

Three species of *Hypocrella* with large stromata pathogenic on scale insects

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Abstract: Three species of *Hypocrella* characterized by large stromata and living on scale insects are described or redescribed. Two rarely reported species, *H. gaertneriana* and *H. schizostachyi*, are associated with bamboo scale insects and are redescribed from South America and Thailand, respectively. The new species *H. africana* is described from scale insects on wood in Africa. A hyphomycetous anamorph with enteroblastic conidiogenous cells and two different conidial morphologies developed in cultures derived from Thai material of *H. schizostachyi*. These records and observations are put in the context of currently accepted *Hypocrella* taxonomy.

Key Words: Ascomycota, Clavicipitales, Homoptera, systematics, tropics

INTRODUCTION

The genus *Hypocrella* Sacc. (Ascomycota: Clavicipitales) is one of the more easily recognized ascomycete genera because of its brightly colored stromata that form on scale insects. Its many species (Petch, 1921, 1925, 1931; Mains, 1959; Hywel-Jones and Evans, 1993) are primarily tropical or subtropical in distribution.

The genus was originally distinguished from *Hypocrea* Fr. (Ascomycota: Hypocreales) by the formation of eight, filiform ascospores in each ascus (Saccardo, 1878). Petch (1921) further observed that the filiform ascospores disarticulate at the septa while still in asci, giving a multiplicity of part-ascospores in each

ascus. Petch (1921) presumed that where whole ascospores were seen in asci, this was evidence of immaturity. Petch (1921) and Mains (1959) reviewed the genus and confirmed that species of *Hypocrella* are entomogenous. The species occur specifically on immature stages of 'scale insects' belonging to two families of Homoptera (Aleyrodidae and Coccidae). Mains (1959) did not discuss the type of the genus, but he accepted that some members of the genus also discharge whole ascospores. Most notable in this regard was *Hypocrella aurantiaca* (Petch) Mains, a species which Petch (1939) had originally placed in *Stereocrea* H. Sydow & P. Sydow. Hywel-Jones and Evans (1993) examined the type species, *Hypocrella discoidea* (Berk. & Broome) Sacc., from collections in Thailand and Malaysia and compared these with the type material (K) from Sri Lanka. From this study it was recognized that the type of the genus produces and discharges whole mature ascospores.

Known anamorphs, connected either from field associations or from cultural studies, have been referred to the coelomycete genus *Aschersonia* Mont. Conidomata of *Aschersonia* are not outwardly readily distinguished from perithecia in that they are light or brightly colored, immersed in the stroma, and restricted to the insect host. Conidia are unicellular and are produced in great numbers from phialides.

In a survey of the mycota of insects in Thailand by Hywel-Jones (NLH-J) collections were made of a distinctive *Hypocrella* with large stromata that was infecting scale insects (Coccidae) on bamboo. This was identified as *Hypocrella schizostachyi* P. Henn., which was previously known from the type locality in the Philippines, as well as from Borneo (Petch, 1921) and Sumatra (Petch, 1931). Collections of a similar species, also on scale insects on bamboo, were made by Samuels (GJS) from French Guiana, Brazil and Amazonian Venezuela. This was identified as *Hypocrella gaertneriana* Møller, a species previously known only from southern Brazil (Petch, 1921, 1925). African material of a third *Hypocrella* species (BPI 635731) with similarly large stromata, but growing on scale insects on wood, was collected in Liberia, and identified by Mains as *H. gaertneriana*. Examination of this specimen showed it to be distinct from *H. gaertneriana* or any other known species. It is described here as new. All three species are discussed

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in the context of the genus *Hypocrella* as it is currently understood. Cultures are deposited in the National Center for Genetic Engineering and Biotechnology, Bangkok; and in the Centraalbureau voor Schimmelcultures.

MATERIALS AND METHODS

Details of the collection, preparation and isolation of this material have been given elsewhere (Hywel-Jones, 1995). Cultures of *H. schizostachyi* were derived from massed part-ascospores. Part-ascospores germinated on potato dextrose agar (PDA, Difco) either in a dark incubator at 22 C or in the laboratory under ambient light conditions at 25–35 C. Weights of stromata are dry weights. Color references are from Kornerup and Wanscher (1987). Abbreviations of herbaria are taken from Holmgren et al. (1990).

TAXONOMY

Hypocrella africana Hywel-Jones et Samuels, sp. nov. FIGS. 1–7

Stromata superficialia, hemisphaerica, convoluta vel tuberculata, carnosia indurescens, 8–17 mm lata, 7–12 mm alta, brunneolus; hypothallus nullus. Ascumata perithecialia, immersa, obpyriformia, 321–389 μm alt., 135–210 μm lat. Asci cylindrici, octospori, ad apicem incrassati, 104–140 \times 5.7–8.1 μm , aparaphysati. Ascosporeae filiformes, pluriseptatae, mox in asco discedentibus; parti-ascosporeae unicellulares, cylindricae, hyalinae, 5.1–8.6(–10.0) \times 1.4–2.1 μm .

HOLOTYPE. AFRICA. LIBERIA: Near Ganta on branches of unidentified woody dicotyledonous plant, Oct. 1951, *Buchanan* (BPI 635731).

Etymology. In reference to the geographic origin of the type collection.

Anamorph. None known.

