CZECH MYCOLOGY
Publication of the Czech Scientific Society for Mycology

Volume 50 April 1998 Number 3

A new Chaetosphaeria with a Dictyochaeta anamorph

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Réblová M. (1998): A new Chaetosphaeria with a Dictyochaeta anamorph. – Czech Mycol. 50: 151–159

Chaetosphaeria montana spec. nov. with a *Dictyochaeta* anamorph was found on rotten wood of *Fagus sylvatica* in the Czech Republic. The new species are described and illustrated. Relationships of *C. montana* with *C. pulchriseta*, *C. callimorpha* and other taxa are discussed. The diagnostic characters of *Chaetosphaeria montana*, *C. pulchriseta* and *C. callimorpha* and their anamorphs are given.

Key words: Ascomycotina, Lasiosphaeriaceae, systematics.

Réblová M. (1998): Nový druh Chaetosphaeria s anamorfou z rodu Dictyochaeta. – Czech Mycol. 50: 151–159

Z území České republiky je popsán nový druh *Chaetosphaeria montana* spec. nov. s anamorfou z rodu *Dictyochaeta*, nalezený na tlejícím dřevu *Fagus sylvatica*. Jsou diskutovány vztahy mezi nově popsaným druhem a nejblíže příbuznými druhy *Chaetosphaeria pulchriseta* a *C. callimorpha* a dalšími zástupci rodu *Chaetosphaeria*. Diagnostické znaky druhů *Chaetosphaeria montana*, *C. pulchriseta* a *C. callimorpha* jsou uvedeny v tabulkách.

INTRODUCTION

The genus *Chaetosphaeria* Tul. et C. Tul. was introduced by Tulasne and Tulasne (1863), who based its description on *Sphaeria innumera* Berk. et Broome. Booth (1957, 1958) re-established the generic concept of *Chaetosphaeria* on the basis of six British species having superficial, sessile, globose to conical, papillate ascomata seated on the surface of bark or wood or developing on a thin layer of pseudoparenchymatous hypostroma. The hamathecium consits of periphyses and persistent, apically free paraphyses, asci are cylindric to clavate, 8-spored, ascospores are two– or multi-celled, cylindrical to broadly fusoid and hyaline. Booth (1957, 1958) considered three hyphomycetous genera to be the associated anamorphs, *Chloridium* Link: Fr., *Dictyochaeta* Speg. and *Menispora* Pers.: Fr. Although Tulasne and Tulasne (1863) described setose ascomata for the type species,

Chaetosphaeria innumera (Berk. et Broome) Tul. et C. Tul., they actually observed conidiophores of a *Chloridium* anamorph. Ascomata of *Chaetosphaeria* species lack simple setae that grow out of the perithecial wall but they can be clothed with both conidiophores and setae of the anamorph when the associated anamorph possesses setae [e.g. *Catenularia cuneiformis* (Richon) Mason anamorph of *Chaetosphaeria cupulifera* (Berk. et Broome) Sacc., *Catenularia* sp. anamorph of *C. novae-zelandiae* S. Hughes et al., *Dictyochaeta* sp. anamorph of *C. callimorpha* (Mont.) Sacc. and the *Dictyochaeta* sp. anamorph of *C. pulchriseta* S. Hughes et al.]. The setae of the anamorph arise among the conidiophores and have sterile, blunt or strongly pointed apicies which may develop into a conidiogenous cell.

Presently, *Chaetosphaeria* is recognized as a member of the Lasiosphaeriaceae Nannf. (Barr 1990) and accommodates a group of species associated with twelve hyphomycetous genera that produce enteroblastic-phialidic conidia. These are *Catenularia* Grove, *Chaetopsis* Grev., *Chalara* (Corda) Rabenh. , *Chloridium* Link: Fr., *Custingophora* Stolk et al., *Dictyochaeta* Speg., *Gonytrichum* Pers.: Fr., *Kylindria* DiCosmo et al., *Menispora* Pers.: Fr., *Phialophora* Medlar, *Stachybotrys* Corda and *Zanclospora* S. Hughes et B. Kendrick. DiCosmo et al. (1983) concluded that these anamorphic genera, however different in habit, have a number of common morphological and ecological characters and that they may well be closely related.

