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Tectimyces, a new genus of *Harpellales* on mayfly nymphs (*Leptophlebiidae*) in Spain

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The genus *Tectimyces* gen. nov. (*Harpellales*: *Legeriomycetaceae*) is described with two species, *T. leptophlebiidarum* and *T. robustus* spp. nov., collected on the hindgut of the mayfly nymph *Habroleptoides confusa* (*Ephemeroptera*: *Leptophlebiidae*) in northern Spain. This is the second report of a trichomycete inhabiting a member of this family of ephemerids. Diagnostic for the new genus are type II zygospores and unappendaged trichospores, borne on long generative cells and carrying a very short collar after release. The position and morphological traits of the newly described taxa are discussed and compared with other genera and species, such as *Bojamyces repens* and *Orphella* spp.

INTRODUCTION

Two new species in a new genus of *Trichomycetes* (*Zygomycota*) are reported and described from Catalonia (Spain). These fungi have the characteristic features of the *Legeriomycetaceae* (*Harpellales*) which includes species with branched thalli producing trichospores (asexual spores) and zygospores (sexual spores), and typically develop on the hindgut lining of several kinds of arthropods, mainly aquatic insect larvae.

Tectimyces leptophlebiidarum was discovered first, and proved to be a rather common fungus, having a broad distribution in the northeastern Iberian Peninsula. Initial observations on this fungus showed such a unique thallial structure that it encouraged us to do an intensive survey of *Habroleptoides* nymphs throughout the Catalan region. Meanwhile, in prospecting amongst *Leptophlebiidae* hosts, a second species, *T. robustus*, was collected, so named because of its stout thallus. When compared, the two species seem to be too different to be included in the same genus, but some shared features support this choice: (1) the trichospores are unappendaged and bear an inconspicuous collar upon release; (2) the generative cells are long, appearing inflated below the trichospore before its release; (3) the trichospores follow the same pattern of development and differentiation; and (4) the hosts and ecology are identical.

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Ephemeropteran nymphs of the family *Leptophlebiidae* are common in streams with pebble gravel, sand, and bank vegetation, mostly fallen leaves from the deciduous riparian forest. This organic debris is the basic nourishment of the nymphs and is consumed together with the accompanying saprophytic fungi which decompose it. *Habroleptoides confusa* is the most widespread species of this family in the area studied, and occurs in both calcareous and siliceous streams. It extends from the Pyrenees to the Mediterranean littoral and prelittoral mountain streams, and is also rather common around all the Mediterranean, central and eastern European countries (Putz 1978).

MATERIALS AND METHODS

Descriptions of the new taxa are based on material found in various localities of northeastern Spain. Collections of ephemeropteran nymphs were made by hand picking from the stream substrate, and also by dragging aquatic nets under rocks and sand in the edge of both wide rivers and little mountain streams, all of them preferentially in clean or low organically-polluted waters, from 50 to 2000 m altitude. The insect larvae were dissected to extract and clean the guts under a stereomicroscope and then the fungi were mounted in water on a slide and photomicrographed using phase contrast and interference contrast optics. Slides were fixed with lactophenol cotton blue and preserved in BCB herbarium, of the Universitat Autònoma de Barcelona.

TAXONOMY

Tectimyces L. G. Valle & Santam., **gen. nov.**

Etym.: From Latin *Tectus* = hidden; and Greek *myces* = fungus. Based on the concealed condition of the thalli among abundant bacteria and gut debris.

Trichosporae sine appendicibus, inconspicuum collarem post liberatas ferentes. Genitales cellulae elongatae et distaliter latae factae. Zygosporae biconicae, zygosporophoro oblique et in submedio affixae. Zygosporae post liberatas cum laterali collare et una mucilaginosa appendicis simili structura. Ad cuticulam proctodaei nympharum Leptophlebiidarum affixi.

Typus generis: *Tectimyces leptophlebiidarum* L. G. Valle & Santam. 2002.

Trichospores without appendages and bearing an inconspicuous collar upon release. *Generative cells* elongate and broadened distally. Biconical *zygospores* of type II (Moss, Lichtwardt & Manier 1975), submedially and obliquely attached to the *zygosporophore*. Upon release the *zygospores* bear a lateral collar and a single mucilaginous appendage-like structure. *Thalli* irregularly pinnate or umbellate. Attached to the hindgut cuticle of *Leptophlebiidae* nymphs.

