

Molecular systematics of *Ceratostomella sensu lato* and morphologically similar fungi

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Abstract: The systematic position and phylogenetic relationships of *Ceratostomella sensu lato* and phenotypically similar fungi using comparative morphological and culture studies and phylogenetic analyses of the nuclear large- and small-subunit ribosomal DNA were explored. In the light of inferred phylogenies and morphological data the genus *Ceratostomella* is redescribed, the generic concept is emended and four species are accepted (viz. *C. cuspidata*, *C. pyrenaica*, *C. rhyngophora* and *C. rostrata*). A new genus *Xylomelasma* is introduced and delimited from *Ceratostomella*, with two new species described (viz. *X. novaezelandiae* and *X. sordida*). In culture species of both *Ceratostomella* and *Xylomelasma* produced sterile mycelium. The genus *Lentomitella* with a phaeoisaria-like anamorph formed in vitro is reinstated to encompass taxa formerly attributed to the broadly perceived *Ceratostomella* with three accepted species (viz. *L. cirrhosa*, *L. crinigera* and *L. tomentosa*). *Lentomitella* and *Ceratostomella* are clearly distinguishable by the morphology of asci, ascospores and centrum. *Lentomitella* is compared to phenotypically similar *Ceratospaeria*, which formed a harpophora-like anamorph in vitro. In the present phylogenies *Ceratostomella*, *Ceratospaeria*, *Lentomitella* and *Xylomelasma* are shown as clearly separate genera belonging to three different groups of perithecial ascomycetes. *Ceratostomella*, *Lentomitella* and *Xylomelasma* reside within a large unsupported clade consisting of members the Ophiostomatales, the freshwater Annulatascaceae and a group of nonstromatic, terrestrial taxa. *Ceratospaeria* is well supported within the Magnaporthaceae. The systematic value of morphological characters of ascospores, paraphyses, asci, centrum and conidiogenesis in segregating taxa from *Ceratostomella sensu lato* and their relatives is discussed.

Key words: Annulatascaceae, *Ceratospaeria*, *Endoxyla*, *Harpophora*, *Lentomitella*, LSU and SSU rDNA, Ophiostomatales, *Phaeoisaria*, *Sporothrix*, systematics, *Wegelinia*, *Xylomelasma*

INTRODUCTION

Ceratostomella Sacc. is a cosmopolitan genus of perithecial nonstromatic ascomycetes that colonize wood of angiosperms and gymnosperms in late stages of decay. Saccardo's (1878) simple generic diagnosis of *Ceratostomella* reads: “*Perithecia et asci Ceratostomatis. Sporidia continua, hyalina*”. Consequently the genus became a large, heterogeneous entity that included more than 100 taxa. Höhnelt (1918) removed species with evanescent asci from *Ceratostomella* to *Linostoma* Höhnelt. Sydow and Sydow (1919) recognized *Linostoma* to be a later homonym for a genus of flowering plants (Thymeleaceae); they proposed the new name *Ophiostoma* Syd. & P. Syd., where several *Ceratostomella* species were transferred. Several other species of *Ceratostomella* with evanescent asci later were recognized congeneric with *Ceratocystis* Ellis & Halst. in a broad sense (e.g. Elliott 1925, Moreau 1952, Hunt 1956).

Although *Ceratostomella* should include fungi with hyaline ascospores, nonstromatic perithecia and persistent asci, von Arx and Müller (1954) treated *Ceratostomella* as a synonym of *Endoxyla* Fuckel, characterized by ellipsoidal, smoky-brown ascospores with terminal germ pores, asci with dissolving stipe and perithecia with reduced stromatic tissue around the base of a projecting neck. For the next 20 years, *Ceratostomella* (under *Endoxyla*) was included in the Diaporthaceae (von Arx 1952, von Arx and Müller 1954, Müller and von Arx 1973, Munk 1952, 1957, Gilman et al 1959). The study of Danish members of *Endoxyla* by Munk (1965) did not shed light on the systematics of the genus and it remained heterogeneous. Munk (1965) doubted his former placement of *Endoxyla* in the Rhamphorioideae of the Diaporthaceae and noted that some *Endoxyla* species may even represent calosphaeriaceous elements. Barr (1978, 1990) excluded *Endoxyla* from the Diaporthales because of the carbonaceous perithecial wall, asci that do not float freely within the centrum, presence of free-ended paraphyses, occurrence on wood as a secondary saprobe, and she classified the genus in the family Clypeosphaeriaceae. Untereiner (1993) distinguished *Ceratostomella* from *Endoxyla* and suggested affinity of the former genus with the Lasiosphaeriaceae while *Endoxyla* was accepted in the Clypeosphaeriaceae. Eriksson et al (2003) followed Barr's concept and accepted *Ceratostomella* as a member in the Clypeosphaeriaceae of the Xylariales.

