CZECH MYCOLOGY

VOLUME 51
JANUARY 1999

1

CZECH SCIENTIFIC SOCIETY FOR MYCOLOGY PRAHA

ISSN 0009-0476

Vol. 51, No. 1, January 1999

CZECH MYCOLOGY
formerly Česká mykologie
published quarterly by the Czech Scientific Society for Mycology

Czech Mycology is an international scientific journal publishing papers in all aspects of mycology. Publication in the journal is open to members of the Czech Scientific Society for Mycology and non-members.

Contributions to: Czech Mycology, National Museum, Department of Mycology, Václavské nám. 68, 115 79 Praha 1, Czech Republic. Phone: 02/24497259

SUBSCRIPTION. Annual subscription is Kč 350,– (including postage). The annual subscription for abroad is US $ 86,– or DM 136,– (including postage). The annual membership fee of the Czech Scientific Society for Mycology (Kč 270,– or US $ 60,– for foreigners) includes the journal without any other additional payment. For subscriptions, address changes, payment and further information please contact **The Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, Czech Republic.**

This journal is indexed or abstracted in:
Biological Abstracts, Abstracts of Mycology, Chemical Abstracts, Excerpta Medica, Bibliography of Systematic Mycology, Index of Fungi, Review of Plant Pathology, Veterinary Bulletin, CAB Abstracts, Rewiew of Medical and Veterinary mycology.

No. 4 of the vol. 50 of Czech Mycology appeared in July 12, 1998

CZECH MYCOLOGY
Publication of the Czech Scientific Society for Mycology

Volume 51 January 1999 Number 1

Teleomorph-anamorph connections in Ascomycetes. 1. Cylindrotrichum and Cacumisporium anamorphs of Chaetosphaeria

Martina Réblová[1] and Walter Gams[2]

[1]Institute of Botany, Academy of Sciences, 252 43 Průhonice, Czech Republic
[2]Centraalbureau voor Schimmelcultures, P. O. Box 273, 3740 AG Baarn, The Netherlands

Réblová M. and Gams W. (1999): Teleomorph-anamorph connections in Ascomycetes 1. Cylindrotrichum and Cacumisporium anamorphs of Chaetosphaeria. – Czech Mycol. 51: 1–40

The teleomorph-anamorph connections of *Chaetosphaeria* are discussed. On the basis of the revision of the type and other herbarium material, *Zignoëlla crustacea, Lasiosphaeria britzelmayri* subsp. *fennica*, *Sphaeria decastyla* and *Melanomma macrosporum* proved to be members of *Chaetosphaeria*. The new combinations *Chaetosphaeria crustacea, Chaet. fennica* and *Chaet. decastyla*, are proposed, *Melanomma macrosporum* is included in the synonymy of the latter. *Chaetosphaeria crustacea* has an anamorph intermediate between *Chloridium* and *Cylindrotrichum, Chaetosphaeria fennica* has a *Chloridium*-like anamorph, and *Chaetosphaeria decastyla* has *Cacumisporium capitulatum* as its anamorph. Two new species, *Chaetosphaeria tulasneorum* associated with the anamorph *Cylindrotrichum oligospermum* and *Chaetosphaeria acutata* associated with a *Cylindrotrichum* anamorph, are described. The teleomorph-anamorph connections of all accepted *Chaetosphaeria* species, except for *Chaet. fennica*, were confirmed by culture studies. *Chaetosphaeria abietis* and *Chaet. fusiformis* are also considered, and the connection with the *Chloridium cylindrosporum* anamorph of the latter is confirmed by culture studies for the first time. The genus *Cylindrotrichum* and its relationship to *Chloridium* and other related genera is discussed. A key to the species of *Chaetosphaeria* with *Cylindrotrichum* and *Cacumisporium* anamorphs is provided.

Key words: Ascomycetes, *Chaetosphaeria*, culture studies, wood-inhabiting fungi, systematics.

Réblová M. and Gams W. (1999): Vztahy teleomorfa-anamorfa u askomycetů 1. Cylindrotrichum a Cacumisporium, anamorfní rody rodu Chaetosphaeria. – Czech Mycol. 51: 1–40

Jsou diskutovány teleomorfní-anamorfní vztahy rodu *Chaetosphaeria*. Na základě revize typového a dalšího herbářového materiálu jsou druhy *Zignoëlla crustacea, Lasiosphaeria britzelmayri* subsp. *fennica, Sphaeria decastyla* a *Melanomma macrosporum* umístěny do rodu *Chaetosphaeria*. Jsou navrženy tři nové kombinace, a to *Chaetosphaeria crustacea, Chaet. fennica* a *Chaet. decastyla*. *Melanomma macrosporum* je zařazena do synonymiky druhu *Chaet. decastyla*. Rodové zařazení anamorfy druhů *Chaetosphaeria crustacea* a *Chaet. fennica* je na pomezí rodů *Cylindrotrichum* a *Chloridium*. Anamorfou *Chaetosphaeria decastyla* je *Cacumisporium capitulatum*. Jsou popsány dva nové druhy, *Chaetosphaeria tulasneorum* s anamorfou

Cylindrotrichum oligospermum a *Chaetosphaeria acutata* s anamorfou *Cylindrotrichum* sp. Teleomorfní-anamorfní vztahy všech výše uvedených druhů rodu *Chaetosphaeria* byly ověřeny kultivačními studiemi. Jsou zahrnuty také druhy *Chaetosphaeria abietis* a *Chaet. fusiformis*. Spojení *Chaet. fusiformis* s anamorfou *Chloridium cylindrosporum* je poprvé potvrzeno kultivačními studiemi. Jsou diskutovány vztahy rodu *Cylindrotrichum* s rodem *Chloridium* a dalšími příbuznými rody. Je vytvořen klíč pro určování druhů *Chaetosphaeria* s anamorfami *Cylindrotrichum* a *Cacumisporium*.

INTRODUCTION

The genus *Chaetosphaeria* Tul. et C. Tul. (Tulasne and Tulasne 1863) accommodates lignicolous, saprobic fungi with superficial, dark, glabrous or sometimes setose, non-collapsing perithecia, the perithecial wall is brittle, consisting of thin-walled, opaque, brick-like cells or cells that form a network (*textura epidermoidea*); paraphyses and periphyses are persistent, asci have a distinct non-amyloid, refractive apical annulus and ascospores are transversely 1- to multi-septate, non-fragmenting and hyaline. Associated anamorphs have pigmented conidiophores and phialidic conidiogenesis, and are classified in several genera of hyphomycetes.

Among the synonyms of *Chaetosphaeria, Zignoëlla* Sacc. was characterized by hyaline, phragmosporous ascospores (Saccardo 1878), a criterion not recognized here as having generic relevance. *Zignoëlla* is a broadly conceived genus (Saccardo 1878, 1883) whose lectotype species, *Zignoëlla pulviscula* (Currey) Sacc., was selected only by Clements and Shear (1931) and was recombined by Booth (1957) in *Chaetosphaeria*.

Barr (1990) and Eriksson and Hawksworth (1993) placed *Chaetosphaeria* in the broadly perceived Lasiosphaeriaceae Nannf. Recently, *Chaetosphaeria* and six other related genera, viz. *Ascocodinaea* Samuels et al., *Melanochaeta* E. Müll. et al., *Melanopsammella* Höhnel, *Porosphaerella* E. Müll. et Samuels, *Porosphaerellopsis* Samuels et E. Müll., and *Striatosphaeria* Samuels et E. Müll., were transferred to a new family, the Chaetosphaeriaceae Réblová et al., in the order Sordariales Chadef. ex D. Hawksw. et O. E. Erikss. (Réblová et al. 1999). The Chaetosphaeriaceae are separated from the more narrowly delimited Lasiosphaeriaceae Nannf. and its core genera, viz. *Lasiosphaeria* Ces. et De Not., *Bombardia* (Fr.) P. Karst., *Eosphaeria* Höhnel, *Cercophora* Fuckel, and *Apiosordaria* Arx et W. Gams, on the basis of characters of perithecium, perithecial wall, asci and ascospores. Réblová et al. (1999) recognized twenty-two species of *Chaetosphaeria* with associated dematiaceous hyphomycetous anamorphs in nine genera, viz. *Catenularia* Grove, *Cylindrotrichum* Bonord., *Chalara* (Corda) Rabenh., *Chloridium* Link: Fr., *Custingophora* Stolk et al., *Dictyochaeta* Speg., *Menispora* Pers.: Fr., *Phialophora* Medlar, and *Zanclospora* S. Hughes et B. Kendrick (Saccardo 1883; Booth 1957, 1958; Müller and von

Arx 1962; Hughes and Kendrick 1968; Gams and Holubová-Jechová 1976; Barr and Crane 1979; Holubová-Jechová 1973, 1982, 1984; Barr 1993; Constantinescu et al. 1995; Réblová 1998 a, b).

The genus *Cylindrotrichum* was discussed by a number of authors (e.g. Hughes 1951; Gams and Holubová-Jechová 1976; Morgan-Jones 1977, 1980; Kendrick 1980; DiCosmo et al. 1983; Cabello and Arambarri 1988; Holubová-Jechová 1990), but no clear and final generic concept is available. The genus comprises species with erect, unbranched conidiophores, terminal conidiogenous cells with multiple or single conidiogenous loci produced by sympodial or percurrent proliferation and hyaline, cylindrical to long ellipsoidal, 1–3-septate conidia. DiCosmo et al. (1983) placed species of the genus *Cylindrotrichum* into two new genera, *Kylindria* DiCosmo et al. and *Xenokylindria* DiCosmo et al., and transferred one species formerly placed in *Cylindrotrichum* to *Uncigera* Sacc., two to *Dictyochaeta* Speg. and five to *Chaetopsis* Greville emend. DiCosmo et al., including the type species, *Cylindrotrichum oligospermum* (Corda) Bonord. These authors emphasized especially the shape of the conidia and the conidiogenous cells, the distinction between mono– and polyphialides being a main differentiating character. They preferred to distinguish several closely related anamorph genera of *Chaetosphaeria*, such as *Chaetopsis*, *Dictyochaeta*, *Kylindria* and *Xenokylindria*, based on details of conidiogenesis, though they share a number of morphological, developmental and ecological characteristics (DiCosmo et al. 1983).

Cabello and Arambarri (1988) considered the concept proposed by DiCosmo et al. (1983) incorrect. They redefined the generic concept of *Cylindrotrichum* and accepted eleven species. The genera *Kylindria* and *Xenokylindria* were reduced to synonyms of *Cylindrotrichum*. According to Cabello and Arambarri (1988), *Cylindrotrichum* accommodates species formerly placed in three closely related genera, viz. *Kylindria, Xenokylindria* and *Chaetopsis*, that are associated with one teleomorph genus, *Chaetosphaeria*. Although they did not consider teleomorph-anamorph connections of any of the species accepted in *Cylindrotrichum*, their generic concept of *Cylindrotrichum* justifies the close relationship of the *Chaetosphaeria* anamorphs better than the system proposed by DiCosmo et al. (1983).

In the present paper we describe five species of *Chaetosphaeria*, four of them having *Cylindrotrichum* anamorphs and one a *Cacumisporium* Preuss anamorph. Three species were previously known as *Zignoëlla crustacea* Sacc. (Saccardo 1883), *Lasiosphaeria britzelmayri* Sacc. subsp. *fennica* P. Karst. (Karsten 1887) and *Sphaeria decastyla* Cooke (Cooke 1878) [= *Melanomma macrosporum* Sacc. (Saccardo 1875)]. The respective type specimens were examined. On the basis of perithecial anatomy, ascal, ascospore and hamathecium anatomy, and conidiogenesis of the anamorphs, these three species belong to *Chaetosphaeria*. They are recombined as *Chaetosphaeria crustacea, Chaet. fennica* and *Chaet. decastyla*. *Melanomma macrosporum* is included in the synonymy of the latter. These species,

except for *Chaet. fennica*, were recollected on strongly decayed wood of coniferous and deciduous trees in Europe (France, Czech Republic, Ukraine). They are redescribed and illustrated along with notes on previous descriptions and illustrations. The anamorph of *Chaet. crustacea* belongs to *Cylindrotrichum*, though it shows great similarity with *Chloridium*. The anamorph of *Chaet. fennica* is *Chloridium*-like. The anamorph of *Chaet. decastyla* is *Cacumisporium capitulatum* (Corda) S. Hughes. On the basis of conidiogenesis and the structure and function of the phialides, *Cac. capitulatum* may also be included in *Cylindrotrichum*, but we refrain at the moment from making this combination before the anamorph-generic delimitations are further analysed. With the exception of *Chaet. fennica*, conidiophores of all these species were observed on a natural substratum and in living cultures.

Several collections of another fungus associated with a *Cylindrotrichum* anamorph were made on decayed wood of deciduous trees in the Czech Republic, France and Ukraine. It has fusiform, hyaline, at maturity 3-septate ascospores, persistent paraphyses and periphyses, unitunicate asci, black glabrous perithecia with a fragile wall and a dematiaceous hyphomycete anamorph with phialidic conidiogenesis. The anamorph was also obtained in culture. This fungus belongs to *Chaetosphaeria* and is described here as *Chaet. acutata*.

A single collection of the fifth species was made on a dead branch of *Sambucus nigra* in the Czech Republic. The anamorph that was obtained in culture represents *Cylindrotrichum oligospermum* (Corda) Bonord., the type of the generic name *Cylindrotrichum*. On the basis of the black, glabrous perithecia with brittle wall, persistent paraphyses and periphyses, ascospores that are hyaline, 1–3-septate and fusiform, and the anamorph, this recent collection represents an undescribed species of *Chaetosphaeria*, which is described here as *Chaet. tulasneorum*.

Chaetosphaeria abietis (Höhnel) W. Gams et Holubová-Jechová and *Chaetosphaeria fusiformis* W. Gams et Holubová-Jechová (Gams and Holubová-Jechová 1976, 1981) are discussed. A key to the species of *Chaetosphaeria* with *Cylindrotrichum* and *Cacumisporium* anamorphs is provided.

MATERIAL AND METHODS

Dry herbarium specimens were rehydrated in 3% (aq.) KOH and subsequently studied in water, Congo Red (aq.) and Melzer's reagent. The abbreviations of herbaria and institutes that kindly lent the material are cited in accordance with the Index Herbariorum (Holmgren et al. 1990).

In the lists of material examined M. R. is the abbreviation for M. Réblová.

Single ascospores of *Chaetosphaeria crustacea, Chaet. acutata, Chaet. fusiformis, Chaet. decastyla* and *Chaet. tulasneorum* were isolated with the aid of a single-spore isolator on cornmeal agar (CMA, Difco). Colonies were grown

on CMA, malt extract agar (MEA), oatmeal agar (OA) and potato-carrot agar (PCA), colony characters were taken from PCA cultures grown for 10 days at 25 °C in darkness and 10 days at 25 °C in cool white fluorescent light. The cultures are maintained in the Institute of Botany, Academy of Sciences at Průhonice and the Centraalbureau voor Schimmelcultures (CBS) at Baarn, the Netherlands.

TAXONOMIC PART

Key to the species of *Chaetosphaeria* with *Cylindrotrichum* and *Cacumisporium* anamorphs

1. Occurring on decayed wood and bark of angiosperms 2
1. Occurring on decayed wood and bark of gymnosperms 5
   2. Ascospores at maturity 3–5-septate, long cylindrical to fusiform; anamorph *Cacumisporium capitulatum* ..... 6. *Chaetosphaeria decastyla*
   2. Ascospores at maturity 3-septate 3
3. Ascospores short fusiform, not exceeding 21 µm; anamorph *Cylindrotrichum oligospermum* ..... 7. *Chaetosphaeria tulasneorum*
3. Ascospores elongate-fusiform, longer than 30 µm 4
   4. Ascospores (34.5–)36.5–42(–43) × (3.5–)4(–4.5) µm, immediately after the middle septum tapering very strongly towards the ends; anamorph *Chloridium*-like; conidia mid-brown, 1-celled ..... 4. *Chaetosphaeria fennica*
   4. Ascospores (28–)30.5–38(–44) × 3–4(–5) µm, slightly tapering towards the ends; anamorph *Cylindrotrichum* sp.; conidia hyaline, 2-celled ..... 2. *Chaetosphaeria acutata*
5. Ascospores cylindrical-fusiform, 3–5-septate, perithecia setose; anamorph *Cylindrotrichum-Chloridium*-like ..... 3. *Chaetosphaeria crustacea*
5. Ascospores cylindrical-fusiform, at maturity 3-septate, perithecia glabrous ... 6
   6. Ascospores asymmetric, tapering towards one end and rounded at the other end; anamorph *Chloridium cylindrosporum* ... 5. *Chaetosphaeria fusiformis*
   6. Ascospores symmetric with rounded ends; anamorph *Cylindrotrichum zignoëllae* ..... 1. *Chaetosphaeria abietis*

1. **Chaetosphaeria abietis** (Höhnel) W. Gams et Hol.-Jech., Stud. Mycol. 13: 53, 1976. Fig. 1a-f.

   ≡ *Zignoëlla abietis* Höhnel, in Rehm, Ann. Mycol. 5: 469, 1907; more elaborated in Höhnel, Sitzungsber. K. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1, 118: 332, 1909.

Anamorph. **Cylindrotrichum zignoëllae** (Höhnel) W. Gams et Hol.-Jech., Stud. Mycol. 13: 53, 1976.

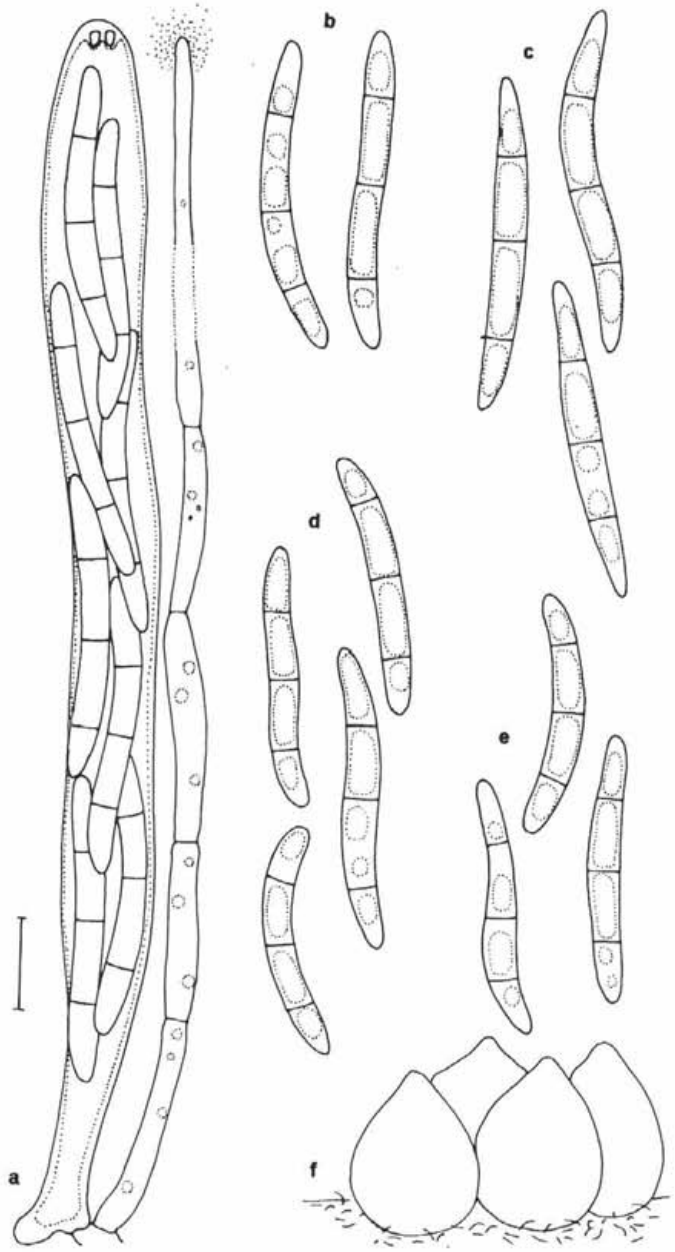

Fig. 1a–f. *Chaetosphaeria abietis.* – a. Ascus with ascospores and a paraphysis. – b–e. Ascospores. – f. Habit sketch of a group of perithecia. – a, b, f from Herb. M. R. 1058/97; c from Herb. M. R. 957/97; d from Herb. M. R. 969/97; e from the type K 49555. – Scale bar: a-e = 10 μm.

≡ *Acrotheca zignoëllae* Höhnel, Sitzungsber. K. Akad. Wiss. Wien, Math.-naturw. Abt. 1, Kl. 118: 332, 1909.

≡ *Kylindria zignoëllae* (Höhnel) DiCosmo et al., Mycologia 75: 971, 1983.

= *Cylindrotrichum oblongisporum* G. Morgan-Jones, Mycotaxon 5: 487, 1977.

Material examined. 1) Type material. Rehm Ascom. exsicc. No. 1740 (AUSTRIA. Dürrwien, Wiener Wald, on inner side of decayed bark, F. von Höhnel, July 1907, K 49555 – lectotype of *Zignoëlla abietis*).

2) Additional material. Czech Republic. Southern Bohemia, Šumava Mts., glacial cirque of the lake Čertovo jezero near Železná Ruda, on inner surface of bark of *Abies alba*, 28 Aug. 1997, M. R. (Herb. M. R. 1027/97); ibid., glacial cirque of the lake Černé jezero near Železná Ruda, on bark of *Abies alba*, 27 Aug. 1997, M. R. (Herb. M. R. 1058/97). – France. Pyrenees, Quérigut, Laurenti Lake, on bark of *Abies alba*, 17 July 1997, M. R. (Herb. M. R. 969/97, 973/97). – Ukraine. Eastern Carpathian Mts., Kvasi near Rachiv, on left bank of the river Tisa, on inner side of bark of *Abies alba*, 28 June 1997, M. R. (Herb. M. R. 957/97).

Descriptions and illustrations. Rehm (1907: 469); Höhnel (1909: 332); Gams and Holubová-Jechová (1976: 53, Fig. 26 a, b).

Habitat. Saprobe on decayed wood and inner surface of bark of conifers.

Known host. *Abies alba*.

Known distribution. Europe: Austria, Czech Republic, France, Ukraine.

Note. The tips of paraphyses were seen enclosed in a small gelatinous cap that was well visible in phase contrast. This character was not seen in any other *Chaetosphaeria* species.

Chaetosphaeria abietis has not yet been grown in culture. The associated anamorph *Cylindrotrichum zignoëllae* was regularly observed growing around the perithecia (Gams and Holubová-Jechová 1976; Réblová, unpublished observations). Hawksworth and Minter (1980) reported the anamorph from dead herbaceous material of *Filipendula ulmaria* to be associated with perithecia of a *Chaetosphaeria*-like fungus; its ascospores were described as differing from *Chaet. abietis*, being 1–3-septate, shortly fusiform, 13–17 × 3–4 μm. Hawksworth and Minter (1980) concluded that *Cylindrotrichum zignoëllae* sensu Gams and Holubová-Jechová (1976) was circumscribed too broadly and may accommodate two taxa belonging to distinct teleomorphs. The perithecia found on *Filipendula ulmaria* could not be investigated further, for most of them were immature. No attempt was made to cultivate the specimen (Hawksworth and Minter 1980).

Chaetosphaeria abietis occurs rarely. All recent collections were made in regions with natural stands of *Abies alba*. Ascospore germination was not observed.

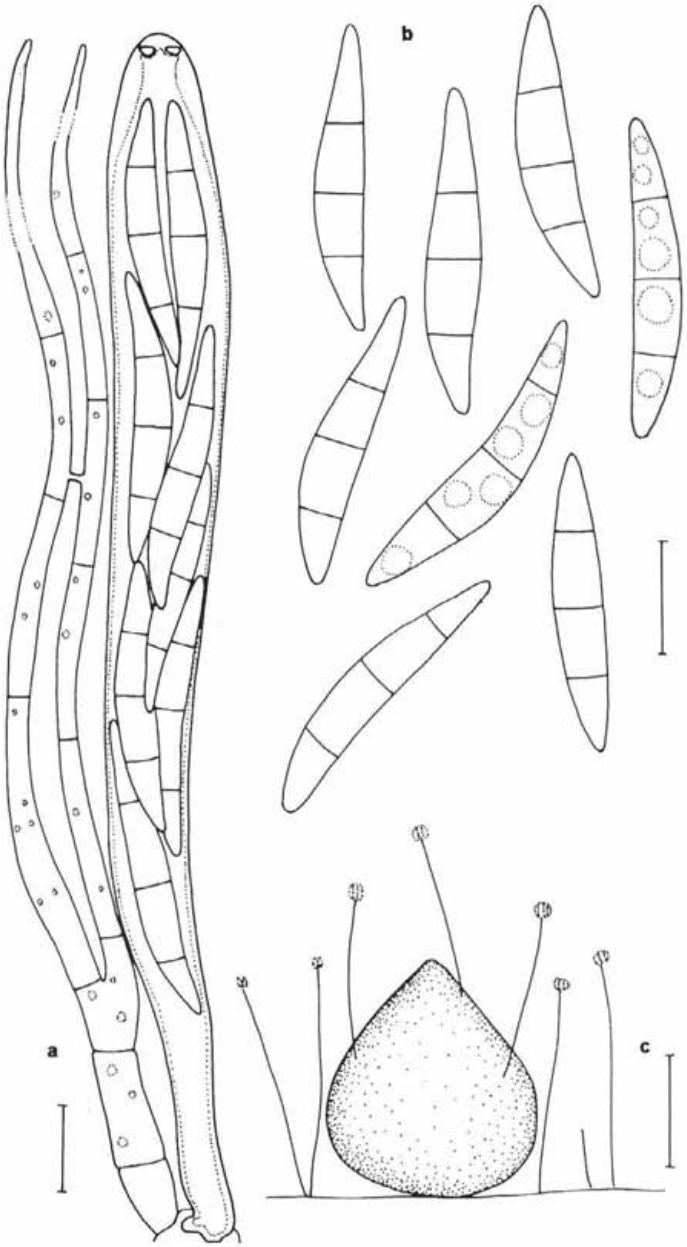

Fig. 2a–c. *Chaetosphaeria acutata.* – a. Ascus with ascospores and paraphyses. – b. Ascospores. – c. Habit sketch of the perithecium and conidiophores. – a–c from the type PRM 842979. – Scale bars: a, b = 10 μm; c = 100 μm.

2. **Chaetosphaeria acutata** Réblová et W. Gams, sp. nov. Figs. 2, 3.

Perithecia superficialia, gregaria vel solitaria, subglobosa, 170–220 μm alta, 170–200 μm diam, papillata, ostiolata, fusca vel quasi atra, lucida, glabra vel conidiophoris obtecta, modice asperulata. Canalis ostiolaris periphysatus. Paries perithecii fragilis, ad latus 26–33 μm crassus, bistratosus: stratum exterius e cellulis tenuitunicatis, fuscis, lateriformibus constans, interius e cellulis tenuitunicatis, compressis, subhyalinis. Paraphyses copiosae, intervallis 11–21 μm septatae, ad septa non constrictae, ramosae, anastomosantes, hyalinae, 3–4 μm latae in parte inferiore, ad 1.5–2 μm angustatae, ultra ascorum apices protrudentes. Asci 8-spori, cylindrici vel clavati, (95–)121–147 × (8.5–)9.5–10.5(–11.5) μm, breviter stipitati, apex anulo I-, refringente, 3.0–3.5 μm lato et 1.0–1.2 μm alto praeditus, 8-spori. Ascosporae fusiformes, utrinque fere acutatae et minime rotundatae, (28–)30.5–38(–44) × 3–4(–5) μm, 3-septatae, non constrictae, leves, hyalinae, oblique 1–2(–3)-seriatae in asco, tubis polaribus germinantes.

Anamorphosis *Cylindrotrichum* sp.: Conidiophoris simplicibus, fuscis, sursum pallidioribus, 125–190 × (4–)5–6.5 μm, sursum ad 3–4 μm angustatis, monophialidicis, saepe semel percurrenter proliferentibus. Phialides supra collare 4–10.5 μm extendentes, quinquies ad dodecies annellatae. Conidia cylindrica vel clavata, recta vel modice curvata, ad basim truncata, ad apicem rotundata, 1-septata, haud constricta, levia, hyalina, (11–)12.5–15.5(–16.5) × 4–5 μm.

Holotypus. Bohemia meridionalis, montes Šumava, Železná Ruda, ad lignum putridum *Fagi sylvaticae*, 28 Aug. 1997, leg. M. R. 994/97 (PRM 842979).

Etymology. Lat. *acutatus* = pointed, referring to the tapering ends of the ascospores.

Anamorph. *Cylindrotrichum* sp. (described here). Fig. 3a-d.

Teleomorph. Perithecia superficial, gregarious to solitary, subglobose, 170–220 μm high and 170–200 μm diam, papillate, ostiolate, dark brown to nearly black, glistening, glabrous or covered with conidiophores of the anamorph, slightly roughened. Perithecial wall brittle, lateral wall 26–33 μm thick, consisting of two layers; an outer layer of thin-walled, dark brown, opaque brick-like cells, and an inner layer of thin-walled, compressed, subhyaline cells. Ostiolar canal periphysate. Paraphyses copious, septate at 11–21 μm intervals, non-constricted at the septa, branching, anastomosing, 3–4 μm wide in the lower part, tapering to 1.5–2 μm, protruding beyond the tips of the asci. Asci cylindrical-clavate, (95–)121–147 × (8.5–)9.5–10.5(–11.5) μm, shortly stipitate, ascal apex with a J-, refractive, 3–3.5 μm wide and 1–1.2 μm deep apical annulus. Ascospores fusiform, narrowly rounded at the ends, (28–)30.5–38(–44) × 3–4(–5) μm, 3-septate, not

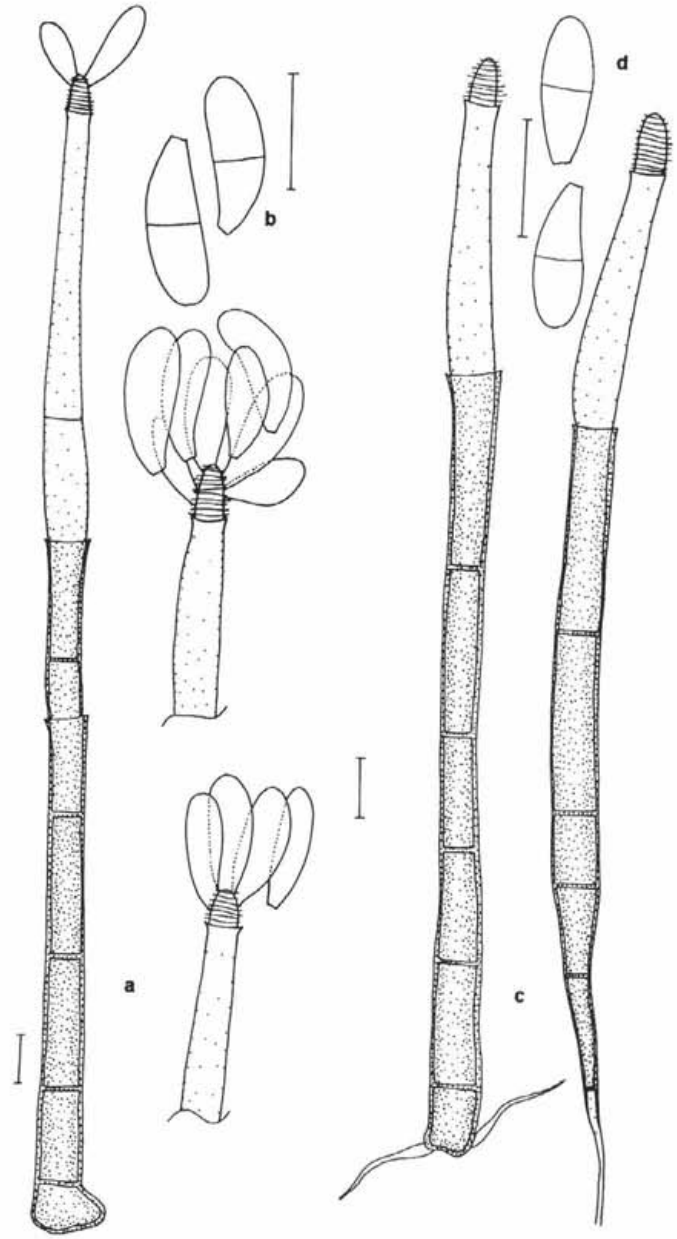

Fig. 3a–d. *Chaetosphaeria acutata.* – a. Conidiophore and sporogenous apices of the conidiophores, from nature. – b. Conidia, from nature. – c. Conidiophores, from PCA culture. – d. Conidia, from PCA culture. – a–d from CBS 101315, PRM 842979. – Scale bar: a–d = 10 μm.

constricted, smooth, hyaline, obliquely 1–2(–3)-seriate, partially overlapping in the ascus, germinating by germ tubes at the ends.

Anamorph. Colonies hairy, dark, conidiophores arising from the substratum or covering the perithecia. Setae absent. Conidiophores macronematous, mononematous, solitary, erect, unbranched, cylindrical, 125–190 μm long and (4–)5–6.5 μm wide in the middle, tapering to 3–4 μm, straight or slightly flexuous, dark brown, paler towards the apex, smooth, often with 1 percurrent proliferation. Phialides terminal, cylindrical, the percurrently proliferating part above the collarette 4–10.5 μm long and 3.5–5 μm wide, with 5–12 densely annellate proliferations. Primary collarettes hyaline, 4.5–5.5(–6) μm wide and 1 μm deep. Conidia (11–)12.5–15.5(–16.5) × 4–5 μm, cylindrical to clavate, straight or slightly curved, tapering and truncate at the proximal end, rounded at the distal end, 1-septate, not constricted, smooth-walled, hyaline.

Characteristics in culture. Colonies on PCA slow-growing, reaching 3–4 mm diam in 10 days at 25 °C in darkness, when grown for another 10 days at 25 °C in cool white fluorescent light reaching 7–8 mm diam; felty, greyish brown, aerial mycelium developed, margins fimbriate, no conidiation; reverse dark brown to nearly black. In 20 days: CMA: 4–4.5 mm diam, MEA: 6–7 mm diam; OA: 3.5–4 mm diam; CMA, MEA: felty, greyish brown, aerial mycelium well-developed, margins fimbriate, no conidiation; OA: colonies having a moist appearance, mid-brown, aerial mycelium scant, no conidiation. Colonies sporulated only on PCA, OA and CMA in 2–3-month-old slant cultures preserved at 18 °C under cool white fluorescent light. Mycelium superficial or immersed; hyphae branched, septate, subhyaline, smooth, 2.5–3 μm wide. Setae absent. Conidiophores as on the natural substratum 84–150(–200) μm long and 5–6 μm wide in the middle, tapering to 3–4.5 μm. Phialides with hyaline primary collarette 4–6 μm wide and 1–1.5(–2) μm deep. Conidia 10.5–14.5 × 3–4.5 μm.

Material examined. 1) Type material. Czech Republic. Southern Bohemia, Šumava Mts., glacial cirque of the lake Čertovo jezero near Železná Ruda, on wood of *Fagus sylvatica*, 28 Aug. 1997, M. R. 994/97 (PRM 842979 – holotype of *Chaetosphaeria acutata*)

2) Additional material examined. Czech Republic. Southern Bohemia, Šumava Mts., glacial cirque of the lake Černé jezero near Železná Ruda, on wood of *Fagus sylvatica*, 23 Oct. 1996, M. R. (Herb. M. R. 906/96); ibid., 27 Aug. 1997, M. R. (Herb. M. R. 1043/97). – France. Central Pyrenees, Bagnères de Luchon, Lys valley, on wood of *Fagus sylvatica*, 13 July 1997, M. R. (Herb. M. R. 974/97). – Ukraine, Eastern Carpathian Mts., Kvasi near Rachiv, on left bank of the river Tisa, on wood of *Corylus avellana*, 26 June 1997, M. R. (Herb. M. R. 948/97).

