NEW SPECIES OF TORRUBIELLA, HIRSU-TELLA AND GIBELLULA

E. B. MAINS

(with 2 figures)

Torrubiella pulvinata sp. nov. (Fig. 1, A & B)

Mycelium album, corpus hospitis tegente et ad articulos f1occos creante; perithecia partim immersa vel superficialia in pulvino mycelii, ovoidea, 450-600 X 220-270 #, brunnea, a tenui tunica f1avi mycelii tecta; asci cylindrici, 450 X 4.5-6 #, deorsum attenuata, tenuibus membranis, ad apices membranis spissatis 2.5-3 #; ascospores filiformes, 0.5-0.7 # crassae, multiseptatae, cellis 4-8 # longis; conidiophora et mycelio, sparsa vel caespitosa, 2-2.5 # crassa, sursum capitulis phialidum; phialides anguste fusoido-ovoideae, sursum acuminatae, 8-12 X 2 #; conidia hyalina, fusoido-ellipsoidae, 2-3 X 1.5-2 #, catenulata.

Ex Opilionoideis, Waianauka, Oahu, Hawaii. Dec. 9, 1945, D. P. Rogers (2090).

Mycelium white, covering the body of the host and developing tufts on the legs specially at the joints; perithecia partly embedded or superficial on a pulvinate mass of mycelium, ovoid, 450-600 X 220-270 #, brown, covered by a thin layer of yellow mycelium; asci cylindric up to 450 # long, 4.5-6 # wide, narrowing toward the base, the wall thin, thickened at the apex, 2.5-3 #; ascospores filiform, 0.5-0.7 # thick, multiseptate, the cells 4-8 # long; conidiophores arising from the mycelium, scattered or crowded, 2-2.5 # wide, phialides grouped in whorls or heads in the upper part of the conidiophores or occasionally from short lateral hyphae, narrowly fusoid-ovoid, acuminate above, 8-12 X 2 #; conidia hyaline, fusoid-ellipsoidal, 2-3 X 1.5-2 #, catenulate.

On Opilionoidea, south fork of Kaukonahau, 1100 ft., Waianauka, Oahu, Hawaii, Dec. 9, 1945, D. P. Rogers, 2090, type. (Univ. of Mich. and N. Y. Bot. Gard.)

The hosts of this collection are so severely parasitized that accurate determination is difficult. They appear to be arachnids belonging to the Opilionoidea. The conidial stage resembles Spi-
caria longipes Petch. In the latter species the phialides generally develop from short hyphal branches. Petch (7) states that S. longipes is the conidial stage of Torrubiella gonylepticida (Möller) Petch. T. gonylepticida differs from T. pulvinata in having the

![FIG. 1. Torrubiella pulvinata and T. confragosa.](image-url)
species the phialides generally

Petch (7) states that S.
Tubiella gonylepticida (Möller)
oon T. pulvinata in having the

Möller (2) describes the perithecia of T. gonylepticida as orange red, flask-shaped, 300-400 μ long, and the asci as 170 × 3 μ. Since it is desirable to have a name for the conidial stage, Spicaria pulvinata is proposed for that of T. pulvinata.

Torrubiella confragosa sp. nov. (Fig. 1, C)

Mycelium tenue, album vel cremeum, hospitem tegente, f1occosum, pulverulentum; perithecia irregulariter sparsa vel congesta, superficialia vel paulull1m immersa, ovoidea, 350-650 × 200-375 μ, rubro-brunnea vel castanea, muris 20-35 μ crassis ex duobus stratis constructis, interno strato rubro-brunneo, externo strato brunneo-flavo; asci cylindric, 200-350 × 3.5-4 μ, tenibus membranis, ad apices membranis spissatis 2-2.5 μ; ascospores filiformes, multisectae; synnemata summe brevia, 300-800 μ longa, 80 μ crassa, cylindricea, interdum furcata; phialides 14-20 μ longae, deorum 1.5 μ latae, conidia oblonga, 3-4 × 1.5-1.7 μ, musco tecta, 2-5 in glebulas congregata.

In Coccidis, Novo Petropolis, Brazil, May 1923, Rick, specimen typicum; Bayeaux, Haiti, J. R. Weir.

