

Revision of the Hypocreales with Cultural Observations  
 XI. Additional notes on *Hypocrea* and its  
 Allies in Japan (1)

By

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*Protocrea seminuda* DOI, sp. nov. (Fig. 1)

*Perithecia seminuda* ex subiculis, dispersa vel aggregata, cremea vel ochraceo-carnosa, subglobosa, 90–130  $\mu$  diam., ostiolis erumpentibus, longis, cylindricis, leviter attenuatis, 50–60  $\mu$  longis, 25–40  $\mu$  diam., cellulis texturarum ostiolarum hyalinis vel albo-ochraceis, 5–8  $\times$  2–3  $\mu$ . Subicula alba, generaliter praesentia ad basim perithecorum, sparsim intertexta, hyphis subicularum gracilibus, hyalinis, 2–4  $\mu$  diam. Partosporae hyalinae, punctatae, partosporis distalibus subgloboso-ovatis, 2.0–2.5  $\times$  1.8–2.5  $\mu$ , partosporis proximalibus obovato-subcylindricis, 2.2–2.9  $\times$  1.5–2.1  $\mu$ .

Hab. On bark of dead broad-leaved tree.

Specimen examined. Tsushima Isl.; the foot of Mt. Tatera-yama, Izuhara-Chō, Shimo-agata-Gun, Nagasaki Pref., 16-X-1977, Y. DOI, D. 3386=F-232069 (Holotype in TNS).

Culture\* Partspores of the holotype material germinated within two days after isolation. Hyphal growth rapid. Hyphae at first submerged and more or less radiate from the inoculated portions; afterwards aerial hyphae prominent, cottony, white. Conidiophores produced among or covering aerial vegetative hyphae after a week, of

Table 1. Comparison of *Protocrea seminuda* and *P. lattissima*.

	<i>P. seminuda</i>	<i>P. lattissima</i>
Perithecia	Naked from subicula in the half	Almost imbedded in subicula
Ostioles	Cylindrical, long, 50–60 $\mu$ long, with elongated cells more or less radiately arranged	Cylindrical, short, 30–40 $\mu$ long
Partspores	Distal 2.0–2.5 $\times$ 1.8–2.5 $\mu$ ; proximal 2.2–2.9 $\times$ 1.5–2.1 $\mu$ , faintly warded (punctulate-punctate)	Distal 2.9–3.2 / 2.6–3 $\mu$ ; proximal 2.6–3.2 / 2.6–2.9 $\mu$ , minutely and densely warded
Conidiophores	<i>Trichoderma</i> -like <i>Verticillium</i> -type	<i>Verticillium</i> -like <i>Cephalosporium</i> -type
Conidia	Small, 2.2–3.5 $\times$ 1.5–2.0 $\mu$	Large, 5–10 / 1.5–3.2 $\mu$

\* All cultures described in this paper were made on slant media of malt agar under room temperature.

