

Revision of the Hypocreales with Cultural Observations  
VII. The Genus *Hypocrea* and its allied Genera  
in South America (1)

By

Yoshimichi DOI

Department of Botany, National Science Museum, Tokyo

The South American Hypocreales seems to be very important not only for the infrageneric classification of each genus of the order, as indicated by THEISSEN (1911) in *Hypocrea*, but also for the systematics of the Hypocreales.

For the genus *Hypocrea* and its allied genera of South America, about 80 species have been reported mainly by the following authors. SPEGAZZINI (1881–1926) reported more than ten species including eight new species from Argentine, Paraguay and Brazil, and STARBÄCK (1889–1905) six species from Argentine and Brazil. PATOULLARD and GUILLARD (1888) reported six species from Venezuela, and PATOULLARD and LAGERHEIM (1892, 1893) five species from Ecuador. SYDOW *et al* (1907, 1930) and DENNIS (1970) reported about 25 species in total from Venezuela and adjacent regions. MONTAGNE (1856), BRESADOLA (1896, 1920), REHM (1898, 1911), MÖLLER (1901), HENNINGS (1893–1904), RICK (1906) and THEISSEN (1910, 1911) reported about 40 species of *Hypocrea* and its allied genera from Brazil.

Nevertheless, *Hypocrea* of South America includes many species still undescribed as is the same in the other genera of the Hypocreales, and the conidial states of almost all species of the order of South America have not yet been studied except in cases of a few species described and illustrated by MÖLLER (1901).

As for the classification of the genus *Hypocrea*, THEISSEN (1911) proposed six infrageneric taxa mainly on the basis of the species of the southern districts of Brazil. Those six taxa were distinguished by the presence or absence of subicula or stroma, and the developmental characters of subicula or stroma. Nowadays his six infrageneric taxa are generally treated as three or five genera in the Hypocreales (DOI, 1969; ROGERSON, 1970).

In 1973 the present writer had a chance to collect the fungi of South America mainly in Colombia and he had also a chance to visit some herbaria in South America and examined the specimens of the Hypocreales preserved there.

This paper deals with 22 species of the genus *Hypocrea* and its allied genera, *Pseudohypocrea*, *Thuemenella* and *Podostroma*, on the basis of the writer's collection and the specimens in the herbaria of FITO, IMI, K, LPS, NY, and SP.

The arrangement of the genus *Hypocrea* and its allied genera and the infrageneric

classification of the genus *Hypocrea* in this paper conform to the writer's (Doi, 1969, 1972).

The writer wishes to express his sincere thanks to Prof. J. M. IDROBO of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia (COL), Dr. J. C. LINDQUIST and Dr. I. J. GAMUNDI of the Instituto de Botanica C. SPEGAZZINI, Museo de La Plata (LPS), Prof. J. E. WRIGHT of the Universidad Nacional de Buenos Aires (BAFC), Dr. A. R. TEIXEIRA, the Director, Dr. A. I. MILANEZ, Dr. O. FIDALGO and Dr. J. S. FURTADO of the Instituto de Botanica, São Paulo (SP), Dr. O. PARADELA of the Instituto Agronomico, Campinas, Brazil (FITO), Dr. C. T. ROGERSON and Dr. K. P. DUMONT of the New York Botanical Garden (NY), for their kind helps during the writer's stay in their Institutions.

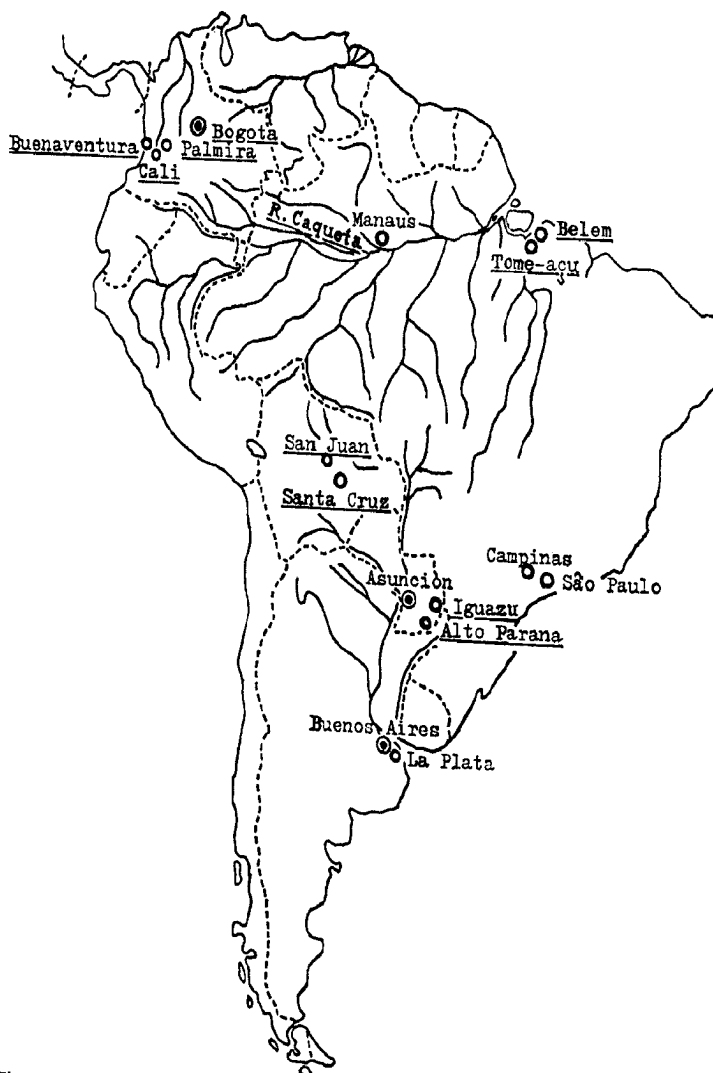


Fig. 1. Localities of the writer's collection (underlined place) in South America.

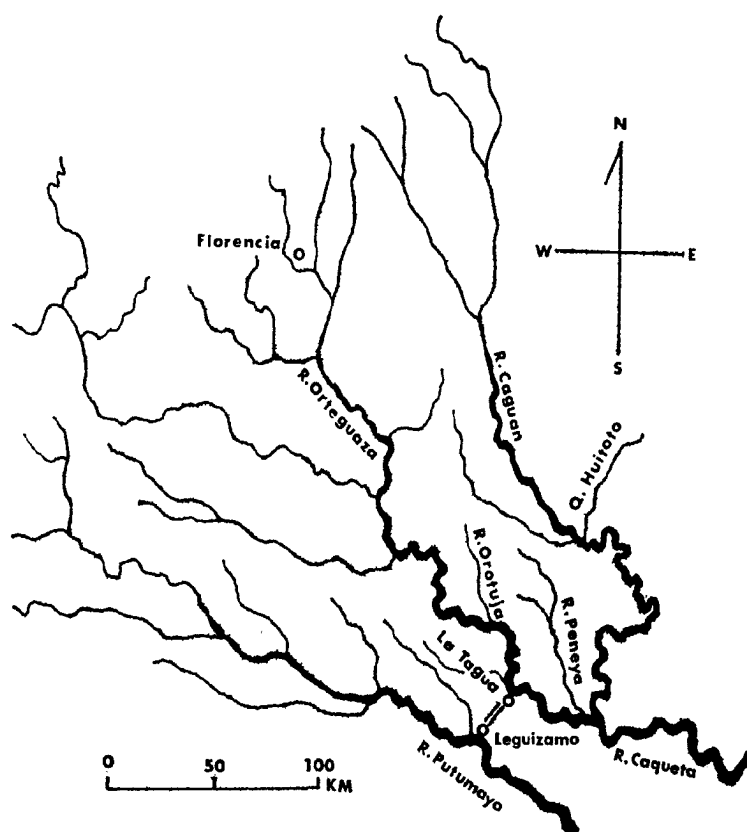


Fig. 2. Map of the region of Rio Caqueta, Colombia.

The following persons kindly helped the writer during his field works in South America: the Commander of the Navy of Colombia at Leguizamo, Putumayo, Colombia; the Director of SAJA, Palmira, Colombia; and Dr. K. IZAWA from the Japan Monkey Center, who was the generous field companion and helped the writer in many ways. Miss H. MUTŌ helped the writer in isolating and making cultures of many strains in Tokyo, and the writer is very much indebted to her.

The writer is also indebted to Dr. R. W. G. DENNIS of the Herbarium of the Royal Botanic Gardens, Kew (K), to Dr. C. BOOTH and Dr. D. L. HAWKSWORTH of the Commonwealth Mycological Institute (IMI), to Dr. E. J. H. CORNER of the Botany School of Cambridge University, to Miss DINGLEY of the Department of Scientific and Industrial Research, New Zealand (PDD), and to Dr. R. SANTESSON and Dr. L. HOLM of the University of Uppsala (UPS), for their kindness in sending many important specimens on loan to the writer.

All of the specimens collected by the writer in Colombia are kept in TNS, and the duplicates in the Herbarium of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia (COL).

Gen. *Hypocrea* FR. Subgen. *Hypocrea*  
Sect. *Homalocrea* (SACC.) DOI Subsect. *Citrinae* DOI\*

1. *Hypocrea protocitrinoides* sp. nov.

Stromata effusa, subcitrina, usque ad  $5 \times 10 \text{ cm}^2$ , 0.15–0.3 mm crassa, texturis stromatarum interiorum superficialiumque intricatis sparsis. Perithecia subgloboso-obovata, 120–150  $\mu$  in diametro verticali. Ascus 16-partosporus, partosporis hyalinis, verrucosis; partosporis distalibus subgloboso-obovatis,  $3.4\text{--}5.0 \times 2.7\text{--}3.0 \mu$ ; partosporis proximalibus obovato-subcylindricis,  $4.5\text{--}5.0 \times 2.2\text{--}2.7 \mu$ .

Str. effuse, pale lemon-yellow, dotted with brown ost., almost white and byssoid in younger stages, up to  $5\text{--}10 \text{ cm}^2$ , sometimes confluent, thin, 0.15–0.3 mm thick. In vertical section t.o.s.s. of *t. intricata*, a little more compactly interwoven than that of

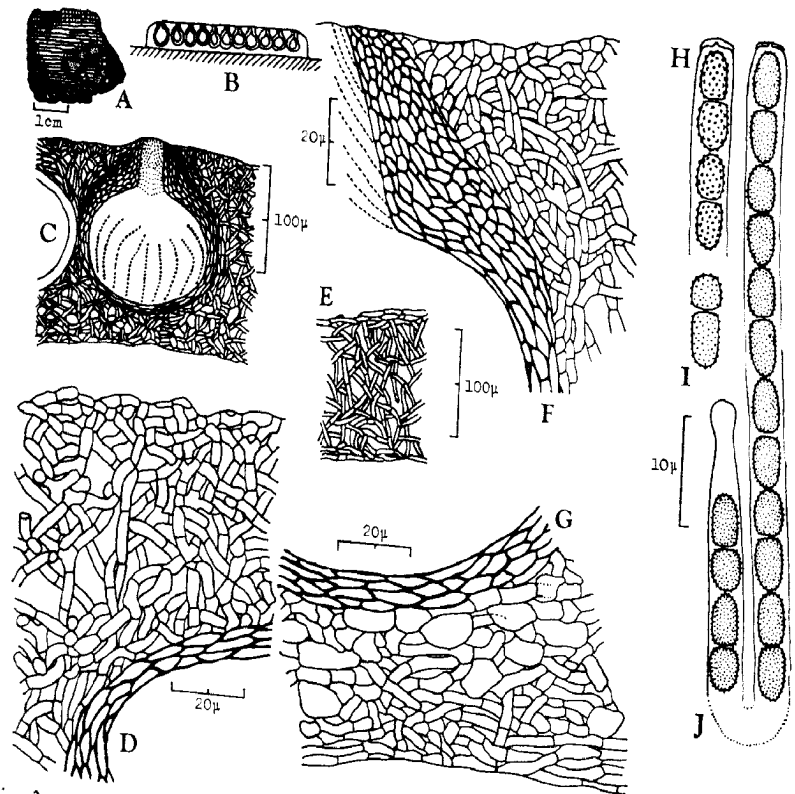


Fig. 3. *Hypocrea protocitrinoides* sp. nov. (TNS-F-224811, holotype) A. Habit. B–G. Vertical sections of stroma. H–J. Ascus and p.sp.

\* In the description of species, some general terms are abbreviated as follows: alt.=altitude; a.sp.=ascospore(s); diam.=diameter(s); "the distal" or "the proximal"=the partspores at distal side or proximal side of ascus, respectively; Hab.=Habitat; inn.t.=inner tissue of stroma; ost.=ostiole(s); perith.=perithecium (-ia); p.sp.=part-spore(s); st.conid.=status conidiis; str.=stroma(ta); t.=textura in Latin or tissue(s); t.o.s.s.=tissue of the surface of the stroma on which perithecial ostioles are situated.

inn.t., pale yellow-colored. Hyphae of t.o.s.s. slender, thin-walled,  $2.3\text{--}3.5\ \mu$  in diam., accompanying with a few swollen hyphae  $5\text{--}8\ \mu$  in diam. In younger stages t. of str. indistinguishable from subicula of the genus *Protocrea*. Perith. subglobose-ovate, with thickened t. around ost. and upper portions of perith.,  $120\text{--}150\ \mu$  in vertical diam. Ost. scarcely project from str. Ascus containing 16 p.sp. P.sp. hyaline, coarsely and sparsely warted; the distal subglobose-ovate or elongated-ovate,  $3.4\text{--}5.0 \times 2.7\text{--}3.0\ \mu$ ; the proximal obovate-subcylindrical,  $4.5\text{--}5.0 \times 2.2\text{--}2.7\ \mu$ .

*Hab.* On decayed leaf-stalks of *Palm* on the ground of tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, about 350m alt., 25–28, VII-1973, Y. Doi (D. 1582=TNS-F-224811).

