violaceous black (38) with age. Pore surface vinaceous buff (31) to cigar brown (16), hymenophore cracking exposing the context, (3–)4–8(–9) pores per mm, pores (81–)98.3–343.4(–353) μ m wide; dissepiments thin, entire, (30–)40–89(–97) μ m thick, pores

lacerated on vertical substrata. Sterile margin (0.1–)0.1–2.0(–3.5) mm wide, cottony, fibrose, thinning out, whitish (2) to cream (4), buff (52) to clay buff (32) in pileate parts, up to 0.5 mm wide. Context fibrous, cream (4) to sepia (26), tomentum cottony, lighter, up to 0.75 mm thick.

Hyphal system dimittic; generative hyphae hyaline, thin to moderately thick-walled, 2.0–3.5 μm wide, sparsely branched, with clamps; skeletal hyphae dominating, straight or slightly tortuous, sometimes shortly branched, 4–7 μm wide, inflated parts up to 9 μm , moderately thick-walled to almost solid, with rounded apices, some with secondary simple septa. *Hymenium*: *cystidia* hyaline, of two types; *cystidia* thin to moderately thick-walled, clavate to fusoid, 15–20 \times 5–6 μm projecting up to 12 μm , mammillate or rounded, with an apical crown of crystals; skeletocystidia thick-walled to almost solid, bulbous capitate to clavate, 7–12 μm wide, apex rounded to obtuse with a large mass of crystals, not projecting, often with a triangular lumen in the capitate portion. *Basidia* clavate, difficulty to observe, not measured. *Basidiospores* cylindrical, (6–)6.4–10(–11) \times (2–)2.3–3.2(–3.5) μm , \bar{x} = 7.7 \times 2.7 [Q = 2.2–3.4(–3.8), Q = 2.8], hyaline, smooth, thin-walled, IKI–.

Habitat and distribution:—Known only from Santa Catarina Island, Florianópolis, Santa Catarina State, southern Brazil, in Mangrove Forests and their vicinities, found on branches and trunks of living and dead *Laguncularia racemosa* (L.) C.F. Gaertn (1807: 209), *Avicennia schaueriana* Stapf & Leechm. ex Moldenke (1939: 336) and *Schinus terebinthifolius* Raddi (1820: 399).

Conservation:—Vulnerable (VU) A3c (Dahlberg & Mueller 2011). The species is estimated to undergo a population decline of 30–40% in the next 30 years, due to impacts of climate change on mangroves and deforestation. Full assessment is available at The Global Fungal Red List Initiative platform (<http://iucn.ekoo.se/en/iucn/welcome>).

Specimens examined (paratypes):—BRAZIL. Santa Catarina: Florianópolis, UCAD, on dead wood, 16 December 1997, Cruz, Fernandes & Gonçalves 1159 (FLOR11845); *ibidem*, April 2017, Bittencourt, F. 905 (FLOR63678); *ibidem*, Parque Municipal do Manguezal do Itacorubi, on dead *Avicennia schaueriana*, 01 June 2005, Trieveiler-Pereira 13 (FLOR32072, as *T. biforme*); *ibidem*, on dead wood, *idem*, Trieveiler-Pereira 17 (FLOR32071, as *T. byssogenum*); *ibidem*, on dead *Avicennia schaueriana*, 26 October 2005, Trieveiler-Pereira & Marcon-Baltazar 68 (FLOR32076, as *T. biforme*); *ibidem*, Parque Municipal do Manguezal do Itacorubi, on living and dead branches of *Schinus terebinthifolius*, 27°34'40.2"S 48°31'15.2"W, 31 August 2018, Kossmann, T. 145 (FLOR67489); *ibidem*, *idem*, Kossmann, T. 147 (FLOR67490); *ibidem*, Manguezal do Ratonos, on dead *Avicennia schaueriana*, 31 October 2005, Marcon-Baltazar & Triervelier-Pereira 25 (FLOR32174, as *T. byssogenum*); *ibidem*, on dead wood, 29 November 2005, Marcon-Baltazar & Triervelier-Pereira 51 (FLOR32176, as *T. byssogenum*); *ibidem*, on dead *Laguncularia racemosa*, *idem*, Marcon-Baltazar & Triervelier-Pereira 54 (FLOR32177, as *T. byssogenum*); *ibidem*, Manguezal do Saco Grande, on *Laguncularia racemosa*, 28 May 2006, Marcon-Baltazar & Triervelier-Pereira 200 (FLOR32181, as *T. byssogenum*); *ibidem*, Manguezal do Rio Tavares, on dead *Avicennia schaueriana*, 31 March 2006, Trieveiler-Pereira & Marcon-Baltazar 203 (FLOR32086, as *T. biforme*); *ibidem*, on dead *Laguncularia racemosa*, 31 June 2006, Trieveiler-Pereira 242 (FLOR32094, as *T. biforme*); *ibidem*, on dead *Avicennia schaueriana*, 5 August 2006, Triervelier-Pereira, Maccarini & Assis 317 (FLOR32103, as *T. biforme*).