According to the large number of anamorphic genera, *Chaetosphaeria* is considered to be a large, heterogenous taxon. Species of the genus have similar ascoma morphology and consequently can be recognized only on the basis of ascospore morphology and especially on their anamorphs. The anamorphs are of great significance in differentiating species when the teleomorphs are hardly distinguishable. Mycelia and conidiophores of the anamorphs may accompany ascomata forming dense colonies on the substrate, but more often we can find both the teleomorph and the anamorph independently of each other. The separate occurrence of both morphs makes identification more difficult, therefore, culture studies are essential. For instance, among the species possessing two-celled ascospores there are some, e.g. *Chaetosphaeria aspergilloides* M.E. Barr et Crane, *C. aterrima* (Fuckel) Réblová , *C. bramleyi* C. Booth , *C. brevispora* Shoemaker, *C. dingleyae* S. Hughes et al., *C. lentomita* W. Gams et Hol.-Jech., *C. chloroconia* W. Gams et Hol.-Jech., ascomata, asci and ascospores of which are similar in size. Without knowledge of the anamorphs their identification is virtually impossible. On the other hand, anamorphs connected to the *Chaetosphaeria* species mentioned above (*Chloridium*, *Custingophora, Dictyochaeta, Gonytrichum* and *Zanclospora*) are found to be regularly associated with the ascomata. The opposite case is found among the *Menispora* species, which seldom accompany ascomata of their teleomorphs *Chaetosphaeria ovoidea* (Fr.) Constant. et al. and *C. pulviscula* (Currey) C. Booth.

Species of *Chaetosphaeria* and their anamorphs are lignicolous saprobes; although the genus is cosmopolitan in distribution, the majority of species is known to occur in the temperate zones of both hemispheres. They occur mostly on strongly decayed wood but also on bark, inner surface of the bark and wood in different stages of decay. Two species are known from aquatic habitats on submerged wood (Kohlmeyer 1963; Fisher and Petrini 1983).

MATERIAL AND METHODS

Dry herbarium specimens were briefly rehydrated in 3 % KOH and subsequently studied in 100 % lactic acid, cotton blue in lactic acid, Congo Red or Melzer's reagent. Two types of microscopy were used in this study. These are indicated in the legends to the illustrations as bright field (BF) and phase contrast (PC). Photographs were taken in Congo Red or in Melzer's reagent. Abbreviations of the herbaria and institutes which kindly lent material are cited in accordance with Index Herbariorum (Holmgren et al. 1990).

DESCRIPTIONS AND DISCUSSION

Four species of *Chaetosphaeria* with *Dictyochaeta* anamorphs have been described, namely *C. dingleyae* S. Hughes et al. and *C. pulchriseta* S. Hughes et al., both from New Zealand, *C. talbotii* S. Hughes et al. from Australia and *C. callimorpha* (Mont.) Sacc. which is cosmopolitan (Booth 1957; Hughes and Kendrick 1968). A new *Chaetosphaeria* and its *Dictyochaeta* anamorph was collected on rotten wood of *Fagus sylvatica* in the Czech Republic. Among these taxa the new species is most closely related to *Chaetosphaeria pulchriseta* and *C. callimorpha*. Nevertheless, it could not be identified with those species, nor with any of the hitherto described species of *Chaetosphaeria*.

Chaetosphaeria montana Réblová, spec. nov. Figs 1-5., 13 a,b,e.

Ascomatibus nigris, laevibus, 200-250 μm altis et 170-240 μm latis, ascis 100-130 × 10.5-12.5 μm, paraphysibus apice liberis, interdum anastomosantibus, septatis, strangulatis, 4-6.5(-7) μm crassis, ascosporis ellipsoideis usque fusoideis (18.5)19-25 × 5.5-7 μm, hyalinis, laevibus sed postea subtiliter verrucosis, 2-(4)-cellularibus, a *Chaetosphaeria pulchriseta* discrepat.