*Note.* This species resembles *Hypocrea protocitrina* Doi known from Japan (Doi,

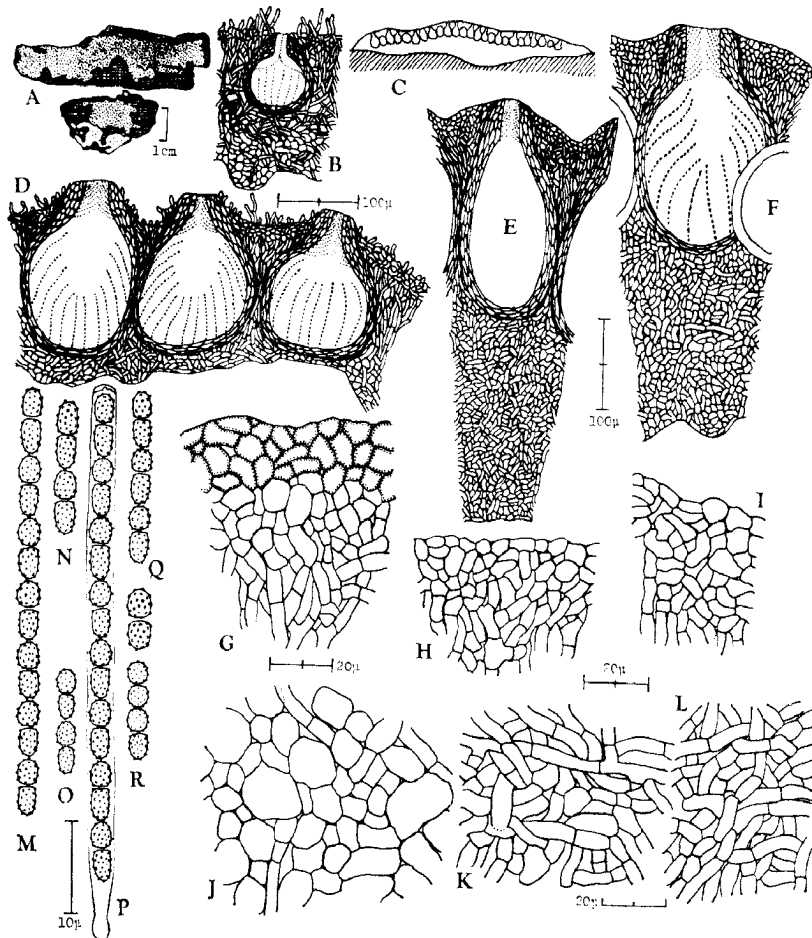


Fig. 4. *Hypocrea corticioides* SPEG. A. Habit. B-F. Vertical sections of stroma (B,D. TNS-F-224997; E. LPS 1719 bis, [holotype]; F. under *Hypocrea flava* in NY). G-I. Vertical sections of t.o.s.s. (G. under *H. flava* in NY; H. TNS-F-224997; I. LPS 1719 bis). J-L. Vertical sections of inner tissue of stroma (J. under *H. flava* in NY; K. TNS-F-224997; L. LPS 1719 bis). M-R. Ascus and p.sp. (M,O. TNS-F-224997; N,P. under *H. flava* in NY; Q,R. LPS 1719 bis).

1972) in the external appearance and the tissue-type of str. and shape of p.sp. But the present fungus is different from the latter mainly in the larger and more coarsely warted p.sp.

This species also resembles *Hypocrea corticioides* SPEG. in the effuse str., but it has more loosely interwoven tissue-type of str. and larger p.sp. than *H. corticioides*.

### 2. *Hypocrea corticioides* SPEG.

Anal. Mus. Nac., Buenos Aires, 23: 75 (1912).

Str. broadly effuse, thin, 0.2–0.5 mm thick, pale lemon-yellow, pale cream-brown in well matured portions, brown or dark brown in overmatured portions of dried specimen, roughened with brown perithecial protuberances and dotted with dark brown, slightly projected ost.; interperithecial portions pale ochre-brown. In vertical section t.o.s.s. of *t. intricata* close to *t. globulosa*. Hyphae of t.o.s.s. as thick as those of inn. t. or slightly thick-walled and pale yellow-colored especially in well matured str., 3–8  $\mu$  in diam. Inn. t. of *t. intricata*; hyphae of inn. t. compactly interwoven, sparsely interwoven at the younger stages, swollen, constricted at the septa, 4–20  $\mu$  in diam. Perith. obovate, with more or less projected ost., 180–210  $\mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. hyaline, coarsely and sparsely warted; the distal subglobose-obovate, 2.3–3.3  $\times$  2.2–2.8  $\mu$ ; the proximal obovate-subcylindrical, 2.8–3.7  $\times$  2.0–2.5  $\mu$ .

*Hab.* On barks of trees in temperate to tropical climates.

*Holotype*. S/. *Erythrina crista-galli*, Entre Rios, Ibicuy, 28–VI–1911, C. SPEG., no. 911 (LPS 1719 bis).

*Other specimens examined*. Rio Peneya, Caqueta, Colombia, 25–28, VII–1973, Y. DOI, (D.1775=TNS-F-224997); data of locality absent, RICK, under *Hypocrea flava* P. HENN. (NY).

*Note*. This species resembles *Hypocrea ustulinoides* RICK ex LLOYD in the appearances of str. and tissue-types of t.o.s.s., but it is different from the latter by far larger p. sp. and thick-walled hyphae of stromatal tissue below perith.

### 3. *Hypocrea ustulinoides* RICK ex LLOYD

Mycological writings 7: 1257, Plate 277, fig. 2730 (1924).

Str. effuse with irregularly incurved margins, up to 1  $\times$  2 cm<sup>2</sup>, thin, generally 0.3–0.5 mm or sometimes up to 0.7 mm thick, pale yellow, ochre to pale ochre-brown with dark ost. In vertical section t.o.s.s. of *t. intricata*, almost the same with inn.t. Hyphae of t.o.s.s. remaining filamentous elements, thin-walled, pale yellow, 2–6  $\mu$  in diam. Inn. t. of *t. intricata*; t. above perithecial zone composed of sparse, slender, thin-walled hyphae 3–5  $\mu$  diam.; t. below perithecial zone composed of compactly interwoven hyphae; the hyphae slightly thick-walled, swollen, constricted at the septa, 5–18  $\mu$  diam. Perith. subglobose, yellow or pale brown, 180–280  $\mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. hyaline, verrucose; the distal subglobose-obovate, (4.2)–5.2–5.6–(7.0)  $\times$  (4.0)–4.4–4.8–(5.0)  $\mu$ ; the proximal obovate-subcylindrical, (4.5)–5.0–6.2–(7.1)  $\times$  (3.3)–4.0–4.4–(4.8)  $\mu$ .

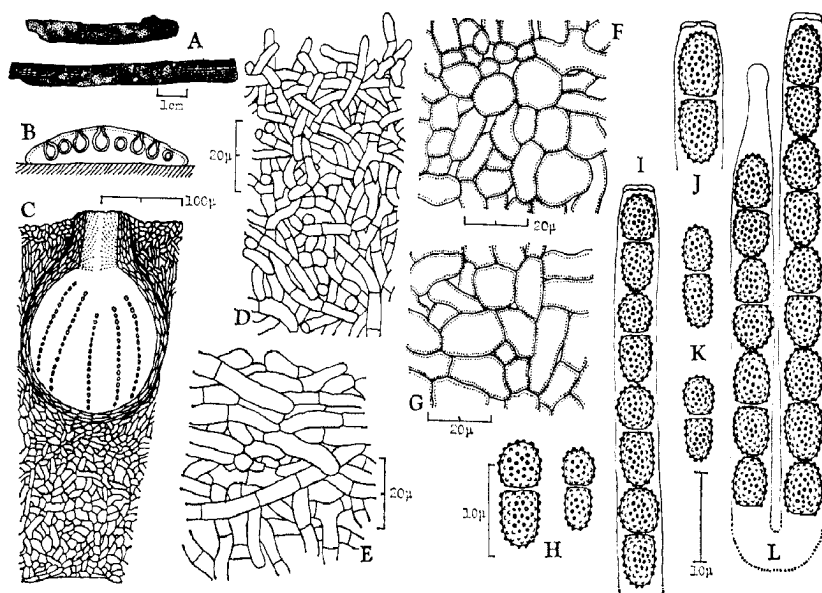


Fig. 5. *Hypocrea ustulinoides* RICK ex LLOYD. A. Habit. B,C. Vertical sections of stroma. D,E. Vertical sections of t.o.s.s. (D. TNS-F-224937; E. Specimen in NY). F,G. Vertical sections of inner tissue of stroma (F. TNS-F-224937; G. in NY). H-L. Asci and p.sp. (H, I. in NY; J, K, L. TNS-F-224937).

*Hab.* On decayed branchlets in subtropical and tropical climates.

*Specimens examined.* Rio Peneya, Caqueta, Colombia, 25-28, VII-1973, Y. DOI (D. 1715=TNS-F-224937); W 42 NT 23, RICK (NY).

*Notes.* (1) The size of perith. and hyphae of t.o.s.s. are somewhat variable; for instance, perith. are 180-220  $\mu$  in vertical diam. and hyphae of t.o.s.s. are 2-3  $\mu$  in diam. in TNS-F-224937; and perith. 250-280  $\mu$  in vertical diam. and hyphae of t.o.s.s. 5-6  $\mu$  in diam. in RICK's specimen in NY. These variations are considered to be within the limitation of the species. (2) This species was first published by LLOYD with a short English description. According to STEVENSON and CASH (1936), the Latin diagnosis made by RICK is filed together with the specimen no. 6094 at LLOYD Mycological Collections (BPI), which may be considered as the holotype.

#### 4. *Hypocrea flavo-miniata* BRES. ex THEISS.

Ann. Mycol. 8: 457 (1910).

*Str.* pale cream-carnose in fresh materials, pale brown with dark ost. in dried specimens, effuse, comparatively thick, 0.5-1.5mm thick. In vertical section t.o.s.s. of *t. intricata* composed of two layers; t. of the outer layer almost the same with inn. t., composed of sparsely interwoven, thin-walled hyphae of 3-4  $\mu$  in diam.; the inner layer of *t. intricata* close to *t. epidermoidea*; hyphae of the inner layer thick-walled, compactly interwoven, 4-6  $\mu$  in diam. Inn.t. of *t. intricata*. Hyphae of inn.t. rather compactly interwoven, comparatively slender, 4-8  $\mu$  in diam. Perith. obovate, 240-

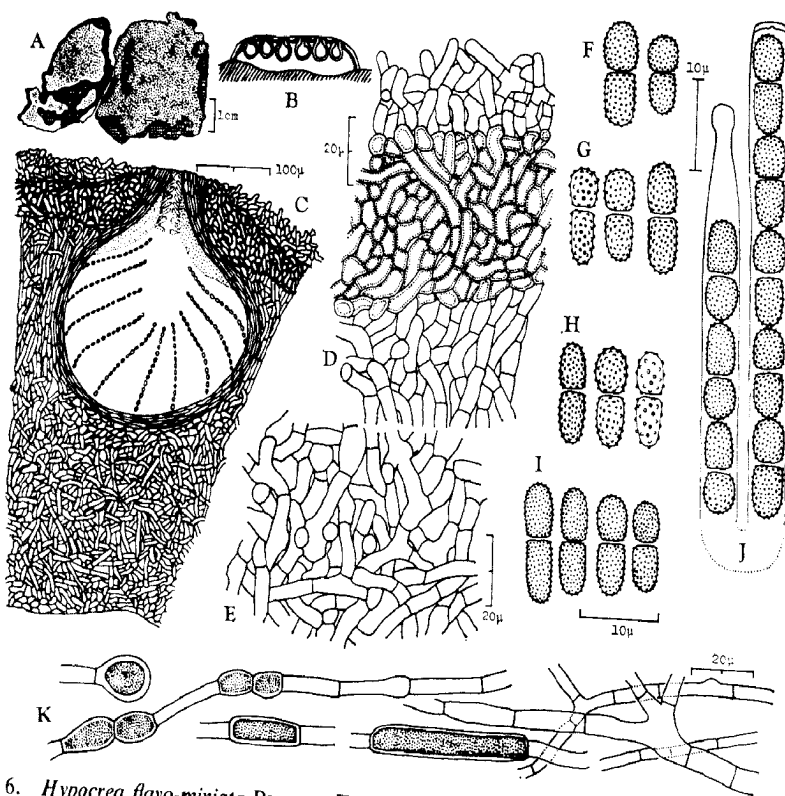


Fig. 6. *Hypocrea flavo-miniata* BRES. ex THEISS. A. Habit. B,C. Vertical sections of stoma. D. Vertical section of t.o.s.s. E. Vertical section of inner tissue of stroma. F-I. P.sp. (F,J. TNS-F-224759; G. SP 22641; H. SP 22647 [isotype]; I. Isotype in NY). K. Hyphae and chlamydospore-like cells in culture (TNS-F-224759).

280  $\mu$  in vertical diam. Ascus containing 16 p.sp. P. sp. hyaline, finely echinulate to minutely and sparsely warted; the distal subglobose-obovate, 4.0-5.6  $\times$  4.0-4.3  $\mu$ ; the proximal obovate-subcylindrical, 4.5-6.5  $\times$  3.3-3.9  $\mu$ .

*Hab.* On decayed woods in subtropical or temperate climates.

*Isotypes.* São Leopold, Rio Grande do Sul, Brasil, J. RICK in 1904 (SP 22647, NY).

*Other specimens examined.* Golondrina, near Cali, Valle, Colombia, about 1,500 m alt., 27-28, VI-1973, Y. DOI, (D. 1539=TNS-F-224759); São Leopold, Rio Grande do Sul, Brasil, J. RICK in 1907, under *Hypocrea flava* P. HENN. (SP 22641).

*Culture\**. The following descriptions were taken from the cultures of TNS-F-224759. Growth rapid, aerial hyphae dense, white, later pale cream-colored. Conidial state not observed. Chlamydospore-like cells more or less present on submerged hyphae in aged cultures, globose to irregularly shaped, 10-30  $\times$  7-15  $\mu$ . Reversed sides of colonies pale brown.

\* For making cultures a single ascus containing p.sp. was picked up with micromanipulator and incubated in malt-agar media of slant tubes at room temperature (18-28°C).



*Notes.* (1) Specimens SP 22647 (isotype) and SP 22641 have rather sparsely warted p.sp.; on the other hand, the specimens of NY (isotype) and TNS-F-224759 have minutely and densely echinulated p.sp. Such variation is considered to be within the limit of one species. (2) T.o.s.s. of this species shows the two layered tissue-type, which is also observed often in *Hypocrea pseudostraminea* Doi (Doi, 1972) and in *Hypocrea subflavominiata* (see below). (3) The cultural characteristics of the species well resemble those of *Hypocrea lactea* (FR. ex FR.) FR. reported by Doi (1972). (4) The specimens of this species indicated as "tipo" or "type" seem to have been distributed in several herbaria. Although the writer has not examined the specimen of the species in Fungi Rickiani, the holotype should be designated to the specimen of Fungi Rickiani kept in the Herbarium Anchieta, Porto Alegre, Brazil (PACA).

#### 5. *Hypocrea subflavominiata* sp. nov.

Stromata effusa, citrina, in sicco ochraceo-brunnea, usque ad  $2 \times 3 \text{ cm}^2$ , 0.4–0.6 mm crassa, texturis superficiebus stromatarum intricatis, bistratis; texturis stratarum exteriorum quasi eadem ac texturarum interiorum; texturis stratarum interiorum similis texturarum epidermoidium. Perithecia subglobosa, 220–250  $\mu$  in diametro verticali.

