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Circumscribing *Propolis farinosa* (Fungi, Ascomycota) II: Typification of *Tremella saligna*, a synonym, based on a study of original material of Albertini & Schweinitz

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Introduction

This contribution is the second in a planned series of three publications dealing with names in *Stictis* subg. *Propolis* Fr. (Fries 1822: 198–199; 1828: 26–27) that have long been treated as synonyms of *Propolis farinosa* (Pers.) Fr. (Fries l.c., Minter 2003) though without recent, critical examination of type or original materials. *Propolis farinosa* is the type of *Propolis* (Fr.) Corda (Leotiomycetes, Marthamycetales). A brief description of *P. farinosa* with an illustration is given in the first contribution (Karakehian & Miller 2024). A definitive circumscription of *P. farinosa* is needed to elucidate the distribution, biology, and ecology of this fungus, as well as its evolutionary relationships with other species in the genus.

One name that has been considered a synonym of *Propolis farinosa* is *Stictis saligna* (Alb. & Schwein.) Pers. (Fries 1822: 198, Minter 2003). The basionym of *S. saligna* is *Tremella saligna* Alb. & Schwein., published in Johann Baptist von Albertini and Lewis David von Schweinitz's *Conspectus fungorum in Lusatiae superioris* (Albertini & Schweinitz 1805, Hewitt *et al*. 2016). The name *T. saligna* has not been typified.

In this contribution, we outline our search for original material of *Tremella saligna* and provide a description of a specimen that we designate here as lectotype. Using our search for original material as a

Abstract

To circumscribe *Propolis farinosa* (Pers.) Fr., type of the taxonomically understudied genus *Propolis* (Fr.) Corda, we investigated the nomenclature and taxonomy of the synonym *Stictis saligna* (Alb. & Schwein.) Pers. The basionym of *S. saligna* is *Tremella saligna* Alb. & Schwein., described in Albertini and Schweinitz's *Conspectus fungorum in Lusatiae superioris*. *Tremella saligna* has not been typified. We located original material of *T. saligna* in the form of published and unpublished illustrations and a specimen that is part of a set of specimens connected to the *Conspectus fungorum* in the National Herbarium of Victoria (MEL), Australia. Here, we lectotypify *T. saligna* and describe the type specimen. We conclude that *T. saligna* is appropriately placed as a synonym of *P. farinosa*.

***Keywords*:** fungal nomenclature, fungarium, Johann Baptist von Albertini, lectotypification, Leotiomycetes, Lewis David von Schweinitz, mycological illustration, typification.

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case study, we discuss the need to critically examine all original material and the importance of typifying using specimens versus illustrations when possible.

Methods

Literature research

We compared Persoon's handwriting on specimen labels in the Persoon fungarium in L to handwriting samples by Persoon in Burdet (1979). We compared Albertini's handwriting of the fungus name on the packet of specimen MEL 2332215 to a sample of his handwriting in Albertini (1801–1803).

We examined the published illustrations of *Tremella saligna* in four different copies of Albertini & Schweinitz (1805: Tab. IX, Fig. 7a-c) in the following collections: New York Botanical Garden, LuEsther T. Mertz Library (accessed through https://www.biodiversitylibrary.org); Farlow Reference Library, Harvard University (in-person); University of Illinois Urbana-Champaign Rare Books and Manuscripts (image); reproduction of Albertini & Schweinitz (1805) issued by Associazione Micologica Bresadola, Centro Studi Micologici. Vicenza, Italy, 1992 (location of the copy reproduced not specified).

We also examined an unsigned, undated manuscript that we attribute to Schweinitz based on the handwriting ([Schweinitz] n.d.). This is Schweinitz's list of new taxa described in Albertini & Schweinitz (1805), reviewed by Albertini. It provides notes on plant associates, localities, and specific dates of collections in addition to those published in Albertini & Schweinitz (1805).