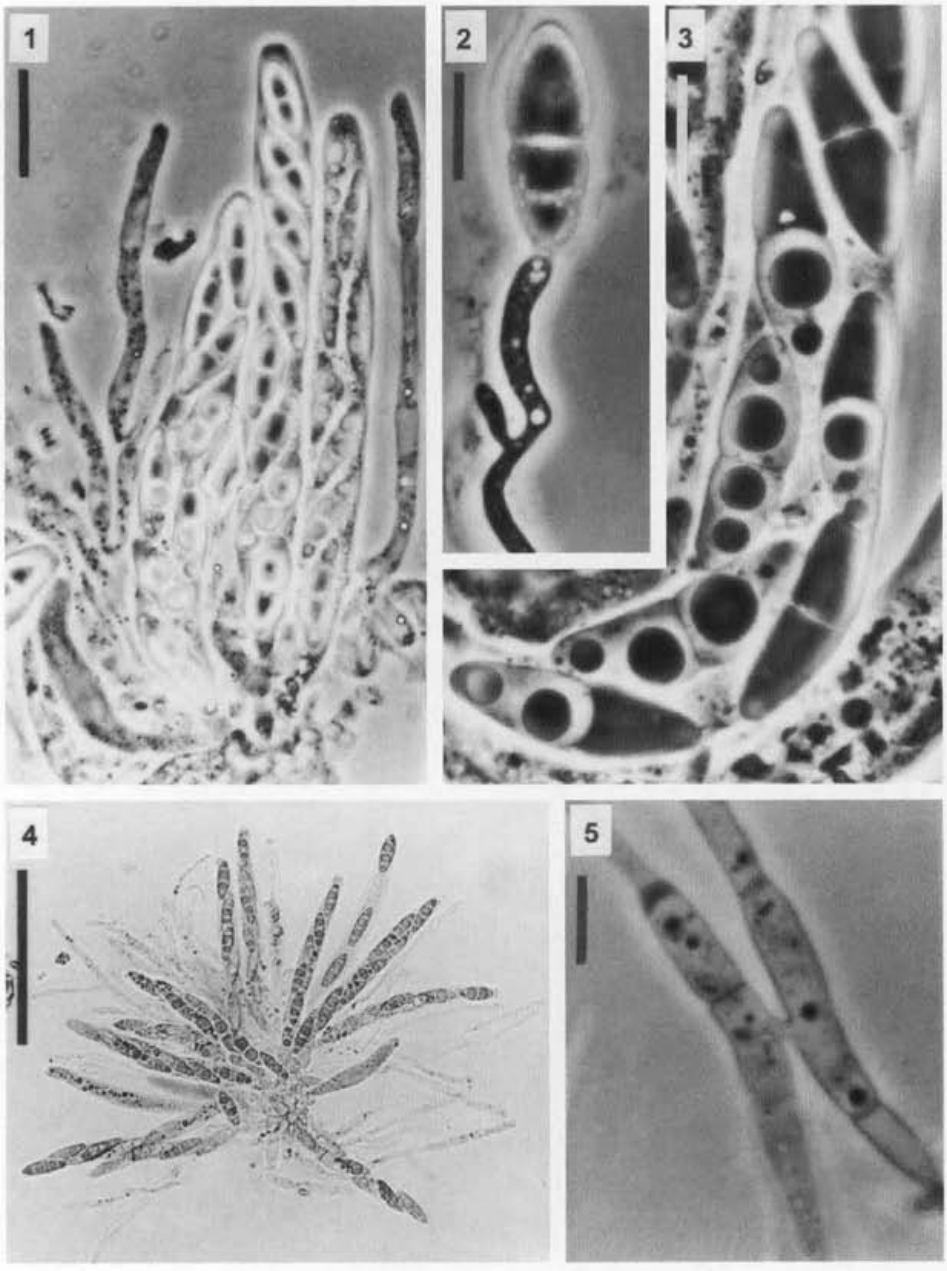
Ascomata in societate hyphomycetis generis *Dictyochaeta*, quid conidiophoris 30-52 μm longis, 5-6 μm medio crassis, pallide brunneis, setis 7-10 septatis, obscure brunneis, apicem versus pallidioribus, cellula apicali obtusa vel clavato-dilatata (3.5-4 μm) nonnumquam phialide terminatis, phialosporis 22-26(-29) × 3-4 μm magnis, a *Dictyochaeta* anamorpha *Chaetosphaeriae pulchrisetae* diversa est.

