Six new species of *Chaetosphaeria* from tropical rain forests in Thailand and redescription of *Chaetosphaeria hiugensis*

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Six new species of *Chaetosphaeria* are described and illustrated based on collections from tropical rain forests in Thailand, i.e. *Chaetosphaeria exserticlavoides* (anamorph: *Exserticlava* sp.), *Ch. falacrospora* (anamorph: *Dictyochaeta* sp.), *Ch. hispida* (anamorph: *Dictyochaeta* sp.), *Ch. triangulocondidia* (anamorph: *Catenularia* sp.), *Ch. tubulicollaris* (anamorph: chalara-like) and *Ch. verruculospora* (anamorph: *Dictyochaeta* sp.). *Chaetosphaeria hiugensis* (anamorph: *Exserticlava triseptata*) is redescribed on the basis of material collected in Puerto Rico. The connections of the new *Chaetosphaeria* species with their anamorphs were proven experimentally using single and mass ascospore isolations. The generic concept of *Chaetosphaeria* is discussed.

Keywords: life history, Chaetosphaeriaceae, generic concept, *Exserticlava*, *Catenularia*, chalara-like, *Dictyochaeta*, systematics.

The Chaetosphaeriaceae is a family of more than 100 closely related anamorphic and holomorphic species, with the main morphological diversity expressed in the anamorphic phenotypes of *Chaetosphaeria* Tul. & C. Tul. species (ca. 10 anamorph genera). Nine other teleomorph genera are assigned to the family (Réblová & al., 1999; Réblová, 2000; Réblová & Winka, 2000, 2001; Matsushima, 2001; Sivanesan & Alcorn, 2002). These differ from *Chaetosphaeria* mostly by their associated (syn)anamorphs and/or a combination of ascospore characters and perithecial morphologies. Some of these genera are narrowly delimited and closely related to *Chaetosphaeria*, i.e. *Ascochalara* Réblová, *Ascocodinaea* Samuels & al., *Australiasca* Sivanesan & Alcorn and *Menisporopascus* Matsush. Unfortunately, there is still a considerable overlap of characters between these segregates and *Chaetosphaeria,* which is currently characterized by the production of dark brown to black, glabrous or setose perithecia with thin carbonaceous walls of thin-walled cells with opaque walls,

rarely with an evanescent hyaline surface layer (*Ch. lentomita* W. Gams & Hol.-Jech.), unitunicate thin-walled asci with a shallow apical annulus, persistent paraphyses, hyaline, and 1–10-septate ascospores that disarticulate in some species. The anamorphs are all phialidic, dematiaceous hyphomycetes with a variety of conidium morphologies, patterns of proliferation within phialide apertures, conidiophore branching patterns, and sterile structures.

Published phylogenetic analyses (Réblová & Winka, 2000, 2001) and our recent studies of additional species (Réblová & Seifert, unpublished) clearly show that the inconsistent weighting of morphological characters in both anamorph and teleomorph generic concepts has resulted in a mixture of paraphyletic and polyphyletic genera. *Chaetosphaeria* itself is not monophyletic. At the moment, it is probable that some of the genera segregated on the basis of their associated anamorphs are monophyletic, but it is also clear that several of the anamorph genera in the Chaetosphaeriaceae are not monophyletic as presently defined. This makes it difficult to evaluate the taxonomic significance at the holomorph level when new anamorph genera are connected to *Chaetosphaeria*-like fungi. One such example is the new species *Ch. exserticlavoides* and its close relative *Chaetosphaeria hiugensis* Hino, which has larger ascospores. Both species have *Exserticlava* S. Hughes anamorphs with phialidic conidia produced successively on multiple conidiogenous loci. These species differ from the generic concept of *Chaetosphaeria* by their production of a yellowish to pale brown powdery layer on the perithecial surface and septate ascospores that become versicolored at maturity, with the middle cells subhyaline to stramineous to pale brown and the polar cells hyaline. Such a combination of characters could conceivably lead to the recognition of a separate genus. However, in our most recent parsimony analyses (results not shown) *Ch. exserticlavoides* forms a monophyletic clade with *Chaetosphaeria* species having *Chloridium* Link, *Cacumisporium* Preuss and *Chalara*-like anamorphs, all with phialidic conidiogenesis on multiple, successively produced conidiogenous loci within the collarette.

Our current results, based on internal transcribed spacer (ITS) and large ribosomal subunit DNA sequences of 56 species of the Chaetosphaeriaceae, make it clear that a serious reconsideration of both holomorph and anamorph generic concepts will require the sampling of even more taxa. Such findings lead us to temporarily stop introducing new genera.

Included in our work are the six new *Chaetosphaeria* species from tropical rain forests in Thailand (Asia), described and illustrated here; i.e. *Ch. exserticlavoides*, *Ch. hispida*, *Ch. falacrospora*, *Ch. triangulo conidia*, *Ch. tubulicollaris* and *Ch. verruculospora*, with anamorphs in *Catenularia* Grove, *Chalara* (Corda) Rabenh. *sensu*

lato, *Dictyochaeta* Speg. *sensu lato*, and *Exserticlava*. *Chaetosphaeria hiugensis* is redescribed on the basis of material recently collected in rain forests in Puerto Rico. All the species described here are based on single specimen, except *Ch. verruculospora*, but their characters are so distinctive that there is no possibility that they represent variants of previously known species. Two separate dichotomous keys to previously known *Chaetosphaeria* species, one based on teleomorph characters and the other on anamorph characters, were provided by Réblová (2000).

The six new *Chaetosphaeria* species were collected during an expedition in 2001 in Khao Yai National Park, Thailand, the country's second largest national park, recently designated an ASEAN National Heritage Site. A more detailed description of Khao Yai National Park and an overview of other, primarily fungicolous, representatives of the Hypocreales are provided by Põldmaa & Samuels (2004). Other freshwater and terrestrial members of the Sordariales (Chaetosphaeriaceae) from Thailand were studied by Sivichai & al. (2000, 2002a). Other publications surveying Thai ascomycetes include representatives of the Xylariaceae (Whalley & al., 1995, 1998), lignicolous freshwater ascomycetes and hyphomycetes (Pang & al., 2002; Pinruan & al., 2002; Sivichai & al., 2002a, b), discomycetes (Dissing, 1963; Phanichapol, 1968; Sivichai & al., 2003) and Clavicipitaceae (Hypocreales) (e.g. Hywel-Jones & Sivichai, 1995; Hywel-Jones, 1997; Hywel-Jones & Samuels, 1998).

Material and methods

Dried specimens were rehydrated in 3% (aq.) KOH and subsequently mounted for microscopic examination in water, Melzer's reagent, cotton blue in lactic acid, and 90% lactic acid. All measurements were made in lactic acid. A minimum of 20–25 ascospores, asci and conidia were measured, and means and standard errors of the means are presented for these. Images were captured in Melzer's reagent using differential interference microscopy (DIC) and phase contrast (PC) and processed using Adobe Photoshop 6.0 CE.

Single- and mass-ascospore and conidial isolates were obtained from fresh material with the aid of a single-spore isolator (Meopta). All anamorph-teleomorph connections are based on the isolation of ascospores, and the development of conidia and conidiophores in the cultures derived from those ascospores. Colonies were grown on cornmeal agar (CMA, Difco), oatmeal agar (OA) and potato-carrot agar (PCA, Gams & al., 1998). Colony characters were taken from cultures grown on PCA and OA for 14 d at 24 C in darkness, or at room temperature (24–26 C with incident light). The colors of colonies were taken from Kornerup & Wanscher (1978). The cultures are

maintained at the Institute of Botany, Academy of Sciences in Průhonice, Centraalbureau voor Schimmelcultures, Utrecht and the Canadian Collection of Fungal Cultures (DAOM), Agriculture & Agri-Food Canada, Ottawa. Unfortunately, the cultures of *Ch. triangloconidia*, *Ch. tubulicollaris*, *Ch. verruculospora* were lost before they were deposited in the culture collections cited above. Abbreviations for collectors are M. R. (M. Réblová), G. J. S. (G. J. Samuels), N. H. J. (Nigel Hywel-Jones) and R. N. (Rungtip Nasit).

Taxonomy

Chaetosphaeria exserticlavoides Réblová & Seifert, **sp. nov.** – Figs. 1–8.

Perithecia superficialia, solitaria vel gregaria, subglobosa ad globosa, papilla minuta, 210–250 µm diam, 250–320 µm alta, pulvere luteofusco obtecta, papilla nigra glabra exclusa, ostiolo periphysato, setosa, setis sensim acutis, simplicibus, obscure fuscis, opacis, 30–170 µm longis, basi 5.5–7.5 µm latis. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes. Asci unitunicati, cylindrici ad clavati, 86.0–94.0 ($\bar{x}$ = 89.2±1.8)×11.0–13.0 ($\bar{x}$ = 12.4±0.5) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae ellipsoideae ad fusiformes 28.0–32.0 (–33.5) ($\bar{x}$ = 30.7±0.4)×3.5–4.5 ($\bar{x}$ = 4.2±0.3) µm, 3–7-septatae, leves, fuscae, apice untrinque hyalinae.

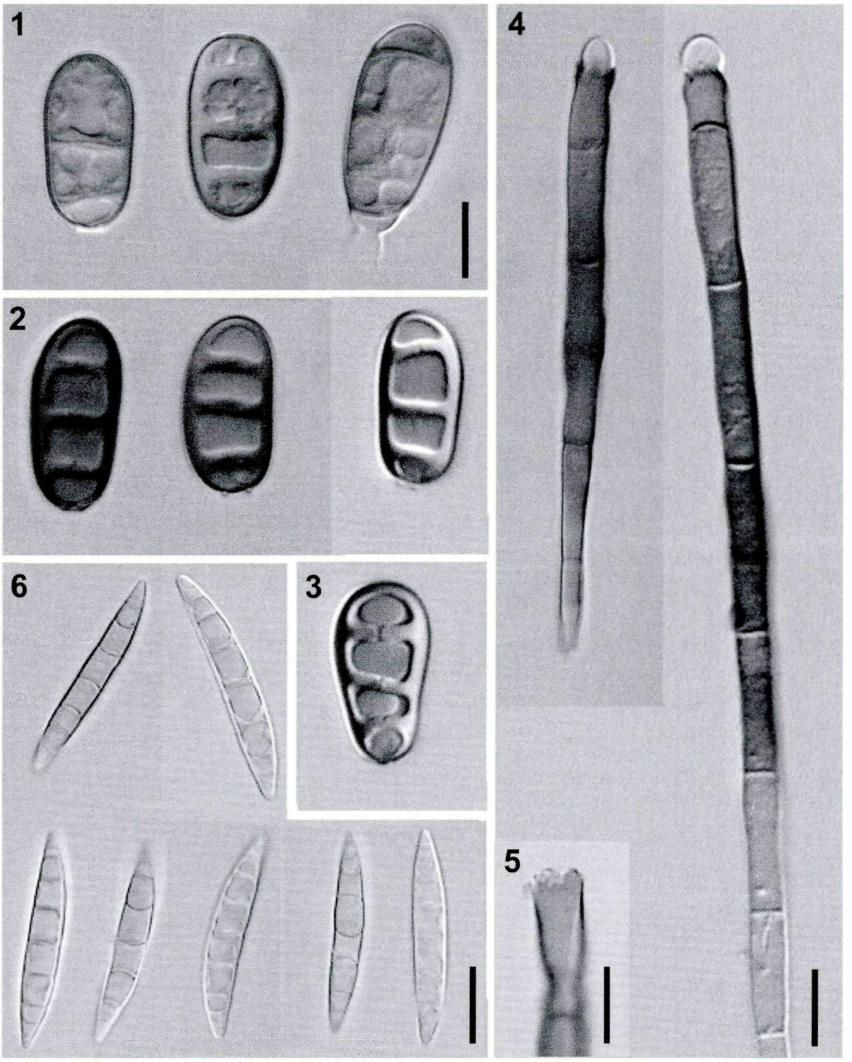
Anamorphosis *Exserticlava*: Conidiophora macronematosa, mononematosa, fusca, (61–)84–165(–180) µm alta, 5.0–6.0 µm lata in parte media, subcylindrica terminantia. Paries externus cellulae conidiogenae brunneus et disruptus in apicem, strophio parvo marginis fimbriatis formato; paries internus hyalinus. Conidia ellipsoidea ad obovoidea, 22.5–27.0 ($\bar{x}$ = 24.7±0.5)×(10.0–)11.0–12.5(–13.0) ($\bar{x}$ = 11.5±2.2) µm, successiva, 3-distoseptata, crassitunicata, brunnea.

Anamorph. – *Exserticlava*.

Holotype. – THAILAND: Nakhon Nayok Province, Khao Yai National Park NE of Bangkok, trail to Haew Suwat waterfall ca. 4.5 km E of Khao Yai Forest Headquarters, N 14°26' E 101°25', elev. 720 m, 2 Aug. 2001, decayed bamboo culm, M. R., G. J. S., R. N. (PRM 900540).

Culture. – CBS 112963, DAOM 231138.