Mycelium thin, white to cream color, covering scale insects and extending slightly beyond on the substratum, slightly tufted, pulverulent; perithecia irregularly scattered to crowded over the scale, superficial or slightly embedded at the base in the mycelium, ovoid, 350-650 × 200-375 μ, reddish brown to dark chestnut brown, the wall 20-35 μ thick and consisting of two layers, the inner reddish brown, the outer brownish yellow; asci cylindric, 200-350 × 3.5–4 μ, the wall thin, thickened at the apex, 2–2.5 μ; ascospores filiform, 0.5 μ wide, almost as long as asci, multisectae, part-spores not seen; synnemata very short, 300–800 μ long, 80 μ thick, cylindric or furcate with short irregular branches, consisting of loosely interwoven hyphae; phialides arising from the outer hyphae or from short lateral hyphae, 14–20 μ long, 1.5 μ wide below, gradually narrowing to an acuminate apex; conidia oblong, 3–4 × 1.5–1.7 μ, produced in a mucus, often in clumps of 2 to 5.


Both of these collections were received as Torrubiella rubra. T. rubra develops perithecia only at the margin of the mycelium cover-
ing the scale or on a hypothallus and the asci are much larger than those of *T. confragosa*. Petch (3) describes a conidial stage for *T. rubra* which differs considerably from that of *T. confragosa*. The latter can best be classified as a *Hirsutella*, although the synnemata are poorly developed. The scattered phialides and clumped spores in a surrounding mucus are characteristic of that genus. Since the conidial stage of fungi of this group frequently develop without the perithecial stage it is convenient to have a name applying to it and consequently *Hirsutella confragosa* is proposed.

**Torrubiella liberiana** sp. nov. (Fig. 2, A)

Perithecia albido-brunnea, ex myceliis in articulis hospitis erumpentia, partim immersa, ovoidea, 300–400 × 150–200 μ; asci cylindrici, tenues, 210 μ longa, 3–4 μ crassa, tenuibus membranis, ad apices membranis spissatis, 2 μ; ascospore filiformes, multisepitae, fragentes, segmentis 3–4 × 0.5–0.7 μ.

*Ex formica*, Bonata, Liberia, Dec. 8, 1947, J. T. Baldwin, Jr.

Perithecia light brown, developing in small white patches of mycelium at the joints of the appendages and of the body, partly embedded, ovoid, 300–400 × 150–200 μ; asci cylindric, slender, up to 210 μ long, 3–4 μ wide, wall thin, thickened at the apex, 2 μ; ascospores filiform, nearly as long as the asci, multisepitate, breaking into one-celled fragments, 3–4 × 0.5–0.7 μ.


As far as the writer is aware, this is the first report of a species of *Torrubiella* on ants. It occurs in close association with synnemata of a *Hirsutella* which may be the conidial stage. However, it was separated from a collection of ants which were mostly parasitized by *Cordyceps australis*. A *Gibellula* also occurs on a few specimens. The relationship of these fungi is therefore very uncertain and it seems best to describe them separately.

**Hirsutella liberiana** sp. nov. (Fig. 2, B)

Synnemata pausca, sparsa, ex exiguis albis myceliis plerumque in articulis erumpentia, albi, tenui, cylindrica, 3 mm. longa, deorsum 100 μ crassa, sursum paululum attenuata, simplicia vel interdum furcata; phialides sparsae vel conregatae, plerumque nonnullae ex brevibus lateribus hyphis erumpentes, deorsum fusideo-ellipsoideae vel fusideo-oblongae, 8–12 × 3 μ,
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\textit{Hirsutella sp. nov. (Fig. 2, A)}

\( \text{myceliis in articulis hospitis erumpentia,}
\langle 150-200 \mu; \text{asci cylindrici, tenues, } 210 \mu
\text{; asci, ad apices membranis spissatis, } 2 \mu;
\text{fragentes, segmentis } 3-4 \times 0.5-0.7 \mu.
\quad \sim 8, 1947, \text{J. T. Baldwin, Jr.}
\)

\( \text{This species, developing in small white patches of}
\text{appendages and of the body, partly}
\text{50-200 } \mu; \text{asci cylindric, slender, up}
\text{thin, thickened at the apex, } 2 \mu; \text{as-
\text{as the asc}, multisepate, breaking}
\times 0.5-0.7 \mu.
\)

\( \text{Province, Liberia, Dec. 8, 1947,}
\text{type.}
\)

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\textit{La sp. nov. (Fig. 2, B)}

\( \text{ignis albidis myceliis plerumque in arti-
ylindrica, } 3 \text{ mm. longa, deorsum } 100 \mu
\text{ simplicia vel interdum furcata; phialides}
\text{nonnullae ex brevibus lateribus hyphis}
oideae vel fusideo-oblongae, } 8-12 \times 3 \mu,
\)