Tectimyces leptophlebiidarum L. G. Valle & Santam., **sp. nov.** (Figs 1–25)

Etym.: From Latin *leptophlebiidarum*, referring to the host family where the fungus is found.

Thallus pinnatus aut irregulariter ramosus, cum secundariis vel tertiariis ramis ex ambobus lateribus principalis axis ortis. Una aut plures laterales, conspicuae, rhizoidei similes ramae principali axe ortae. Cellula basalis lata et aliquando lobulata, cum disciformi pede. Omnes fertiles ramae cum 1–2(–4) ovato-ellipsoidalibus et sine appendicibus trichosporis, 45–52 × 10.5–12.5 μm, cum late rotundato apice et complanata base. Genitales cellulae usque ad 110 μm in longitudinem. Zygosporae 41–47 × 6–8 μm metientes, cum laterali extrinsecus flammiformi collare 3–4 × 3–4 μm et 11–14(–80) μm in longitudinem appendicis simili flammiformi structura. Ad cuticulam proctodaei nympharum *Habroleptoidis confusae*, *Leptophlebiidae* (*Ephemeroptera*) affixi.

Typus: **Hispania orientalis**: *Barcelona*: Cantonigròs, Els Aiats, Torrent de La Rotllada, UTM 31T DG5156, alt. 920 m, ad *Habroleptoides confusa*, 26 Feb. 2001, *L. G. Valle* (BCB Tr0540 – holotypus; BCB Tr0538, BCB Tr0539, BCB Tr0541, BCB Tr0542 – isotypi).

Thalli pinnate (in young thalli) to irregularly branched (in old thalli), attached to the host gut cuticle by means of a broadened and sometimes lobulate *basal cell*, with a disk-like secreted *holdfast*. A variable number of lateral, rhizoid-like branches, arising from the main axis, probably functioning as 'subsidiary' holdfasts (Figs 3–7). Remaining branches projecting laterally from the main axis showing typically arcuate tips. Each fertile branch giving rise to 1–4 ovate-ellipsoidal unappendaged *trichospores* of 45–52 × 10.5–12.5 μm, with a rounded apex and a flattened base (Figs 14, 17–19). *Trichospores* developing at the tips of up to 110 μm long generative cells, or from a lateral outgrowth (3.5–)8–15(–25) μm of intermediate *generative cells*. Free *trichospores* bearing a very short collar, 1.5–2 μm, remainder of the upper part of the swollen generative cell (Fig. 14). Biconical *zygospores* of type II, measuring 41–47 × 6–8 μm, arising up from the scalariform conjugation area, developing on long and thin specialized hyphae. Once released, *zygospores* show a lateral outwardly flared collar 3–4 × 3–4 μm. A single mucilaginous flame-shaped appendage-like structure, with a total length of 11–14(–80) μm, was found in most of the detached *zygospores* (Figs 21–25). *Habitat*: Found on the hindgut cuticle of *Habroleptoides confusa*.