Perithecia superficial, solitary, subglobose to globose, papillate, 210–250 µm diam, 250–320 µm high, covered by a yellowish to pale brown powder except for the black glabrous papilla, setose, ostiolate. The powdery covering ca. 5.0–15.0 µm thick, consisting of thin-walled, pseudoparenchymatous cells that later deliquesce and form an amorphous matrix. The covering disappears with age, leaving the perithecia dark and glabrous. – Setae sparsely cover perithecia, arising from the perithecial wall, and surface of the substrate around perithecia, and are acute, dark brown, opaque, unbranched, septate, and were never observed to be conidiogenous, 30–170 µm long, 5.5–7.5 µm wide near the base. – Ostiolar canal periphysate. – Perithecial wall 19.0–24.0 µm thick, carbonaceous, consisting



Figs. 1–6. *Chaetosphaeria exserticlavoides*. – 1–3. Conidia of the *Exserticlava* anamorph. – 4, 5. Conidiophores. – 6. Ascospores. – Scale bar = 10 µm. – Figs. 1–6: DIC. – Figs. 1–6 from culture CBS 112963 ex PRM 900540 (Holotype).

of two regions; outer region formed of dark brown, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, hyaline, septate, 3.5–4.0 µm wide near the base, tapering to 2.0–2.5 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 86.0–94.0 ($\bar{x}$ = 89.2±1.8) µm long, 11.0–13.0 ($\bar{x}$ = 12.4±0.5) µm wide, rounded to narrowly truncate at the apex, refractive apical annulus

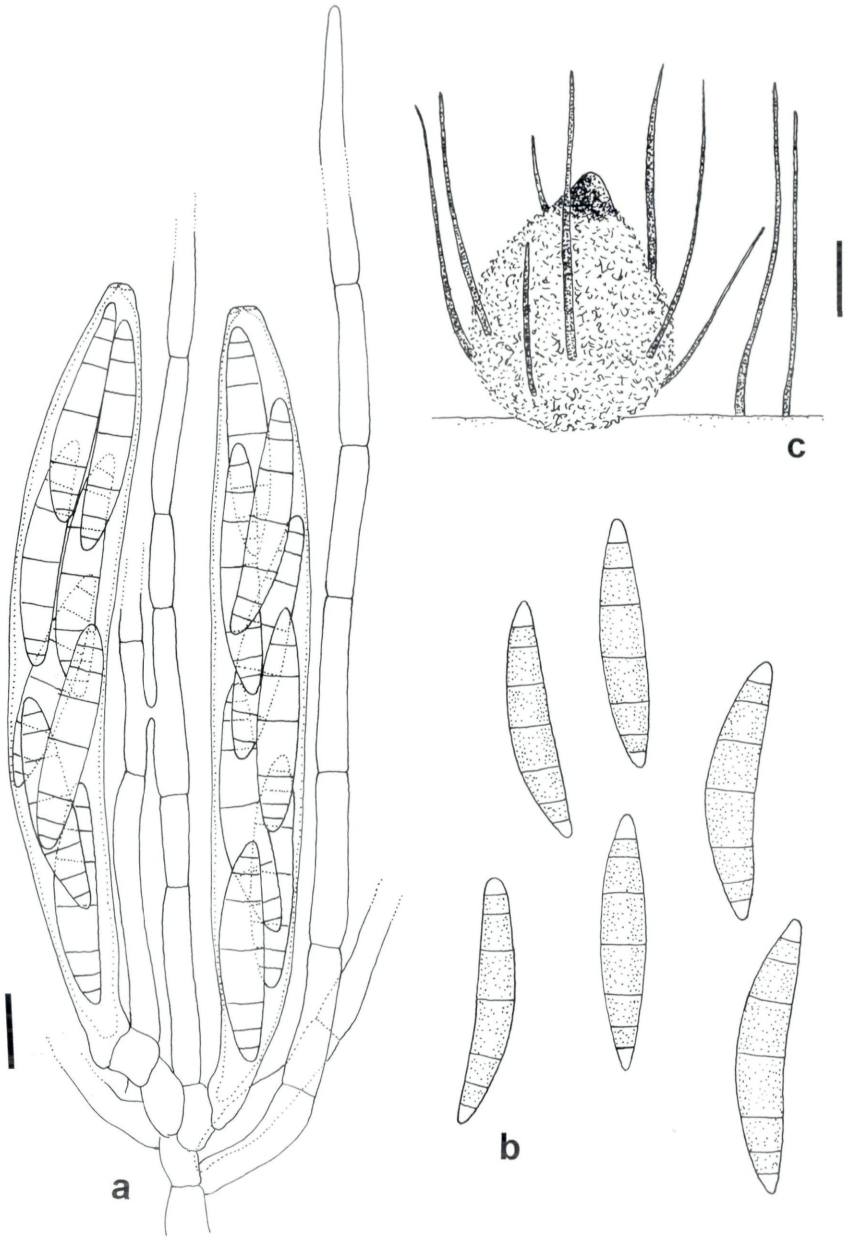


Fig. 7a–c. *Chaetosphaeria exserticlavoides*. – a. Mature asci with ascospores and paraphyses. – b. Ascospores. – c. Habit sketch of perithecium. – Scale bar: a, b = 10 µm, c = 100 µm. – From PRM 900540 (Holotype).

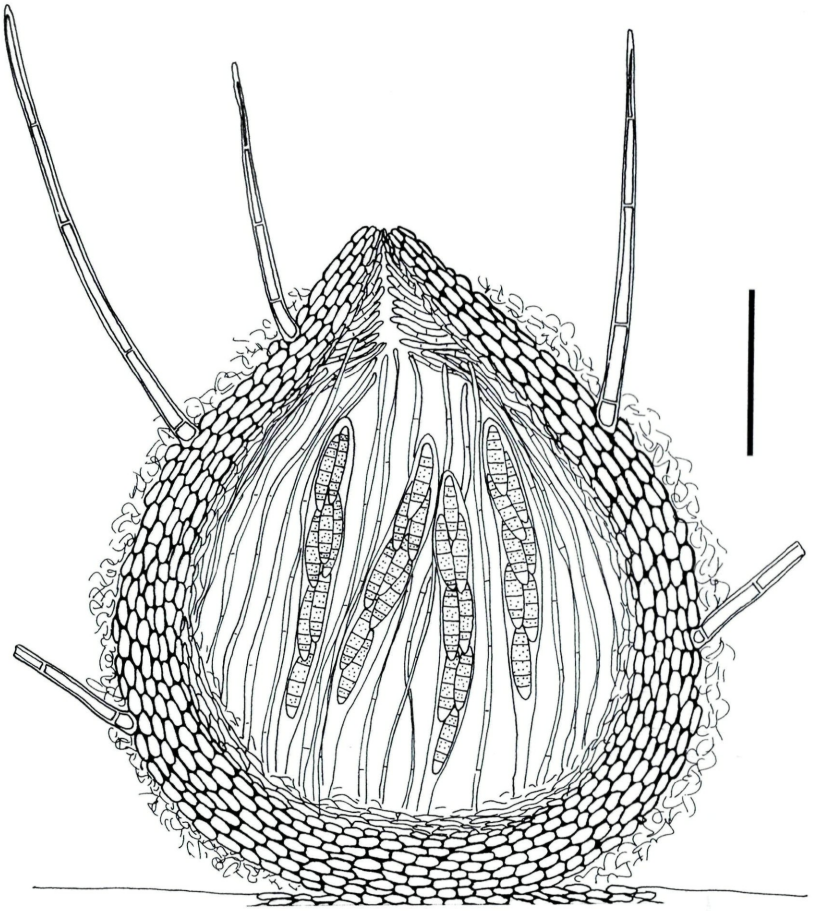


Fig. 8. *Chaetosphaeria exserticlavoides*. – Median longitudinal section of the perithecium. – Scale bar = 50 µm. From PRM 900540 (Holotype).

distinct, ca. 3.0 µm diam, 1.5–2.0 µm high, 8-spored, L/W 7:1. – Ascospores ellipsoidal to fusiform, straight or inequilateral, 28.0–32.0(–33.5) ($\bar{x}$ = 30.7 ± 0.4) µm long, 3.5–4.5 ($\bar{x}$ = 4.2 ± 0.3) µm wide, 3–7-septate, when young hyaline, at maturity central cells becoming subhyaline to stramineous to very pale brown, end cells remaining hyaline, smooth, 2-seriate in the ascus.

Characteristics in culture. – Colonies on PCA 4–5 mm diam, convex, aerial mycelium scarcely developed, denser in the center, with moderate sporulation that is widespread, dark cocoa (5F8), darker at the margins, reverse obscured by the densely translucent medium, margin grayish, subsurface, entire. – Conidiophores macronematous, mononematous, solitary, erect, straight or

slightly flexuous, cylindrical, unbranched, 5–7-septate, brown, darker brown at the septa, (61–)84–165(–180) µm tall, 5–6 µm wide in the middle, tapering slightly towards the base, 4.0–4.5(–5.0) µm wide at the base. – Conidiogenous cells phialidic, 10.0–23.0 µm long, 5.0–6.0 µm wide, subcylindrical, integrated, terminal, brown. – Collarettes 5.0–6.5 µm diam, lacerate at the margins as a result of the rupture of the distal outer wall of the conidiogenous cell. The hyaline inner layer of the conidiogenous cell expanding and slightly protruding beyond the collarette ca. 1.5–2.0 µm. Up to 6 conidia are produced successively on multiple conidiogenous loci in a cluster on the inner hyaline extension of the conidiogenous cell. – Conidia broadly ellipsoidal to obovoidal, 22.5–27.0 ($\bar{x}$ = 24.7 ± 0.5) µm long, (10.0–)11.0–12.5(–13.0) ($\bar{x}$ = 11.5 ± 2.2) µm wide, L/W 2 : 1, 3-distoseptate, pale brown, with a minute, basal conidial scar.

Etymology. – *Exserticlavoides*, chosen to match the generic name of the anamorph.

Known distribution. – Thailand, known only from the type collection.

Habitat. – Saprobic on decayed bamboo culm.

No anamorph was observed on the original material. The *Exserticlava* conidia and conidiophores were formed *in vitro* from isolated ascospores.

Chaetosphaeria exserticlavoides differs from the related *Ch. hiugensis* [anamorph *Exserticlava triseptata* (Matsush.) S. Hughes], redescribed below (Figs. 30, 31, 34), by its shorter asci and ascospores and shorter, narrower conidia. The intensity of pigmentation of the mature ascospores is less remarkable in *Ch. exserticlavoides* than in *Ch. hiugensis*, because the middle cells of the ascospores of the former are subhyaline to stramineous to very pale brown, while those of the latter are usually distinctly pale brown to mid brown.

Exserticlava vasiformis (Matsush.) S. Hughes, the type of the genus (Figs. 32, 33), has conidia that are regularly ellipsoidal, broader and conidiophores that produce a characteristic hyaline, subulate extension of the inner conidiogenous wall. It has not yet been connected to a teleomorph.

Exserticlava is a dematiaceous hyphomycete genus with pantropical distribution presently including six species. A key and information on the distribution of *Exserticlava* spp. were given by Tsui & al. (2001).

Chaetosphaeria falacrospora Réblová & Seifert, **sp. nov.** – Figs. 9–17.

Perithecia superficialia, solitaria vel gregaria, subglobosa ad globosa, papilla minuta, 190–220 µm diam, 210–230 µm alta, nigra, papillata, glabra, ostiolo peri-

physato. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes. Asci unitunicati, cylindrici ad clavati, 70.0–80.0 ($\bar{x}$ = 76.5 ± 1.3) × 7.0–7.5(–10) ($\bar{x}$ = 7.2 ± 0.1) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae ellipsoideae, (7.5–)8.0–10.0 (–11.0) ($\bar{x}$ = 8.6 ± 0.1) × 3.0–3.5(–3.7) ($\bar{x}$ = 3.4 ± 0.04) µm, 1–3-septatae, verruculosae, hyalinae.

Anamorphosis *Dictyochaeta*: Conidiophora macronematosa, mononematosa, fusca ad basim, sursum pallidiora, 54.0–62.0(–80.0) µm alta, 2.5–3.5 µm lata prope basin, sub collari 1.5 µm constricta. Collare hyalinum, 2.5–3.0 µm diam. Conidia ellipsoidea usque obovoidea, ad basim truncata, ad apicem rotundata, 5.0–7.0(–7.5) ($\bar{x}$ = 60.7) × 2.0–3.0 ($\bar{x}$ = 2.6 ± 0.08) µm, 0–1-septata, hyalina, setula evanescentia.