Holotypus: Bohemia meridionalis, montes Novohradské hory, silva virginea Žofínský prales apud Pivonice; ad lignum putridum *Fagi sylvaticae*, 20.V.1997, leg. M. Réblová (PRM 842969).

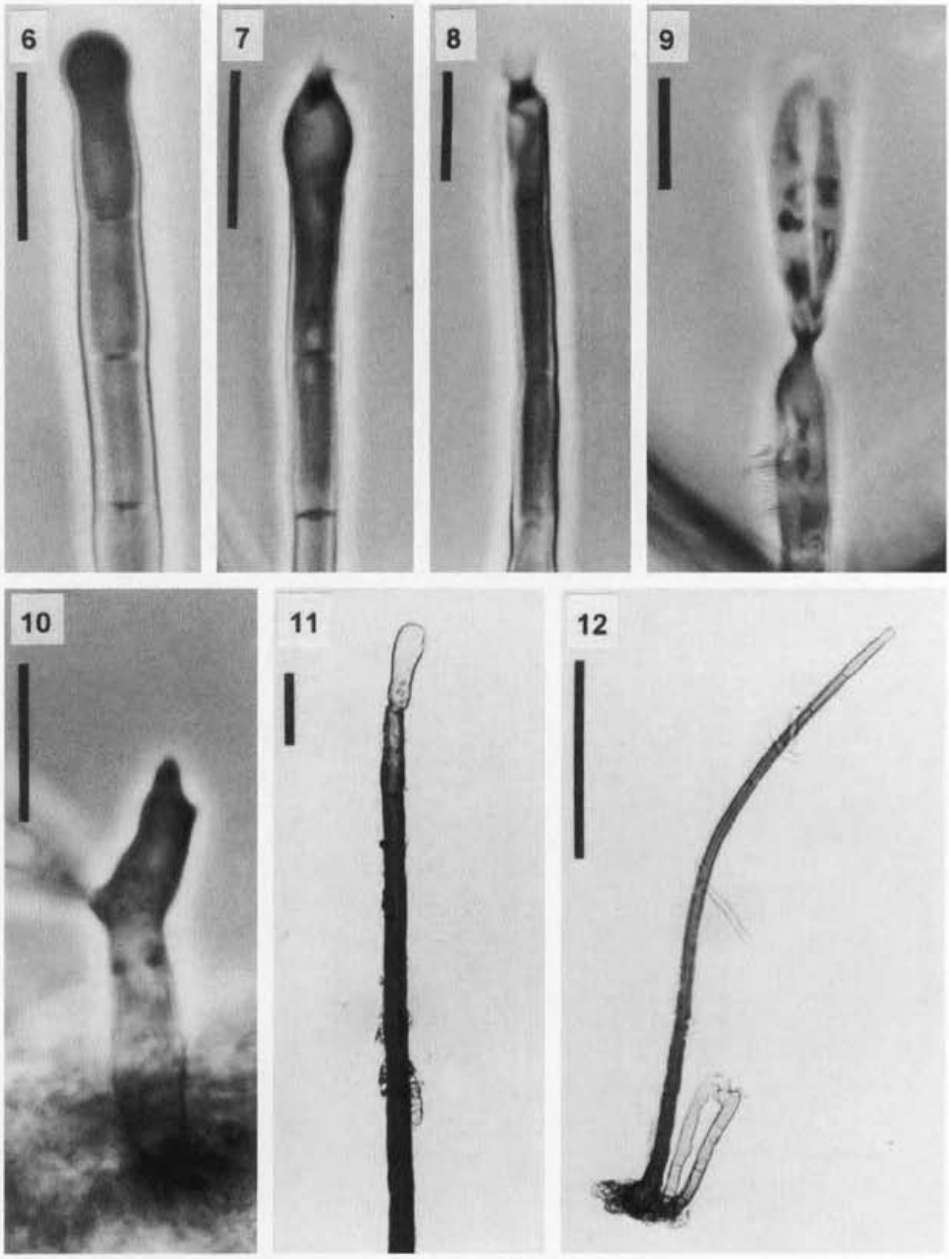
Ascomata superficial, scattered in small groups or densely crowded and forming a dark crust, base slightly immersed, globose, 200-250 μm high and 170-240 μm wide, papillate, black, glistening, smooth, covered by sterile anamorph setae and conidiophores. Ascomatal wall fragile, carbonaceous, in surface view a *textura epidermoidea*, the lateral wall 35-45 μm thick, *textura prismatica*, consisting of two layers. The outer layer of thick-walled, dark brown pseudoparenchymatous cells; the inner layer of thin-walled, subhyaline, compressed cells. Asci unitunicate, 8-spored, numerous in a broad hymenium arising from repeating croziers, 100-130 × 10.5-12.5 μm, cylindrical, shortly stipitate, truncate at the apex, ascal apex non-amyloid with a delicate, refractive apical annulus. Paraphyses numerous among the asci and exceeding them, simple, persistent, filiform, sometimes anastomosing, thin-walled, 4-6.5(-7) μm wide, septate, constricted at the septa, cells conspicuously inflated. Ascospores ellipsoid to fusiform, (18.5-)19-25 × 5.5-7 μm, hyaline, when young smooth-walled and filled with four prominent oil drops, at maturity with a median transverse septum, slightly constricted, the wall smooth or slightly verrucose, rarely two additional septa may develop, obliquely monostichous to distichous in the ascus.