Additional specimens examined:—*Nigrofomes melanoporus*. BRAZIL. Santa Catarina: Itapoá, Reserva Particular do Patrimônio Natural Volta Velha, 29 February 2012, Drechsler-Santos, E.R. 796; Bahia: Uruçuca, Parque Estadual do Condurú, 29 November 2012, Drechsler-Santos, E.R. 891. *Trichaptum griseofuscum*. BRAZIL. Bahia: Utinga, 1971, H.S. Irwin s.n. (ALCB30436, as *Irpex* sp.). *Trichaptum perrottetii*. BRAZIL. Mato Grosso: Nova Ubiratã, Estação Ecológica do Rio Ronuro, 22 February 2017, Drechsler-Santos, E.R. 1890; *ibidem*, 23 February 2017, Drechsler-Santos, E.R. 1934. *Trichaptum sector*. BRAZIL. Santa Catarina: Blumenau, Parque Natural Municipal São Francisco de Assis, 13 May 2015, Bittencourt, F.429 (FURB 47438); *ibidem*, *idem*, Bittencourt, F. 430 (FURB 47439); Itapoá, Reserva Particular do Patrimônio Natural Volta Velha, 7 March 2013, Drechsler-Santos E.R. 1009; Florianópolis, Ilha de Santa Catarina, Trilha da Lagoinha do Leste, 9 October 2010, Neves, M.A & Smith, N.P 627 (FLOR 49828); São Francisco de Assis, Parque Estadual do Acaraí, 7 August 2014, Drechsler-Santos, E.R. 1383.

Discussion

The new species is quite remarkable, with its large, mostly resupinate basidiomata and fairly large spores (up to 11 μm). In the genus, only *T. subchartaceum* (Murril) Ryvarden (1972: 237) has comparable spores (up to 11 μm). On the other hand, *T. subchartaceum* differs by having thick, pileate basidiomata and larger pores (3–4/mm) (Gilbertson & Ryvarden 1987). Furthermore, the presence of two types of *cystidia* has only been observed in *T. bulbocystidium*

Ryvarden (2014: 64), which is only known for its type locality, in Costa Rica, and has larger pores (Ryvarden 2014).

Trichaptum fissile is closely related to *T. griseofuscum* and *T. sector*, the latter described from the same locality, Santa Catarina Island, in 1820, as *Boletus sector* Ehrenberg (in Esenbeck 1820: 86). Nonetheless, *T. sector* presents thin, mostly dimidiate (rarely effused) basidiomata, and smaller spores ($6\text{--}7 \times 2\text{--}2.5 \mu\text{m}$) (Ryvarden 2016). Its phylogenetic closest related species, *T. griseofuscum*, also has resupinate basidiomata but is easily distinguishable by having darker brownish colors and a hymenophore composed mainly by flattened teeth, and is only known to occur in Northeastern parts of South America. Microscopically, it presents smaller spores and darker skeletal hyphae (Gibertoni *et al.* 2011). In our analysis, the same type of skeletocystidia of *T. fissile* and *T. bulbocystidium* was found in *T. griseofuscum*, which was not previously described for the species (Ryvarden & Iturriaga 2003, Gibertoni *et al.* 2011) although being shown in an illustration by Gibertoni *et al.* (2011). A comparison among morphologically similar species is given in Table 2.

Recently, some studies (Vlasak & Vlasak Jr. 2017, Zhou *et al.* 2018) have shown that *Trichaptum* is nested within Hymenochaetales, which is corroborated by the presence of imperforated parentosome, as previously observed (Traquair & McKeen 1978, Alexander *et al.* 1989). It is closely related to *Nigrofomes*, but the family status is so far uncertain, regarded as *Incertae sedis* in taxonomic databases (indexfungorum.org, mycobank.org). In a recent study, it was shown that the type species, *T. perrottetii*, and other *Trichaptum* species form a sister clade to *Nigrofomes*. Nonetheless, many other *Trichaptum* species grouped as a sister clade (Vlasak & Vlasak Jr. 2017). This was also observed in our analysis (Fig. 1), indicating that the genus as currently circumscribed is polyphyletic. Both *Trichaptum* and *Nigrofomes* share similar cystidia, as well as vinaceous colored basidiomata (Vlasák & Vlasák Jr. 2017). In this case, we believe that shared characters and the phylogenetic proximity are good indicators that *Trichaptum* should be treated as a member of Nigrofomitaceae.