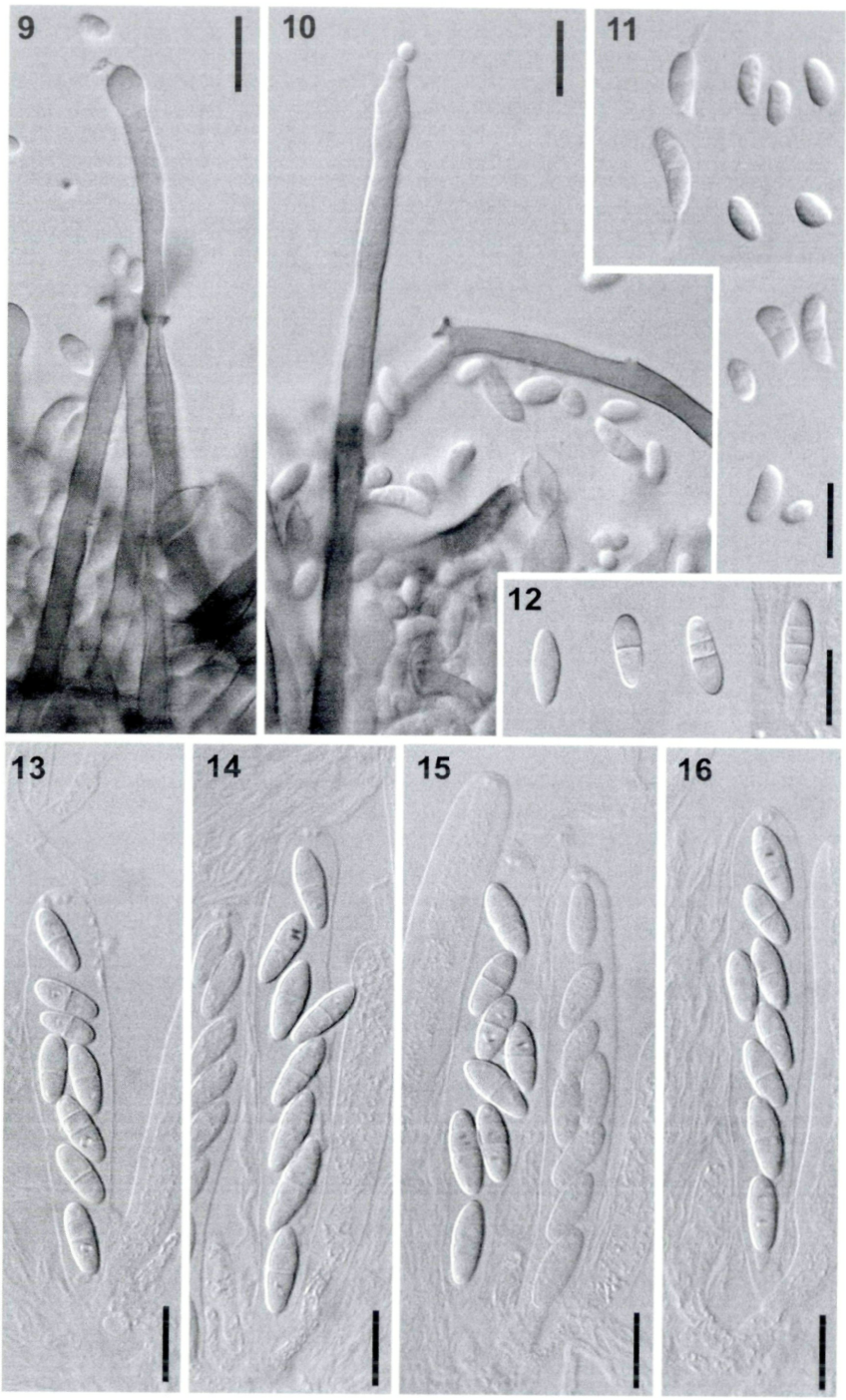
Anamorph. – *Dictyochaeta*.

Holotype. – THAILAND: Nakhon Nayok Province. Khao Yai National Park NE of Bangkok, trail to Tat Ta Phu waterfall ca. 2.5 km S of Khao Yai Forest Headquarters, N 14°28' E 101°21', elev. 750 m, 7 Sep. 2001, decayed wood, M. R., R. N. (PRM 900541).

Culture. – CBS 112962, DAOM 231139.

Perithecia superficial, solitary or in groups, subglobose to globose, papillate, 190–220 µm diam, 210–230 µm high, dark brown to nearly black, papillate, glabrous, ostiolate. – Ostiolar canal periphysate. – Perithecial wall 18.0–25.0 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, hyaline, septate, 3.5–4.0 µm wide near the base, tapering to 2.0 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 70.0–80.0 ($\bar{x}$ = 76.5 ± 1.3) µm long, 7.0–7.5(–10) ($\bar{x}$ = 7.2 ± 0.1) µm wide, narrowly rounded to truncate at the apex, refractive apical annulus distinct, ca. 2.0 µm diam, 1.5 µm high, 8-spored, L/W 10.5 : 1. – Ascospores ellipsoidal, straight or slightly curved, (7.5–)8.0–10.0 (–11.0) ($\bar{x}$ = 8.6 ± 0.1) µm long, 3.0–3.5(–3.7) ($\bar{x}$ = 3.4 ± 0.04) µm wide, L/W 7.5 : 1, 1–3-septate, hyaline, finely verruculose at maturity, obliquely 1 to 2-seriate in the ascus.

Characteristics in culture. – Colonies on PCA 10–14 mm diam, convex, with lanose white aerial mycelium, densest in the centre, with moderately dense sporulation consisting of white, slimy conidial heads under the aerial mycelium, Olive (2E3), grey in the centre where aerial mycelium is denser, the reverse Olive (2F3) in the centre, surrounded by a grey ring, margin subsurface, discrete, entire. – Colonies on OA 8–10 mm diam, planar, with more sporulation than on PCA, with a uniform layer of conidiophores and little aerial mycelium, Olive (2F4-7), reverse obscured by the opaque medium, margin discrete, usually entire, sometimes gnawed. – Conidiophores macronematous, mononematous, solitary, erect, straight or slightly flexuous, cylindrical, unbranched, thick-walled,



3–8-septate, brown, paler upwards, darker brown at the septa, 54.0–62.0(–80.0) µm tall, 2.5–3.5 µm wide near the base, tapering to 1.5 µm below the collarette, usually with 1 or 2 percurrent proliferations, often slightly swollen below the collarette. – Conidiogenous cells phialidic, 15.0–40.0(–50.0) µm long, 3.0–5.0 µm wide, terminal, integrated with 1 apical conidiogenous aperture or rarely polyphialidic with 1–2 lateral apertures, sometimes slightly swollen below the collarette, conidia formed on a single conidiogenous locus within the aperture. – Collarettes funnel-shaped, hyaline, 2.5–3.0 µm wide, 1.2–2.5 µm deep. – Conidia ellipsoidal to obovoidal, truncate at the base, often curved, 5.0–7.0(–7.5) ($\bar{x}$ = 60.7) µm long, 2.0–3.0 ($\bar{x}$ = 2.6 ± 0.08) µm wide, L/W 2.3 : 1, 0–1-septate, hyaline, when young with thin, 4.0–7.0 µm long setulae at both ends, setulae disappearing with age.

Etymology. – *Falacro-* (Greek) losing hairs, for the setulae of conidia that disappear with increasing age.

Known distribution. – Thailand, known only from the type collection.

Habitat. – Saprobic on decayed wood.

No anamorph was observed on the natural material. The conidiophores and conidia of the *Dictyochaeta* anamorph were formed *in vitro* from isolated ascospores. Young conidia (in colonies up to 14 days old) were seen with setulae. After ca. one month on PCA medium at room temperature in the dark, the setulae disappeared, leaving conidia lacking any indication of appendages. The asetulate conidia of the *Dictyochaeta* anamorph of *Ch. falacrospora* are similar to those of the *Chloridium* anamorph of *Ch. acutata* Réblová & W. Gams, but the latter species differs by the production of narrowly fusiform, 3-septate, larger ascospores and larger conidia produced successively from multiple conidiogenous loci (Réblová & Gams, 1999). The ascospores of *Ch. falacrospora* are of a typical shape for *Chaetosphaeria* species with *Chloridium, Dictyochaeta* and *Gonytrichum* C. G. Nees & F. Nees anamorphs.

Chaetosphaeria hispida Réblová & Seifert, **sp. nov.** – Figs. 18–29.

Perithecia superficialia, solitaria vel gregaria, subglobosa ad globosa, papilla minuta, 170–230 µm diam, 200–250 µm alta, nigra, papillata, ostiolo periphysato, setosa, setis sensim acutis, simplicibus, obscure fuscis, opacis, 27.0–37.0 m longis,

Figs. 9–16. *Chaetosphaeria falacrospora*. – 9, 10. Conidiophores of the *Dictyochaeta* anamorph. – 11. Conidia. – 12. Ascospores. – 13–16. Mature asci containing ascospores. – Scale bar = 10 µm. – Figs. 9–16: DIC. – Figs. 9–16 from PRM 900541 (Holotype); 9–11 from culture CBS 112962.

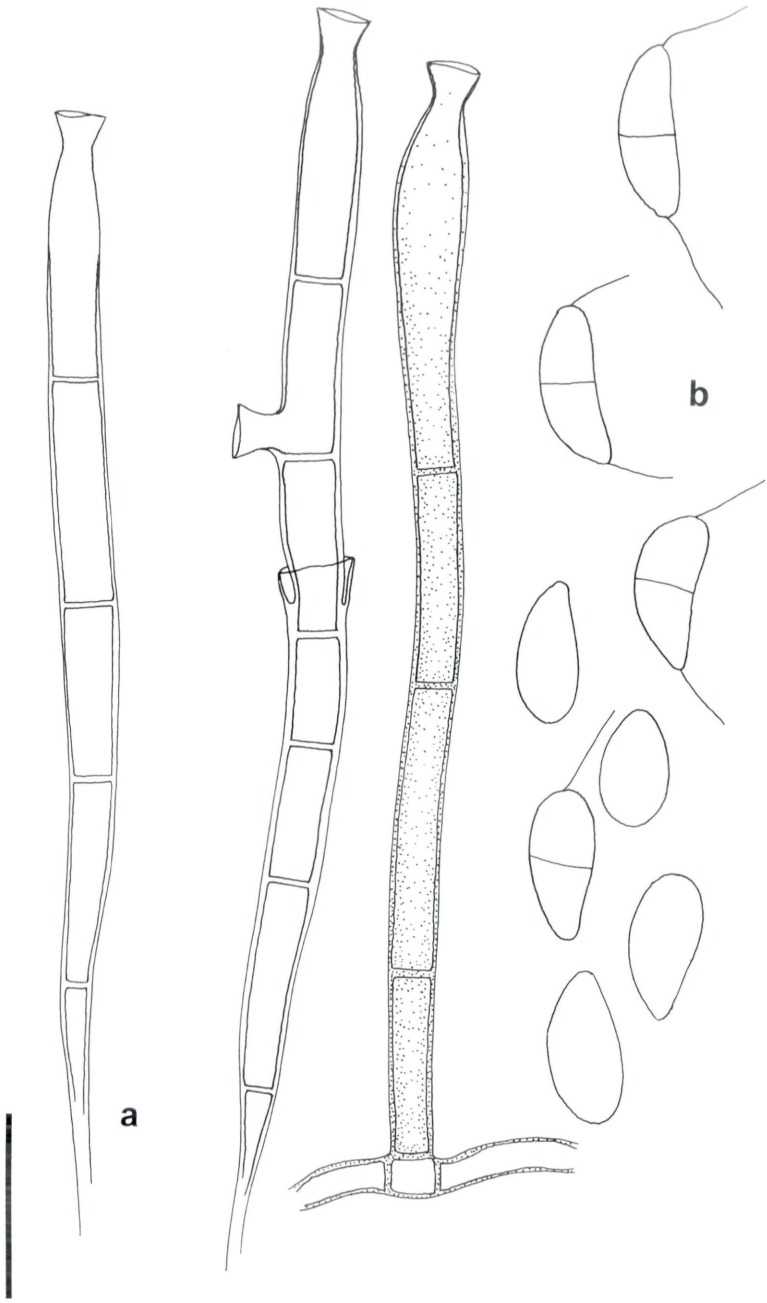


Fig. 17a, b. *Chaetosphaeria falacrospora*. – a. Conidiophores of the *Dictyochaeta* anamorph. – b. Conidia. – Scale bar = 10 µm. – From culture CBS 112962 ex PRM 900541.

basi (4.5–)5.0–6.5 µm latis. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes. Asci unitunicati, cylindrici ad clavati, 141.0–152.0 ($\bar{x}$ = 148±2.8) µm × 13.0–17.0 ($\bar{x}$ = 14.3±0.9) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae cylindricae vel anguste fusiformes 74.0–82.0 (–87.0) ($\bar{x}$ = 80±1.3) × (3.0–)3.5–4.0 ($\bar{x}$ = 3.6±0.1) µm, 1–7-septatae, leves, hyalinae.

Anamorphosis *Dictyochaeta*: Conidiophora macronematosa, mononematosa, fusca ad basim, sursum pallidiora, 46.0–82.0 µm alta, (3.0–)3.5–4.0 µm lata prope basin, sub collaris 1.5 µm constricta. Collare hyalinum, 2.5–3.0 µm diam. Conidia ellipsoidea ad obovoidea, recta vel leniter curvata, ad basim truncata, ad apicem rotundata, (4.5–)5.0–6.0 ($\bar{x}$ = 5.5±0.3) × 2.5–3.0 ($\bar{x}$ = 2.60.1) µm, aseptata, hyalina.