Additional specimens: **Spain**: *Barcelona*: Rupit, Sant Julià de Cabrera, Font de Cabrera, UTM 31T DG5057, alt. 850 m, from *Habroleptoides confusa*, 19 Feb. 2001, *L. G. Valle* (BCB Tr0519 to BCB Tr0528); *Idem*, 26 Feb. 2001, *L. G. Valle* (BCB Tr0543 to BCB Tr0550); Rupit, Riera de Rupit, UTM 31T DG5552, alt. 890 m, from *H. confusa*, 26 Mar. 2001, *L. G. Valle* (BCB Tr0554 to BCB Tr0557); El Brull, La Castanya, Riera de La Castanya, UTM 31T DG4625, alt. 650 m, from *H. confusa*, 30 Oct. 2000, *L. G. Valle* (BCB Tr0387); Fogars de Monclús, Santa Fe del Montseny, Riera de Santa Fe, Font de Passavets, UTM 31T DG5425, alt. 1250 m, from *H. confusa*, 24 Oct. 2001, *L. G. Valle* (BCB Tr1105); Fogars de Monclús, Santa Fe del Montseny, Torrent de Can Ramis, UTM 31T DG5524, alt. 1100 m, from *H. confusa*, 23 Jan. 2002, *L. G. Valle* (BCB Tr1214 to BCB Tr1216); Fígols, Peguera, Font del Coix, UTM 31T CG9968, alt. 1600 m, from *H. confusa*, 31 May 2001, *L. G. Valle* (BCB Tr0818, BCB Tr0819). *Girona*: Susqueda, Coll de Condreu, Riera de l'Om, UTM 31T DG5855, alt. 1020 m, from *H. confusa*, 1 Mar. 2001, *L. G. Valle* (BCB Tr0576); Osor, Riera d'Osor, Font Bunyola, UTM 31T DG5939, alt. 780 m, from *H. confusa*, 1 Mar. 2001, *L. G. Valle* (BCB Tr0577). *Lleida*: Bellver de Cerdanya, Riu de la Vall del Pi, UTM 31T DG9787, alt. 1300 m, from *H. confusa*, 9 Aug. 2000, *L. G. Valle* (BCB Tr0213); Farrera, Riu de la Vall de Burg i de Ferrera, UTM 31T CH1229, alt. 1229 m, from *H. confusa*, 22 June 2001, *L. G. Valle* (BCB Tr0895 to BCB Tr0897); Vielha, Conangles, Riu Noguera Ribagorçana, UTM 31T CH1621, alt. 1580 m, from *H. confusa*, 30 July 2001, *L. G. Valle* (BCB Tr0940); Les Bordes, Artiga de Lin, Barranc de la Betum, Riu Joeu, UTM 31T CH1230, alt. 1160 m, from *H. confusa*, 31 July 2001, *L. G. Valle* (BCB-Tr0949). *Tarragona*: Capafonts, Riu Brugent, UTM 31T CF3573, alt. 700 m, from *H. confusa*, 11 Jan. 2001, *L. G. Valle* (BCB Tr0456); *Idem*, 30 Jan. 2001, *L. G. Valle* (BCB Tr0461); Farena, Riu Brugent, UTM 31T CF3975, alt. 600 m, from *H. confusa*, 9 Jan. 2001, *L. G. Valle* (BCB Tr0453, BCB Tr0455, BCB Tr0556). *Teruel*: Beseit, El Parrissal, Riu Matarranya, UTM 31T BF6320, alt. 650 m, from *H. confusa*, 24 Mar. 2001, *L. G. Valle* (BCB Tr0639).

Tectimyces robustus L. G. Valle & Santam., **sp. nov.** (Figs 26–36)

Etym.: From Latin, *robustus*, referring to the stout thallus habitus.

Thallus umbellatus, axes distaliter lati facti, usque ad quinctum ordinem ramas ferentes. Ramae apicales angustatae et cum arcuatis apicibus. Cellula basalis lata, cum parvo disciformi pede, tantum distinguibili in juvenibus thallis. Omnes fertiles ramae cum 1–3 obovato-elliposoidalibus et

sine appendicibus trichosporis, (33–)38–40(–44) × 9–11 μm. Genitales cellulae usque ad 118 μm in longitudinem, abrupte contractae infra apicem. Zygosporae ignotae. Ad cuticulam proctodaei nympharum *Habroleptoidis confusae*, *Leptophlebiidae* (*Ephemeroptera*) affixi.

Typus: **Hispania orientalis**: *Barcelona*: El Brull, La Castanya, Riera de la Castanya, UTM 31T DG4625, alt. 650 m, ad *Habroleptoides confusa*, 7 Nov. 2001, *L. G. Valle* (BCB Tr1129 – holotypus; BCB Tr1126 to BCB Tr1128, BCB Tr1147 to BCB Tr1149, BCB Tr1051 – isotypi).

