Trichoconis hafellneri sp. nov. on *Athallia pyracea* and *Xanthoria parietina*, a generic discussion of *Trichoconis* and keys to the species of this genus

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Abstract: Braun, U. Khodosovtsev, A. Y., Darmostuk, V. V. & Diederich, P. 2016. *Trichoconis hafellneri* sp. nov. on *Athallia pyracea* and *Xanthoria parietina*, a generic discussion of *Trichoconis* and keys to the species of this genus. – Herzogia **29**: 307–314.

The new lichenicolous species *Trichoconis hafellneri*, growing on *Athallia pyracea* and *Xanthoria parietina*, is described, illustrated and compared with lichenicolous and other species hitherto assigned to *Trichoconis*. This is followed by a brief discussion on the current circumscription of that genus, supplemented by keys to the accepted species of *Trichoconis*.

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Der neue auf *Athallia pyracea* und *Xanthoria parietina* wachsende lichenicole Pilz *Trichoconis hafellneri* wird beschrieben, mit Abbildungen dokumentiert und mit anderen lichenicolen und sonstigen bisher zu *Trichoconis* gestellten Arten verglichen. Einer kurzen Diskussion der gegenwärtigen Umschreibung dieser Gattung folgen Schlüssel zur Bestimmung anerkannter Arten der Gattung *Trichoconis*.

Key words: *Dactylaria* complex, lichenicolous fungi, Ukraine, unpigmented hyphomycetes.

Introduction

Species of the lichen genus *Xanthoria* (Fr.) Th.Fr., above all *Xanthoria parietina* (L.) Th.Fr., are inhabited by a wide range of lichenicolous fungi. A survey of lichenicolous fungi on *Xanthoria parietina*, which are relatively well studied, has been worked out by Fleischhacker (2011). Nevertheless, the diversity of lichenicolous fungi on species of *Xanthoria* seems to be richer than assumed and not yet comprehensively examined. It is thus not surprising that in the course of routine examinations of lichenicolous fungi in the Kherson region (oblast) of Ukraine a new undescribed mucedinaceous hyphomycete has been found. At first glance, the colourless, denticulate conidiophores suggested a close affinity to the *Dactylaria* Sacc. complex (de Hoog & van Oorschot 1985, Seifert et al. 2011). Further analyses finally revealed a close affinity to the genus *Trichoconis* Clem. (Deighton & Pirozynsky 1972, Seifert et al. 2011), which currently comprises two lichenicolous, numerous fungicolous, and a few saprobic species. Notwithstanding the uniformly aseptate conidia, the new species can readily be assigned to

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Trichoconis. Thus a discussion of the circumscription of this genus and an emendation of its description is required.

Material and methods

Material of the new species was examined by means of light microscopy (Olympus BX 50) mounted in distilled water or 10 % KOH. Measurements were taken from water mounts, based on 30 measurements of each particular structure. Macroscopic photographs were taken using a Canon 40D camera with a Nikon BD Plan10 objective, StackShot (Cognisys) and Helicon Focus (HeliconSoft) for increasing the depth of field. Microscopic photos were prepared using a Leica DMLB microscope, a Leica EC3 camera and Helicon Focus. The examined material is housed in the herbarium KHER and the private collection of Paul Diederich.

Taxonomy

Trichoconis hafellneri U.Braun, Khodos., Darmostuk & Diederich, **sp. nov.** (Figs 1–2)
[MycoBank 815798]

Morphologically similar to the lichenicolous species *Trichoconis physciicola*, but conidiophores 0–2-septate, mature conidia aseptate, 9–22(–30) × 5–10 µm, apically often apiculate or occasionally with a short extension, only 3–8(–14) µm long, cut off from the conidium by a minor septum, but the conidium usually not distinctly rostrate.