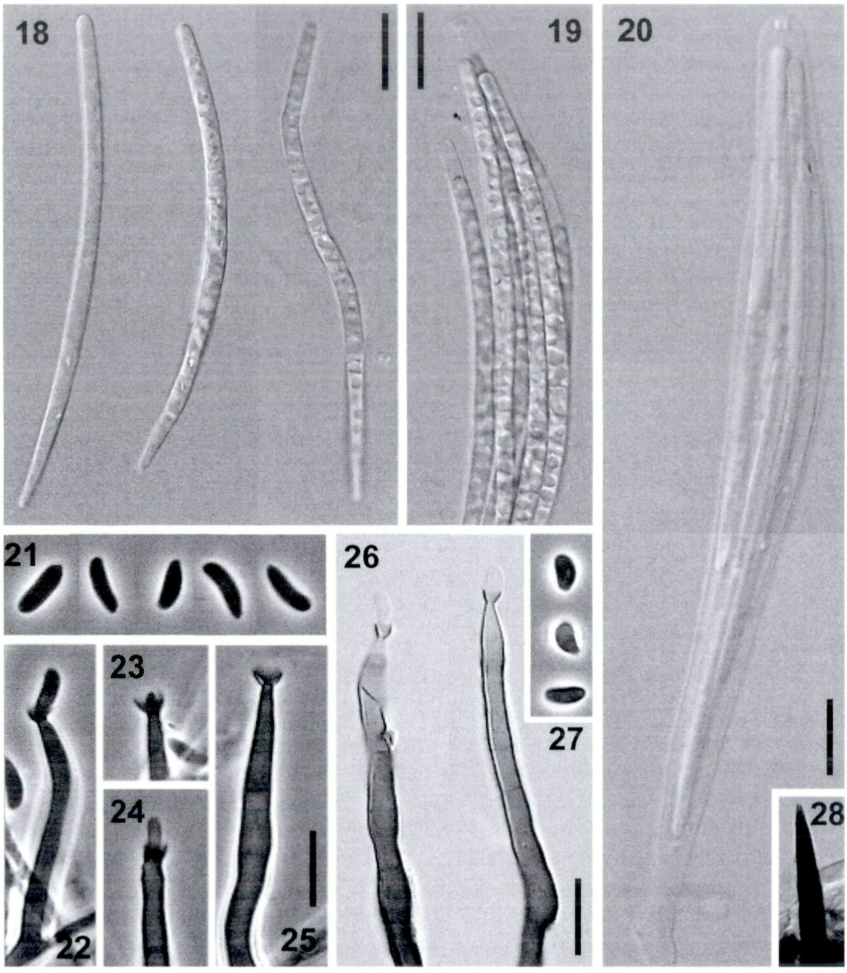
Anamorph. – *Dictyochaeta*, *cf. Chloridium curviellipticum* Matsush.

Holotype. – THAILAND: Nakhon Nayok Province, Khao Yai National Park NE of Bangkok, Bung Phai trail ca. 5 km NW from Khao Yai Forest Headquarters on a way to Pak Chong, N 14°28' E 101°23', elev. 750 m, decayed wood, 6 Sep. 2001, M. R., G. J. S., R. N. (PRM 900543).

Culture. – CBS 112964, DAOM 231140

Perithecia superficial, solitary or in small groups, subglobose to globose, papillate, 170–230 µm diam, 200–250 µm high, dark brown to nearly black, papillate, setose, ostiolate. – Setae acute, dark brown, opaque, unbranched, aseptate, never conidiogenous, 27.0–37.0 m long, (4.5–)5.0–6.5 µm wide near the base. – Ostiolar canal periphysate. – Perithecial wall 19.0–28.0 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, hyaline, septate, 4.5–6.0 µm wide near the base, tapering to 2.5–3.0 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 141.0–152.0 ($\bar{x}$ = 148±2.8) µm long, 13.0–17.0 ($\bar{x}$ = 14.3±0.9) µm wide, narrowly rounded at the apex, refractive apical annulus distinct, ca. 2.0 µm diam, 1.5 µm high, 8-spored, L/W 10.5 : 1. – Ascospores cylindrical to narrowly fusiform, straight or slightly curved, 74.0–82.0(–87.0) ($\bar{x}$ = 80±1.3) µm long, (3.0–)3.5–4.0 ($\bar{x}$ = 3.6±0.1) µm wide, L/W 22 : 1, 1–7-septate, not constricted at septa, hyaline, tapering at the base, rounded apically, smooth, 2–3-seriate in the ascus.

Colony on the natural substrate effuse, hairy, conidiophores sparsely spread among and on the perithecia. – Conidiophores macronematous, mononematous, solitary, erect, straight or slightly flexuous, cylindrical, unbranched, thick-walled, brown, paler upwards, 4–6-septate, darker brown at the septa, 46.0–82.0 µm tall, (3.0–)3.5–4.0 µm wide near the base, tapering to ca. 1.5 µm below the collarette, usually with one percurrent proliferation. – Conidiogenous cells phialidic, 15.0–35.0 µm long, 3.0–4.0 µm wide, term-



Figs. 18–28. *Chaetosphaeria hispida*. – 18. Ascospores. – 19. Upper part of ascus containing apical annulus. – 20. Ascus. – 21. Conidia of the *Dictyochaeta* anamorph. – 22–26. Conidiophores and conidiogenous cells. – 27. Conidia. – 28. Perithecial seta. – Scale bar = 10 µm. – Figs. 18–20, 26, 28: DIC; 21–25, 27: PC. – Figs. 18–28 from PRM 900543 (Holotype); 21–25 from culture CBS 112964; 26, 27 from nature.

inal, integrated, with 1 apical conidiogenous aperture or polyphialides with 2–5 lateral apertures arising from the sympodial proliferation, conidia formed on single conidiogenous loci within the aperture. – Collarettes funnel-shaped, hyaline, 2.5–3.0 µm wide, 2.0–2.5(–3.0) µm deep. – Conidia ellipsoidal to obovoidal, truncate at the base, rounded apically, (4.5–)5.0–6.0 ($\bar{x}$ = 5.5 ± 0.3) µm long, 2.5–3.0 ($\bar{x}$ = 2.6 ± 0.1) µm wide, L/W 2 : 1, aseptate, hyaline, smooth.

Characteristics in culture. – Colonies on PCA 10–14 mm diam, convex, with lanose white aerial mycelium, densest on the inoculum block, with scattered brown hyphae (perhaps setae), with a ring of sporulation consisting of white, slimy conidial heads on the agar surface and under the aerial mycelium, Grey to slightly Olive (2E1-2), the reverse Olive (3E3) in the centre, grey near the margin, margin subsurface, discrete, entire. – Colonies OA 8–10 mm diam, growing in lobes from the inoculum, planar, with less aerial mycelium than on PCA, conidiophores arising in a ring from agar surface, Olive Grey (3E2) in the centre, more grey in sporulating areas, sometimes with a faint yellow soluble pigment, reverse obscured by the opaque medium, margin discrete, entire. – Conidiophores as on the natural substrate, 27.0–67.0(–78.0) µm tall, 2.5–4.0(–4.5) µm wide near the base, tapering to ca. 1.5 µm below the collarette. Conidiophores occasionally bearing 1 or 2 lateral branches 9.0–12.0 µm long with a terminal collarette. – Collarettes 2.5–4.0 µm wide, 1.5–2.5(–3.0) µm deep. – Conidia 6.0–8.0 ($\bar{x}$ = 7.2 ± 0.2) µm long, 2.0–2.5(–3.0) ($\bar{x}$ = 2.4 ± 0.7) µm wide, L/W 3 : 1.

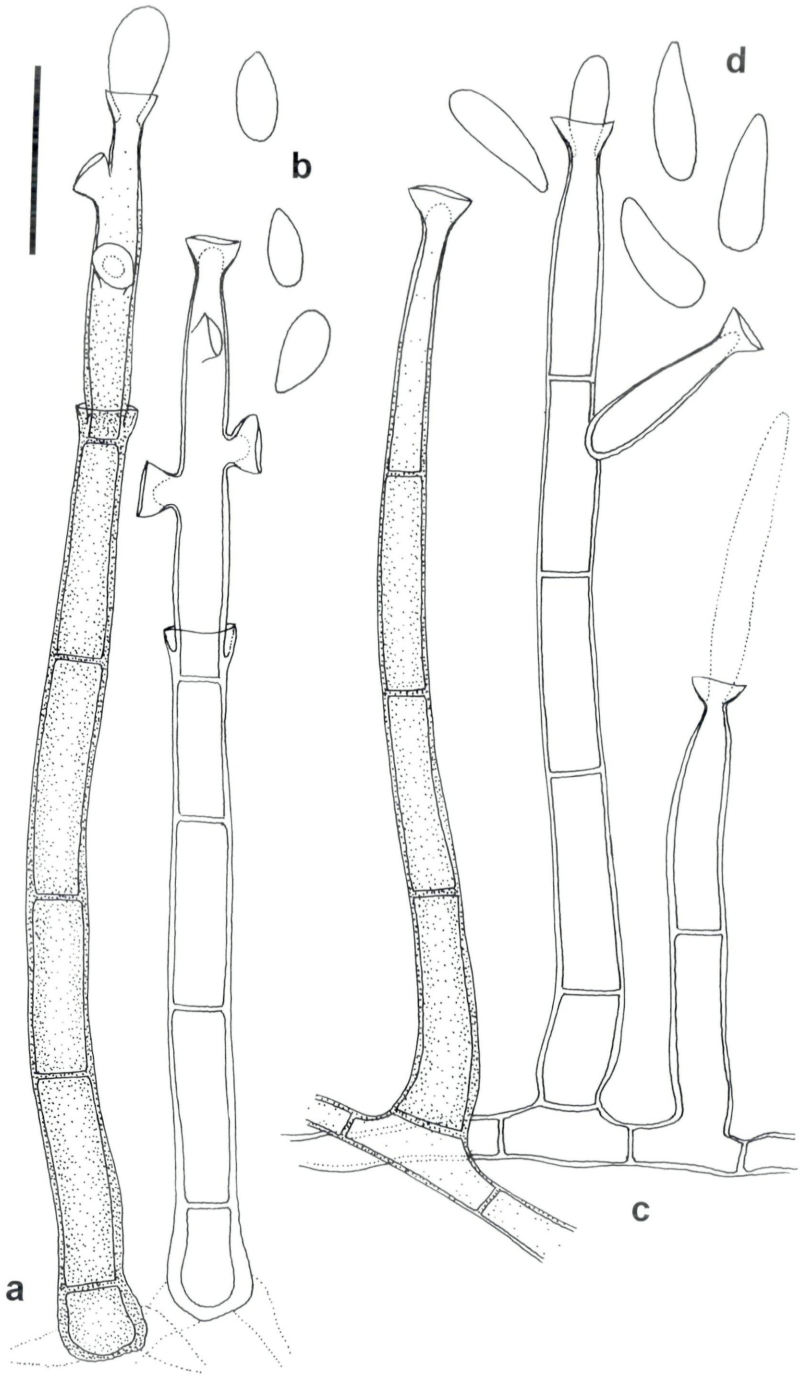
Etymology. – *Hispidus* (L), hispid, hirsute, for the setose perithecia.

Known distribution. – Thailand, known only from the type collection.

Habitat. – Saprobic on decayed wood.

Chaetosphaeria hispida is characterized by cylindrical to narrowly fusiform asymmetrical ascospores, tapered at the base and rounded apically. Ascospores with a similar shape are also produced by *Chaetosphaeria fusiformis* W. Gams & Hol.-Jech. and *Chaetosphaeria capitata* Sivan. & H. S. Chang. *Chaetosphaeria fusiformis* can be distinguished from the new species by nonsetose perithecia, shorter ascospores and asci and its *Chloridium cylindrosporum* W. Gams & Hol.-Jech. anamorph (Réblová & Gams, 1999), while *Ch. capitata* differs by its larger ascospores and asci and by the presence of capitate hyphae on the perithecial wall (Sivanesan & Chang, 1995). The setae in the new species are pointed, dark brown and opaque. The capitate hyphae are typical of some *Chaetosphaeria* species with *Catenularia* anamorphs and species of *Melanochaeta* E. Müll. & al. with *Sporoschisma* Berk. & Broome and *Chalara*-like synanamorphs. The anamorph of *Ch. capitata* is unknown.

No anamorph was observed on the natural material. The conidiophores and conidia of the *Dictyochaeta* anamorph were formed *in vitro* from isolated ascospores and match the description of *Chloridium curviellipticum* (Matsushima, 1993). We refrain from



making a new combination of this epithet into *Dictyochaeta* until anamorph generic concepts in this complex are more settled.