Cultures. CBS 101311 (Herb. M. R. 948/97); CBS 101312 (Herb. M. R. 974/97); CBS 101315 (PRM 842979).

Habitat. Saprobe on decayed wood of deciduous trees.

Known hosts. *Corylus avellana, Fagus sylvatica.*

Known distribution. Europe: Czech Republic, France, Ukraine.

Note. The species was initially identified as *Lasiosphaeria britzelmayri* Sacc. subsp. *fennica* P. Karst. (Karsten 1887). The redescription of this taxon by Podlahová (1974) seemed to match our fungus perfectly. But the type specimen in H showed that ascospores clearly differ in shape and size. They are rather longer [(34.5–)36.5–42(–43) × (3.5–)4(–4.5) μm], elongate-fusiform and tapering strongly towards the ends immediately after the middle septum. The asci are of a size [(126–)133–152(–168) × (8.5–)9–10.5 μm] comparable to that of *Chaetosphaeria acutata*. The anamorph associated with perithecia on the type material of *Lasiosphaeria britzelmayri* subsp. *fennica* is *Chloridium*-like and entirely different from the *Cylindrotrichum* anamorph of *Chaet. acutata*. The conidia are mid-brown and non-septate. *Lasiosphaeria britzelmayri* Sacc. subsp. *fennica* is therefore another species of *Chaetosphaeria* to be included in the present paper.

Chaetosphaeria acutata clearly differs from other species of the genus by its typically long fusiform, at maturity 3-septate ascospores, the *Cylindrotrichum* anamorph and its exclusive occurrence on decayed wood of deciduous trees. In areas with near-natural and natural stands dominated by *Fagus sylvatica* and *Abies alba*, where the fungus occurs, it is not uncommon.

Conidia of the *Cylindrotrichum* anamorph of *Chaet. acutata* are formed successively from the sporogenous apex of the proliferating conidiogenous cells. *Cacumisporium capitulatum* has similarly proliferating conidiogenous cells but differs in having at maturity 4-celled, bicolorous and larger conidia.

3. **Chaetosphaeria crustacea** (Sacc.) Réblová et W. Gams, comb. nov. Figs. 4–6.

≡ *Zignoëlla crustacea* Sacc., Syll. Fung. 2: 220, 1883. – basionym.

≡ *Sphaeria crustacea* P. Karst., Fungi fenn. exs. 865, 1869; more elaborated in Bidr. Känn. Finl. Nat. Folk. 23: 95, 1873 [non *Sphaeria crustacea* Sow., Col. Fig. Engl. Fung. 1: Tab. 372, Fig. 3, Pl. 372, 1803 = *Hypoxylon multiforme* (Fr.: Fr.) Fr.].

Anamorph. Intermediate between *Cylindrotrichum* and *Chloridium* (described here). Fig. 6a–f.

Teleomorph. Perithecia superficial, solitary to densely gregarious, subglobose to globose, 130–250 μm high and 120–220 μm diam, papillate, ostiolate, papilla

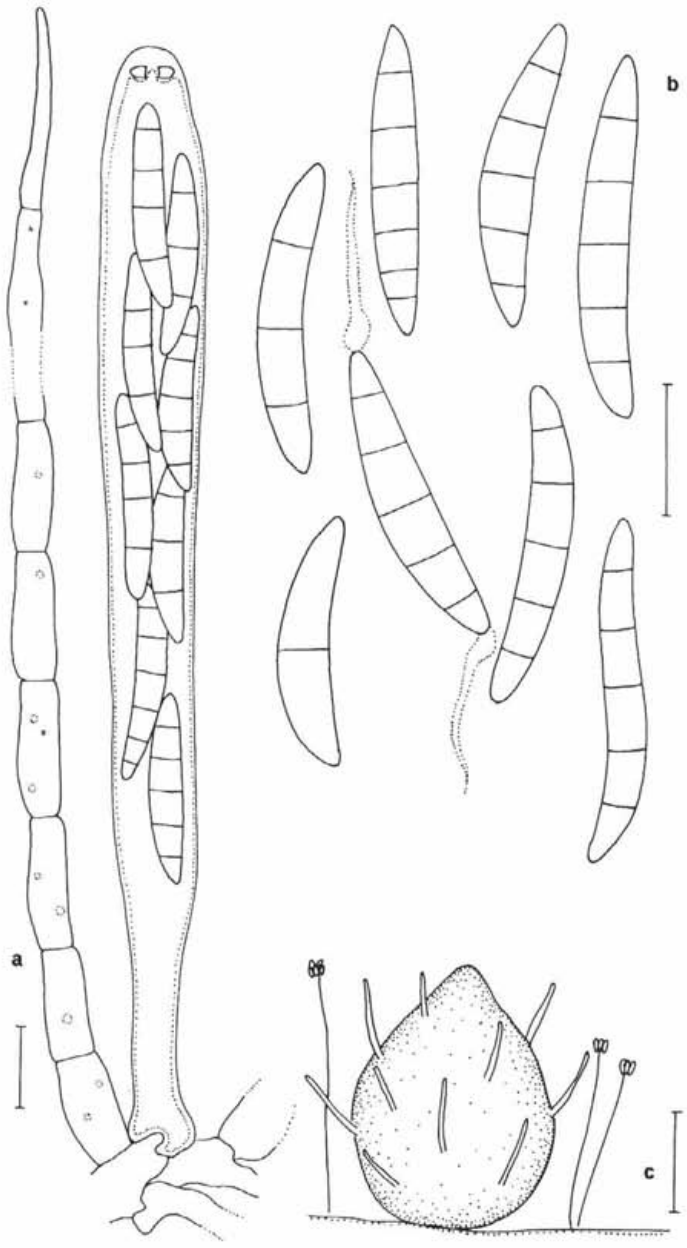

Fig. 4a–c. *Chaetosphaeria crustacea.* – a. Ascus with ascospores and a paraphysis. – b. Ascospores. – c. Habit sketch of perithecium and conidiophores. – a–c from Herb. M. R. 996/97. – Scale bars: a, b = 10 μm; c = 100 μm.

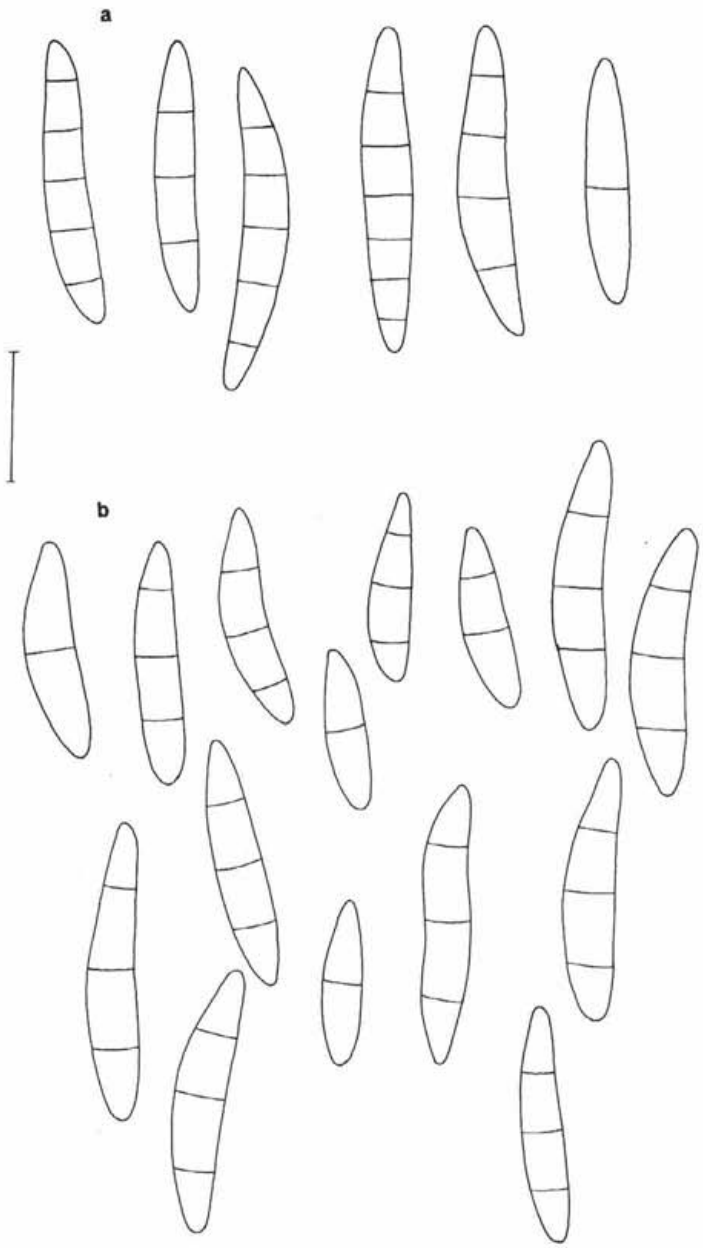

Fig. 5a, b. *Chaetosphaeria crustacea.* – a, b. Ascospores. – a from H; b from Herb. M. R. 1169/97. – Scale bar: a, b = 10 μm.

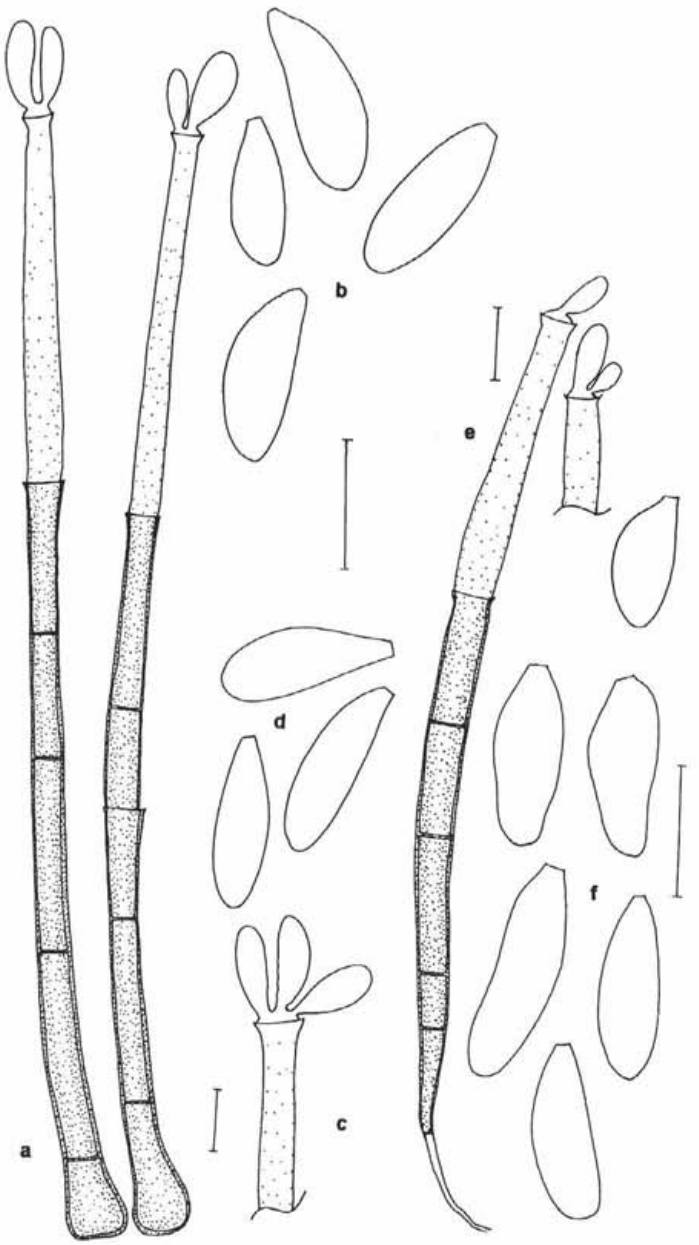

Fig. 6a–f. *Chaetosphaeria crustacea.* – a. Conidiophores, from nature. – b. Conidia, from nature. – c. Sporogenous apex of the conidiophore, from PCA culture. – d, f. Conidia, from PCA culture. – e. Conidiophore, from PCA culture. – a, b, e, f from Herb. M. R. 996/97; c, d from CBS 101321, Herb. M. R. 1169/97; e, f from CBS 101316. – Scale bar: a–f = 10 μm.

perforated by a rounded pore in old perithecia, black, glistening, setose, slightly roughened. Setae scattered over the perithecia, erect, dark brown, septate, obtuse, 30–130 μm long and 3–3.5 μm wide in the middle. Perithecial wall brittle, lateral wall 15–22 μm thick, consisting of two layers; an outer layer of thin-walled, opaque, brick-like cells, and an inner layer of thin-walled, subhyaline, compressed cells. Ostiolar canal periphysate. Paraphyses copious, septate at 18–21 μm intervals, slightly constricted at the septa, branching, anastomosing, 4–5 μm wide in the lower part, tapering to 2 μm, protruding beyond the tips of the asci. Asci cylindrical-clavate, 75–105(–115) × (8.5–) 9.5–10.5 μm, shortly stipitate, 8-spored, ascal apex with a J-, 2.5 μm wide and 1.5 μm deep apical annulus. Ascospores cylindrical-fusiform, straight or curved, (15.5–)19–26(–28) × 3–3.5(–4) μm, predominantly 3-septate, with a delayed formation of the 2–3 additional septa, not constricted, smooth, hyaline, 2–3-seriate, partially overlapping in the ascus, germinating by a germ tube at one or both ends; no tendency of fragmentation.

Anamorph. Colonies hairy, dark, conidiophores arising from decayed wood and also covering the perithecia. Setae absent. Conidiophores macronematous, mononematous, solitary, erect, unbranched, 170–210 μm long and 4.5–5.5 μm wide above the base, tapering to 3–3.5 μm below the collarette, cylindrical, straight or slightly flexuous, septate, often with 1(–2) distant percurrent proliferation, dark brown, paler towards the apex, smooth-walled. Phialides terminal, cylindrical, 23–32 × 3.5–4.5 μm. Collarettes hyaline, 4–5 μm wide and 1.5–2.5 μm deep. Conidia arising in a sympodial manner on a central dome inside the collarette like in *Chloridium virescens*, cylindrical-clavate, (11.5–)14.5–17(–21) × 3–4.5 μm, straight or curved, rounded at the tip, tapering and truncate at the base, 1-celled, smooth, hyaline.

Characteristics in culture. Colonies on PCA slow-growing, reaching 4–5 mm diam in 10 days at 25 °C in darkness, when grown for another 10 days at 25 °C in cool white fluorescent light reaching 10–11 mm diam; velvety, centre dark greyish brown due to hyphae of aerial mycelium and conidiophores, dark brown to nearly black at the fimbriate margin, forming a conspicuous dark, sterile zone of submerged mycelium; conidial production copious in 10 days; conidiophores arising in the centre; conidial masses globose, whitish; reverse dark grey; no pigments released. In 20 days: CMA: 9–10 mm diam; MEA 12 mm diam; OA 9–12 mm diam; CMA, MEA, OA: velvety, dark grey, with copious conidial production in 10 days on CMA, OA; on MEA after 20 days. The black sterile zone formed by substrate mycelium at the margins is most pronounced on CMA, less on PCA and OA and is not developed on MEA. Mycelium superficial or immersed; hyphae branched, septate, subhyaline, smooth, 2–3 μm wide. Setae absent. Conidiophores as on the natural substratum, 70–160 μm

long, 4–5 μm wide in the middle, tapering to 3–3.5 μm below the collarette. Phialides 23–44 × 3.5–4.5 μm; collarettes 4–5 μm wide and 1.5–2.5(–3) μm deep. Conidia (11–)12.5–16.5(–20) × 3–4(–5) μm. Chlamydospores absent.

Material examined. 1)Type material. Finland. Ostrobottnia, Vaasa, on *Pinus sylvestris*, P. A. Karsten, Fung. Fenn. exsicc. 865, (H – lectotype of *Zignoëlla crustacea*).

2) Additional material. Czech Republic. Southern Bohemia, glacial cirque of the lake Černé jezero near Železná Ruda, on wood of *Abies alba*, 7 Nov. 1997, K. Prášil (Herb. M. R. 1169/97). – Ukraine. Eastern Carpathian Mts., Kvasi near Rachiv, on left bank of the river Tisa, on wood of *Picea abies*, 26 June 1997, M. R. (Herb. M. R. 996/97).

Cultures. CBS 101316 (Herb. M. R. 996/97); CBS 101321 (Herb. M. R. 1169/97).

Descriptions and illustrations. Karsten (1873: 95); Saccardo (1883: 220).

Habitat. Saprobe on decayed wood and bark of conifers.

Known hosts. *Abies alba, Picea abies, Pinus sylvestris.*

Known distribution. Europe: Czech Republic, Finland, Ukraine.

Note. The type collection of *Zignoëlla crustacea* made by Karsten in Finland (Karsten 1873) contains densely setose perithecia seated on wood of *Pinus sylvestris*, and 3–5 transversely septate, hyaline ascospores (22–24.5 × 3–3.5 μm). No anamorph was observed. The perithecia from the recent collections are densely setose in a collection made in the Czech Republic and sparsely setose in a collection made in the Ukraine. In both collections the same *Cylindrotrichum* species was found growing on the substratum and was also obtained in the living culture. Traditionally, *Chaetosphaeria* only contains species with glabrous perithecia. They may, however, become setose when the setae and conidiophores of the associated anamorph arise both from the substratum and the perithecial surface. *Chaetosphaeria crustacea* is an example of a fungus with setose perithecia associated with a *Cylindrotrichum-Chloridium*-like anamorph. The recent finds represent the first records of this fungus since its description.

In the type material both 3-septate and 4–5-septate ascospores were present. Inside the asci only the 3-septate ascospores were seen. The 4–5-septate ascospores were released from the perithecium and seen attached to the perithecial surface and on the substratum. In the specimen from the Ukraine mainly 5-septate ascospores and in that from the Czech Republic only 3-septate ascospores were seen.

Chaetosphaeria crustacea is similar in ascospore shape and septation to *Chaet. decastyla* but differs in shorter ascospores and asci, setose perithecia, the *Cylindrotrichum-Chloridium*-like anamorph and the occurrence on decayed wood of conifers. *Chaetosphaeria crustacea* occurs rarely and is known from three localities in Europe only.

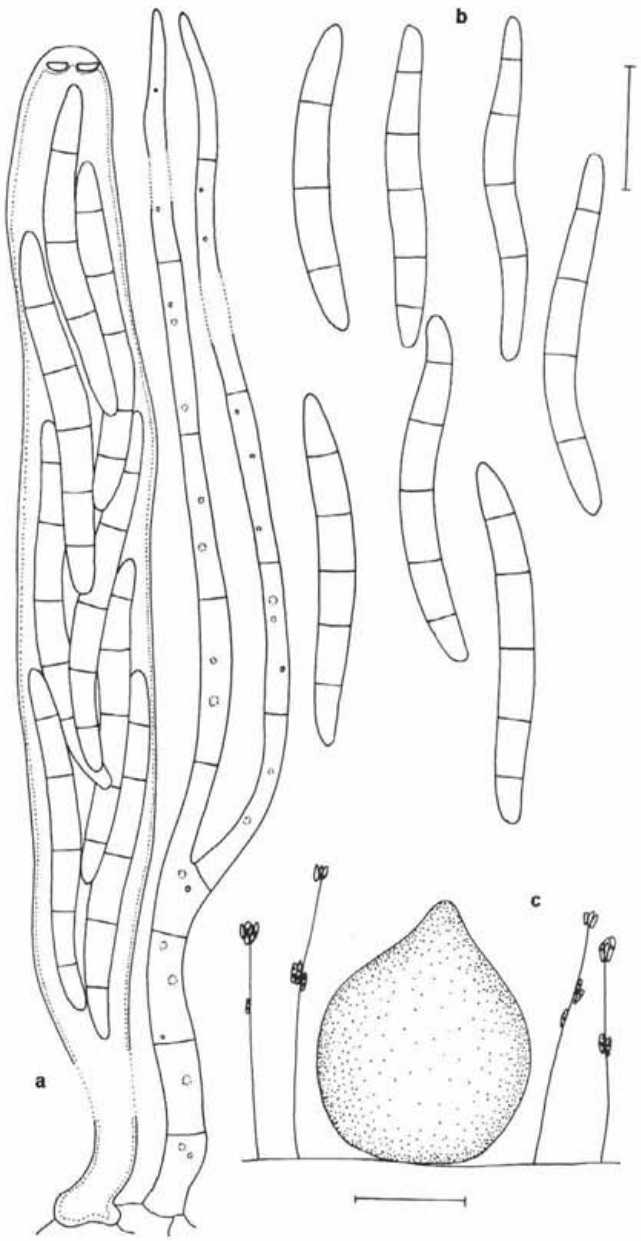

Fig. 7a–c. *Chaetosphaeria decastyla.* – a. Ascus with ascospores and paraphyses. – b. Ascospores. – Habit sketch of perithecium and conidiophores. – a–c from Herb. M. R. 985/97. – Scale bars: a, b = 10 μm; c = 100 μm.

4. **Chaetosphaeria decastyla** (Cooke) Réblová et W. Gams, comb. nov.
Figs. 7–9.

≡ *Sphaeria decastyla* Cooke, Grevillea 7: 52, 1878. – basionym.
≡ *Acanthostigma decastylum* (Cooke) Sacc., Syll. Fung. 2: 210, 1883.
= *Melanomma macrosporum* Sacc., Hedwigia 14: 73, May 1875; see also Saccardo, Fungi ital. delin. 300, Feb. 1878; Michelia 1: 449, 15 Nov. 1878.
≡ *Zignoëlla macrospora* (Sacc.) Sacc., Michelia 1: 346, 1 July 1878; Syll. Fung. 2: 221, 1883 [non *Chaetosphaeria macrospora* (Kawamura) Hara, J. Pl. Prot. Tokyo 16(2): 16, 1930].

Anamorph. **Cacumisporium capitulatum** (Corda) S. Hughes, Canad. J. Bot. 96: 743, 1958. Fig. 9a–d.
≡ *Helminthosporium capitulatum* Corda, Ic. Fung. 2: 13, 1838.
= *Cacumisporium tenebrosum* Preuss, Linnaea 24: 130, 1851.

Teleomorph. Perithecia superficial, solitary or in groups of 3–5, subglobose to conical, 200–260 μm high and 180–210 μm diam, papillate, papilla perforated by a rounded pore in old perithecia, ostiolate, dark brown to black, glistening, glabrous or covered with conidiophores of the anamorph, slightly rugose. Perithecial wall brittle, 17–22 μm thick, consisting of two layers; an outer layer of thin-walled, dark brown, opaque, polyhedral to brick-like cells, and an inner layer of thin-walled, compressed, hyaline cells. Ostiolar canal periphysate. Paraphyses copious, branching, septate at 18–42 μm intervals, 3–3.5 μm wide in the lower part, tapering to 1.5 μm, protruding beyond the tips of the asci. Asci clavate-cylindrical, 68–90 μm long in the *pars sporifera* × 10.5–11.5 μm, stipe 30–54 μm long, narrowly rounded at the tip, with a J-, refractive, 3–3.5 μm wide and 1 μm deep apical annulus. Ascospores cylindrical to cylindrical-fusiform or fusiform, occasionally tapering towards one end, (28–)30–42(–46) × 3–4 μm, at maturity 5-septate, not constricted or very slightly constricted at the septa, smooth-walled, hyaline, 2–3-seriate, overlapping in the upper part of the ascus, germinating by germ tubes at the ends.

Anamorph. Colonies hairy, dark, conidiophores arising from the substratum or covering the perithecia. Setae absent. Conidiophores macronematous, mononematous, solitary, erect, unbranched, cylindrical, up to 200 μm long, 6.5–7.5 μm wide above the base, tapering to 5–6 μm below the primary collarette, straight or slightly flexuous, septate, brown to pale brown, paler towards the apex, smooth, with 1–2 major percurrent proliferations. Phialides terminal, cylindrical, the proliferating part above the primary collarette 10–15 μm long and 5–6 μm wide, with 9–12 narrow annellate proliferations. Primary collarettes almost hyaline, 7–9.5 μm wide and (1–)1.5–2 μm deep. Conidia cylindrical, 15–20 × 5–6.5 μm, straight or slightly curved, rounded at the tip, truncate at the base, 3-septate, not constricted, at

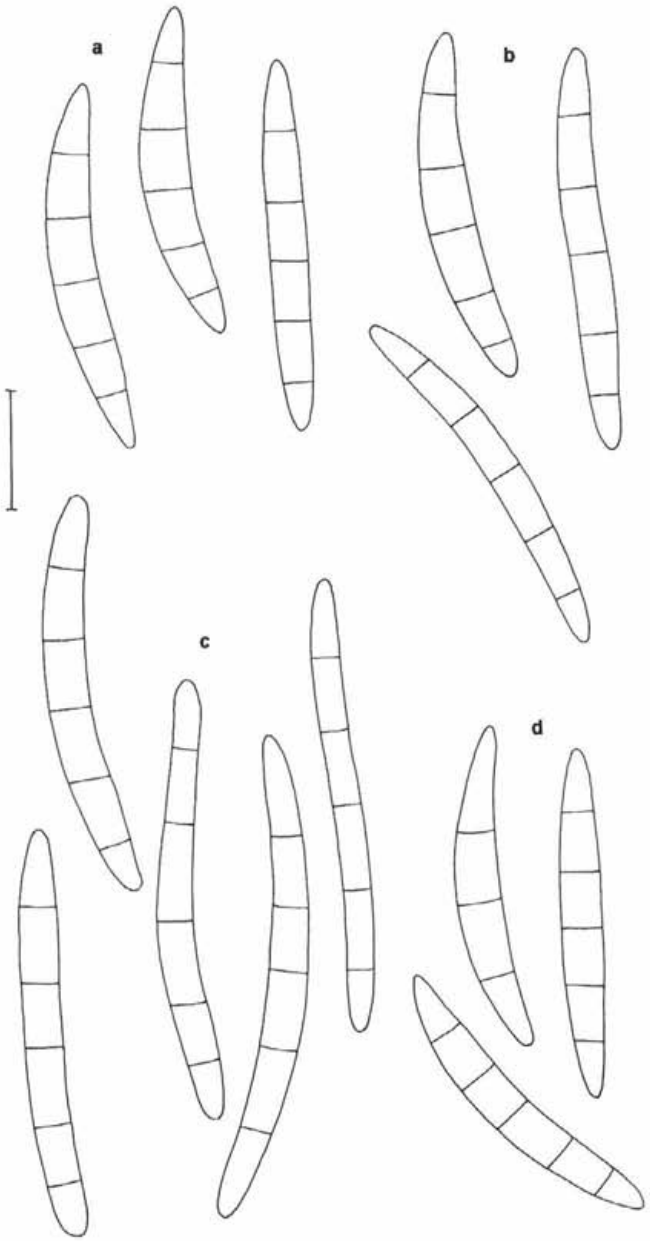

Fig. 8a–d. *Chaetosphaeria decastyla.* – a–d. Ascospores. – a–d from NY: a (USA, New Jersey, Newfield, on bark and wood of *Magnolia* sp.); b (USA, Georgia, Darien, on wood of *Quercus* sp., Ravenel 2420); c (Gloucester County, Newfield, 22 Jan. 1878); d (USA, Louisiana, on a decayed log of oak, 2 Jan. 1886, A. B. Langlois). – Scale bars: a–d = 10 μm.

first hyaline, at maturity the two middle cells turning brown and the two end cells remaining hyaline, mature conidia often attached to the middle and lower part of the conidiophore.

Characteristics in culture. Colonies on PCA slow-growing, reaching 4–5 mm diam in 10 days at 25 °C in darkness, when grown for another 10 days at 25 °C in cool white fluorescent light reaching 8 mm diam; velvety, dark grey, aerial mycelium well-developed, margins fimbriate; conidial production scarce after 20 days; conidiophores scattered, conidial masses globose, hyaline; reverse greyish. Colonies sporulating copiously with conidiophores arranged in 2–3 concentric zones in 2 month-old slant cultures preserved at 18 °C under cool white fluorescent light. In 20 days: CMA: 7–8 mm diam; OA: 6–7 mm diam; CMA, OA: velvety, dark grey, conidial production scarce at the margins; MEA: 9–10 mm diam, velvety, greyish to pale brown, no conidial production. Mycelium superficial or immersed; hyphae branched, septate, subhyaline, smooth, 1.5–2.5 μm wide. Setae absent. Conidiophores as on the natural substratum, (100–)127–176 μm long, 5.5–6.5(–7.5) μm wide in the middle and 13–16 μm wide at the base, tapering to 5–6(–6.5) μm. Phialides with the proliferating part 5–14 μm long and 5–6(–6.5) μm wide, with 10–12 proliferations. Conidia 19–22(–24) × 6–7 μm. In 2-month old slant cultures the conidia became mature, the two middle cells gradually turning brown and the two end cells remaining hyaline or at least paler, mature conidia often sticking to the middle and lower part of the conidiophore.

Material examined. 1) Type material. Italy. Cansiglio (Treviso), on decorticated wood of *Fagus sylvatica*, Oct. 1874, P. A. Saccardo (PAD – holotype of *Melanomma macrosporum*). – USA, Georgia, Darien, on wood of *Quercus* sp., Ravenel 2420, (K 59126 – holotype of *Sphaeria decastyla*; NY – isotype).

2) Additional material. France, Central Pyrenees, Bagnères de Luchon, Lys valley, on decayed wood of *Fagus sylvatica*, 13 July 1997, M. R. (Herb. M. R. 985/97, 988/97). – USA, New Jersey, Newfield, on bark of *Magnolia* sp., 10 July 1887 (NY); New Jersey, Gloucester County, Newfield, 22 Jan. 1878 (NY); ibid., on a bark of *Magnolia* sp., 29 June 1882 (NY); Louisiana, on a decayed log of oak, 2 Jan. 1886, A. B. Langlois (NY).

Cultures. CBS 101313 (Herb. M. R. 985/97); CBS 101314 (Herb. M. R. 988/97).

Descriptions and illustrations. Saccardo (1875: 73; 1878: 449; 1883: 210, 221); Cooke (1878: 52); Ellis and Everhart (1882: 155); Berlese (1894: 100, Tab. 94, Fig. 1).

Habitat. Saprobe on decayed wood of deciduous trees.

Known hosts. *Fagus sylvatica, Magnolia* sp., *Quercus* sp.

Known distribution. Europe: France, Italy; North America: USA (New Jersey, Lousiana).

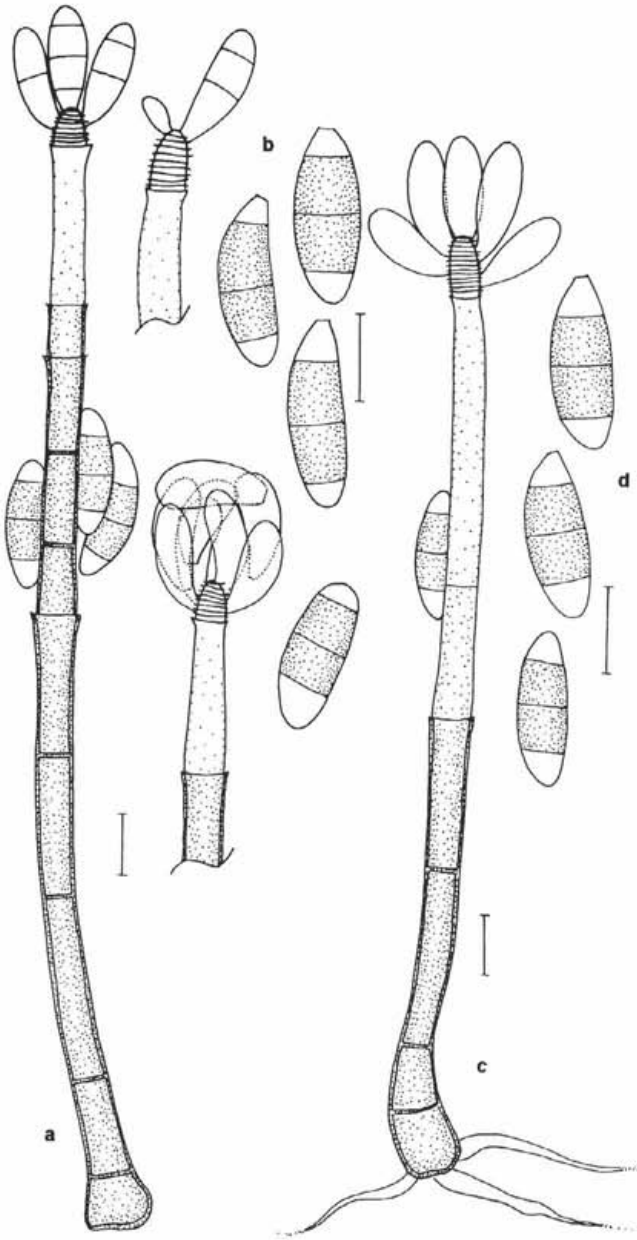

Fig. 9a–d. *Chaetosphaeria decastyla.* – a. Conidiophore with conidia and sporogenous conidiophore apices, from nature. – b. Conidia, from nature. – c. Conidiophore with conidia, from PCA culture. – d. Conidia, from PCA culture. – a–d from Herb. M. R. 985/97; c, d from CBS 101313. – Scale bar: a–d = 10 μm.

Nomenclatural note. The name *Chaetosphaeria decastyla* is based on *Sphaeria decastyla* Cooke 1878, even though the name *Melanomma macrosporum* Sacc. 1875 would have priority. If the epithet '*macrosporum*' were transferred to *Chaetosphaeria* this would result in a homonymous combination (Art. 53.1, Greuter et al. 1994) with *Chaetosphaeria macrospora* (Kawamura) Hara [Hara, J. Pl. Prot. Tokyo 16(2): 16, 1930] that is based on *Miyoshiella macrospora* Kawamura [Kawamura, J. Coll. Sci. Imp. Univ. Tokyo 23(2): 295, 1929]. *Miyshiella macrospora* does not belong to *Miyoshiella* Kawamura, a member of the Trichosphaeriaceae G. Winter (Réblová 1998c). *Miyshiella macrospora* is a pyrenomycetous ascomycete forming black spots on bamboo culms having transversely 7-septate, blackish brown ascospores and unitunicate asci. Therefore, the second available name is chosen and the new combination *Chaetosphaeria decastyla* is proposed.

Note. The holotype and isotype and other collections of *Sphaeria decastyla*, including those cited by Ellis and Everhart (1882), are preserved in K and NY. They possess perithecia accompanied by conidiophores of the *Cacumisporium capitulatum* anamorph. Ascospores of North American collections, except for one specimen (USA, New Jersey, Gloucester County, Newfield, 22 Jan. 1878), differ in shape and size from European material that is represented by Saccardo's type material of *Melanomma macrosporum* and two recent collections made in France. Specimens from North America have rather fusiform and shorter ascospores (Fig. 8) [(28–)30–34.5(–36.5) × 3–4 μm] than those of the European material, in which the ascospores (Fig. 7) are cylindrical to cylindrical-fusiform and longer [(31.5–)35.5–42(–46) × 3–4 μm]. The specimen collected in USA, New Jersey, Gloucester County, Newfield, has ascospores much like those of the European collections, cylindrical, measuring (27–) 30.5–39(–42) × 3–4 μm.