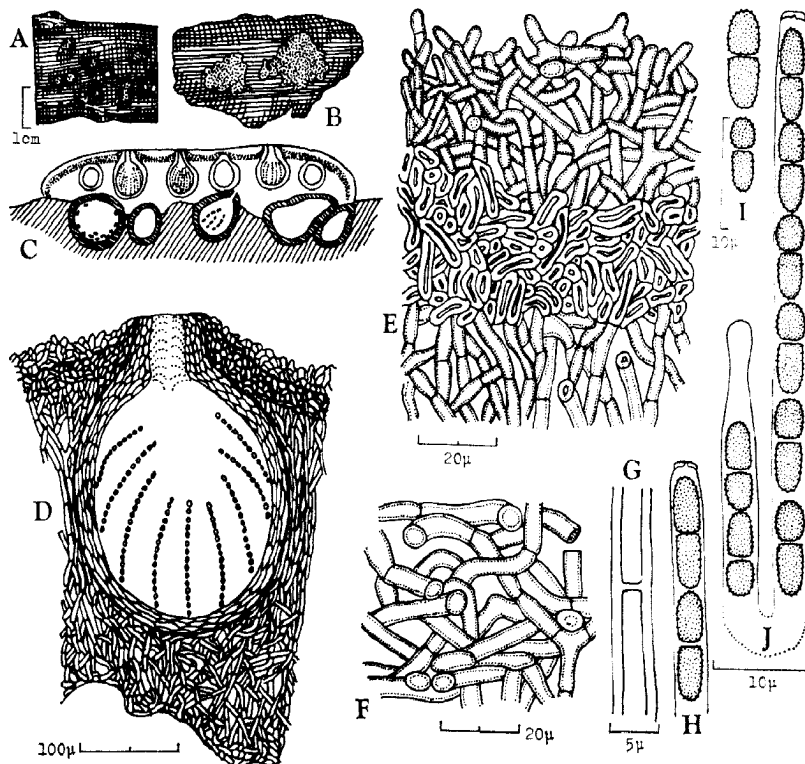


Fig. 7. *Hypocrea subflavominiata* sp. nov. (TNS-F-224935, holotype). A, B. Habits. C, D. Vertical sections of stroma. E. Vertical section of t.o.s.s. F. Vertical section of inner tissue of stroma. H–J. Ascii and p.sp.

Ascus 16-partosporus. Partosporae hyalinae vel subflavae, echinulatae; partosporis distalibus subgloboso-obovatis, generaliter  $3.0-4.6 \times 2.6-3.2 \mu$ ; partosporis proximalibus obovato-subcylindricis,  $3.7-4.8 \times 2.1-3.8 \mu$ .

Str. lemon-yellow in fresh, ochre-brown in dried specimens, effuse, up to  $2 \times 3 \text{ cm}^2$ , thin, 0.4-0.6 mm thick. In vertical section t.o.s.s. of *t. intricata*, composed of different two layers; t. of the outer layer almost the same with inn.t., composed of hyaline, thick-walled and slender hyphae  $3.0-3.5 \mu$  in diam.; t. of the inner layer close to *t. epidermoidea* composed of compactly interwoven, strongly thick-walled, yellow-colored hyphae  $3.0-3.5 \mu$  in diam. Inn. t. of *t. intricata*. Hyphae of inn. t. sparsely interwoven, hyaline, slender, thick-walled,  $3-6 \mu$  in diam. Perith. subglobose,  $220-250 \mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. hyaline, minutely echinulate; the distal subglobose-obovate, generally  $3.0-4.6 \times 2.6-3.2 \mu$ , sometimes more elongated, up to  $5.3 \mu$  long; the proximal obovate-subcylindrical,  $3.7-4.8 \times 2.1-3.8 \mu$ .

*Hab.* On other fungi or neighbouring decayed woods in tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, 25-28, VII-1973, Y. DOI (D.1713=TNS-F-224935).

*Note.* Although this new species resembles *H. flavo-miniata* BRES. ex THEISS. in the tissue-type of str. and shape of p.sp., it is different from the latter species in prominently thick-walled hyphae of str., and smaller size of p.sp.

#### Sect. Homalocrea (SACC.) DOI Subject. Pulvinatae DOI

##### 6. *Hypocrea impressa* MONT.

Syll. gen. spec. Crypt. 210 (1856).

Str. disperse, irregularly pulvinate, ochre to grayish brown, pale ochre in young stages, with distinct protuberances of perith. in rows in dried specimens, up to 3 mm in diam., 0.6-0.9 mm thick. Perith. visible from the surface of str., honey-colored, confluent in rows in stromatic crusts, subglobose,  $250-300 \mu$  in vertical diam. In vertical section t.o.s.s. of *t. globulosa* close to *t. angularis*, composed of more or less thick-walled, globose-polyhedric cells  $12-20 \times 10-18 \mu$ . Inn.t. of *t. intricata*. Hyphae of inn.t. slightly thick-walled, swollen, constricted at the septa,  $8-15 \mu$  in diam. Surface layer of undersides of str. almost the same with t.o.s.s. Ascus containing 16 p.sp. P.sp. hyaline or pale yellow, strongly verrucose; the distal obovate,  $7.2-11 \times 7.2-7.5 \mu$ ; the proximal obovate-subcylindrical,  $7.3-12 \times 6.2-6.5 \mu$ .

*Hab.* On *Camillea* sp. or neighbouring decayed wood in subtropical or tropical climates.

*Specimen examined.* Rio Orotuja, Caqueta, Colombia, 10-VIII-1973, Y. DOI, (D. 1860=TNS-F-225082).

*Notes.* (1) As DENNIS (1970) described, this species is characterized by honey-colored perith. situated in rows in stromatic crusts. DENNIS also described the a.sp. of this species as 1-septate,  $18-20 \times 8.5-10 \mu$ . Although the septation and size of a.sp. described by DENNIS are considered to correspond to closely attached two p.sp.

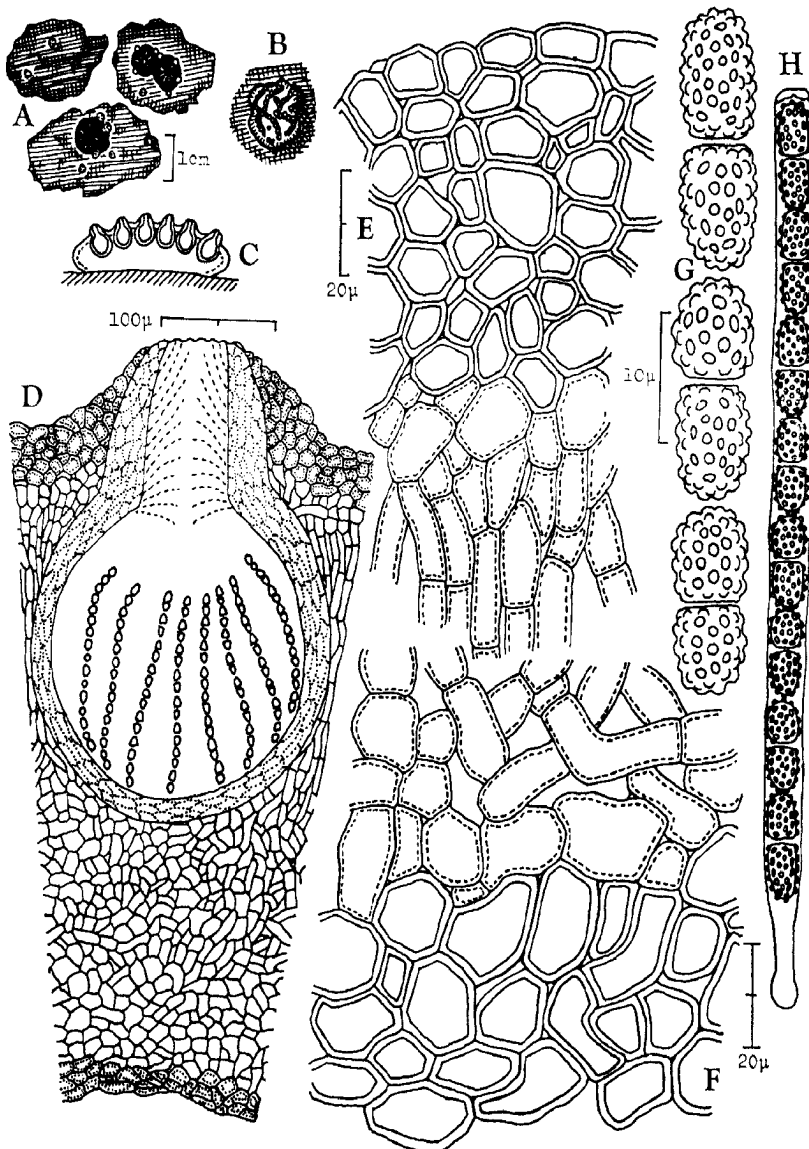


Fig. 8. *Hypocrea impressa* MONT. (TNS-F-225082). A,B. Habits. C,D. Vertical sections of stroma. E. Vertical section of t.o.s.s. F. Vertical section of surface layer of underside of stroma. G,H. Ascus and p.sp.

measuring about 8–10  $\mu$  in diam., examination of the authentic material of the species is required for determining the characteristics of a.sp. or p.sp. of the species. (3) This species resembles *Hypocrea macrospora* DINGLEY (DINGLEY, 1956) in the appearance of str. and size and shape of p.sp., but DINGLEY's species was reported to have green p.sp.

7. *Hypocrea trachycarpa* SYDOW

Ann. Mycol. 28: 126 (1930).

Str. disperse, irregularly pulvinate or subdisciform, pale brown to brown in dried specimens, dotted with darker ost., up to 3 mm in diam., 0.5–0.8 mm thick. In vertical section t.o.s.s. of *t. intricata*, a little more compactly interwoven than inn.t. Hyphae of t.o.s.s. almost slender, 3–4  $\mu$  in diam. Inn.t. of *t. intricata*. Hyphae of inn.t. swollen, constricted at the septa, 6–12  $\mu$  in diam. Perith. subglobose or vertically elongated, 180–230  $\mu$  in vertical diam. Ascus containing 8 a.sp. A.sp. hyaline or pale yellow-ochre-colored, obovate, verrucose, 7–11  $\times$  5–6  $\mu$ .

*Hab.* On decayed trunk of *Inga*.

*Isotypes.* On *Inga spectabilis*, Los Rastrojos, Puerto La Cruz, Venezuela, H. SYDOW, 31-XII-1927, (IMI, K "H. SYDOW 841" in SYDOW's Fungi exotici exsiccati).

*Notes.* (1) Although the species has hyaline or pale yellow-ochre 8 a.sp., the species should not be classified into the genus *Thuemenella*, but into gen. *Hypocrea*, subgen. *Hypocrea*, sect. *Homalocrea*, subsect. *Pulvinatae*, ser. *Pulvinatae* in the writer's classification (Doi, 1969, 1972). The reason of the present classification of the species is as follows: the number of p.sp. in an ascus is not stable and 8 or 16 in the same

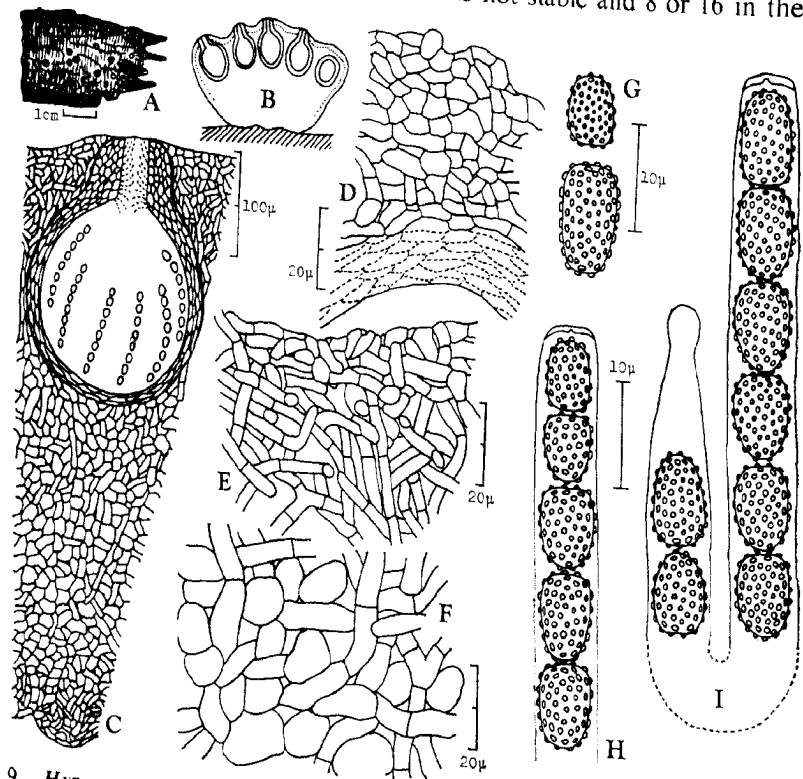


Fig. 9. *Hypocrea trachycarpa* SYDOW A. Habit. B,C. Vertical sections of stroma (IMI 16948, isotype). D,E. Vertical sections of t.o.s.s. (D. SYDOW 841 in K [isotype]; E. IMI 16948). F. Vertical section of inner tissue of stroma (IMI 16948). G-I. Asci and a.sp. (G,I. IMI 16948; H. SYDOW 841 in K).

species as already shown in *Hypocrea yasudae* Doi (Doi, 1972), and that species has many important characters connected with other species of ser. Pulvinate such as *t. intricata*-type or *t. globulosa*-type of t.o.s.s. and hyaline or yellowish (at least not green) a.sp. or p.sp., and pulvinate str. Such characteristics are generally accompanied with the conidial states, if present, characterized by hyaline conidia produced generally on *Cephalosporium*-type or primitive *Verticillium*- or *Trichoderma*-type conidiophores. (2) According to STEVENSON (1971), the type materials were divided into several sets and were distributed to several herbaria. The holotype specimen is considered to have been kept in B., and the specimen might have been destroyed during the World War II.

