

Some species of *Cordyceps* and its allies on spiders

Y. KOBAYASI* & D. SHIMIZU*

Summary. Four species of *Cordyceps* and *Torrubiella* from Japan are described, including *C. nelumboides* sp. nov., *T. arachnophila* f. *alba* f. nov. and *T. leiopus* stat. nov.

***Cordyceps nelumboides* Y. Kobayasi & Shimizu, sp. nov.**

Mycelia superficiem hospitis contegentia, pulvinata, tomentosa, albida; hyphis hyalinis, 3-4 μm crassis, multiseptatis, irregulariter curvatis. Phialides ex cellulis terminalibus mycelii oriundae, elongatae, attenuatae. Conidia singularia, ovoidea, hyalina, ca 5 \times 3 μm , sine muco. Stroma e parte dorsi hospitis oriundum, singulare, erectum, 5 mm altum. Stipes cylindricus, equalis, carnosus, solidus, 4 mm longus, 0.4 mm crassus, albus, fere levis, cortice destituto; medulla e hyphis hyalinis 3.5-7.5 μm crassis, longitudinally et compacte ordinatis contexta; hyphis superficialibus tenuioribus, 2.5-3 μm crassis, multiseptatis verrucosis. Pars fertilis crasso-discoidea, 2 \times 0.8 mm, flavescens, superficie leviter convexa, ca. 50 papillata, textu interno ut in stipite, superficie e hyphis irregulariter colligatis, sinuatis, 2.5-3 μm crassis composita; superficies lateralis signis pyriformibus ornata, textu e hyphis 3-3.5 μm crassis, distincte verrucosis composito. Perithecia omnino immersa, rectim inserta, fusoido-ellipsoidea vel naviculata, interdum curvata, 535-545 \times 180-190 μm . Asci 400-450 \times 5-6 μm , capitibus 4-4.5 μm diam., articuli ascosporarum ca 5 \times 1 μm . (Fig. 1 & 2.)

Status-conidialis: ut in *Hirsutella* phialidibus in pulvino myceliali positus. Sterigmata longa, tenuia, ad cellulam apicalem hypharum procumbentium apicaliter vel lateraliter producta.

Spider, attached to the frond of *Polystichum tripterum*.

JAPAN. Yamagata Pref., Kakurezawa of Shione River, Mogami-Gun, 11 Aug. 1970, Shimizu (holotype, TNS).

The specific epithet compares the fertile part of the fungus to the receptacle of the lotus.

***Cordyceps cylindrica* Petch** in Trans. Brit. Mycol. Soc. 21: 46 (1937); Mains in Bull. Torrey Bot. Club 81: 495 fig. 3-5 (1954).

Mycelium covering head and abdomen of host, thick, cottony tomentose; hyphae 8.5-12.5 μm , slightly thick-walled, pale brown or almost hyaline, septate, branches extending at right angles, frequently with oblong apical cell (reproductive organ?). *Stroma* single, arising from head of host, fleshy, 3.6 cm long, composed of simple stalk and clavate fertile part. *Stalk* cylindric, equal, soft, fleshy, 2.3 cm long, 2-2.6 mm thick, loosely stuffed, surface pure

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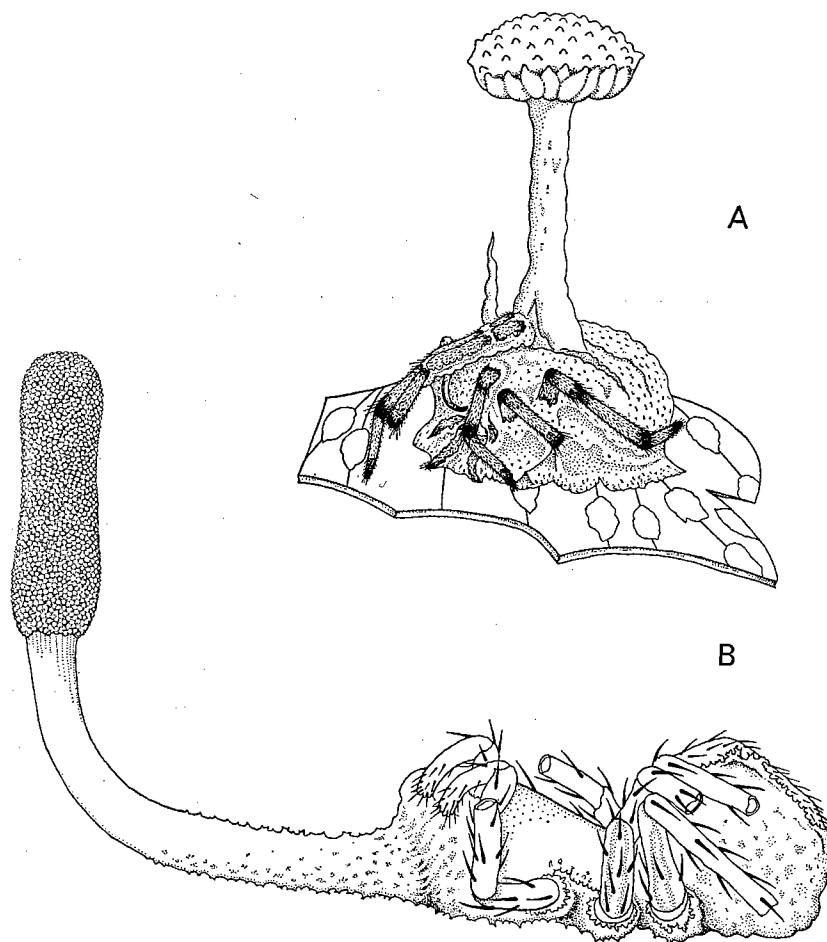


FIG. 1. **A**, *Cordyceps nelumboides*, $\times 8.5$. **B**, *C. cylindrica*, $\times 3$.

white, lower half pubescent, upper half smooth, faintly striate, not glossy; inner tissue soft and loose, then becoming hollow leaving membranous outer layer, without special peridial layer, medullae composed of compact layer of hyaline, septate hyphae, $2.5-4.5 \mu\text{m}$ thick.