Fungarium research

We conducted in-person and online searches (https://mycoportal.org, https://www.gbif.org/) for specimens labelled *Tremella saligna* or *Stictis saligna*. We paid special attention to fungaria where Schweinitz specimens are preserved: the Persoon fungarium at the Naturalis Biodiversity Center in Leiden, the Netherlands (L); the Schweinitz fungarium at the Academy of Natural Sciences of Drexel University in Philadelphia, Pennsylvania, USA (PH); the Curtis fungarium at the Farlow Herbarium of Harvard University in Cambridge, Massachusetts, USA (FH); the Ezra Michener fungus specimens held at the U.S. National Fungus Collections, USDA-ARS in Beltsville, Maryland, USA (BPI); and the National Herbarium of Victoria at the Royal Botanic Gardens Victoria, Australia (MEL).

Additional specimens examined

Propolis angulosa. FINLAND: Ostrobothnia, Jakobstad; in dry branches of *Salix* sp.; 4 Nov1862; *Karsten* (UPS F-632612, original material). GERMANY: as *Stictis saligna*, on bark and wood, probably of *Salix* sp. (L 0118547 [Persoon Herbarium, Herb. Lugd. Bat. No. 910.263-970]).

Morphology

Photomacrographs of UPS F-632612 and L 0118547 were made with a Canon EOS 6D digital SLR camera equipped with a Canon MP-E 65 mm lens with a ring light. The photomacrograph of MEL 2332215 was made using an Olympus DP74 camera attached to an SZX16 stereomicroscope and processed with the cellSens Standard 1.16 software.

Photomicrographs of UPS F-632612 and L 0118547 were made using transmitted light microscopy with an Olympus BX51 compound light microscope with 40×, 100×/1.30 oil immersion plan-achromatic objectives together with an Olympus XC50 5.0-megapixel digital camera and Olympus cellSens Standard 1.14 image processing software. Preparations of these specimens were mounted in 10% KOH followed by a tap water rinse and the addition of aqueous phloxine. Preparations of MEL 2332215 were mounted in 10% KOH and photographed with an Olympus DP73 camera attached to a BX51 microscope and processed with the cellSens Standard 1.16 software.

Images were processed in Adobe Photoshop version 25.2. Figures were created in Adobe Illustrator version 28.1. To save space in a figure or improve readability, we manipulated certain images using Photoshop. To save space, the image in Figure 1b is a photomontage. For improved readability, the illustrations surrounding that of *Tremella saligna* were erased in Fig. 2a.

Measurements in the description of MEL 2332215 in the results section are given as minimum/maximum ranges with the number of measurements given as "n=".

Results

Disposition of *Tremella saligna* as a synonym of *Propolis farinosa*

Propolis farinosa (Pers.) Fr. *Summa veg. Scand*., Sectio Post.: 372 (1849) [for typification and other information see Karakehian & Miller (2024)].

Synonym: *Tremella saligna* Alb. & Schwein., *Consp. fung. lusat*.: 303 (1805).

≡ *Stictis saligna* (Alb. & Schwein.) *Pers. Mycol. eur*. 1: 337 (1822).

Typification: Lectotype designated here: "*Tremella saligna* Mis. Albert.," MEL 2332215! (MB 10020458).

Description of lectotype specimen MEL 2332215. *Apothecia* 0.5–1.7 × 0.3–0.6 mm (n=9); erumpent through the end-grain of wood substratum; inner surface of marginal flaps black; disc with farinaceous layer (pseudoepithecium) white–cream, without this layer semi-opaque, reddish; *paraphyses* 1–2 µm diam, filamentous, apices somewhat contorted, occasionally branching or with short projections, tips immersed in a pseudoepithecium; *asci* 131–175 × 14–17 µm (n=7), cylindric-clavate, with undifferentiated, dome-shaped, inamyloid apices, ascospores biseriate at the apex, becoming uniseriate toward the foot; *ascospores* 22.4–26.6 × 6–7.9 µm (n=16), cylindrical, straight or slightly curved, thin-walled, smooth, hyaline, poles obtuse, with two large guttules that flank the midpoint 4.5–6.6 µm diam. (n=24) (Fig. 1a–c).