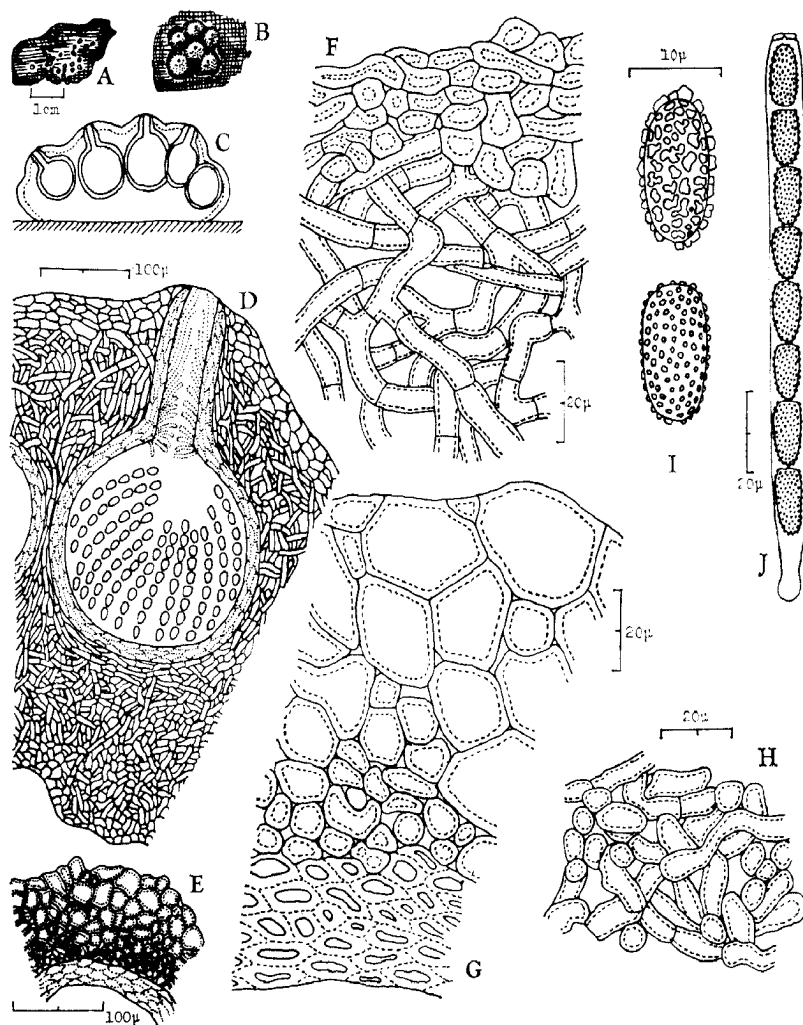


Fig. 10. *Hypocrea subtrachycarpa* sp. nov. (TNS-F-224807, holotype). A, B. Habits. C, D. Vertical sections of stroma. E-G. Vertical sections of t.o.s.s.: E, G. Vertical sections of t.o.s.s. of marginal portions of stroma. F. Vertical section of t.o.s.s. of central portion of stroma. H. Vertical section of inner tissue of stroma. I, J. Ascus and a.sp.

8. *Hypocrea subtrachycarpa* sp. nov.

Stromata dispersa, irregulariter pulvinata, flavo-ochracea vel brunneo-fusca, usque ad 1.5 mm diam., 0.6–0.8 mm crassa, superficiebus stromatarum processis. Perithecia subglobosa vel verticaliter elongata, 200–260  $\mu$  in diametro verticali. Ascus 8-ascosporus; ascosporis hyalinis vel subflavis, varde verrucosis, obovato-subcylindricis, 13–18  $\times$  7–8  $\mu$ .

Str. disperse, irregularly pulvinate, strongly roughened with perithecial protuberances, yellow-ochre when young, brown to dark brown when mature, up to 1.5 mm in diam., 0.6–0.8 mm thick; perithecial protuberances strongly reddish-brown; pale ochre-brown at the interperithecial portions. In vertical section t.o.s.s. principally of *t. intricata* mainly at the central portions of t.o.s.s. or of *t. globulosa* close to *t. angularis* especially at the marginal portions of str. Hyphae of t.o.s.s. strongly thick-walled, 6–10  $\mu$  in diam. in *t. intricata* at the central portions of str., or 20–40  $\times$  18–30  $\mu$  in *t. globulosa* of the marginal portions of str. Inn.t. of *t. intricata*. Hyphae of inn.t. almost slender, strongly thick-walled, 6–9  $\mu$  in diam. Perith. subglobose or vertically elongated, 220–260  $\mu$  in vertical diam. Ascus containing 8 a. sp. A.sp. hyaline or pale yellow, strongly roughened (foveate-verrucose), obovate-subcylindrical, 13–18  $\times$  7–8  $\mu$ .

*Hab.* On decayed wood in tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, 25–28, VII–1973, Y. Doi, (D.1578=TNS-F-224807).

*Note.* This species is different from *Hypocrea trachycarpa* SYD. mainly in having larger a.sp. and smaller str. with strongly thick-walled hyphae. *H. trachycarpa* was collected by SYDOW in Caribbean coast of Venezuela, while *H. subtrachycarpa* was collected in the Basin of Colombian Amazon.

9. *Hypocrea patella* COOKE et PECK

29th Rep. of the St. Mus. N.Y., 57 (1878).

*Lectotype.* On rotten wood, Buffalo, N.Y., G.W. CLINTON, comm. C.H. PECK, (K).  
f. *patella*

St. Conid. *Verticillium*-type close to *Trichoderma*-type with hyaline conidia, in Bull. Natn. Sci. Mus. Tokyo, 15: 679 (1972).

*Specimen examined.* Quisquina near Palmira, Valle, Colombia, about 1,500 m alt., 5–VII–1973, Y. Doi (D.1521=TNS-F-224610).  
f. *tropica* f. nov.

Stromata minoria, usque ad 1.5 mm diam., 0.4–0.5 mm crassa, hyphis stromatarum valde crassitunicatis. Partosporae eadem ac partosporarum typo-formarum, partosporis distalibus subglobosis, 2.7–3.2  $\times$  2.5–2.7  $\mu$ , partosporis proximalibus obovato-subcylindricis, 3.2–4.0  $\times$  2.0–2.4  $\mu$ .

Str. disciform to hemisphaerical, minute, up to 1.5 mm in diam., 0.4–0.5 mm thick, yellow-ochre, ochre-brown in dried specimens. In vertical section t.o.s.s. principally of *t. globulosa* close to *t. angularis*. Hyphae of t.o.s.s. strongly thick-

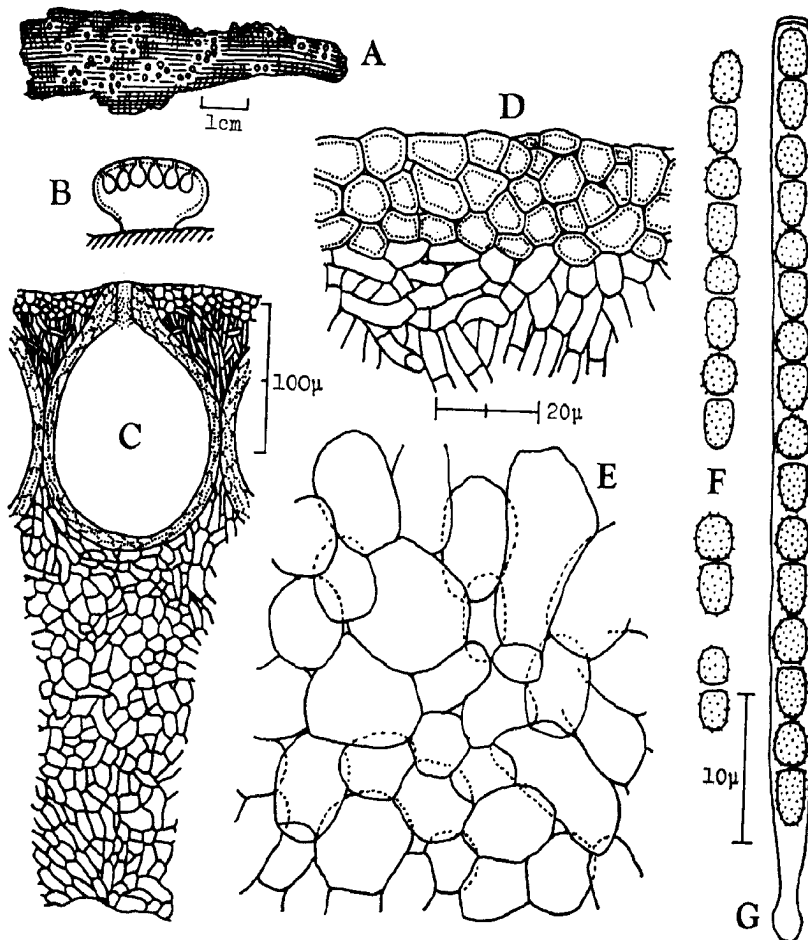


Fig. 11. *Hypocrea patella* f. *tropica* f. nov. (A-E. and G., TNS-F-225083, holotype), and *H. patella* f. *patella* COOKE et PECK (F, TNS-F-224610). A. Habit. B,C. Vertical section of stroma. D. Vertical section of t.o.s.s. E. Vertical section of inner tissue of stroma. F. P.sp. G. Ascus and p.sp.

walled, rounded or almost polyhedral,  $8-12 \times 4-8 \mu$ . Inn.t. of *t. intricata*, appearing *t. globulosa* in thin-sectioned str. Hyphae of inn.t. thin-walled, swollen, constricted at the septa,  $8-25 \mu$  in diam. Perith. subglobose,  $150-170 \mu$  in vertical diam. P.sp. identical with those of f. *patella*, hyaline, minutely and rather sparsely warted; the distal subglobose,  $2.7-3.2 \times 2.5-2.7 \mu$ ; the proximal obovate-subcylindrical,  $3.2-4.0 \times 2.0-2.4 \mu$ .

*Hab.* On decayed woods in tropical rainforest.

*Holotype.* Rio Orotuja near La Tagua, Caqueta, Colombia, 10-VIII-1973, Y. Doi (D.1861 = TNS-F-225083).

*Note.* This form is different from f. *patella* in small str. and thick-walled hyphae of t.o.s.s. Str. of the lectotype specimen of f. *patella* are up to 5 mm in diam., and the hyphae of t.o.s.s. of the specimen are not so thick-walled as those of the new form.

The new form inhabits in tropical rainforest, whereas f. *patella* inhabits in temperate or subtropical climates.

Sect. *Hypocrea* Subsect. *Creopus* (LINK) DOI

10. *Hypocrea aurantio-lutea* sp. nov.

Stromata dispersa, irregulariter pulvinata, minoria, usque ad 1.5 mm in diam., 0.3–0.4 mm crassa, aurantio-lutea, aurantio-brunnea vel subflavo-ochracea, marginibus stromatarum processis, cellulis superficibus stromatarum valde crassitunicatis. Perithecia subglobosa, 210–230  $\mu$  in diametro verticali, ostiolis obscure projectis. Ascus 16-partosporus, partosporis hyalinis, verrucosis, partosporis distalibus subglobose-obovatis, 4.2–4.7  $\times$  3.5–3.8  $\mu$ ; partosporis proximalibus obovato-subcylindricis, generaliter 4.5–5.2  $\times$  3.2–3.7  $\mu$ .

Str. disperse or rarely aggregate, irregularly pulvinate, pale orange-yellow, pale orange-brown or yellow-ochre, minute, up to 1 mm in diam., 0.3–0.4  $\mu$  thick. Surface of str. roughened with perithecial protuberances. In vertical section t.o.s.s. of *t. intricata*, cells of t.o.s.s. strongly thick-walled, pale yellow-orange colored, polyhedral, 10–15  $\times$  8–13  $\mu$ . Inn.t. of *t. intricata*, composed of thin-walled, comparatively slender hyphae 6–8  $\mu$  diam. Perith. subglobose, 210–230  $\mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. hyaline, warted; the distal subglobose-obovate, 4.2–4.7  $\times$  3.5–

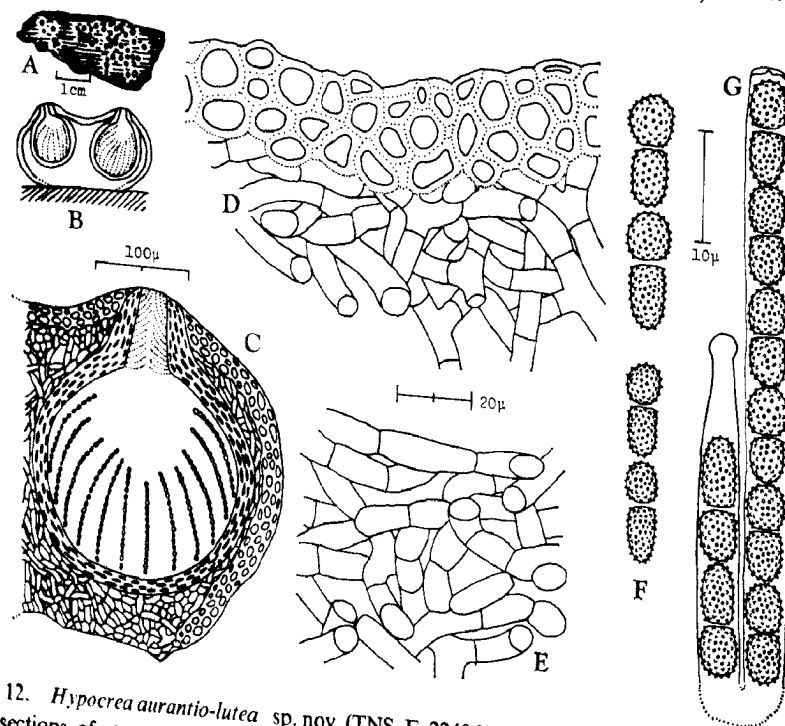


Fig. 12. *Hypocrea aurantio-lutea* sp. nov. (TNS-F-224961, holotype). A. Habit. B, C. Vertical sections of stroma. D. Vertical section of t.o.s.s. E. Vertical section of inner tissue of stroma. F, G. Ascus and p.sp.



3.7  $\mu$ , sometimes more elongated, up to 6.3  $\mu$  long.

*Hab.* On decayed wood in tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, 25–28, VII–1973, Y. Doi, (D. 1739 = TNS-F-224961).

*Note.* The distinguishing characteristics of the species include the extremely thick-walled ofcells t.o.s.s. and hardly recognizable adjacent border of each cell. The epithet of this species is due to the close relation to *Hypocrea lutea* (TODE) PETCH with orangish colored str.

#### 11. *Hypocrea brunneo-lutea* sp. nov.

Stromata dispersa vel aggregata, pulvinata vel disciformia, brunnea, usque ad 2 mm diam., 0.5–0.6 mm crassa, marginibus stromatarum tuberculatis. Perithecia subglobosa vel verticaliter elongata, 210–240  $\mu$  in diametro verticali. Ascus 16-partosporus. Partosporae hyalinae, subtiliter echinulatae, partosporis distalibus subgloboso-obovatis, 3.8–4.8  $\times$  3.2–4.6  $\mu$ , generaliter 4.3  $\times$  4.0  $\mu$ , partosporis proximalibus obovatis, 4.0–5.6  $\times$  2.8–3.8  $\mu$ , generaliter 4.9  $\times$  3.8  $\mu$ .