Dictyochaeta anamorph of **Chaetosphaeria montana** Réblová Figs 6-12., 13c-d.

Colonies effuse, black, whitish-grey when sporulating, composed of conidiophores, sterile setae and ascomata. Sterile setae arising from partly immersed mycelia or from peridia of ascomata, straight, septate with 7-10 septa, dark brown, paler towards the apex, thick-walled, to 320 μm long, 4-5 μm wide in the middle, 9-10 μm wide at base, 3.5-4 μm wide at the apex; apical cell rounded and sometimes somewhat inflated, subhyaline and often ending with a phialide or polyphialide. Conidiophores mononematous, macronematous, erect, straight or slightly flexuous, unbranched, arising singly or in small groups, often scattered among the sterile setae and sometimes growing out of peridia of the ascomata, cylindric, 1-4-septate, pale brown, darker at the basal part and paler towards the apex, 30-52 μm long and 5-6 μm wide in the middle part, the terminal of each conidiophore comprising a single phialide; phialides mono– or polyphialide, with a terminal narrow neck and collarette, after successive sympodial proliferation with up to 3 collarettes in the upper part. Collarette funnel-shaped, hyaline, 1.5-3 μm wide and 2 mm deep, inconspicuous, quickly disappearing. Phialoconidia hyaline, one-celled, fusiform, falcate with pointed ends, 22-26(-29) × 3-4 μm, short subulate setula at each end, 1.5-2 μm long, multiguttulate, accumulating in slimy fascicles on the phialides.



Figs 1-5. *Chaetosphaeria montana* Réblová (PRM 842969 – holotype).
1. Asci with ascospores and paraphyses; 2. Germinating ascospore; 3. Ascospores; 4. Asci with ascospores and paraphyses; 5. Paraphyses. Figs 1-5: PC. Scale bars: 1-3. 5 = 10 μm; 4 = 100 μm.