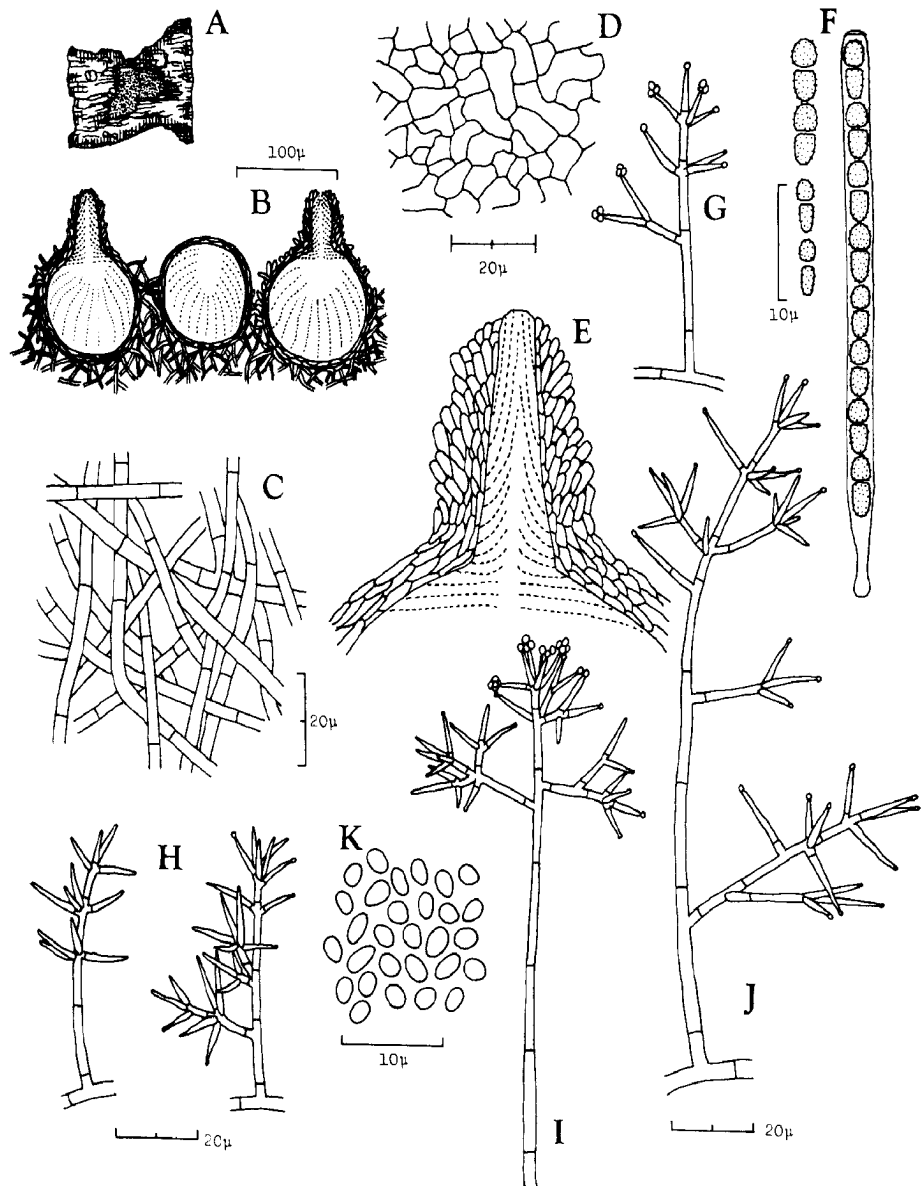


Fig. 1. *Protocrea seminuda* Doi, sp. nov. (TNS-F-232069, Holotype). A. Habit. B. Perithecia and subicula in vertical section. C. Hyphae of subiculum. D. Tissue of perithecial wall in surface view. E. Ostiole in vertical (longitudinal) section. F. Ascus and partspores. G-J. Conidiophores. K. Conidia.

the *Verticillium*-type close to the *Trichoderma*-type, up to 200  $\mu$  long in main axial hyphae. Phialides slender, tapering toward the top, 6-15  $\mu$  long, 1.5-2.0  $\mu$  diam. Conidia hyaline, smooth, ellipsoid or more or less ovate, each with a minute truncate base, forming loosely aggregated masses, 2.2-3.5  $\times$  1.5-2.0  $\mu$ .

Note. Partspores of the present new species are the smallest among those of the known species of *Protocrea*. This species is considered to be close to *P. lattissima* MERCULI & RANALLI reported from Argentine (MERCULI & RANALLI, 1976). These two species are distinguished from each other by the characters shown in the Table 1.

***Hypocrea albocornea* DOI (Fig. 2)**

Bull. Natn. Sci. Mus. Tokyo, **15**:712 (1972).

Additional specimens examined. Morozuka-Mura, Miyazaki Pref., 15-X-1975, Y. DOI, D. 2173=F-226696 (TNS); Amami-Ōshima Isl.; Yuwan, Uken-Son, Amami-Gun, Kagoshima Pref., 31-I-1977, Y. DOI, D. 2943=F-232001; D. 2927=F-232049; D. 3016=F-232068 (TNS); Yakushima Isl.; Kusakawa—Shiratani, Yaku-Chō, Kumage-Gun, Kagoshima Pref., 18-IX-1977, Y. DOI, D. 3244=F-232070 (TNS).

Culture. Partspores of F-226696 and F-232070 germinated and conidiophores were formed. Germination rate of partspores low. Germination of partspores and hyphal growth slow. Hyphae at first submerged; afterwards conidiophores aerially produced, forming colonies of about 1 cm diam. after a month. Colonies restricted, green or deep green with the color of aggregate conidia. Conidiophores of irregular *Trichoderma*-type, somewhat resembling the *Gliocladium virens*-type or the *G. deliquescens*-type, up to 0.7 mm long. Branchlets of conidiophores dense with narrow angles at upper portions of conidiophores. Phialides slender, tapering toward the top, 15–40  $\mu$  long, 2.5–4  $\mu$  diam. Conidia ellipsoid, ovate or subcylindrical, green, smooth, each with a minute truncate base, 5.5–12  $\times$  3.8–5.0  $\mu$ . Chlamydospores not observed. Reversed sides of colonies pale brown.