Stromata superficial, lacking a hypothallus, 8–17 mm diam, 7–12 mm high, hemispherical, broadly attached, fleshy when fresh but hard when dry, convoluted or tuberculate, the individual convolutions or tubercles separated by deep cracks; several ostiola visible on the surface, ostiolar openings as minute dots; the surface of larger stromata ca. 5C5 ('topaz'), smaller stromata darker 6F4 ('chocolate'), no reaction to 3% KOH (at most leaching of pale yellow pigment). Internal tissue of stroma white, solid, of densely intertwined, branched, septate hyphae ca. 6 μm wide, walls 1.5 μm thick, surface not differentiated from rest of stroma but appearing more compact with a yellow deposit in lactic acid. Ascumata perithecioid, completely immersed in the tubercles, obpyriform with a constriction between the body and the beak, 321–389 μm high, 135–210 μm wide ($n = 15$, $356 \pm 21 \times 159 \pm 21 \mu\text{m}$); ostiolar

canal periphysate, 141–202 μm ($163 \pm 18 \mu\text{m}$) long and ca. 50 μm wide at the opening, ostioles appearing crowded on the tubercles, ostiolar elevations not evident. Ascumatal wall 15–29 μm thick; of several layers of small, nondescript cells; cells continuous with the neck. Paraphyses not observed. Asci cylindrical, 104–140 \times 5.7–8.1 μm wide ($n = 11$, $122 \pm 10 \times 6.7 \pm 0.9 \mu\text{m}$), with a prominent refractive cap 4.3–5.7 μm wide and 3–5.3 μm deep with wide canal; asci arising from a basal cluster. Ascospores filiform, multi-transversely septate, disarticulating into unicellular segments early in development; part-ascospores cylindrical, ends truncate, 5.1–8.6(–10) \times 1.4–2.1 μm ($n = 29$, $6.7 \pm 0.8 \times 1.7 \pm 0.2 \mu\text{m}$).

Habitat. On unidentified larval coccid (*Coccus* sp.—Homoptera) feeding on living woody twig.

Known distribution. Known only from the type.

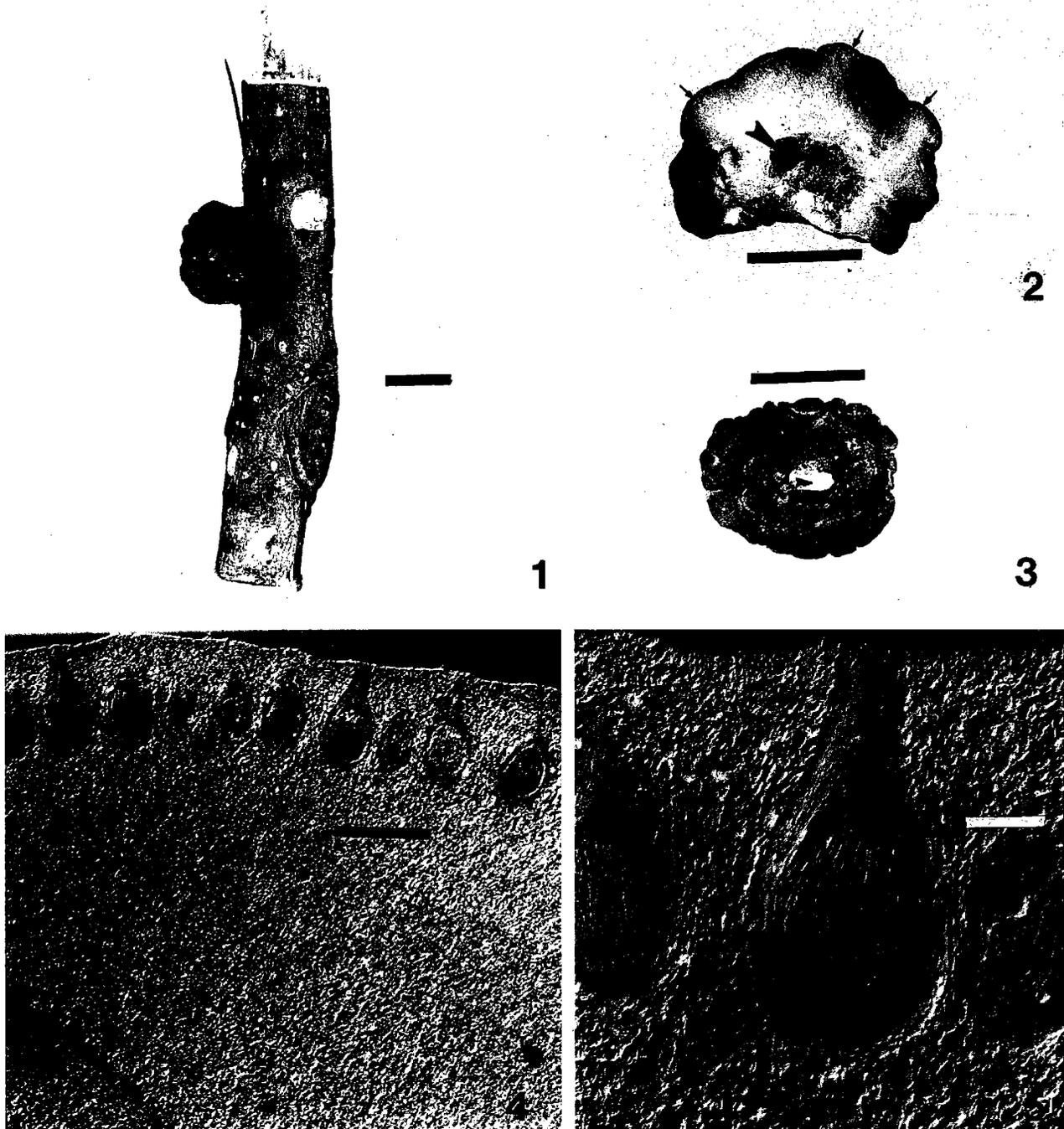
Notes. The fertile tubercles of *H. africana* are large and irregular (FIGS. 1, 2). The base of the stroma has a chalky texture where it has arisen from the host coccid (FIG. 3). Openings of individual perithecia are visible on tubercles as minute dots but are not raised above the surface. Ascospores appear parallel or are disposed in a loose spiral (FIG. 6). The terminal part-ascospores are slightly pointed (FIG. 6) while the discharged part-ascospores appear truncate (FIG. 7). This species is known only from a 45-yr-old herbarium specimen. It is not associated with an anamorph.