Thalli umbellate, with distally broadened axes, with 3–7 branches arising per node (Fig. 26), reaching up to a fifth order of ramification, attached to the host gut cuticle by a rounded *basal cell* with a disc-like *holdfast* (in young thalli), but later, when thalli mature, the *holdfast* is no longer observed and bidirectional growth occurs, giving rise to a napiform basal hypha, from which *generative cells* and *trichospores* can develop (Figs 26–28). Basal and medial cells broader than those of the apex, with a swollen zone at the apex, giving rise to multiple tapering branches with curled tips. Each fertile branch giving rise to 1–4 obovate-ellipsoidal unappendaged *trichospores* of (33–)38–40(–44) × 9–11 μm (Figs 30–35). *Trichospores* developing at the tips of *generative cells* that are abruptly constricted at the apex like a bottleneck (Figs 30–31). Free *trichospores* carrying a very short collar, 1.5–2 μm, consisting of the remainder of the upper part of the swollen *generative cell* (Figs 34–35). Terminal *generative cells* can reach up to 118 μm long. Intermediate *generative cells* very variable in size, with *trichospores* developing from lateral outgrowths of 15–90 μm. *Zygospores* unknown.

Habitat: Found on the hindgut cuticle of *Habroleptoides confusa*.

Additional specimens: **Spain**: *Barcelona*: Riera de Santa Fe del Montseny, Font de Passavets, UTM 31T DG5425, alt. 1250 m, from *Habroleptoides confusa*, 25 Oct. 2001, *L. G. Valle* (BCB Tr1083, BCB Tr1084, BCB Tr1090 to BCB Tr1094).

DISCUSSION

Tectimyces is the second harpellid genus described from the ephemeropteran family *Leptophlebiidae*, after *Bojamyces repens* collected on *Leptophlebia intermedia* (Longcore 1989). Moreover, another unnamed harpellid, similar to *Bojamyces* was found on a *Leptophlebiidae* (*Australonusia* sp.) from Tasmania (Lichtwardt & Williams 1992b). Trichospores of *Bojamyces* are interspersed with vegetative (non sporulating) cells in a long thallus, are unappendaged, have a collar of 3–5 × 3–5 μm after release, and no zygospores were described (Longcore 1989). In contrast, *Tectimyces* trichospores grow from generative cells, which arise from fertile branches, have extremely short collars (Figs 14, 34–35), and zygospores of type II. Longcore (1989) also reported that cells of *B. repens* separate disarticulating from the thallus. This event is not observed in *Tectimyces*.

Zygospores have only been observed in *T. leptophlebiidarum* (Figs 20–24). These sexual spores seems to be formed after conjugation from specialized, long and very thin hyphae, following a scalariform pattern that results in the production of numerous zygospores, arising from the centre of the conjugation tube, at the tip of elongate zygosporophores (Figs 20, 24). The production of specialized hyphae for conjugation has been also reported in *Furculomyces* (Lichtwardt & Williams 1992a), where zygospores develop from conjugating branches that fuse at their tips in a furculum-like structure.