Note. The irregular branching of conidiophores observed in the present species should be included in the delimitation of the form-genus *Trichoderma*. Similar branching of conidiophores has been also reported in those of *Hypocrea centri-sterilis* DOI, *Thuemenella fragilis* DOI and in *Thuemenella sordida* DOI (DOI, 1972), though they have not been sufficiently discussed whether they should be classified into the form-genus or not.

*Hypocrea tawa* DINGLEY

Trans. Roy. Soc. New Zealand, **79**:335 (1952).

St. conid.: *Verticillium*-like *Trichoderma*-type, in DINGLEY, J. M., Trans. Roy. Soc. New Zealand, **84**:689, Text-Fig. 1, fig. 4 (1956).

f. *tawa* (Fig. 3)

Stromata disperse or sometimes aggregate, disciform, dark brown, attached to the substratum with narrow bases, 2–4 mm diam., 0.6–0.8 mm thick. In vertical section t. o. s. s.\* of *t. angularis*, composed of slightly thick-walled cells of 8–13  $\times$  5–10  $\mu$ , generally covered with brown, crushed cells. Inner tissue of *t. intricata* close to *t. angularis*;

\* Abbreviations are the same as those used in the writer's previous paper (DOI, 1969).

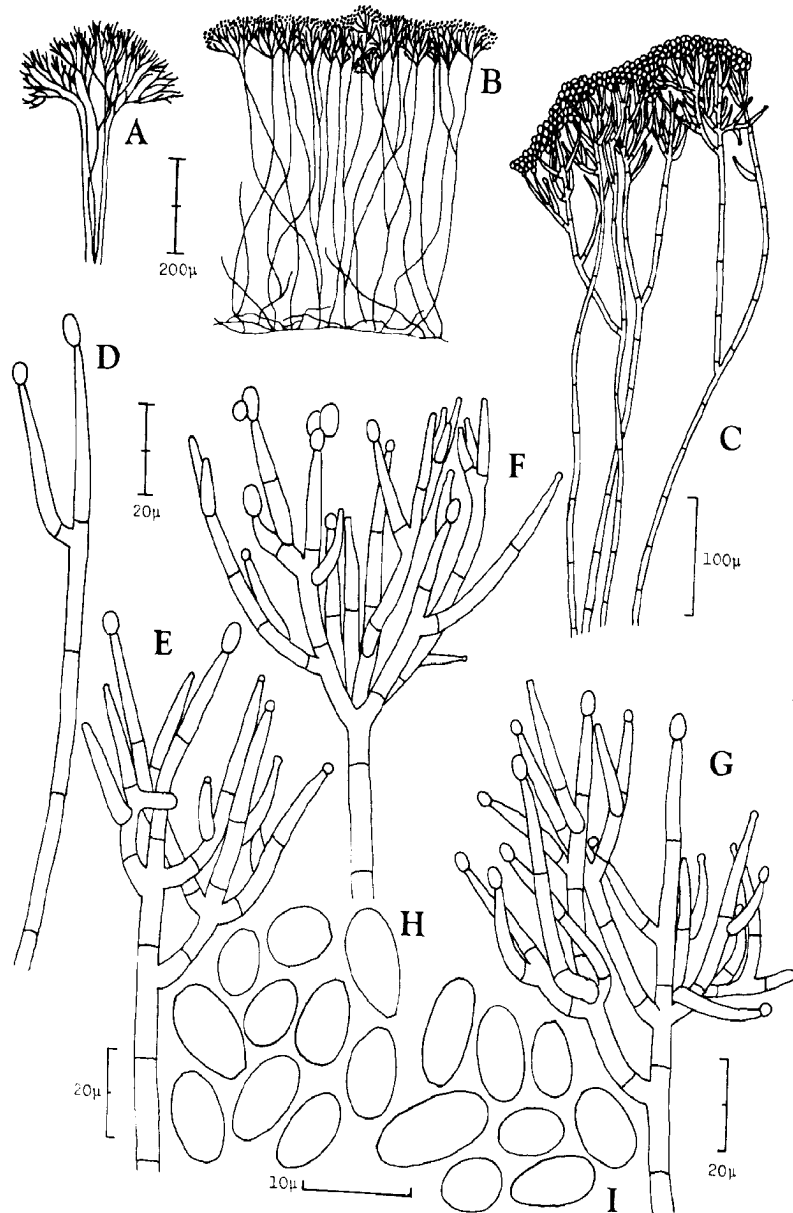


Fig. 2. Conidial state of *Hypocrea albocornea* Dot (A-E. G. I. TNS-F-226696; F. H. TNS-F-232070). A-G. Conidiophores. H. I. Conidia.

cells of inner tissue below perithecia  $6-14 \mu$  diam. Perithecia subglobose to vertically elongate,  $180-220 \mu$  in vertical diam. Ostioles cylindrical,  $90-120 \mu$  long,  $60-90 \mu$  diam. Apical paraphyses clearly visible in well-matured perithecia. Asci cylindrical with flattened, slightly thickened apical walls,  $90-100 \mu$  long,  $4.5-5.0 \mu$  diam. Partspores green, densely warted; distal subglobose to ovate,  $4.5-6.0 \times 4.0-$

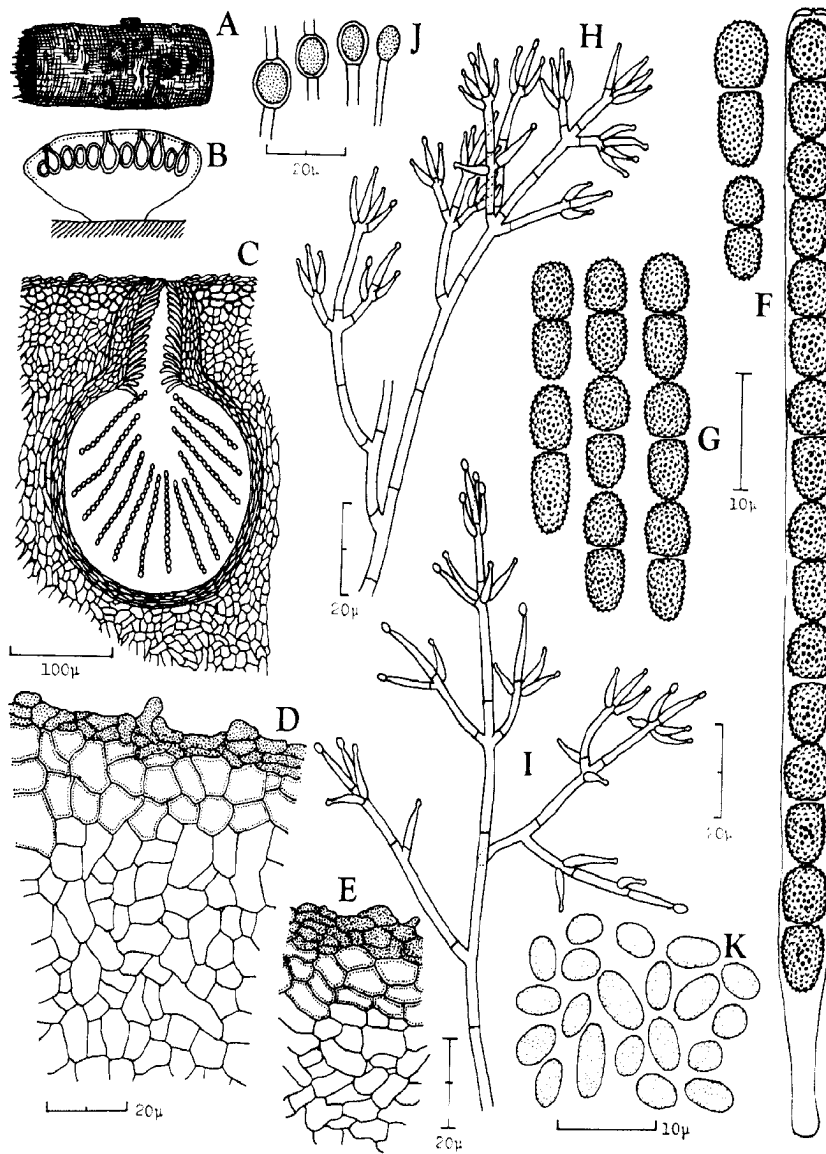


Fig. 3. *Hypocrea tawa* f. *tawa* Dingley (A-D. F. H-K. TNS-F-226462; E. G. PDD 4268, part of type collection). A. Habit. B. C. Stroma in vertical section. D. E. T.o.s.s. in vertical section. F. Ascus and partspores. G. Partspores. H. I. Conidiophores. J. Chlamydospores. K. Conidia.