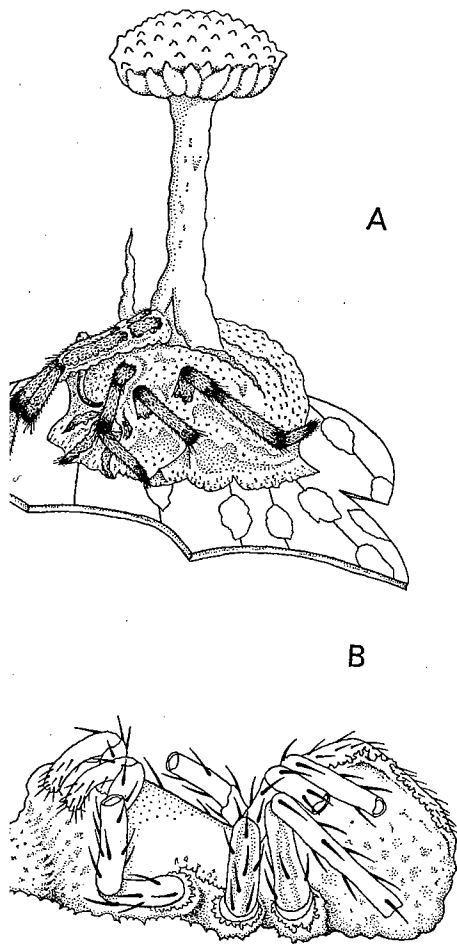
Fertile part abruptly enlarged, cylindric clavate with obtuse end, 1.3 cm long, $3.7-4 \text{ mm}$ thick, covered with densely packed innumerable perithecia, viscid, pale ochraceous, density of ostiolae being 4-6 per mm; inner tissue rather distinct, ca $200 \mu\text{m}$ thick, pale brown, composed of irregularly arranged, densely septate hyphae; interperithecial layer composed of loosely and irregularly running hyphae. *Perithecia* almost immersed, fusiform-elliptical or flask-shaped with long neck, $850-1000 \times 200-225 \mu\text{m}$, wall $10 \mu\text{m}$ thick, ostiola low, obtuse, $125-150 \mu\text{m}$ high. *Asci* $4.5-5.5 \mu\text{m}$ thick, cap $5 \mu\text{m}$ thick. Secondary ascospores $3-4 \times 1.2 \mu\text{m}$, with truncate ends. (Figs. 1B & 3.)



FIG. 2. *Cordyceps nelumbo* section, $\times 19$; **D**, section ascospore; **H**, peridial layer on host-body; **L**, conidia.

Conidial state: p

Trapdoor spider.
JAPAN. Iriomote.
1971, Shimizu & Y.

*C. cylindrica*, $\times 3$.

half smooth, faintly striate, not glossy; forming hollow leaving membranous outer, medullae composed of compact layer of n thick.

clavate with obtuse end, 1.3 cm densely packed innumerable perithecia, ostioles being 4-6 per mm; inner tissue hyphae, 2.5-3 μm thick; peridial layer pale brown, composed of irregularly interperithecial layer composed of loosely *Perithecia* almost immersed, fusiform-; neck, 850-1000 \times 200-225 μm , wall 5-150 μm high. *Asci* 4.5-5.5 μm thick, res 3-4 \times 1.2 μm , with truncate ends.