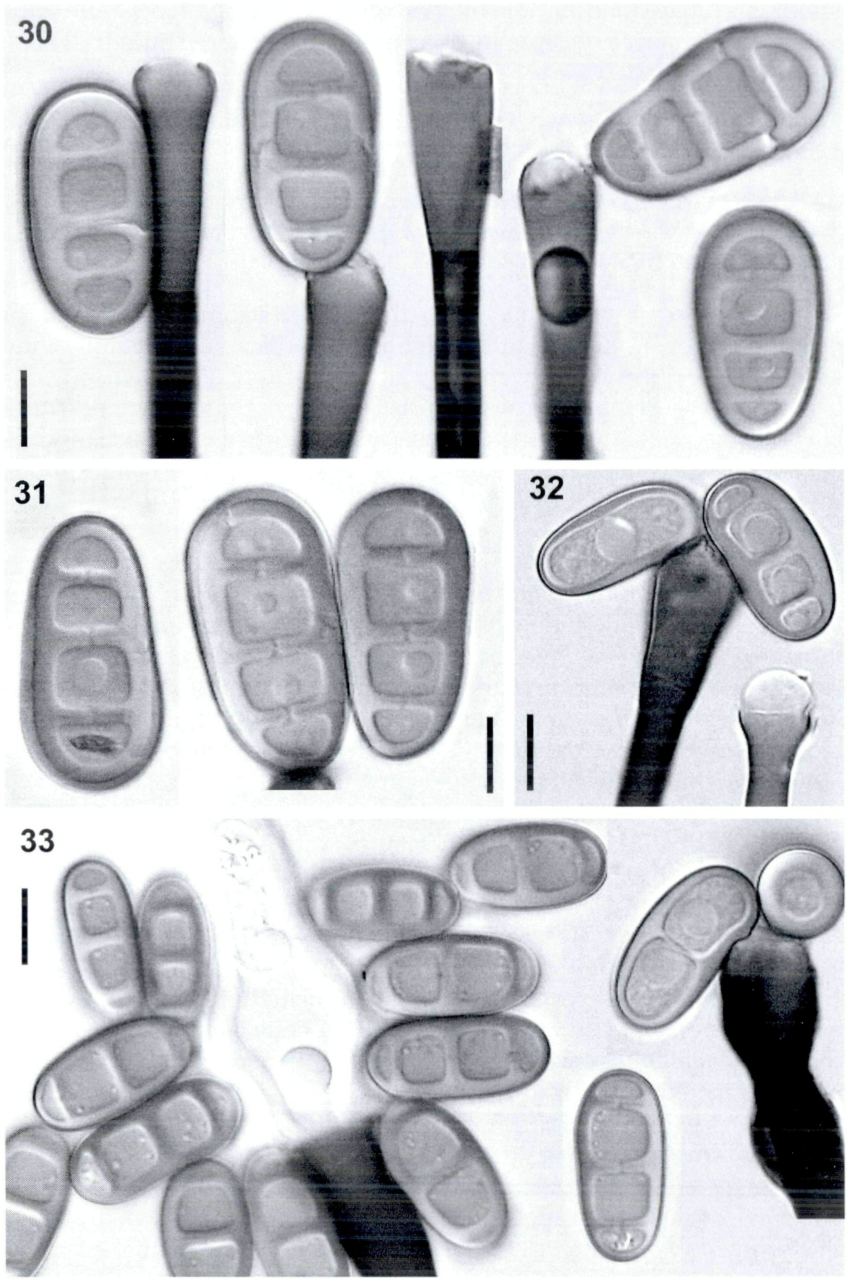
Chaetosphaeria hiugensis Hino, Bull. Miyaz. Coll. Agr. For. 10: 63, 1938. – Figs. 30, 31, 34.

Anamorph. – *Exserticlava triseptata* (Matsush.) S. Hughes, New Zealand J. Bot. 16: 333, 1978.
≡ *Cordana triseptata* Matsush., Icon. Microfung. Matsush. Lect. p. 39, 1975.

Perithecia superficial on a thin basal stroma, solitary or in groups of 2 or 3, globose to subglobose, papillate, 210–250 µm wide and 250–300 µm high, covered by a pale yellowish-brown powder except for the black glabrous papilla, setose, ostiolate. The powdery covering ca. 7.0–12.0 m thick, consisting of thin-walled, pseudoparenchymatous cells, later deliquescing and forming an amorphous matrix. The covering disappears with age, leaving the perithecia dark and glabrous. – Setae sparsely covering perithecia, arising from the perithecial wall, erect, acute to obtuse, dark brown, opaque, unbranched, septate, never seen to be conidiogenous, 100–175 µm long and 4.0–4.5 µm wide in the middle. – Ostiolar canal periphysate. – Perithecial wall 25.0–30.0 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, hyaline, septate, 5.0–6.0 µm wide near the base, tapering to 2.5–3.0 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 130.0–149.0 ($\bar{x}$ = 13±73) µm long, 17.0–22.0 ($\bar{x}$ = 19.5±0.7) µm wide, narrowly rounded at the apex, refractive apical annulus distinct, ca. 5.0–5.5. µm diam, 1.0–1.5 µm high, 8-spored, L/W 7:1. – Ascospores fusiform, straight or slightly curved, 36.0–43.0(–48.0) ($\bar{x}$ = 40.3±0.8) µm long, (6.0–)7.0–7.5(–8.0) ($\bar{x}$ = 7.1±0.1) µm wide, L/W 5.5:1, 5–7(–8)-septate with a delayed formation of septa, hyaline becoming versicolored at maturity, middle cells turning pale brown to brown, end cells remaining hyaline, slightly constricted at septa or not constricted, smooth, 2–3-seriate in the ascus.

Colony on the natural substrate effuse, hairy, conidiophores sparsely spread among perithecia. – Conidiophores macronematous, mononematous, solitary, erect, straight or slightly flexuous, cylindrical, unbranched, thick-walled, brown, darker brown at the septa, 5–7-septate, 180–290 µm tall, 8.0–9.0 µm wide near the

Fig. 29a–d. *Chaetosphaeria hispida*. – a. Conidiophores of the *Dictyochaeta* anamorph. – b. Conidia. – c. Conidiophores. – d. Conidia. – Scale bar = 10 µm. – From PRM 900543 (Holotype); a, b from nature; c, d from culture CBS 112964.



Figs. 30, 31. *Chaetosphaeria hiugensis*. – 30, 31. Conidiogenous cells and conidia of the *Exserticlava triseptata* anamorph. – 32, 33. *Exserticlava vasiformis*. – 32, 33. Conidiogenous cells and conidia. – Scale bar = 10 µm. – Figs. 20–33: DIC. – Figs. 30, 31 from MFC 1960 (Holotype). – Figs. 32, 33 from MFC 4915 (Holotype).

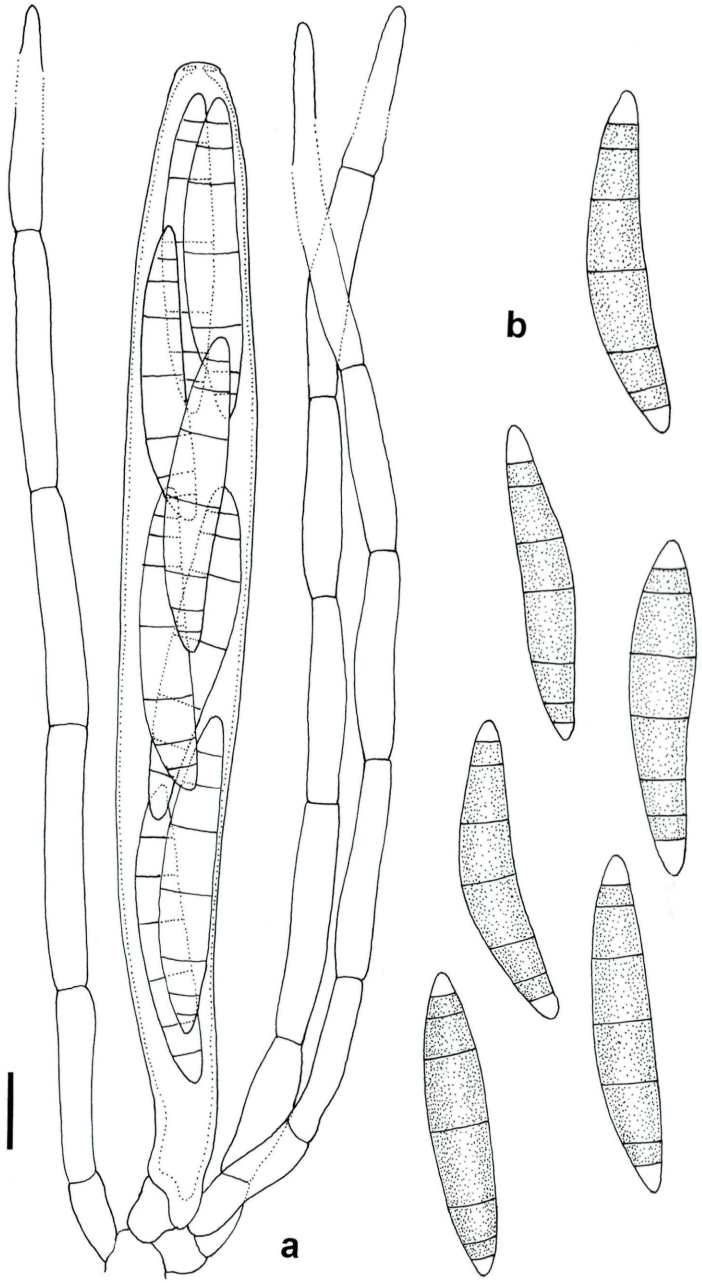


Fig. 34a, b. *Chaetosphaeria hiugensis*. – a. Ascus with ascospores and paraphyses. – b. Ascospores. – Scale bar = 10 µm. Fig. 34a, b from MFC 1960 (Holotype).

base, slightly tapering upwards to 6.0–7.5 µm below the collarette. – Conidiogenous cells phialidic, 25.0–35.0 µm long, 7.0–11.0 µm wide, integrated, terminal, and brown. – Collarettes 9.0–11.0 µm wide, lacerate at the margins as a result of the rupture of the outer wall of the conidiogenous cell. The hyaline inner layer of the conidiogenous cell expanding and slightly protruding beyond the collarette, 6–13 conidia are produced successively in a cluster on this extension. – Conidia broadly ellipsoidal to obovoidal, 25.0–35.0 ($\bar{x}$ = 30±1.1) µm long, 13.0–15.0 ($\bar{x}$ = 14±0.3) µm wide, L/W 2:1, 3-distoseptate, pale brown, thick-walled, smooth, with minute basal scar.

Descriptions and illustrations. – Hino & Katumoto (1961: 63, Fig. 9a–f); Matsushima (1975: 39, Fig. 239, *3–4*; 1985: 4, Figs. 324–328); Kuthubutheen & Nawawi (1994: 681, Fig. 29); Tsui & al. (2001: 138, Figs. 13–18, 21).

Known distribution. – China, Japan, Malaysia, Micronesia, Puerto Rico, Seychelles.

Habitat. – Saprobic on decayed bamboo culms of *Phyllostachydis edulis*, *Semiarundinaria fastuosa*, *Sinobambusa tootsik*, unidentified angiosperm hard wood and submerged wood.

Material examined. – Puerto Rico: Sierra de Luquillo Mts., Luquillo, Sabana, Chicken Farm, decayed unidentified hard wood, 10 Jun. 1998, M. R. 1208-98.

Hino & Katumoto (1961) and Matsushima (1985) illustrated the dematiaceous, phialidic hyphomycete that was associated with perithecia of *Ch. hiugensis* on the natural substrate. Matsushima (1985) described the anamorph of *Ch. hiugensis* as *Cordana triseptata* Matsush., based on material collected in Japan. Hughes (1978) transferred *C. triseptata* to a new genus, *Exserticlava* S. Hughes. We were unable to confirm the teleomorph-anamorph connection by isolating ascospores on PCA and CMA, but reports by Hino & Katumoto (1961) and Matsushima (1985) concerning the regular association of *E. triseptata* with *Ch. hiugensis* make this connection highly probable. The type specimen of *Ch. hiugensis* (JAPAN: Hyuga Province, Kibana-mura, dead stem of *Semiarundinaria fastuosa*, 11 Jun. 1937, I. Hino) requested from the YAM and NICH herbaria was unavailable for our study.

Within the Chaetosphaeriaceae, *Ch. exserticlavoides* and *Ch. hiugensis* can be compared to species of *Melanochaeta*. Species of this genus differ by the pale, coerulescent to whitish layer of densely interwoven hyphae on the perithecial surface, capitate setae and

oblong to ellipsoidal to suballantoid ascospores, and the *Sporoschisma* and chalara-like synanamorphs.

Umbrinosphaeria caesariata (Clinton & Peck) Réblová (Chaetosphaeriaceae) differs from both *Ch. exserticlavoides* and *Ch. hiugensis* by its perithecial wall composed of thick-walled, brown, angular cells, different morphology of setae and its *Sporidesmium* and *Chloridium* synanamorphs.

Chaetosphaeria triangulo conidia Réblová & Seifert, **sp. nov.** – Figs. 35–41.