Type: UKRAINE, Kherson oblast', Goloprystanskiy district, Chalbaskaya area, village Promin', near lake Shelemenske, 46°20'15"N, 32°49'7"E, alt. 26 m, on *Xanthoria parietina* (apothecia) inhabiting *Populus tremula*, 21.11.2015, A. Khodosovtsev & V. Darmostuk (holotype: KHER 9328; isotypes: KHER 3929 and hb. Diederich).

Description: Colonies growing on apothecia of the host, effuse-caespitose, loose to somewhat aggregated, delicate, whitish. **Mycelium** internal; hyphae sparingly branched, septate, 2–5 µm wide, hyaline, thin-walled, smooth. **Stromata** lacking. **Conidiophores** solitary to loosely aggregated, arising from internal hyphae or immersed swollen hyphal cells, erect, straight to somewhat curved, unbranched, subcylindrical to mostly narrowed from base to top, 20–60 × 3–8 µm (5–8 µm wide below and 3–5 µm wide above), aseptate or with 1–2 septa mostly in the lower half, colourless, thin-walled, smooth, apex more or less obtuse. **Conidiogenous cells** integrated, terminal, or conidiophores reduced to conidiogenous cells, about 10–35 µm long, denticulate, with (1–)2–5 subcylindrical to conical denticles, 1.5–3 × 1 µm, formed as "separating cells" (i.e. denticles separated from the conidiogenous cell by a thin, not very conspicuous septum), terminal, occasionally lateral, scattered. **Conidia** solitary, shape variable, subglobose, ovoid, limoniform, broadly navicular, pyriform to droplet-shaped, mature conidia 9–22(–30) × 5–10 µm, small immature conidia only 5–10 µm long, length/width ratio 1.3–2.5, aseptate, hyaline, thin-walled, smooth, apex rounded to apiculate, occasionally with a short extension (projection), 3–8 µm long, up to 14 µm long in a few old, over-ripe conidia, cut off from the conidial body by a minute septum, base rounded or with apiculum-like peg, occasionally with remnants of the separating cell, conidial secession rhexolytic.

Etymology: The new species is dedicated to the Austrian lichenologist and mycologist Josef Hafellner on the occasion of his 65th birthday.

Host range and distribution: So far known only from two localities in Ukraine, growing on thalli (mainly apothecia) of *Athallia pyracea* (Ach.) Arup, Frödén & Søchting and *Xanthoria parietina* (L.) Th.Fr. Distinct symptoms of pathogenicity not observed.

Additional specimens examined: **Ukraine. Kherson oblast'**, same locality as type, on *Athallia pyracea* inhabiting *Populus tremula*, 5. 12. 2015, A. Khodosovtsev (KHER 9432); same host, 21. 11. 2015, A. Khodosovtsev & V. Darmostuk (KHER 9430); on *Xanthoria parietina*, 5. 12. 2015, A. Khodosovtsev (KHER 9431). **Poltava oblast,** Semenivsky district, near village Stary Kalkayiv, national park "Nyzhnyosulskiy", 49°43'26.3"N, 32°43'45.7" E, alt.