Nomenclatural history. We note that the treatment by Persoon (1822) of *Stictis saligna* is adapted from Albertini & Schweinitz's protologue. Fries (1822: 198) synonymised *Stictis saligna* and *Hysterium fagineum* Schrad. under one of his four unnamed, unranked infraspecies of *Stictis* (*Propolis*) *versicolor*: "a. disco lacteo, […]". Therefore, the names *S. saligna* and *H. fagineum* are not sanctioned. We found no previous typifications of *Tremella saligna* by searching under this name and *S. saligna* in fungal name databases (http://indexfungorum.org, https://mycobank.org), Sherwood (1977: 241–242), and general internet queries.

The search for original material of **Tremella saligna**. We studied the protologue of *T. saligna* (Albertini & Schweinitz 1805: XV, XXII, 303-304, Tab. IX, Fig. 7a–c) to locate original material with which to lectotypify this name. The protologue included an illustration that is original material (Art. 9.4b in Turland *et al*. (2018), hereafter, *ICN*). This is a hand-coloured etching made by Schweinitz (Hewitt *et al*. 2016, Karakehian *et al*.

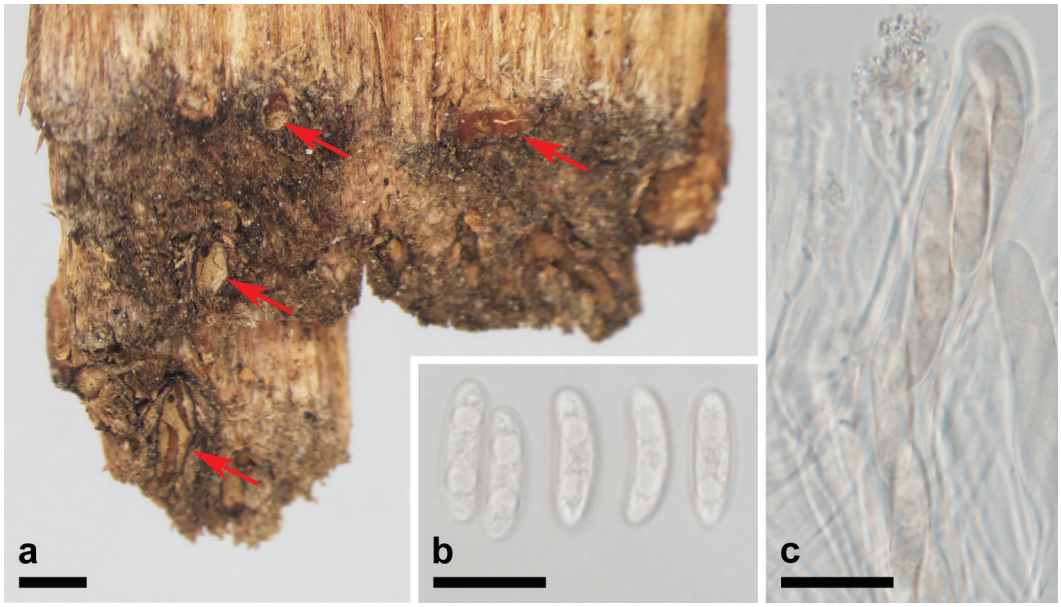

Figure 1. Morphology of MEL 2332215, lectotype of *Tremella saligna*. **a** Face-view of end grain of wood showing dried apothecia (marked by red arrows); the apothecia on the left have tan-coloured, farinaceous discs (pseudoepithecium), while this is lost in the apothecium on the right. **b** Ascospores, mounted in 10% KOH. **c** Immature ascus (far right) and mature ascus (center), with filamentous paraphyses; note the remains of the crystalline material that comprises the pseudoepithecium at the tips of the paraphyses to the left of the mature ascus; mounted in 10% KOH. **Scale bars**: **a** 1 mm; **b**, **c** 20 µm.