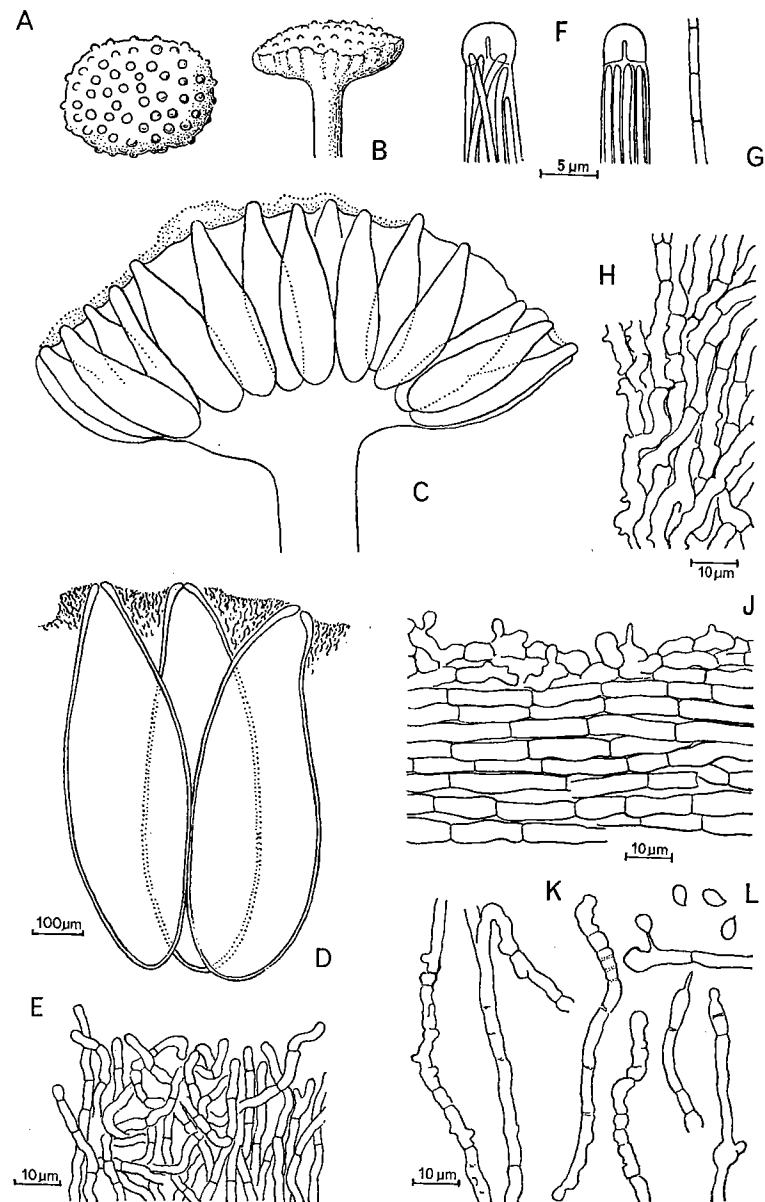


FIG. 2. *Cordyceps nelumboides*. A, upper surface of fertile part, $\times 5.5$; B, side view; C, median section, $\times 19$; D, section through perithecia; E, interperithecial tissue; F, apex of asci; G, ascospore; H, peridial layer of fertile part; J, peridial layer & medulla of stalk; K, mycelium on host-body; L, conidia on mycelium.

Conidial state: probably *Isaria (Paecilomyces) atypicola* Yasuda.

Trapdoor spider.

JAPAN. Iriomote Is., near Kampira Water Fall of Urauchi River, 16 July 1971, Shimizu & Y. Suzuki 01-2 (TNS).

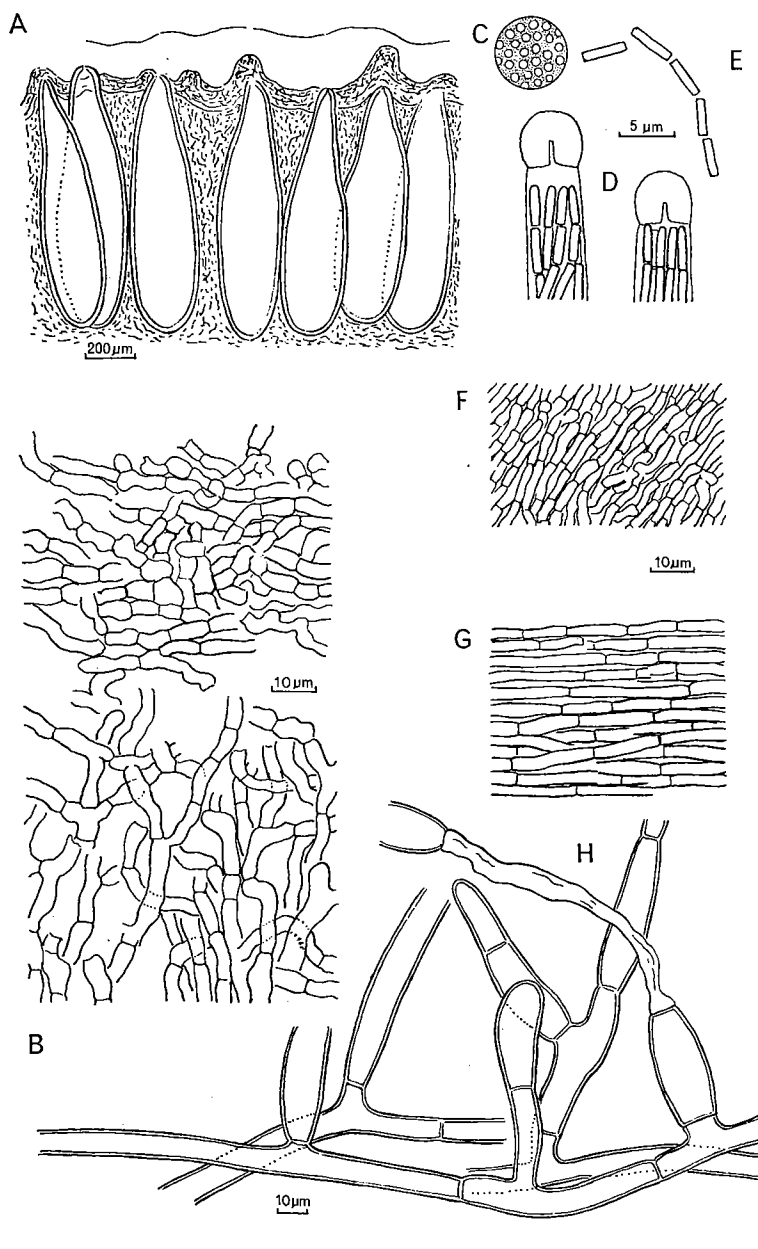


FIG. 3. *Cordyceps cylindrica*. **A**, section through perithecia; **B**, peridial layer and interperithecial tissue of fertile part; **C**, surface view of fertile part showing the density of ostiola; **D**, apex of asci; **E**, secondary ascospores; **F**, medulla of fertile part; **G**, medulla of stalk; **H**, mycelium on host-body.