*Cultura.* Auctis rapidis, conidiophoris *Trichoderma*-typicis normalibus, conidiis viridibus, laevibus, ellipsoidibus, 3–4.5  $\times$  2.0–3.7  $\mu$ .

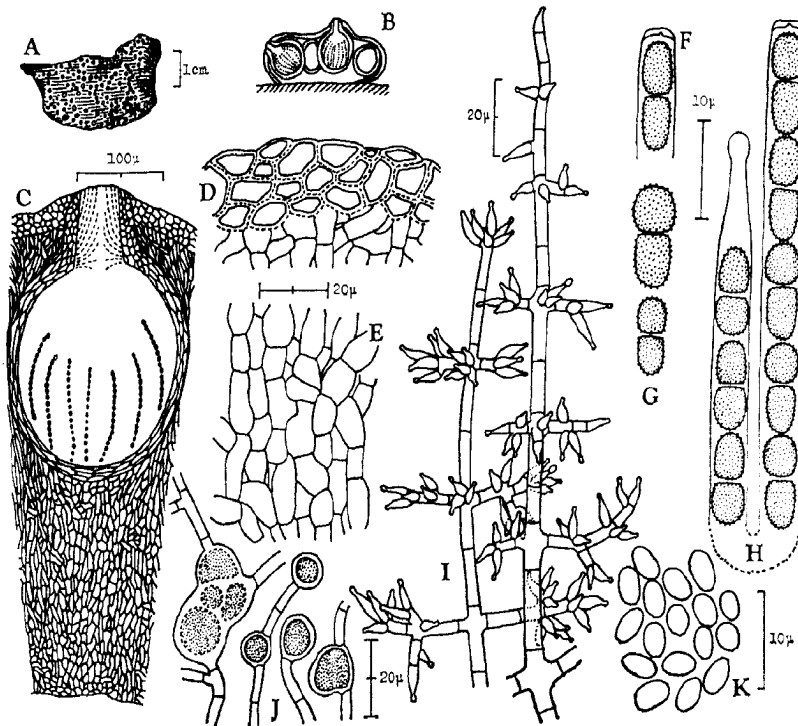


Fig. 13. *Hypocrea brunneo-lutea* sp. nov. (TNS-F-224812, holotype). A. Habit. B, C. Vertical sections of stroma. D. Vertical section of t.o.s.s. E. Vertical section of inner tissue of stroma. F–H. Asci and p.sp. I. Conidiophores. J. Chlamydospores. K. Conidia.

Str. disperse or aggregate, pulvinate or disciform, brown, minute, up to 2 mm in diam., 0.5–0.6 mm thick. Surface of str. roughened with perithecial protuberances. In vertical section t.o.s.s. of *t. angularis* close to those of *H. lutea*. Hyphae of t.o.s.s. thick-walled, polyhedric, slightly yellow-brown colored, 8–12 × 5–7  $\mu$ . Inn. t. of *t. intricata*. Hyphae of inn.t. swollen, constricted at the septa, more or less vertically parallel, 6–9  $\mu$  in diam. Ascus containing 16 p.sp. P.sp. hyaline, minutely warted; the distal subglobose-obovate, (3.8)–4.3–(4.8) × (3.2)–4.0–(4.6)  $\mu$ ; the proximal obovate, (4.0)–4.9–(5.6) × (2.8)–3.8–(3.8)  $\mu$ .

*Hab.* On decayed wood in tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, 25–28, VII–1973, Y. Doi (D.1583–TNS-F-224812).

*Culture.* Growth rapid. Conidial colonies at first minute, green, dispersed mainly at the upper part of slant media, later forming mat-like colonies, green with a tinge of blue. Reversed sides of colonies pale brown. Conidiophores of the typical *Trichoderma*-type. Main axial hyphae of conidiophores up to 250  $\mu$  long. Branches of conidiophores rectangularly radiate from axial hyphae, up to 60  $\mu$  long. Phialides bottle-shaped, produced from branches of conidiophores at narrower angles than rectangle, 7–10 × 2–3  $\mu$ . Conidia green, ellipsoid, smooth, with a minute truncate base, 3.0–4.5 × 2.0–3.7  $\mu$ . Chlamydo-spores abundant on submerged hyphae in aged cultures, subglobose or irregularly shaped, 8–30 × 8–17  $\mu$ .

*Note.* The appearance of this species resembles that of *H. lutea*, but p.sp. of the present species are larger than those of *H. lutea*, and the conidial state is of the typical *Trichoderma*-type. The epithet of this species is due to the close relation to *H. lutea* with brown str.

## 12. *Hypocrea sulfurella* KALCHBRENNER et COOKE

Grevillea 9: 26 (1880).

*Hypocrea virescenti-flava* SPEG., Fungi Puiggarii, Bolet. Acad. Nac. Cienc. Cordoba 11: 151 (1889). *Holotype* s/l. Bambusea, Brasil, Apiaty, invierno, 1888, J. PUIGGARI, no. 2353 (LPS 1726).

Str. dispersed, disciform or pulvinate, pale yellow to pale brown, dotted with dark-colored ost., up to 3 mm in diam., generally 1–2 mm in diam., 0.5–0.8 mm thick. In vertical section t.o.s.s. of *t. angularis* composed of polyhedric, comparatively thin, pale colored cells 10–13 × 7–11  $\mu$ . Inn.t. of *t. intricata*. Hyphae of inn.t. thin-walled, swollen, constricted at the septa, 8–10  $\mu$  diam. Perith. subglobose-obovate, 140–170  $\mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. green, verrucose; the distal subglobose-obovate, (4.0)–4.5–(5.0) × (3.6)–4.4–(4.8)  $\mu$ ; the proximal obovate, (4.0)–4.7–(6.0) × (2.8)–4.0–(4.5)  $\mu$ .

*Hab.* On decayed woods in temperate to tropical climates.

*Holotype.* Natal, INWOOD 178 (K).

*Other specimens examined.* Santa Fé, Oliveros, Argentina, 11–X–1970, J. E. WRIGHT, as *Creopus pezizaeformis* (LPS 35799); Golondrina near Cali, Valle, Colombia, 27–28, VI–1973, Y. Doi (D.1511=TNS-F-224600, immature); Rio

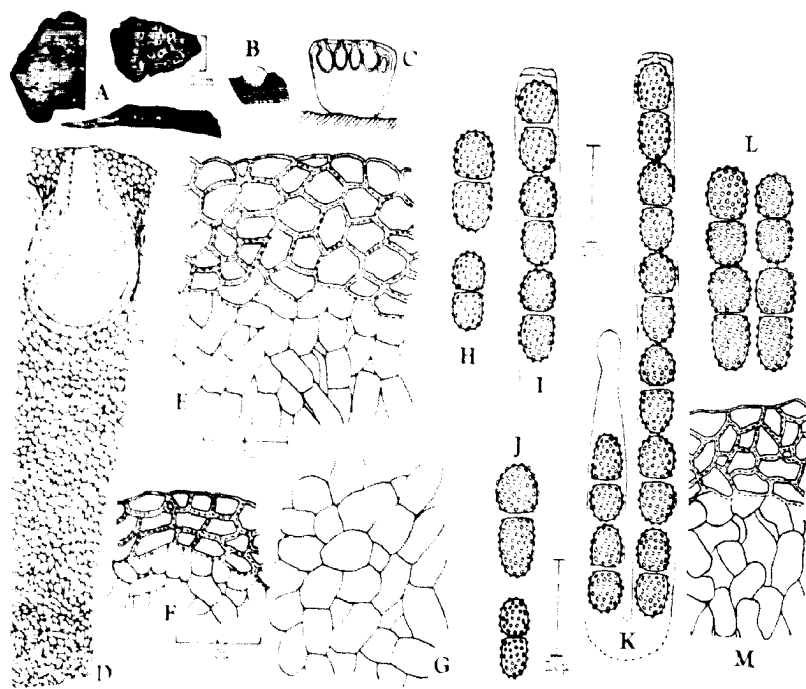


Fig. 14. *Hypocrea sulfurella* KALCHBRENNER et COOKE. A, B. Habits. C, D. Vertical sections of stroma. E, F. and M. Vertical sections of t.o.s.s. G. Vertical section of inner tissue of stroma H-L. Asci and p.sp. (E, G, J, K. TNS-F-224600; D, F, H, I. Natal 178 in K [Holotype]; L, M. LPS 1726, holotype of *Hypocrea virescentiflava* SPEG.).

Orotuja near La Tagua, Caqueta, Colombia, 10-VIII-1973, Y. Doi (D.1875=TNS-F-225097).

*Notes.* (1) This species is distributed in Africa (Natal), New Zealand (DINGLEY, 1956) and South America. (2) In the holotype material of *H. virescentiflava* in LPS, the outlook and tissue-type of t.o.s.s. of str., shape and size of p.sp. conform well to those of the holotype material of *H. sulfurella*. (3) This species resembles *Hypocrea virens* BERK. and *H. girosa* THEISSEN in the appearances of str. P.sp. of *H. flavo-virens* are almost identical with those of *H. sulfurella*. However, str. of *H. flavo-virens* are almost white or very pale lemon-yellow and very friable and easily liberated from substratum, while str. of *H. sulfurella* are robust and pale yellow-brown with a tinge of orange. *H. flavo-virens* was collected only in Asia (India and Japan). *Hypocrea girosa* has more slender and smaller p.sp. as described and illustrated below.

### 13. *Hypocrea girosa* THEISSEN

Ann. Mycol. 9: 59, Taf. VI, f. 53 (1911).

Str. disperse, disciform, pulvinate or hemisphaerical, pale yellow-ochre, dotted with dark-colored ost., up to 4 mm in diam., 0.4-0.6 mm thick. In vertical section t.o.s.s. of *t. angularis*; cells of t.o.s.s. comparatively thin-walled, very pale yellow,

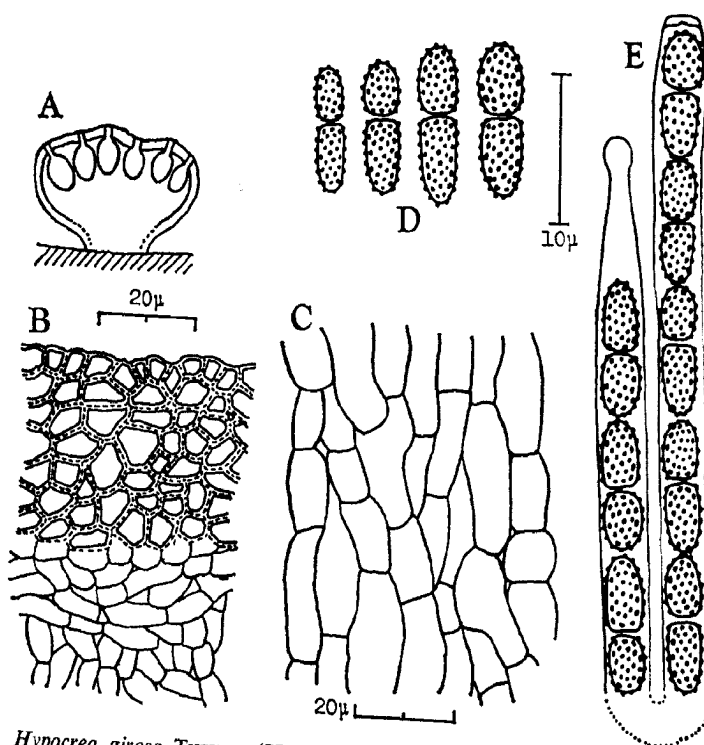


Fig. 15. *Hypocrea girosa* THEISS. (SP 22646, isotype ?). A. Vertical section of stroma. B. Vertical section of t.o.s.s. C. Vertical section of inner tissue of stroma. D, E. Ascus and p.sp.

polyhedric,  $7-10 \times 4-8 \mu$ . Inn. t. of *t. intricata*. Hyphae of inn.t. swollen, constricted at the septa,  $8-12 \mu$  in diam. Ascus containing 16 p.sp. P.sp. green, verrucose; the distal obovate,  $3.6-4.8 \times 2.1-3.6 \mu$ ; the proximal obovate-subcylindrical,  $4.0-6.0 \times 2.0-3.5 \mu$ .

*Hab.* On decayed wood.

*Specimen examined.* São Leopold, Rio Grande do Sul, 1909, RICK, Det. THEISSEN (SP 22646).

*Note.* The data of above-listed specimen agree with those of the specimen quoted in the original description of the species. Thus, the specimen SP 22646 may be a part of type collection.

#### 14. *Hypocrea andinogelatinosa* sp. nov.

Stromata dispersa, ochraceo-brunnea vel rufa, pulvinato-hemisphaerica, usque ad 1 mm in diam., 0.4-0.6 mm crassa, marginibus stromatarum tuberculatis. Perithecia obovata, 200-230  $\mu$  in diametro verticali. Ascus 16-partosporus, partosporis viridibus, verrucosis, partosporis distalibus subgloboso-obovatis,  $4.5-6.7 \times 4.2-5.7 \mu$ , partosporis proximalibus obovatis,  $5.0-7.3 \times 3.6-5.0 \mu$ .

Str. disperse, pulvinate-hemispherical with prominent perithecial protuberances,

ochre-brown to rufous, resembling aggregate fruitbodies of some reddish *Nectria* in dried specimens, up to 1 mm in diam., 0.4–0.6 mm thick. In vertical section t.o.s.s. of *t. angularis*. Cells of t.o.s.s. slightly thick-walled, polyhedral, generally directly adjacent to perithecial walls especially at the marginal portion of str.,  $7\text{--}10 \times 5\text{--}8 \mu$ . Inn.t. of *t. intricata* composed of compactly interwoven hyphae  $10\text{--}16 \mu$  in diam. Perith. obovate,  $200\text{--}230 \mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. green, verrucose; the distal subglobose-obovate,  $4.5\text{--}6.7 \times 4.2\text{--}5.7 \mu$ ; the proximal obovate,  $5.0\text{--}7.3 \times 3.6\text{--}5.0 \mu$ .

*Hab.* On other fungi or on well decayed and well moistened wood in temperate or subtropical climates.

*Holotype.* Quisquina near Palmira, Valle, Colombia, about 2,000 m alt., 5–VII–1973, Y. DOI (D.1514=TNS-F-224603).

*Paratype.* Hosp. fallen branch in wood, Instituto de Botanica, Parque do Estado S. Paulo, SP., Brasil, Máris B. FIGUEIREDO, II–1966, as *Hypocrea gelatinosa* (TODE ex FR.) FR. (SP 91087).