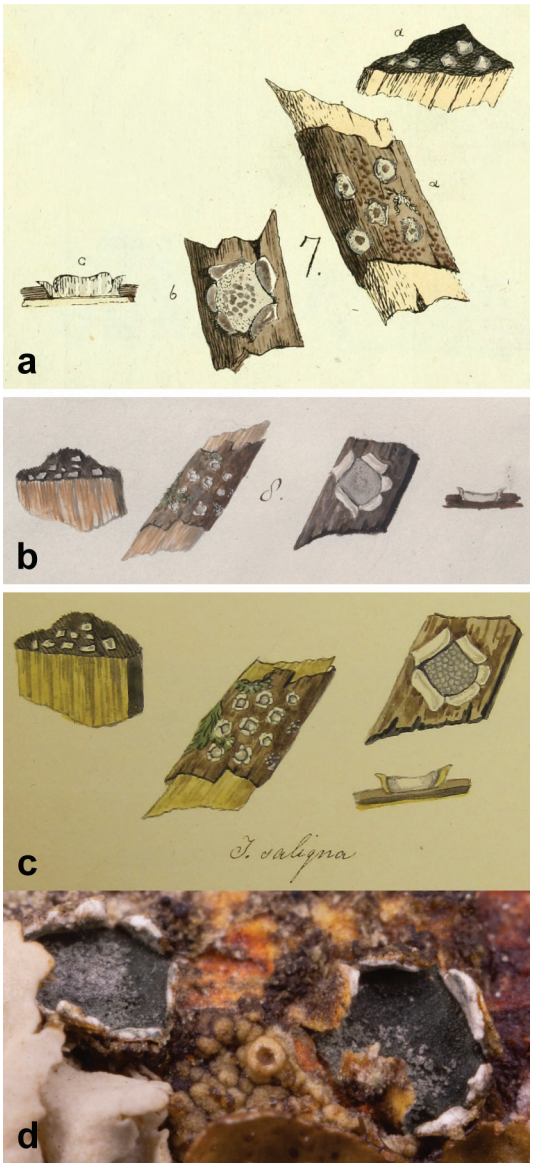

Figure 2. Illustrations of *Tremella saligna* by Schweinitz, and apothecia of *Propolis angulosa* from original material.
a hand-coloured etching published in Albertini & Schweinitz (1805: Tab. IX, Fig. 7a–c [caption: XXII]).
b unpublished watercolour painting in (Schweinitz 1803: pl. 235 fig. 8).
c unpublished, hand-painted copy of the illustration shown in b (Schweinitz ca. 1818–1826: pl. 212).
d hydrated apothecia of *Propolis angulosa* (original material, UPS F-632612), showing erumpent habit (through bark), dark-grey farinaceous discs (pseudoepithecium) dusted with a thin white layer, and stark-white inner surfaces of the marginal flaps.

2018), which comprises four elements that depict the macromorphology of *T. saligna* (Fig. 2a).