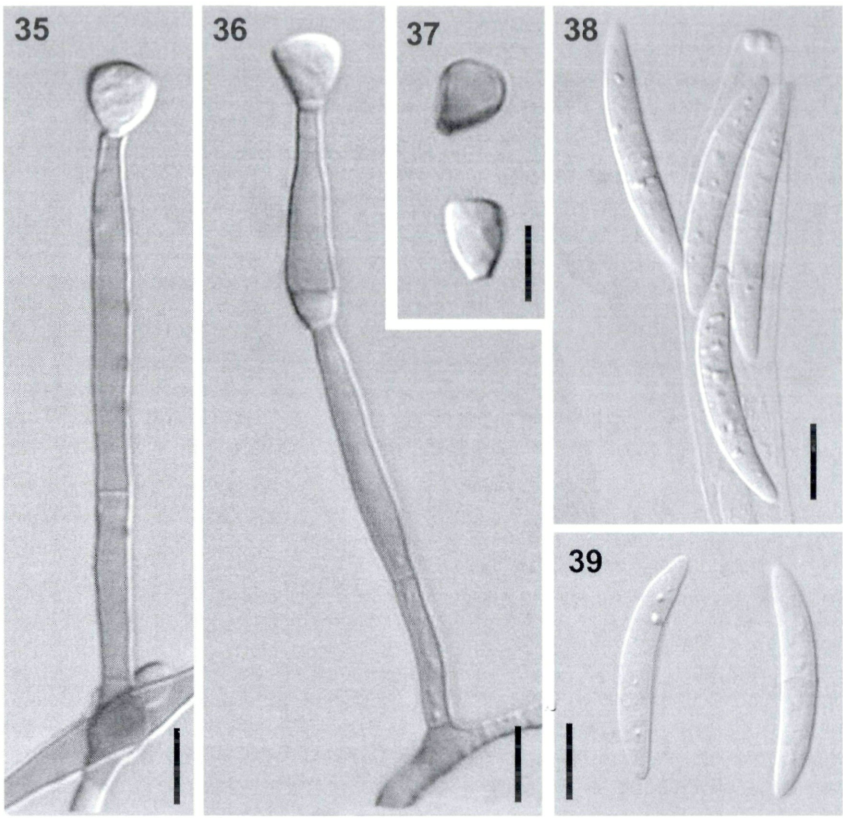
Perithecia superficialia, gregaria, subglobosa usque globosa, papilla minuta, 230–250 µm diam, 250–275 µm alta, glabra, pulvere grisello vel albido obtecta, papilla nigra exclusa, ostiolo periphysato. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes. Asci unitunicati, cylindrici usque clavati, 102.0–112.0 ($\bar{x}$ = 106 ± 1.6) × 8.0–9.0(–9.5) ($\bar{x}$ = 8.9 ± 0.2) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae fusiformes 25.0–29.0(–30.0) ($\bar{x}$ = 27 ± 0.5) × (3.5–)4.0–4.5 ($\bar{x}$ = 4 ± 0.7) µm, 1–3-septatae, leves, hyalinae.

Anamorphosis *Catenularia*: Conidiophora macronematosa, mononematosa, fusca ad basim, sursum pallidiora, in duobus stratis formata, breviora pallide fusca, 4–6-septata, 125–150(–187) µm alta, 5.0–8.5 µm lata prope basin, sub collari ad 3.0 µm constricta, altiora fusciora, crassitunicata, setiformia, 7–10-septata, 260–355 µm alta, 8.5–10.0 µm lata prope basin, sub collari ad 4.0–4.5 µm constricta. Collare subhyalinum, 5.0–6.0 µm diam. Conidia rotundato-obconica, basi truncata, apice rotundata vel parum triangulata, (8.0–)9.0–10.0 ($\bar{x}$ = 9.4 ± 0.3) × 9.0–11.0 ($\bar{x}$ = 9.8 ± 0.2) µm, ad basin 2.0 µm lata, aseptata, pallido brunnea, solitaria vel catenulata, laevia.

Anamorph. – *Catenularia*.

Holotype. – THAILAND: Nakhon Nayok Province. Khao Yai National Park NE of Bangkok, trail to Haew Suwat waterfall ca. 4.5 km E of Khao Yai Forest Headquarters, N 14°26' E 101°25', elev. 720 m, decayed bamboo culm, 2 Sep. 2001, M. R., G. J. S., R. N.(PRM 900544).

Perithecia superficial, densely aggregated, subglobose to globose, 230–250 µm diam, 250–275 µm high, covered by a whitish-gray powder except for the back glabrous papilla, setose, ostiolate. The powdery covering is ca. 5.0–15.0 µm thick, disappearing with age, leaving the perithecia dark and glabrous. Perithecia sparsely covered with conidiophores. – Perithecial wall 30.0–37.5 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, opaque, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Ostiolar canal periphysate. – Paraphyses persistent, branching, anastomosing, hyaline, septate, 3.0–4.0 µm wide near the base, tapering to 2.0 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 102.0–112.0 ($\bar{x}$ = 106 ± 1.6) µm long, 8.0–9.0(–9.5) ($\bar{x}$ = 8.9 ± 0.2) µm



Figs. 35–39. *Chaetosphaeria triangulocondia*. – 35, 36. Conidiophores of the *Catenularia* anamorph. – 37. Conidia. – 38, 39. Ascospores. – Scale bar = 10 µm. – Figs. 35–39: DIC. – Figs. 35–39 from PRM 900544 (Holotype); 35–37 from culture.

wide, rounded at the apex, refractive apical annulus distinct, ca. 3.0 µm diam, 1.5–2.0 µm high, 8-spored, L/W 12:1. – Ascospores fusiform, straight or curved, 25.0–29.0(–30.0) ($\bar{x}$ = 27 ± 0.5) µm long, (3.5–)4.0–4.5 ($\bar{x}$ = 4 ± 0.7) µm wide, L/W 6.7:1, 1–3-septate, not constricted at septa, smooth, 1–2-seriate in the ascus.

Colony on the natural substrate effuse, hairy, conidiophores macronematous, mononematous, solitary, erect, straight or slightly flexuous, cylindrical, unbranched, thick-walled, brown, and paler upward, forming two layers. – Conidiophores of the lower layer 4–6-septate, pale brown, 125–150(–187) µm tall, 5.0–8.5 µm wide near the base, tapering to 3.0 µm below the collarette, ending in a monophialide. Conidiophores of the upper layer 7–10-septate, dark brown, 260–355 µm tall, 8.5–10.0 µm wide near the base, tapering to 4.0–4.5 µm below the collarette, usually with 1 or 2 percurrent prolife-

rations, ending in a monophialide. – Conidiogenous cells phialidic, 15.0–25.0 µm long, 5.0–8.0 µm wide, terminal, integrated, with one apical conidiogenous aperture producing conidia successively on multiple conidiogenous loci, conidia formed basipetally in chains. – Collarettes small funnel-shaped, subhyaline, 5.0–6.0 µm diam, 1.5–2.0 µm deep. – Conidia rounded-obconic, broadly rounded to flattened at the apex, with 2 rounded corners when viewed from the front, truncate at the basal scar, (8.0–)9.0–10.0 ($\bar{x}$ = 9.4 ± 0.3) µm long, 9.0–11.0 ($\bar{x}$ = 9.8 ± 0.2) µm wide at the distal end, 2.0 µm wide at the flattened base, L/W 1 : 1, hyaline when young, becoming mid brown at maturity, aseptate, smooth.

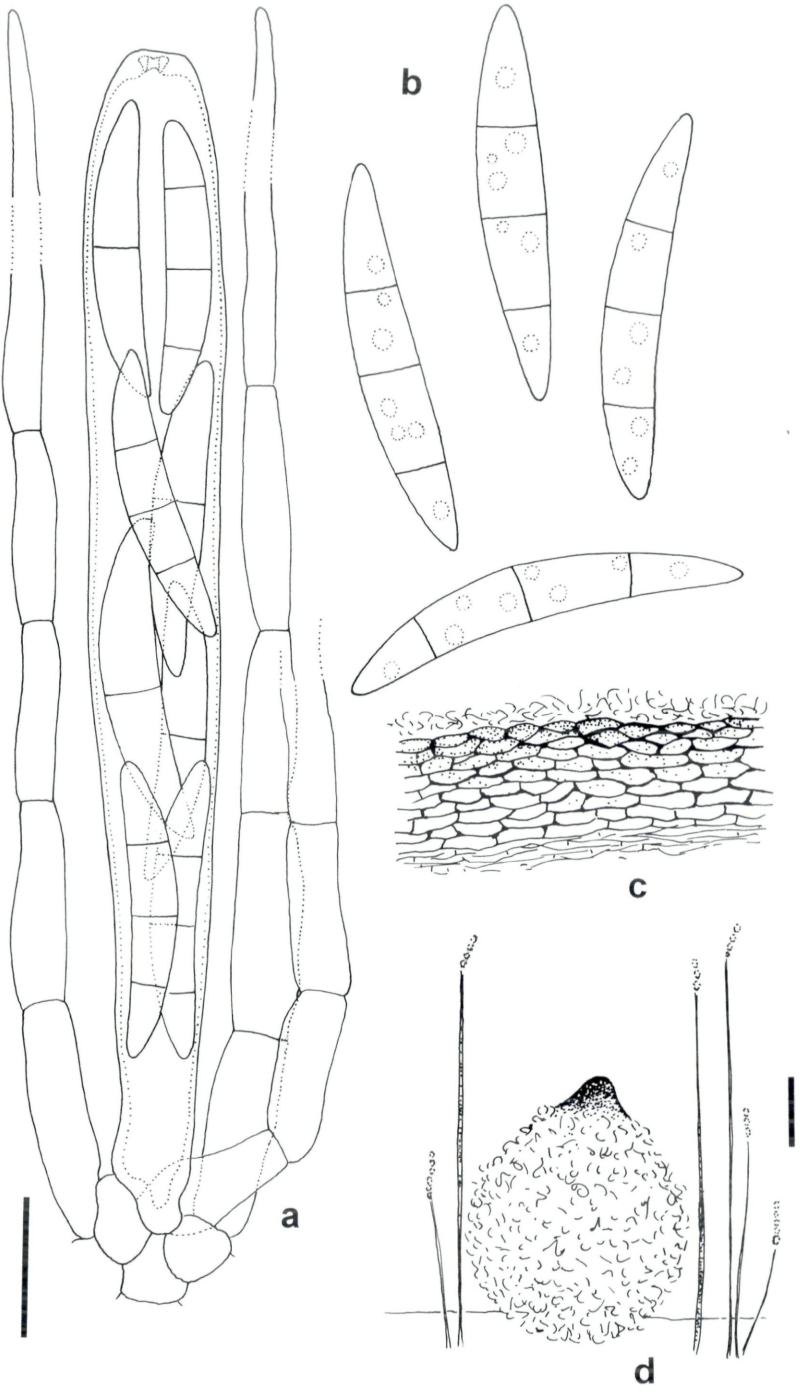
Characteristics in culture. – Conidiophores as on the natural substrate but forming only one layer, 30.0–60.0 µm tall, 3.5–4.0 µm wide near the base, tapering to 3.0 µm below the collarete. – Conidia as on the natural substrate, 6.0–7.0 ($\bar{x}$ = 6.6 ± 0.1) µm long, (4.0–)5.0–6.5 ($\bar{x}$ = 5.4 ± 0.3) µm wide, 1.3–2.0 µm wide at the flattened base, L/W 1.2:1.

Etymology. – *Triangulo-* (L), provided with 3 angles, for the shape of conidia from the front view.

Known distribution. – Thailand, known only from type collection.

Habitat. – Saprobic on decayed bamboo culm.

The genus *Catenularia* includes 12 species, and the known teleomorphs belong exclusively to *Chaetosphaeria*, i.e. *Ch. cubensis* Hol.-Jech., *Ch. cupulifera* (Berk. & Broome) Sacc. and *Ch. novae-zelandiae* S. Hughes & Shoemaker. *Chaetosphaeria cupulifera* has ascospores and asci of a comparable size to the new species, but differs in having 4–5-septate ascospores, black perithecia lacking any superficial light pigment layer (Booth, 1958). Its anamorph, *Catenularia cuneiformis* (Richon) Mason, has longer conidia, narrower at the distal end and wider at the flattened base (Mason, 1941; Holubová-Jechová, 1973) than the anamorph of *Ch. triangulospora*. *Chaetosphaeria novae-zelandiae* differs from *Ch. triangulospora* by the smaller 3-septate ascospores, smaller asci and larger conidia of its *Catenularia* anamorph (Hughes, 1965). In comparison to all *Chaetosphaeria* species with *Catenularia* anamorphs, *Ch. cubensis* has the smallest ascospores, asci and its anamorph *C. cubensis* Hol.-Jech. has the smallest conidia (Holubová-Jechová, 1982). Of the remaining species of *Catenularia* that have not been yet linked to the teleomorph, none matches the description of the *Catenularia* anamorph of *Ch. triangulospora*.



Some *Catenularia* species produce capitate hyphae that accompany tufts of conidiophores on the natural substrate. Such hyphae occur also on the perithecial wall of the associated teleomorphs. The temperate sexual and asexual species of *Catenularia*, including *Ch. cuneiformis* and *Ch. novae-zelandiae* form capitate hyphae, while the tropical species, including *Ch. cubensis* and *Ch. triangulo-conidia*, do not produce such setae.

Seven species of *Chaetosphaeria* have been documented from bamboo (Sawada, 1942; Dôke, 1947; Hino & Katumoto, 1961; Eriksson & Yue, 1988, 1998; Petrini & al., 1989; Candoussau & al., 1996), but none of these species including their anamorphs if known, has much similarity to *Ch. triangulo-conidia* or its anamorph.

Chaetosphaeria tubulicollaris Réblová & Seifert, **sp. nov.** – Figs. 42–53.