This species is thus far represented by only one collection. While we are generally reluctant to propose a new species on the basis of only a single collection, the general aspect of the stromata of *H. africana*, and its occurrence on scale insects on wood rather than bamboo, clearly distinguishes it from *H. gaertneriana* and *H. schizostachyi*, the only two species that have stromata of similar stature.

Hypocrella gaertneriana A. Møller, *Phycomc. & Ascomyc.* p. 299. 1901. FIGS. 8–14

Anamorph. None known.

Stromata superficial, irregularly two-thirds globose or globose to subglobose, 6–30 mm wide, 6–20 mm high, comprising a massive, sterile base, from which arise many large, low, close-set pulvinate to tuberculate, fertile tubercles; buff to pale greenish when dry; a rufous pigment (ca. 6C7, but with more red) released in 3% KOH. Fertile tubercles each 1–3 mm wide, 1–1.5 mm high, white to pale green, immediately red-orange in 3% KOH, lacking any differentiated surface layer; internal tissue of densely intertwined, branched, septate hyphae, 5–6 μm wide with walls 1.5–2 μm thick. Ascumata perithecioid, immersed and scattered just below surface of tubercles, openings appearing golden yellow and projecting slightly above the stromal surface as

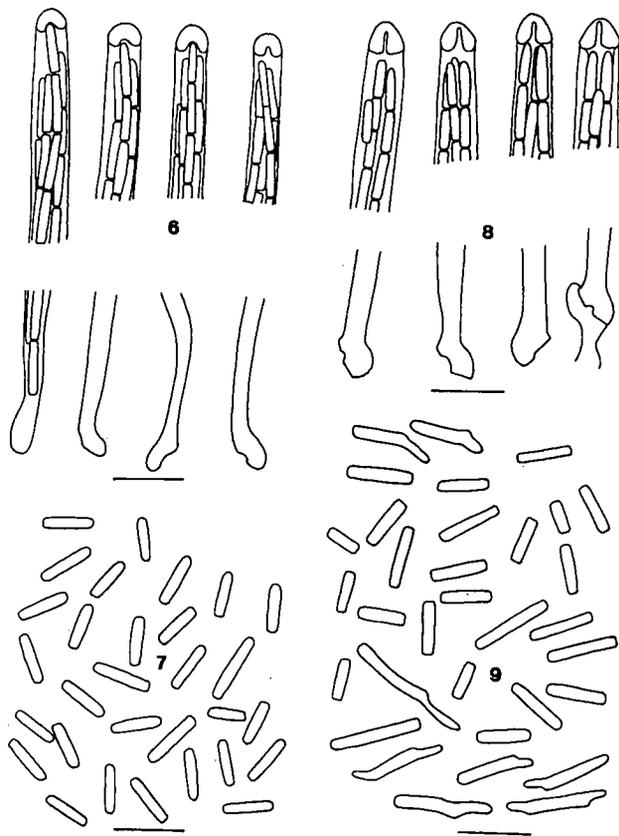


FIGS. 1-5. *Hypocrella africana*. 1. Stroma on substrate showing the large and irregular tubercles. 2. Section of a stroma showing perithecial locules (small arrows) in tubercles. Hole (large arrow) excavated by ant in the middle of the stroma. 3. Lower surface of a stroma showing the typical scar (arrow) left by the remains of the scale insect. 4. Several perithecia immersed in stromal tissue. 5. Median longitudinal section of a mature perithecium. Scale bars: FIG. 1-3 = 0.5 mm; 4 = 350 μ m, 5 = 50 μ m. All from BPI 635731.

minute papillae; pyriform, 247-378 μ m high \times 142-378 μ m wide ($n = 31$, $324 \pm 34 \times 198 \pm 23 \mu$ m), ventral portion more or less globose; neck stout, 71-149 μ m ($n = 31$, $111 \pm 18 \mu$ m); ascomatal wall deep yellow-brown, 19-33 μ m thick. Asci cylindrical, 120-178

\times 4-6.4 μ m ($n = 19$, $157 \pm 18 \times 5.5 \pm 0.6 \mu$ m), 8-spored; cap stout, 4-4.7 \times 3.3-4 μ m tall. Part-asco-spores oblong to cylindrical, 3.9-8 \times 1.5-2 μ m ($n = 30$, $5.4 \pm 1.1 \times 1.5 \pm 0.1 \mu$ m).

Habitat. On scale insects on bamboos.



FIGS. 6-9. *Hypocrella* species. 6, 7. *H. africana* (BPI 635731). 6. Ascus apices and bases showing the arrangement of the part-ascospores. 7. Part-ascospores from mature asci. 8, 9. *H. gaertneriana* (GJS 1776). 8. Ascus apices and bases showing the arrangement of the part-ascospores. 9. Part-ascospores from mature asci, some of which germinated in the ascus. Scale bars = 10 μm .

Known distribution. Tropical South America (Brazil, French Guiana, Venezuela).

Specimens examined. VENEZUELA. DPTO. RIO NEGRO: Cerro de la Neblina, along Río Mawarinuma, just outside Cañon Grande, vic. Neblina Base Camp, ca. 140 m elev., 00°50'N, 66°10'W, low primary forest on white sand, Apr. & May 1984, *Samuels 1776* (NY). FRENCH GUIANA. SAÛL: ca. 20 km SW of Saül (03°60'N, 53°20'W) toward Mt. Galbao (03°50'N, 53°20'W), Camp 3, elev. 650 m, on living bamboo culm (? *Guadua*), 22 Jan. 1986, *Samuels & Boise 3255* (NY); ca. 150 km S of St. Laurent du Moroni, Citron, Mt. Lucifer, 04°70'N, 53°90'W, on living bamboo culms, Mar. 1986, *Samuels & Searwar 4305* (CAY, NY).