Figs 6-12. *Dictyochaeta* anamorph of *Chaetosphaeria montana* Réblová (PRM 842969 – holotype).
6. Anamorphic seta with inflated apex; 7,8. Anamorphic seta with the apex developed into a phialide; 9. Conidiophore with phialoconidia; 10. Conidiophore apex with sympodial proliferation; 11. Anamorphic seta with inflated apex; 12. Anamorphic seta with inflated apex and conidiophores. Figs 6-10: PC; 11, 12: BF. Scale bars: 6-11 = 10 μm; 12 = 100 μm.

Material examined. 1) Type material. Czech Republic: Southern Bohemia, Novohradské hory Mts., virgin forest Žofínský prales near Pivonice; on rotten wood of *Fagus sylvatica*, 20.V.1997, leg. M. Réblová (holotype – PRM 842969).

2) Additional material. Czech Republic: Southern Bohemia, Šumava Mts., the gl acial cirque of the lake Čertovo jezero near Železná Ruda; on rotten wood of a trunk of *Fagus sylvatica*, 25.V.1996, leg. M. Réblová (Herb. M. Réblová 768/96); ibid., Šumava Mts., virgin forest Boubínský prales near Zátoň; on rotten wood of a trunk of *Fagus sylvatica*, 16.IX.1982, leg. V. Holubová-Jechová (*Dictyochaeta* anamorph, PRM 828868); ibid., Novohradské hory Mts., virgin forest Žofínský prales near Pivonice; on rotten wood of a branch of *Fagus sylvatica*, 29.VI.1971, leg. V. Holubová-Jechová (*Dictyochaeta* anamorph, PRM 826870).

Notes on the anamorph. Holubová-Jechová (1984: 432, Fig. 10: 3a-c).
Habitat. On rotten wood of a deciduous tree (*Fagus sylvatica*).
Distribution. Europe, Czech Republic.

Within *Chaetosphaeria, C. montana, C. callimorpha* and *C. pulchriseta* are superficially similar but differ in many ways (Tables 1., 2.). The collections of *C. pulchriseta* with the associated *Dictyochaeta* anamorph preserved in the PDD, DAOM and BPI herbaria and those of *C. callimorpha* in the K herbarium were examined and compared with the recent finds of *C. montana* described above.

Material examined of *Chaetosphaeria pulchriseta*.
New Zealand: Auckland Prov., Cornwallis; on *Leptospermum scoparium*, 3.I.1963, leg. S. Hughes (holotype – PDD 26228; isotype – DAOM 93528b). – French Guiana: Saint Laurent, Piste Balate, 12 km from Saint Laurent; on dead branch, 19.XI.1986, leg. A. Rossman, C. Feuillet and L. Skog (BPI 622098).

Material examined of *Chaetosphaeria callimorpha*.
France: Meudon; on *Rubus* sp., leg. Montagne (holotype of *Sphaeria callimorpha* Mont. – K 49557). – Great Britain: Esher, West End Common; on dead stem of *Rubus fruticosus* in litter, 22.XI.1996, leg. B.M. Spooner (K 44768); Great Britain: Ossetts Hole; on dead stem of *Rubus fruticosus*, 8.VIII.1970, leg. M.C. Clark (K 46879).

C. pulchriseta can be distinguished from *C. montana* by its dark brown ascomata clothed with sterile anamorphic setae that have strongly pointed apices, the smaller size of its asci and ascospores, and ascospores that are smooth-walled and that have three septa. The *Dictyochaeta* anamorph of *C. pulchriseta* was defined as possessing straight, sterile, up to 13-septate anamorphic setae that have pointed apices and the penultimate cell 36-81 μm long and usually a dark, almost