Perithecia superficialia, subglobosa ad globosa, papilla minuta, 150–180 µm diam, 150–220 µm alta, glabra, ostiolo periphysato. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes. Asci unitunicati, cylindrici ad clavati, 47.0–58.0 ($\bar{x}$ = 52.2±1.0) × 8.5–9.0(–10.0) ($\bar{x}$ = 9±0.1) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae fusiformes ad ellipsoideae (13.0–)15.0–17.0 ($\bar{x}$ = 15.2±0.5) × 4.0–5.0 ($\bar{x}$ = 4.4±0.2) µm, 0–1–3-septate, leves, hyalinae.

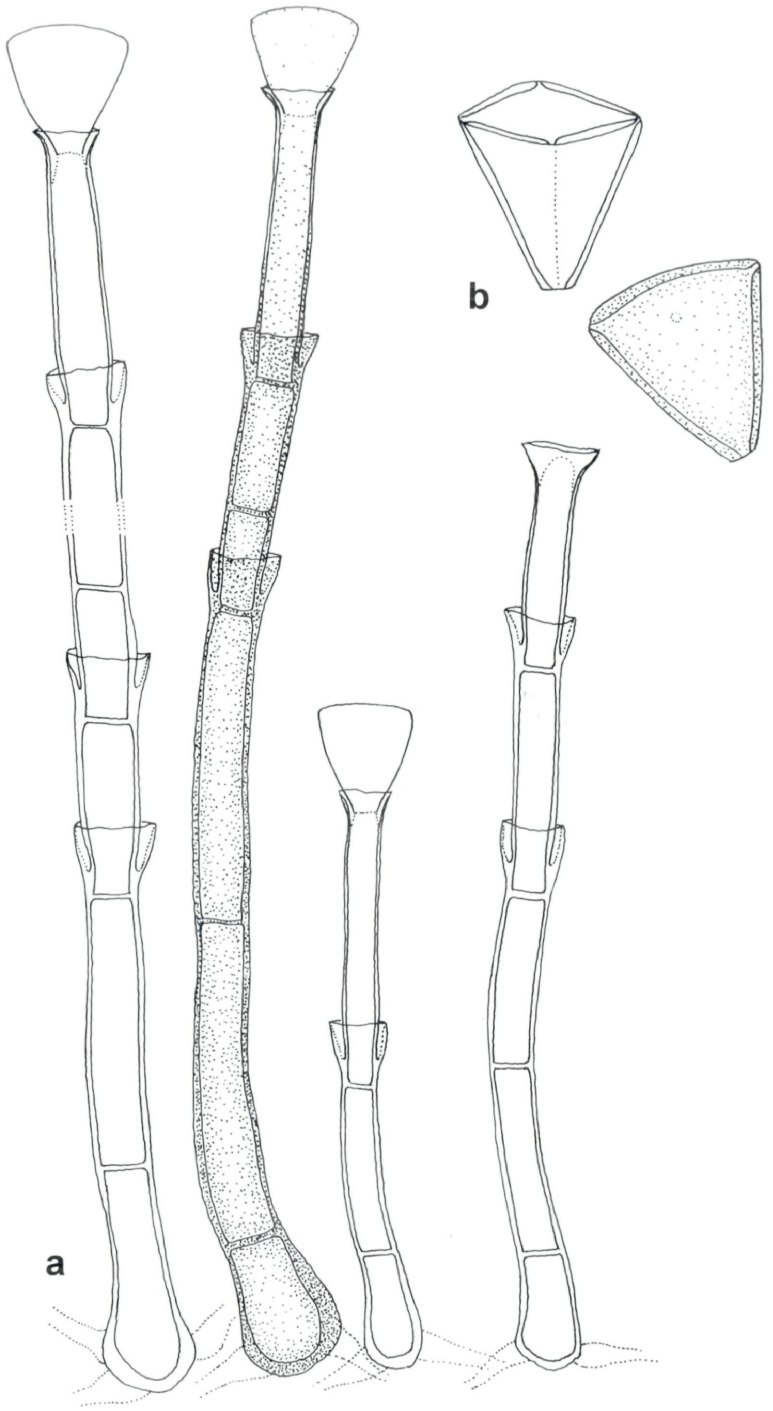
Anamorphosis *Chalarae* similis: Conidiophora macronematosa, mononematosa, fusca ad basim, sursum pallidiora, 1–3-septata, 35.0–95.0 µm alta, 5.0–6.0(–7.0) µm lata prope basin, sub collari ad 5.0–6.0 µm constricta. Collare subcylindricum, subhyalinum, 5.0–6.0(–7.0) µm diam. Conidia obclavata, basi truncata, apice rotundata, 11.0–16.0 ($\bar{x}$ = 13±0.6) × 4.0–6.0 ($\bar{x}$ = 5±0.6) µm, ad basin 3.0–4.5(–5.0) µm lata, aseptata, hyalina, solitaria.

Anamorph. – *Chalara*-like.

Holotype. – THAILAND: Nakhon Nayok Province. Khao Yai National Park NE of Bangkok, Mor Singh To trail ca. 1 km SW of Khao Yai Forest Headquarters, N 14°26' E 101°22', elev. 800 m, decayed wood of *Quercus* sp., 19 Aug. 2001, M. R., N. H. J. (PRM 900545).

Perithecia superficial, scattered on the surface, subglobose to globose, 150–180 µm diam, 150–220 µm high, papillate, setose, ostiolate, sparsely covered with the conidiophores of the associated anamorph. – Perithecial wall 15.0–20.0 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, opaque, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, hyaline, septate, 4.0–5.0 µm wide near the base,

Fig. 40a–d. *Chaetosphaeria triangulo-conidia*. – a. Asci with ascospores and paraphyses. – b. Ascospores. – c. Longitudinal section of the perithecial wall. – d. Habit sketch of perithecia and conidiophores of the anamorph. – Scale bar: a–c = 10 µm, d = 50 µm. – From PRM 900544 (Holotype).



tapering to 2.0–2.5 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, 47.0–58.0 ($\bar{x}$ = 52.2±1.0) µm long, 8.5–9.0(–10.0) ($\bar{x}$ = 9±0.1) µm wide, narrowly rounded or truncate to obtuse at the apex, refractive apical annulus distinct, ca. 2.0 µm diam, 1.0–1.5 µm high, 8-spored, L/W 6:1. – Ascospores fusiform to ellipsoidal, straight or slightly curved, (13.0–)15.0–17.0 ($\bar{x}$ = 15.2±0.5) µm long, 4.0–5.0 ($\bar{x}$ = 4.4±0.2) µm wide, L/W 3.5:1, hyaline, but becoming yellowish with age, 0–1–3-septate, delayed formation of septa, not constricted at septa, smooth, obliquely 1-seriate or 2(–3)-seriate in the ascus.

Characteristics in culture. – Conidiophores macronematous, mononematous, solitary, erect, straight or slightly bent, cylindrical, unbranched, thick-walled, mid brown, paler brown to subhyaline upwards, 1–3-septate, 35.0–95.0 µm tall, 5.0–6.0(–7.0) µm wide near the base, tapering to 5.0–6.0 µm below the collarette, ending in a monophialide, sometimes with 1 percurrent proliferation. – Conidiogenous cells phialidic, 15.0–35.0 µm long, 5.0–6.0 µm wide, subcylindrical, subhyaline to very pale brown, terminal, integrated, conidia develop successively on multiple conidiogenous loci within the collarette. – Collarettes subcylindrical to obconical, subhyaline to hyaline, 5.0–6.0(–7.0) µm diam, 10.0–15.0(–20.0) µm deep, later the wall of the collarette disappears leaving the collarette ca. 1.0–2.0 µm deep. – Conidia obclavate, broadly rounded at the distal end, truncate and slightly rounded at the base, 11.0–16.0 ($\bar{x}$ = 13±0.6) µm long, 4.0–6.0 ($\bar{x}$ = 5±0.6) µm wide at the distal end, 3.0–4.5(–5.0) µm wide at the conspicuous basal scar, L/W 2.6:1, hyaline, aseptate, smooth.

Etymology. – *Tubuli-* (L), cylindrical, *-collaris* (L), collarette, for the shape of collarette in the chalara-like anamorph.

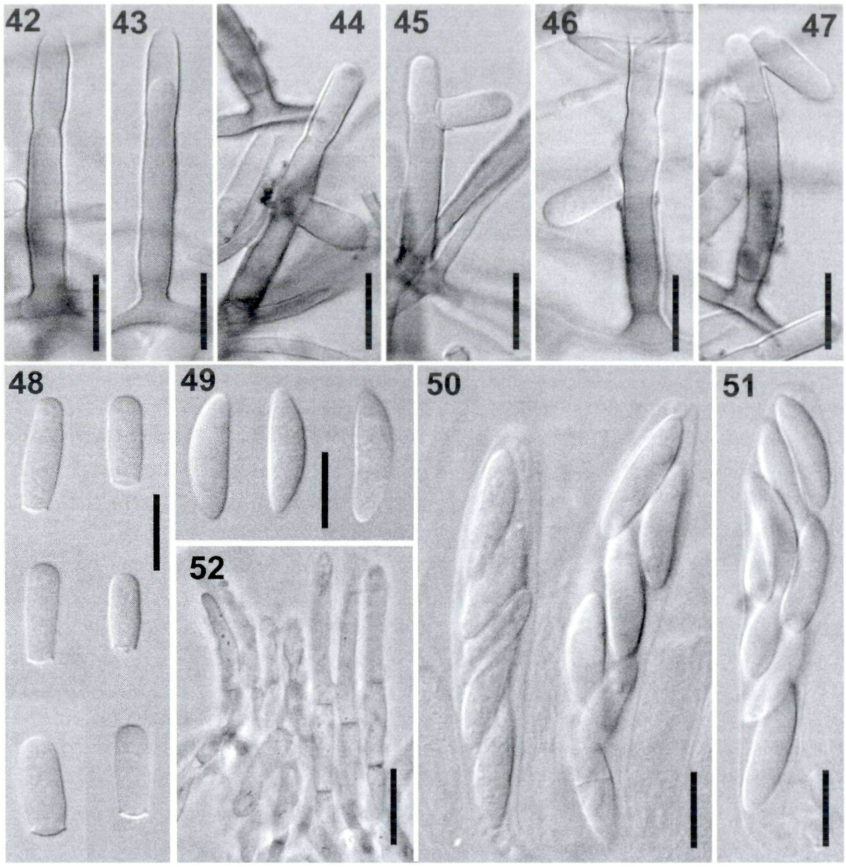
Known distribution. – Thailand, known only from the type collection.

Habitat. – Saprobic on decayed wood.

Only young conidiophores were seen on the surface of the perithecial wall of the type specimen. The chalara-like conidia and conidiophores were formed *in vitro* from isolated ascospores.

The formation of septa in ascospores of *Ch. tubulicollaris* is delayed. The median septum is formed when the ascospores are still in the ascus, while the second and third septa often develop after the ascospores are discharged.

Fig. 41a, b. *Chaetosphaeria triangulocondidia*. – a. Conidiophores of the *Catenularia* anamorph. – b. Mature conidia. – Scale bar = 10 µm. – From PRM 900544 (Holotype); from nature.



Figs. 42–52. *Chaetosphaeria tubulicollaris*. – 42–47. Conidiophores and conidiogenous cells of the chalara-like anamorph. – 48. Conidia. – 49. Ascospores. – 50, 51. Asci with ascospores. – 52. Paraphyses. – Scale bar = 10 μm. – Figs. 42–51: DIC; 52: PC. – Figs. 42–52 from PRM 900545 (Holotype); 42–48 from culture.

Chaetosphaeria tubulicollaris can be compared to *Ch. chalaroides* Hol.-Jech., which differs by having narrower ascospores, and longer and narrower asci (Holubová-Jechová, 1984). Its anamorph, *Chalara breviclavata* Nag Raj & Kendrick has narrower conidia (Nag Raj & Kendrick, 1975).

Chaetosphaeria verruculospora Réblová & Seifert, **sp. nov.** – Figs. 54–62.

Perithecia superficialia, gregaria, subglobosa ad globosa, papilla minuta, 170–220 μm diam, 170–230 μm alta, nigra, papillata, glabra, setosa, setis 200–287 4.5–5.0 μm, ostiolo periphysato. Paries perithecii fragilis, bistratosus. Paraphyses copiosae, persistentes, cylindraceae, septatae, ultra ascorum apices protrudentes.