Notes. The massive stroma of *H. gaertneriana* almost encircles smaller bamboo culms and obscures the host scale insect (FIG. 10). The tuberculate processes are so closely packed that their form is only apparent when sectioned (FIG. 11). The texture is very hard in dried specimens, and any knife cut fractures the brittle tissue, which has the quality of dried

resin. Re-hydrated material was more easily sectioned. When the stromata were dislodged from the bamboo substrate it was possible to see the scar made by the coccid host on the underside of the stroma. Occasionally, chitinous material from the host was seen adhering to the base of the stroma or to the insect's bamboo substrate.

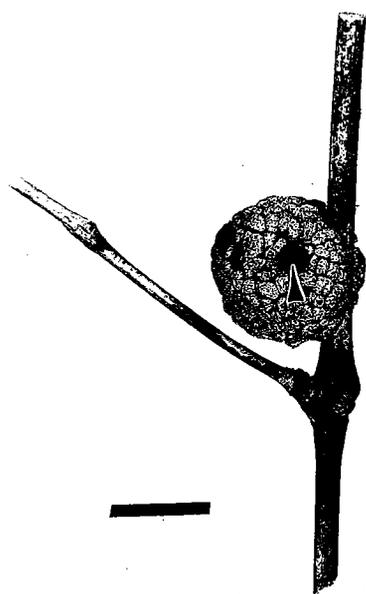
The ascospores, while still in asci, are mainly parallel to each other with three or four appearing below the prominent cap and the others being formed some way further down in the ascus (FIG. 8). A notable feature of the terminal part-ascospores is that they tend to be fusiform and to have slightly pointed ends (FIG. 8); the rest of the part-ascospores are noticeably cylindrical and have truncate ends (FIG. 9). The asci appear to break down, releasing the part-ascospores into the ascomatal centrum. Part-ascospores germinated in the centrum (FIG. 9). No culture isolations were attempted from this material.

Hypocrella schizostachyi P. Henn., *Philippine J. Sci.* 3: 45. 1908. FIGS. 15-29

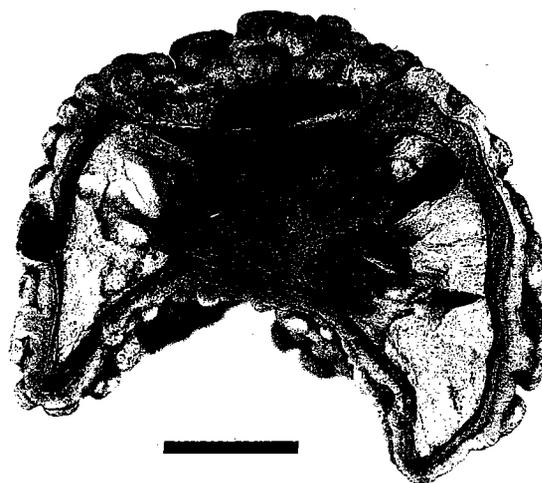
Anamorph. Unidentified sporodochial ("A") and coelomycetous ("B") synanamorphs FIGS. 22-29

The isotype specimen comprises a single stroma. *Stroma* 12 mm diam \times 10 mm high, compound, subglobose, tuberculate. Fertile region divided into cauliflower-like, dark red 8E7 ('mahogany'), fertile tufts; arising from a robust sterile base with central point of attachment; violet pigment released in 3% KOH. Internal tissue white but gold immediately below the surface, the gold turning red in 3% KOH. *Ascomata* perithecioid, pyriform, 353-515 μm ($n = 11$, $422 \pm 44 \mu\text{m}$) high, 159-240 μm ($n = 11$, $182 \pm 25 \mu\text{m}$) wide, distinction between ventral portion and neck not pronounced; ostiolar canal 150-266 ($n = 11$, $208 \pm 32 \mu\text{m}$) long; ascomatal wall, dark yellow-brown, 26-37 μm wide. *Asci* cylindrical, 113-158 μm ($n = 10$, $132 \pm 17 \mu\text{m}$) long, 6-9 μm ($n = 10$, $7 \pm 1 \mu\text{m}$) wide, arising from a basal fascicle, 8-spored. *Ascospores* separating in ascus into part-ascospores; part-ascospores cylindrical with rounded ends, 4.0-9.4 μm ($n = 33$, $6.8 \pm 1.1 \mu\text{m}$) long, 1.6-2.6 μm ($2 \pm 1.2 \mu\text{m}$) wide.

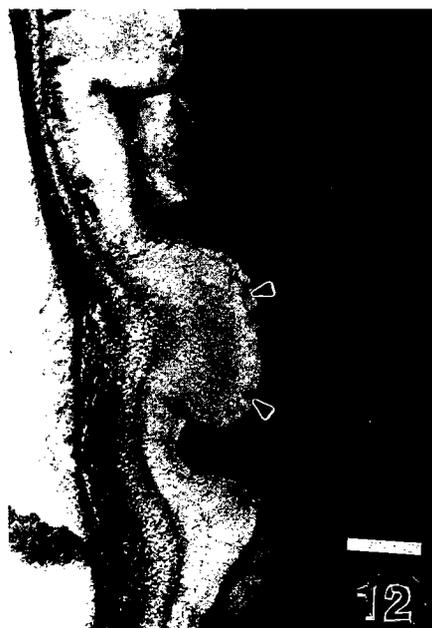
Fresh specimens from Thailand are described as follows. *Stromata* 6-12 \times 5-10 mm high, strongly botryoso-tuberculate, cerebriform, very hard and resinous when fresh, irregularly furrowed, verrucose or irregularly tuberculate. Exterior color yellowish grey, yellowish brown to grey-brown or buff, becoming carbonaceous blackish brown to black. Interior pale