*Note.* This species is named in relation with that the holotype specimen was collected in the Colombian Andes. This species is characterized by the appearance of str. resembling that of *H. gelatinosa*, and the larger p.sp. in comparison with those

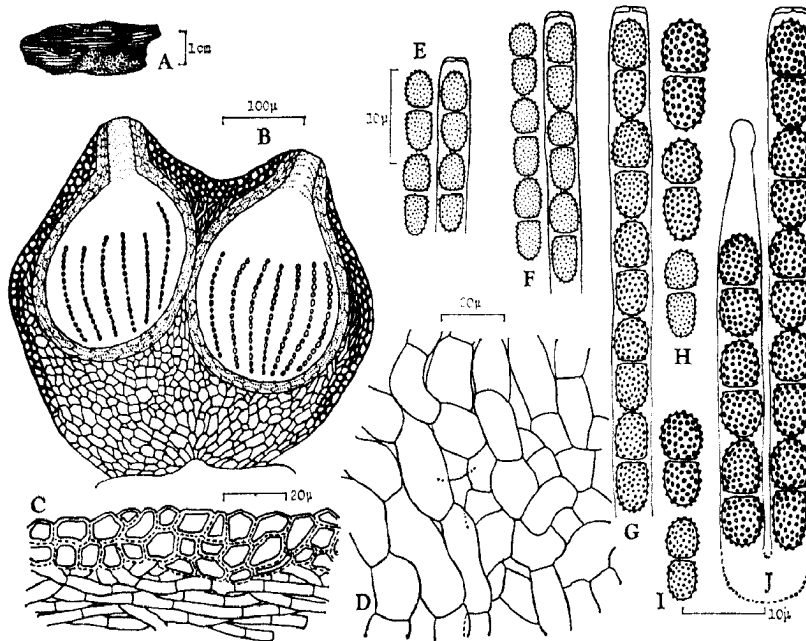


Fig. 16. *Hypocrea andinogelatinosa* sp. nov. (A–D, G, J), *Hypocrea pseudogelatinosa* KOMATSU et DOI (E), and *Hypocrea gelatinosa* (TODE ex FR.) FR. (F). A. Habit. B. Vertical section of stroma (TNS-F-224603, holotype). C. Vertical section of t.o.s.s. (TNS-F-224603). D. Vertical section of inner tissue of stroma (TNS-F-224603). E–J. Ascus and p.sp. (E. TNS-F-192712 [holotype of *H. pseudogelatinosa*]; F. IMI 33645; G, I. SP 91087 [paratype of *H. andinogelatinosa*]; H, J. TNS-F-224603).

of *H. gelatinosa* as well as those of *H. pseudogelatinosa*\*.

### 15. *Hypocrea atrogelatinosa* DINGLEY

Trans. Roy. Soc. New Zealand, **83**: 645 (1956).

St. Conid. *Trichoderma*-type, in DINGLEY, J. M., *ibid.*, **84**: 689 (1956); DOI, Y., Bull. Natn. Sci. Mus. Tokyo, **14**: 396 (1971).

*Holotype*. On *Fuscoporia* sp., Auckland, Hunua Ra, Otau, New Zealand, IV-1950, J. M. DINGLEY (PDD 10471).

*Specimen examined*. Golondrina near Cali, Valle, Colombia, about 1,200 m alt., 27-28, VII-1973, Y. DOI (D. 1497=TNS-F-224586).

*Note*. This species is distributed in New Zealand, New Guinea and South America. The South American strain agreed well with the holotype material listed above.

### Sect. *Hypocrea* Subsect. *Hypocrea*

### 16. *Hypocrea schweinitzii* (Fr.) SACC.

Syll. Fung. **2**: 522 (1883).

Basionym: *Sphaeria schweinitzii* Fr., Elenchus Fungorum **2**: 60 (1828).

St. Conid. Irregular *Trichoderma*-type, in DINGLEY, J. M., Trans. Roy. Soc. New Zealand, **70**: 332, Pl. 52, fig. 1, a.b. (1952); *ibid.*, **84**: 690 (1957); DOI, Y., Bull. Natn. Sci. Mus. Tokyo, **12**: 708 (1969); *ibid.*, **15**: 740 (1972).

Synonym: *Hypocrea atrata* KARST., Mycologica Fennica **2**: 207 (1873). *Isotype*: Mustiala, 25-VIII-1866, KARSTEN, Fungi Fennici exsicc. 878 (K).

*Hypocrea olivacea* COOKE et ELLIS, Grevillea **8**: 92 (1878). *Specimen examined*: On pine board, February, 1898?, sent to COOKE, no. 602=2826 (Labelled as "Cotype", NY)\*\*

*Hypocrea ibicuyensis* SPEG., Anal. Mus. Nac. Buenos Aires, **23**: 75 (1912). *Holotype*: *Sclerotium* *Erythrina crista-galli*, Entre Rios, Ibicuy, Argentina, V-1911, C. SPEG. (LPS 1720).

*Hypocrea borneensis* H. S. YATES, Philip. Journ. Sc. sect. C. **13**: 237 (1918). *Holotype*: On *Hevea brasiliensis*, Membakut, British North Borneo, X-1907, H. S. YATES, 100 (K).

*Specimens examined*. Leguizamo, Putumayo, Colombia, 19-VII-1973, Y. DOI (D.1631=TNS-F-224853); Arlington, Verginia, U. S. A., C. L. SHEAR no. 60161, under *Hypocrea lenta* (TODE) FRIES (IMI 49271); On *Gliricidia maculata*, Malaya, V-1948, under *Hypocrea jecorina* BERK. et BR. (IMI 24386); Mycotheca Veneta 689 under *Hypocrea rufa* f. *umbrina* SACC. (K); *Sclerotium* *Prosopis* sp., La Plata, 21-V-1912, C. SPEGAZ-

\* The original description and illustration of p.sp. of *Hypocrea pseudogelatinosa* were given in mistake. The description should be amended as follows: "P.sp. green, minutely warted; the distal subglobose-obovate, 3.8-4.7 × 3.7-4.0 μ; the proximal obovate-subcylindrical, 3.9-4.8 × 2.8-3.6 μ." The shape and size of p.sp. of *H. pseudogelatinosa* closely resemble those of *Hypocrea gelatinosa* which were examined in the specimen IMI 33645 and given in the descriptions of those of some specimens made by WEBSTER (1964). P.sp. of *H. gelatinosa*, and *H. pseudogelatinosa* as well as *H. andinogelatinosa* are illustrated in Fig. 16 for comparison. *H. pseudogelatinosa* is now characterized mainly by the *Verticillium*-like *Trichoderma*-type conidial state and fairly larger and yellow-ochre str.

\*\* SEAVER (1910) listed only this specimen for the present species. He stated in the same paper that the type specimen of *Hypocrea melaleuca* ELLIS et EBERH. conformed exactly to the present species; therefore, *H. melaleuca* might be reduced to a synonym of *H. schweinitzii*.

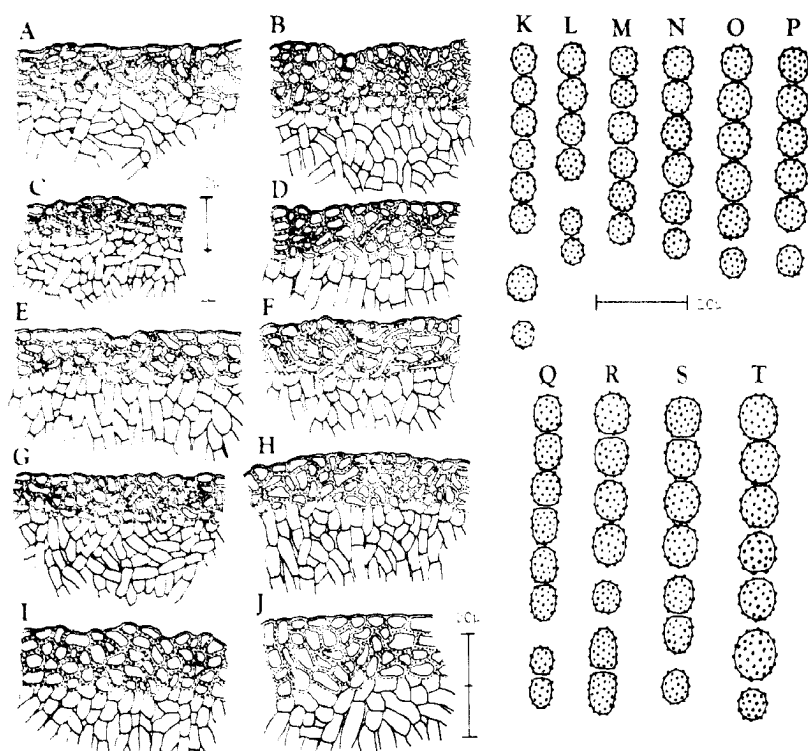


Fig. 17. *Hypocrea schweinitzii* (FR.) SACC. A-J. Vertical sections of t.o.s.s. K-T. P.sp. A, T. TNS-F-224853; B, N. LPS 7763; C, M. Isotype of *Hypocrea atrata* KARST. in K; D, L. Myc. Veneta 689 in K; E, P. Holotype of *Hypocrea borneensis* YATES in K; F, R. LPS 37800; G, O. under *Hypocrea jecorina* in K; H, S. Holotype of *Hypocrea ibicuyensis* SPEG. (LPS 1720); I, K. "Cotype" specimen of *Hypocrea olivacea* COOKE et ELLIS in NY; J, Q. IMI 49271.

ZINI, under *Hypocrea lenta* (TODE) BERK.

*Note.* The writer accepts Miss DINGLEY's opinion (1952) on the nomenclature of the present species. She listed two synonymy of *H. schweinitzii* as follows; *Hypocrea contorta* (SCHW.) BERK. et CURT., Grev., 4: 14 (1875) [= *Sphaeria contorta* Schw., Trans. Amer. Phil. Soc. 2: 194, (1882)]. *Hypocrea rigens* (FR.) SACC., Michelia 1: 301 (1878). [= *Sphaeria rigens* Fr., Elenchus Fungorum 2: 61, (1828)].

P.sp. of the South American strains are slightly larger than those of the strains collected in the other regions, as shown in Fig. 17.

#### 17. *Hypocrea caquetensis* sp. nov.

Stromata disciformia vel irregulariter pulvinata, complanata in sicco, ochraceo-brunnea vel castanea, usque ad 3 mm in diam., 0.2-0.3 mm crassa. Textura superficialia stromatarum epidermoidea, distratosa, hyphis stratarum exteriorum verticaliter parallelibus, texturis stratarum interiorum epidermoidibus normalibus. Perithercia subgloboso-obovata vel verticaliter elongata, 130-150  $\mu$  in diametro verticali. Ascus

16-partosporus, partosporis hyalinis, subtiliter echinulatis, partosporis distalibus subgloboso-obovatis,  $(1.8)-2.3-(2.5) \times (1.8)-2.0-(2.5) \mu$ , partosporis proximalibus obovatis,  $(2.0)-2.5-(3.5) \times (1.6)-1.8-(2.4) \mu$ .

Str. closely resembling that of *H. schweinitzii* in appearance, disciform or irregularly pulvinate, flat in dried specimens, ochre-brown or chestnut-brown, up to 3 mm in diam., 0.2-0.3 mm thick. In vertical section t.o.s.s. principally of *t. epidermoidea*, composed of two layers; the outer layer composed of vertically parallel hyphae close to *t. oblita*; the inner layer of typical *t. epidermoidea*. Hyphae of t. o. s. s. strongly thick-walled, 3-4  $\mu$  in diam. Inn.t. of *t. intricata*. Hyphae above perith. slender, 2.5-3.5  $\mu$  in diam. Basal layer of str. almost the same with t.o.s.s. except for the hyphae slightly larger than those of t.o.s.s., 4-5  $\mu$  in diam. Perith. subglobose-obovate or vertically elongated, 130-150  $\mu$  in vertical diam. Ascus containing 16 p.sp. P.sp. hyaline, minutely echinulate; the distal subglobose-obovate,  $(1.8)-2.3-(2.5) \times (1.8)-2.0-(2.5) \mu$ ; the proximal obovate,  $(2.0)-2.5-(3.5) \times (1.6)-1.8-(2.4) \mu$ .

*Hab.* On decayed wood in the secondary forest in tropical climate.

*Holotype.* Florencia, Caqueta, Colombia, 16-VII-1973, Y. Doi (D.1626=TNS-F-224848).

*Note.* This species is related to *H. schweinitzii* in appearance of str. and p.sp., but

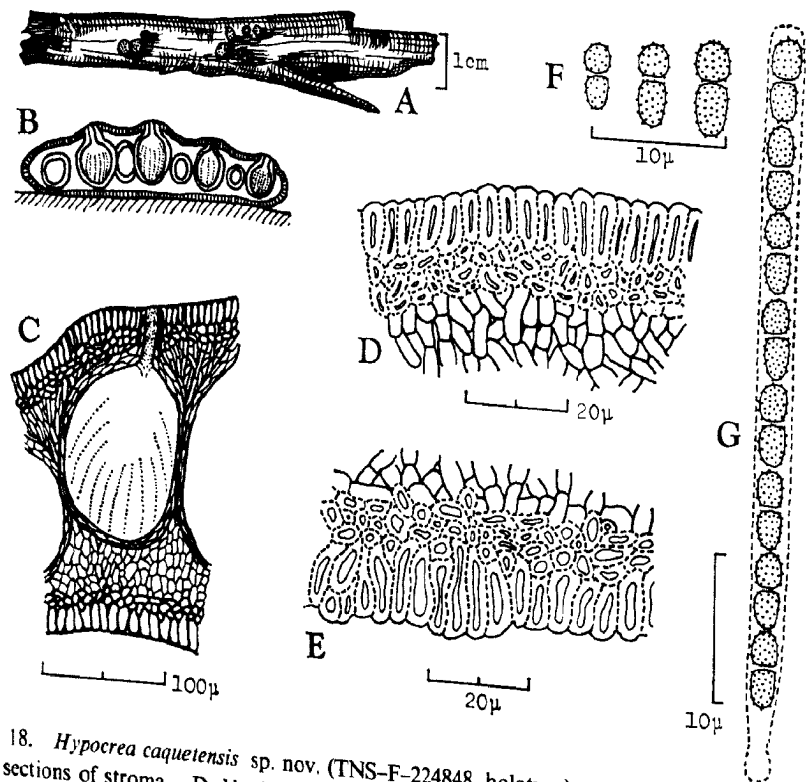


Fig. 18. *Hypocrea caquetensis* sp. nov. (TNS-F-224848, holotype). A. Habit. B,C. Vertical sections of stroma. D. Vertical section of t.o.s.s. E. Vertical section of surface layer of underside of stroma. F. P.sp. G. Ascus and p.sp.



p.sp. of the new species are smaller than those of *H. schweinitzii*. In addition, the vertically parallel hyphae of t.o.s.s. of the present new species is very remarkable characteristic among the species of *Hypocrea*. The specific epithet was given in relation with the district of Caqueta, the type locality of the species.