The hand-coloured etching published in Albertini & Schweinitz (1805) corresponds to an unpublished watercolour painting by Schweinitz (1803: pl. 235 fig. 8) (Fig. 2b) that is also original material. An unpublished, hand-painted copy of this was made by Schweinitz after publication of Albertini & Schweinitz (1805) and is not original material (Schweinitz ca. 1818–1826: pl. 212) (Fig. 2c). The watercolour painting was created in conjunction with the development of Albertini & Schweinitz (1805): Schweinitz assiduously painted the specimens that he and Albertini collected. This was especially important to document ephemeral characters of fresh, fleshy fungi such as shape, coloration, and size, all of which would begin to change soon after the specimen was collected, and dramatically so after being dried for storage in their fungarium (Albertini & Schweinitz 1805: XI–XII, Hewitt *et al*. 2016: 57). However, Schweinitz also illustrated fungi that were tough, hard, carbonised, or that generally changed little upon drying, like *T. saligna*. Ultimately, Schweinitz bound these illustrations into a set of five volumes. These contain illustrations for nearly every species in Albertini & Schweinitz (1805). This is notable because not all the new species in Albertini & Schweinitz (1805) are illustrated, but nearly all of them have an illustration in the unpublished, five-volume set. Several of their new species, such as *T. saligna*, are illustrated in both (Karakehian *et al*. 2018). Schweinitz's volumes of unpublished watercolour paintings are original material because Albertini and Schweinitz (1805) explicitly state in the introduction that they [Schweinitz] referred to these volumes as the etchings for publication were prepared (Art. 9.4a of *ICN*) (Albertini & Schweinitz 1805: XI–XII, Hewitt *et al*. 2016: 57). The volumes are now housed in the archives of various institutions and are available online through Biodiversity Heritage Library (https://www.biodiversitylibrary.org) (Hewitt *et al*. 2016, Karakehian *et al*. 2018). A list of the volumes and their contents, as well as links to each volume are published in Karakehian *et al*. (2018). A forthcoming publication will provide an index to taxa in Albertini & Schweinitz (1805) that is cross-referenced to Schweinitz's published and unpublished illustrations. A partial index to 78 names of fungi introduced by Albertini & Schweinitz (1805) is given in Karakehian *et al*. (2024, Table 1).

A comparison of the published and unpublished illustrations of *T. saligna* (Fig. 2a, b) demonstrates that the published illustration was clearly based on the unpublished painting, but it is not an exact copy. The overall elements of the two illustrations are highly similar, particularly the inclusion of four pieces of substrate, the shape and aspect of which can be matched between the two illustrations, except that the order is reversed due to the printing process. However, there are slight differences between the two illustrations in the number and distribution of apothecia on the two elements depicting bark on a branch and the end-grain of a piece of wood (elements "a" in Fig. 2a). Furthermore, there is a subtle yet important difference that could have taxonomic implications. In the published illustration (Fig. 2a, apothecium "b"), in each of the four different copies of Albertini & Schweinitz (1805) that we examined, the discs are white with some grey colouration in the centre, and with dark-grey inner surfaces of the flaps. This agrees with *Propolis farinosa* (cf Karakehian & Miller 2024: Fig. 1b). In the unpublished illustration (Fig. 2b, apothecium to the right of the number 8) the disc is medium grey with white inner surfaces of the flaps, which is more consistent with *P. angulosa* P. Karst. (cf Fig. 2d, from UPS F-632612, original material of *P. angulosa*). Therefore, to reduce ambiguity in the definition of *T. saligna* and to maintain its previously accepted disposition as a synonym of *P. farinosa*, we remove the unpublished watercolour illustration from further consideration as a potential lectotype.

Although no specimens or gatherings were cited in the protologue of *Tremella saligna*, information given in the text of the protologue could help to identify original material in the form of specimens. This included collection localities in or near Niesky, Germany (Cane and Schinderleibchen), plant associate (*Salix alba*), substratum (bark and decorticated wood), and months when the fungus was observed (October and November). We consulted the entry for *T. saligna* in [Schweinitz] (n.d.) and obtained further information in the form of a specific day (31 Oct) and another locality (Jänkendorf).

With this information we conducted in-person and online searches for specimens labelled *Tremella saligna* or *Stictis saligna*. We did not locate specimens at PH, FH, or BPI. We located a specimen labelled "Stictis Saligna.