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11



12



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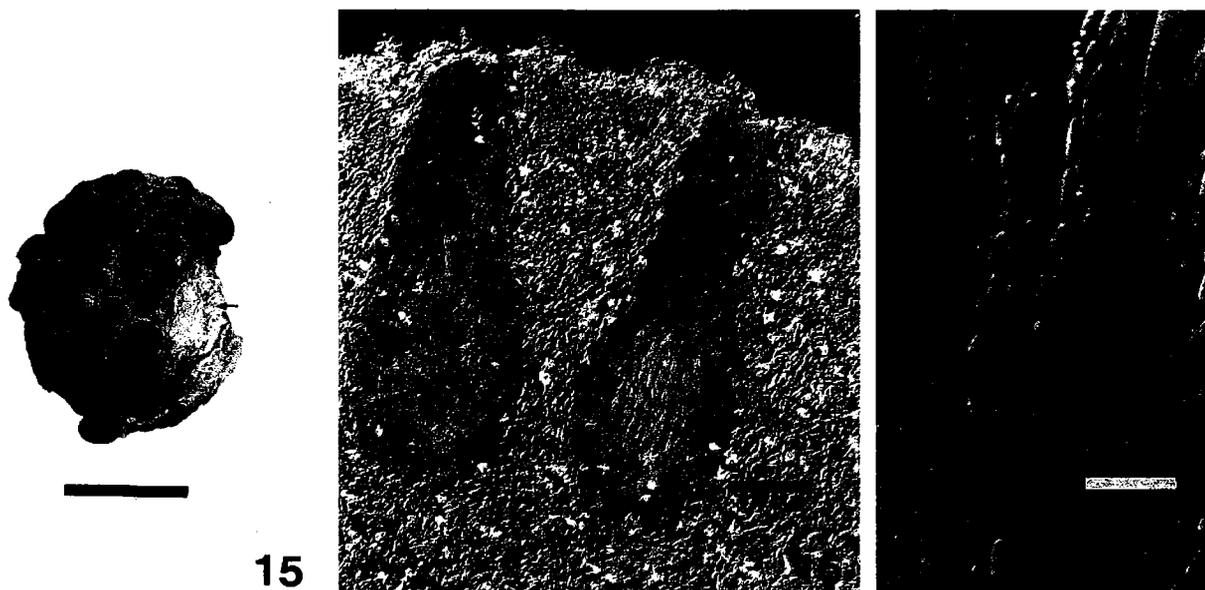


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FIGS. 10-14. *Hypocrella gaertneriana*. 10. Stroma composed of closely packed tubercles studded with ostiola. The dark, circular region in the middle (arrow) was excavated by ants. 11. Section through a stroma showing internal structure and the form of the tubercles. 12. Section through the surface of a stroma and tubercles. Perithecia (arrows) arranged at the surface of the tubercle. 13. Median longitudinal section through a mature perithecium showing asci arising from a basal cluster. 14. Upper half of a mature ascus showing the thick ascial cap and the part-ascospores. Scale bars: FIG. 10 = 10 mm, 11 = 5 mm, 12 = 1 mm, 13 = 100 μ m, 14 = 10 μ m. All from *GJS 1776*.

cream-brown or yellow-brown or orange-yellow, becoming chalky white to cream-white. *Ascomata* scattered, embedded, pyriform, 260-560 \times 145-260 μ m diam, body comparatively small, neck long, ostioles slightly projecting, walls to 35 μ m thick. Paraphyses not seen. *Asci* 160-205 μ m \times 6-8 μ m with caps 3 μ m tall. *Part-ascospores* cylindrical with rounded ends, 8-11 \times 1.5-2.0 μ m.

Characteristics of culture. Part-ascospores germinating on potato dextrose agar (PDA). The following cultural characters are taken from specimen *NHJ4547*. Slow growing, within 1 mo colony restricted, pulvinate, compact and firm; leading edge of colony immersed; surface velutinous from projecting hyphae and conidiophores, at first 5B6 ('apricot') but soon becoming more green (29B6, 29D8) as more



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FIGS. 15–17. *Hypocrella schizostachyi*. 15. Stroma showing closely packed tubercles. The arrow indicates the point of attachment of the stroma to the host scale insect. 16. Median longitudinal sections through two mature perithecia showing asci arising from a basal cluster. 17. Two asci with part-ascospores. Scale bars: FIG. 15 = 0.5 mm, 16 = 100 μm ; 17 = 20 μm . All from BPI 635854.

hyphae are produced; hyphae of the colony much branched, frequently septate and thick walled; colony reverse in shades of brown or orange-brown. Conidiophores arising profusely in a continuous hymenium over the colony surface ('anamorph A') and also from scattered, immersed pycnidial conidiomata ('anamorph B'). After 3 mo the colony was pulvinate, stromatic, similar to, but not as hard as, stromata found on fresh material on the host.

Anamorph A. (FIG. 22) Within 4 wk conidiophores forming in extensive areas on the surface of the colony, individual conidiophores arising as outgrowths of hyphae, unbranched or dichotomously branched, each branch terminating in 1(–2) conidiogenous cells. Conidiogenous cells cylindrical to ampulliform, 7.3–17.3 μm long \times 2.0–2.7 μm wide, each with a tapering, conidiogenous, denticle 2.0–4.7 μm long; the method of conidial production not clear (? enteroblastic). Conidia ellipsoidal, 5.0–6.5 \times 2.0–2.7 μm , with a slightly protuberant, flat basal abscission scar, unicellular, hyaline, smooth, borne singly, with no indication of a mucous coat.

Anamorph B. (FIG. 23) Pycnidial; pycnidia appearing as minute locules immediately below the colony surface, marked on the surface only by the oozed conidia; locules globose or somewhat labyrinthiform, opening broadly, lacking a differentiated wall and a preformed opening. Conidiogenous cells phialidic, arising directly from the somewhat more compacted hyphae of the colony that delimit the pycnidium, held in a hymenium over the entire interior of the

pycnidium. Phialides monoblastic or polyblastic, each with 1–3 conidiogenous loci, cylindrical, ca. 15 \times 2 μm . Conidia allantoid, 5.5–9.5 \times 2.0–2.7 μm , hyaline, single-celled, produced in basipetal succession and exuded in cream colored slime.