Ellis and Everhart (1882) described perithecia sparsely clothed with obtuse, septate setae. These setae (50–115 × 3–4.5 μm) were found only on several perithecia of the holotype of *Sphaeria decastyla* and other material (USA, New Jersey, Newfield, on bark of *Magnolia* sp., 10 July 1887, NY). The majority of perithecia were glabrous and bore remnants of conidiophores. The obtuse setae were not found in European material. Ellis and Everhart (1882) noted that the substratum surface in both collections was clothed with hairs similar to those growing on the perithecia. Our revision revealed that the so-called hairs are conidiophores of the *Cacumisporium capitulatum* anamorph.

Ellis and Everhart (1882) cited in a synonymy of *Acanthostigma decastylum* three names, viz. *Sphaeria cariosa* Cooke et Ellis, *Sphaeria atriella* Cooke et Ellis and *Lasiosphaeria subvelutina* Ellis et Everhart. *Sphaeria cariosa* (Holotype: USA, New Jersey, Newfield, on bark of decayed oak, 15 Feb. 1877, J. B. Ellis 2789, K 59125, NY – isotype) is a species of *Chaetosphaeria*, known as *Chaet. ovoidea* (Fr.) O. Constant. et al.; the *Menispora glauca* Pers. anamorph is abundantly present on the type. *Sphaeria atriella* Cooke et Ellis (Isotype: USA, New Jersey,

Newfield, Gloucester County, on rotten wood of *Acer* sp., Dec 1876, NY) was combined by Barr (1993) under *Chaetosphaeria*, as *Chaet. atriella* (Cooke et Ellis) M. E. Barr. We do not believe that this is a true *Chaetosphaeria* species, for it differs in several characters that would characterize a *Chaetosphaeria*. The perithecial wall is leathery, three-layered, ca. 35–48 μm thick, composed of non-opaque, thick-walled cells; paraphyses were not present and the asci were enclosed in a hyaline matrix that could be formed of dissolved paraphyses. No anamorph was associated. The wall of perithecium of *Chaetosphaeria* is different; it is thiner, ca. 15–25 μm, comprising thin-walled, opaque brick-like cells or cells that form a network, paraphyses are always persistent and do not dissolve. *Lasiosphaeria subvelutina* is another possible synonym of *Chaetosphaeria decastyla*, but the type could not be examined (not available in NY).

The type material of *Melanomma macrosporum* contained several mature perithecia and conidiophores of the *Cacumisporium capitulatum* anamorph arising sparsely from the substratum. Mature bicolorous conidia were found attached to the substratum and to the perithecial walls.

The conidiogenesis of *Cac. capitulatum* was described in detail by Goos (1969). The conidia have a flat basal scar and are formed successively from multiple growing points on the apex of the conidiogenous cell. The conidiogenous cells proliferate conspicuously 5–14 μm above the shallow collarette. A similarly proliferating apex of the conidiogenous cells is also found in the *Cylindrotrichum* anamorph of *Chaetosphaeria acutata*, which differs by smaller, hyaline, 2-celled conidia. The measurements of conidia of *Cac. capitulatum* are given from the original culture obtained immediately after isolation from the ascospores. Conidia are generally larger in vitro than on material from nature. After several transfers, *Cac. capitulatum* produces much smaller conidia in vitro [(14–)16–22(–24) x 5–7 μm] than in nature.

The ascospores of *Chaetosphaeria decastyla* are somewhat similar in shape to those of *Chaet. crustacea*. *Chaet. decastyla* can be clearly distinguished from *Chaet. crustacea* by the exclusive occurrence on wood of angiosperms, longer ascospores and asci, and the *Cac. capitulatum* anamorph.

5. **Chaetosphaeria fennica** (P. Karst.) Réblová et W. Gams, comb. nov.

Figs. 10, 11.

≡ *Lasiosphaeria britzelmayri* Sacc. subsp. *fennica* P. Karst., Rev. Mycol. Toulouse 9: 160, 1887. – basionym.

≡ *Acanthostigma fennicum* (P. Karst.) Berlese, Icon. Fung. 1: 102, 1894.

≡ *Zignoëlla abietis* Höhnel var. *fennica* (P. Karst.) Höhnel, Sitzungsber. K. Akad. Wiss., Wien, Math.-naturw. Kl., Abt. 1, 118: 332, 1909.

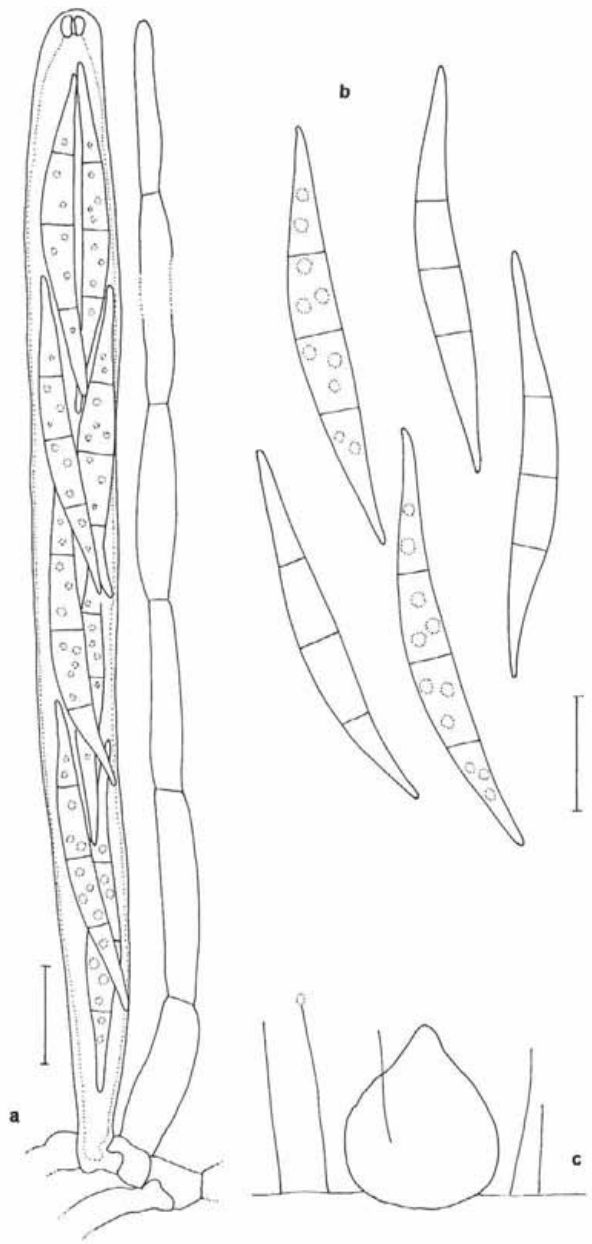

Fig. 10a–c. *Chaetosphaeria fennica.* – a. Ascus with ascospores and a paraphysis. – b. Ascospores. – c. Habit sketch of perithecium and conidiophores. – a–c from H 929. – Scale bars: a, b = 10 μm.

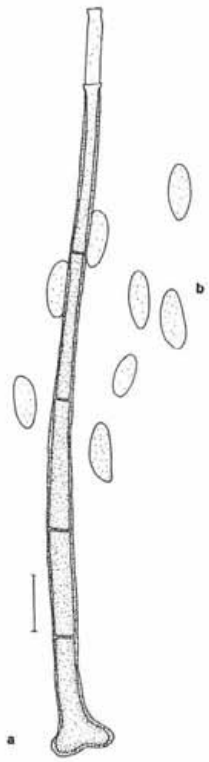

Fig. 11a, b. *Chaetosphaeria fennica*. – a. Conidiophore, from nature. – b. Conidia, from nature. – a, b from H 929. – Scale bar: a, b = 10 μm.

Anamorph. *Chloridium*-like (described here). Fig. 11a, b.

Teleomorph. Perithecia solitary, scattered, subglobose, 150–200 μm high and 200–220 μm diam, papillate, papilla perforated by a rounded pore in old perithecia, ostiolate, dark brown to black, glabrous or covered with conidiophores of the anamorph, smooth. Perithecial wall brittle, 22–26 μm thick, consisting of two layers; an outer layer of thin-walled, dark brown, opaque, polyhedral to brick-like cells, and an inner layer of thin-walled, compressed, hyaline cells. Ostiolar canal periphysate. Paraphyses copious, branching, anastomosing, septate, 4–5 μm wide in the lower part, tapering to 2.5 μm, protruding slightly beyond the tips of the asci. Asci long-cylindrical, (126–)133–152(–168) × (8.5–)9–10.5 μm, narrowly rounded at the tip, with a J-, refractive apical annulus, 2.5 μm wide and 1–1.5 μm deep. Ascospores elongate-fusiform and tapering strongly towards the ends immediately after the middle septum, (34.5–)36.5–42(–43) × (3.5–)4(–4.5) μm, at maturity 3-septate, not constricted at the septa, smooth-walled, hyaline, 2-seriate, overlapping partially in the upper part of the ascus.

Anamorph. Remnants of conidiophores with broken apices were observed growing copiously from the substratum surface and occasionally from the outer wall of the perithecia. Conidiophores macronematous, mononematous, erect, solitary, unbranched, septate, opaque, paler to subhyaline towards the top, 250–270 μm long, 5.5–6.5 μm wide above the base and 20–22 μm wide at the base. Once, a conidiophore with an inconspicuously proliferated apex ending in a hyaline collarette 3 μm wide and 2 μm deep was observed. A lot of conidia were seen attached to the conidiophore. Conidia mid-brown, ellipsoidal, straight or inequilateral, slightly truncate at the base, 8.5–9.5(–10) × 3–4.5 μm.

The teleomorph-anamorph connection could not yet be proved by culture studies and is only suggested by the joint occurrence of perithecia and conidiophores.

Material examined. Type material. Finland, Mustiala Myllyperä, on decayed bark of *Betula* sp., on old stromata of *Eutypa* sp., 28 July 1887, K. Starbäck, herb. P. Karsten 929 (H – holotype of *Chaetosphaeria fennica*).

Descriptions and illustrations. Karsten (1887: 160); Berlese (1894: 102, Pl. 119, Fig. 3); Saccardo (1891: 852); Podlahová (1974: 149, Tab. 42).

Habitat. Saprobe on stromata of *Eutypa* sp.

Known host. *Eutypa* sp. on *Betula* sp.

Known distribution. Europe: Finland, known only from the type locality.

Note. Podlahová (1974) revised the type material and her observations agree well with ours. Although Karsten (1887) and Berlese (1894) described and illustrated the perithecia as sparsely setose, Podlahová (1974) found them being glabrous. The present revision of the type material showed that the presumed setae were conidiophores that are usually quite firm but only visible as remnants in old herbarium material.

Lasiosphaeria britzelmayri Sacc. (Saccardo 1883) differs from *Chaetosphaeria fennica* in having shorter asci (90–100 × 9–10 μm) and shorter (28–35 × 3.5–4 μm), 6–11-celled, cylindrical-fusiform ascospores. Winter (1887) considered this fungus to have bitunicate asci and classified it as *Trematosphaeria paradoxa* G. Winter.

On the basis of ascospore anatomy, *Chaetosphaeria fennica* is closest to *Chaet. acutata*. The ascospores of the latter, though also long-fusiform, are much less tapering towards the ends and are rather shorter. The *Cylindrotrichum* anamorph of *Chaet. acutata* with hyaline and 1-celled conidia at maturity is entirely different from the *Chloridium*-like anamorph associated with *Chaet. fennica*.

6. **Chaetosphaeria fusiformis** W. Gams et Hol.-Jech., Mycotaxon 13: 257, 1981. Figs. 12, 13.

≡ *Chaetosphaeria fusispora* W. Gams et Hol.-Jech., Stud. Mycol. 13: 45, 1976. (illegitimate, Art. 53.1.) [non *Chaetosphaeria fusispora* (Kawamura) Hino,

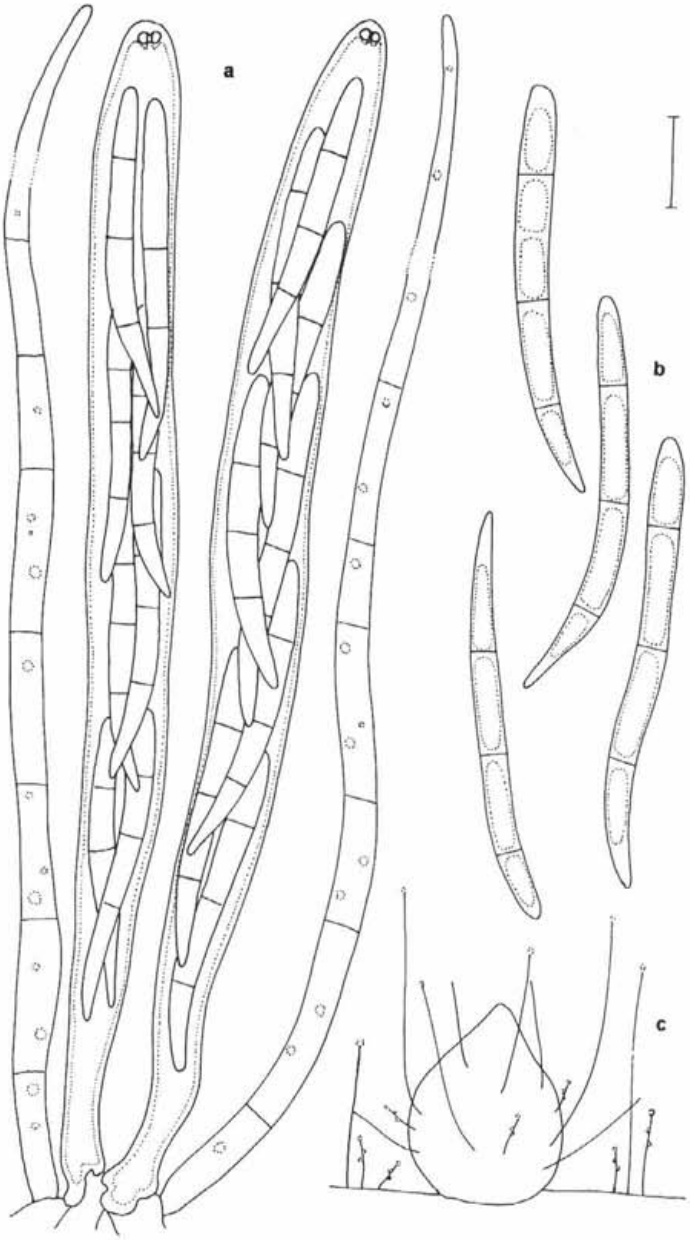

Fig. 12a–c. *Chaetosphaeria fusiformis.* – a. Asci with ascospores and paraphyses. – b. Ascospores. – c. Habit sketch of the perithecium and conidiophores. – a–c from Herb. M. R. 862/96. – Scale bar: a, b = 10 μm.

Bull. Miyazaki Coll. Agr. For. 4: 191, 1932, nec *Chaetosphaeria fusispora* P. Larsen, Dansk Bot. Ark. 14(7): 7, 1952.]

Anamorph. **Chloridium cylindrosporum** W. Gams et Hol.-Jech., Stud. Mycol. 13: 46, 1976. Figs. 13a–c.

≡ *Chaetopsis cylindrospora* (W. Gams et Hol.-Jech.) DiCosmo et al., Mycologia 75: 962, 1983.

Teleomorph. Perithecia superficial, densely gregarious or in small groups, globose, 170–250 μm high and 160–240 μm diam, papillate, ostiolate, black, glistening, glabrous, covered with conidiophores of the anamorph, slightly rugose. Perithecial wall brittle, lateral wall 18–28 μm thick, consisting of two layers; an outer layer of dark brown, thin-walled, opaque, brick-like cells, and an inner layer of thin-walled, subhyaline, compressed cells. Ostiolar canal periphysate. Paraphyses copious, septate at 10–21 μm intervals, slightly constricted at the septa, branching, 3–5 μm wide in the lower part, tapering to 2–2.5 μm, rounded at the top, protruding beyond the tips of the asci. Asci cylindrical-clavate, (89–)99–126(–146) × 8.5–10.5(–11.5) μm , shortly stipitate, ascal apex with a J-, refractive, 2.5–3 μm wide and 1–1.5 μm deep apical annulus that is situated ca. 1 μm below the apex. Ascospores fusiform, tapering at one end and rounded at the other, rarely tapering to both ends, (34.5–)39–53.5(–62) × 2.5–3(–4) μm, 3-septate, not constricted at the septa, smooth-walled, hyaline, 2–3-seriate, overlapping in the ascus.

Anamorph. Colonies hairy, dark, conidiophores arising from the substratum or covering the perithecia. Setae absent. Conidiophores macronematous, mononematous, solitary, erect, unbranched, forming two layers. Conidiophores of the lower layer cylindrical, 33–55 μm tall and 3.5–4 μm wide in the middle, tapering to 1.5–2 (–2.5) μm below the collarette, straight or slightly flexuous, 0–2-septate, pale brown, sympodially proliferating. Conidiophores of the upper layer cylindrical, (88–)116–230 μm tall and 6–7 μm wide above the base, tapering to 2.0–2.5 μm below the collarette, straight, 6–10-septate, thick-walled, brown to dark brown, paler upwards, usually with 1 percurrent proliferation, ending in a monophialide. Phialides terminal, integrated or intercalary, polyblastic, with 1 apical or 1–3 lateral phialidic openings arising from the sympodial proliferation. Collarettes hyaline, 4–5 μm wide and 2–3 μm deep. Conidia phialidic, cylindrical, centrally slightly constricted, tapering towards the ends, truncate at the base, 10.5–13.5 × 3.5–5 μm, aseptate when young, later forming 2–3 additional septa, smooth-walled, hyaline, in dry, irregular or star-like heads.

Characteristics in culture. Colonies on PCA slow-growing, reaching 3 mm diam in 10 days at 25 °C in darkness; when grown for another 10 days at 25 °C in

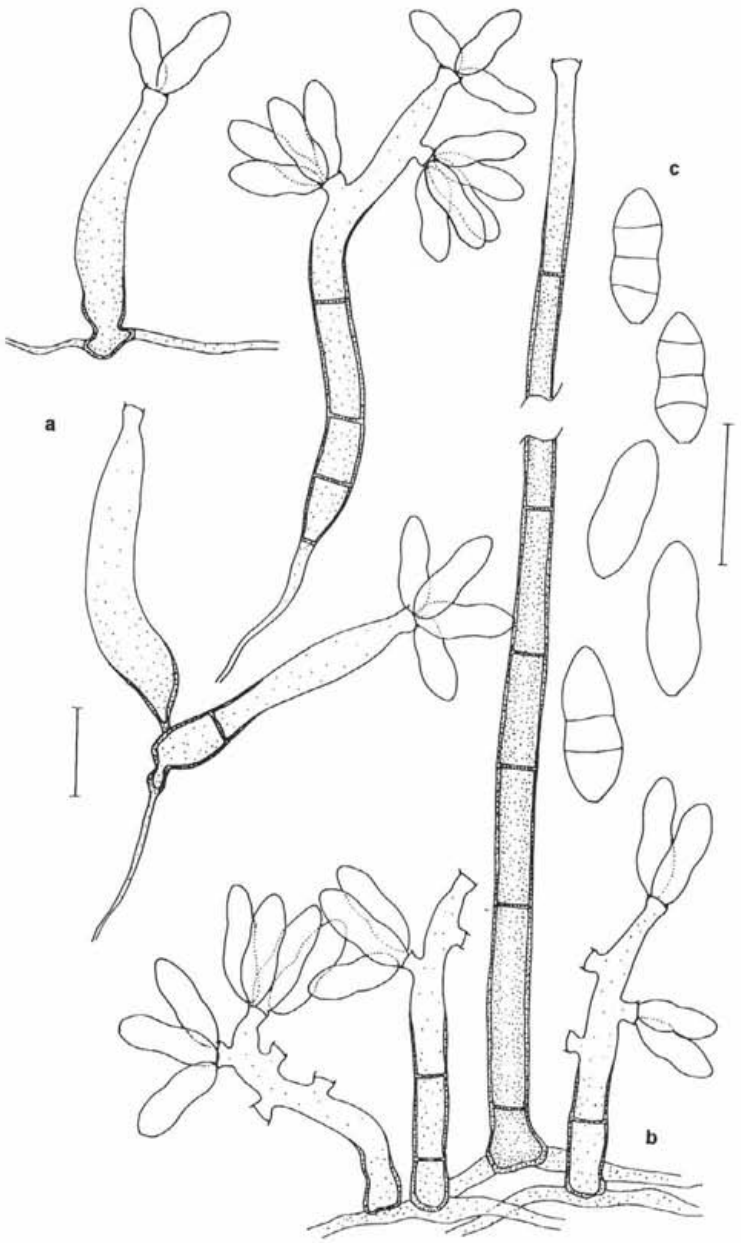

Fig. 13a–c. *Chaetosphaeria fusiformis.* – a. Conidiophores with conidia, from PCA culture. – b. Taller and shorter conidiophores with conidia forming two distinct layers, from nature. – c. Conidia, from nature. – a from CBS 101430; b, c from Herb. M. R. 862/96. – Scale bar: a–c = 10 μm.

cool white fluorescent light reaching 4–5 mm diam; velvety, mid-brown, zonate, aerial mycelium developed, margins fimbriate; conidial production copious in 20 days, conidiophores scattered, conidial masses globose, hyaline; reverse pale brown. CMA, OA: 4–5 mm diam, velvety, zonate, aerial mycelium developed, conidial production copious in the centre in 10 days; CMA: ochraceous to pale brown; OA: mid-brown; MEA: 2–2.5 mm diam, felty, not zonate, mid-brown, aerial mycelium scant, no conidiation in 20 days. Mycelium superficial or immersed; hyphae branched, septate, subhyaline, smooth-walled, 1.5–2.5 μm wide. Setae absent. Conidiophores as on the natural substratum, conidiophores of the lower layer (24–)30–59(–65) μm tall and 5–6(–7) μm wide above the base, tapering to 1.5–2.5 μm; conidiophores of the upper layer up to 136 μm tall and 6–7 μm wide above the base, tapering to 2.5–3 μm. Phialides with collarettes 4–5 μm wide and 2–3 μm deep. Conidia 11.5–13.5(–17) × 4–5 μm.

An upper layer of longer conidiophores was only seen in 4-months old slant cultures on PCA preserved at 18 °C under cool white fluorescent light.

Material examined. 1) Type material. Czech Republic. Moravia, Hrubý Jeseník Mts., on slopes of Mt. Mravenečník near Loučná nad Desnou, on decayed branch of *Abies alba*, 3 Aug. 1971, V. Holubová-Jechová (PRM 794008 – holotype of *Chaetosphaeria fusispora* (≡ *Chaetosphaeria fusiformis*).

2) Additional material. Czech Republic. Southern Bohemia, Šumava Mts., glacial cirque of the lake Černé jezero near Železná Ruda, on the inner surface of bark of *Abies alba*, 23 Oct. 1996, M. R. (Herb. M. R. 862/97, 863/97, 866/96, 867/96, 868/96, 874/96, 889/96); ibid., 27 Aug. 1997, M. R. (Herb. M. R. 1042/97, 1048/97, 1049/97); ibid., glacial cirque of the lake Čertovo jezero near Železná Ruda, on bark of *Abies alba*, 22 Oct. 1996, M. R. (Herb. M. R. 864/96). Moravia, Hrubý Jeseník Mts., on slopes of Mt. Mravenečník near Loučná nad Desnou, on decorticated wood of *Abies alba*, 3 Aug. 1971, V. Holubová-Jechová (PRM 794111). – Ukraine. Eastern Carpathian Mts., Kvasi near Rachiv, on the left bank of the Tisa River, on the inner side of bark on a stump of *Abies alba*, 26 June 1997, M. R. (Herb. M. R. 949/97, 958/97).

Cultures. CBS 101429 (Herb. M.R. 1048/97), CBS 101430 (Herb. M.R. 1049/97).

Descriptions and illustrations. Gams and Holubová-Jechová (1976: 45; Figs. 21a, b, 22).

Habitat. Saprobe on decayed wood and inner surface of bark of gymnosperms.

Known host. *Abies alba*.

Known distribution. Europe: Czech Republic, Ukraine.

Note. Although the conidia of *Chloridium cylindrosporum* were described as non-septate (Gams and Holubová-Jechová 1976), 3-septate conidia were seldom observed on recent material from nature. The 3-septate conidia can easily escape our

attention because they are usually attached to the lower part of the conidiophores, the surface of the perithecia or the substratum. The presence of conidial septation, although the septa are formed much later, would argue for placement of the *Chloridium cylindrosporum* anamorph of *Chaet. fusiformis* in *Cylindrotrichum*. Because no applicable and final generic concept of *Cylindrotrichum* is available and the relationships between *Cylindrotrichum* and *Chloridium* require further analysis, we refrain at the moment from making this combination. However, *Chaetosphaeria fusiformis* is considered another member of a group of related species of *Chaetosphaeria* with *Cylindrotrichum* anamorphs.

Chaetosphaeria fusiformis is highly host-specific and occurs seldom, exclusively on decayed wood and bark of coniferous trees. All recent collections were made in regions with natural stands of *Abies alba*.

Of *Chaetosphaeria* species with *Cylindrotrichum* anamorphs, *Chaet. abietis* and *Chaet. crustacea* also occur exclusively on coniferous wood and bark. *Chaet. fusiformis* differs from these two species in having longer, at maturity 3-septate and slightly asymmetrical ascospores that taper towards one end and are rounded at the other end, and the *Chloridium cylindrosporum* anamorph. The ascospores of *Chaet. abietis* and *Chaet. crustacea* are symmetrical and cylindrical-fusiform, 3-septate in the former and 3–5-septate in the latter.

This is the first report of successful cultivating of *Chaet. fusiformis*. The anamorph-teleomorph connection, previously suggested on the basis of the regular joint occurrence, is herewith confirmed.

7. **Chaetosphaeria tulasneorum** Réblová et W. Gams, sp. nov. Figs. 14–16.

Perithecia superficialia, ad basim modice immersa, solitaria vel pauca aggregata, subglobosa vel conica, deorsum applanata, 190–220 μm alta, 185–210 μm diam, minute papillata, ostiolata, fusca, glabra, modice verrucosa. Canalis ostiolaris periphysatus. Paries perithecii fragilis, ad latus et apicem scleroticus, deorsum attenuatus; paries lateralis 26–39 μm crassus, bistratosus: stratum exterius e cellulis tenuitunicatis, fuscis, lateriformibus compositum, interius e cellulis tenuitunicatis, compressis, subhyalinis. Paraphyses copiosae, filiformes, raro septatae, ad septa haud constrictae, ramosae, anastomosantes, reticulum formantes, hyalinae, 12 μm latae in parte inferiore, ultra ascorum apices protrudentes. Asci cylindrici vel clavati, 93.5–115 × 8.5–10.5(–12.5) μm, sursum modice truncati, breviter stipitati, apex anulo I-, refringente, 2 μm lato et 0.5–1 μm alto praeditus, 8-spori. Ascosporae fusiformes, 15.5–20(–21) × 4–5(–6) μm, plerumque bicellulares, sero 2 alteris septis divisa, haud vel paene constrictae in medio, leves, hyalinae, 1–2-seriatae in asco.

Anamorphosis *Cylindrotrichum oligospermum* (Corda) Bonord.

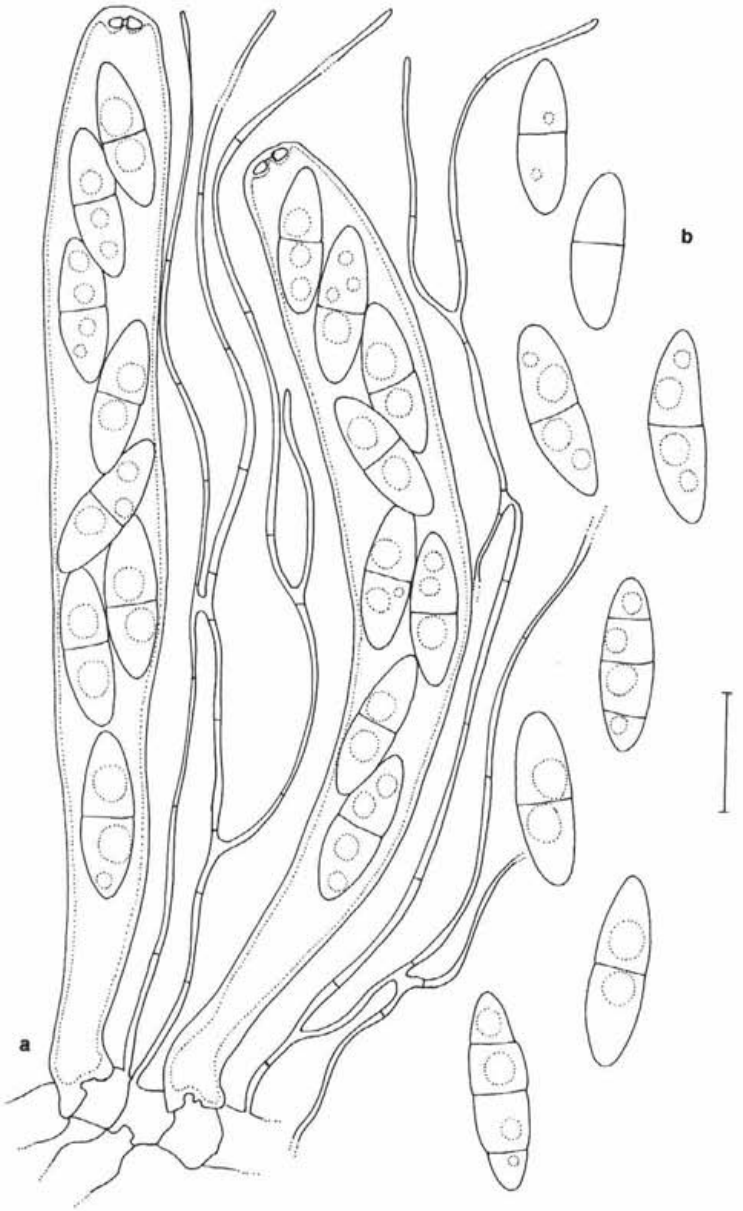

Fig. 14a, b. *Chaetosphaeria tulasneorum.* – a. Asci with ascospores and paraphyses. – b. Ascospores. – a, b from PRM 842978. – Scale bar: a, b = 10 μm.

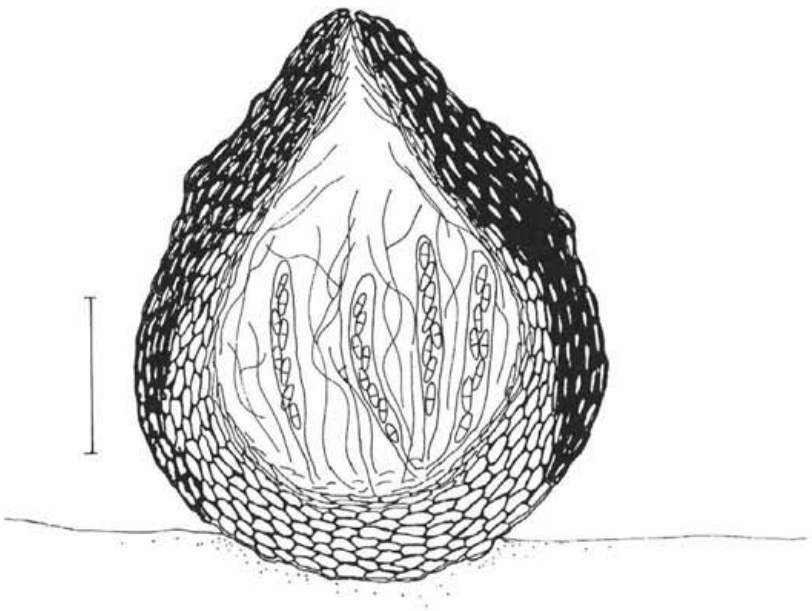

Fig. 15. *Chaetosphaeria tulasneorum.* – Median, longitudinal section of perithecium, note the sclerotisation of the lateral perithecial wall. – From PRM 842978. – Scale bar: 50 μm.

Holotypus. Bohemia meridio-occidentalis, montes Javornická hornatina, Strašín apud Sušice, ad lignum putridum *Sambuci nigrae*, 21 Oct. 1997, leg. M. Svrček (PRM 842978).

Anamorph. **Cylindrotrichum oligospermum** (Corda) Bonord., Handb. allg. Mykol. p. 88, 1851. Fig. 16a–e.

≡ *Menispora oligosperma* Corda, Icon. Fung. 2: 12, 1838.

= *Acrothecium deliculatum* Berk. et Broome, Ann. Mag. nat. Hist., Ser. 3, 15: 402, 1865.

≡ *Cordana deliculata* (Berk. et Broome) O. Kuntze, Rev. Gen. Pl. 2: 850, 1891.

Etymology. Honouring the Tulasne brothers, L.-R. Tulasne and C. Tulasne, who described the genus *Chaetosphaeria*.

Teleomorph. Perithecia superficial, at the base slightly immersed, solitary or in small groups, subglobose to conical, base flattened, 190–220 μm high and 185–210 μm diam, minutely papillate, ostiolate, dark brown, glabrous, slightly verrucose. Perithecial wall brittle, the whole wall heavily sclerotised in the upper part, sclerotisation disappearing towards the bottom and absent at the base.

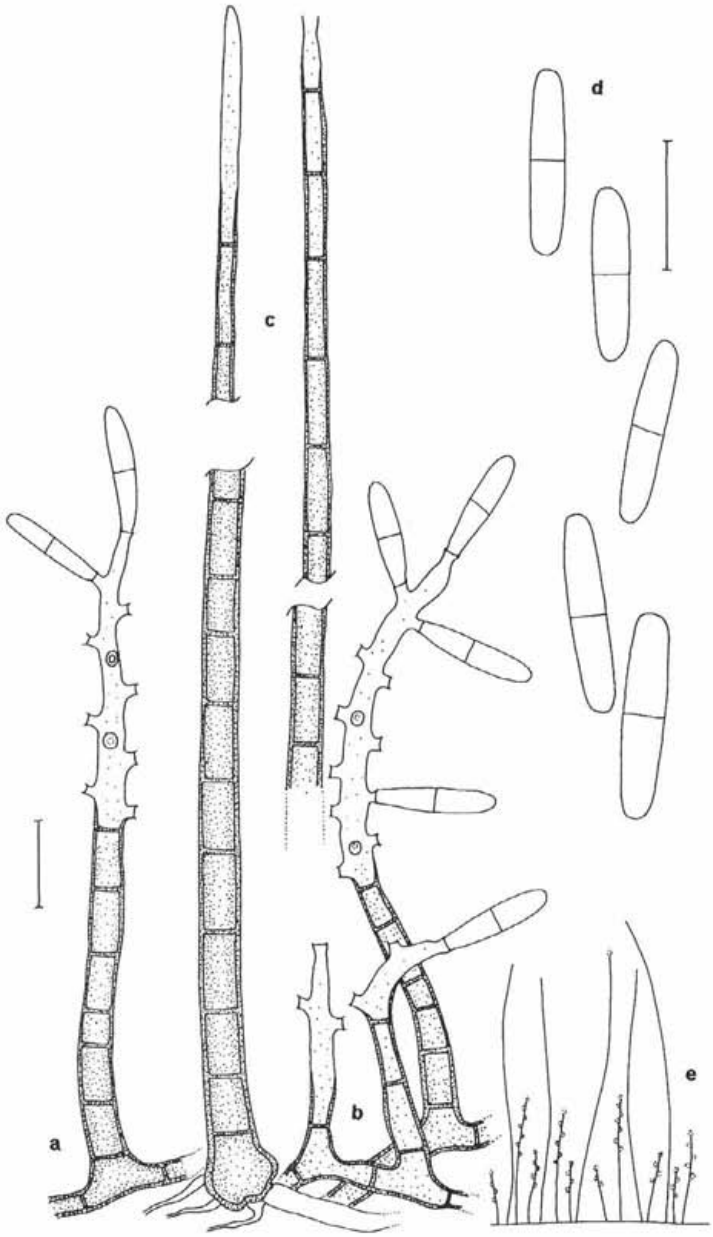

Fig. 16a–e. *Chaetosphaeria tulasneorum.* – a–c. Taller and shorter conidiophores with conidia forming two distinct layers and setae, from PCA culture. – d. Conidia, from PCA culture. – e. Habit sketch of conidiophores and setae. – a–e. from CBS 101319, PRM 842978. – Scale bar: a–d = 10 μm.