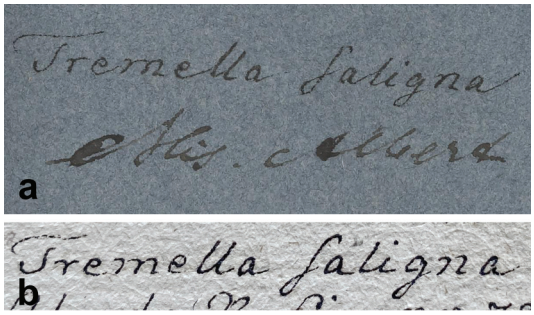

Figure 3. **a** Label on specimen packet of MEL 2332215, lectotype of *Tremella saligna*, with "Tremella Saligna" written by Albertini and "Mis. Albert" [*misit Albertini*: sent by Albertini] written by an unknown scribe. **b** Handwriting sample from page of a manuscript written by Albertini (1801–1803) for comparison to the handwriting of the fungus name in a (cf Karakehian *et al*. 2024).

Tremella [saligna] Albertini et Schweinitz. Germania." in the Persoon fungarium at L, L 0118547, that is not original material. We provide further analysis of this specimen in the Discussion section, below. The only other specimen that we located is MEL 2332215 (http://plants.jstor.org/stable/10.5555/al.ap.specimen.mel2332215), which is original material of *Tremella saligna*. It is part of a set of 77 specimens of new names published in Albertini & Schweinitz (1805) that have recently come to light at MEL. These are presumed to have come to MEL in the late 19th century as part of the herbarium of Otto Wilhelm Sonder (Short 1990). Karakehian *et al*. (2024) demonstrated that these specimens are original material of the 77 new names.

The name *Tremella saligna* was written on the packet of MEL 2332215 by Albertini, judging by a comparison of this (Fig. 3a) and a sample of the same name from an archived manuscript known to have been written by him (Albertini 1801–1803) in conjunction with the preparation of Albertini & Schweinitz (1805) (Fig. 3b). The material consists of a small piece of decorticated wood bearing several apothecia on the end-grain (Fig. 1a). A comparison of the position of these apothecia and the shape of the piece of wood against Schweinitz's published and unpublished illustrations (Fig. 2a uppermost right element "a"; Fig. 2b leftmost element) indicated that the two are not identical, although they share a general similarity in that the apothecia are on the end grain. Although the specimen is not ample, it

is well-preserved and adequate to conduct studies of macro- and micromorphological characters.

***Lectotypification of* Tremella saligna**. In lectotype designation, any extant isotypes must be selected from over illustrations. If there are no isotypes, then syntypes or isosyntypes must be selected from. Finally, if there are no syntypes or isosyntypes, then paratypes must be selected from. In the absence of any of these specimens "the lectotype *must* be chosen from among the uncited specimens *and* cited and uncited illustrations that comprise the remaining original material, if such exist [our italics (Art. 9.12 of *ICN*)]". The remaining original material that we located included three elements: specimen MEL 2332215 and the published and unpublished illustrations (Art. 9.4(a, b) of *ICN*). We excluded the unpublished illustration from consideration as a lectotype because it was ambiguous which species was being depicted (discussed on p. 67). We chose specimen MEL 2332215 over the published illustration as lectotype of *Tremella saligna*. This specimen agrees with the protologue of *Tremella saligna*. It is preferrable as a lectotype because, unlike the illustration, it may be subjected to morphological and other analyses.

***Disposition of* Tremella saligna *as a synonym of* Propolis farinosa**. The morphological features of the lectotype specimen MEL 2332215 agree with descriptions of *Propolis farinosa* given in Rehm (1888, as *P. faginea*), Saccardo (1889, as *P. faginea*), Breitenbach & Kränzlin (1984, as *P. versicolor*), Thompson (2013), Chlebická (2014), and Minter (2019), as well as our observations of the proposed conserved type of *P. farinosa* (Karakehian *et al*. 2023). Based on the similarities in macro- and micromorphology of this lectotype specimen of *T. saligna* and our proposed conserved type of *P. farinosa*, we consider the former name to be a synonym of the latter.