5.0  $\mu$ ; proximal obovate or short cylindrical, 4.0-6.5  $\times$  3.7-4.8  $\mu$ .

Hab. On bark of fallen branch of broad-leaved trees.

Specimens examined. Yakushima Isl.; Kurio, Yaku-Chō, Kumage-Gun, Kagoshima Pref., 1-VII-1975, Y. Doi, D. 2023=F-226462 (TNS); New Zealand; on *Beilschmiedia tawa*, Auckland, Alfriston, 10-VII-1948, J. M. DINGLEY, PDD 4268

(part of type collection).

**Culture.** Partspores of F-226462 germinated within a day. Hyphal growth rapid (slightly slower than those of common strains of *Trichoderma*). Colonies at first submerged, afterwards provided with aerial conidiophores and becoming pale yellow-green, green or sometimes dark green with the color of conidia. Conidiophores produced within 4 days after isolation of partspores, covering whole culture media. Branching-type of conidiophores belonging to the *Verticillium*-type close to the *Trichoderma*-type. Main axial hyphae of conidiophores up to  $250\ \mu$  long,  $2\text{--}3\ \mu$  diam. Phialides verticillate with narrow angles, slender, tapering toward the apices, or bottle-shaped in aged cultures,  $10\text{--}16 \times 1.7\text{--}3.2\ \mu$ . Conidia green, faintly roughened (punctulate), ellipsoid to subcylindrical,  $3.5\text{--}5.9 \times 2.5\text{--}3.2\ \mu$ . Chlamydoconidia often produced on aerial hyphae, hyaline, smooth, subglobose,  $7\text{--}12\ \mu$  diam. Reversed sides of colonies not colored.

**Notes.** (1) The typical form of this species (f. *tawa*) is newly recorded from Japan. (2) The typical form is distinguished from f. *microspora* mainly by the larger partspores. In addition, the typical form produced principally conidiophores only of the *Verticillium*-type, while f. *microspora* produced dimorphic conidiophores, i.e., of the *Verticillium*-type especially when they were scattered on culture media, and of almost typical *Trichoderma*-type when they form compactly aggregated colonies. (3) The present species is considered to be closely related to *Hypocrea subalbocornea* DOI, though they are clearly discriminated from each other mainly by the color of stromata, roughness of partspores and the dimension of conidia. (4) In Japan the typical form of this species is known only in Yakushima Isl., while f. *microspora* is known in Yakushima Isl. (along Miyanoura Forestry Road, Kamiyaku-Chō, Kumage-Gun, Kagoshima Pref., 21-I-1977, Y. DOI, D. 2952=F-232023, in TNS), Kyūshū (Cape Satamisaki, Kagoshima Pref., D. 230=F-223392, the holotype of the form, in TNS), and Honshū (Arakasizawa, Tokyo University Forest, Chiba Pref., 10-X-1977, N. AMANO, D. 3339=F-232017, in TNS).

**Podostroma solmsii** (E. FISCH.) IMAI f. **octospora** DOI, f. nov. (Fig. 4)

Differt haec forma a typo octo-ascosporis in asco. Ascosporae obovato-ellipsoideae, hyalinae vel albo-stramineae, colliculato-granulatae,  $10\text{--}16 \times 4.5\text{--}5.5\ \mu$ .

**Specimen examined.** On eggs of *Phallus impudicus* in bamboo forest, Gando-Yama, Bessho-Chō, Kanazawa City, Ishikawa Pref., 17-X-1976, Y. IKEDA, no. 493=F-228252 (Holotype in TNS and isotype in private herbarium of Mr. Y. IKEDA).

**Notes.** (1) According to the illustration and description given by ED. FISCHER (1887), the typical form of this species produces 16 warted-partspores in an ascus. DOI (1967) reported a specimen of this species collected in Japan, but the specimen was not well-matured and had very few partspores and very few ascospores that were not divided into partspores. In the specimen of the present form, on the other hand, undivided ascospores are well-matured and no partspores are found.