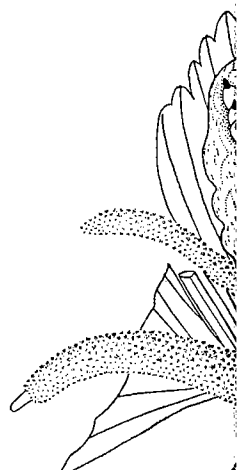


FIG. 4. *Torrubiella arachnophilus*.

The present species was described by D. H. Linder in Trinidad. In the original specimen, the Japanese collector has suggested that *Isaria* writers have also the same species grow on the trap for the fertile part, although verification. It is very interesting that it was first described about forty years ago in

Torrubiella arachnophilus

forma *alba* K. Kobayashi

Mycelium album, perithecia
Cetera ut in typo.

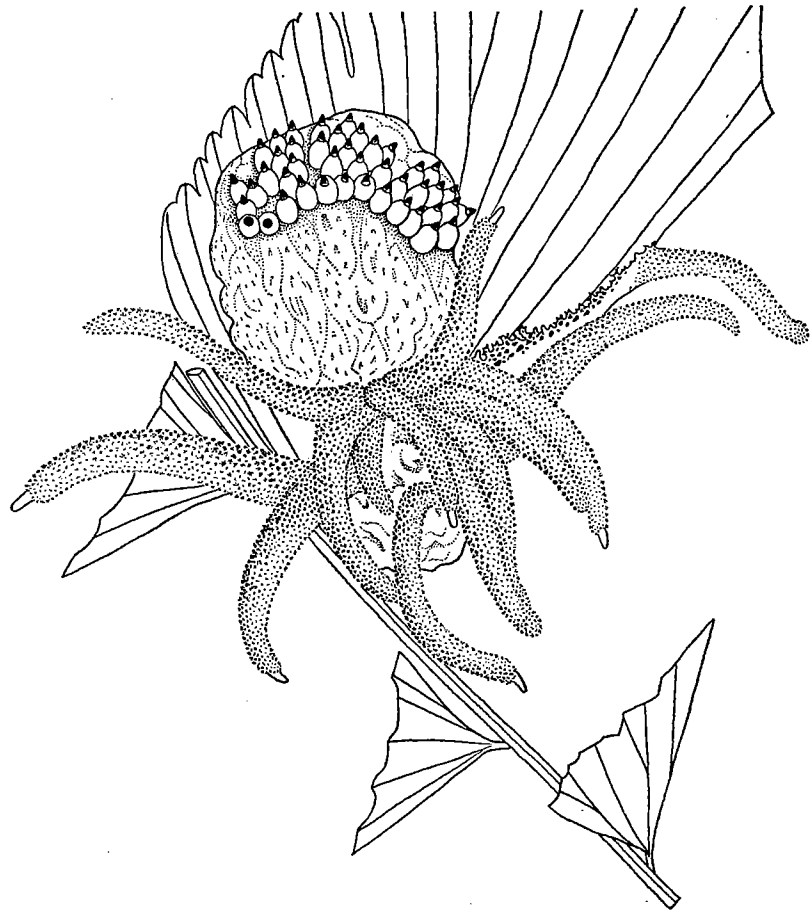
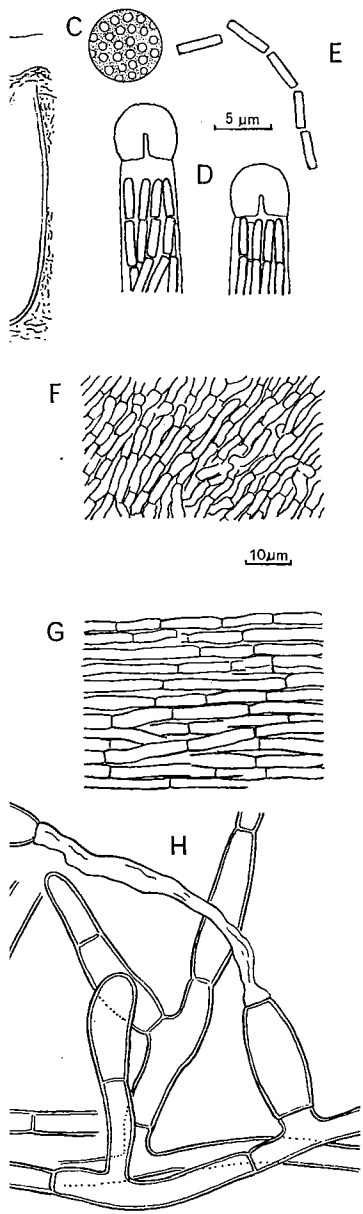


FIG. 4. *Torrubiella arachnophila* f. *alba*, $\times 7.5$.