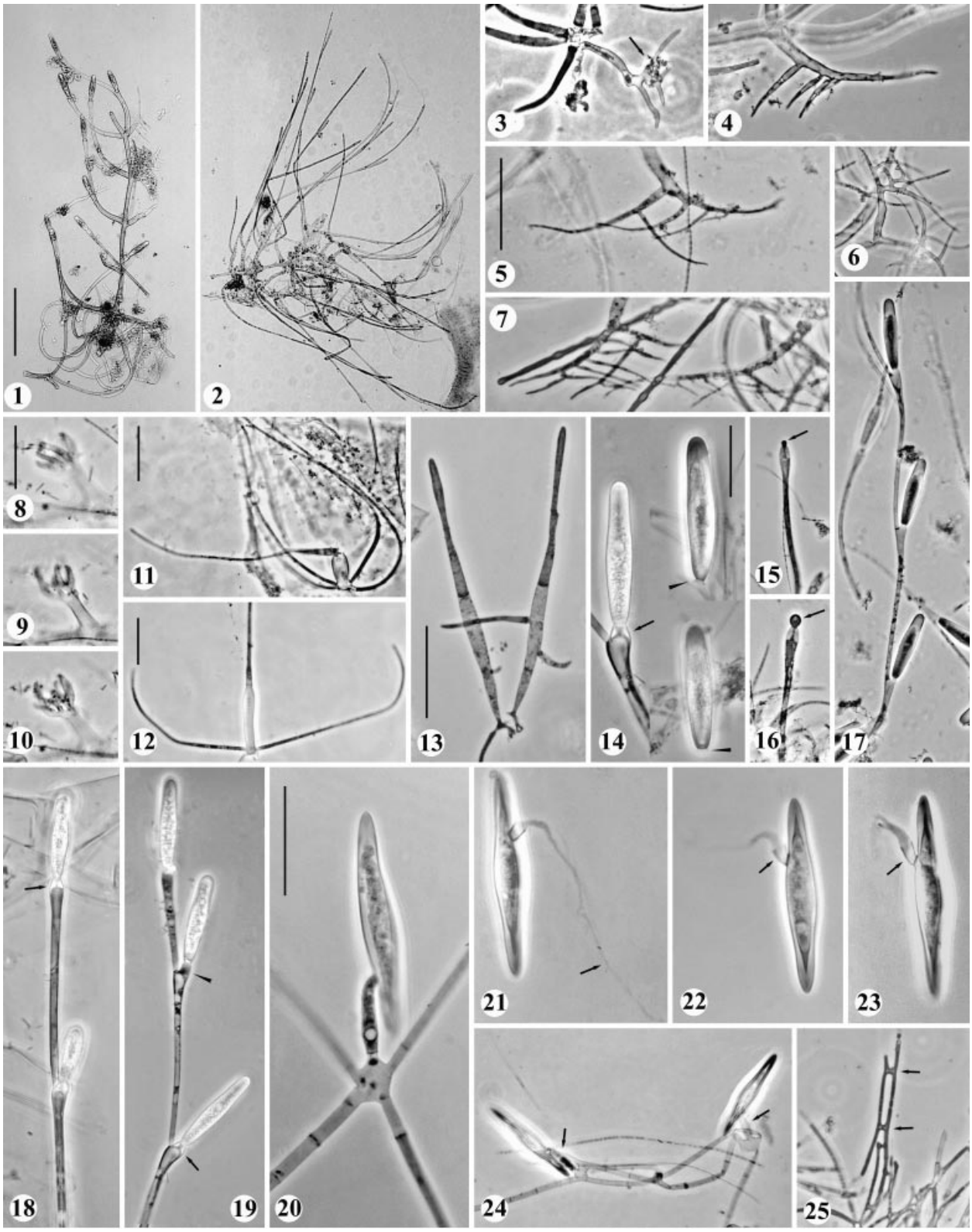
In *Tectimyces*, fertile hyphae produce series of swellings, which correspond to the apical wider apices of the future generative cells. Afterwards, septa form to delimit each generative cell. Terminal trichospores develop directly from the top of generative cells; intercalary trichospores grow at the tip of lateral outgrowths (Figs 17–19), which are very variable in size, reaching lengths (specially in *T. robustus*) only comparable to those of *Caudomyces japonicus* (Lichtwardt, Kobayasi & Indoh 1987). The fragile appearance of the narrow and long generative cells is remarkable, especially those of *T. leptophlebiidarum*.

Trichospores of *Tectimyces* lack appendages, although a differentiated appendage-associated structure has been noted inside the generative cell, just underneath the trichospore (Figs 14, 30–31). These appendage structures are comparable to those of other species of *Harpellales*, where a refractive material is displayed alongside the wall of the generative cell apex. Just before the trichospore release the refractive appearance of this material disappears (Fig. 19, arrowhead; Figs 32–33). As in *Zygopolaris*, these structures will not develop into an appendage (Moss *et al*. 1975, Moss & Lichtwardt 1976, Lichtwardt & Williams 1984). The reason for the late degradation observed in mature trichospores of *Tectimyces* has not yet been clarified. However, some material of the appendage structure frequently appears attached to the very recently released trichospores (Figs 32–33). This phenomenon was also reported on *Z. ephemeridarum* (Moss *et al*. 1975). The absence of appendages could be related to the ecology of the host, which prefers hush zones of flowing streams where plant debris tends to accumulate. In this

***Key to species of* Tectimyces**

1 Thalli umbellate, generative cells abruptly constricted at the apex, like a bottleneck. Trichospores (33–)38–40(–44) × 9–11 μm. . . . . **robustus**

Thalli pinnate to irregularly branched, generative cells uniformly inflated. Trichospores 45–52 × 10.5–12.5 μm. . . . . **leptophlebiidarum**