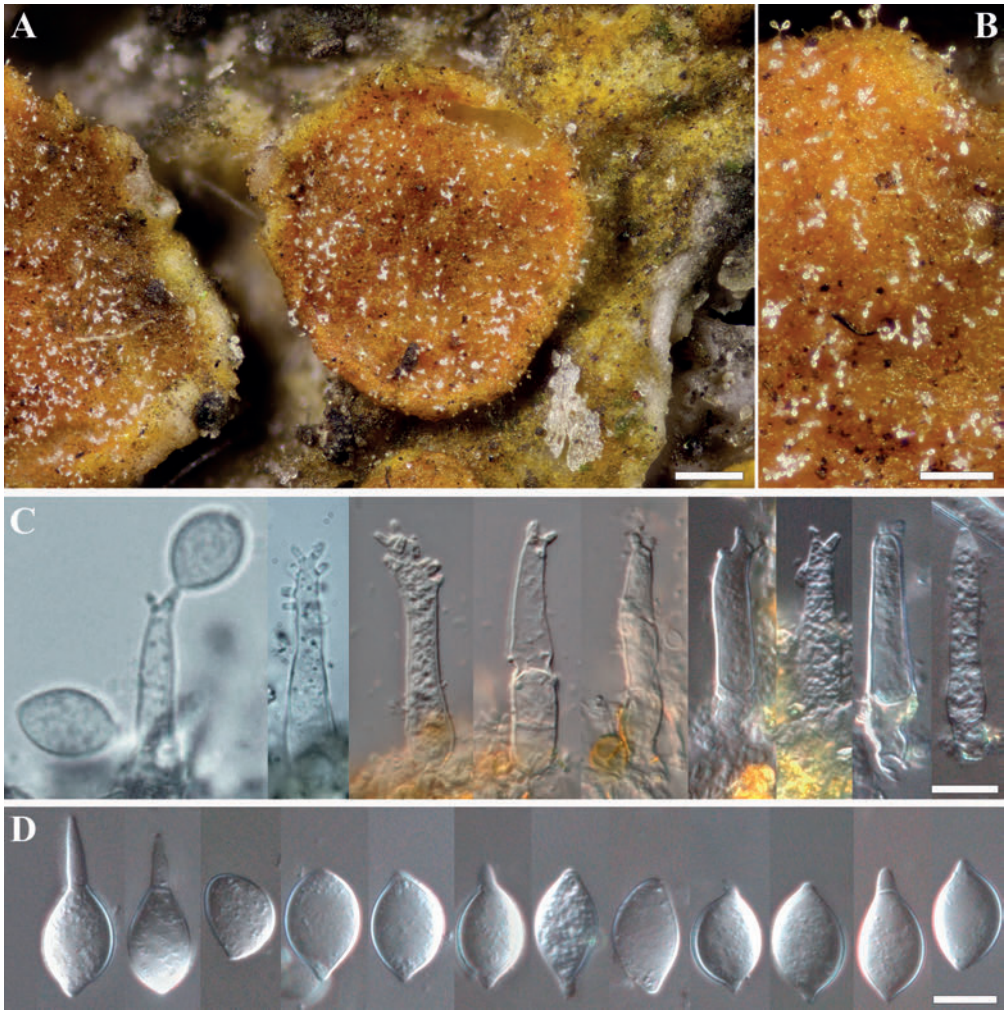

Fig. 1: *Trichoconis hafellneri* (holotype). **A** – Conidiophores growing on apothecia of *Xanthoria parietina*. **B** – Same as in A, at a higher magnification. **C** – Conidiophores. **D** – Conidia. – Scales: A = 200 µm; B = 100 µm; C–D = 10 µm.

90 m, on *Xanthoria parietina* inhabiting *Populus tremula*, 03. 05. 2016, A. Khodosovtsev & V. Darmostuk (KHER 9708, 9709); same locality, date, and collector, on *Athallia pyracea* inhabiting *Populus tremula* (KHER 9707).

Discussion

Based on colourless conidiophores, denticulate conidiogenous cells, rhexolytic conidial secession, and hyaline conidia, the new hyphomycete from Ukraine on *Athallia pyracea* and *Xanthoria parietina* can easily be assigned to *Trichoconis* in its currently wide circumscription (Deighton & Pirozynsky 1972, Seifert et al. 2011). *Trichoconis* comprises lichenicolous, numerous fungicolous and some saprobic species found on leaf litter. Most species of this genus, including *T. caudata* (Appel & Strunk) Clem. (type species) as well as the lichenicolous *T. lichenicola* D.Hawksw. (Hawksworth 1980), are characterised by having septate, mostly