The present species was published based on a single specimen collected by D. H. Linder in Trinidad. According to his note, the stalk is white with pale yellow-coloured head when fresh. No asci are found. Compared to the type specimen, the Japanese collection produces slightly smaller perithecia. Petch has suggested that *Isaria atypicola* is the conidial stage of *C. cylindrica*, and the writers have also the same opinion since both of these perfect and conidial species grow on the trapdoor spider and have similar fructifications, except for the fertile part, although no attempt has been made at experimental verification. It is very interesting that *Isaria atypicola* had already been found about forty years ago in neighbouring Ishigaki Is.

***Torrubiella arachnophila* (Johnston) Mains** in *Mycologia* 42: 316 (1950).

forma ***alba*** *Y. Kobayasi & Shimizu*, f. nov.

Mycelium album, peritheciis partim immersis in pulvino mycelii albi. Cetera ut in typo.

A, perithecia; B, peridial layer and interperithecial fertile part showing the density of ostioli; D, ostioli of fertile part; G, medulla of stalk; H,

Y. KOBAYASI

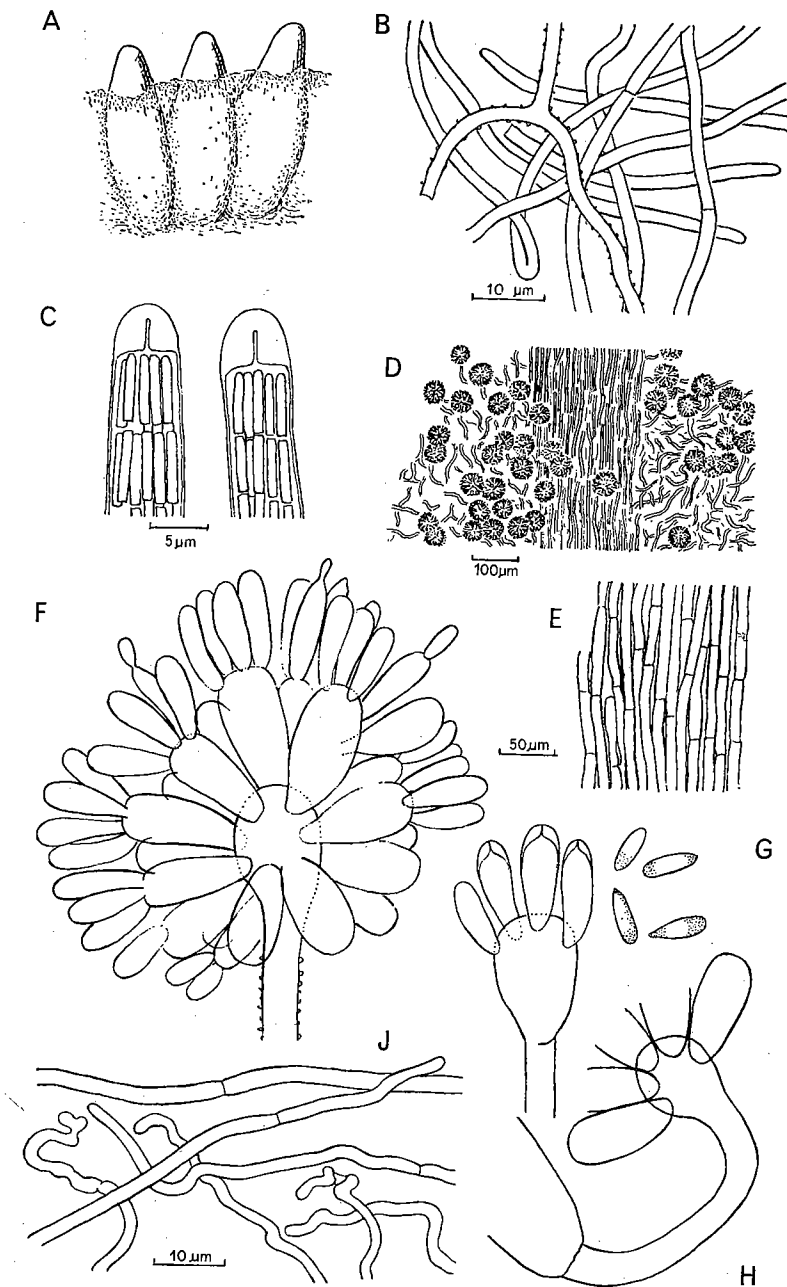
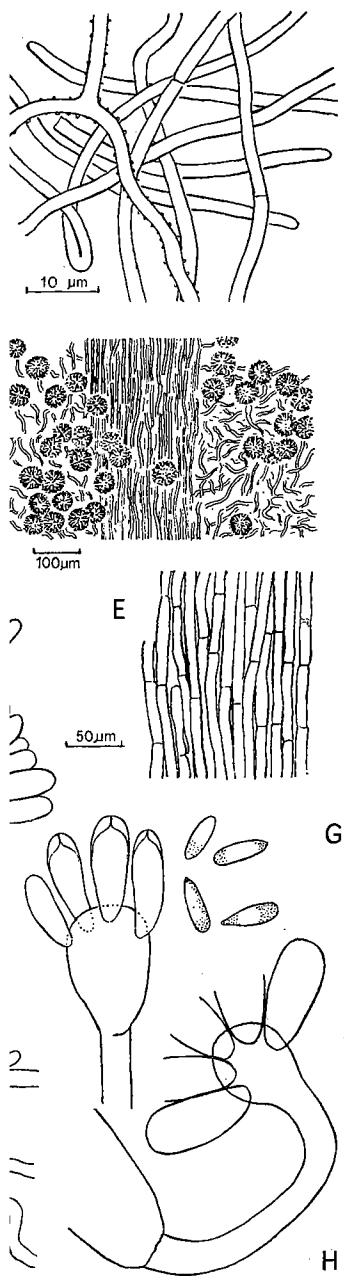


FIG. 5. *Torrubiella arachnophila* f. *alba*. A, perithecia, $\times 23$; B, hyphae covering perithecia; C, apex of asci; D, part of synnema; E, tissue of synnema; F, head of mature sporophore; G, phialids & conidia; H, terminal cell of sporophore; J, mycelium on host-body.