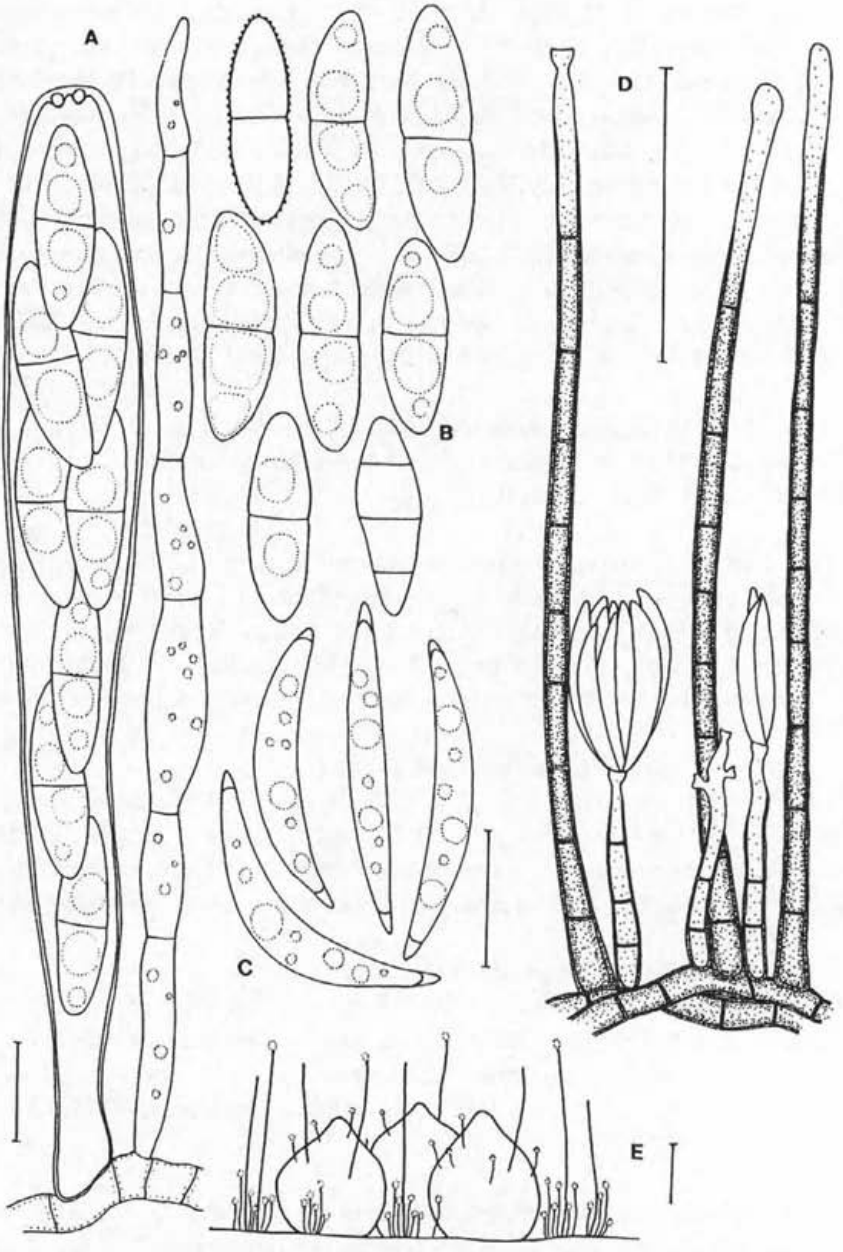


Fig. 13A-E. *Chaetosphaeria montana* Réblová and the *Dictyochaeta* sp. anamorph (PRM 842969 – holotype).
A. Ascus with ascospores and paraphyses; B. Ascospores; C. Phialoconidia; D. anamorphic setae, sterile or ending in a phialide, and conidiophores; E. Habit sketch of ascomata. Scale bars: a-c = 10 μm; d-e = 100 μm.

Table 1. Morphological characters of *Chaetosphaeria pulchriseta, C. callimorpha* and *C. montana*.