Lateral wall 26–39 μm thick, consisting of two layers; an outer layer of thin-walled, dark brown, brick-like cells, and an inner layer of thin-walled, compressed, subhyaline cells. Ostiolar canal periphysate. Paraphyses copious, filiform, sparsely septate, not constricted at the septa, forming a branching network, hyaline, 1–2 μm wide, protruding beyond the tips of the asci. Asci cylindrical to clavate, 93.5–115 × 8.5–10.5(–12.5) μm, slightly truncate at the top, shortly stipitate, ascal apex with a J-, refractive, 2 μm wide and 0.5–1 μm deep apical annulus, 8-spored. Ascospores fusiform, 15.5–20(–21) × 4–5(–6) μm, mostly 2-celled, with a delayed formation of the 2 additional septa, not constricted or slightly constricted at the median septum, smooth, hyaline, 1–2-seriate, partially overlapping in the ascus.

Anamorph. Remnants of shorter and longer conidiophores and setae with broken apices were found growing from the perithecia and from the substratum surface on a decorticated branch of *Sambucus nigra*.

Characteristics in culture. Colonies on PCA slow-growing, reaching 27 mm diam in 10 days at 25 °C in darkness, when grown for another 10 days at 25 °C in cool white fluorescent light reaching 15–16 mm diam; velvety, greyish-yellowish in the centre due to crowded conidiophores, yellowish at the margins, margins fimbriate, thin, aerial mycelium scant, conidiophores scattered, copious conidial production in 10 days, conidial masses whitish; reverse yellow-greyish. CMA, OA: 21–25 mm diam; MEA: 18 mm diam; CMA, OA, MEA: velvety, aerial mycelium scanty, conidial production copious in 10 days; CMA, OA: yellowish to pale brown in the centre due to crowded conidiophores, whitish sterile zone at the margins; MEA: whitish to pale brown in the centre due to crowded conidiophores, withish sterile zone at the margins. Mycelium superficial or immersed; hyphae branched, septate, subhyaline, smooth, 2–3 μm wide. Setae straight, cylindrical, 180–560 μm tall and 3–4.5 μm wide in the middle, tapering to 1.5–2 μm, 5–23-septate, dark brown, paler towards the apex, narrowly rounded at the top or some developing into a monophialide. Conidiophores macronematous, mononematous, solitary, erect, unbranched, arising from both aerial and substrate mycelium, forming two layers. Conidiophores of the lower layer 33–66(–104) μm tall and 3.5–4.5 μm wide in the middle, tapering to 1.5–2.5 μm below the collarette, cylindrical, straight or slightly flexuous, 0–4-septate, subhyaline to pale brown, sympodially proliferating. Conidiophores of the upper layer 180–280 μm tall and 3–4.5 μm wide in the middle, paler towards the apex, tapering to 1.5–2 μm below the collarette, cylindrical, straight or slightly flexuous, 10–12-septate, mid-brown to dark brown, less commonly sympodially proliferating at the top. Phialides integrated, terminal or intercalary, with 6–11 lateral phialidic openings arising from a sympodial elongation, fertile apices 23–47(–57) × 3.5–4(–4.5) μm. Collarettes hyaline, disappearing early, 2–2.5 μm wide and 2–3 μm deep. Conidia phialidic,

cylindrical to clavate, (9–)11–14.5(–17) × (2–) 2.5–3(–4) μm, 1-septate, not constricted, rounded at the tip, tapering and truncate at the base, smooth, hyaline.

Material examined. Type material. Czech Republic. South-western Bohemia, Javornická hornatina Mts., Strašín near Sušice, on wood of a dead branch of *Sambucus nigra*, 21 Oct. 1997, M. Svrček (PRM 842978 – holotype of *Chaetosphaeria tulasneorum*).

Culture. CBS 101319 (Herb. M. R. 1164/97).

Habitat. Saprobe on decayed wood of a shrub.

Known host. *Sambucus nigra*.

Known distribution. Europe: Czech Republic; known only from the type locality.

Note. Shape and septation of the ascospores of *Chaetosphaeria tulasneorum* resemble those of *Chaet. innumera* Berk. et Broome ex Tul. et C. Tul., *Chaet. pulviscula* (Currey) C. Booth and *Chaet. ovoidea* (Fr.) O. Constant. et al., but the ascospores are longer than those of the first and shorter than those of the two latter species. *Chaet. tulasneorum* is also distinct in the *Cylindrotrichum oligospermum* anamorph and the occurrence on decorticated wood of an angiosperm shrub. The lateral perithecial wall has a very characteristic sclerotisation that was not observed in any other *Chaetosphaeria* species.

We are not aware of any report of a *Cylindrotrichum oligospermum* anamorph isolated from ascospores of any pyrenomycetous ascomycete. The connection to the teleomorph is reported here for the first time by a culture study. The conidiophores obtained in the living culture formed two layers of taller and shorter conidiophores accompanied by much longer setae. The upper layer of conidiophores was observed neither on the natural substratum nor in culture by Gams and Holubová-Jechová (1976). In all other respects our isolate of *Cyl. oligospermum* agrees well with the observations of Gams and Holubová-Jechová (1976) and Barron (1968).

The size of setae, shorter conidiophores, phialides, collarettes and conidia are given from the original culture of *Cyl. oligospermum* obtained immediately after the isolation from ascospores. The description of taller conidiophores that have 8–11 lateral phialidic openings is given from an older culture after several transfers. In the original culture fertile apices with well-developed lateral phialidic openings were hardly seen.

DISCUSSION

The division of *Cylindrotrichum* into five genera, viz. *Chaetopsis*, *Dictyochaeta, Kylindria, Xenokylindria* and *Uncigera*, and their delimitation proposed by DiCosmo et al. (1983), seems to be rather schematic, apparently disregarding

natural units. *Chaetopsis grisea* (Ehrenb.) Sacc. has holoblastic conidiogenesis and a predominantly lateral branching pattern of the conidiophores unlike *Cylindrotrichum oligospermum* and is regarded as representing a distinct genus. *Uncigera cordae* Sacc. cannot be separated from *Cylindrodendrum album* Bonord. (W. Gams, unpublished), as redescribed by Buffin and Hennebert (1984). The remaining genera are very closely related indeed. *Cylindrotrichum* is closest to *Chloridium* Link: Fr., from which it is merely separated by conidial septation and shape. Conidia in *Cylindrotrichum* are 1- to multi-septate, usually cylindrical to long-ellipsoidal, straight or slightly curved and truncate at the base. Conidia of *Chloridium* are non-septate, generally shortly ellipsoidal, rarely fusiform to clavate (*Chloridium codinaeoides* Pirozynski) or shortly catenate to dacryoid [*Chloridium clavaeforme* (Preuss) W. Gams et Hol.-Jech.] or reniform (*Chloridium reniforme* Matsushima). But longer ellipsoidal conidia have also been described, e.g. in *Chloridium matsushimae* W. Gams et Hol.-Jech. (1976: 29). Thus the anamorphs of *Chaetosphaeria crustacea* and *Chaet. fusiformis* might be classified in either genus. *Cylindrotrichum* accommodates species with both sympodial and percurrent proliferation of the conidiophores (Cabello and Arambarri 1988); *Cyl. oligospermum* (Corda) Bonord., the type species of the genus, has sympodially proliferating conidiophores with numerous lateral phialidic openings, the conidiophores are accompanied by sterile setae and the conidiogenesis is multiple from different loci within a collarette. The presence of percurrent besides sympodial conidiophore proliferation would argue for distinguishing two sections within *Cylindrotrichum*, comparable with the situation in *Chloridium*. *Chloridium* was divided into three sections (Gams and Holubová-Jechová 1976), viz. species with sympodial proliferation of conidiophores with single conidiogenous loci (sect. *Psilobotrys*), and percurrent proliferation of conidiophores with multiple (sect. *Chloridium*) or single conidiogenous loci (sect. *Gongromeriza*). Species of both *Cylindrotrichum* and *Chloridium* are currently associated with *Chaetosphaeria* and *Melanopsammella* Höhnel species (Booth 1957, 1958; Gams and Holubová-Jechová 1976; Réblová et al. 1999).

The conidiogenesis of the *Cacumisporium capitulatum* anamorph of *Chaetosphaeria decastyla* is identical to that of the *Cylindrotrichum* anamorph of *Chaet. acutata*, the *Cylindrotrichum* anamorph of *Chaet. crustacea*, and the *Chloridium virescens* (sect. *Chloridium*) anamorph of *Melanopsammella vermicularioides* (Sacc. et Roum.) Réblová et al. (Réblová et al. 1999). However, the conidiophores of *Cac. capitulatum* proliferate percurrently and the conidia are 3-septate and bicolorous. The conidia are formed successively from multiple conidiogenous loci on the sporogenous apex of the percurrently proliferating conidiogenous cell. The conidia mature after being liberated and usually remain attached to the conidiophores separately or in groups of 2–3. In the *Cylindrotrichum* anamorph of *Chaet. acutata* and the *Cac. capitulatum* anamorph of *Chaet. decastyla* the

sporogenous apex of the conidiogenous cell has a similar function and structure as in *Xenokylindria* if a generic separation were required (DiCosmo et al. 1983).

Nine genera have been described for anamorphs of *Chaetosphaeria* (Réblová et al. 1999). In the present paper *Cacumisporium* is introduced as another anamorph genus. The anamorph genera of *Chaetosphaeria* are more or less closely related to each other and require further analysis. Until this has been done, we retain the Saccardoan treatment for them. In Saccardo's (1886) scheme conidial septation was a major criterion and thus we retain *Chloridium, Cylindrotrichum*, and *Cacumisporium* for the time being as separate though very closely related taxa.

ACKNOWLEDGMENTS

We wish to thank the Directors and Curators of the H, NY, PAD and PRM herbaria for loaning material. We are grateful to Dr. Mirko Svrček for providing the Latin diagnosis of *Chaetosphaeria acutata*. This project was partly supported by the Grant Agency of Charles University in Prague (26266/96), Grant "Centres of Biological Diversity in the Šumava Mts. Biosphere Reserve" from the World Bank supported by GEF (Global Environment Facility) and by the Grant "Monitoring of lignicolous Ascomycetes in glacial cirques of the lakes in Šumava Mts." of Agency for nature conservation and landscape protection.

REFERENCES

BARR M. E. (1990): Prodromus to non-lichenized, pyrenomycetous members of class Hymenoascomycetes. – Mycotaxon 39: 43–184.

BARR M. E. (1993): Redisposition of some taxa described by J. B. Ellis. – Mycotaxon 46: 45–76.

BARR M. E. and CRANE J. L. (1979): Another conidial state for a species of Chaetosphaeria. – Can. J. Bot. 57: 835–837.

BARRON G. L. (1968): The Genera of Hyphomycetes from soil. – Williams and Wilkins Co., Baltimore, 364 pp.

BERLESE A. N. (1894): Icones fungorum omnium hucusque cognitorum. Vol. 1. (Reprint Biblioth. Mycol. 16A: 1–243.).

BOOTH C. (1957): Studies on pyrenomycetes I. and II. – Mycol. Pap. 68: 1–27.

BOOTH C. (1958): The genera Chaetosphaeria and Thaxteria in Britain. – Naturalist 1958: 83–90.

BUFFIN N. and HENNEBERT G. L. (1984): Cylindrodendrum album Bonorden, a pleoanamorphic semiaquatic hyphomycete. – Mycotaxon 19: 323–341.

CABELLO M. and ARAMBARRI A. (1988): Considerations about the validity of the genus Cylindrotrichum Bonorden. – Mycotaxon 31: 435–438.

CLEMENTS F. E. and SHEAR C. L. (1931): The genera of fungi. – New York, 496 pp.

CONSTANTINESCU O., HOLM K. and HOLM L. (1995): Teleomorph-anamorph connections in Ascomycetes: the anamorphs of three species of Chaetosphaeria. – Mycol. Res. 99: 585–592.

COOKE M. C. (1878): Ravenel's American Fungi. – Grevillea 7: 32–54.

DICOSMO F., BERCH S. and KENDRICK W. B. (1983): Cylindrotrichum, Chaetopsis, and two new genera of hyphomycetes, Kylindria and Xenokylindria. – Mycologia 75: 949–973.

ELLIS J. B. and EVERHART B. M. (1892): North American Pyrenomycetes. – Newfield, 793 pp. (Reprinted 1966).

ERIKSSON O. E. and HAWKSWORTH D. L. (1993): Outline of the Ascomycetes – 1993. – Syst. Ascom. 12: 51–257.

GAMS W. and HOLUBOVÁ-JECHOVÁ V. (1976): Chloridium and some other dematiaceous hyphomycetes growing on decaying wood. – Stud. Mycol. 13: 1–99.
GAMS W. and HOLUBOVÁ-JECHOVÁ V. (1981): Chloridium and some other dematiaceous hyphomycetes growing on decaying wood. Corrections and additions. – Mycotaxon 13: 257–258.
GOOS R. D. (1969): Conidium ontogeny in Cacumisporium capitulatum. – Mycologia 61: 52–56.
GREUTER W. et al. (1994): International Code of Botanical Nomenclature. – Regnum Vegetabile 131: [1–18], 1–389.
HAWKSWORTH D. L. and MINTER D. W. (1980): New and interesting microfungi from the 1978 Exeter Foray. – Trans. Brit. Mycol. Soc. 74: 567–577.
HÖHNEL F. VON (1909): Fragmente zur Mykologie 7. – Sitzungsber. K. Akad. Wiss. Wien, Math.-naturw. Kl. 118: 275–452.
HOLMGREN P. K., HOLMGREN N. H. and BARNETT L. C. (1990): Index herbariorum. Part I: The herbaria of the world. Eighth edition. – Regnum Vegetabile vol. 120, p.(1)-(10), 1–693, New York.
HOLUBOVÁ-JECHOVÁ V. (1973): Lignicolous hyphomycetes from Czechoslovakia 4. Menispora. – Folia Geobot. Phytotax. 8: 317–336.
HOLUBOVÁ-JECHOVÁ V. (1982): New or interesting phialidic hyphomycetes from Cuba. – Mycotaxon 15: 277–292.
HOLUBOVÁ-JECHOVÁ V. (1984): Lignicolous hyphomycetes from Czechoslovakia 7. Chalara, Exochalara, Fusichalara and Dictyochaeta. – Folia Geobot. Phytotax. 19: 387–438.
HOLUBOVÁ-JECHOVÁ V. (1990): Problems in the taxonomy of the dematiaceous hyphomycetes. – Stud. Mycol. 32: 41–48.
HUGHES S. J. (1951): Stachylidium, Gonytrichum, Mesobotrys, Chaetopsis and Chaetopsella. – Trans. Brit. Mycol. Soc. 34: 551–576.
HUGHES S. J. and KENDRICK W. B. (1968): New Zealand fungi 12. Menispora, Codinaea, Menisporopsis. – New Zealand J. Bot. 6: 323–375.
KARSTEN P. A. (1873): Mycologia fennica, pars secunda. – Bidr. Känn. Finl. Nat. Folk 23: 1–252.
KARSTEN P. A. (1887): Ascomycetes novi fennici. – Rev. Mycol. Toulouse 9: 159–177.
KENDRICK W. B. (1980): The generic concept in Hyphomycetes – a reappraisal. – Mycotaxon 11: 339–364.
MORGAN-JONES G. (1977): Notes on Hyphomycetes XVIII. Chaetoblastophorum ingramii gen. et sp. nov. and Cylindrotrichum oblongisporum. – Mycotaxon 5: 484–490.
MORGAN-JONES G. (1980): Notes on Hyphomycetes XXXIX. Cylindrotrichum curvatum sp. nov. – Mycotaxon 12: 249–252.
MÜLLER E. and ARX J. A. VON. (1962): Die Gattungen der didymosporen Pyrenomyceten. – Beitr. Krypt.-Fl. Schweiz 11(2): 1–922.
PODLAHOVÁ R. (1974): Lignicolous members of the Lasiosphaeriaceae (Fuck.) Nannf. I, II. – 320 pp., ms. in Czech, [PhD thesis; deposited in: Fac. Nat. Sci., Charles University, Prague].
RÉBLOVÁ M. (1998a): A new Chaetosphaeria with a Dictyochaeta anamorph. – Czech Mycol. 50: 151–159.
RÉBLOVÁ M. (1998b): Revision of three Melanomma species described by L. Fuckel. – Czech Mycol. 50: 161–179.
RÉBLOVÁ M. (1998c): Studies in Chaetosphaeria sensu lato III. The genera Umbrinosphaeria gen. nov. and Miyoshiella with Sporidesmium anamorphs. – Mycotaxon 71 (in press).
RÉBLOVÁ M., BARR M. E. and SAMUELS G. J. (1999): Chaetosphaeriaceae, a new family for Chaetosphaeria and its relatives. – Sydowia (in press).
REHM H. (1907): Ascomycetes novi. – Ann. Mycol. 5: 516–546.
SACCARDO P. A. (1875): Fungi Veneti novi vel critici. Serie 3. – Hedwigia 14: 68–76.
SACCARDO P. A. (1878): Fungi Veneti novi vel critici. Serie 3. – Michelia 1: 446–452.
SACCARDO P. A. (1883): Pyrenomyceteae. Sylloge Fungorum omnium hucusque cognitorum 2: 1–813, Padova.
SACCARDO P. A. (1886): Hyphomyceteae. – Sylloge Fungorum omnium hucusque cognitorum 4: 1–807, Padova.
SACCARDO P. A. (1891): Supplementum universale. – Sylloge Fungorum omnium hucusque cognitorum 9: 1–1141, Padova.
TULASNE L. R. and TULASNE C. (1863): Selecta Fungorum Carpologia, Vol. 2. – Paris, 319 pp.
WINTER G. (1887): Die Pilze, Ascomyceten: Gymnoasceen und Pyrenomyceten. – In: Rabenhorst's Kryptogamen-Flora Deutschl., Österr. und der Schweiz, 2nd ed., Band 2, 1(2): 1–928, Leipzig.

CZECH MYCOL. 51 (1), 1999

Revision von Velenovskýs Galera-Arten, die den Gattungen Conocybe und Pholiotina angehören

ANTON HAUSKNECHT

Sonndorferstraße 22, A-3712 Maissau, Österreich

Hausknecht A. (1998): Revision of Velenovský's species of the genus Galera which belong to the genera Conocybe and Pholiotina – Czech Mycol. 51: 41–70

All species of Galera described by Velenovský and belonging to the genera Conocybe and Pholiotina are critically revised. Of 31 species cited in Velenovský's papers many are considered dubious, the herbarium material being in a too bad state to allow a correct interpretation; in a number of cases such material is even not existing. Two species are described as new, nine new combinations are proposed and six species are reduced to synonyms.

Key words: Agaricales, Bolbitiaceae, *Galera, Conocybe, Pholiotina*, Velenovský, J. – Mycoflora of the Czech Republic.

Hausknecht A. (1998): Revision von Velenovskýs Galera-Arten, die den Gattungen Conocybe und Pholiotina angehören – Czech Mycol. 51: 41–70

Alle von Velenovský als Galera beschriebenen Arten, die den Gattungen Conocybe oder Pholiotina zuzuordnen sind, werden revidiert. Von den 31 in seinen Arbeiten aufgeführten Arten werden viele – meist weil das Herbarmaterial in zu schlechtem Zustand für eine korrekte Interpretation ist oder fehlt – als zweifelhaft eingestuft; zwei neue Arten werden beschrieben und neun Neukombinationen werden vorgeschlagen, sechs Arten werden als Synonyme erkannt.

Hausknecht A. (1998): Revize Velenovského druhů rodu Galera náležejících do rodů Conocybe a Pholiotina – Czech Mycol. 51: 41–70

Byly revidovány všechny druhy, které popsal Velenovský v rodu *Galera* a které dnes patří do rodů *Conocybe* nebo *Pholiotina*. Z 31 druhů, které Velenovský uvádí ve svých publikacích, mnohé autor pokládá za pochybné vzhledem k tomu, že dokladový materiál je v příliš špatném stavu, aby umožnil správnou interpretaci; v mnoha případech takový materiál vůbec neexistuje. Dva druhy jsou zde popsány jako nové, je navrženo 9 nových kombinací a 6 druhů je považováno za synonyma.

In seinen drei wichtigsten Werken (Velenovský 1920–1922, 1940, 1947) hat Velenovský über 2000 neue Arten von Basidio- und Ascomyceten beschrieben, darunter 74 Arten in der Gattung *Galera*, die in der aktuellen Systematik den Gattungen *Agrocybe, Conocybe, Galerina, Phaeogalera, Pholiotina* und in Einzelfällen sogar noch anderen Gattungen zugeordnet werden. In der vorliegenden Arbeit werden all jene Taxa, bei denen auf Grund der Beschreibung Velenovskýs, von Literaturzitaten basierend auf früheren Revisionen oder infolge sonstiger Hinweise der Verdacht bestand, daß sie in die Gattungen *Conocybe* und *Pholiotina* gehören, kritisch untersucht. Bei einigen Herbarbelegen lagen bereits Revisionszettel von Singer und auch Svrček bei, wobei allerdings nur wenige Ergebnisse von Singer

(1989) bzw. Singer und Hausknecht (1988) bisher publiziert worden sind. Die von Svrček erzielten Resultate wurden mit den Analysen des Autors abgestimmt und sind in der vorliegenden Arbeit integriert.

Es war zu erwarten, daß der überaus fleißige und vielseitige Sammler und Neubeschreiber Velenovský auch die häufigsten Arten von *Bolbitiaceae*, die in seinem Sammelgebiet vorkommen, in Händen gehabt und sie zum Großteil als neue Arten angesehen haben mußte. Nachdem Kühner (1935) in seiner grundsätzliche *Galera*-Arbeit fast alle Conocyben ungültig beschrieben hat (ohne lateinische Diagnose) und diese oft erst viel später validiert wurden, haben in den meisten Fällen die von Velenovský publizierten Taxa Priorität. Die Frage war in den Einzelfällen daher vor allem, ob das derzeit noch vorhandene Material, in Abstimmung mit der makroskopischen Typusbeschreibung, eine vertretbare Interpretation zuläßt. Die von Velenovský publizierten mikroskopischen Daten sind bekannterweise zu ungenau und die Meßangaben oft unrichtig, sodaß nur die vom Autor selbst am Originalmaterial vorgenommenen mikroskopischen Untersuchungen (in Abstimmung mit den Messungen von Svrček) berücksichtigt werden durften.

Zusammenfassend ist zu bemerken, daß in der vorliegenden Arbeit zwei Arten, *Conocybe microrrhiza* Hauskn. und *Conocybe pragensis* Hauskn., neu beschrieben werden, und weiters folgende Neukombinationen vorgeschlagen werden: *Conocybe brachypodii* (Velen.) Hauskn. et Svrček, *Conocybe dumetorum* (Velen.) Svrček var. *laricina* (Kühn.) Hauskn., *Conocybe microrrhiza* var. *tetraspora* (Singer et Hauskn.) Hauskn., *Conocybe microrrhiza* var. *parvispora* (Hauskn.) Hauskn., *Conocybe pulchella* (Velen.) Hauskn. et Svrček, *Conocybe rostellata* (Velen.) Hauskn. et Svrček, *Conocybe velutipes* (Velen.) Hauskn. et Svrček, *Pholiotina rimosa* (Velen.) Hauskn. et Svrček und *Pholiotina velata* (Velen.) Hauskn. Für *Conocybe microspora* (Velen.) Dennis wird ein Neotypus benannt. Zu allen untersuchten Kollektionen werden Mikrozeichnungen vom Originalbeleg beigegeben.

Galera albipes Velen., Novitates mycologicae 1940: 128. Abb. 1a-d

Material: Böhmen, auf dem Hügel Budíkov, 16. 8. 1939 (PRM 153767, Holotypus).

Mikroskopische Eigenschaften: Sporen: 6,8–8,7 × 4,0–4,8 μm, im Mittel 7,8 × × 4,4 μm, ellipsoidisch, nicht lentiform, dünnwandig mit deutlichem, teils über 1 μm breitem Porus, hell gelbbraun in KOH, teilweise in Tetraden. Basidien: 4-sporig, 13–18 × 6–7,5 μm. Cheilozystiden: 15–22 × 6–11 μm, mit 4–5,3 μm breitem Köpfchen. NH3-Reaktion auch nach 10 Stunden negativ. Stielbekleidung: fast nur aus lecythiformen Zystiden ähnlich den Cheilozystiden bestehend. Huthaut: hymeniform aus rundlich-gestielten Elementen.

Galera albipes ist konspezifisch mit *Galera brachypodii* und hätte gegenüber letzterer Priorität. Das Epitheton *albipes* kann aber in der Gattung *Conocybe* nicht verwendet werden, da *Bolbitius albipes* Otth ein früherer Name für *Conocybe lactea*

(Lange) Métrod ist und bereits gültig in *Conocybe albipes* (Otth) Hausknecht umkombinier wurde (Hausknecht 1998). Bezüglich weiterer Bemerkungen hiezu siehe bei *Galera brachypodii*.

Galera apala Fr. 1821, České houby 1921: 539 (mit SW-Abbildung)

Material: nicht mehr vorhanden in PRC.

Die Beschreibung und vor allem die dazugehörige Zeichnung lassen keinen Zweifel offen, daß dies *Conocybe albipes* (Otth) Hauskn. [= *C. lactea* (Lange) Métrod] ist.

Galera brachypodii Velen., Novitates mycologicae novissimae 1947: 67. Abb. 1 e-h

Material: Böhmen, Mnichovice, Jidášky, 2. 9. 1941 (PRM 153778, Holotypus).

Mikroskopische Eigenschaften: Sporen: 6,8–10,3 × 4–4,8 µm, im Mittel 8,2 × × 4,5 µm, ellipsoidisch, nicht plattgedrückt, dünnwandig mit deutlichem Porus (unter 1 µm breit), in KOH gelbbraun. Basidien: 4-sporig, 15–20 × 7–9 µm. Cheilozystiden: lecythiform, 17–23 × 6–12 µm, mit 3,5–5 µm breitem Köpfchen. Stielbekleidung: fast nur aus lecythiformen Zystiden ähnlich den Cheilozystiden zusammengesetzt. Huthaut: hymeniform aus rundlich-pedunculaten Elementen.

Diese Sippe ist dem Autor gut bekannt, er hat sie bisher als "zarte Form" von *Conocybe excedens* Kühn. und Watling var. *pseudomesospora* Singer und Hausknecht aufgefaßt, obwohl einige makroskopische Abweichungen vorhanden sind (siehe dazu Singer und Hausknecht 1992). Jedenfalls ist die gültige Publikation von *Galera brachypodii* älteren Datums, ganz egal ob sie sich in Zukunft als eigenständige Art, als Varietät bzw. Form oder sogar konspezifisch mit der bisherigen *C. excedens* erweisen sollte. Folgende Neukombination wird vorgeschlagen:

Conocybe brachypodii (Velen.) Hausknecht und Svrček, comb. nova

Basionym: *Galera brachypodii* Velen., Novitates mycologicae novissimae: 1947: 67

Synonym: *Galera albipes* Velen., Novitates mycologicae: 1940: 128

Galera bulbosa Velen., České houby 1921: 543. Abb. 2 a-e

Material: Böhmen, Roblín, Juli 1918 (PRC, Holotypus, ausgesondert aus Flasche 440).

Mikroskopische Eigenschaften: Sporen 7,2–10,5 × 4,4–6 µm, im Mittel 9,0 × × 5,4 µm, bei einem Fragment 6,5–7,5 × 4–4,7 µm, im Mittel 7,0 × 4,4 µm, ellipsoidisch, nicht lentiform, mit leicht doppelter Wand und deutlichem Porus, relativ hell gelbbraun in KOH. Basidien: 4-sporig, 20–26 × 7–11 µm. Cheilozystiden (vom Fragment mit den größeren Sporen): lecythiform, 15–24 × 5–9 µm,

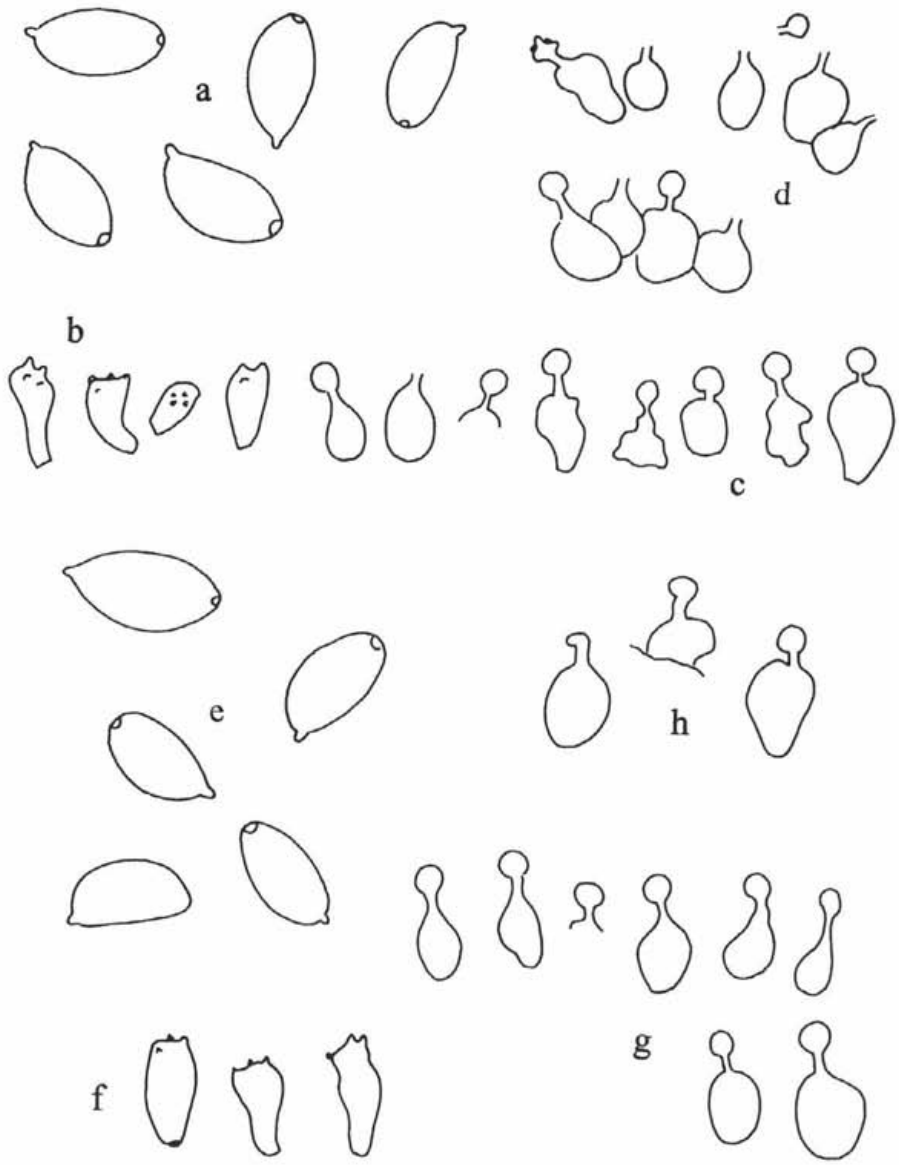

Abb. 1. a-d *Galera albipes* (PRM 153767, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Stielbekleidung, × 800. **Abb. 1. e-h** *Galera brachypodii* (PRM 153778, Holotypus); e Sporen, × 2000; f Basidien, × 800; g Cheilozystiden, × 800; h Stielbekleidung, × 800.

mit 3,7–4,5 µm großen Köpfchen. Stielbekleidung: stark kollabiert, einige spindelige bis unregelmäßig länglich-rundliche Zellen vorhanden, keine lecythiformen Zystiden beobachtet. Huthaut: hymeniform aus rundlich-gestielten Elementen, 30–45 × × 15–24 µm.

Der Typus könnte eine gemischte Sammlung aus zwei verschiedenen Arten beinhalten, leider ist nur mehr bei einem Fragment ein Stielstummel vorhanden. Singer (1951: 435) kombiniert die Art in *Conocybe bulbosa* (Velen.) Singer um, mit dem Hinweis auf eine mögliche Konspezifität zu *Conocybe mairei* Kühner und *Galera tenera* var. *hyalopoda* Bresadola. Diese vermutete Konspezifität mit *Pholiotina mairei* stimmt zumindest auf jenen Teil des Beleges nicht, bei dem kopfige Cheilozystiden gefunden wurden. In Anbetracht der Inhomogenität des Materials und auch seines schlechten Zustandes ist es wohl besser, *C. bulbosa* als zweifelhafte Art zu betrachten.

Eine weitere Kollektion Velenovskýs unter dem Namen *Galera bulbosa*, Mnichovice, Robinienwald, Juli 1940 (PRM 153781, Abb. 2 g-j), hat folgende Mikromerkmale: Sporen: 6,4–10 × 4–5,2 µm, im Mittel 8,0 × 4,6 µm, ellipsoidisch, dünnwandig mit deutlichem Porus (unter 1 µm breit). Basidien: wahrscheinlich 4-sporig. Cheilozystiden: lecythiform, bis 20 × 9,5 µm, mit Köpfchen bis 5 µm. Stiel: zwar oft kollabierte, aber deutlich lecythiforme Zystiden ähnlich den Cheilozystiden.

Diese Kollektion gehört einer ganz anderen Sektion an und hat mit Ausnahme der Sporengröße nichts mit dem Typusmaterial gemeinsam. Sie stimmt mikroskopisch exakt mit *Galera albipes* bzw. *G. brachypodii* überein.

Galera conferta Bolt. 1791, České houby 1921: 544, (mit SW-Abbildung).
Abb. 3 a-e

Material: Böhmen, Prag, Botanischer Garten, November 1914 (PRC, Flasche 501).

Mikroskopische Eigenschaften: Sporen: 11–15,2 × 7,6–9,8 µm, im Mittel 13,7 × × 8,8 µm, eiförmig-ellipsoidisch mit großem Apiculus, nicht linsenförmig breitgedrückt, extrem dickwandig (1,5–2 µm), mit großem, um 1 µm breitem Porus, stumpf gelb– bis dunkelrotbraun in KOH, mit rötlicher Wand; keine Makro– und Mikrosporen untermischt. Basidien: 2-sporig, 20–26 × 7–10 µm. Cheilozystiden: lecythiform, 11–19 x 4,5–8,5 µm, mit 2,5–4,5 µm großen Köpfchen. Stielbekleidung: nur aus lecythiformen Elementen bestehend, diese oft haarförmig dünn mit deutlichem Köpfchen, auch schlank lecythiform, 18–26 × 2–9 µm, Köpfchen mit 2–4 µm Durchmesser. Huthaut: hymeniform, aus rundlich-gestielten Elementen (bis 32 × 20 µm).