FIG. 6. *Torrubiella leiopus*, \times

Mycelial mat white, extending to leaf surface thick, sinuate, springly; compactly gregarious on the cottony white hyphal mat 250–300 μm in diameter, cinereous, glossy; hyphae septate, 1.5–2.5 μm thick, asperulate. *Asci* 6–7 μm long, ascospores 5–7 \times 1.2–1.5 μm .

Conidial state: *Gibellina* 347 (1894); Mains in M.



A, perithecia, $\times 23$; B, hyphae covering perithecia; C, synnema; D, head of mature sporophore; E, head of mature sporophore; F, head of mature sporophore; G, spores; H, mycelium on host-body.

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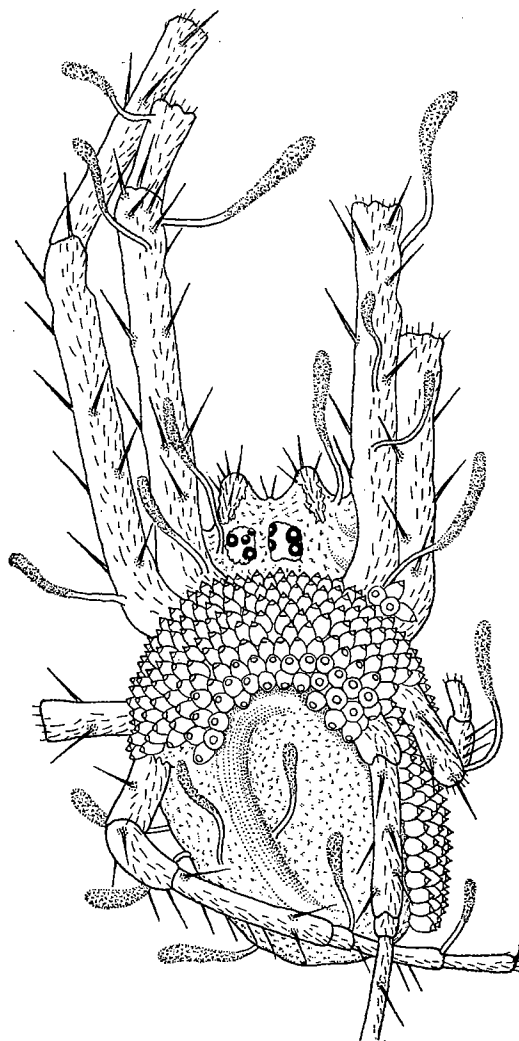


FIG. 6. *Torrubiella leiopus*, $\times 7.5$.

Mycelial mat white, cottony membranous, covering whole host-body, extending to leaf surface as netted membrane; hyphae septate, $1.2-2.5 \mu\text{m}$ thick, sinuate, sparingly septate, dichotomously branched. *Perithecia* compactly gregarious on the abdominal part of host, almost covered with cottony white hyphal tissue, narrowly ovoid to conoid, $1-1.2 \text{ mm}$ long, $250-300 \mu\text{m}$ in diameter; ostiola naked, conical with obtuse end, dark cinereous, glossy; hyphae covering perithecia loosely bound, sparsely septate, $1.5-2.5 \mu\text{m}$ thick, dichotomously branched, frequently finely asperulate. *Asci* $6-7 \mu\text{m}$ thick, with cap $5.5-6 \mu\text{m}$ in diameter. Secondary ascospores $5-7 \times 1.2-1.5 \mu\text{m}$. (Fig. 4 & 5.)

Conidial state: *Gibellula pulchra* (Sacc.) Cavara in Att. 1st. Pavia II, 3: 347 (1894); Mains in Mycologia 42: 317, f. 1-4 (1950).

Synnemata, 10 or more, arising from the dorsal side of cephalothrix of host, diffused or erect-patent, simple cylindric, attenuated, wholly covered with heads of conidiophores, 4–5 mm long, 400–800 μm thick, consisting of fasciculate, septate, 10–15 μm thick hyphae; fertile hyphae along outer surface of synnema, 5–8 μm in diameter, frequently finely asperulate. *Conidiophore* arising as long arm of intermediate cell of fertile hyphae or from the apex of elongate fertile hyphae, cylindric, septate, asperulate, 5–8 μm thick, terminal cell abruptly attenuated, 23–28 \times 3–4 μm , apical part globosely incrassate, 6–8 μm wide, bearing many prophialides and phialides, forming spherical, violaceous heads, 40–50 μm wide. Prophialides obpyriform, 8–12 \times 3–4 μm , bearing several phialides; phialides subcylindric or clavate, 7–10 \times 2–2.5 μm , producing single or catenate conidia; conidia fusiform-ellipsoidal, hyaline, 4–6 \times 1.5–2 μm .

Spider, attached to the frond of *Adiantum pedatum*.