Species	Ascoma	Ascus	Ascospores
C. pulchriseta (PDD 26228)	250-300 μm high 220-300 μm wide	65-80 × 7-12 μm (stalk 10-15 × 3-4 μm)	12-18 × 4-6 μm ellipsoidal to fusiform, 4-celled
C. callimorpha (K 44768)	150-200 μm high 150-190 μm wide	60-80 × 6-8 μm (stalk 10-20 × 3-4 μm)	11-16 × 3-4 μm ellipsoid, 2-celled, rarely 4-celled
C. montana (PRM 842969)	200-250 μm high 170-240 μm wide	100-130 × (9.5-) 10.5-12.5 μm	(18.5-)19-25 × 5.5– 7 μm ellipsoid to fusiform, 2-celled, rarely 4-celled

Table 2. Morphological characters of the *Dictyochaeta* anamorphs of *Chaetosphaeria pulchriseta, C. callimorpha* and *C. montana*.

Species	Sterile setae	Conidiophores	Phialospores
Dictyochaeta of *C. pulchriseta* (PDD 26228)	to 360 μm long to 13-septate pointed at the apex never ending in a phialide	26-38 μm long 4-4.4 μm wide above the base	23-29 × 2.4-3 μm
Dictyochaeta of *C. callimorpha* (K 44768)	to 270 μm long rounded at the apex sometimes ending in a polyphialide	80-90 μm long 4.5-5 μm wide above the base	10-15.5 × 2-3 μm
Dictyochaeta of *C. montana* (PRM 842969)	to 320 μm long with 7-10 septa rounded or somewhat inflated at the apex, sometimes ending in a phialide or polyphialide	30-52 μm long 5-6 μmm wide above the base	22-26(-29) × 3-4 μm

opaque contents (Hughes and Kendrick 1968). The anamorphic setae in the Czech collections of *C. montana* are rounded or somewhat inflated at the apical end and can often develop into a phialide. In the Czech material, the darker contents have never been observed in apical cells of the anamorphic setae. On the contrary, the setae were found to be paler towards the apex, and the conidiophores were observed to be longer and broader.

The differences in anamorph morphology between the New Zealand and Czech collections were also cited by Holubová-Jechová (1984), who based her observations on two finds on rotten wood of *Fagus sylvatica*; in neither case the teleomorph was present. Despite these differences Holubová-Jechová identified the Czech finds as the anamorph of *Chaetosphaeria pulchriseta* and added that the dark, anamorphic setae with pointed apices are probably connected to the teleomorph. This assumption could not be confirmed, for in our material, coming also from the Czech Republic and containing both the anamorph and the teleomorph, the apical ends of the anamorphic setae were rounded or somewhat inflated. In addition, their sizes and those of the conidiophores were similar to those found in two former collections (Holubová-Jechová 1984). The *Dictyochaeta* anamorph of *C. pulchriseta* and the *Dictyochaeta* anamorph of *C. montana* have morphologically almost indistinguishable phialoconidia, but they are easily recognizable by the sterile anamorphic setae and the conidiophores.

The closely allied *C. callimorpha* resembles the new *Chaetosphaeria* in having similar ellipsoid, two-celled ascospores which rarely develop two additional septa, but it differs in the smaller size of asci and ascospores and in the associated *Dictyochaeta* anamorph. Phialoconidia of *C. callimorpha* are one-celled, curved, asymmetrical, bluntly rounded at the distal end and proximally tapered with an inconspicuous basal scar. Also the conidiogenous cells are entirely different.

Although *Chaetosphaeria montana* has not apparently been grown in culture, and my attempts to cultivate the species have been unsuccessful, the regular association of the teleomorph and the anamorph makes the connection highly probable.

ACKNOWLEDGEMENTS

I acknowledge with thanks the Directors and Curators of the BPI, DAOM, K and PDD herbaria for loaning material. I am indebted to Dr. Mirko Svrček for providing the Latin diagnoses. I wish to thank Dr. M.E. Barr Bigelow, Dr. Zdeněk Pouzar and Dr. Gary J. Samuels for reviewing the manuscript, discussing and their valuable comments. This project was partly supported by the Grant Agency of Charles University in Prague (26266/96) and by the Grant "Centres of Biological Diversity in the Šumava Biosphere Reserve" from the World Bank supported by GEF (Global Environment Facility).

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