### 18. *Hypocrea rufa* (PERS. ex FR.) FR.

Summ. Veg. Scand., 383 (1849).

St.Conid. *Trichoderma viride* PERS. ex FR. *sensu stricto*, Syst. Mycol. 3: 214 (1829); in WEBSTER, J., Trans. Brit. Mycol. Soc. 47: 75 (1964); DOI, Y., Jap. Journ. Bot. 20: 403 (1974).

*Specimens examined.* Quisquina—Prov. Trima, Valle, Colombia, about 2,500 m alt., 11-VII-1973, Y. DOI (D.1616=TNS-F-224838; D.1551=TNS-F-224780); Golondrina near Cali, Valle, Colombia, about 1,500 m alt., 27-28, VI-1973, Y. DOI (D.1590=TNS-F-224763; D.1592=TNS-F-224765).

*Note.* P.sp. of TNS-F-224780 and TNS-F-224838 agree well with those of the Scandinavian specimen (Ad lignum vetustum, Ostergötland, Simonstorp s: n, Bjorkli-

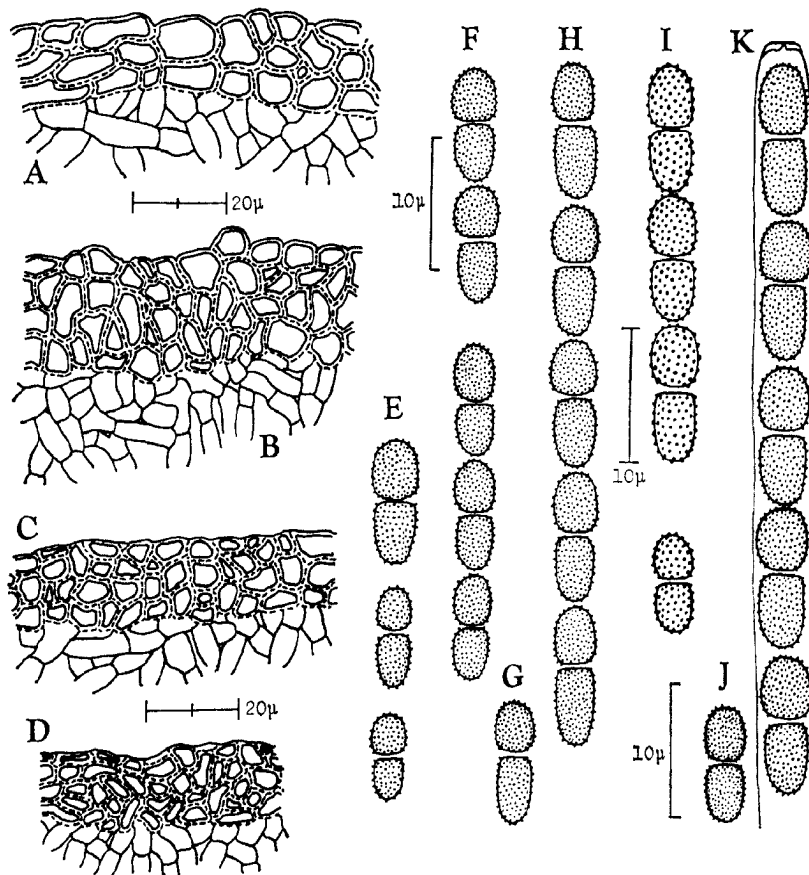


Fig. 19. *Hypocrea rufa* (PERS. ex FR.) FR. A-D. Vertical sections of t.o.s.s. E-K. Ascus and p.sp.; A,H. TNS-F-224765; B,I. TNS-F-224838; C,K. TNS-F-224780; D,F. TNS-F-224763.

den, 8-IX-1912, Elik HAGLUND in UPS) and a Japanese strain (D.648 in TNS). Although p.sp. of the strains, TNS-F-224763 and TNS-F-224765, are a little smaller than those of Scandinavian and Japanese specimens as shown in Fig. 19, such variations are considered to be included in a limit of one species.

### 19. *Hypocrea muroiana* HINO et KATSUMOTO

Bull. Fac. Agr. Yamaguchi Univ. 9: 888 (1958).

*Isotype*: On bamboo, Tainohata, Suma-ku, Kobe City, Hyogo Pref., Japan, 11-X-1957, H. MUROI (TNS-F-223461).

f. *minor* f. nov.

Partosporae minoraе, partosporis distalibus subglobose-obovatis, (2.0)–3.0–(4.3) × (2.0)–2.8–(3.9) μ, partosporis proximalibus obovatis, (3.0)–3.3–(4.6) × (2.0)–2.7–(3.4) μ.

Str. and its tissue-type almost the same with those of f. *muroiana*. Perith. slightly smaller, subglobose-obovate or vertically elongated, 140–160 μ in vertical diam. P. sp. smaller than those of the type form, hyaline, minutely and densely echinulate; the distal subglobose-obovate, (2.0)–3.0–(4.3) × (2.0)–2.8–(3.9) μ; the proximal (3.0)–3.3–(4.6) × (2.0)–2.7–(3.4) μ.

*Hab.* On decayed wood in tropical rainforest.

*Holotype*. Rio Peneya, Caqueta, Colombia, 25–28, VII-1973, Y. Doi (D. 1776=TNS-F-224998).

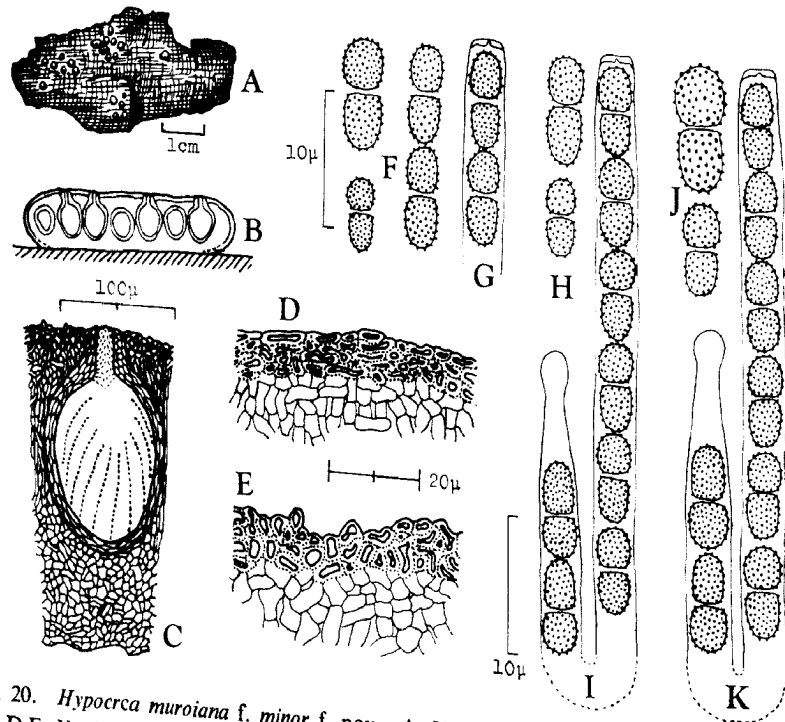


Fig. 20. *Hypocrea muroiana* f. *minor* f. nov. A. Habit. B, C. Vertical sections of stroma. D, E. Vertical sections of t.o.s.s. (D. TNS-F-224951; E. TNS-F-224998, holotype) F-K. Asci and p.sp. (F, G. TNS-F-224951; H, I. TNS-F-224956; J, K. TNS-F-224998).

*Paratype.* The same data with the holotype, (D.1722=TNS-F-224944; D.1729=TNS-F-224951; D.1734=TNS-F-224956).

*Note.* P.sp. of the type form of this species are measured  $3.2-4.4 \times 3.0-4.1 \mu$  in the distal and  $3.8-5.0 \times 2.7-3.2 \mu$  in the proximal. In comparison of p.sp. of the new form with those of the type form, the p.sp. of the new form are fairly smaller than those of the type form. As there are no other characters distinctly different from the type form, the writer evaluated the difference of spore size to be of form taxonomically in the same species.

*f. dimorphospora* f. nov.

Partosporae dimorphae, micropartosporis distalibus obovatis,  $3.0-4.3 \times 2.5-3.0 \mu$ ; micro-partosporis proximalibus obovato-subcylindricis,  $3.4-4.2 \times 2.5-2.9 \mu$ . Macro-partosporis distalibus obovatis,  $4.0-5.0 \times 3.3-4.1 \mu$ , macro-partosporis proximalibus obovatis,  $4.0-5.0 \times 3.0-3.5 \mu$ .

*Cultura.* Auctis rapidis, conidiophoris *Trichoderma*-typicis, conidiis viridibus, laevibus, ellipsoidibus, generaliter  $3.2-4.5 \times 2.0-2.5 \mu$ .

*Str.* almost the same with that of *f. muroiana* in appearance and its tissue-type. Perith. subglobose-obovate or vertically elongated,  $180-200 \mu$  in vertical diam. P.sp. composed of 2 units of smaller 4 p.sp. and 2 units of larger 4 p.sp. Sometimes the

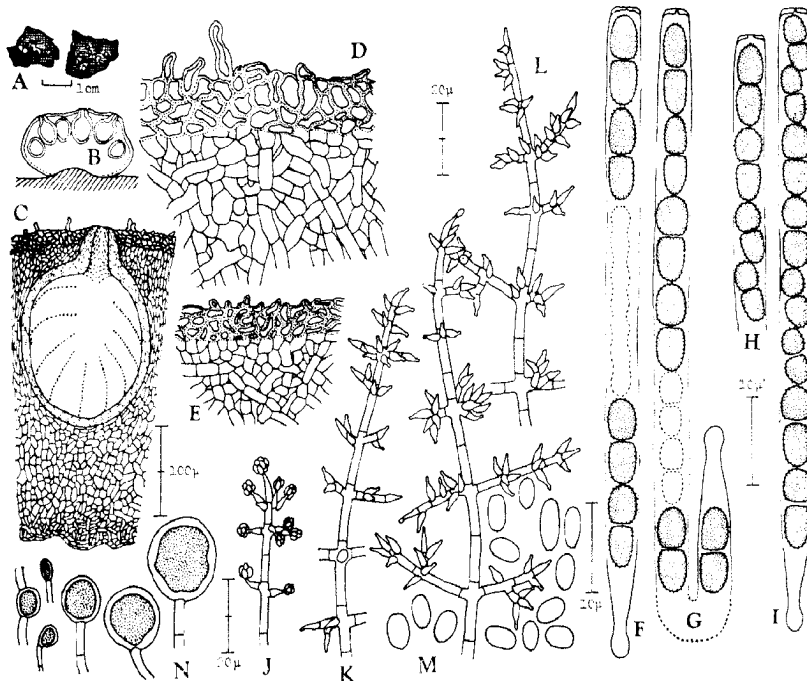


Fig. 21. *Hypocrea muroiana* f. *dimorphospora* f. nov. A. Habit. B, C. Vertical sections of stroma. D, E. Vertical sections of t.o.s.s. (D. TNS-F-224873, holotype; E. TNS-F-224796, paratype). F-I. Asci and p.sp. (F, G. TNS-F-224873; H, I. TNS-F-224796). J-L. Conidiophores (TNS-F-224796). M. Conidia (TNS-F-224796). N. Chlamydo-spores (TNS-F-224796).

smaller p.sp. eliminated. In the smaller p.sp. the distal obovate,  $3.0-4.3 \times 2.5-3.0 \mu$ ; the proximal obovate-subcylindrical,  $3.4-4.2 \times 2.5-2.9 \mu$ . In the larger P.sp., the distal subglobose-obovate,  $4.0-5.0 \times 3.3-4.1 \mu$ ; the proximal obovate,  $4.0-5.0 \times 3.0-3.5 \mu$ .

*Hab.* On decayed woods in tropical rainforest.

*Holotype.* Leguizamo, Putumayo, Colombia, 19-VII-1973, Y. Doi (D. 1651=TNS-F-224873).

*Paratype.* Florencia, Caqueta, Colombia, 16-VII-1973, Y. Doi, (D.1567=TNS-F-224796).

*Culture.* The following descriptions are taken from the strain TNS-F-224796. Growth rapid. Minute colonies of conidial state disperse, later confluent, covering over the upper parts of slant media. Reversed sides of colonies pale brown. Conidiophores of the typical *Trichoderma*-type, resembling that of the type form except for phialides slightly shorter and more crowded on branches of conidiophores. Conidia green, smooth, normally ellipsoid (without a tendency to form obovate conidia),  $3.0-4.3 \times 2.5-3.0 \mu$ ; sometimes cylindrically elongate, up to  $6 \mu$  long. Chlamydo-spores abundant on submerged hyphae in aged cultures, globose-obovate,  $5-25 \mu$  in diam.

*Note.* The type form of *H. muroiana* is distributed in Asia and Europe and the two new forms are distributed in the Amazon Basin. Considering the localities of the two new forms, they may be geographically segregated within the Amazon Basin.

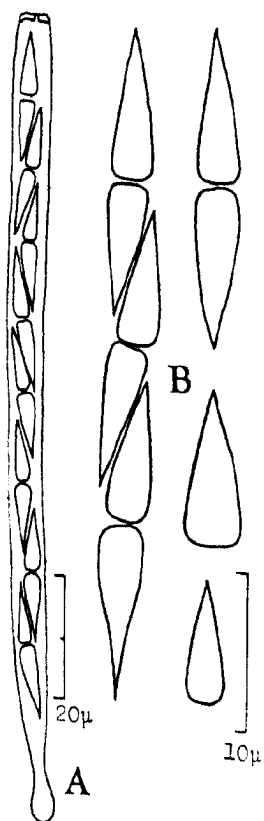


Fig. 22. *Pseudohypocrea citrinella* (ELLIS) DOI (TNS-F-224939).  
A. Ascus and p.sp. B. P.sp.

#### Gen. *Pseudohypocrea* DOI

##### 20. *Pseudohypocrea citrinella* (ELLIS) DOI

Bull. Natn. Sci. Mus. Tokyo, 15: 655 (1972).

*Hypocrea citrinella* ELLIS, Bull. Torrey Bot. Club. 6: 108 (1876).

*Specimen examined.* Rio Peneya, Caqueta, Colombia, 25-28, VII-1973, Y. Doi (D. 1717=TNS-F-224939).

*Note.* The conical edges of p.sp. of the South American strain are sharper than those of the strains collected in North America and Japan, as shown in Fig. 22.