Tropical or subtropical species of *Hypocrea* or its allied genera are sometimes

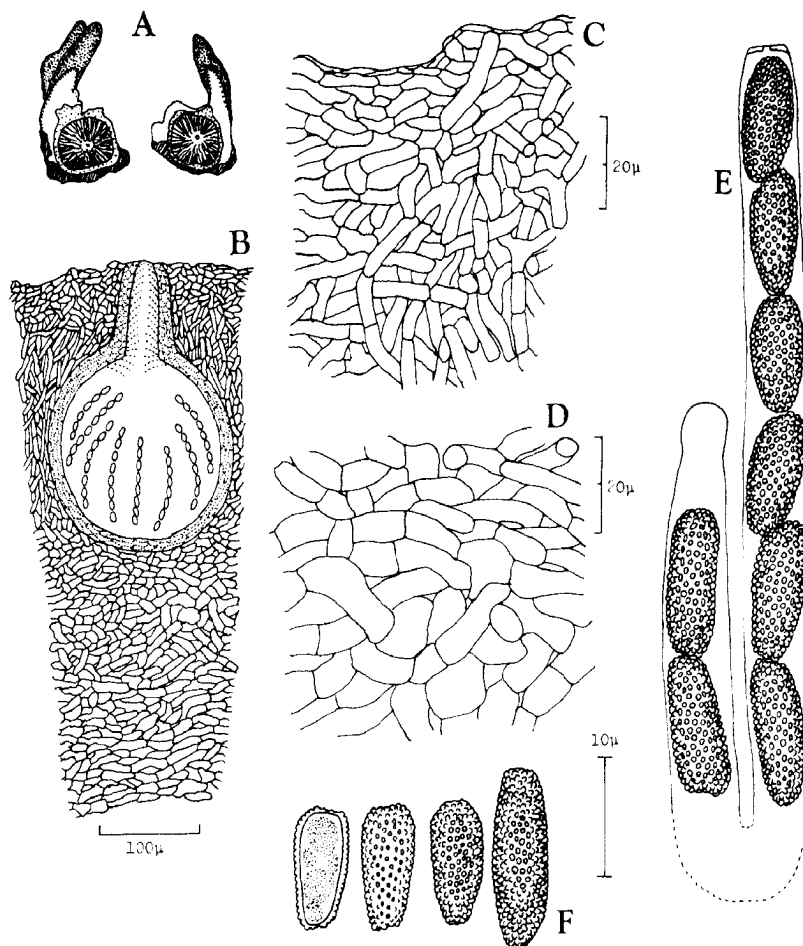


Fig. 4. *Podostroma solmsii* (E. FISCH) IMAI f. *octospora* DOI, f. nov. (TNS-F-228252, Holotype). A. Stromata with host fungi (eggs of *Phallus impudicus*) in longitudinal section. B. Stroma in transverse section. C. T.o.s.s. in transverse section of stroma. E. Ascus and ascospores. F. Ascospores.

collected in temperate regions. In these specimens, ascospores are subject not to be divided into partspores. Such undivided ascospores are almost always found together with normal and abnormal (including immature) partspores.

With this reason mentioned above, the ascospores of the present fungus are not considered to be abnormal ones in a tropical species growing under inadequate condition.

(2) This form of the species has t. o. s. s. of *t. intricata* composed of thin-walled cells, while the typical form, including a collection in Japan (D. 223 = F-223353 in TNS), has *t. globulosa*-type t. o. s. s. which is close to *t. angularis*.

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### Summary

*Protocrea seminuda* DOI, sp. nov. has the smallest partspores among those of the known species of the genus. This species has the *Verticillium*-type conidial state close to the *Trichoderma*-type with minute hyaline conidia.

*Hypocrea albocornea* DOI produced irregularly branched conidiophores with smooth green conidia. This conidial state should be included in the form-genus *Trichoderma*.

*Hypocrea tawa* f. *tawa* DINGLEY is newly recorded from Japan.

*Podostroma solmsii* (E. FISCH.) IMAI f. *octospora* DOI, f. nov. has eight ascospores which are not divided into 16 partspores. Under temperate climate conditions some tropical species of *Hypocrea* or its allied genera are subject to produce ascospores undivided into partspores usually together with normal or abnormal partspores. Because the undivided ascospores are well-matured and no partspore is found, the present fungus is described as a new form.

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