Discussion

The specimen labelled *Stictis saligna* in the Persoon fungarium at L (L 0118547) is not *Propolis farinosa*. Our examination of this material led us to consider whether the fungus depicted in Schweinitz's unpublished watercolour illustration of *Tremella saligna* was in fact *Propolis angulosa*. The following discussion provides a case study in the need for critical examination of all original material when designating a lectotype.

The handwriting on the two labels of specimen L 0118547 is mostly Persoon's, with the notation "Hb. Pers." written by an unknown scribe (Fig. 4a, b). Other than the locality of Germany, there is no further collection information or notes that would serve to connect it to

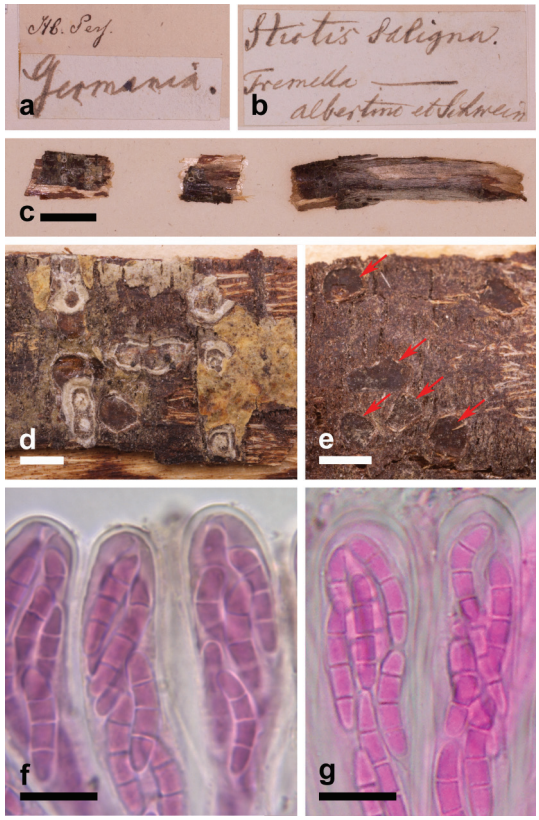

Figure 4. Morphology of a specimen of *Propolis angulosa* in the Persoon fungarium at L, labelled as *Stictis saligna*, and asci of *P. angulosa* from original material. **a–f** *Propolis angulosa*, L 0118547. **a** Specimen label with "Germania." [Germany] written by Persoon and the notation "Hb. Pers." written by an unknown scribe. **b** Specimen label with "Stictis Saligna. Tremella [saligna] Albertini et Schwein" written by Persoon. **c** Specimen consisting of three pieces of wood glued to paper. **d, e** Detail views from the leftmost and rightmost elements of specimen shown in c with red arrows pointing to damaged apothecia that have lost their marginal flaps and pseudoepithecium. **f** Asci and ascospores. **g** Asci and ascospores of original material of *P. angulosa*, UPS F-632612, for comparison to f.
Reagents used: **f**, **g** 10% KOH pretreatment followed by water rinse, then dilute aqueous phloxine.
Scale bars: **c** 1 cm; **d**, **e** 1 mm; **f**, **g** 10 µm.

the information given in the protologue. We also do not know how the specimen came into Persoon's collection. Therefore, there is no way to determine whether the specimen is original material. The macromorphology of the specimen is obliterated; it had been exposed to elements or handled in such a way that the marginal flaps and farinaceous pseudoepithecium were missing (Fig. 4c–e). However, the hymenia were intact, and we studied asci and ascospores (Fig. 4f). The specimen is *P. angulosa* (cf Fig. 4g, from UPS F-632612, original material of *P. angulosa*). We examined several apothecia sampled from the three different pieces of wood in specimen L 0118547 and all of them were *P. angulosa*, except for one that was *P. farinosa*. The *P. farinosa* apothecium was near to apothecia of *P. angulosa*. Given that specimen L 0118547 contains apothecia of both *Propolis angulosa* and *P. farinosa*, and that *Tremella saligna* and *P. angulosa* were both described from *Salix,* it is possible that Albertini and Schweinitz had, at one time or another, gathered both species and did not recognise them as distinct.