Diese Kollektion stellt eine eigenständige, bisher nicht beschriebene Sippe dar und wird nachfolgend als neue Art beschrieben:

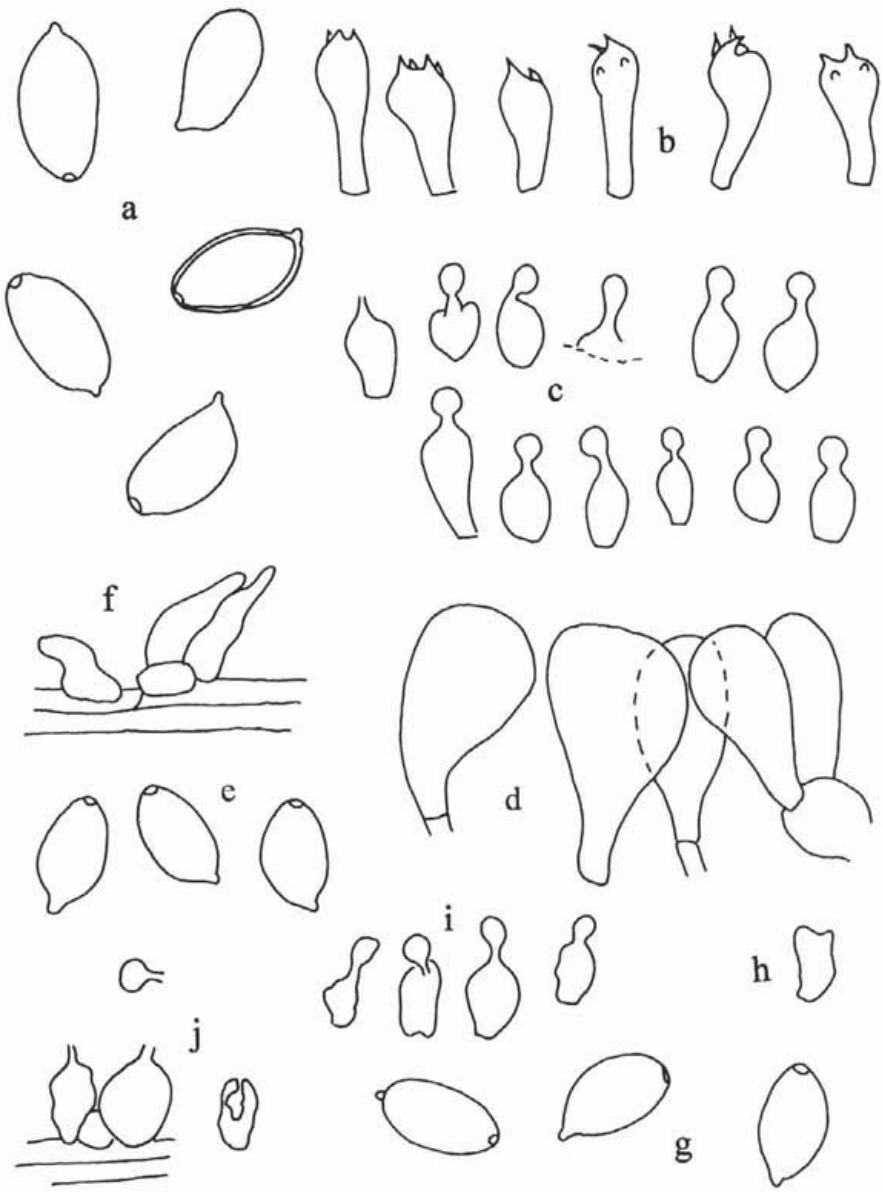

Abb. 2. a-e *Galera bulbosa* (PRC, aus Flasche 440, Holotypus). a-d stielloses Hutfragment: a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Huthaut, × 800. e-f Fragment mit Sitelstummel: e Sporen, × 2000; f Stielbekleidung, × 800. **Abb. 2. g-j** *Galera bulbosa* (PRM 153781); g Sporen, × 2000; h kollabierte Basidie, × 800; i Cheilozystiden, x 800; j Elemente der Stielbekleidung, × 800.

Conocybe pragensis Hausknecht, spec. nova
= *Galera conferta* Bolt. ss. Velenovský 1921: 544

Diagnosis latina

Pileus 20–30 mm latus, campanulato-convexus, saepe flexuosus, distincte obtuse umbonatus, pallide ochraceus, non hygrophanus, non striatus. Superficies circum umbonem radiato-rugosa. Lamellae infirme adnatae, mox liberae, non latae, insigniter confertae, pallide ochraceae. Stipes (sine radice) ca. –35 mm longus, 3–5 mm latus, radice firmo, –55 mm longo, albus (radix pallide ochracea), superficies rimoso-striata pruinosa. Caro firma, pileo distincte crassa. Sporae 11–15,2 × × 7,6–9,8 μm, ellipsoideae, guttiformes, non lentiformes, crassetunicatae, pariete 1,5–2 μm crasso, poro germinativo distincto (ca. 1 μm lato), ochraceo-ferrugineae usque rufobrunneae, pariete rubescente in KOH. Basidia bispora, 20–26 × 7–10 μm. Fibulae desunt. Cheilocystidia lecythiformia, 11–19 × × 4,5–8,5 μm, capitulo 2,5–4,5 μm lato. Stipitipellis solum elementis lecythiformibus saepe haud ventricosis, sed anguste cylindricis distincte capitatis, 18–26 × 2–9 μm. Pileipellis hymeniformis, e cellulis sphaericis ad 32 × 20 μm latis. Ad stratum fimi, gregarius.

Typus: Bohemia, Prag, Hortus Botanicus, November 1914, J. Velenovský legit (PRC 501, holotypus).

Singer und Hausknecht (1988) glaubten zunächst, daß *Galera conferta* ss. Velenovský identisch mit *Conocybe neoantipus* (Atk.) Singer sei. Der Autor hat jedoch inzwischen nachgewiesen (Hausknecht 1996), daß der Typus von *C. neoantipus* aus wahrscheinlich drei verschiedenen Arten besteht und dieses Taxon deshalb nicht interpretierbar ist. Zusätzlich steht fest, daß die Kollektion aus Prag mit keiner der drei im Typusmaterial von *C. neoantipus* inkludierten Sippen konspezifisch sein kann.

Sie unterscheidet sich von der ebenfalls wurzelnden *Conocybe alboradicans* Arnolds und ihrer var. *carinthiaca* (Singer und Hauskn.) Hauskn. durch nicht hygrophanen, viel helleren, semmelfarbigen Hut, viel kräftigere Gestalt mit dickerem, länger wurzelndem Stiel ("Wurzel bis fünfmal länger") und als hart bezeichnetes Fleisch. Die Sporenmaße der beiden Arten sind annähernd gleich, die neue Art ist aber auf Grund der Sporen mit mehr als doppelt so dicken Wänden und viel gleichförmigerer Gestalt, Fehlen von Makrosporen und viel schlankeren und zarteren Stielzystiden mikroskopisch klar verschieden.

Es gibt in Europa bisher nur zwei Vertreter der Gattung *Conocybe*, die ähnlich langwurzelnde Stiele haben, nämlich *Conocybe watlingii* Hausknecht und *Conocybe fiorii* (Saccardo) Watling (von welcher 1997 ein Neufund gelang – siehe Hausknecht und al. 1998). Erstere wächst direkt auf Dung und hat noch größere, viel dünnwandigere Sporen, 4-sporige Basidien und eine andere

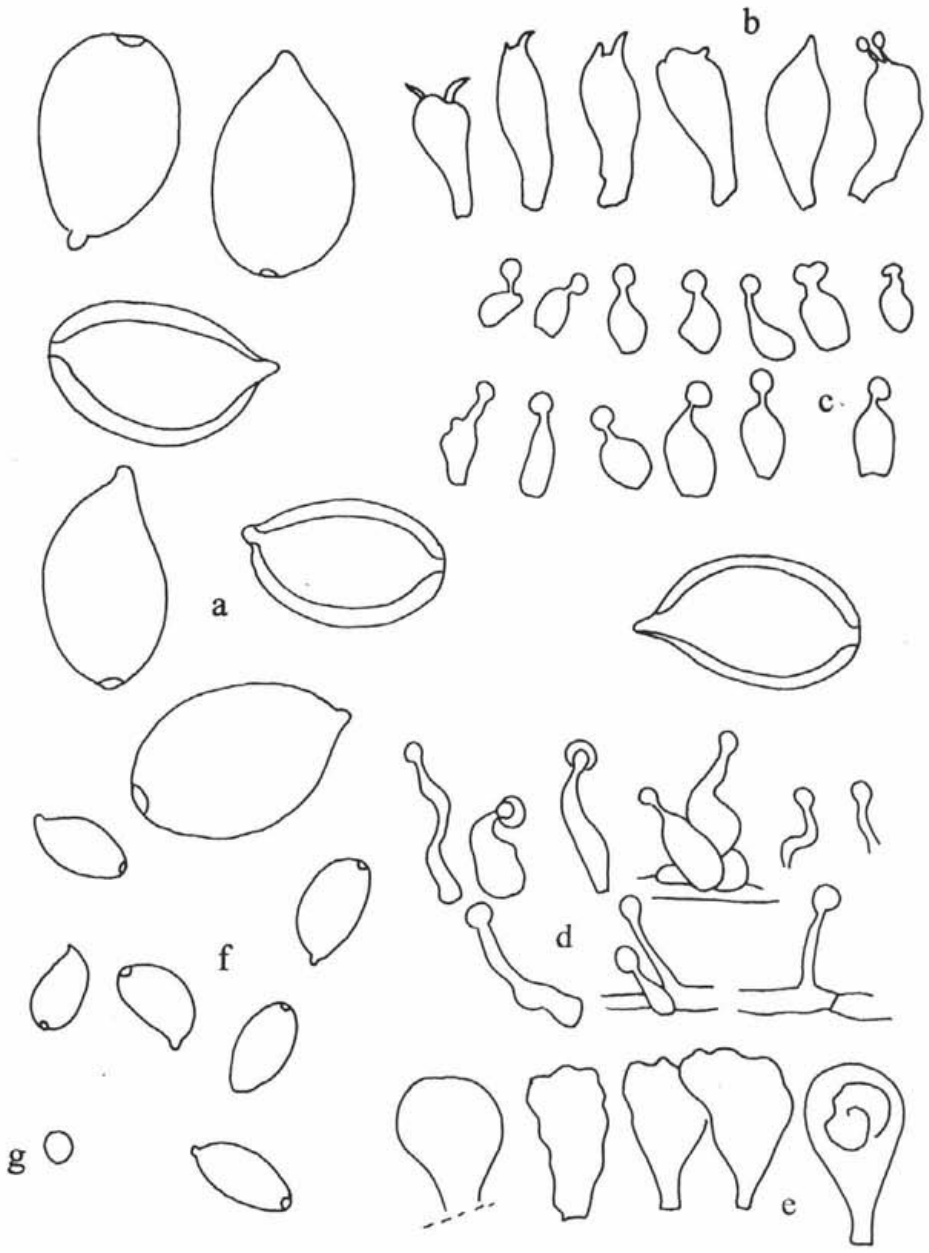

Abb. 3. a-e *Galera conferta* (PRC Flasche 501, Holotypus von *Conocybe pragensis*); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Stielbekleidung, × 800; e Elemente der Huthaut, × 800. **Abb. 3. f-g** *Galera dumetorum* (PRC, aus Flasche 78 g, Lektotypus); f Sporen, × 2000; g Köpfchen einer Cheilozystide (?), × 800.

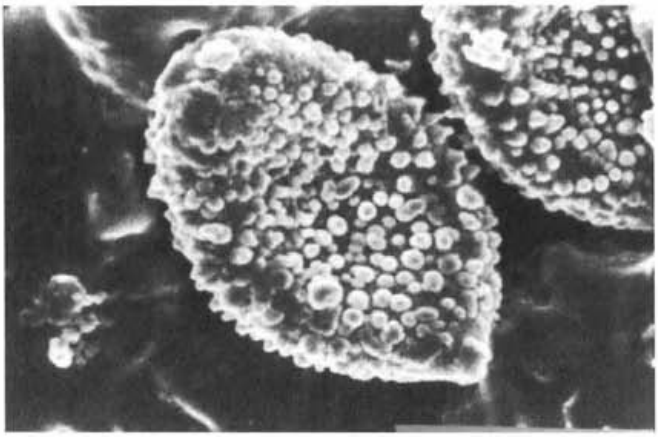

Abb. 3. h *Galera dumetorum* (PRC, aus Flasche 78 g, Lektotypus); Spore, × 10000.

Stielbekleidung sowie eher nördliche Verbreitung (siehe dazu Hausknecht 1996: 193), die zweitgenannte Art ist bisher nur aus Italien bekannt, wächst direkt im Sand, ihre Sporen haben Wände von maximal 0,5 µm Dicke und einen viel größeren Keimporus, weiters hat sie 2–4-sporige Basidien und überwiegend nicht-lecythiforme Zystiden am Stiel.

Galera digitalina Velen., Novitates mycologicae novissimae 1947: 70. Abb. 4 a-d

Material: Böhmen, Mnichovice, bei Myšlín, bei *Epilobium angustifolium* (= *Chamerion angustifolium*), 9. 9. 1941 (PRM 153719, Holotypus).

Mikroskopische Eigenschaften: Sporen: 12,8–15,2 × 6,8–8,8 µm, im Mittel 14,0 × 7,9 µm, ellipsoidisch, nicht linsenförmig breitgedrückt, mit bis 0,7 µm dicker Wand und 1,2–1,5(–2,5) µm breitem Porus, in KOH rotbraun mit weinrötlicher Wand. Basidien: 4-sporig, bis 27 × 12,5 µm. Cheilozystiden: lecythiform, 17–23 × 5,5–9,5 µm, mit 3–4,5 µm breitem Köpfchen. Stielbekleidung: vom Typ einer echten *Mixtae* mit annähernd gleichvielen lecythiformen und nicht-lecythiformen Elementen und langen Haaren. Huthaut: aus rundlich-gestielten Elementen.

Die Ergebnisse meiner Untersuchung decken sich voll mit jenen von Singer (1989), der die Art zu *Conocybe digitalina* (Velen.) Singer umkombiniert und *Conocybe subpubescens* Orton sowie *Conocybe cryptocystis* (Atk.) Singer ss. auct. als konspezifisch ansieht. Zwar werden in der Literatur für die beiden letzteren Taxa oft etwas kleinere Sporenmaße angegeben, meine zahlreichen österreichischen Kollektionen erreichen aber auch öfter die beim Typus vorgefundenen Maße.

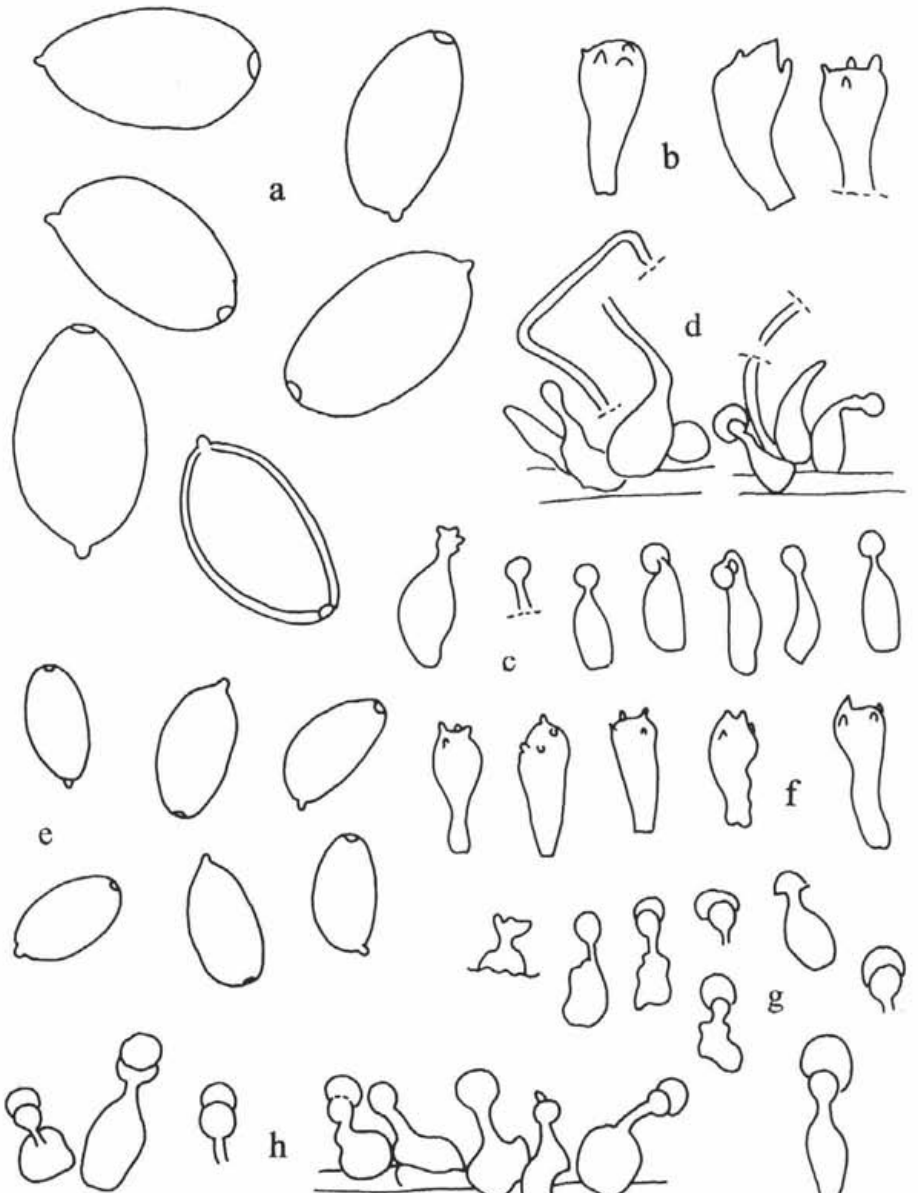

Abb. 4. a-d *Galera digitalina* (PRM 153719, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Stielbekleidung, × 800. **Abb. 4. e-h** *Galera echinata* (PRM 153744, Holotypus); e Sporen, × 2000; f Basidien, × 800; g Cheilozystiden, × 800; h Stielbekleidung, × 800.

Galera dumetorum Velen., České houby 1921: 541. Tafel I, Abb. 3 f-h

Material: Böhmen, Mnichovice, 1918 (PRC, Lectotypus, ein ca. 1 × 1 mm großes Hutfragment aus Flasche 78 g von mir aussortiert und zum Lectotypus bestimmt).

Mikroskopische Eigenschaften: Sporen 5,7–7,5 × 3,6–4,4 µm, im Mittel 6,4 × × 4,0 µm, ellipsoidisch, nicht lentiform, im Lichtmikroskop mit ± glatter Wand, im REM mit deutlicher, meist isoliert warziger Oberfläche; in KOH hell gelblichocker mit dünner Wand und deutlichem, nicht truncatem Porus. Basidien: nicht gefunden. Cheilozystiden: kollabiert, ein Köpfchen mit einem Durchmesser von 5 µm gesehen. Struktur der Stielbekleidung und Huthaut: unbekannt.

Der Typus von *Galera dumetorum* galt als verschollen. *G. dumetorum* sollte – jeweils zusammen mit einigen anderen Arten – in den Flaschen 78 und 381 aufbewahrt sein; in letzterer konnte ich nichts finden, was auf einen zarten, kleinsporigen Vertreter der Gattung *Conocybe* paßte. Nach intensiver Nachsuche in Flasche 78 g, die von E. Gerhardt nach Aufteilung des Inhalts der Flasche 78 in 6 Teile als "indet." beschriftet worden war, gelang es, ein Hutfragment zu finden, das auf Grund der Sporenform und -größe zu keiner anderen der ursprünglich in Flasche 78 aufbewahrten Arten, auch nicht zu *Galera velata* (Mikrodaten siehe dort), gehören konnte. Die an diesem Fragment festgestellten Sporen haben im REM eine typisch warzige Oberfläche (siehe Abb. 3h), wie sie unter allen Vertretern der Untergattung *Ochromarasmius* nur *C. dumetorum* in der Interpretation von Svrček (1956) und zuletzt auch Hausknecht (1995) hat (siehe dazu auch Hausknecht und Krisai-Greilhuber 1998). Somit dürfte auch der von Enderle (1996: 21) geäußerte Zweifel an der Interpretation von *C. dumetorum* ausgeräumt sein; wie aber Enderle richtig feststellt, entspricht die Sporenform in der Beschreibung von Velenovský – und auch bei Betrachtung im Lichtmikroskop – nicht der typischen *Conocybe laricina* (Kühner) Kühner; sie hat vielmehr große Ähnlichkeit mit *C. dumetorum* var. *austriaca* Hauskn., auch wenn sie um eine Spur breiter sind als beim Typus der var. *austriaca*. Im REM zeigt der Typus von *C. dumetorum* teilweise etwas spitzere, weniger abgerundete Warzen, stimmt aber insofern perfekt überein, als die Warzen fast bis zum Porus hin annähernd gleich hoch sind und nicht wie bei den beiden anderen Varietäten viel niedriger werden und in der Nähe des Porus gänzlich fehlen. Als Konsequenz ergibt sich, daß *C. dumetorum* var. *austriaca* ein Synonm von var. *dumetorum* wird und für die häufigste Varietät, bisher als var. *dumetorum* bezeichnet, folgende Neukombination zu machen ist:

Conocybe dumetorum (Velen.) Svrček var. *laricina* (Kühner) Hausknecht, comb. nova

Basionym: *Galera laricina* Kühner, Le Botaniste 17: 170, 1926

Galera echinata Velen., Novitates mycologicae novissimae 1947: 69. Abb. 4 e-h

Material: Böhmen, Mnichovice, Božkov, im Wald unter *Crataegus*, 21. 8. 1940 (PRM 153744, Holotypus).

Mikroskopische Eigenschaften: Sporen: 7,2–9 × 4–5,2 μm, im Mittel 7,8 × × 4,5 μm, ellipsoidisch, nicht lentiform, mit dünner Wand und kleinem, aber deutlichem Porus (0,5–0,8 μm breit), in KOH hellbraun. Basidien: 4-sporig, 19–24 × 6,5–8 μm. Cheilozystiden: bis 22 × 8,5 μm groß, mit 4–6 μm breiten Köpfchen (oft schwer zu messen, da alle Zystidenköpfchen Schleimkappen tragen). Stielbekleidung: fast nur aus lecythiformen Zystiden bestehend, diese 19–25 × × 8–10 μm, mit Köpfchen 3,5–7,5 μm breit. Huthaut: hymeniform, aus rundlichen Elementen mit langem Pedicel.

Singer (1989: 103) hat die Art in *Conocybe echinata* (Velen.) Singer umkombiniert und *Conocybe sordida* Kühn. et Watling in Synonymie gestellt. Die mikroskopischen Eigenschaften ähneln aber eher *Conocybe sordescens* Orton, mit Ausnahme der etwas zu kleinen Sporen. Bis zur Klärung aller offenen Fragen rund um den *Conocybe magnicapitata*-Komplex sehe ich aber davon ab, Synonyme zu benennen.

Galera juniana Velen., Novitates mycologicae novissimae 1947: 68. Abb. 5 a-c

Material: Böhmen, Mnichovice, Menčice, unter *Ligustrum*, 9. 6. 1941 (PRM 153717, Holotypus).

Mikroskopische Eigenschaften: Sporen: (8–)10–11(–12) × 5,2–6(–7) μm, im Mittel 10,4 × 5,7 μm, ellipsoidisch bis leicht zitronenförmig, nicht lentiform, mit doppelter Wand und 1–1,5(–2,0) μm breitem Porus, in KOH rotbraun mit weinrötlicher Wand. Basidien: kollabiert, keine Sterigmen gefunden; Svrček konnte bei seiner Untersuchung eindeutig 2– und 4-sporige Basidien feststellen. Cheilozystiden: großteils kollabiert, insgesamt drei lecythiforme Zystiden bis 17 × 12 μm, mit 3,5–6 μm breiten Köpfchen, gesehen (Svrček hat seinerzeit Cheilozystiden 20–25 × 8–12 μm, mit bis 7 μm breitem Köpfchen, gemessen). NH3-Reaktion: auch nach 10 Stunden negativ. Stielbekleidung: nur aus lecythiformen Zystiden bestehend, diese 25–35 × 12–19 μm, mit 6–11 μm großen Köpfchen. Huthaut: hymeniform aus rundlich-gestielten Elementen, dazwischen (laut Svrček) zahlreiche riesige, lecythiforme Pileozystiden (bis 28 × 16 μm, mit Köpfchen 8–10 μm).

Diese Kollektion ist dem *Conocybe magnicapitata*–Komplex zuzuordnen. Das Typusmaterial besteht aus einem teilweise zerbrochenenem Fruchtkörper in sehr schlechtem Zustand, weshalb ich eine Umkombination in *Conocybe* vorerst unterlasse. *C. magnicapitata* Orton weicht jedenfalls makroskopisch etwas ab, und auch mikroskopisch fehlen zu viele Informationen bzw. bestehen zu große Differenzen gegenüber *Galera juniana*, um Konspezifität zu behaupten. Sollte sich bei einer

genauen Durchleuchtung dieses Komplexes herausstellen, daß *C. magnicapitata* wesentlich weiter und variabler aufzufassen ist, als dies beim reinen Vergleich von *G. juniana* mit dem Typusmaterial von *C. magnicapitata* derzeit geschieht, müßte man wohl doch nomenklatorische Konsequenzen ziehen.

Galera lateritia Fr. 1821, České houby 1921: 539.

Material: existiert nicht.

Die makroskopische Beschreibung und das Vorkommen auf Kompost lassen darauf schließen, daß es sich um einen Vertreter der *Conocybe pubescens*-Gruppe handelt.

Galera leporina Velen., Novitates mycologicae novissimae 1947: 68. Abb. 5 d-h

Material: Böhmen, Mnichovice, auf Hasendung im Nadelwald, Juli 1940 (PRM 153750, Holotypus).

Zusätzlich untersuchtes Material: Österreich: Niederösterreich, Hainfeld, Michelbach Dorf (MTB 7960/2), 20. 5. 1984, leg. W. Klofac (WU 18015); – Hainfeld, Michelbach Markt (MTB7860/4), 2. 5. 1988, leg. W. Klofac (WU 18016).

Mikroskopische Eigenschaften (nur vom Typus): Sporen: 9,2–12(–14,8) × 5–6,7 (–8,5) µm, im Mittel 11,8 × 6,1 µm, ellipsoidisch-zitronenförmig, nach beiden Polen zuspitzend, kaum lentiform, mit doppelter Wand und deutlichem, oft papilliertem, ca. 1 µm breitem Porus, kräftig gelbbraun in KOH. Basidien: (1–)2–(3–, 4–) sporig, davon 30–50 % 3– oder 4-sporig, 17–27 × 7–9 µm. Cheilozystiden: lecythiform, 15–18 × 6–8,5 µm, mit 3,5–4,5 µm breitem Köpfchen. Stielbekleidung: ziemlich kollabiert und von parasitischem Pilz befallen; einige haarförmige und rundliche bis länglich-spindelige Elemente (bis 24 x 8 µm) und an der obersten Stielspitze auch mehrere kopfige Zystiden gesehen. Huthaut: hymeniform aus rundlichen bis rundlich-gestielten Elementen.

Das Typusmaterial besteht aus einem ganzen Fruchtkörper, der offensichtlich im Substrat wurzelt. Im ersten Augenblick kam ich zu der Annahme, daß es sich auf Grund der variablen Sterigmenanzahl der Basidien und der dadurch bedingten sehr unterschiedlichen Sporengröße um ein etwas gestörtes Exemplar handeln könnte. Zwei Kollektionen aus Niederösterreich, beide aus sehr feuchtem Mischwald mit Fichte, Weide, Hainbuche und Erle, stimmen makro– und vor allem mikroskopisch (davon eine Aufsammlung allerdings mit überwiegend 4-sporigen Basidien) mit Velenovskýs Art so gut überein, daß ich nunmehr überzeugt bin, daß die Funde von offenen, wärmebegünstigten Stellen mit rein 2– oder 4-sporigen Basidien, viel breiteren oder kleineren, anders geformten Sporen und gänzlich fehlenden lecythiformen Zystiden am Stiel (auch nicht an der Spitze), also *Conocybe leporina* ss. Singer und Hausknecht 1988, eine selbständige Art darstellen.

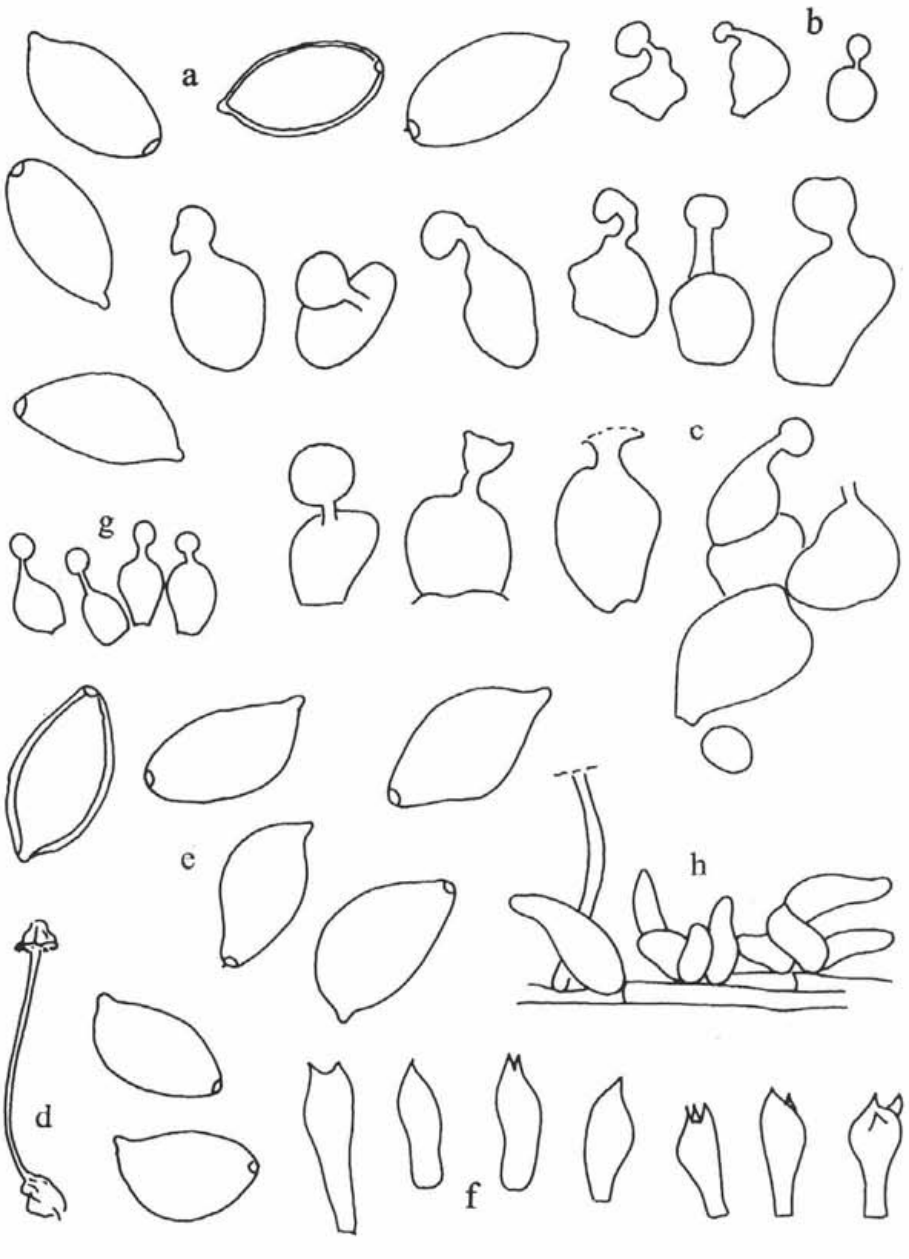

Abb. 5. a-c *Galera juniana* (PRM 153717, Holotypus); a Sporen, × 2000; b Cheilozystiden, × 800; c Stielbekleidung, × 800. **Abb. 5. d-h** *Galera leporina* (PRM 153750, Holotypus); d Fruchtkörper (Exsikkat), × 0,8; e Sporen, × 2000; f Basidien, × 800; g Cheilozystiden, × 800; h Stielbekleidung, × 800.

Galera leporina wurde von Singer und Hausknecht (1988) gültig in *Conocybe leporina* (Velen.) Singer und Hausknecht umkombiniert, auch wenn die dort angefügte Beschreibung nunmehr einer anderen Sippe zugeordnet werden muß. Für die Funde aus Trockenrasen und warmen, offenen Stellen ist eine Neubeschreibung notwendig, welche ich nachfolgend gebe:

Conocybe microrrhiza Hausknecht, spec. nova
(= *Conocybe leporina* ss. Singer et Hausknecht 1988)

Diagnosis latina

Pileus 6–22 mm latus, 6–15 mm altus, acute conicus, obtuse conicus ad late convexus, primum brunneus ad obscure brunneus rubrotinctus, interdum luteobrunneus ad fulvobrunneus, hygrophanus, in statu humido striatus, superficies glabra. Lamellae anguste adnatae, confertae, ventricosae, luteobrunneae, deinde ferrugineae. Stipes 30–50 mm longus, 1–2 mm latus, radicans, primum albus, mox luteolus, demum melleus ad brunneus, superficies primum pruinosa, demum glabra. Caro stipitis firma, odor nullus. Sporae (9,0–)10,3–12,0 × 7,3–7,8 × 7,0–7,5 μm, late ellipsoideae, leviter guttiformes, saepe leviter lentiformes, pariete glabro crassiusculoque, poro germinativo 1 μm lato. Basidia 16–20 x 8–10 μm, bispora. Cheilocystidia lecythiformia, 18–25 × 8–10 μm, capitulo 2,7–4 μm lato. Reactio ammoniaca nulla. Stipitipellis cystidiis non-lecythiformibus (10–25 × 6–9 μm) et pilis (30–80 × 2–3 μm) consistens, cystidia lecythiformia desunt. Pileipellis hymeniformis, cellulis sphaeropedunculatis (22,5–31–50 × 17–22 μm) consistens, parce cystidiis lecythiformibus cheilocystidiis similibus immixtis. In pratis siccis, locis apertis.

Typus: Austria: Vindobona, Lobau, Kreuzgrundtraverse (MTB 7865/1), 29. 9. 1984, A. Hausknecht legit (WU 5222, holotypus).

Weiters ergeben sich daraus folgenden Neukombinationen:

Conocybe microrrhiza var. *tetraspora* (Singer et Hausknecht) Hausknecht, comb. nova

Basionym: *Conocybe leporina* var. *tetraspora* Singer und Hausknecht, Pl. Syst. Evol. 159: 112, 1988

Conocybe microrrhiza var. *parvispora* (Hausknecht) Hausknecht, comb. nova

Basionym: *Conocybe leporina* var. *parvispora* Hausknecht, Österr. Z. Pilzk. 5: 190, 1996

Galera major Velen., České houby 1921: 540.

Material: existiert nicht.