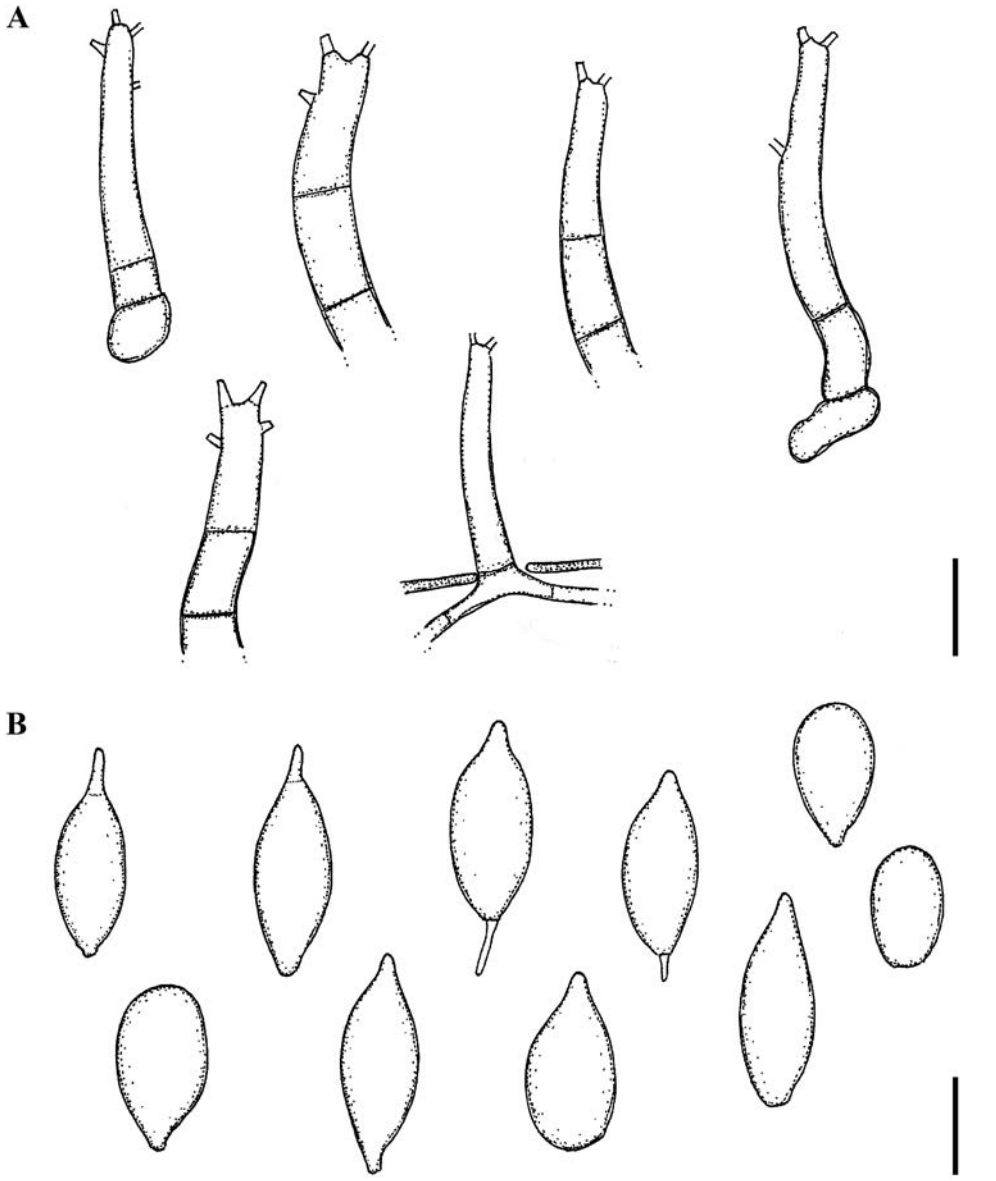

Fig. 2: *Trichoconis hafellneri* (holotype). **A** – Conidiophores. **B** – Conidia. – Scale = 10 µm [U. Braun].