Figs 1–25. *Tectimyces leptophlebiidarum* (Figs 1, 4, 18, BCB-Tr1130; Fig. 2, BCB-Tr0895; Fig. 3, BCB-Tr0526; Fig. 5, BCB-Tr0461; Figs 6, 19, BCB-Tr1159; Figs 7, 25, BCB-Tr0819; Figs 8–10, BCB-Tr0546; Fig. 11, BCB-Tr0897; Fig. 12, BCB-Tr0902; Fig. 13, BCB-Tr0387; Fig. 14, 20–24, BCB-Tr0525; Figs 15–16, BCB-Tr1141; Fig. 17, BCB-Tr0455; Fig. 19, BCB-Tr1159). **Figs 1–2.** Overall view of two branching thalli. **Fig. 3.** Holdfast and rhizoid-like branch (arrow). **Figs 4–7.** Different models of lateral rhizoid-like branches. **Figs 8–10.** Lobulate basal cell at three different focusing levels to demonstrate its three-dimensional structure. **Figs 11–13.** Young thalli in different stages of development, showing progressive cell elongation and branch production. **Fig. 14.** At left, trichospore attached to its generative cell showing refractive contents (arrow); at right, two released trichospores showing the inconspicuous collars (arrowheads). **Figs 15–16.** Trichospore development at the tip of fertile branches (arrows). **Figs 17–19.** Fertile branches bearing trichospores.

environment, trichospores could remain secure from the drift effect of fast waters. Hence, no appendages need be present to guarantee stability, necessary to allow spore ingestion by another host. The absence of appendages in other species, such as *Bojamyces repens*, a host with similar ecology, support this possibility, as mentioned by Longcore (1989).

Young thalli show a pattern of development similar to those of other genera of *Legeriomycetaceae*. Initially, a hypha grows upwards from the newly attached sporangiospore (Figs 29, 36). Later, new hyphae develop laterally from the base of the sporangiospore, close to the hindgut cuticle. At this stage, a typical structure with several young branches radiating from the initial sporangiospore is seen (Figs 11–13). This pattern was observed in both species of *Tectimyces*, with slight differences observable in later development. The presence in *T. robustus* of a mucilaginous skirt covering the young germinating thalli is remarkable (Fig. 36).

The final umbellately branched structure in thalli of *T. robustus* (Figs 26–28) could be compared to that of *Orphella* species, which are also apically ramified, with multiple branches arising from a main axis. Species of *Orphella* have a main axis consisting of numerous cells that can be laterally branched, notably *O. avalonensis* (Lichtwardt, White & Colbo 2001), *O. catalaunica* (Santamaria & Girbal 1998), *O. coronata* (Léger & Gauthier 1931), *O. haysii* (Williams & Lichtwardt 1987), and *O. hiemalis* (Lichtwardt, Peterson & Huss 1991). However, in *T. robustus*, merely one or two cells, shorter and wider than those of *Orphella* species, will give rise to all the umbellately branched structure.