JAPAN. Yamagata Pref., near Ootori Pond, Asahi Range, 23 Sept. 1963, Shimizu 200 (holotypus, TNS).

The typical *T. arachnophila* accompanied with *G. pulchra* has also been found in Japan.

Torrubiella leiopus (Mains) Y. Kobayasi & Shimizu, stat. & comb. nov.

Torrubiella arachnophila (Johnst.) Mains var. *leiopus* Mains in *Mycologia* 42: 318 (1950).

Mycelial mat covering whole host-body except for legs, membranous floccose, citron-yellow, hyphae thin-walled, remotely septate, 2–3 μm thick. *Perithecia* gregarious, compact on dorsal side of host-body, thick ovate with papillate apex, 600–700 \times 300–400 μm , almost covered with cottony citron-yellow hyphae, hyphae irregularly branched, sparsely septate, 2–3 μm thick; ostiola obtuse conoid, glabrous, pale yellowish brown. Cap of *ascus* 4–5 μm in diameter. Secondary ascospores 5–9 \times 1–1.5 μm , truncate at both ends. (Fig. 6 & 7.)

Conidial state: *Gibellula leiopus* (Vuill.) Mains in *Mycologia* 42: 318, f. 7–12 (1950) (*Gibellula arachnophila* f. *leiopus* Vuill. apud Maubl. in *Bull. Soc. Mycol. Fr.* 36: 42 (1920)).

Synnemata scattered, arising from mycelial mat and legs of host, cylindric simple, 2–4 mm long, 200–300 μm thick, stalk slender 100–130 μm thick, pale yellowish, fertile part clavate with tufted surface, violaceous; medulla 170–250 μm thick, consisted of hyphae longitudinally and compactly arranged, septate, 2.5–3 μm in diameter. Fertile hyphae loosely attached to surface of synnema, closely septate, frequently asperulate, 2–4 μm thick. *Conidiophore* arising as a lateral arm of intermediate cell of fertile hyphae or on the apex of them, short clavate, obpyriform or rarely cylindric and septate, 11–17(–25) \times 3–6 μm , bearing prophialides and phialides, forming wedge-shaped, violaceous head, 25–40 μm thick in side view. Prophialides, several on conidiophore, obovate or fusiform-elliptical, 9–11 \times 3–4 μm ; phialides 3–5 on prophialide, subcylindric or clavate, 9–10 \times 2.5 μm , wall slightly thickened toward apex; conidia singly or in chain on phialide, elliptic fusiform, 5–6 \times 1.2–2 μm .

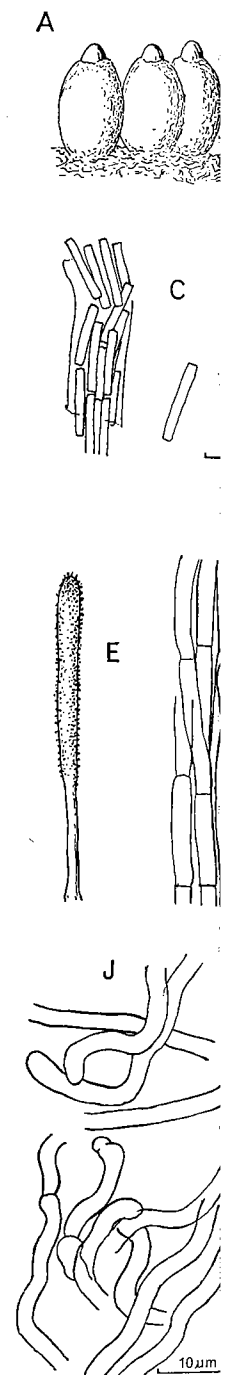


FIG. 7. *Torrubiella leiopus*. A, heads of mature conidiophores; B, secondary ascospores; C, synnema; D, detail of synnema; E, detail of synnema; F, detail of synnema; G, detail of synnema; H, detail of synnema; I, detail of synnema; J, detail of synnema.

; from the dorsal side of cephalothrix of host, sterile cylindrical, attenuated, wholly covered with sterile hyphae; fertile hyphae along outer margin, 10–15 μm long, 400–800 μm thick, consisting of thick hyphae; fertile hyphae along outer margin, 10–15 μm in diameter, frequently finely asperulate. Sterile hyphae of intermediate cell of fertile hyphae or sterile hyphae, cylindrical, septate, asperulate, abruptly attenuated, 23–28 \times 3–4 μm , apical 10–15 μm wide, bearing many prophialides and lanceolate heads, 40–50 μm wide. Prophialides bearing several phialides; phialides subcylindrical, 5 μm long, producing single or catenate conidia; conidia, 4–6 \times 1.5–2 μm .

on *Adiantum pedatum*.

Ootori Pond, Asahi Range, 23 Sept. 1963,

accompanied with *G. pulchra* has also been found

by *Kobayasi & Shimizu*, stat. & comb. nov.

Mains var. *leiopus* Mains in *Mycologia* 42:

on host-body except for legs, membranous, thin-walled, remotely septate, 2–3 μm thick. Sterile hyphae on dorsal side of host-body, thick ovate with diameter 400 μm , almost covered with cottony mycelium, regularly branched, sparsely septate, 2–3 μm thick, brown, pale yellowish brown. Cap of *ascus* containing 8 ascospores 5–9 \times 1–1.5 μm , truncate at apex.