phragmosporous conidia. Few species are didymosporous, e.g. *T. capitata* Piroz. described from India on *Meliolina mollis* (Berk. & Broome) Höhn. (Pirozynsky 1974) and *T. hamata* (Hansf.) Deighton known from Uganda on *Meliola* spp. (Deighton & Pirozynsky 1972), both characterized by having a more or less median septum. *T. physciicola* Brackel, a lichenicolous species described from Germany on *Physcia* spp. (Brackel 2014), is the morphologically closest relative with similar conidiophores and conidia, which are however 0–1-septate, much longer and sometimes distinctly rostrate. The conidia in *T. hafellneri* cannot be consid-

ered to be 1-septate, although small terminal projections are sometimes cut off by a minute basal septum. However, the main body of the conidium is aseptate, and the minute apical septum has to be seen as the locus of the conidial apex giving rise to the small projection. For a long time, *Trichoconis* was classified as a hyphomycete genus with phragmosporous, rarely didymosporous conidia. *T. physciicola*, characterized by having 0–1-septate conidia, is the link to the new species allowing the circumscription of *Trichoconis* to be extended from amero- to phragmosporous. The conidial septation in hyphomycete genera is often subordinate in importance, as exemplified in *Alternaria* Nees : Fr. (Woudenberg et al. 2013), *Cladosporium* Link : Fr. (Bensch et al. 2012), cercosporoid genera (Crous & Braun 2003), and the *Sporidesmium* Link : Fr. complex (Wu & Zhuang 2005), and wide ranges from aseptate to pluriseptate conidia within genera have also been confirmed by means of molecular methods. Attempts to cultivate and sequence the new species on *Xanthoria parietina* failed, and its assignment is just based on the current morphological concept of the genus. The phylogeny of *Trichoconis* based on sequence data of its type species, *T. caudata*, is quite unknown, i.e. corresponding sequences for a phylogenetic comparison are lacking. The only available phylogenetic information refers to *T. echinophila* (C.Massal.) de Hoog & Oorschot (de Hoog & van Oorschot 1985). Based on LSU data, this species clustered together with *Isthmolongispora minima* Matsush. within Leotiomycetes close to species of Rutstroemiaceae (Bhilabutra 2009). *Trichoconis echinophila* was originally described as a species of the genus *Dactylaria*, which is highly polyphyletic (Bhilabutra 2009), although assigned to Helotiales in Index fungorum (http://www.indexfungorum.org/names/names.asp). This information is, however, irrelevant for the phylogeny of *Trichoconis* since the non-type species *T. echinophila* has been excluded and placed in the new monotypic genus *Pseudotrichoconis* W.A.Baker & Morgan-Jones (Baker et al. 2001), which has been recognized in Seifert et al. (2011). The latter genus differs from *Trichoconis* in having sterile capitate hyphae, subhyaline to pigmented conidiophores and verruculose conidia.

The following species are recognized and maintained in *Trichoconis* s.lat. in its current circumscription: *T. africana* (Hansf.) Deighton & Piroz. (Deighton & Pirozynski 1972), *T. amazonensis* Matsush. (Matsushima 1993), *T. angustispora* (Hansf.) Deighton & Piroz. (Deighton & Pirozynski 1972), *T. antillana* R.F.Castañeda, W.B.Kendr. & Guarro (Castañeda Ruiz et al. 1997), *T. appendiculata* Deighton & Piroz. (Deighton & Pirozynski 1972), *T. capitata* (Pirozynski 1974), *T. caudata* (Appel & Strunk 1904, Deighton & Pirozynski 1972), *T. englerulae* (Hansf.) Deighton & Piroz. (Deighton & Pirozynski 1972), *T. foliicola* S.S.Silva, Gusmão & R.F.Castañeda (Silva et al. 2015), *T. hamata* (Deighton & Pirozynski 1972), *T. hibernica* Deighton & Piroz. (Deighton & Pirozynski 1972), *T. lichenicola* D.Hawksw. (Hawksworth 1980), *T. malloti* (Sacc.) Deighton & Piroz. (Deighton & Pirozynski 1972), *T. pedicephora* R.F.Castañeda & W.B.Kendr. (Castañeda Ruiz & Kendrick 1991), *T. physciicola* (Brackel 2014), *T. queenslandica* Matsush. (Matsushima 1989), *T. schiffnerulae* (Hansf.) Deighton & Piroz. (Deighton & Pirozynski 1972), *T. sigmoidea* Deighton & Piroz. (Deighton & Pirozynski 1972), *T. trichiliae* (Hansf.) Deighton & Piroz. (Deighton & Pirozynski 1972), and *T. viridula* Deighton & Piroz. (Deighton & Pirozynski 1972).