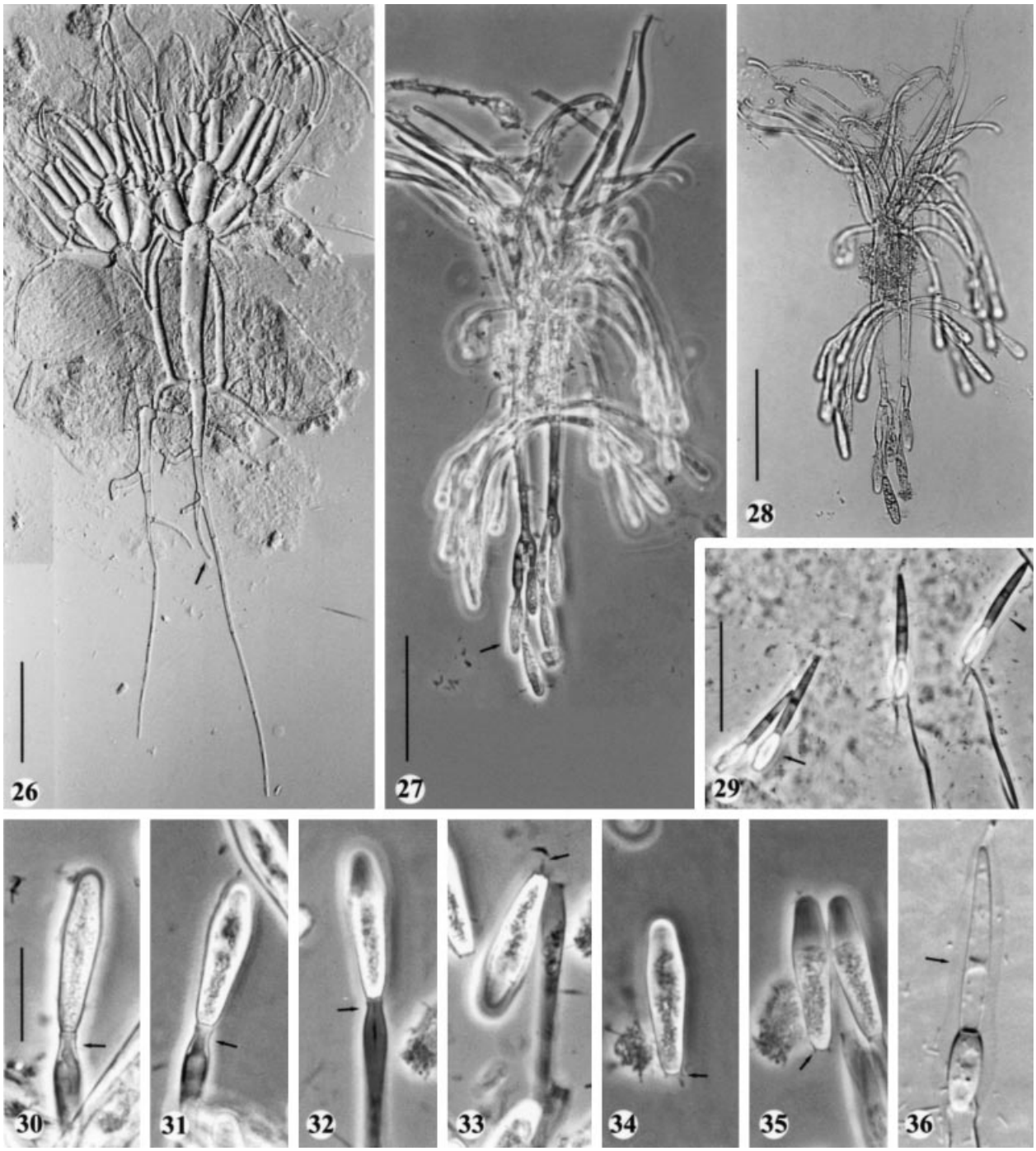
Affinities within both species in *Tectimyces* are evident when trichospores are observed, albeit generative cells and thallial structure allow a clear specific distinction between them. In *T. leptophlebiidarum*, the generative cell apex (collar region) appears uniformly inflated (Fig. 18), whereas it is constricted or bottleneck-shaped in *T. robustus* (Figs 30–33). Once released, only the distal part of the generative cell is carried with the trichospore as a short collar, nearly identical in both species (Figs 34–35). The appendage-associated structure inside generative cells is longer and thinner in *T. robustus* (Fig. 31), while is shorter and broader, as well as closely crowded to the apex in *T. leptophlebiidarum* (Fig. 19).

Other characters used to segregate the two species are the presence of rhizoid-like lateral branches in *T. leptophlebiidarum* (Figs 3–7), not seen in *T. robustus*. These branches are unique amongst *Harpellales*. A main broad or sometimes lobulate basal cell is found only in young thalli of *T. leptophlebiidarum* (Fig. 3). Mature individuals grow so profusely that the presence of a single basal holdfast is probably insufficient to forcefully anchor the fungus to the gut, and therefore, the presence of these lateral branches might improve this role. Most of these rhizoidal branches grow in an evident unilateral ramification pattern (Fig. 4), but those thalli from the single collection from Font Cabrera (Figs 3, 5–6) show dichotomous branching. In the same population, a lobulate basal cell form is also predominant (Figs 8–10). These are assumed to be intraspecific variations.