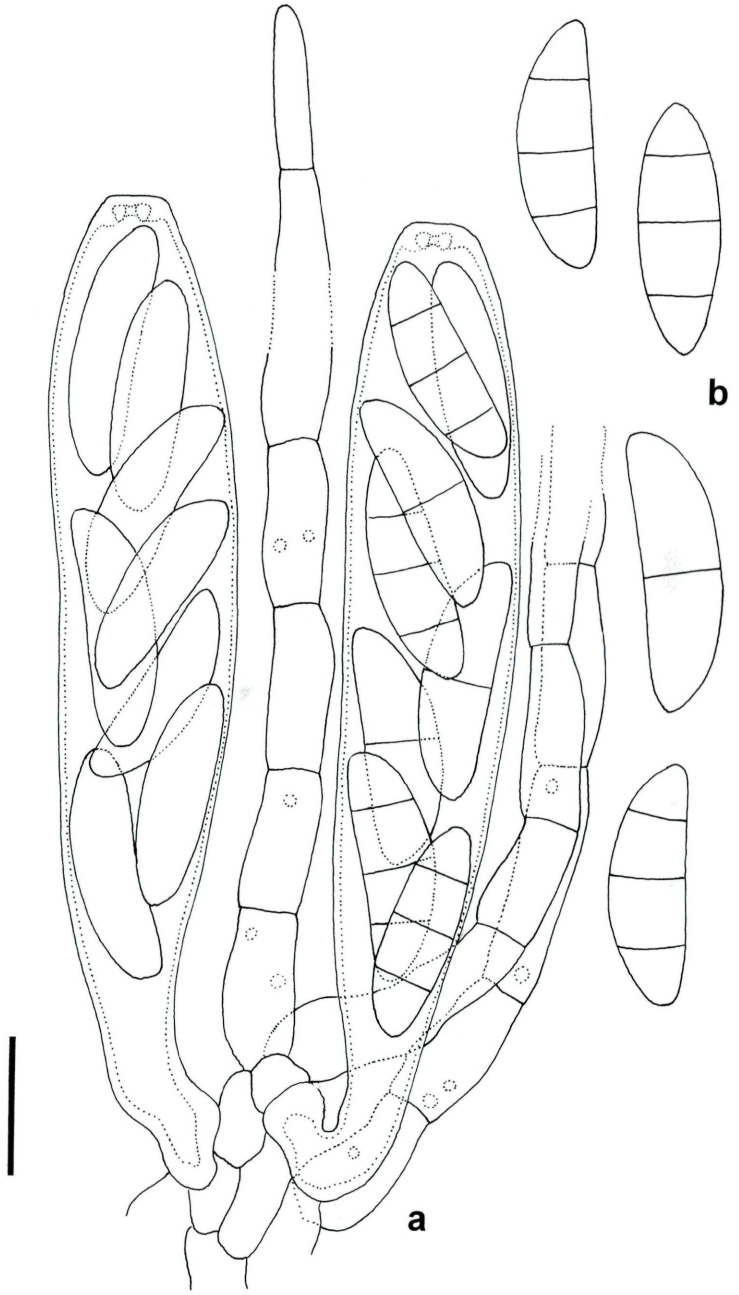
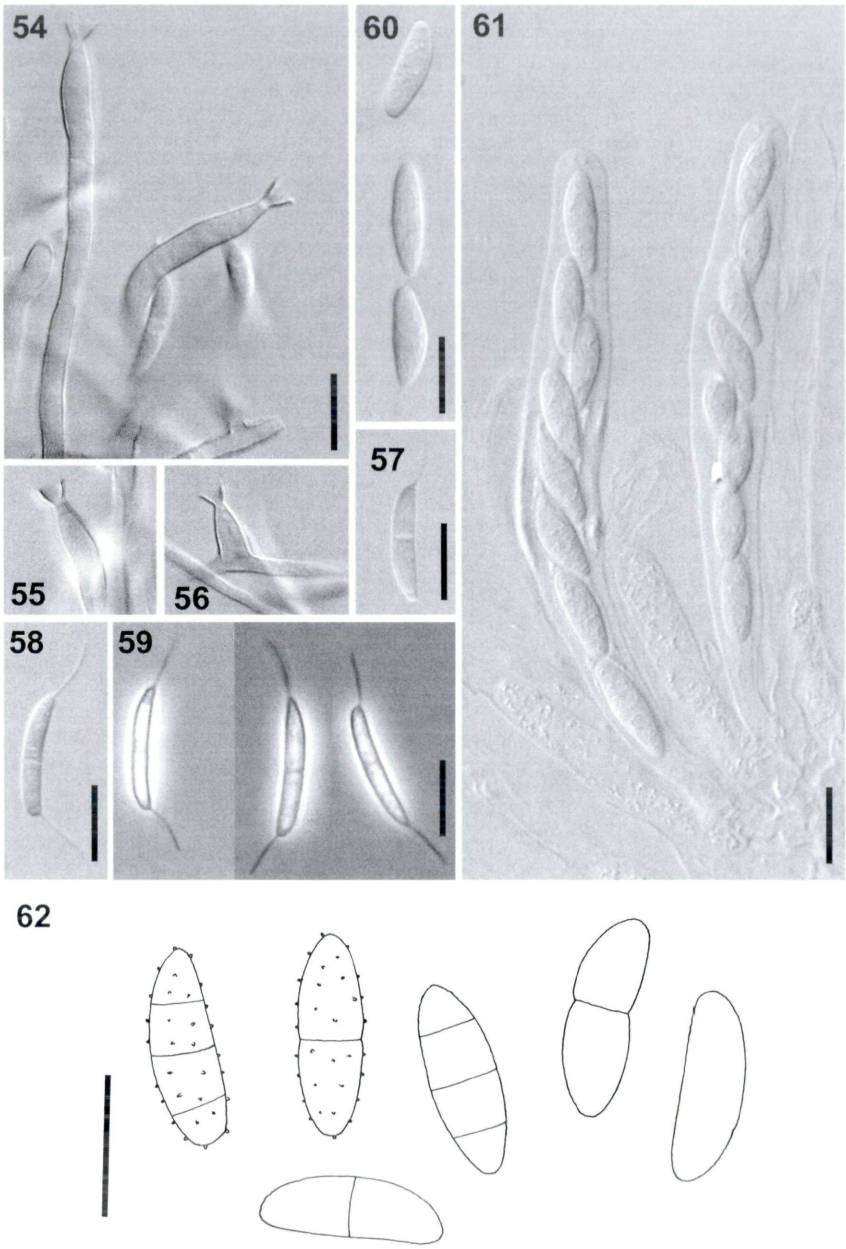


Fig. 53a, b. *Chaetosphaeria tubulicollaris*. – a. Asci with ascospores and paraphyses. – b. Ascospores. – Scale bar = 10 µm. From PRM 900545 (Holotype).



Figs. 54–62. *Chaetosphaeria verruculospora*. – 54–56. Conidiophores and conidiogenous cells of the *Codinaea* anamorph. – 57–59. Conidia. – 60. Ascospores. – 61. Asci containing ascospores. – 62. Ascospores. – Scale bar = 10 µm. – Figs. 54–58, 60, 61: DIC; 59: PC. – Figs. 54–62 from PRM 900542 (Holotype); 54–59 from culture.

Asci unitunicati, cylindrici ad clavati, (65.0–)70.0–82.0(–87.0) ($\bar{x}$ = 74.5 ± 1) × 7.0–8.0 ($\bar{x}$ = 7.5 ± 0.1) µm, apice non amyloideo, annulo refractivo, 8-spori. Ascosporae ellipsoideae, (10.0–)11.0–12.5(–13.0) ($\bar{x}$ = 11.7 ± 0.1) × 3.5–4.0 ($\bar{x}$ = 3.9 ± 0.03) µm, 1-septatae, verruculosae, hyalinae.

Anamorphosis *Dictyochaeta*: Conidiophora macronematosa, mononematosa, fusca ad basim, sursum pallidiora, apice subhyalina, in duobus stratis formata, breviora pallide fusca, 2–4-septata, 37.0–55.0 µm alta, 3.5 µm lata prope basin, sub collari ad 1.5–2.0 µm constricta, altiora fusciora, crassitunicata, setiformia, 5–9-septata, 200–287 µm alta, 4.0–5.0 µm lata prope basin, sub collari ad 2.0–2.5 µm constricta. Collare hyalinum, 3.5–4.0 µm diam. Conidia falcata, basi inconspicuo truncata, apice rotundata, (12.0–)13.0–16.0(–19.0) ($\bar{x}$ = 15 ± 0.5) × longe 2.0–2.5 ($\bar{x}$ = 2.2 ± 0.06) lata µm, recta vel leniter curvata, 1-septata, hyalina, untrinque setula singula, setula (4.0–)5.0–8.0 (–9.0) µm longa.

Anamorph. – *Dictyochaeta*.

Holotype. – THAILAND: Nakhon Nayok Province. Khao Yai National Park NE of Bangkok, Bung Phai trail ca. 5 km NW from Khao Yai Forest Headquarters on a way to Pak Chong, N 14°28' E 101°23', elev. 750 m, decayed bark of a twig, 6 Sep. 2001, M. R., G. J. S., R. N. (PRM 900542).

Perithecia superficial, densely aggregated, subglobose to globose, papillate, 170–220 µm diam, 170–230 µm high, dark brown to nearly black, papillate, setose, ostiolate. Setae cover the perithecia and the surface of the substrate around the perithecia, dark brown, paler to subhyaline upwards, rounded at the apex, 5–9-septate, unbranched, sometimes conidiogenous, 200–287 µm tall, 4.5–5.0 µm wide near the base. – Ostiolar canal periphysate. – Perithecial wall 22.0–30.0 µm thick, carbonaceous, consisting of two regions; outer region formed of dark brown, opaque, thin-walled, polyhedral cells; inner region formed of hyaline, thinner-walled, elongated, compressed cells. – Paraphyses persistent, branching, anastomosing, hyaline, septate, 3.0–3.5 µm wide near the base, tapering to (1.5–)2.0 µm, longer than asci. – Asci unitunicate, cylindrical-clavate, (65.0–)70.0–82.0 (–87.0) ($\bar{x}$ = 74.5 ± 1) µm long, 7.0–8.0 ($\bar{x}$ = 7.5 ± 0.1) µm wide, rounded to truncate at the apex, refractive apical annulus distinct, ca. 2.0 µm diam, 1.0–1.5 µm high, 8-spored, L/W 10:1. – Ascospores ellipsoidal, straight or slightly curved, (10.0–)11.0–12.5(–13.0) ($\bar{x}$ = 11.7 ± 0.1) µm long, 3.5–4.0 ($\bar{x}$ = 3.9 ± 0.03) µm wide, 1–3-septate, slightly constricted at the median septum, formation of septa delayed, hyaline, often finely verruculose at maturity, 1–2-seriate in the ascus.

Colony on the natural substrate effuse, hairy, conidiophores macronematous, mononematous, solitary, erect, straight or slightly flexuous, cylindrical, unbranched, thick-walled, dark brown, and paler upwards, forming two layers. – Conidiophores of the lower layer 2–4-septate, pale brown, 37.0–55.0 µm tall, 3.5 µm wide near the base, tapering to 1.5–2.0 µm below the collarette, ending in a

monophialide. Conidiophores of the upper layer more robust, 5–9-septate, dark brown, often sterile with the penultimate cell paler brown to subhyaline and broadly rounded, 200–287 µm tall, 4.0–5.0 µm wide near the base, sometimes conidiogenous, then tapering to 2.0–2.5 µm below the collarette, usually with 1 or 2 percurrent proliferations. – Conidiogenous cells phialidic, 10.0–25.0 µm, 3.5–4.0 µm wide, terminal, integrated, with one apical opening. – Collarettes funnel-shaped, hyaline 3.5–4.0 µm diam, (2.5–)3.0–4.0 µm deep. – Conidia not observed on the natural substrate.

Characteristics in culture. – Conidiophores as on the natural substrate but forming only one layer, 10.0–62.0 µm tall, 3.0 µm wide near the base, tapering to 1.5–2.0 µm below the collarette. – Collarettes (3.5–)4.0 µm diam, (2.5–)3.0–4.0 µm deep. – Conidia falcate, slightly asymmetrical, slightly tapering at the apical end, bluntly pointed at the distal end with an inconspicuous basal scar, (12.0–)13.0–16.0(–19.0) ($\bar{x} = 15 \pm 0.5$) µm long, 2.0–2.5 ($\bar{x} = 2.2 \pm 0.06$) µm wide, L/W 6.8:1, 1-septate, with fine straight or slightly curved (4.0–)5.0–8.0(–9.0) µm long setula at each end, setulae persistent.

Etymology. – *Verruculosus-* (L) verruculose, for the appearance of the ornamentation of mature ascospores that were released from the asci.

Known distribution. – Thailand.

Habitat. – Saprobic on decayed wood and bark of deciduous trees.

Other material examined. – THAILAND: Nakhon Nayok Province, Khao Yai National Park NE of Bangkok, Bung Phai trail ca. 5 km NW from Khao Yai Forest Headquarters on the way to Pak Chong, N 14°28' E 101°23', elev. 750 m, decayed wood and bark of a trunk, 6 Sep. 2001, M. R., G. J. S., R. N. (M.R. 2216-01).

Chaetosphaeria verruculospora resembles *Ch. dingleyae* S. Hughes & W.B. Kendr., but differs in its shorter asci, longer and wider ascospores that can be finely verruculose at maturity and the longer setulae on the conidia of its *Dictyochaeta* anamorph. Moreover, the *Dictyochaeta* anamorph of *Ch. dingleyae* produces polyphialides, and the conidiophores may occasionally bear up to three lateral branches with a terminal collarette, or such branches may occur in a group at a geniculation (Hughes & Kendrick, 1968). The anamorph of *Ch. dingleyae* was transferred to *Dictyochaetopsis* Aramb. & Cabello (Arambarri & Cabello, 1990) because of the branching pattern of conidiophores.

Dictyochaeta septata (Hodges & B. Sutton) Whitton & al. is similar in many respects to the anamorph of *Ch. verruculospora*, but differs by its 1- or 2-septate conidia, polyphialides and the absence of sterile setae that develop into apical monophialides.

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