The following species are excluded: *Trichoconis crotalariae* M.A.Salam & P.N.Rao (≡ *Phaeotrichoconis crotalariae* (M.A.Salam & P.N.Rao) Subram., Subramanian 1956), *T. echinophila* (≡ *Pseudotrichoconis echinophila* (C.Massal.) W.A.Baker & Morgan-Jones, Baker et al. 2001), *T. indica* Pavgi & R.A.Singh (Pavgi et al. 1966, conidiogenous loci not denticle-like, conidiogenesis rather tretic, structures pigmented, conidia rather alternarioid), and *T. padwickii* Ganguly (≡ *Alternaria padwickii* (Ganguly) M.B.Ellis, Ellis 1971).

Lichenicolous species of *Trichoconis* can be keyed out as follows:

1 Conidia 2–4-septate, 35–65 × 5.5–7 µm, consistently with a distinct filiform rostrum, to 30 µm long; on *Peltigera collina* ..... ***T. lichenicola***
1* Conidia 0–1-septate, shorter, < 45 µm, rostrum lacking in aseptate conidia **2**

2 Conidiophores 0–6-septate; conidia 0–1-septate, apex of septate conidia with distinct long rostrum, mature septate conidia about 20–35(–45) µm long; on *Physcia* spp. ..... ***T. physciicola***
2* Conidiophores 0–2-septate; conidia aseptate, apex rounded, apiculate or occasionally with a short protrusion, 3–8(–14) µm long, cut off at the base from the conidial body by a minute septum, but conidia without a long rostrum, mature conidia shorter, usually 9–22 µm long; on *Athallia pyracea* and *Xanthoria parietina* ..... ***T. hafellneri***

Deighton & Pirozynsky (1972) offered a first key to species of *Trichoconis*. An updated key has recently been published by Silva et al. (2015). The following key, including *T. hafellneri*, was prepared before we became aware of the recent publication of Silva et al. (2015) and may be seen as an alternative key including the new lichenicolous species:

1 Conidiophores narrow, 15–50 × 2.2–3 µm; conidia narrowly clavate, only 2.5–3.5 µm wide, body about 35–50 µm long, apex flagelliform, 17–38 µm long, obscurely 1–2-septate; saprobic ..... ***T. amazonensis***
1* Conidiophores and conidia wider, > 3 µm, or apex non-flagelliform, or with more than 2 septa **2**

2 Mature conidia (1–)2–10-septate **3**
2* Mature conidia 0–1-septate **18**

3 Denticles short (less than 2 µm long) **4**
3* Denticles long (more than 2 µm long) **9**

4 Conidia with a conspicuous basal appendage (remnant of a separating cell), at least 0.5 µm long; conidiophores septate or at least with a basal septum **5**
4* Conidia without basal appendages, at most with a minute frill; conidiophores continuous, without basal septum **8**

5 Conidial appendages about 3 µm long, usually curved ..... ***T. appendiculata***
5* Conidial appendage 0.5–1 µm long **6**

6 Conidiophores and conidia faintly olivaceous; conidia filiform ..... ***T. viridula***
6* Conidiophores and conidia colourless; conidia obclavate to cylindrical, but not filiform **7**