\( \text{FIG. 2. Torrubiella, Hirsutella and Gibellula}
\)
Synnemata few, scattered, arising from a slight whitish mycelium, usually from the joints of the body and the appendages, whitish, slender, cylindric, slightly narrowing upward, up to 3 mm long, 10 \( \mu \) thick, simple or occasionally branched above; phialides scattered to crowded, usually several arising from short, one-celled lateral hyphal branches from the outer hyphae of the synnemata, the lower part fusoid-ellipsoid to fusoid-oblong, 8-12 \( \times \) 3 \( \mu \), the upper part prolonged into an attenuated, acuminate sterigma, 10-14 \( \mu \) long, each producing several conidia which adhere together in a persistent mucous; conidia cylindric, rounded at both ends, 3-4 \( \times \) 0.7-1.0 \( \mu \).


Petch (6) has described \textit{Hirsutella formicarum} on ants from British Guiana and Ceylon and has stated that it is the conidial stage of \textit{Cordyceps unilateralis}. He describes the conidia as narrowly cymbiform, 9-11 \( \times \) 2 \( \mu \). In an earlier publication (4) he described the conidia of the Ceylon specimens as oval, 3-5 \( \times \) 1 \( \mu \). Kobayasi (1) has identified Japanese collections on ants as \textit{H. formicarum}, describing the conidia as ovoid, ellipsoid or fusiform, 3-4.2 \( \times \) 1.5-2 \( \mu \). It would seem probable that more than one species is concerned. \textit{Hirsutella liberiana} is distinguished by its cylindric narrow conidia. It was associated with perithecia of \textit{Torrubiella liberiana} which is described herein.

\textbf{Hirsutella ramosa sp. nov. (Fig. 2, C)}

Synnemata multa, gregaria, tenua, irregulariter ramosa, 8 mm longa, deorsum 52-140 \( \mu \) crassa, sursum attenuata, acuminatis apicibus, deorsum albid-o-flava, sursum alba, multis albis rectis vel obliquis ramulis; phialides sparsae vel 1-3 caespitosae, hyalinae, subulatae, 19.3-36.4 \( \mu \) longae, deorsum 2.1-3.2 \( \mu \) crasse, sursum attenuatae, acuminatis apicibus; conidia oblonga, 3.2-5.5 \( \times \) 1.1-1.4 \( \mu \), tenui mucio tecta, in parvas globosas glebulas 4.3-6.4 \( \mu \) dia. congregata.

Ex larva lepidopteri, Salmon River, Nova Scotia, Sept. 7, 1931, L. E. Wehmeyer (1474).

Synnemata numerous, arising from all parts of the host, slender, irregularly branched, the main stem up to 8 mm long, 52-140 \( \mu \) thick at the base, gradually narrowing upward, up to 3 mm long, 100 \( \mu \) thick at the base, gradually narrowing upward, yellow below, white at angles or slightly obliquely branched, the walls interwoven, minutely roughened, 4-8 \( \mu \), usually from the joints of the body and the appendages, whitish, slender, cylindric, slightly narrowing upward, up to 3 mm long, 100 \( \mu \) thick, simple or occasionally branched above; phialides scattered to crowded, usually several arising from short, one-celled lateral hyphal branches from the outer hyphae of the synnemata, the lower part fusoid-ellipsoid to fusoid-oblong, 8-12 \( \times \) 3 \( \mu \), the upper part prolonged into an attenuated, acuminate sterigma, 10-14 \( \mu \) long, each producing several conidia which adhere together in a persistent mucous; conidia cylindric, rounded at both ends, 3-4 \( \times \) 0.7-1.0 \( \mu \).

On fragments of a larva lepidopteri, Salmon River, Nova Scotia, Sept. 7, 1931, L. E. Wehmeyer (1474).

The much branched \textit{H. ramosa} Lepidoptera.

\textbf{Gibellula formicarinata} Petch

Synnemata sparsa, plerumque, anguste cylindric, hyphis laxis brunneis asperis inferioribus cellulis 3-5 \( \mu \) latis, 4-8 \( \mu \), levibus, hyalinis, globosis phialidum gerentis; phialides sparsae vel 1-3 caespitosae, hyalinae, subulatae, 19.3-36.4 \( \mu \) longae, deorsum 2.1-3.2 \( \mu \) crasse, sursum attenuatae, acuminatis apicibus; conidia oblonga, 3.2-5.5 \( \times \) 1.1-1.4 \( \mu \), tenui mucio tecta, in parvas globosas glebulas 4.3-6.4 \( \mu \) dia. congregata.