(Vuill.) Mains in *Mycologia* 42: 318, 1950. *leiopus* f. *leiopus* Vuill. apud Maubl. in *Bull.*

on mycelial mat and legs of host, cylindrical, 10–15 μm thick, stalk slender 100–130 μm thick, with tufted surface, violaceous; medulla of sterile hyphae longitudinally and compactly attached to substrate. Fertile hyphae loosely attached to substrate, frequently asperulate, 2–4 μm thick. Sterile hyphae of intermediate cell of fertile hyphae or sterile hyphae, ovate, obpyriform or rarely cylindrical and bearing prophialides and phialides, forming heads, 40–50 μm thick in side view. Prophialides, cylindrical or fusiform-elliptical, 9–11 \times 3–4 μm ; phialides, cylindrical or clavate, 9–10 \times 2.5 μm , wall 0.5 μm thick, producing conidia singly or in chain on phialide,

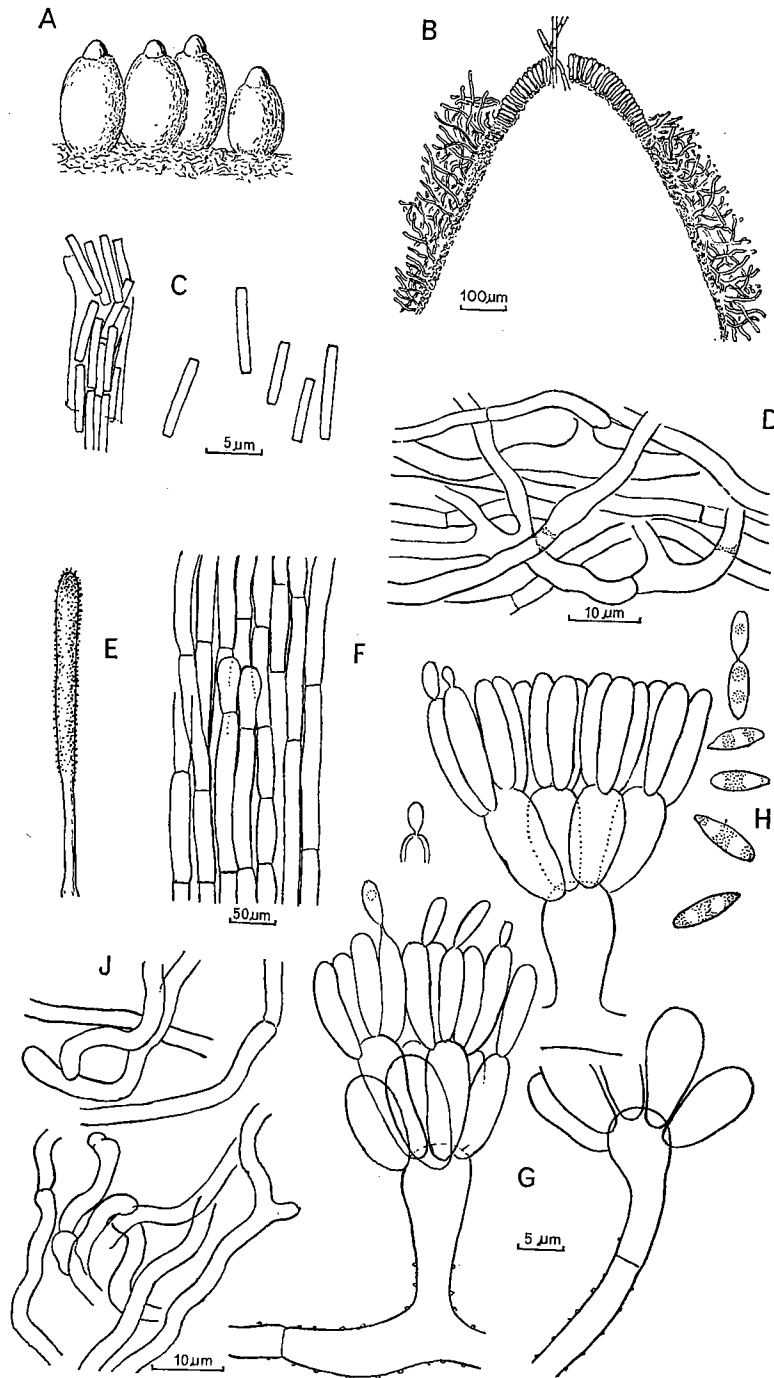


FIG. 7. *Torrubiella leiopus*. A, perithecia, \times 21; B, section through upper part of perithecia; C, secondary ascospores; D, hyphae covering perithecia; E, synnema, \times 15; F, tissue of synnema; G, heads of mature sporophore; H, conidia; J, mycelium on host-body.

Small spider.

JAPAN. Niigata Pref., along Shikamata River, Kurokawa-mura, 7 Aug. 1966, Shimizu 188 (TNS).

Torrubiella leiopus is separated from *T. arachnophila* by the shape and size of the perithecia and the wedge-shaped head of the conidiophore.

Summary. *Typhula chamaem*
Phaeonaevia gen. nov. w
described from cloudb

Rubus chamaemorus,
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During the last ye
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Typhula chamaem

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matica, e hyphis par
8(-15) mm altus, 0.1
decrementibus, vulg
clavula subcylindrica,
claviformia, 25-30 ×
Sporae oblongae, hy
petiolis venisque folio
Fig. 1A.)

* Institute for Systematic