Die Art wurde von Singer (1951: 439) als "species incertae sedis" eingestuft und in *Conocybe major* (Velen.) Singer umkombiniert. Die Beschreibung der Makro-

und Mikromerkmale von Velenovský (Hut bis 4 cm, Stiel weiß, bis 0,4 cm dick, Zystiden mit gestieltem Köpfchen, aber Sporen nur bis 10 μm), läßt m. E. keine eindeutige Identifizierung zu; *Conocybe major* ist demnach als nomen dubium anzusehen.

Galera melea Velen., České houby 1921: 541. Abb. 6 a-d

Material: Böhmen, Chuchle bei Prag, auf Kuh- und Pferdedung, Juli 1918 (PRC, Flasche 381/5, von E. Gerhardt aus Flasche 381 separiert). Durch die Aufbewahrung in Äthanol gänzlich entfärbt und in sehr schlechtem Zustand. Typusmaterial aus Mnichovice nicht mehr vorhanden.

Mikroskopische Eigenschaften: Sporen: 15–18 × 9,6–11,2 × 8,7–9,6 μm, im Mittel 16,6 × 10,4 × 9,1 μm, ellipsoidisch, linsenförmig plattgedrückt, dickwandig mit großem Porus, von Äthanol total entfärbt und die Außenwand teilweise aufgelöst. Basidien: kollabiert, die Anzahl der Sterigmen nicht feststellbar. Cheilozystiden: völlig kollabiert, nicht mehr gefunden. Stielbekleidung: einige rundliche, keulige bis haarförmige Elemente vorhanden, komplette lecythiforme Zystiden nicht gesehen. Huthaut: hymeniform aus rundlich-gestielten Elementen, ca. 25–33 × 22–26 μm, bestehend.

Singer (1951) hat die Art in *Conocybe melea* (Velen.) Singer umkombiniert. Der vorgefundene Beleg betrifft zweifellos einen Vertreter der *C. pubescens*-Gruppe, auf Grund der nicht mehr intakten Basidien und Stielbekleidung ist eine Zuordnung auf eine innerhalb dieses Komplexes derzeit unterschiedenen Arten nicht möglich und *C. melea* daher als zweifelhafte Art zu betrachten.

Galera microcephala Velen., České houby 1921: 543. Abb. 6 e-h

Material: Böhmen, Mnichovice, April 1918 (PRC, Lectotypus, separiert von mir in ein eigenes Gefäß aus Flasche 92, wo er zusammen mit anderen Pilzen aufbewahrt worden war). Die Art sollte auch in Flasche 352 vorhanden sein, ich konnte aber nichts finden, was der Beschreibung Velenovskýs entspricht.

Mikroskopische Eigenschaften: Sporen: 9,5–11,5 × 5–6 μm, im Mittel 10,3 × × 5,5 μm, ellipsoidisch-zitronenförmig, nicht lentiform, mit leicht doppelter Wand und deutlichem Keimporus (ca. 1 μm), in KOH blaßgelb. Basidien: 4-sporig, 18–24 × 8–11 μm. Cheilozystiden: lecythiform, 15–20 × 6–12 μm. Stielbekleidung: ziemlich kollabiert, einige rundliche bis keulig-rundliche Elemente und eine lecythiforme Zystide unmittelbar unterhalb des Lamellenansatzes vorhanden. Huthaut: hymeniform aus rundlich-gestielten Elementen.

Singer (1951) nahm die Umkombination zu *Conocybe microcephala* (Velen.) Singer vor. Die Art gehört zweifelsohne in den bisher von mir noch nicht kritisch durchleuchteten Komplex um *C. sienophylla* (Berk. et Br.) Singer, auch eine

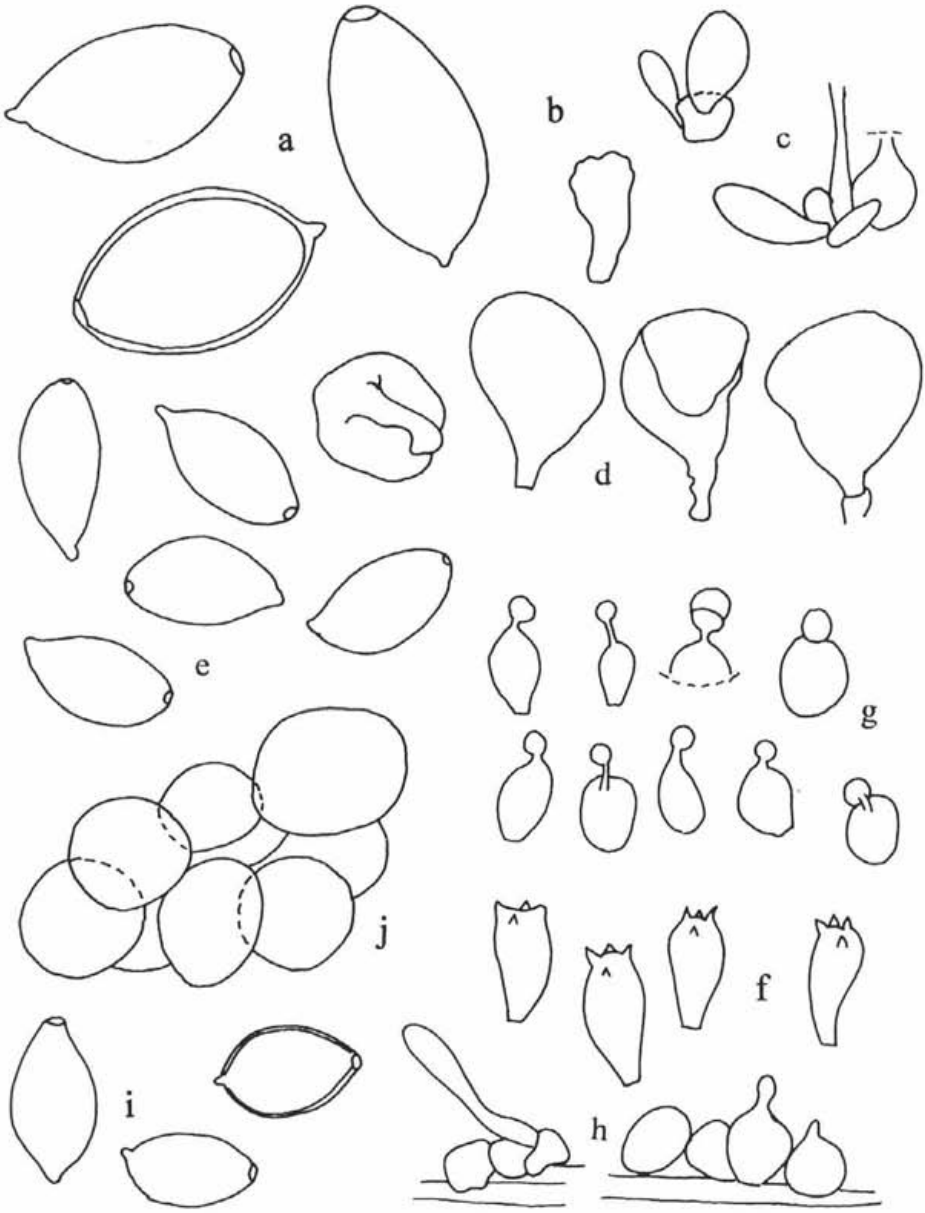

Abb. 6. a-d *Galera melea* (PRC Flasche 381/5); a Sporen, × 2000; b kollabierte Basidie, × 800; c Elemente der Stielbekleidung, × 800; d Elemente der Huthaut, × 800. **Abb. 6. e-h** *Galera microcephala* (PRC Flasche 92, Lektotypus); e Sporen, × 2000; f Basidien, × 800; g Cheilozystiden, x 800; h Stielbekleidung, × 800. Abb. 6. i-j *Galera sordida* (PRC Flasche 381/6); i Sporen, × 2000; j Huthaut (Aufsicht), × 800.

Verwandtschaft zu *Conocybe moseri* Watling (Hut: "vertice atrofusco") ist nicht auszuschließen. Der schlechte Zustand des Beleges, vor allem der Stieloberfläche, erlaubt es aber nicht, eine Synonymie zu letzterem Taxon zu vermuten, sodaß ich *C. microcephala* zu den zweifelhaften Arten zähle.

Galera microspora Velen., České houby 1921: 543.

Material: Böhmen, Radotín, 1918 (PRC, laut Etikett in Flasche 400). Die Flasche ist ausgetrocknet und trotz intensiver Suche konnte nichts gefunden werden, was auf eine *Conocybe* mit kleinen Sporen hindeutet.

Svrček (1983) hat fast an derselben Stelle wie Velenovský im Jahr 1956 eine *Conocybe* gefunden, die ausgezeichnet auf die Originalbeschreibung paßt. Da der Typus in PRC nicht mehr vorhanden ist, schlage ich die Kollektion von Svrček, 17. 6. 1956, Prag-Radotín (PRM), als Neotypus vor.

Laut Singer und Hausknecht (1992) wurde *G. microspora* von Dennis (1953) korrekt zu *Conocybe microspora* (Velen.) Dennis umkombiniert, obwohl das zugrundeliegende Material eine andere Art darstellte, nämlich *Conocybe microsperma* Singer 1992. Die von Svrček (1983) vorgenommene Neukombination war daher überflüssig.

Galera pulchella Velen., České houby 1921: 543. Abb. 7 a-d

Material: Böhmen, Mnichovice, im Rasen, Juli 1919 (PRM 678157, Holotypus).

Mikroskopische Eigenschaften: Sporen: (12–)12,7–15,8 × 7,6–9,3(–10) μm (Riesensporen bis 19 μm lang), im Mittel 14,6 × 8,6 μm, ellipsoidisch, leicht linsenförmig, mit doppelter, dicker Wand und großem (1,5–2,5 μm breitem) Keimporus, in KOH kräftig rotbraun mit weinroter Wand. Basidien: 4-sporig, 22–30 × 12–17 μm. Cheilocystiden: lecythiform, 17–22 × 6–9 μm, mit 3,5–5 μm großem Köpfchen. Stielbekleidung: einer echten *Mixtae*, aus lecythiformen Zystiden (bis 37 x 13 μm), nicht-lecythiformen Elementen und Haaren zusammengesetzt. Huthaut: hymeniform aus rundlich-gestielten Elementen.

Das gut erhaltene Typusmaterial und die makroskopische Beschreibung erlauben eine eindeutige Bestimmung als das, was bisher in der Literatur *Conocybe pseudopilosella* Kühner et Watling bezeichnet worden ist. Da Velenovskýs Art Priorität hat, ist folgende Neukombination notwendig:

Conocybe pulchella (Velen.) Hausknecht et Svrček, comb. nova

Basionym: *Galera pulchella* Velen., České houby 1921: 543

Synomyme: *Conocybe pubescens* var. *pseudopilosella* Kühner 1935, ungültig publiziert

Conocybe pseudopilosella Kühner et Watling 1980.

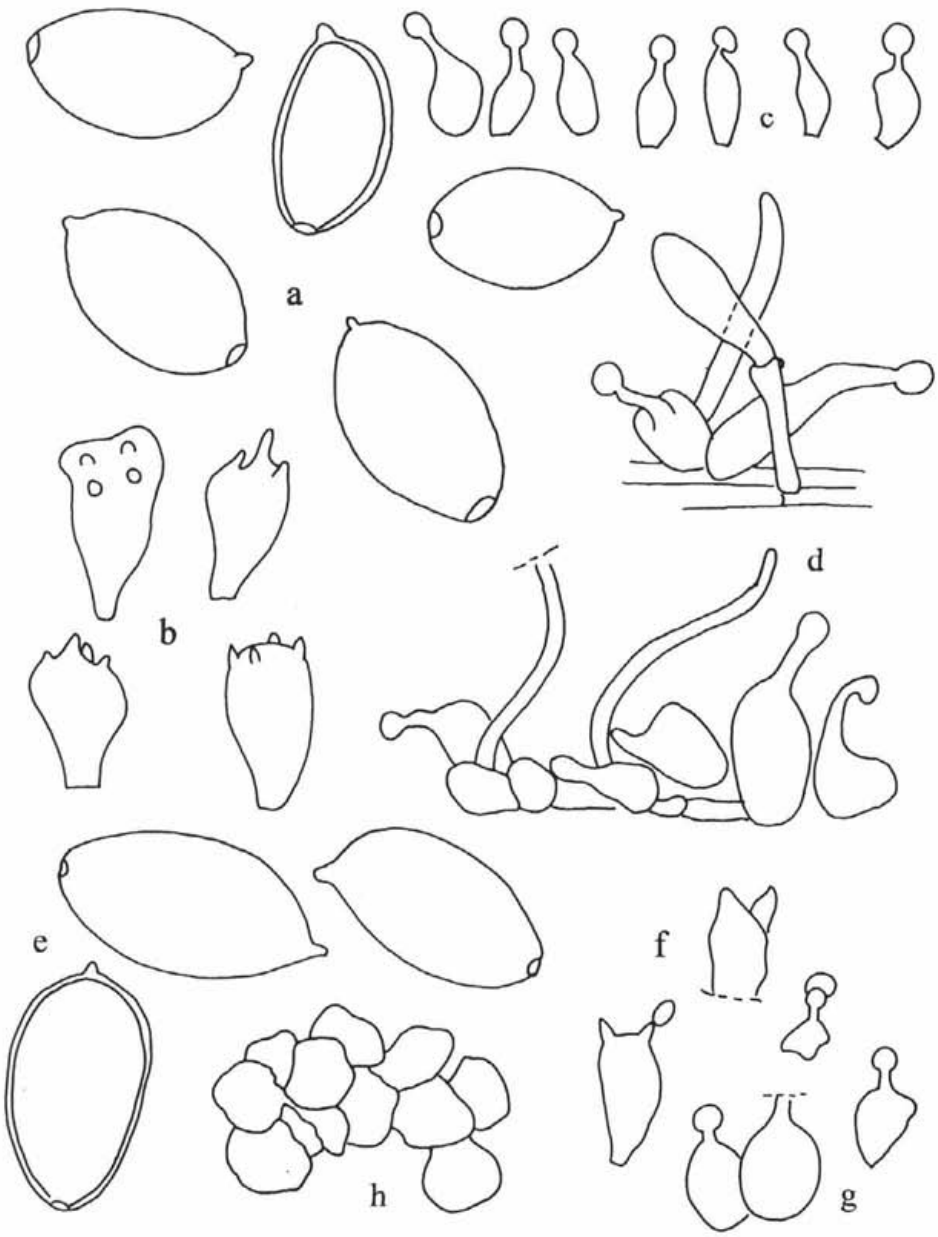

Abb. 7. a-d *Galera pulchella* (PRM 678157, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Stielbekleidung, × 800. **Abb. 7. e-i** *Galera reticulata* (PRC, aus Flasche 435, Holotypus); e Sporen, x 2000; f Basidien, × 800; g Cheilozystiden, × 800; h Huthaut (Aufsicht, kollabiert), × 800.

Galera pygmaeoaffinis Fr. 1863, České houby 1921: 542.

Material: nicht vorhanden.

Die Erwähnung von Zystiden mit langgestielten Köpfen von 3 μm und satt gelben, großen Sporen in Verbindung mit dem Habitat (Pferde- und Rinderexkremente) lassen fast nur die Möglichkeit einer *Conocybe* zu. Mit einiger Wahrscheinlichkeit handelt es sich um *Conoybe rickenii* (Schaeff.) Kühner mit etwas zu groß angegebenen Sporen – Fruchtkörpergröße, Hutfarbe und fehlende Riefung würden passen.

Galera reticulata Velen., České houby 1921: 542. Abb. 7 e-i

Material: Böhmen, Mnichovice, im Gras, Juli 1918 (PRC, Holotypus, von mir ausgeschieden aus Flasche 435 und in ein separates Gefäß überführt). Die Flasche war ausgetrocknet, das Material (aus verschiedenen Pilzen bestehend) zusammengeklebt und völlig hart und spröde.

Mikroskopische Eigenschaften: Sporen: 14,5–18,5 × 7,9–9,6 μm, im Mittel 16,1 × 8,8 μm, ellipsoidisch, teilweise leicht eckig, nicht lentiform, mit über 0,5 μm dicker, doppelter Wand und 1–1,3 μm großem Porus, in KOH olivlich gelbbraun (verfärbt?). Basidien: 2-sporig, ca. 22 × 10 μm, mit breiten, fast dreieckigen Sterigmen. Cheilozystiden: lecythiform, bis 25 × 13,5 μm, mit 3,5–5 μm großen Köpfchen. Stielbekleidung: nicht feststellbar, das Fragment enthielt nur einen völlig kahlen Stielstummel. Huthaut: hymeniform aus rundlichen, stark geschrumpften Zellen.

Kühner (1935: 123) zitiert *G. reticulata* im Zusammenhang mit *Conocybe lateritia* (= *C. lactea* = *C. albipes*) und spricht davon, daß sich erstere nur durch den stark netzig gezeichneten Hut unterscheidet; in seinem provisorischen Schlüssel stellt Singer (Singer, ined.) *Galera reticulata* mit Fragezeichen ebenfalls zu *Conocybe lactea*. Die Sporen der ersteren Art sind aber wesentlich größer, dunkler gefärbt und auch etwas dickwandiger, sodaß ich eine nahe Verwandtschaft der beiden Sippen nicht für möglich halte. Ich kenne allerdings Aufsammlungen einer *C. albipes* mit ausgebreitetem, grubig-netzig gezeichnetem Hut aus Deutschland und den Niederlanden (var. *rugata* Hauskn., siehe Hausknecht 1998), die recht gut zur makroskopischen Beschreibung Velenovskýs passen würden, nur sind deren Sporen sogar noch etwas kleiner als bei *C. albipes*, und eine Konspezifität ist daher auszuschließen; *Galera reticulata* ist deshalb für mich auch eine zweifelhafte Art.

Galera rimosa Velen., Novitates mycologicae 1940: 130. Abb. 8 a-d

Material: Böhmen, Mnichovice, Jidášky, im Gras, September 1934 (PRM 153772, Holotypus).

Mikroskopische Eigenschaften: Sporen: 7,2–9,1 × 4,4–5,6 µm, im Mittel 8,4 × × 5,2 µm, ellipsoidisch mit dünner, einfacher Wand und deutlichem Keimporus (1–1,2 µm breit), hell gelbbraun in KOH. Basidien: 4-sporig, 16–20 × 6–8 µm. Cheilozystiden: 29–55 × 6,5–9,5 µm, unregelmäßig zylindrisch, gegen die Basis zu bauchig verdickt, oft auch unregelmäßig wellig und mit leicht kopfig angeschwollener Spitze. Huthaut: aus rundlich-gestielten Elementen (35–50 × 17–25 µm).

Diese Kollektion stellt eine makroskopisch etwas untypische ("centro depresso") *Pholiotina sulcatipes/ P. aberrans* dar, da ja die Frage, ob man in Europa wirklich zwei Arten unterscheiden kann, noch immer nicht geklärt ist (siehe zuletzt Krisai-Greilhuber und al. 1997: 176, Enderle 1997). Für den Fall, daß es in Europa nur eine Art, *Pholiotina aberrans* (Kühner) Singer, gibt und diese nicht konspezifisch mit der nordamerikanischen Sippe ist, hätte Velenovskýs Art Priorität. Ich schlage daher folgende Neukombination vor:

Pholiotina rimosa (Velen.) Hausknecht et Svrček, comb. nova

Basionym: *Galera rimosa* Velen., Novitates mycologicae 1940: 130

Galera rostellata Velen., Novitates mycologicae 1940: 129. Abb. 9 a-e

Material: Böhmen, Mnichovice, im Gras, 5. 10. 1935 (PRM 153691, Holotypus)

Mikroskopische Eigenschaften: Sporen: 6,4–8,7(–9,5) × 4,0–4,8 µm, im Mittel 7,6 × 4,3 µm, ellipsoidisch-eiförmig, nicht lentiform, nicht bohnenförmig, mit einfacher, dünner Wand und deutlichem, bis 1 µm breitem Keimporus, in KOH roströtlich. Basidien: 4-sporig, 13–20 × 6–8 µm. Cheilozystiden: lecythiform, 14–20 × 6–10,5 µm, mit 4–5,5 µm breitem Köpfchen. Stielbekleidung: in sehr schlechtem Zustand, trotz intensiver Suche konnten einige kollabierte haarförmige Elemente sowie rundliche bis rundlich-längliche Zellen entdeckt werden, das Vorhandensein von überwiegend lecythiformen Zystiden ist jedenfalls auszuschließen. Huthaut: hymeniform aus rundlich-gestielten Elementen (30–45 × 15–25 µm), dazwischen vereinzelt lecythiforme Pileozystiden ähnlich den Cheilozystiden.

Diese Art ist ein kleinsporiges Mitglied des Artenkomplexes rund um *C. sienophylla*, sie ist aber von der echten *C. sienophylla* sicher verschieden; trotz des schlechten Zustandes des Beleges und einer nicht gerade typischen Hutform ("acute rostellato") spricht sehr vieles dafür, daß sie mit den vielen Funden aus verschiedenen Ländern Europas konspezifisch ist, die ich unter dem provisorischen Namen "forma *paupera*" führe. Für den Fall, daß sich diese Annahme bestätigen sollte und die Sippe Artrang verdient, ist folgende Neukombination vonnöten:

Conocybe rostellata (Velen.) Hausknecht et Svrček, comb. nova

Basionym: *Galera rostellata* Velen., Novitates mycologicae 1940: 129

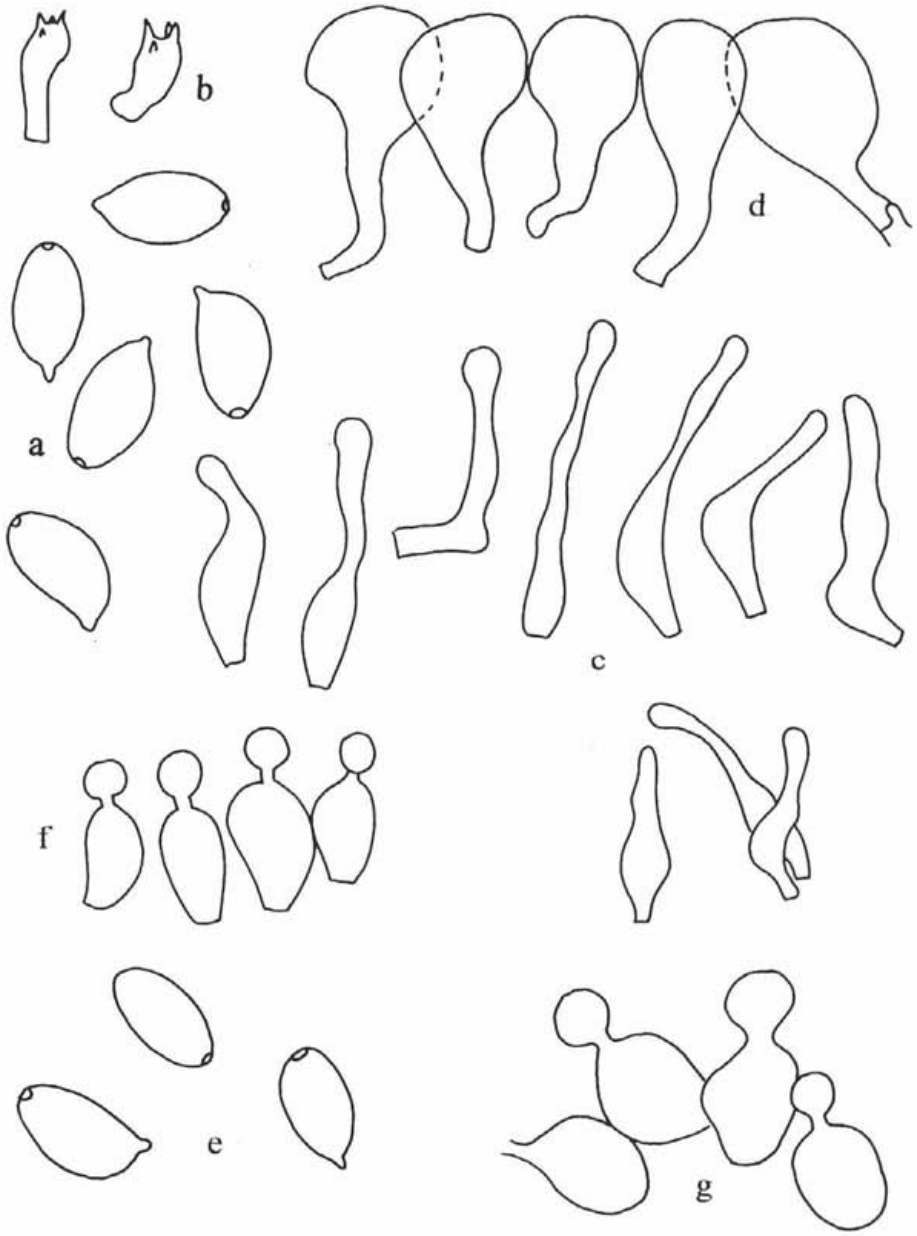

Abb. 8. a-d *Galera rimosa* (PRM 153772, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Huthaut, × 800. **Abb. 8. e-g** *Galera rostellata* (PRM 153718); e Sporen, × 2000; f Cheilozystiden, × 800; g Stielbekleidung, × 800.

Galera rostellata Velen., Novitates mycologicae novissimae 1947: 68. Abb. 8 e-g

Material: Böhmen, Mnichovice, bei Mirošovice, auf einer Waldwiese, 25. 10. 1941 (PRM 153718)

Mikroskopische Eigenschaften: Sporen: 7,5–9,5 × 4–5,2 µm, im Mittel 8,1 × × 4,5 µm, ellipsoidisch, dünnwandig mit deutlichem Porus, in KOH gelbbraun. Basidien: 4-sporig. Cheilozystiden: lecythiform, 24–31 × 10–16 µm, mit 5,5–8,5 µm breiten Köpfen. Stielbekleidung: nur aus lecythiformen bestehend, diese bis 33 × 17 µm groß, mit bis 12 µm großen Köpfchen.

Diese Kollektion ist etwas völlig anderes als der Typus. Die Farbangabe "species pulchella" zusammen mit den riesigen Cheilo– und Kaulozystiden und kleinen Sporen führen ganz klar zu *Conocybe rickeniana* Orton.

Galera siliginea Fr. 1824, České houby 1921: 540 (mit SW-Abbildung)

Material: existiert nicht.

Auf Grund der in Abbildung 5 gezeichneten Zystide handelt es sich zweifelsohne um eine *Conocybe*, die kleinen Sporen schließen *C. siliginea* (Fr.: Fr.) Kühner aus; es könnte sich aber auf Grund der Standortangabe "im Gras auf Viehweiden, im Sommer allgemein entlang von Wegen" und der als gelblich-bräunlich beschriebenen Farbe des Hutes um *C. fuscimarginata* (Murrill) Singer gehandelt haben.

Galera sordida Velen., České houby 1921: 541. Abb. 6 i-j

Material: Böhmen: Chuchle bei Prag, Juli 1918 (PRC, Flasche 381/6, von E. Gerhardt aus Flasche 381 separiert und durch die Aufbewahrung in Äthanol in extrem schlechtem Zustand). Typusmaterial nicht vorhanden.

Mikroskopische Eigenschaften: Sporen 8,7–10 × 5,2–6,2 µm, im Mittel 9,5 × × 5,7 µm, ellipsoidisch, leicht lentiform, glatt, mit deutlichem Keimporus, vom Äthanol total entfärbt, die Außenwand teilweise aufgelöst. Basidien und Cheilozystiden: nicht gefunden. Huthaut in Aufsicht deutlich zellig-hymeniform. Stielbekleidung: nur Hyphen, keine Haare oder Zystiden gefunden.

Eine Interpretation der echten *Galera sordida* ist auf Grund des Fehlens des Originalbeleges nicht möglich und die Art als zweifelhaft zu betrachten.

Galera spartea Fr., Novitates mycologicae 1940: 129.

Material: Böhmen, Mnichovice, Kunice, 26. 7. 1938 (PRM 153774, ursprünglich als *G. carbonaria*)

Mikroskopische Eigenschaften: Sporen: 7–8 × 3,8–4,6 µm, im Mittel 7,5 × × 4,3 µm, ellipsoidisch-apfelkernförmig, nicht lentiform, mit dünner Wand und

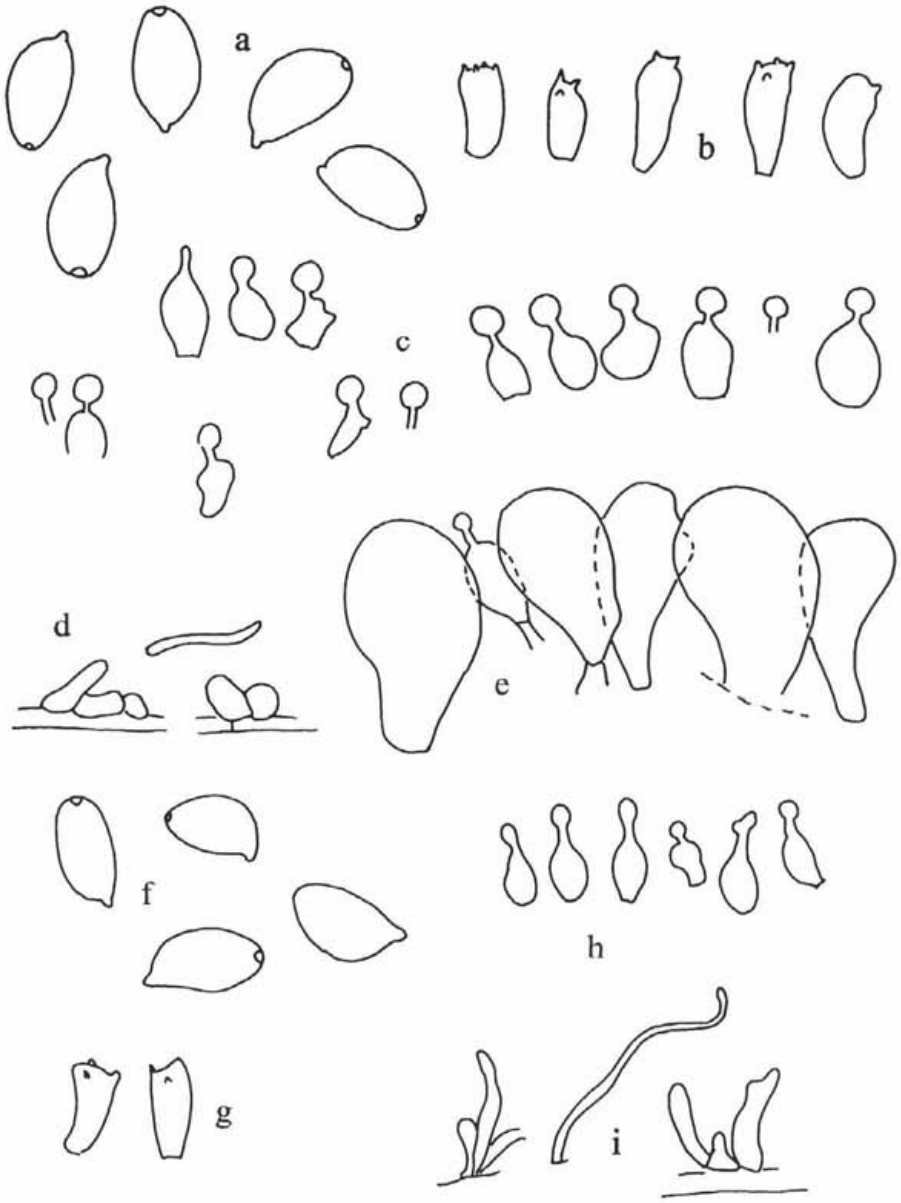

Abb. 9. a-e *Galera rostellata* (PRM 153691, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Elemente der Stielbekleidung, x 800; e Huthaut, × 800. **Abb. 9. f-i** *Galera spartea* ss. Velen. (PRM 153774); f Sporen, × 2000; g Basidien, × 800; h Cheilozystiden, × 800; i Elemente der Stielbekleidung, × 800.

teilweise undeutlichem Porus, sehr hell gelblich in KOH. Basidien: 4-sporig. Cheilozystiden: lecythiform, 11–17 × 5–6,5 µm, mit 2,5–4 µm großem Köpfchen. Stielbekleidung: nur aus Haaren und nicht-lecythiformen, meist zylindrischen Elementen zusammengesetzt.

Auf Grund der hellen, schwach gelblichen, kleinen Sporen und der Stielbekleidung stellt diese Kollektion *Conocybe pallidospora* Kühn. et Watling dar.

Galera spicula Lasch 1828, České houby 1921: 543.

Material: in PRC nicht mehr vorhanden.

Die makroskopische Beschreibung mit dem Hinweis auf eine Ähnlichkeit mit *Galera hypnorum* und die Angabe von Zystiden mit besonders großen Köpfen und großen Sporen führen zu *Conocybe magnicapitata* Orton. Singer (1951: 440) hat diesen Fund *Conocybe velenovskyi* Singer, nomen nudum, genannt. Laut Watling und Gregory (1981) ist dieses Taxon als 2-sporige Form von *C. magnicapitata* aufzufassen.

Galera tenera Schaeff. 1762, České houby 1921: 540 (mit SW-Abbildung)

Material: in PRC nicht vorhanden.

Die Abbildung stellt einen zarten, gerieften Pilz dar, die gezeichnete Zystide paßt zur Gattung *Conocybe*. Mehr kann dazu nicht gesagt werden.

Galera togularis Bull. 1792, České houby 1921: 552 und Novitates mycologicae novissimae 1947: 74

Material: im PRC nicht vorhanden.

Die makroskopische Beschreibung und die Angaben, die über Sporen und Zystiden ("lang, scharf zuspitzend") gemacht werden, weisen darauf hin, daß es sich um *Pholiotina arrhenii* (Fr.) Singer handeln müßte.

Galera urticae Velen., Novitates mycologicae 1940: 131. Abb. 10 a-c

Material: Böhmen, Mnichovice, Plecháč, unter Brennessel, Oktober 1939 (PRM 153688, Holotypus).

Mikroskopische Eigenschaften: Sporen: 6,4–7,9 × 3,8–4,6 µm, im Mittel 7,3 × × 4,2 µm, ellipsoidisch, nicht linsenförmig breitgedrückt, mit dünner, einfacher Wand und teilweise undeutlichem Porus, hell gelblich in KOH. Basidien: 4-sporig, z. B. 15 × 7 µm. Cheilozystiden: einige stark kollabierte, zylindrisch-spindelige Elemente gesehen; die genaue Form der Zystiden läßt sich nicht mehr feststellen. Lamellen-Trama von *Pholiotina*-Typ. Huthaut: aus rundlich-gestielten Elementen zusammengesetzt.

Singer (1986) nahm eine Umkombination in *Conocybe urticae* (Velen.) Singer vor und stellt sie in die Sektion *Mixtae*. Das Material ist in schlechtem Zustand und von einem Parasiten befallen, sodaß sich die Struktur der Lamellenschneide nicht mehr exakt feststellen läßt. Bei den von mir untersuchten Exemplaren handelt es sich aber zweifelsohne um eine *Pholiotina*, auch Svrček kam laut beiliegendem Begleitzettel zum selben Schluß. *C. urticae* kann demnach nur als fragliche Art aufgefaßt werden.

Galera velata Velen., České houby 1921: 547. Abb. 10 d-g

Material: Böhmen, Mnichovice, im Garten, 1918 (PRC, Holotypus, von mir selektiert aus Flasche 78 g und in ein eigenes Gefäß überführt).