Ex larva lepidopteri, Salmon River, Nova Scotia, Sept. 7, 1931, L. E. Wehmeyer (1474).
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thick at the base, gradually narrowing to acuminate apices, light yellow below, white above, the branches numerous, white, at right angles or slightly oblique to the main stem, occasionally producing secondary branches, the hyphae in the stem and branches longitudinal and parallel, multisepate, 2μ wide; phialides hyaline, minutely roughened, subulate, 19.3–36.4μ long, 2.1–3.2μ wide at the base, gradually narrowing to an acuminate apex, scattered on the upper part of the stem and branches giving a setose appearance, arising singly directly from a cell of the outer hypha of the synnema or 1–3 at the apex of short, 6.4–10.7μ, laterally projecting cylindrical hyphae; conidia oblong, 3.2–5.5 X 1.1–1.4μ, covered with a slight mucus, adhering to form small, 4.3–6.4μ, spheroidal chumps.

On fragments of a lepidopterous larva on a mossy log, Salmon River, Nova Scotia, Sept. 7, 1931, L. E. Wehmeyer, 1474, type (Univ. Mich.).

The much branched synnemata and narrow subulate phialides distinguish H. ramosa from other species of Hirsutella infecting Lepidoptera.

Gibellula formicarum sp. nov. (Fig. 2, D & E)

Synnemata sparsa, plerumque ex articulis hospitis erumpentia, albido-brunnea, anguste cylindrica, 1–2 mm. longa, 50–150μ crassa, exterioribus hyphis laxis brunneis asperulatis; conidiophora 50–150μ longa, 2-4-septata, inferioribus cellulis 3-5μ latis, asperulatis, superiore cella obovoida, 7-8 X 4-8μ, levigata, globosum vel cylindricum capitulum prophialidium et phialidium gerentis; prophialides ellipsoideae vel subglobose, 3.5-4.2 X 1.5-2.5μ, quisque paucam phialides gerentem; phialides ovoideae vel cylindraceae, 4-14 X 1.5-2.5μ; conidia hyalina, cylindraceae, 3-4.5 X 1-1.5μ.


Synnemata scattered, arising from various parts of the body and appendages of the host, usually at the joints, very light brown, narrowly cylindric, 1–2 mm. long, 50–150μ thick, composed of longitudinal somewhat interwoven hyphae, the outer, loose, brown, asperulate; conidiophores arising from short lateral prolongations of cells of the outer hyphae, 50–150μ long, 2-4-septate, the lower cells 3-5μ wide, the walls brownish, asperulate, the terminal cell obvoid, 7-8 X 4-8μ, smooth, hyaline, bearing a globose to cylindrical head of prophialides and phialides; prophialides ellipsoid to sub-spherical, 3.5-4 × 2.5-3μ, each bearing several phialides; phialides ovoid to cylindric, 4-14 X 1.5-2.5μ; conidia hyalina, cylindric, rounded at the ends, 3-4.5 X 1-1.5μ.
On ants, along the route Belleyella-Kondessu-Zui, Western Province, Liberia, Dec. 8, 1947, J. T. Baldwin, Jr. (Univ. Mich.). The specimens were included in collections of *Cordyceps australis* (Speg.) Sacco which were received from Dr. Baldwin. The collections were composites collected from several localities. The synnemata of *Gibellula formicarum* were not found associated with clavae of *C. australis* upon the same insect and therefore the ascogenous stage is uncertain. Petch (5) has reported that the conidial stage of *C. australis* is an *Hymenostilbe*.

**LITERATURE CITED**


**EXPLANATION OF FIGURES**

**Fig. 1.** A & B. *Torrubiella pulvinata*. A. Pulvinate mass of mycelium bearing perithecia arising from a leg of the host. ×12. B. Body of a host covered by a mass of mycelium and conidiophores. ×7. C. *Torrubiella confragosa*. Large scale-insects covered with a thin layer of mycelium-bearing synnemata and perithecia. ×4.

**Fig. 2.** A. *Torrubiella liberiana* showing perithecia developing on a small mass of mycelia at the base of an antenna of an ant. ×25. B. *Hirsutella liberiana* showing synnemata arising from a small patch of mycelium on an ant. ×7. C. *Hirsutella ramosa* showing the branched synnemata. ×7. D & E. *Gibellula formicarum*. D. An ant showing the scattered synnemata on various parts of the body. ×7. E. A portion of a synnema showing capitate conidiophores (stained with nigrosin). ×200.