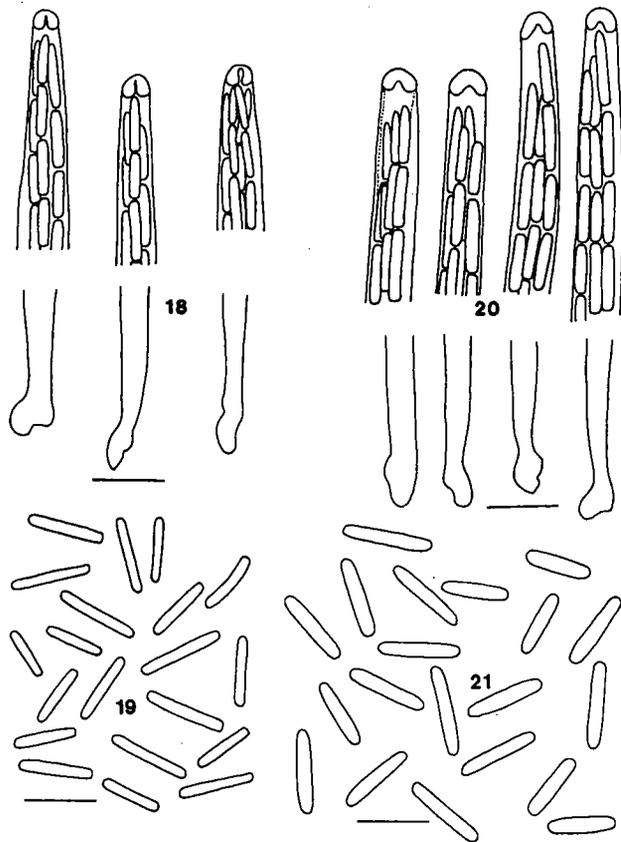
Habitat. On scale insects on bamboos.

Known distribution. Southeast Asia (Thailand, Philippines).

ISOTYPES. PHILIPPINES. RIZAL PROVINCE: Luzon, on bamboo, Jan. 1906, *Foxworthy* (Flora of the Philippines Herbarium, Bureau of Science No. 46, BPI 635854! NY!).

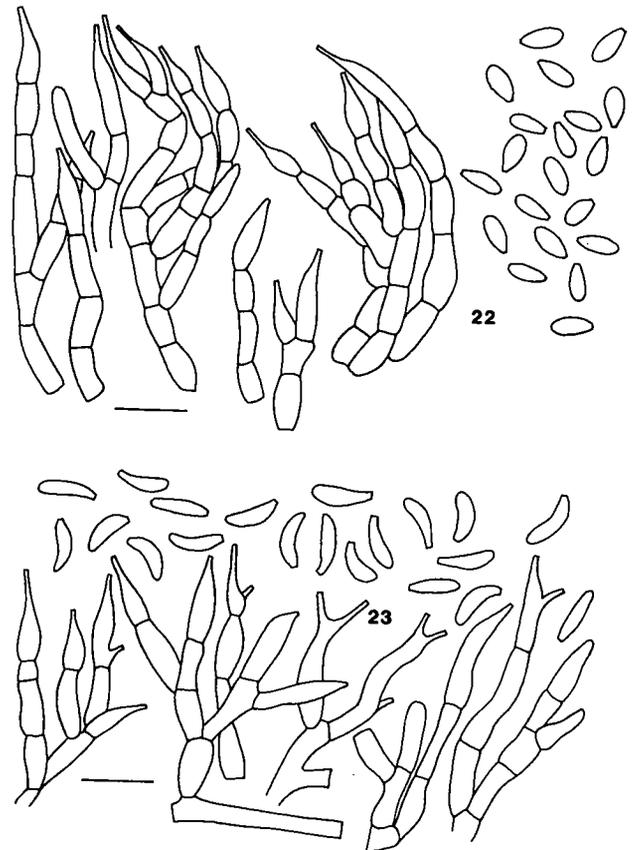
Additional specimens examined. THAILAND. Khao Yai National Park, Phakrajai, on bamboo, 15 Sept. 1992, *NLHJ NHJ883.01* (BPI); Phakrajai, on bamboo, 10 Nov. 1992, *NLHJ NHJ968.01, 968.02, 968.03, 968.04* (BPI); Phakrajai, on bamboo, 13 Jan. 1993, *Hywel-Jones NHJ993* (BPI); Phakrajai, on bamboo, 27 May 1993, *NLHJ & Nasit NHJ1057* (BPI); Phakrajai, on bamboo, 6 Aug. 1993, *NLHJ, Nasit, Plomhan & Sivichai NHJ1745* (BPI); Phakrajai, on bamboo, 24 May 1994, *NLHJ & Nasit NHJ3932* (BPI); Phakrajai, on bamboo, 29 Sept. 1994, *NLHJ, Artjaryisara-pong & Whalley NHJ4900* (BPI). Khao Sabap National Park, Trok Nong waterfall, 16 Aug. 1994, *NLHJ, Nasit & Sivichai NHJ4547* (BPI).

Notes. The whole stroma of the isotype of *H. schizostachyi* appears to be immature as no ostiolar openings are visible in most tubercles. A few tubercles have minute obscure dark dots indicating the ascatal openings. These are not elevated (FIG. 16). In Thai material, clusters of stromata occur along the lengths of the bamboo culms. The stromata of *H.*



FIGS. 18–21. *Hypocrella schizostachyi*, asci and part-ascospores. 18, 19 from BPI 635854. 20, 21 from Thai material. 18, 20. Ascus apices and bases, showing arrangement of part-ascospores in asci and variation in the ascus cap. 19, 21. Discharged part-ascospores. Scale bars = 10 μ m.

schizostachyi are buff colored when immature but become hard, pseudocarbonaceous, and blacken with maturity. When the young buff stromata are moistened, they change from buff grey-yellow to buff yellow-brown. Tubercles appear to develop irregularly as the ascomata form within. In immature pale-colored specimens there is no evidence of ostioles on the surface. Later a few scattered darker brown ostioles of ascomata can be seen in small clusters. In many Thai collections the ascomata are mainly immature and asci undeveloped. However, in these some ascomata also contain mature asci that are tightly packed with part-ascospores. This pattern appeared in our examination of the isotype (FIG. 17). The part-ascospores are arranged roughly parallel and just behind the ascus cap (FIGS. 18, 20). Although part-ascospores are generally rod-shaped (FIGS. 19, 21), terminal part-ascospores in the ascus have a more pointed tip (FIGS. 18, 20). Asci deliquesce at maturity, releasing part-ascospores into the centrum. The centra of some specimens are filled with masses of part-ascospores and only the fragmented remains of asci were seen.