Mikroskopische Eigenschaften: Sporen: 6–7,9 × 4–5 μm, im Mittel 6,9 × 4,2 μm, ellipsoidisch, nicht breitgedrückt, dünnwandig mit deutlichem Porus, hell gelbbraun in KOH. Basidien: 4-sporig, 17–22 × 5–9 μm. Cheilozystiden: 21–37 × × 5–10 μm, zylindrisch-spindelig, seltener leicht flaschenförmig mit kopfig erweiterter Spitze. Schnallen vorhanden. Huthaut: hymeniform aus rundlich-gestielten Elementen, bis 43 × 25 μm.

Dies ist unzweifelhaft *Conocybe appendiculata* Lange et Kühner 1935, ungültig publiziert (= *C. appendiculata* Watling 1971). Das ausgewählte Material besteht zwar nur aus zwei Hutfragmenten, ist aber gut erhalten, man kann alle wichtigen mikroskopischen Eigenschaften nachvollziehen. Die nachfolgende Neukombination ist notwendig:

Pholiotina velata (Velen.) Hausknecht, comb. nova
Basionym: *Galera velata* Velen., České houby 1921: 547.
Synonyme: *Conocybe appendiculata* Lange et Kühner 1935, ungültig publiziert
Conocybe appendiculata Watling 1971
Pholiotina appendiculata (Watling) Courtecuisse

Galera velutipes Velen., Novitates mycologicae 1940: 128. Abb. 11 a-d

Material: Böhmen, Mnichovice, September 1939 (PRM 153695, Holotypus).

Mikroskopische Eigenschaften: Sporen: 10–13,5 × 7,2–9 × 6,4–7,2 μm, im Mittel 11,1 × 7,8 × 6,8 μm, ellipsoidisch, deutlich linsenförmig breitgedrückt, mit doppelter Wand und großem, deutlichem Keimporus, in KOH rötlichbraun mit weinrötlich gefärbter Wand. Basidien: meist kollabiert, 4-sporig, 17–20 × 8,5–10 μm. Cheilozystiden: lecythiform, 12–22 × 6–9 μm, mit 3,5–5 μm breiten Köpfchen. Stielbekleidung: nur aus nicht-lecythiformen, zylindrischen, spindeligen bis keuligen Elementen (bis 47 × 8,5 μm) und Haaren bestehend. Huthaut: hymeniform aus rundlich-gestielten Elementen.

Obwohl das Exsikkat nur aus einem Fruchtkörper in mäßig gutem Zustand besteht, kann kein Zweifel darüber herrschen, daß dies *Conocybe siliginea* var.

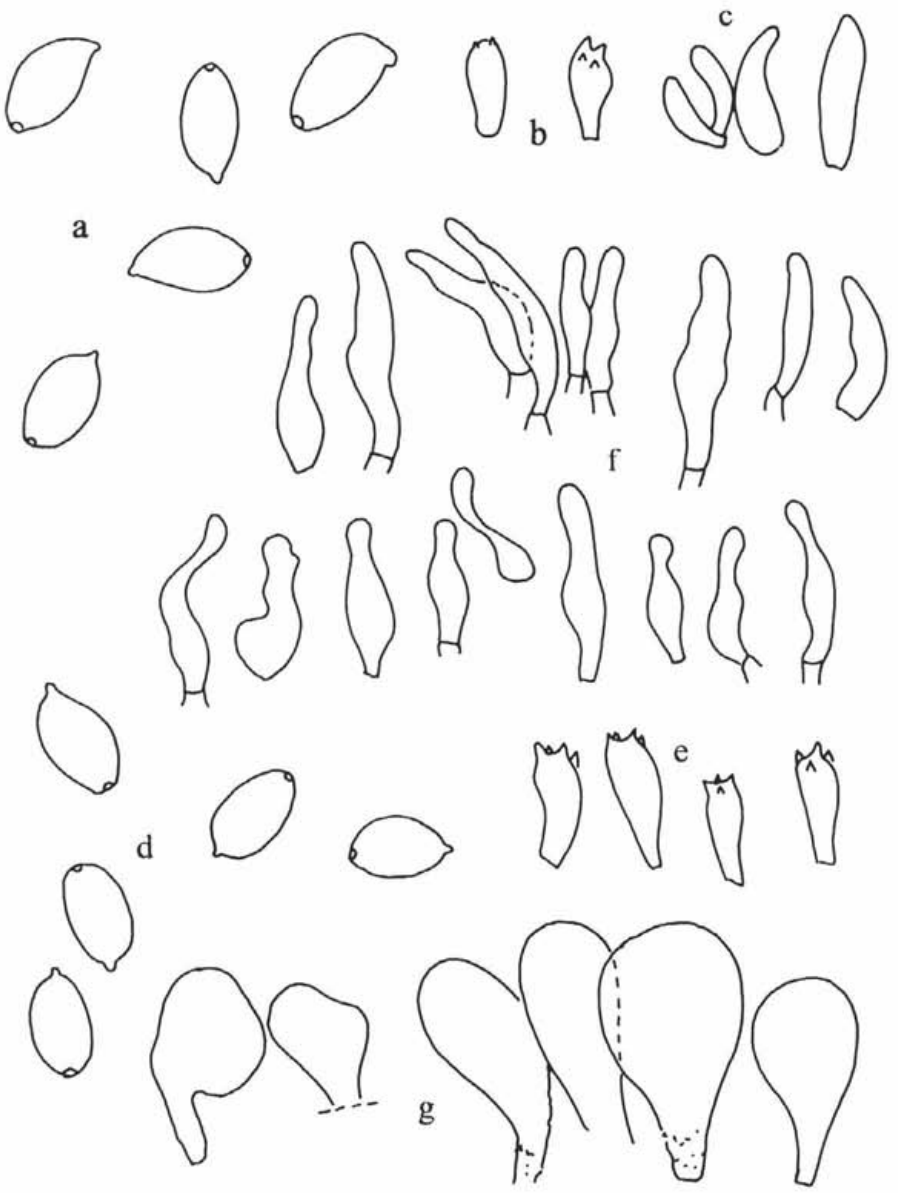

Abb. 10. a-c *Galera urticae* (PRM 153688, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Elemente der Stielbekleidung, × 800. **Abb. 10. d-g** *Galera velata* (PRC, aus Flasche 78 g, Holotypus); d Sporen, × 2000; e Basidien, × 800; f Cheilozystiden, × 800; g Elemente der Huthaut, × 800. c

ochracea, forme macrospore (Kühner 1935) ist, die von Singer (1969) gültig in *C. kuehneriana* Singer umbenannt wurde. Da Velenovskýs Art Priorität hat, wird folgende Neukombination vorgeschlagen:

Conocybe velutipes (Velen.) Hausknecht und Svrček, comb. nov.
Basionym: *Galera velutipes* Velen., Novitates mycologicae 1940: 128
Synomyme: *Conocybe siliginea* var. *ochracea*, forme macrospore (Kühner 1935)
Conocybe kuehneriana Singer 1969

Galera vesicaria Velen., Novitates mycologicae novissimae 1947: 69. Abb. 11 e-h

Material: Böhmen, Mnichovice, Myšlín, auf Brandstelle, 2. 8. 1940 (PRM 153732, Holotypus).

Mikroskopische Eigenschaften: Sporen: 14,3–16,6 × 8,5–10,3 μm, im Mittel 15,3 × 9,0 μm, ellipsoidisch, nicht lentiform, mit dicker, doppelter Wand und 1,2–1,8 μm breitem Porus, in KOH rötlich gelbbraun mit weinrötlicher Wand. Basidien: 2-sporig, 17–21 × 10–12 μm, mit dicken, fast dreieckigen Basidien. Cheilozystiden: lecythiform, 14–25 × 5,5–9,5 μm, mit 4–5,5 μm breiten Köpfchen. Stielbekleidung: überwiegend aus Haaren und nicht-lecythiformen Zystiden bestehend, dazwischen nicht selten kopfige Zystiden ähnlich den Cheilozystiden, aber schlanker. Huthaut: hymeniform aus rundlich-gestielten Elementen.

Dies ist *Conocybe siliginea* (Fr.: Fr.) Kühner. Dafür sprechen der frisch tonfarbene, trocken weiße Hut, die zarte Statur, das Habitat sowie natürlich die Mikromerkmale (siehe dazu auch Hausknecht und Passauer 1997).

DANKSAGUNG

Mein besonderer Dank gilt Hr. Dr. Jan Holec, Prag, der mir die Möglichkeit bot, die Belege im Nationalmuseum zu untersuchen und mich in jeder erdenklichen Weise unterstützte, mir die Belege aus PRC und PRM besorgte, wichtige Literatur beschaffte, aus dem Tschechischen übersetzte und zuletzt auch noch das Manuskript durchsah. Ohne seine Hilfe wäre diese Arbeit nicht zustande gekommen. Weiters danke ich Hr. Dr. M. Svrček für den wertvollen Gedankenaustausch und die Diskussion über einzelne Belege sowie Frau Dr. Irmgard Krisai-Greilhuber für die Erstellung der lateinischen Diagnosen und die Durchsicht des Manuskripts, Hr. Dr. R. Watling, Edinburgh, und Hr. M. Enderle, Leipheim-Riedheim, für die Beschaffung wichtiger Literatur, Hr. Z. Pouzar, Prag, für die Durchsicht des Manuskripts, Hr. L. Sandmann, Schrems, für Übersetzungsarbeiten und dem Kurator von PRC für die Ausleihe von Herbarmaterial. Frau Monika Köberl-Hausknecht hat wie immer in dankenswerter Weise die Ausarbeitung der Zeichnungen übernommen.

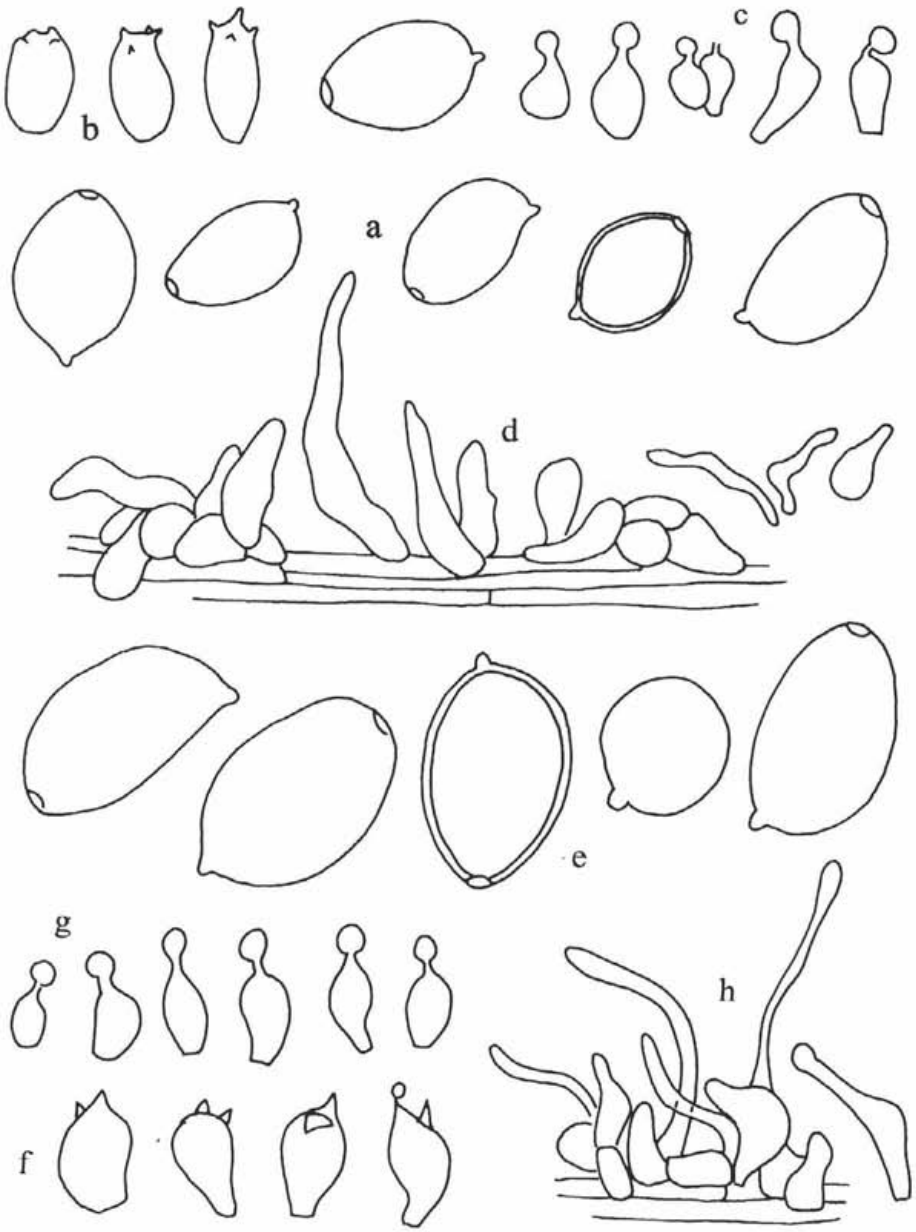

Abb. 11. a-d *Galera velutipes* (PRM 153695, Holotypus); a Sporen, × 2000; b Basidien, × 800; c Cheilozystiden, × 800; d Stielbekleidung, × 800. **Abb. 11. e-h** *Galera vesicaria* (PRM 153732, Holotypus); e Sporen, × 2000; f Basidien, × 800, g Cheilozystiden, × 800; h Stielbekleidung, × 800.

REFERENCES

DENNIS R. W. G. (1953): Les Agaricales de l'ile de la Trinité. Rhodosporeae – Ochrosporeae. – Bull. Soc. Myc. France 69: 145–196.
ENDERLE M. (1996): Conocybe-Pholiotina-Studien VI. – Z. Mykol. 62: 19–36.
ENDERLE M. (1997): Conocybe-Pholiotina-Studien VII. – Z. Mykol. 63: 3–34.
HAUSKNECHT A. (1995): Beiträge zur Kenntnis der Bolbitiaceae 2. Die Variabilität von Conocybe dumetorum. – Österr. Z. Pilzk. 4: 107–117.
HAUSKNECHT A. (1996): Beiträge zur Kenntnis der Bolbitiaceae 3. Europäische Conocybe-Arten mit wurzelndem oder tief im Substrat eingesenktem Stiel. – Österr. Z. Pilzk. 5: 161–202.
HAUSKNECHT A. (1998): Beiträge zur Kenntnis der Bolbitiaceae 4. Die Sektion Candidae und andere hellhütige Arten der Gattung Conocybe. – Österr. Z. Pilzk. 7: 91–120.
HAUSKNECHT A. und KRISAI-GREILHUBER I. (1998): Conocybe spinulosa, a new species of Conocybe subg. Ochromarasmius from Tanzania. – Österr. Z. Pilzk. 7: 1–12.
HAUSKNECHT A. und PASSAUER U. (1997): Was ist Agaricus siligineus im Sinne von Fries? – Österr. Z. Pilzk. 6: 35–46.
HAUSKNECHT A., ZUCCHERELLI A. und CETTO R. (1998): Ritrovamenti interessanti dal Ravennate. 5a parte. – Boll. Gr. Micol. Bresadola (im Druck).
KRISAI-GREILHUBER I., SCHEUER C. und HAUSKNECHT A. (1997): Ergebnisse des Mykologischen Arbeitstreffens in Sibratsgfäll (Vorarlberg) vom 31. 8. – 6. 9. 1995. – Österr. Z. Pilzk. 6: 155–180.
KÜHNER R. (1935): Le genre Galera (Fries) Quélet. – Paris: Lechevalier.
SINGER R. (1951 "1950"): Naucoria Fries and affinitive genera in the USSR. – Acta Inst. Bot. Komarov Acad. Sci. USSR, Series 2,6: 402–498.
SINGER R. (1969): Mycoflora australis. – Beih. Nova Hedwigia 29: 1–405.
SINGER R. (1986): The Agaricales in modern taxonomy, 4th ed. – Koenigstein: Koeltz.
SINGER R. (1989): New taxa and new combinations of Agaricales. – Fieldiana ND 21: 1–133.
SINGER R. (unveröff.): Conocybe keys.
SINGER R. und HAUSKNECHT A. (1988): Notes on Conocybe (Bolbitiaceae). – Pl. Syst. Evol. 159: 107–121.
SINGER R. und HAUSKNECHT A. (1992): The group of Conocybe mesospora in Europe (Bolbitiaceae). – Pl. Syst. Evol. 180: 77–104.
SVRČEK M. (1956): Nové, vzácné nebo méně známé československé houby bedlovié III. – Česká Mykol. 10: 174–183.
SVRČEK M. (1983): Nové a vzácnější Agaricales z Čech. – Česká Mykol. 37: 212–236.
VELENOVSKÝ J. (1920–22): České houby 1–5. – Prag.
VELENOVSKÝ J. (1940 "1939"): Novitates mycologicae. – Prag.
VELENOVSKÝ J. (1947): Novitates mycologicae novissimae. – Opera Botanica Čechica 4: 1–158.
WATLING R. und GREGORY N. M. (1981): Census catalogue of world members of the Bolbitiaceae. – Bibl. Mycologica 82.

CZECH MYCOL. 51 (1), 1999

Induction of extracellular glycosidases in filamentous fungi and their potential use in chemotaxonomy

Zdenka Huňková[1], Alena Kubátová[2], Lenka Weignerová[1], Vladimír Křen[1]

[1]Institute of Microbiology, Academy of Sciences of the Czech Republic, Laboratory of Biotransformation, Vídeňská 1083, CZ 142 20 Prague 4, Czech Republic
[2]Department of Botany, Faculty of Natural Sciences, Charles University, Benátská 2, CZ 128 01 Prague 2, Czech Republic

Huňková Z., Kubátová A., Weignerová L. and Křen V. (1999): Induction of extracellular glycosidases in filamentous fungi and their potential use in chemotaxonomy – Czech Mycol. 51: 71–87

Data on the occurrence and inducibility of extracellular β-*N*-acetylhexosaminidase, α-galactosidase, α- and β-mannosidase and α-L-fucosidase, including inductors, are given for selected *Aspergillus, Penicillium* and *Fusarium* strains. These data represent additional information on the strains in the Culture Collection of Fungi, Department of Botany, Charles University, Prague, and in the Culture Collection of the Institute of Microbiology, Prague, Czech Republic, thus extending their usability in biochemistry and biotechnology. With respect to these biochemical data a taxonomic evaluation of the examined strains is presented. Several strains were re-identified after biochemical and morphological comparisons with the type strains. The strains of *A. niveus* CCF 544, *A. terreus* CCF 76, CCF 869, and CCIM USA were re-identified as *A. flavipes,* the strain *A. oryzae CCF 1301* as *A. wentii.*

Key words: glycosidases, induction, *Aspergillus, Penicillium, Fusarium*

Huňková Z., Kubátová A., Weignerová L. a Křen V. (1999): Indukovatelnost extracelulárních glykosidás vláknitých hub a jejich potenciální využití v chemotaxonomii – Czech Mycol. 51: 71–87

Pro vybrané kmeny rodů *Aspergillus, Penicillium a Fusarium* jsou uvedeny údaje o výskytu a indukovatelnosti β-*N*-acetylhexosaminidasy, α-galaktosidasy, α- a β-manosidasy a α-L-fukosidasy. Tyto údaje představují další informaci o kmenech ve Sbírce kultur hub při katedře botaniky Přírodovědecké fakulty Karlovy university a ve sbírce mikroorganismů Mikrobiologického ústavu AV ČR, což zvyšuje jejich využitelnost v biochemii a biotechnologii. S ohledem na získaná biochemická data bylo provedeno taxonomické vyhodnocení zkoumaných kmenů. Po biochemickém a morfologickém porovnání s typovými kulturami byly některé zkoumané kmeny přeurčeny. Kmeny *A. niveus* CCF 544, *A. terreus* CCF 76, CCF 869 a CCIM USA byly přeurčeny jako *A. flavipes,* kmen *A. oryzae* CCF 1301 byl přeurčen na *A. wentii.*

INTRODUCTION

Glycosidases from fungi have proved to be very useful in the preparation of many glycosidic structures, such as β-galactosides, β-glucosides, β-mannosides, β-*N*-acetylglucosaminides and β-*N*-acetylgalactosaminides, by transglycosylation or a reversed glycosylation (Křen et al. 1994, Taubken et al. 1993, Crout et al. 1992). Despite of the copious methods developed for the chemical synthesis

of glycosides, the use of enzymes as catalysts is an attractive alternative, since the sugar coupling steps can be performed with high stereoselectivity and certain regioselectivity (Křen and Thiem 1997). There is a continuous effort to identify and to characterise novel glycosidases applicable in biochemistry (Koga et al. 1991, Holazo et al. 1992, Yamamoto et al. 1986a).

Extensive screening to obtain the desired glycosidases from selected fungal strains originating mostly from the Culture Collection of Fungi, Department of Botany, Charles University, Prague was started. Our attention was concentrated mostly on the fungal genera already known for their glycosidase production. Induction by specific inductors (oligosaccharides, glycomimetics) enabled us to obtain the desired glycosidases in sufficient quality and quantity (Huňková et al. 1996a,b, Huňková et al. 1997).

In addition, biochemical characteristics, i.e. production of particular glycosidases, and their inducibility can reveal new chemotaxonomic features for better characterisation and eventual taxonomic re-identification of the strains. So far, profiles of secondary metabolites and isoenzymes were used as an aid in the identification of many fungal genera, e.g. *Penicillium* (Cruickshank and Pitt 1987, Frisvad and Filtenborg 1989, Paterson et al. 1989), *Aspergillus* (Zohri and Ismail 1994, Bridge and Hawksworth 1984), *Fusarium* (Wasfy et al. 1987), *Phoma* (Monte et al. 1991), *Monascus* (Bridge and Hawksworth 1985), and *Beauveria* (Mugnai et al. 1989). Glycosidase activities were also used in some of these studies but only in combination with other features (Bridge and Hawksworth 1984, Bridge and Hawksworth 1985, Bridge et al. 1989). Besides their production, enzyme inductibility and catabolic repression can provide an additional set of data reflecting regulatory systems and physiological typology of the strains studied. Biochemical and physiological differences can, therefore, help to identify species which can be hardly distinguished morphologically. Thus, we have also focused on strains requiring further taxonomic characterization. For comparison we examined in parallel strains derived from the type specimen (ex-type cultures).

Here, we summarize the data on the occurrence of the most important extracellular glycosidases and their inducibility. These results represent further biochemical information on the strains in the Collections and they can also serve as the basis for their chemotaxonomy.

Some glycosidases from our screening were already successfully employed for glycoside synthesis (Weignerová et al. 1996, Rajnochová et al. 1997, Huňková et al. 1997, Křen et al. 1998, Weignerová et al. 1998).

Material and methods

Strains and cultivation conditions

The strains used originated from the Culture Collection of Fungi (CCF), Department of Botany, Charles University, Prague, from the Culture Collection of the Institute of Microbiology (CCIM), Prague, Czech Republic, from the American Type Culture Collection (ATCC), Rockville, Maryland, U. S. A., and from the International Mycological Institute (IMI), Egham, U. K.

Before the glycosidase assay, the cultures were maintained on the slants [g/l]: agar-agar, 20; bacto-peptone, 5; malt extract, 35. Conical flasks (500 ml) with 100 ml of medium were inoculated with a suspension of spores in 0.1% Tween 80 solution. The flasks were cultivated on a rotary shaker at 28 C. Media used: Sabouraud's medium [g/l]: mycological peptone, 10; glucose, 40; pH 5.6. Casamino-acid medium [g/l]: yeast extract, 0.5; mycological peptone, 5; KH_2PO_4, 3; $NH_4H_2PO_4$, 5; casein hydrolysate, 7.5; pH 6.0. After sterilization each flask was supplemented with 0.5 ml of 10 % $MgSO_4.7H_2O$. The inductor supplemented medium (production medium) was the same as the casamino-acid medium, the casamino-acids were replaced by respective amounts of inductor. Concentrations of inductors are given in the respective cases – see Tab. 1–3.

For morphological examination of the *Penicillia* and *Aspergilli* three agar media were used: Czapek yeast-extract agar (CYA) and malt-extract agar (MEA) according to Pitt (1980), and wort-beer agar. *Fusarium* strains were cultivated on potato-glucose agar and on synthetic nutrient agar according to Nirenberg (1976).

Enzyme activity assay

Glycosidases were assayed using corresponding *p*-nitrophenyl glycosides as substrates according to Mega et al. (1970). Proteins were determined according to Bradford (1976) using the kit from Bio-Rad (München, Germany) with bovine serum albumin as a standard.

Morphological examination

The identity of the *Penicillia* and *Aspergilli* strains was checked according to Raper and Thom (1949), Raper and Fennell (1965), Pitt (1980), Klich and Pitt (1988), Tzean et al. (1990), and Samson and Pitt (1990). *Fusarium* strains were identified according to Burgess et al. (1988).

Preparation of crude chitin hydrolysate

Crude chitooligomers were prepared by the acid hydrolysis of chitine according to Rupley (1964).

Preparation of α-mannooligomers

Mannooligomers were prepared by the condensation of mannose catalysed by α-mannosidase from *Canavalia ensiformis* (jack bean) under conditions as

published (Ajisaka et al. 1995) and separated by gel filtration on BioGel P2 (BioRad, U. S. A.).

RESULTS AND DISCUSSION

Constitutive production of glycosidases

Many fungal strains have low basal levels of glycosidases. For their purification and characterisation constitutively produced glycosidases were used, e.g. *β-N*-acetylhexosaminidase from *Trichoderma harzianum* (Koga et al. 1991) and *Penicillium oxalicum* (Yamamoto et al. 1985), α-galactosidase from *Trichoderma reesei* (Savel'ev et al. 1996) and *Mortierella vinacea* (Shibuya et al. 1997), α-galactosidase and *β-N*-acetylglucosaminidase from *Aspergillus niger* (Bahl and Agraval 1969) . *A. niger* is frequently used as a source microorganism for purification and characterisation of numerous glycosidases or for enzymatic syntheses (e.g., Jones and Kosman 1980, Bahl 1970, Ajisaka and Skirakabe 1992, Itoh and Kamiyama 1995).

We have found low constitutive production of extracellular glycosidases in many fungal strains, e.g. *β-N*-acetylhexosaminidase in *A. oryzae* strains 0.1–1.3 U/mg prot. and in *A. terreus* strains 0.5–2.2 U/mg prot. (Huňková et al. 1996a), in *P. vinaceum* CCF 2384 2.2 U/mg prot., and in *P. oxalicum* strains 0.22–6.3 U/mg prot.; α-galactosidase in *A. terreus* strains 0.25–7.0 U/mg prot.; α-fucosidase in *Fusarium oxysporum* strains 0.25–0.44 U/mg prot. and in *A. flavipes* IMI 171885 0.10–0.15 U/mg protein. Low constitutive production of α-mannosidase was found in many strains and slight constitutive production of β-mannosidase was observed in several strains (see Table 1, 2). Such activities are, however, rather low for practical use. Higher constitutive production of *β-N*-acetylhexosaminidase was found in *P. chrysogenum* CCF 1269 (9.2 U/mg prot.). High constitutive production of *β-N*-acetylhexosaminidase (11.0–24.6 U/mg prot.) and α-galactosidase (7.3–32.9 U/mg prot.), and slight production (under 0.5 U/mg prot.) of α- and β-mannosidase and α-L-fucosidase was found in culture filtrates of *A. niger* CCIM K1 and CCIM K2, *A. awamori* CCF 763 and *A. phoenicis* CCF 61. However, contamination of the main activity by other glycosidases complicates their purification and use in bioorganic chemistry.

Induction and inductors

Some glycosidases in fungi are known to be inducible, e.g. α-galactosidase in *Penicillium ochrochloron* was induced by galactomannan from guar *(Cyamopsis tetragonobola)* gum (Dey et al. 1993), α-fucosidase in *Fusarium oxysporum* was substantially induced by L-fucose and slightly by D-arabinose (Yamamato et al. 1986b), *β-N*-acetylhexosaminidase in *Aspergillus oryzae* was strongly induced

Table 1 Glycosidases in *Aspergillus*

STRAIN (original name)	β-HexNAc		α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate				
A. oryzae CCF 147	I+++ cho	0.26	I++ raf	I mo, MeMan C ca	0	0
A. oryzae CCF 172	I+++ cho	0.34	I+ raf	I mo	ND	ND
A. oryzae CCF 1063	I+++ cho	0.27	ND	ND	ND	ND
A. oryzae CCF 1065	I+++ cho	0.29	ND	ND	ND	ND
A. oryzae CCF 1066	I+++ cho I++ GlcNAc I+ chi I GlcN	0.39	I++ raf	I MeMan, mo C ca	0	0
A. oryzae CCIM NZS	I+++ cho	ND	ND	ND	ND	ND
A. oryzae CCIM NZZ	I+++ cho	ND	ND	ND	ND	ND
*A. oryzae CCF 1301**	C Glc	ND	0	0	0	ND
A. oryzae CCF 1602	I+ cho	0.26	I++ raf	I MeMan C ca	0	0
A. oryzae T IMI 16266ii	I++ cho	0.43	I raf	I MeMan C ca	0	0
A. flavus CCF 146	I cho	0.23	I++ raf	C ca, GlcN	0	0
A. flavus CCF 642	C ca, GlcN NI cho	0.54	I+++ raf	C ca	0	0
A. flavus CCF 814	I+ cho	0.60	I++ raf	I MeMan C ca	0	0
A. flavus CCF 1129	I++ cho I GlcN	0.66	I++ raf I GlcN	C ca	0	ND
A. flavus CCF 1624	C ca, GlcN NI cho	ND	I+ raf	C ca	0	0
A. flavus T IMI 124930	I++ cho I GlcN	0.57	I+++ raf I+ GlcN	C ca	0	0
A. parasiticus CCF 141	I cho	0.25	I+ raf I dGlc	C ca	0	0
A. parasiticus CCF 1298	I+++ cho I GlcN	0.59	I+++ raf I GlcN	I MeMan, mo	0	ND
A. parasiticus T IMI 15957lx	I+ cho	0.32	I++ raf I+ dGlc, GlcN	I MeMan, mo	0	0
A. sojae T IMI 191300	I cho	0.51	I++++ raf I dGlc, GlcN	C Glc, ca	0	0
A. flavofurcatis CCF 107	I+ cho	0.22	I+ raf	C ca	C- ca	0

Table 1 — Continued

STRAIN (original name)	β-HexNAc		α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate				
A. flavofurcatis T IMI 124938	I+ cho I dGlc, GlcN	0.35	I++ raf I+ GlcN I dGlc	C ca	0	0
A. tamarii CCF 1665	I+ cho I dGlc, GlcN	0.30	I+++ raf	I MeMan C ca	0	0
A. tamarii CCF 2492	I++ cho	ND	I+ raf	ND	ND	ND
A. terreus CCF 55	I+ cho	0.50	I++ raf I++ mel I Gal	ND	C- Glc	ND
A. terreus CCF 57	NI cho	1.00	I raf	ND	ND	ND
A. terreus CCF 58	I cho	ND	I++ mel I++ raf	ND	ND	ND
A. terreus ATCC 20542	ND	ND	I+ raf, mel I Gal	ND	ND	ND
A. terreus T IMI 17294	I cho	0.46	I+ raf I dGlc, GlcN	0	0	0
A. terreus CCF 2539	I+ cho	1.01	I+ raf, mel I+ Gal	ND	C- Glc	ND
*A. terreus CCF 76**	I++++ cho	0.54	C ca NI raf, dGlc	ND	C- ca	ND
*A. terreus CCF 869**	I++++ cho I+++ GlcNAc	0.56	C ca NI raf, dGlc	ND	C- ca	ND
A. terreus CCIM LM	I cho	ND	I dGlc NI raf	ND	ND	ND
*A. terreus CCIM USA**	I++ cho	0.68	I dGlc NI raf	ND	ND	ND
A. flavipes CCF 1895	I++ cho NI dGlc, GlcN	0.70	I dGlc NI raf	I MeMan C ca	0	0
A. flavipes CCF 2026	I+++ cho NI dGlc, GlcN	1.00	I++ dGlc NI raf	0	0	0
A. flavipes T IMI 171885	I+++ cho NI dGlc, GlcN	0.90	NI raf, dGlc (C- Glc)	C ca	C Glc	C Glc
A. niveus CCF 544	I++++ cho	0.75	I dGlc NI raf	I MeMan C ca	0	0
A. niveus T IMI 171878	I cho C+ Glc	0.15	NI raf, dGlc C Glc	C- ca	C- Glc	0
A. niger CCIM K1	C++ Glc	0.40	C++ ca	C- ca	C ca	ND

Table 1 — Continued

STRAIN (original name)	β-HexNAc		α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate				
A. niger CCIM K2	C++ Glc	0.42	C++ ca	C ca	C ca	ND
A. awamori CCF 763	C++ ca	ND	C+++ ca	C- ca	ND	ND
A. phoenicis CCF 61	C++ ca	0.49	C++ ca	C Glc	C ca, GlcN	C- Glc
A. versicolor CCF 2491	I++ cho I+ GlcN	0.09	I raf, GlcN	0	0	0

Abbreviations:

T	type strain
*	re-identified strain, see chapter Taxonomic evaluation
ND	not determined
	Constitutive production (basal levels are not given in case of unquestionable induction)
C-	specific activity below 0.02 U/mg prot.
C	spec. act. 0.02–2 U/mg prot.
C+	spec. act. 2–10 U/mg prot.
C++	spec. act 10–20 U/mg prot.
C+++	spec. act. more than 20 U/mg prot.
	Inductive production (compared with basal level)
I	induction less than 5×
I+	5–10×
I++	10–20×
I+++	20× — 50×
I++++	more than 50×
NI	no induction
β-HexNAc	β-*N*-acetylhexosaminidase
β-GlcNAc	β-*N*-acetylglucosaminidase
β-GalNAc	β-*N*-acetylgalactosaminidase
α-Gal	α-galactosidase
α-Ma	α-mannosidase
β-Man	β-mannosidase
α-Fuc	α-L-fucosidase
	Inductors and substrates used (concentrations)
Ara	D-arabinose (0.1 %)
Gal	galactose (1 %)
Glc	glucose (4 %; Sabouraud medium)
GlcNAc	*N*-acetylglucosamine (0.5 %)
dGlc	6-deoxyglucose (0.1 %)
GlcN	glucosamine (0.1 %)
Fuc	L-fucose (0.1 %)
MeMan	α-methylmanoside (0.1 %)
cho	chitooligomers (0.2 %; crude chitin hydrolysate)
chi	chitosan (MW 70000, 0.25 %)
raf	raffinose (0.2 %; raffinose pentahydrate)
mel	melibiose (0.2 %; melibiose monohydrate)
mo	α-mannooligomers (0.1%; crude α-mannooligomers)
ca	casamino acids (0.75 %; casein hydrolysate)

Table 2 Glycosidases in *Penicillium* (For legend and abbreviations see Table 1)

STRAIN (original name)	β-HexNAc		α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate				
P. spinulosum CCF 2159	I cho	0.92	I raf, dGlc I GlcN	ND	0	0
P. vinaceum CCF 2384	C+ Glc	ND	I+++ raf	I MeMan C ca	C Glc	0
P. daleae CCF 2365	I+ cho I dGlc, GlcN	ND	I+ raf I dGlc, GlcN	0	0	0
P. melinii CCF 2440	I++ cho I GlcN	0.12	I+ raf	C- ca	0	0
P. brasilianum CCF 2155	I cho	0.75	I raf	I MeMan, mo	0	0
P. brasilianum CCF 2171	I++++ cho I++ dGlc	ND	I raf, dGlc	0	0	0
P. ochrochloron CCF 2379	C Glc	ND	I raf, mel	0	ND	ND
P. commune CCF 2962	0	ND	I+ mel	C- ca	ND	ND
P. chrysogenum CCF 1269	C++ Glc	ND	I+++ mel	C ca	ND	ND
P. funiculosum CCF 1994	I++ cho I dGlc, GlcN	1.20	I raf I+ dGlc	I MeMan, mo	0	I dGlc
P. funiculosum CCF 2325	I+ cho I dGlc, GlcN	0.76	I raf I+ dGlc	C- ca	0	I dGlc
P. purpurogenum var. *rubrisclerotium CCF 2984*	I+ cho	1.22	I raf I++ dGlc	0	C- Glc	I dGlc
P. purpurogenum var. *rubrisclerotium CCF 2985*	I cho	1.15	I raf I+ dGlc	I MeMan, GlcN	C- Glc	I dGlc
P. pitii CCF 2277	I cho	0.63	C+ ca	0	0	0
Talaromyces flavus CCF 2324	C Glc, ca	ND	I raf I++ dGlc	0	C Glc	0
P. oxalicum CCF 1659	I cho	2.8	ND	ND	ND	ND
P. oxalicum CCF 1667	I++ cho	2.0	ND	ND	ND	ND
P. oxalicum CCF 1959	I+ cho I dGlc	1.6	ND	I MeMan	ND	ND

Table 2 — Continued

STRAIN (original name)	β-HexNAc		α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate				
P. oxalicum CCF 2315	I++++ cho	1.4	ND	ND	ND	ND
P. oxalicum CCF 2430	I++++ cho	2.3	ND	ND	ND	ND
P. oxalicum CCF 3009	I+ cho	1.4	ND	ND	ND	ND
*P. asturianum CCF 2062**	I cho	1.5	ND	ND	ND	ND

Table 3 Glycosidases in *Fusarium oxysporum* (for legend and abbreviations see Table 1)

STRAIN (original name)	β-HexNAc		α-GlcNAc	α-Gal	α-Man	β-Man	α-Fuc
	β-GlcNAc	β-GalNAc/ β-GlcNAc rate					
F. oxysporum CCF 377	I cho, Fuc, GlcN	0.18	ND	I+ raf I Fuc I dGlc, GlcN	0	0	I+++ Fuc I Ara
F. oxysporum CCF 483	I Fuc	ND	ND	ND	ND	ND	I++ Fuc
F. oxysporum CCF 906	I Fuc	ND	ND	ND	ND	ND	NI Fuc C ca
F. oxysporum CCF 1389	I Fuc	ND	ND	ND	ND	ND	NI Fuc C ca
F. oxysporum CCF 1414	I Fuc	ND	ND	ND	ND	ND	I++ Fuc

by aminosugar derivatives (Huňková et al. 1996a). For obtaining the glycosidases in higher amount, we tested glycosidase induction susceptibility of all examined strains. Extracellular production of certain glycosidases can be remarkably increased by induction (see Tables 1–3). The data in the tables represent induction in comparison with the basal level (casamino-acids medium without any supplement).