7 Conidia 4–6.5 µm wide ..... ***T. trichiliae***
7* Conidia 6.5–9.5 µm wide ..... ***T. englerulae***

8 Conidia filiform, 3–6-septate, 70–110 × 2.5–3.5 µm ..... ***T. angustispora***
8* Conidia fusiform, shorter and broader, 40–70 × 4.5–7 µm ..... ***T. africana***

9 Conidia distinctly rostrate, with long flagelliform apex **10**
9* Conidia not distinctly rostrate, apex not flagelliform **14**

10 Mature conidia 2-septate; 25–50 × 2.5–4 µm; foliicolous ..... ***T. foliicola***
10* Mature conidia 3–5-septate **11**

11 Conidia mostly 5-septate, second and third cells from the base becoming thick-walled; probably fungicolous, Africa (other records unresolved) ..... ***T. caudata***
11* Conidia uniformly thin-walled **12**

12 Conidiophores 6–10 µm wide at the base; conidia long, 50–120 × 4–6 µm, usually 4-septate; on setae of *Beltrania rhombica* Penz. ..... ***T. antillana***
12* Conidiophores narrower, 3–5.5 µm **13**

13 Denticles (separating cells) cylindrical, to 6 × 1–1.5 µm; conidia without or with minute frill at the base; saprobic ..... ***T. queenslandica***

13* Denticles (separating cells) short filiform, 5–7 × 0.5–1 µm; conidia with distinct filiform appendage (remnant of the separating cell) at the base; lichenicolous, on *Peltigera* ..... ***T. lichenicola***

14 Denticles not cut off from the conidiogenous cell by a septum; conidiophores often with a root-like hypha at the swollen base; conidia fusiform-obclavate, more or less straight, about 20–50 × 3–3.5 µm, 2–4-septate, without basal appendage or conspicuous frill; on setae of an unidentified coelomycete ..... ***T. pedicephora***

14* Denticles cut off from the conidiogenous cell by a thin septum; conidia with basal appendage (remnant of the separating cell), if appendage lacking, conidia sigmoid **15**

15 Conidia sigmoid, without basal appendage ..... ***T. sigmoidea***

15* Conidia not sigmoid, with a conspicuous basal appendage **16**

16 Denticles subcylindrical or slightly conical, discrete and distant ..... ***T. schiffnerulae***

16* Denticles subcylindrical or obconical, often clustered in small groups **17**

17 Denticles obconical ..... ***T. malloti***

17* Denticles subcylindrical ..... ***T. hibernica***

18 Conidia narrowly clavate-fusiform, 20–30 × (2–)3–3.5 µm, with a single more or less median septum, apex with a hooked short beak up to 4 ×1 µm; on *Meliola* spp. ..... ***T. hamata***

18* Conidia broader, > 5 µm, short hooked beak absent, either without a beak or with a short more or less straight protrusion or long rostrum **19**

19 Conidiophores about 50–75 × 3–4 µm, aseptate, denticles up to 1 µm long; conidia navicular, 18–26 × 6–7 µm, with a single more or less median septum, apex often with a mucilaginous droplet about 3 µm diam; on *Meliolina mollis* ..... ***T. capitata***

19* Conidiophores broader, 3–8 µm, at least sometimes septate, denticles 1.5–4 µm long; conidial shape variable, not uniformly navicular, aseptate or with a septum in the upper half, apex without a mucilaginous droplet **20**

20 Conidiophores 0–6-septate; conidia 0–1-septate, apex of septate conidia with distinct long rostrum, mature septate conidia about 20–35(–45) µm long; lichenicolous, on *Physcia* spp. ... ***T. physciicola***

20* Conidiophores 0–2-septate; conidia aseptate, apex rounded without a long rostrum, apiculate or occasionally with a short protrusion 3–8(–14) µm long, cut off from the conidial body by a minute septum, mature conidia shorter, usually 9–22 µm long; lichenicolous, on *Athallia pyracea* and *Xanthoria parietina* ..... ***T. hafellneri***

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