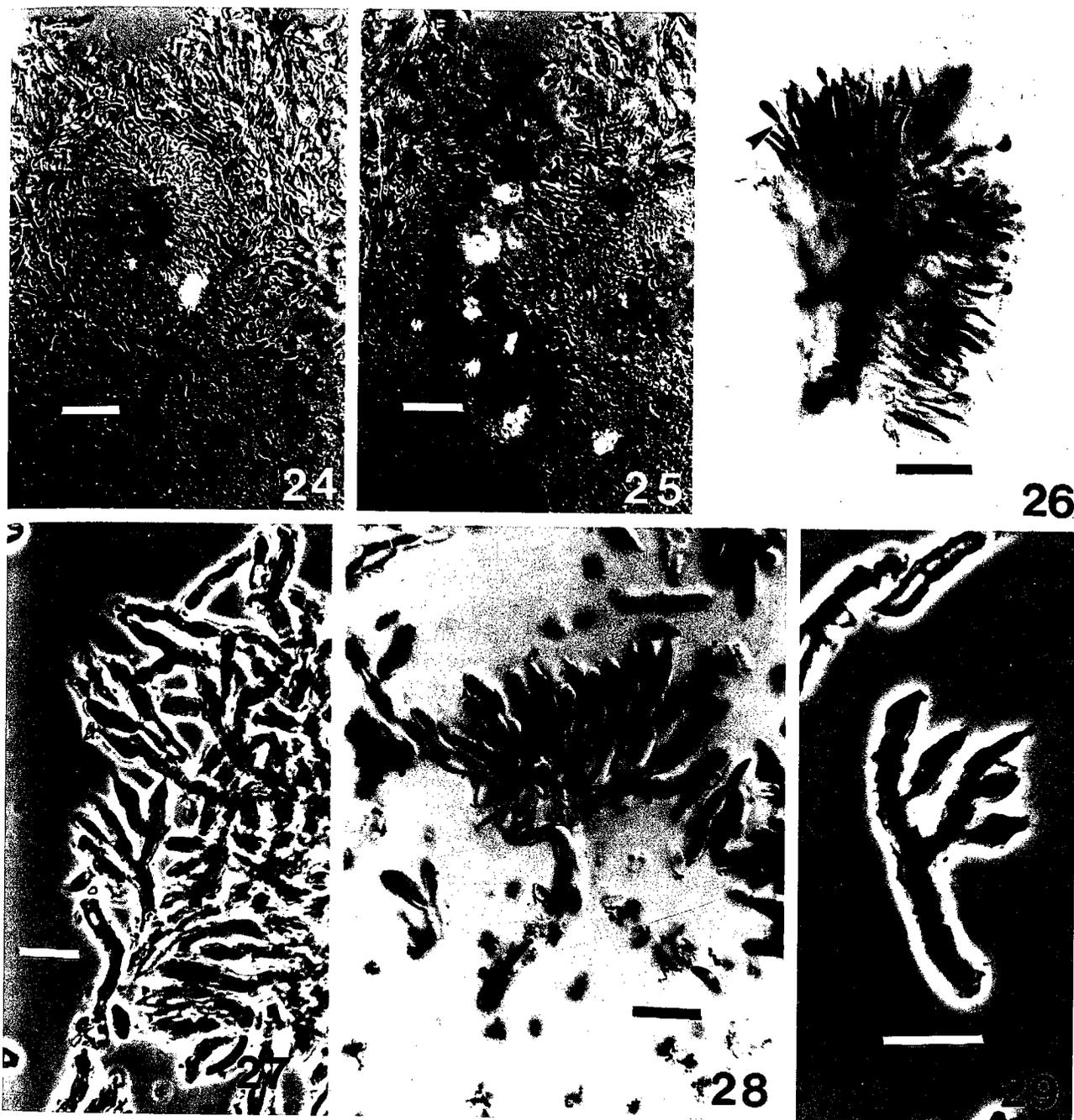
FIGS. 22, 23. *Hypocrella schizostachyi*, synanamorphs in culture. 22. Conidiogenous cells and conidia of Anamorph A. 23. Conidiogenous cells and conidia of Anamorph B. Scale bars = 10 μ m. All from Thai material.

Asci in ascomata found in older, pseudocarbonaceous stromata invariably had broken down. In these cases ascomata contained a mass of part-ascospores.

DISCUSSION

Taxonomy.—*Hypocrella africana*, *H. gaertneriana* and *H. schizostachyi* are the most distinctive species of the genus because of their large stromata. Stromata of more typical species are smaller, and pulvinate to hemispherical, conforming more to the size of the scale insect that they parasitize. Despite the fact that the large-stromal species are distinctive in the genus, we do not propose a new genus for them because we lack information about their life cycles.