β-N-Acetylhexosaminidase

Overproduction of extracellular β-*N*-acetylhexosaminidase from *A. oryzae* by induction with aminosugar-containing inductors was already demonstrated by us

(Huňková et al. 1996a). Induction of this enzyme in *A. oryzae* strains was triggered by crude chitin hydrolysate (chitooligomers containing 2–10 glycosyl units together with ca 75% NaCl produced by neutralization of HCl used for hydrolysis), by *N*-acetylglucosamine and by chitosan. Because the best results were obtained with the crude chitin hydrolysate, we have chosen this preparation as an inductor for all tested strains. Production of a large series of *β-N*-acetylhexosaminidases can be improved in this way (Tab. 1). Moreover, by induction we obtained *β-N*-acetylhexosaminidases in high specific activity without a significant amount of other glycosidases in some strains, e.g. *A. terreus* CCF 76* and 869*, *A. terreus* CCIM USA*, *A. tamarii* CCF 2492, *P. oxalicum* CCF 1959 and with all strains of *A. oryzae* (except the strain CCF 1301*). Thus, culture filtrate containing *β-N*-acetylhexosaminidase could, after precipitation with for example ammonium sulphate, directly be used for many biochemical procedures (Rajnochová et al. 1997, Weignerová et al. 1996, Křen et al. 1998, Weignerová et al. 1997, Weignerová et al. 1998).

With some strains slight improvement of *β-N*-acetylhexosaminidase activity was also reached using 6-deoxyglucose, glucosamine or L-fucose.

β-N-*acetylhexosaminidase* with high *β*-N-*acetylgalactosaminidase* activity

As *β-N*-acetylhexosaminidase having high *β-N*-acetylgalactosaminidase activity and low *β-N*-acetylglucosaminidase activity was required, we have also determined the rate of these two activities. Most of *β-N*-acetylhexosaminidases from fungal sources have a low *β*-GalNAcase/*β*-GlcNAcase rate, being below 0.50 (Table 1–3). A higher *β*-GalNAcase/*β*-GlcNAcase rate was found only in several strains, e.g. *P. brasilianum* CCF 2155: 0.75, *P. funiculosum* CCF 2325: 0.76, *A. terreus* CCF 57: 1.00, *A. terreus* 2539: 1.01, *A. flavipes* CCF 2026: 1.00, *A. flavipes* IMI 171885: 0.90, *P. spinulosum* CCF 2159: 0.92, *P. funiculosum* CCF 1994: 1.20 and *P. purpurogenun* var. *rubrisclerotium* CCF 2985: 1.15 and CCF 2984: 1.22. Unique *β-N*-acetylhexosaminidase with the *β*-GalNAcase/*β*-GlcNAcase rate of about 1.50 was found only in culture filtrates of some strains of *P. oxalicum* (Huňková et al. 1997). These findings are in agreement with those of Yamamoto et al. (1985) obtained with the strain *P. oxalicum* IFO 5748 not exposed to induction. A high *β*-GalNAcase/*β*-GlcNAcase rate seems to be characteristic of the species *P. oxalicum*. Similar *β-N*-acetylhexosaminidase biochemical pattern was found only with *P. asturianum* CCF 2062[1)] (1.50). This species seems to be very close to *P. oxalicum*.

[1)] Strains with an asterisk (*) were re-identified due to the results obtained – see the part "Taxonomic evaluation".

α-Galactosidase

α-Galactosidase catalyzes hydrolysis of terminal α-galactosidic linkages of glycosides (Savel'ev et al. 1996, Kaneko et al. 1990). Both raffinose and melibiose can serve as inductors of extracellular α-galactosidase, giving similar induction rates (Huňková et al. 1996b). Cheaper raffinose was chosen for most of the experiments. After induction, extracellular enzyme was produced in several strains (e.g. *A. terreus* CCF 55, CCF 58, CCF 2539, ATCC 2052 and *P. commune* CCF 2962) in high specific activity and void of contaminating glycosidases (Huňková et. al 1996b). Thus, this enzyme could be directly precipitated by, e.g., ammonium sulphate and then directly used for further reactions (Weignerová et al. 1996, Weignerová et al. 1997, Weignerová et. al. 1998).

Weak induction of α-galactosidase was achieved using galactose. In some strains, a slight improvement of production was observed after adding of 6-deoxyglucose or glucosamine and in *F. oxysporum* also after adding of L-fucose.

In culture filtrates of the strains *Talaromyces flavus* CCF 2324, *P. funiculosum* CCF 2325, *P. purpurogenum* var. *rubrisclerotium* 2984 and CCF 2985, *A. fumigatus* CCF 1059, *A. flavipes* CCF 1895 and CCF 2026, *A. terreus* CCIM LM and CCIM USA*, and *A. niveus* CCF 544* induction of α-galactosidase was triggered by 6-deoxyglucose whilst raffinose induced slightly or not at all. Induction of α-galactosidase by 6-deoxyglucose in fungi is described here for the first time.

α-Mannosidase

Although the occurrence of α-mannosidase in different natural sources was described (Dey and Del Campillo 1984), no effective inductor for this enzyme was found yet. In several strains a slight improvement of extracellular α-mannosidase was observed in the growth phase of cultivation when using α-methylmannoside or α-mannooligomers, but in the lytic phase constitutive production of this enzyme predominated (*A. oryzae* CCF 1066, CCF 147, CCF 172 and IMI 16266ii, *A. flavus* CCF 814, *A. tamarii* CCF 1665, *A. flavipes* CCF 1895, *A. niveus* CCF 544*, *P. vinaceum* CCF 2384 – Table 1, 2). Slight induction both in the growth and lytic phases of cultivation was observed only in the strains *A. parasiticus* CCF 1298 and IMI 15957ix, *P. funiculosum* CCF 1994 and *P. purpurogenum* var. *rubrisclerotium* CCF 2985.

In some strains improvement of α-galactosidase and α-mannosidase was achieved using glucosamine. In our opinion, this improvement cannot be explained in terms of induction, similarly as the improvement of β-*N*-acetylhexosaminidase.

β-Mannosidase

No effective inductor for β-mannosidase was found so far. Brown copra meal (residual cake of coconut oil containing about 50% β-mannan) was used as a substrate in the screening test where *A. niger, A. awamori, A. sojae, P. wort-*

manni and *Emericella nidulans* were found to produce a detectable level of β-mannosidase (Holazo et al. 1992). For purification and characterization studies, the enzyme from *A. niger* produced constitutively was used (Monttreuil 1975, Elbein et al. 1977). In our study we observed slight constitutive production of extracellular β-mannosidase in several strains (*A. flavipes* IMI 171885, *A. niger* CCIM K1 and K2, *A. phoenicis* CCF 61, *P. vinaceum* CCF 2384, *P. purpurogenum* var. *rubrisclerotium* CCF 2984 and 2985 and *T. flavus* CCF 2324).

α-L-Fucosidase

Production of extracellular α-L-fucosidase was slightly induced by 6-deoxyglucose in *P. funiculosum* CCF 1994 and CCF 2325 and *P. purpurogenum* var. *rubrisclerotium* CCF 2984 and CCF 2985. Effect of 6-deoxyglucose as inductor for α-L-fucosidase was observed here for the first time.

On the contrary, in *F. oxysporum* extracellular α-L-fucosidase was not induced by 6-deoxyglucose but its production was improved by L-fucose addition in some strains. The best results were reached with *F. oxysporum* CCF 377, good induction was observed in *F. oxysporum* CCF 483 and CCF 1414. No induction was observed in the strains CCF 906 and CCF 1389. Our results obtained with *F. oxysporum* CCF 377 are consistent with the results of Yamamoto et al. (1986b) obtained with *F. oxysporum,* strain S252. Just as these authors we also found that the amount of induced α-L-fucosidase was increased proportionally with the concentration of L-fucose added (0.1–0.5%) and that the enzyme is slightly induced by D-arabinose.

Taxonomic evaluation

The data on the occurrence and inducibility of selected glycosidases represent additional information on the strains in the Collections. These data will appear in the addendum to the CCF Catalogue of filamentous fungi (Kubátová and Huňková 1998).

From the results given in the Tables 1–3 partial taxonomic conclusions can be deduced in such where more representatives of a particular species were examined, i.e. for *A. oryzae, A. flavus, A. terreus, P. oxalicum* and *F. oxysporum.*

The species *A. flavus, A. parasiticus, A. oryzae* and *A. tamarii* belong to economically important fungi, two first species producing aflatoxins, the other two species being used in food industry. All these species are included in the section *Flavi* of the genus *Aspergillus* and their morphological characters are very similar (Klich and Pitt 1988). The identification of these species based only on morphological features is difficult and quite often incorrect. Therefore, any aid in clarifying their taxonomy and their identification is very useful. Among our strains of *A. flavus, A. parasiticus* and *A. oryzae* large morphological variability was observed, especially in shape and surface texture of the conidias and in colony

habits. Some variability was found in the production of glycosidases as well. Contrary to *A. flavus,* the induction of *β-N*-acetylhexosaminidase in *A. oryzae* was higher than the induction of α-galactosidase, only the strain *A. oryzae* CCF 1602 differed by a higher induction of α-galactosidase. The morphological features of this strain were similar to the strains designated here as *A. tamarii.* Nevertheless, its correct placement in the species *A. oryzae* was confirmed by Dr. Z. Lawrence (IMI, Egham, U. K.). In *A. flavus* strains we found constitutive production of α-mannosidase (except the strain CCF 814) whilst in *A. oryzae* slight induction was observed in the growth phase of cultivation and constitutive procuction prevailed in the lytic phase. However, the fact that no effective inductor exists for α-mannosidase together with the fact that *A. flavus* CCF 814 exhibited typical morphological features makes definite conclusions impossible. In *A. oryzae* a slight induction of α-mannosidase in the growth phase was observed, in *A. flavus* (except the strain CCF 814) constitutive production of this enzyme was found and in *A. parasiticus* CCF 1298 and IMI 15957ix induction of α-mannosidase was observed both in the growth and lytic phase. Current results suggest that clarification of this situation requires detailed comparative study. Anyhow, one of the *A. oryzae* strains (CCF 1301) exhibited strong differences in the production of glycosidases manifested in the absence of induction of *β-N*-acetylhexosaminidase and α-galactosidase and in the absence of constitutive α-mannosidase production. After detailed morphological examination this strain was re-identified as *A. wentii.*

For the cultures of *A. terreus* (compared with the type strain IMI 17394) high induction of α-galactosidase by raffinose or melibiose was typical. In the studied strains of *A. flavipes* (including the type strain IMI 171885) slight constitutive production of α-galactosidase was observed, raffinose and melibiose being non-effective. Inducibility of *β-N*-acetylhexosaminidase in *A. flavipes* was very high but low or absent in *A. terreus.* In spite of the overall similarity of *A. terreus* and *A. flavipes*, these species have several distinct morphological features. *A. terreus* has remarkably shorter stipes, its phialides are more closely arranged and its colonies are growing faster. With respect to the differences in biochemical evaluations and distinct morphological features the strains *A. terreus* CCF 76, CCF 869 and CCIM USA were re-identified as to be *A. flavipes.*

Strain *A. niveus* CCF 544 was found to exhibit other biochemical characteristics than the type strain *A. niveus* IMI 171878 (see Table 1). Morphological examination revealed close resemblance of the strain CCF 544 to *A. flavipes* and the strain was therefore transferred to this species.

Black aspergilli, e.g. *A. niger, A. awamori* and *A. phoenicis,* are closely related to the section *Nigri* of the genus *Aspergillus.* Due to their morphological similarity, *A. awamori* and *A. phoenicis* were considered varieties of *A. niger* (Al-Musallam 1980, Klich and Pitt 1988, Kozakiewicz 1989). However, recent

molecular studies treated *A. awamori* and *A. phoenicis* as synonyms (Pařenicová et al 1997, Varga et al. 1997). Pařenicová et al. (1997) divided the studied strains of *A. awamori* and *A. phoenicis* into three groups: *A. niger, A. tubingensis* and *A. foetidus* varieties. Our results dealing with the glycosidase activity of four strains (constitutive production of all examined glycosidases) confirmed their close relationships. Nevertheless, correct placement of the four strains used in our study can be carried out only after a more detailed study involving comparative strains and molecular methods.

The slight induction of α-L-fucosidase by 6-deoxyglucose in *P. purpurogenum* var. *rubrisclerotium* CCF 2984 and CCF 2985 as well as in *P. funiculosum* CCF 1994 and CCF 2325 together with other biochemical similarities correspond with the fact that *P. purpurogenum* var. *rubrisclerotium* is a species close to *P. funiculosum*. Both species belong to the series *Miniolutea* of the subgenus *Biverticillium*.

P. oxalicum strains represent a group which could be biochemically characterized by induction of unique β-*N*-acetylhexosaminidase with a very high β-*N*-galactosaminidase/β-*N*-glucosaminidase rate. *P. asturianum* CCF 2062, which possesses the same β-*N*-acetylhexosaminidase, has been considered as synonym of *P. oxalicum* since 1990 when Frisvad and Filtenborg (1990) and Frisvad et. al. (1990) made a revision of *Penicillium* subgenus *Furcatum* based on secondary metabolites and conventional characters. Our results fully corroborate their conclusions.

F. oxysporum strains were preferentially examined for the production of α-L-fucosidase and β-*N*-acetylhexosaminidase, and no other glycosidases were studied yet. For chemotaxonomic evaluation it would be necessary to examine all glycosidases, not only in *F. oxysporum* but also in closely related species. *F. oxysporum* is related to *F. solani*. Therefore, besides a morphological study a test of ammonium salts agar with sorbitol according to Brayford and Bridge (1989) was carryed out. All *F. oxysporum* strains showed a red-vinaceous pigment on the colony reverse, one strain (CCF 1389) produced this pigment after a prolonged period of time (two weeks). Although the test confirmed the correct identification, the strains CCF 906 and CCF 1389 still differ from other strains by an absence of α-L-fucosidase induction.

Differences in the production and inducibility of glycosidases certainly cannot serve as a the only criterion for taxonomic determination of strains. Nevertheless, striking biochemical differences among strains of the same species drew our attention to a more detailed morphological examination of disputable strains and led us to eventual re-identification of some of them.

ACKNOWLEDGEMENT

This work was supported by grant No. A6020605 from the Grant Agency of the Academy of Sciences of the Czech Republic. The authors wish to thank

Doc. Dr. Olga Fassatiová for her valuable comments and encouragement, Dr. Zofia Lawrence, International Mycological Institute, Egham, U. K., for examining of *A. oryzae* (CCF 1602) and for providing type strains of *Aspergillus*, and Dr. Martha Christensen, University of Wyoming, Laramie, U. S. A., for kindly supplying the *P. oxalicum* strain (CCF 3009).

REFERENCES

AJISAKA K., MATSUO I., ISOMURA M., FUJIMOTO H., SHIRAKABE M. and OKAWA M. (1995): Enzymatic synthesis of mannobioses by reverse hydrolysis using α-mannosidase from Aspergillus niger. – Carbohydr. Res. 270: 123–130.

AJISAKA K. and SHIRAKABE M. (1992): Regioselective synthesis of α-L-fucosyl-containing disaccharides by use of α-L-fucosidases of various origins. – Carbohydr. Res. 224: 291–299.

AL-MUSALLAM A. (1980): Revision of the black Aspergillus species. – Utrecht, pp. 91 [Thesis].

BAHL O. P. (1970): Glycosidases of Aspergillus niger. Purification and general properties of 1,2-α-L-fucosidase. – J. Biol. Chem. 245: 299–304.

BAHL O. P. and AGRAWAL K. L. M. (1969): Glycosidases of Aspergillus niger. I. Purification and characterization of α- and β-galactosidases and β-N-acetylglucosaminidase. – J. Biol. Chem. 244: 2970–2978.

BRADFORD M. M. (1976): A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein dye binding. – Anal. Biochem. 72: 248–254.

BRAYFORD D. and BRIDGE P. D. (1989): Differentiation of Fusarium oxysporum from Fusarium solani by growth and pigmentation on media containing alcohols. – Lett. Appl. Microbiol. 9: 9–12.

BRIDGE P. D. and HAWKSWORTH D. L. (1984): The API ZYM enzyme testing system as an aid to rapid identification of Penicillium isolates. – Microbiol. Sci. 1: 232–234.

BRIDGE P. D. and HAWKSWORTH D. L. (1985): Biochemical tests as an aid to the identification of Monascus species. – Letters Appl. Microbiol. 1: 25–29.

BRIDGE P. D., HAWKSWOIRTH D. L., KOZAKIEWICZ Z., ONIONS A. H. S., PATERSON R. R. M., SACKIN M. J. and SNEATH P. H. A. (1989): A reappraisal of the Terverticillate penicillia using biochemical, physiological and morphological features. – J. Gen. Microbiol. 135: 2941–2966.

BURGESS L. W., LIDDELL C. M. and SUMMERELL B. A. (1988): Laboratory manual for Fusarium research. – Sydney, Univ. of Sydney, 156 pp.

CROUT D. H. G., SINGH S., SWOBODA B. E. P., CRITCHLEY P. and GIBSON W. T. (1992): Biotransformations in carbohydrate synthesis. N-acetyl-galactosaminyl transfer on to methyl N-acetyl–β-D-glucosaminide (methyl-2-acetamido-2-deoxy–α-D-gluco-pyranoside) catalysed by a β-N-acetylgalactosaminidase from Aspergillus oryzae. – J. Chem. Soc., Chem. Commun. 1992: 704–705.

CRUICKSHANK R. H. and PITT J. I. (1987): The zymogram technique: isoenzyme patterns as an aid in Penicillium classification. – Microbiol. Sci. 4: 14–17.

DEY P. M. and DEL CAMPILLO E. (1984): Biochemistry of the multiple forms of glycosidases in plants. – Adv. Enzymol. Relat. Areas Mol. Biol. 56: 141–249.

DEY P. M., PATEL S. and BROWNLEADER M. D. (1993): Induction of α-galactosidase in Penicillium ochrochloron by guar (Cyamopsis tetragonobola) gum. – Biotechnol. Appl. Biochem. 17: 361–371.

ELBEIN A., ADYA S. and LEE Y. (1977): Purification and properties of β-mannosidase from Aspergillus niger. – J. Biol. Chem. 252: 2026–2031.

FRISVAD J. C. and FILTENBORG O. (1989).: Terverticillate penicillia: chemotaxonomy and mycotoxin production. – Mycologia 81: 837–861.

FRISVAD J. C. and FILTENBORG O. (1990): Revision of Penicillium subgenus Furcatum based on secondary metabolites and conventional characters. – In: Samson R. A., and Pitt J. I. (eds.), Modern concepts in Penicillium and Aspergillus classification, p. 159–170, New York, London.

FRISVAD J. C., SAMSON R. A. and STOLK A. C. (1990): Disposition of recently described species of Penicillium. – Parsoonia 14: 209–232.

HOLAZO A., SHINOYAMA H., KAMIYAMA Z. and YASUI T. (1992): Screening for β-mannosidase with transmannosidation capacity. – Biosci. Biotech. Biochem. 56: 822–824.

HUŇKOVÁ Z., KŘEN V., ŠČIGELOVÁ M., WEIGNEROVÁ L., SCHEEL O. and THIEM J. (1996a): Induction of β-N-acetylhexosaminidase in Aspergillus oryzae. – Biotechnol. Lett. 18: 725–730.

HUŇKOVÁ Z., WEIGNEROVÁ L. and KŘEN V. (1996b): Fungal α-galactosidase with high transglycosylation activity. – Chem. Listy 90: 602–603.

HUŇKOVÁ Z., VAVRUŠKOVÁ P. DVOŘÁKOVÁ J., WEIGNEROVÁ L. and KŘEN V. (1997): Fungal β-N-acetylgalactosaminidase with high transglycosylation activity. – Third Internat. Symp. on Biocatalysis and Biotransformations – Biotrans97, Sept. 22–26, La Grande Motte, France.

ITOH H. and KAMIYAMA Y. (1995): Synthesis of alkyl β-mannosides from mannobiose by Aspergillus niger β-mannosidase. – J. Ferment. Bioeng. 80: 510–512.

JONES C. S. and KOSMAN D. J. (1980): Purification, properties, kinetics, and mechanisms of β-N-acetylglucosaminidase from Aspergillus niger. – J. Biol. Chem. 255: 11861–11869.

KANEKO R., KUSAKABE I., SAKAI Y. and MURAKAMI K. (1990): Substrate specifity of α-galactosidase from Mortierella vinacea. – Agric. Biol. Chem. 54: 237–238.

KLICH M. A. and PITT J. I. (1988): A laboratory guide to the common Aspergillus species and their teleomorphs. – North Ryde, CSIRO Div. Food Processing, pp. 116.

KOGA K., IWAMOTO Z., SAKAMOTO H., HATANO K., ISANO M. and KATO I. (1991): Purification and characterization of β-N-acetylhexosaminidase from Trichoderma harzianum. – Agric. Biol. Chem. 55: 2817–2823.

KOZAKIEWICZ Z. (1989): Aspergillus species on stored products. – Mycol. Pap. 161: 1–188.

KŘEN V., HUŇKOVÁ Z., HALADA P. and SUZUKI Y. (1998): Transglycosylation of thiamin by fungal β-N-acetylhexosaminidases. – Biosci. Biotech. Biochem. 62: 2415–2417.

KŘEN V., ŠČIGELOVÁ M., PŘIKRYLOVÁ V., HAVLÍČEK V. and SEDMERA P. (1994): Enzymatic synthesis of β-N-acetylhexosaminidases of ergot alkaloids. – Biocatalysis 10: 181–193.

KŘEN V. and THIEM J. (1997): Glycosylation employing bio-systems: from enzymes to whole cells. – Chem. Soc. Rev. 26: 463–473.

KUBÁTOVÁ A. and HUŇKOVÁ Z. (1998): Culture Collection of Fungi (CCF) in Prague – Accessions and new biochemical data since 1997. – Novit. Bot. Univ. Carol. 12: 41–52.

MEGA T., IKENAKA T. and MATSUSHIMA Y. (1970): Studies of N-acetyl-β-D-glucosaminidase of Aspergillus oryzae. – J. Biochem. 68: 109–117.

MONTE E., BRIDGE P. D. and SUTTON B. C. (1991): An integrated approach to Phoma systematics. – Mycopathologia 115: 89–103.

MONTTREUIL J. (1975): Recent data on the structure of the carbohydrate moiety of glycoproteins. Metabolic and biologic implications. – Pure Appl. Chem. 42: 431–477.

MUGNAI L., BRIDGE P. D. and EVANS H. C. (1989): A chemotaxonomic evaluation of the genus Beauveria. – Mycol. Res. 92: 199–209.

NIRENBERG H. (1976): Untersuchungen ber die morphologische und biologische Differenzierung in der Fusarium-Section Liseola. – Mitt. Biol. Bund. f. Land– u. Forstw. Berlin-Dahlem 169: 1–117.

PAŘENICOVÁ L., BENEN J. A. E., SAMSON R. A. and VISSER J. (1997): Evaluation of RFLP analysis of the classification of selected black Aspergilli. – Mycol. Res. 101: 810–814.

PATERSON R. R. M., BRIDGE P. D., CROSSWAITE M. J. and HAWKSWORTH D. L. (1989): A reappraisal of the terverticillate penicillia using biochemical, physiological and morphological features. III. An evaluation of pectinase and amylase isoenzymes for species characterization. – J. Gen. Microbiol. 135: 2979–2991.

PITT J. I. (1980): The genus Penicillium and its teleomorphic states Eupenicillium and Talaromyces. – London, Acad. Press, 634 pp.

RAJNOCHOVÁ E., DVOŘÁKOVÁ J., HUŇKOVÁ Z. and KŘEN V. (1997): Reverse hydrolysis catalysed by β-N-acetylhexosaminidase from Aspergillus oryzae. – Biotechnol. Lett. 19: 689–872.

RAPER K. B. and FENNELL D. I. (1965): The genus Aspergillus. – Baltimore, The Williams & Williams Co., 686 pp.

RAPER K. B. and THOM C. (1949): A manual of the Penicillia. – Baltimore, The Williams & Williams Co., 875 pp.

RUPLEY J. A. (1964): The hydrolysis of chitin by concentrated hydrochloric acid, and the preparation of low-molecular-weight substrates for lysozyme. – Biochim. Biophys. Acta 83: 245–255.

SAMSON R. A. and PITT J. I. (1990): Modern concepts in Penicillium and Aspergillus classification. – New York and London, Plenum Press, Pitt J. I., and Samson R. A. (eds.), 478 pp.

SAVEL'EV A. N., IBATYLLIN F. M., ENEYSKAYA E. V., KACHURIN A. M. and NEUSTROEV K. N. (1996): Enzymatic properties of α-D-galactosidase from Trichoderma reesei. – Carbohydr. Res. 296: 261–273.

SHIBUYA H., KOBAYASHI H., SATO T., KIM W.-S., YOSHIDA S., KANEKO S., KASAMO K. and KUSAKABE I. (1997): Purification, characterization, and cDNA cloning of a novel α-galactosidase from Mortierella vinacea. – Biosci. Biotech. Biochem. 61: 592–598.

TAUBKEN N., SAUERBREI B. and THIEM J. (1993): Synthesis of β-mannopyranosides by enzymatic approaches. – J. Carbohydr. Chem. 12: 651–667.

TZEAN S. S., CHEN J. L., LIOU G. Y., CHEN C. C. and HSU W. H. (1990): Aspergillus and related teleomorphs from Taiwan. – Hsinchu, Food Ind. Res. Dev. Inst. (FIRDI), 114 pp.

VARGA J., KEVEI F., HAMARI Z., TOTH B., TEREN J., CROFT J. H. and KOZAKIEWICZ Z. (1997): Genotypic and phenotypic variability among black Aspergilli. – Third International Workshop on Penicillium and Aspergillus, May 26–29, 1979, Baarn, The Netherlands.

WASFY E. H., BRIDGE P. D. and BRAYFORD D. (1987): Preliminary studies on the use of biochemical and physiological tests for the characterization of Fusarium isolates. – Mycopathologia 99: 9–13.

WEIGNEROVÁ L., OLŠOVSKÝ P., HAVLÍČEK V., HUŇKOVÁ Z. and KŘEN V. (1996): Enzymatic glycosylation of pyridoxine. – Chem. Listy 90: 603.

WEIGNEROVÁ L., SUZUKI Y., HUŇKOVÁ Z., SEDMERA P., HAVLÍČEK V. and KŘEN V. (1997): Pyridoxine as a testing substrate for screening of synthetic capabilities of glycosidases. – Third Internat. Symp. on Biocatalysis and Biotransformations – Biotrans97, Sept. 22–26, La Grande Motte, France.

WEIGNEROVÁ L., SUZUKI Y., HUŇKOVÁ Z., SEDMERA P., HAVLÍČEK V., MAREK R. and KŘEN V. (1998): Pyridoxine as a tool for screening of the glycosidases. – Biosci. Biotech. Biochem. (submitted).

YAMAMOTO K., LEE K. M., KUMAGAI H. and TOCHIKURA T. (1985): Purification and characterization of β-N-acetyhexosaminidase from Penicillium oxalicum. – Agric. Biol. Chem. 49: 611–619.

YAMAMOTO K., TSUJI Y., MATSUSHITA S., KUMAGAI H. and TOCHIKURA T. (1986a): Purification and properties of β-N-acetylhexosaminidase from Mucor fragilis grown in bovine blood. – Appl. Environ. Microbiol. 51: 1019–1023.

YAMAMOTO K., TSUJI Y., KUMAGAI K. and TOCHIKURA T. (1986b): Induction and purification of α-L-fucosidase from Fusarium oxysporum. – Agric. Biol. Chem. 50: 1689–1695.

ZOHRI A. A. and ISMAIL M. A. (1994): Based on biochemical and physiological behaviour, where is Aspergillus egyptianus better placed? – Folia Microbiol. (Prague) 39: 415–419.

Index to new names and combinations appearing in Czech Mycology 51 (1)

No. 4 of the vol. 50 of Czech Mycology appeared in July 12, 1998.

Czech Mycology, published by the Czech Scientific Society for Mycology. Graphic design by B. Bednář, PISCES. Typeset by TEX. Printed by Čihák Press, Praha 10. Distributed by the Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, and Kubon & Sagner, P.O.Box 340108, 80328 München, Germany. Annual subscription: Vol. 51, 1999 (4 issues), US $86,–, DM 136,–

Podávání novinových zásilek povoleno Ředitelstvím pošt Praha čj. NP 105/1994 ze dne 4. 2. 1994.

INSTRUCTIONS TO AUTHORS

Preparation of manuscripts. Manuscripts are to be submitted in English, German or French. The text of the manuscript should be written on one side of white paper (A4, 210 × 297 mm) with broad margins (maximum 30 lines per page). Each manuscript must include *an abstract* (in English) not exceeding 200 words and a maximum of five key words. The paper will be followed by an abstract in Czech (or Slovak). The journal is responsible, however, for the translation of abstracts into Czech for foreign authors. Please send *two copies* of the typescript. The authors are asked to submit diskettes with *the accepted manuscripts* prepared on IBM-compatible personal computers. The files should be in ASCII under DOS (preferably in Word Perfect) or in Microsoft Word for Macintosh. Both HD and DD/3.5″ and 5.25″ diskettes are acceptable.

Illustrations and tables. All tables, black and white photographs and figures (in black indian ink on a separate sheet) combined with the legends should be self-explanatory. Legends to the figures must be typed on a separate sheet. Colour photographs can be accepted but the authors will be responsible for the costs. All drawings or a photographs of microstructures should be provided with a scale. All illustration should be submitted as *the original drawing and one clear* copy. Output from computer graphics programmes produced on plotters or laser printers is quite acceptable. The dimension of any figure should not exceed 180 × 260 mm in size. References to illustrative matter in the text should normally in parentheses, e.g. ... spore sizes (Table 1) and ... as shown in Fig. 2 ... Figs 1–5 ...

Nomenclature. Latin names should conform to the International code of botanical nomenclature. New taxa must be substantiated by a Latin diagnosis including a reference to the public herbarium where the type specimen is deposited. The authors are asked to use only the acronyms listed in the Index Herbariorum.

References. References are to be listed in alphabetical order according to the surnames of the first authors. The bibliography should be written as follows:

Moravec J. (1984): Two new species of Coprobia and taxonomic remarks on the genera Cheilymenia and Coprobia (Discomycetes, Pezizales). – Čes. Mykol. 38: 146–155. (journal article)

Ryvarden L. (1978): The Polyporaceae of North Europe, Vol. 2. Inonotus-Tyromyces. – 507 p. Oslo. (book)

Tommerup I. C., Kuek C. and Malajczuk N. (1987): Ectomycorrhizal inoculum production and utilization in Australia. – In: Sylvia D. M., Hung L. L., and Graham J. H. (eds.), Proceedings of the 7th North American Conference on Mycorrhizae, p. 93–295, Gainesville.

The references *in text* should be Moravec (1984), or (Moravec 1984); or Kühner and Romagnesi (1974); When there are three or more authors use the form Tommerup et al. (1987).

Manuscript evaluation. All manuscripts will be reviewed and the authors informed about their acceptance, rejection or necessary revisions within two months. If a manuscript is returned for revision, the authors should submit a revised version within three months. Authors should preferably have their English language texts approved by a native – English speaker.

Proof corrections. Proofs of the paper will be sent to authors together with the original manuscript. If not returned within three weeks, the proof correction will be carried out by the editor. The principal author will receive 30 reprints free of charge.

Correspondence. All correspondence concerning the journal should be sent to the following address: Czech Mycology / Česká mykologie, National Museum, Department of Mycology, Václavské náměstí 68, 115 79 Praha 1, Czech Republic. Phone: 02/24497259

Czech Mycology, published by the Czech Scientific Society for Mycology. Graphic design by B. Bednář, PISCES. Typeset by TEX. Printed by Čihák Press, Praha 10. Distributed by the Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, and Kubon & Sagner, P.O.Box 340108, 80328 München, Germany. Annual subscription: Vol. 51, 1999 (4 issues), US $ 86,–, DM 136,–

Podávání novinových zásilek povoleno Ředitelstvím pošt Praha čj. NP 105/1994 ze dne 4. 2. 1994.

CZECH MYCOLOGY / ČESKÁ MYKOLOGIE

is an international scientific journal publishing papers in all aspects of mycology including taxonomy, ecology, physiology and mycofloristics as well as mycological topics in forestry, agriculture and medicine. Czech Mycology will publish full length papers and short communications reporting original research which make a significant contribution to mycology. Review articles are also published.

Accredited with the International Association for Plant Taxonomy for the purpose of registration of new names of fungi.

CONTENTS