Mature thalli of *T. robustus* do not show a clearly distinguished holdfast (Fig. 26), and often they appear freely 'floating' when the gut is dissected. As a hypothesis, the long, tapering and commonly coiled terminal branches could help retain this fungus inside the gut lumen. Moreover, an additional unusual phenomenon has been observed in this species: a late, bi-directional growth of the thallus seems to occur, since a napiform hypha develops from the original basal cell towards the opposite direction where the terminal vegetative branches grow. Fertile branches arise laterally and even apically from this napiform hypha (Fig. 26, arrow). Other trichospore-producing branches grow from the upper zone of the axial cells, just below the swelled zone from which distal vegetative branches develop (Figs 27, 28, out of focus), and these trichospore-bearing branches appear to be always orientated towards the base of the thallus. Consequently, although shown in the conventional way, with the base at the bottom, the photographed mature thalli seem to be rotated 180° (Figs 27–28).

The percentage of infected individuals varied in relation to the area studied. In some streams few individuals were infected (approx. 5 %), while in others the ratio reached nearly 80 %. Amongst the infected mayflies few had both mature trichospores and zygospores. As in other genera of harpellids, when the thalli reproduce sexually, trichospores are not formed, or at least appear in a very low proportion. Within the infected nymph's guts, just one to three thalli of *T. leptophlebiidarum* were observed per individual. More thalli of *T. robustus* can be found inside the gut, and it was easy to find very immature thalli developing from recently attached spores.

Note the extremely thin generative cells in Figs 17 and 19. In Figs 18 and 19, the arrows indicate the refractive contents at the top of generative cells, which disappear just before trichospore release (Fig. 19, arrowhead). **Fig. 20.** Zygospore arising from a cross-like conjugation area. **Figs 21–23.** Released zygospores showing the collar (Figs 22–23, arrows) and the mucilaginous appendage-like structure (Fig. 21, arrow). **Fig. 24.** Zygospores with zygosporophores (arrows) arising from the middle of conjugation bridges. **Fig. 25.** Scalariform conjugations (arrows). Figs 6, 18–19 from water-mounted slides; remaining Figs from lactophenol cotton-blue mounted slides. Figs 1–2, light transmission optics; Figs 3–25, phase contrast optics. Bar Fig 1 = 100 μm (Figs 1–2); Fig. 5 = 50 μm (Figs 3–7); Fig. 8 = 25 μm (Figs 8–10); Figs 11–12 = 10 μm; Fig. 13 = 50 μm (Figs 13–19, 24–25); Fig. 20 = 25 μm (Figs 20–23).



Figs 26–36. *Tectimyces robustus* (Fig. 26, BCB-Tr1147; Figs 27–28, 30, BCB-Tr1128; Figs 29, 36, BCB-Tr1126; Figs 31–39, BCB-Tr1129). **Fig. 26.** Overall view of two superposed branching thalli. Note the growing branches from which trichospores will develop (arrow). **Figs 27–28.** Two superposed sporulating thalli. Note the trichospore arrangement (arrow) and the backward orientation of trichospore-bearing branches. **Fig. 29.** Sporangiospores (arrow) germinating after its attachment to the hindgut lining, developing a very initial growing thallus (arrowhead). **Figs 30–31.** Trichospore and generative cell. Note the bottleneck-like shape of the generative cell apex and the inner refracting material. **Figs 32–33.** Two successive stages on trichospore release. In Fig. 32, the refractive material disappears just before the trichospore is released (Fig. 33), carrying a tail of cytoplasmic contents (arrow). **Figs 34–35.** Free trichospores showing the extremely short collar (arrows). **Fig. 36.** Extruded sporangiospore showing a mucilaginous skirt (arrow) surrounding all the young structure. All from water-mounted slides. Figs 27 and 29–35, phase contrast optics; Figs 26 and 36, interference contrast optics; Fig. 28, light transmission optics. Bar Figs 26–28 = 100 μm; Fig. 29 = 50 μm; Fig. 30 = 25 μm (Figs 30–36).

A high proportion of the examined specimens of nymphs were also infected with high densities of filamentous bacteria growing on the hindgut and midgut lining. These prokaryotic organisms grew on and between the *Tectimyces* thalli making their detection and observation difficult. *T. leptophlebiidarum* is very

common but *T. robustus* is more geographically restricted, and the proportion of infested larvae is lower. Some molts were collected and examined without any trace of these fungi.

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