Regarding the delimitation of the genus, in our analysis (Fig. 1) the ITS region indicates that *Trichaptum*, as traditionally recognized, is an unnatural group, represented by at least two different clades (*Trichaptum s.s.* and *s.l.*). Further studies, including broader sampling and more phylogenetic markers, could better circumscribe *Trichaptum s.s.* with the species in the vicinity of *T. perrottetii* (so far *T. byssogenum* and *T. resacarium*). In the same way, the remaining clade (including the new species) could represent the genus *Hirschioporus* Donk (1933: 168) since its type species, *H. abietinus* (Pers. ex J.F. Gmel.) Donk (1933: 168) is grouped within the clade. Currently, *Hirschioporus* is considered a synonym of *Trichaptum*, but previously, the genus accommodated many temperate-boreal and one cosmopolitan species, with small basidiomata and adpressed tomentum. Conversely, *Trichaptum* would accommodate species with larger basidiomata, and hirsute pilear surface, such as *T. perrottetii* (Ryvarden & Johansen, 1980). This differentiating morphological pattern is not reflected in our phylogenetic analysis since both tropical and temperate species were recovered in the same clade (*Trichaptum s.l.*), and there is no clear morphological distinction between the two clades. Thus, further studies are still needed to clarify the taxonomic status of *Trichaptum s.l.*

The Mangrove Forests are a very endangered ecosystem, having lost over one third of its original cover, reaching up to 80% deforestation in some areas in the last decades, mainly due to degradation by human occupation (Valiela *et al.* 2001, Alongi 2002, Macintosh & Ashton 2002, Polidoro *et al.* 2010, Ferreira & Lacerda 2016). The Mangroves from Santa Catarina Island, where *T. fissile* is found, are not different. Anthropogenic influence affects most localities in the island, mostly by sewage pollution and human occupation (Mater *et al.* 2004), even in protected areas. While the main mangrove tree species from Brazil [*Avicennia schaueriana*, *Laguncularia racemosa* and *Rhizophora mangle* L. (1753: 443)] are classified as Least Concern on IUCN Red List (Polidoro *et al.* 2010), having a threatened fungal species can help to raise concern about the protection of this important ecosystem and fungi.

Up to now, 423 fungal species are listed on the IUCN Red List, against over 50,000 plants and 78,000 animals. This means that roughly 0.3% of fungi, 5% of animal and 12% of plant known species have been listed (IUCN 2020). This contrast shows that, regarding fungal conservation, there is still much work to be done. Nevertheless, this number has largely increased in the last decade, mainly due to Dahlberg & Mueller (2011) which established the methods to apply the IUCN criteria for fungi, and the efforts of The Global Fungal Red List Initiative. Besides, no fungal species from Mangrove Forests of Brazil are listed so far on the IUCN Red List, with *T. fissile* being potentially the first to be included.

TABLE 2. Comparative table between closely related and morphologically similar species to *T. fissile*.

| Species | Basidiomata shape | Pores/mm | Basidiospore size | Pore surface | Distribution | Reference |
|--|------------------------------------|-----------------------|--|----------------------------------|----------------------------|--|
| <i>Trichaptum fissile</i> sp. nov. | Mostly resupinate | (3–)4–8(–9) | (6–)6.4–9.7(–10) × (2–)2.3–3.2 (–3.5) | Buff to Pinkish Brown | Southern Brazil | This work |
| <i>T. bulboecystidiatum</i> | Resupinate | 2–3(4) | Not seen | Grey | Costa Rica | Ryvarden (2014) |
| <i>T. byssogenum</i> | Resupinate to efused to pileate | 1–2 | 5.5–8 × 2–2.5 | Purple to Purplish Brown | Pantropical | Ryvarden (2016) |
| <i>T. confertum</i> Vlasák & Vlasák Jr. (2017: 1220) | Mostly effused-reflexed to pileate | 6–8 | 4–4.5 × 1.8–2.2 | Dark Purplish to Greyish Brown | Costa Rica | Vlasák & Vlasák Jr. (2017) |
| <i>T. deviatum</i> Ryvarden (2014: 65) | Resupinate | 5–7 | 4.5–6 × 1.7–2 | Grey with Brown tinges | Venezuela | Ryvarden (2014) |
| <i>T. griseofuscum</i> | Resupinate to efused | Hydnoid, 1–3 teeth/mm | 6–7 × 1.5–2 | Pale Brown to Clay Brown | Northeastern South America | Ryvarden & Iturr. (2003), Gibertoni <i>et al.</i> (2011) |
| <i>T. sector</i> | Pileate, rarely efused | 3–6 | 6–7 × 2–2.5 | Grey, Dark Brown to almost Black | Neotropical | Ryvarden (2016) |
| <i>T. variabilis</i> Ryvarden & Iturr. (2003: 1074) | Resupinate to efused to pileate | 1–2 | 4.5–6 × 2.2–2.5 | Brown | Venezuela | Ryvarden & Iturr. (2003) |

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