#### Gen. *Thuemenella* PENZ. et SACC. emend. BOEDIN

##### 21. *Thuemenella izawae* sp. nov.

Stromata disciformia vel hemisphaerica, dilute brunnea, usque ad 1 mm in diam., 0.5-0.7 mm crassa, marginibus stromatarum tuberculatis. Perithecia

obovata, 180–210  $\mu$  in diametro verticali. Ascus 8-ascosporus, ascosporis viridibus, valde verrucosis, subcylindricis, 9.5–14  $\times$  5–6  $\mu$ .

Str. disciform or hemisphaerical, roughened with perithecial protuberances, pale brown, minute, up to 1 mm in diam., 0.5–0.7 mm thick. In vertical section t.o.s.s. of *t. angularis*, composed of comparatively thin-walled, large, polyhedral cells 15–20  $\times$  8–20  $\mu$ . Inn.t. of *t. intricata*; hyphae of inn.t. vertically parallel as a whole, swollen, constricted at the septa, 13–20  $\mu$  in diam. Perith. obovate, 180–210  $\mu$  in vertical diam. Ascus containing 8 a.sp. A.sp. green, strongly verrucose, subcylindrical, 9.5–14  $\times$  5–6  $\mu$ .

*Hab.* On decayed wood in tropical rainforest.

*Holotype.* Rio Peneya, Caqueta, Colombia, 25–28, VII-1973, Y. DOI, (D. 1774 = TNS-F-224996).

*Notes.* (1) The epithet of this species is given in commemoration of Dr. K. IZAWA, an investigator of Japan Monkey Center, who was my good companion for the field studies in the Amazon Basin. (2) A.sp. of this species resembles those of *T. sordida* DOI and *T. britannica* RIFAI et WEBSTER, but *T. sordida* had larger str. up to 7 mm

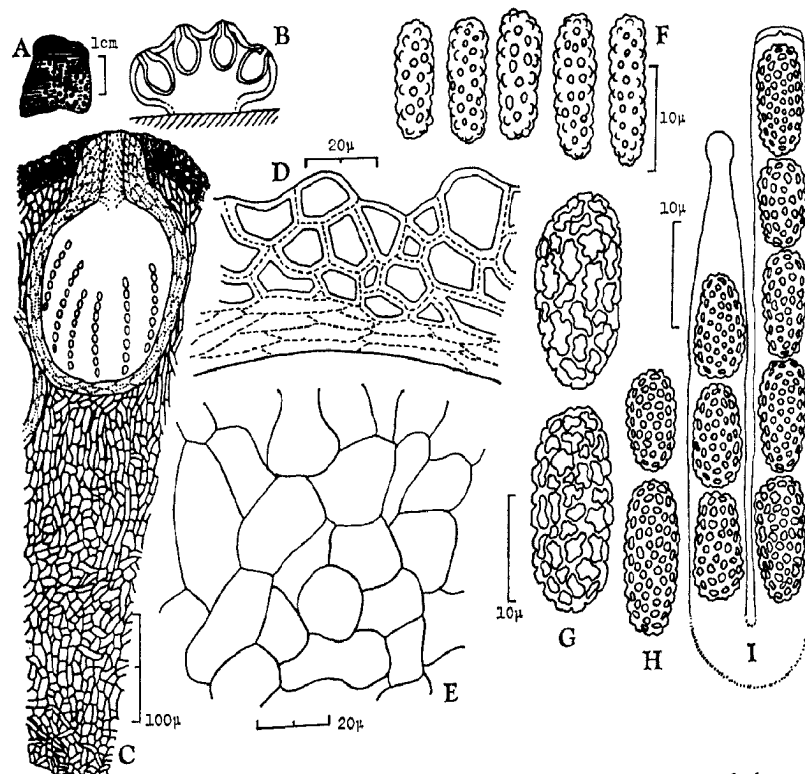


Fig. 23. *Thuemenella izawae* sp. nov. (A–E, and H, I., TNS-F-224996, holotype), *T. britannica* RIFAI et WEBSTER (F, IMI 90311, isotype), and *T. sordida* DOI (G, TNS-F-223430, holotype). A. Habit. B, C. Vertical sections of stroma. D. Vertical section of t.o.s.s. E. Vertical section of inner tissue of stroma. F. A.sp. G. A.sp. H, I. Ascus and a.sp.

in diam. and larger a.sp. *T. britannica* has larger str. up to 3 mm in diam. and smaller, slenderer and more weakly roughened a.sp. A.sp. of the three species are compared in Fig. 21, D,E, and F.

### Gen. *Podostroma* KARSTEN

#### 22. *Podostroma alutaceum* (PERS.) ATK.

Bot. Gaz. 40: 401, Pl. XIV-XVI (1905).

*Sphaeria alutacea* PERS. Observ. Mycol. 2: 66, Pl. I. fig. 2, a,b,c (1797).

St. Conid. Irregular *Trichoderma*-type, in Doi, Y., Bull. Natn. Sci. Mus. Tokyo, 9: 346 (1966).

*Specimen examined.* São Leopold, Rio Grande do Sul, Brasil, J. RICK, 1907 (SP 22935).

*Note.* P.sp., t.o.s.s. and appearance of str. agreed well with those of the specimens collected in Japan. The horn-shaped appearance of str. of the South American and Japanese strains, growing on decayed woods, are more or less different from the longly stipitate form of str. in the strains collected in northern Europe and northern America, growing among the pine needles along with *Spathularia*. It requires further studies to make clear the relationships between the two types of the present fungus.

#### A preliminary note on the differentiation of some species of South American *Hypocrea*

It can be pointed out that some closely related species or forms in the same species

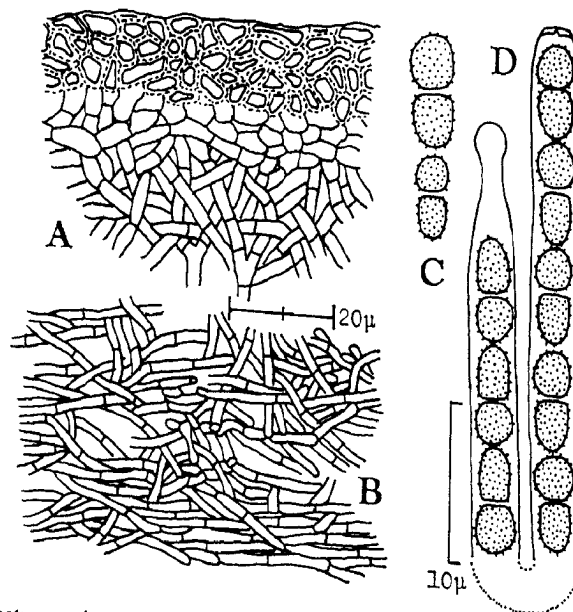


Fig. 24. *Podostroma alutaceum* (PERS.) ATK. (SP 22935). A Vertical (parallel to the axis of clavate stroma) section of t.o.s.s. B. Vertical section of inner tissue of stroma. C,D. Ascus and p.sp.

Table 1. Differentiation of closely related species under different climate zone in South America.

	Habitat	
	in tropical rainforest	in temperate-subtropical climates
Pairs of related species or forms	<i>H. subflavominiata</i>	<i>H. flavo-miniata</i>
	<i>H. muroiana</i> f. <i>minor</i> and <i>H. muroiana</i> f. <i>dimorphospora</i>	<i>H. rufa</i>
	<i>H. patella</i> f. <i>tropica</i>	<i>H. patella</i> f. <i>patella</i>

Table 2. Geographical distributions of some related species of *Hypocrea*.

	Regions	
	in South America	in other regions
Pairs of related species or forms	<i>H. muroiana</i> f. <i>minor</i>	<i>H. muroiana</i> f. <i>muroiana</i>
	<i>H. muroiana</i> f. <i>dimorphospora</i>	in Asia and Europe
	<i>H. sulfurella</i> in South America, New Zealand and Africa	<i>H. flavo-virens</i> in Asia
	<i>H. andinogelatinosa</i>	<i>H. gelatinosa</i> in northern Europe

are distributed in accordance with the climatic differences in South America, as shown in Table 1.

It can also be pointed out that some closely related species are geographically separated under resembling climatic conditions, as shown in Table 2.

It requires further studies to make clear such differentiations in the genus *Hypocrea*.

### Summary

19 species including 4 forms of *Hypocrea*, 1 species of *Pseudohypocrea*, 1 species of *Thuemenella*, and 1 species of *Podostroma* are listed up in this paper. All species and forms were collected in South America by the present writer or by some other mycologists. Among the listed species and forms, 8 species and 3 forms were described as new to science. It is preliminarily pointed out that some closely related species or forms of *Hypocrea* are separated in accordance with the climatic differences in South America or with the geographical factors.

### References

- BRESADOLA, A. G., 1896. Fungi Brasilienses lecti a cl. Dr. Alfredo MÖLLER. *Hedwigia* **35**: 276-302.  
 ——— 1920. Selecta mycologica. *Ann. Mycol.* **18**: 26-70.  
 DENNIS, R. W. G., 1970. Fungus flora of Venezuela and adjacent countries. 531 pp. *Kew Bulletin Additional Series III*. Royal Botanic Gardens, Kew.

- DINGLEY, J. M., 1952. The Hypocreales of New Zealand III. The genus *Hypocrea*. *Trans. Roy. Soc. New Zealand*, **79**: 323-337.
- 1956. The Hypocreales of New Zealand-VII. A revision of records and species in the Hypocreaceae. *Trans. Roy. Soc. New Zealand*, **83**: 643-662.
- DOI, Y., 1969. Revision of the Hypocreales with cultural observations IV. The genus *Hypocrea* and its allies in Japan. (1) General part. *Bull. Natn. Sci. Mus. Tokyo*, **12**: 694-724.
- 1972. ——— IV. The genus *Hypocrea* and its allies in Japan (2). Enumeration of the species. *Bull. Natn. Sci. Mus. Tokyo*, **15**: 649-751.
- 1973. ——— V. *Podostroma giganterum* IMAI, *P. cornu-damae* (PAT.) BOEDJIN and *Hypocrea pseudogelatinosa* sp. nov. *Rept. Tottori Mycol. Inst. (Japan)*, **10**: 421-427.
- HENNINGS, P., 1893. Fungi brasilienses II. *ENGLER's Bot. Jahrb.*, **17**: 523-526.
- 1902. Fungi blumenavienses II. *Hedwigia*, **41**: 1-33.
- 1904. Fungi S. Paulenses III. *Hedwigia*, **43**: 197-209.
- MÖLLER, A., 1901. Phycmyceten und Ascomyceten, Untersuchungen aus Brasilien. 319 pp. G. Fischer, Jena.
- MONTAGNE, J. F. C., 1856. *Sylloge generum specierumque Cryptogamarum*. 498 pp. Paris.
- PATOUILLARD, N., and A. GAILLARD, 1888. Champignons du Venezuela et principalement de la region du Haut-Orinoque. (suite) *Bull. Soc. myc. Fr.*, **4**: 92-129, pl. XVIII-XX.
- & G. de LAGERHEIM, 1892. Champignons de L'Equateur, Pug. II. *Bull. Soc. Myc. Fr.*, **8**: 113-140, pl. XI, XII.
- & ———, 1893. ———, Pug. III. *Bull. Soc. myc. Fr.* **9**: 124-165, pl. VIII-X.
- REHM, H., 1898. Beitrage zur Pilzflora von Sudamerika IV. Hypocreaceae. *Hedwigia*, **37**: 189-201, Taf. VIII.
- 1911. Ascomycetes novi. *Ann. Mycol.*, **9**: 363-371.
- RICK, J., 1906. Pilze aus Rio Grande do Sul. *Broteria*, **5**: 5-53.
- ROGERSON, C. T., 1970. The Hypocrealean Fungi (Ascomycetes, Hypocreales). *Mycologia*, **62**: 865-910.
- SEEVER, F. J., 1910. The Hypocreales of North America III. *Mycologia*, **2**: 48-92, pl. XX, XXI.
- SPEGAZZINI, C., 1881. Fungi Argentini. *Anal. Soc. Cienc. Argentina*, **12**: 208-227.
- 1888. Fungi Guaranitici. *Anal. Soc. Cienc. Argentina*, **28**: 5-74.
- 1889. Fungi Puiggariani, Pug. I. *Bolet. Acad. Nac. Cienc. Cordoba*, **11**: 381-622.
- 1899. Fungi Argentini novi v. critici. *Anal. Mus. Nac. Buenos Aires, Ser. II*, **8**: 81-365, Lam. 4-5.
- 1899-1912. Mycetes Argentinenses. Series I. *Anal. Mus. Nac. Buenos Aires, Ser. II*, **47**: 262-273 (1899); Series IV. *ibid.*, Ser. III. **12**: 257-458 (1909); Series VI. *ibid.*, **23**: 1-146 (1912).
- 1923. Fungi Paraguayenses. *Anal. Mus. Nac. Hist. Nat. Buenos Aires*, **31**: 355-450.
- 1926. Contribucion al conocimiento de la Flora micologica de las sierras de Cordoba. *Bol. Acad. Nac. Cienc. Cordoba*, **28**: 113-190.
- STARBÄCK, K., 1899. Ascomyceten der Ersten Regnellschen Expedition. I. *Bih. K. Svensk. Vet.-Akad. Handl.*, **25**: afd. III, no. 1: 1-68, Taf. I-II.
- 1904. Ascomyceten der ersten Regnellschen Expedition. III. *Ark. f. Bot.*, **2**: no. 5: 1-22, Taf. 1-2.
- 1905. Ascomyceten Schwedischen Chaco-Cordilleren Expedition. *Ark. f. Bot.* **5**: no. 7: 1-35, Taf. 1.
- STEVENSON, J. A., & E. K. CASH., 1936. The new fungus names proposed by C. G. LLOYD. *Bull. Lloyd Library and Museum of Botany, Pharmacy and Materia medica. no. 35. Mycological series*, no. **8**: 1-209.
- 1971. An account of fungus exsiccati containing materia from the America. *Beih. Nova Hedwigia*, **36**: 1-563.
- SYDOW, H., et P. SYDOW, 1907. Verzeichnis der von Herrn F. NOACK in Brasilien gesammelten



- Pilze. *Ann. Mycol.* **5**: 348-363.
- 1930. Fungi Venezuelani. *Ann. Mycol.*, **28**: 29-224.
- THEISSEN, F., 1910. Fragmenta brasílica III. *Ann. Mycol.*, **8**: 452-463.
- 1911. Die Hypocreaceen von Rio Grande do Sul, Südbrasilien. *Ann. Mycol.*, **9**: 40-73, Taf. V-VII.
- WEBSTER, J., 1964. Culture studies on *Hypocrea* and *Trichoderma*. I. Comparison of perfect and imperfect states of *H. gelatinosa*, *H. rufa* and *Hypocrea* sp. 1. *Trans. Brit. Mycol. Soc.*, **47**: 75-96.