Hennings (1908) provided only a short Latin description of *H. schizostachyi* with no illustrations. Petch (1921) dealt briefly with this species following an examination of the 'co-type' sent to him by E. D. Merrill from the Philippine Islands. The stroma was described by Hennings (1908) as hemispherical and tuberculate, 1.5–2 cm diam. Mains (1959) was the last to re-examine *H. schizostachyi* and he recorded the



FIGS. 24-29. *Hypocrella schizostachyi*, synanamorphs in culture. 24-26. 'B' synanamorph. 24, 25. Pycnidia immersed in the dense colony. 26. Conidiogenous cells from a pycnidium, stained in cotton blue. The narrowed tip of a phialide is indicated by an arrow. 27-29. 'A' synanamorph. 27. Conidiophore and thick-walled hyphae of the colony. 28, 29. Conidiophores. Scale bars: FIGS. 24-26 = 25 μ m; 27-29 = 10 μ m. All from Thai material.

stromata to be 6-10 mm, presumably from his examination of the isotype material preserved in NY. Individual stromata of *H. schizostachyi* found in Thailand weighed up to 0.64 g (NLH-J, unpubl. records). Mains (1959) noted that the reddish-brown ascomata were immersed and ovoid with a slightly raised ostiole. The cylindrical asci were observed to have a hemispherical/rounded cap and were 8-spored, 100-

160 \times 6-8 μ m. The asci were described as hyaline, filiform and multi-septate but separating into cylindrical part-ascospores.

In his Latin description of *H. schizostachyi* Hennings (1908) gave no details of the ascomatal size, merely noting that they were ovoid. Petch (1921) gave only a brief description of the ascomatal size of the 'co-type,' saying these were '0.3 mm deep, 0.15

mm. diameter.' Ascomatal size of the isotype and of specimens in Thailand was variable. However, as specimens were collected at different times of the year from the same stand of bamboo this variation must be a characteristic of the species. Immature ascomata appeared smaller than mature ones. It is not known what the state of development was for ascomata measured by Petch (1921). Our measurements of the isotype indicate that the ascomata are larger than was recorded by Petch (1921), and this appears also to be the case for the Thai specimens. Measurements of Thai specimens fall well within our range of measurements for ascomata from the isotype. The length of the ascomata seemed also to be related to how deep in the stroma they developed.

The original collection of *H. schizostachyi* was from a species of the bamboo genus *Schizostachyum*, but its entomogenous habit appears not to have been realized at first. Petch (1921) described the stromal shape as 'two thirds globose, strongly botryoso-tuberculate.' He described the color as 'reddish-purple,' 'blackish-purple,' 'internally yellowish with orange-red zone at periphery' or 'internally reddish-purple.' For this latter color Petch (1921) noted that the specimen had been preserved in alcohol and that the internal color was the result of 'diffusion of colour from the exterior.' Later, Petch (1931) described 'recent, younger, specimens from Sumatra' as 'ochraceous, or reddish ochraceous. Sometimes with an ashy bloom, and blackening irregularly, the tubercles dotted with red-brown ostiola.' We found the color of the isotype to agree with what Petch (1921) reported. Our examination of fresh material (at all stages of development) from Thailand broadly agrees with Hennings' original description and with Petch's (1931) later description, both of which were based on fresh material. The reddening of the stroma in this taxon seems to be a feature of treatment or herbarium conditions. In nature this color is not so noticeable, as material that ages naturally in the forest seems to become pseudocarbonaceous, blackish-brown to black. Material that had been in the field for a long time appeared to be colonized by a wide range of microorganisms. Some specimens in the field had a greenish hue due to single-celled and filamentous algae. Petch (1921) noted this phenomenon for *Hypocrella mollii* Koorders, *H. phyllogena* (Mont.) Petch and *H. viridans* (Berk. & M. A. Curtis) Petch.

In his monograph Petch (1921) used Hennings' original measurements for asci and part-ascospores. Ascumata of Thai specimens contained many rodlike part-ascospores that were larger than was given by Hennings (1908) for the type ($5-8 \times 1.5-2 \mu\text{m}$). However, our reexamination of the isotype showed

that part-ascospores could be up to $9.4 \mu\text{m}$ long. The other characteristics are close enough as to identify these as the same species.

In some damaged specimens the ascumata had separated from the sterile base. This condition is atypical in *Hypocrella*, where the ascumata are normally integrated with the stroma and difficult to remove from the host.

As there is only one other recorded collection of *H. schizostachyi* in addition to the type, this species would seem to be rare in Southeast Asia. Despite extensive surveys in stands of bamboo at more than 50 sites in national parks and forest reserves over five years in Thailand, it was only found at two sites.

The type of *H. gaertneriana* was originally deposited in B but has apparently been lost. Fortunately, the illustration and description of the species provided by Møller (1901) serve adequately to identify the species. Petch (1921) drew heavily on Møller's description and noted that the stromata had only a short neck. Petch noted the similarity between this species and *H. verruculosa* A. Møller, a species also reported to occur on bamboo in Brazil. Mains (1959) did not detail *H. gaertneriana* but noted that it was similar to *H. schizostachyi*, differing mainly in having a paler yellow stroma that did not turn purple with KOH.

Petch (1921) noted for the type that 'apparently only one example was found.' He further noted that Møller's figure indicated the stroma was 'about 3 cms' and later Petch (1925) said that Møller's figure represented a specimen '3.3 cm.' Partly this could be due to the size of the host which (in the specimens examined) was a large, oval coccid scale insect $6-10 \times 5-9 \text{ mm}$. The largest dry stroma of *H. gaertneriana* weighed 4.6 g and other stromata typically weighed more than 1 g. Stromata of *H. schizostachyi* by contrast were typically lighter, usually less than 1 g.

Petch (1925) described a second collection of *H. gaertneriana* from Brazil. The described stromata in these specimens were smaller than the single stroma referred to by Møller but the description by Petch agrees well with recently collected specimens at our disposal. It appears that the type consisted of a particularly large stroma. Asci in the recent collection of *H. gaertneriana* from French Guiana were slightly longer than was given for the type, but the difference is not taxonomically significant given the overall similarity of the material from French Guiana and Brazil.

Petch (1925) noted that the ascospores appeared to be immature in the ascus of his collection of *H. gaertneriana*, and he described septa as being $9-15 \mu\text{m}$ apart. This is larger than the part-ascospore size given for the type material. If this is so, and if these split into part-ascospores, then the size of these