The phenomenon of mixed collections has been observed in other *Propolis* species (Tulasne & Tulasne 1931 [vol. 1]: 226–227 [additional note IX], [vol. 3]: 116–119, Tab. 16, Fig. 4, 7, 8). It has also been observed in other inoperculate discomycetes such as *Orbilia* (Baral *et al*. (2020: 146–147). Mitchell *et al*. (2021: 25) observed it among certain taxa of Sareomycetes and provided a detailed analysis and recommendations for working with mixed collections. These included the need for caution when sampling apothecia for genetic studies or other experiments because harvesting more than one apothecium from a collection without first verifying their micromorphology might lead to a mixture of different species, thus confounding the data.

There are some discrepancies between the features of the MEL specimen of *T. saligna* and the original and published illustrations of this species, and between these two illustrations themselves. Discrepancies are also evident in comparisons between the original watercolours and the published plates for several other species published in Albertini & Schweinitz (1805) (Karakehian *et al*. 2018). There are two broad scenarios that may account for such discrepancies. Focusing on the case of *T. saligna*, firstly, it is conceivable that the specimen is indeed the basis for one of the elements in the illustration (the piece of substratum with apothecia on the end grain), with the differences due to "artistic licence", i.e. not intentional from a taxonomic perspective. Due to the high overall similarity between the illustrations, it is conceivable that differences between them are also due to "artistic licence". Alternatively, a different specimen was involved in making the watercolour illustration, and the differences between the illustrations were also due to different specimens being utilised. Focusing on the difference between the original and published illustrations (which has taxonomic significance), perhaps Albertini & Schweinitz used additional knowledge from familiarity with both *P. farinosa* and *P. angulosa* to intentionally alter the colour scheme to more closely reflect the character of the former species in the published illustration. Deciding on which of these scenarios applied requires a more comprehensive analysis of specimens and corresponding original and published illustrations to shed light on the practice of Albertini and Schweinitz in preparation of published illustrations. In the absence of a definitive explanation for the discrepancies the selection of the specimen as lectotype removes any doubt about the interpretation of *T. saligna*.

Following Art. 9.12 of the *ICN*, because there are no isotypes, syntypes, isosyntypes, or paratypes, we could choose a lectotype from any of the three elements of original material that we found: specimen MEL 2332215, and the published and unpublished illustrations. If we had not excluded the unpublished illustration from consideration as lectotype, and instead chose it as lectotype, *Tremella saligna* would be interpreted as having white inner surfaces of the marginal flaps and a medium- or dark-grey disc. Such an interpretation is consistent with *Propolis angulosa*. To avoid doubt, it would then be advisable to designate a specimen as epitype (Art. 9.9 of *ICN*, Lendemer 2020) to resolve the correct application of *T. saligna* one way or another.

This hypothetical situation serves to emphasise the importance of specimens over illustrations in fixing species definitions. Illustrations often have a higher degree of ambiguity in interpretation than do specimens. Furthermore, a specimen that is ample and well cared for in an institutional fungarium provides a resource that future mycologists may turn to as a reference for questions yet to be formulated.

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The authors declare no conflicts of interest.

Author contributions

JMK researched and wrote the manuscript. ANM edited the manuscript. CT conducted morphological analysis of specimen MEL 2332215 and edited the manuscript. TWM provided history and provenance of the set of Albertini and Schweinitz specimens at MEL, input on nomenclature, and edited the manuscript. — JMK, https://orcid.org/0000-0002-3571-3882; ANM, https://orcid.org/0000-0001-7300-0069; CT, https://orcid.org/0000-0002-8510-1761; TWM, https://orcid.org/0000-0003-2214-4972.

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