Ceratostomella sensu Untereiner (1993) was retained for species with dark-colored, immersed, nonstromatic perithecia with opaque, pseudoparenchymatous walls; central, elongate, separately protruding necks; true paraphyses; unitunicate, sessile asci arising from a crozier system with a distinct, refractive, nonamyloid apical annulus and ellipsoidal, hyaline ascospores. The phylogenetic relationships of *Ceratostomella* have remained unknown and no anamorph connections have been reported.

Höhnelt (1905) introduced a monotypic genus, *Lentomitella* Höhn., for *Ceratostomella vestita* Sacc. He based the segregation of *Lentomitella* from *Ceratostomella* on the ornamented (longitudinally striate) ascospore walls of *C. vestita* and suggested other species of *Ceratostomella* to belong to *Lentomita* Niessl or *Ceratosphaeria* Niessl. *Lentomita brevicollis* Niessl the type of the generic name *Lentomita* (Niessl 1876), was transferred by Müller and von Arx (1962) to *Chaetosphaeria*, as *C. brevicollis* (Niessl) E. Müll., and *Lentomita* was relegated to synonymy of *Chaetosphaeria*. It is difficult to find a difference in teleomorph morphology between *Ceratosphaeria* and *Ceratostomella* except that the ascospores are cylindrical in the type species, *Ceratosphaeria lampadophora* (Berk. & Broome) Niessl, but can range from ellipsoidal to oblong to subcylindrical in other species currently attributed to the genus (Tsuda and Ueyama 1977). The insufficiently delineated generic concept and life histories continued to hamper the distinction between *Ceratostomella* and *Ceratosphaeria* and considerable cross generic and species synonymy can be found in the literature.

When it was proposed originally (Saccardo 1878) two species were included in *Ceratostomella* Sacc (viz. *C. vestita* and *C. cirrhosa* [Pers.:Fr.] Sacc). At the same time Saccardo listed *Ceratostoma rostratum* (Tode:Fr.) Fuckel under *Ceratostomella* without comment. Later (Saccardo 1882) transferred *Ceratostoma rostratum* to *Ceratostomella*. The examination of type and other herbarium material of the three species cited in the protologue of *Ceratostomella* (Saccardo 1878), revealed the genus to be heterogeneous from the beginning and the three cited species represent two distinct genera.

Ceratostomella rostrata (Tode:Fr.) Sacc., the lectotype species of *Ceratostomella* (Clements and Shear 1931), possesses dark, long-beaked perithecia; pale brown, suballantoid to oblong ascospores; branching ascogenous hyphae; broad-celled paraphyses, and clavate asci tapering toward the base from the sporiferous portion with a shallow, indistinct, non-amyloid apical annulus. *Ceratostomella rostrata* matches the generic concept of *Wegelina* Berl., as emended by Barr (1998) and it is identical to *Wegelina*

polyporina M.E. Barr. *Wegelina* was erected by Berlese (1900) to segregate taxa from *Calosphaeria* Tul. & C. Tul. in the Calosphaeriales. Both genera accommodate species with tiny nonstromatic perithecia; hyaline, aseptate or delicately septate, allantoid ascospores; clavate, long-stipitate asci with thickened ascal apex and persistent paraphyses. *Wegelina* comprises species with superficial, separately growing perithecia and separately protruding necks, while *Calosphaeria* encompasses species forming perithecia in ellipsoidal to circinate groups or valsoid configurations with short or elongate, radially converging beaks piercing the periderm. Seven species have been assigned to *Wegelina*; *W. discreta* Berl. was designated as lectotype by Clements and Shear (1931). *Wegelina* was reduced to synonymy of *Scoptria* Nitschke (Barr 1985) or *Calosphaeria* (Barr et al 1993), but later it was reinstated (Barr 1998) and one new species and two new combinations were introduced to the genus. The characteristics of *W. polyporina* and *W. subdenudata* (Peck) M.E. Barr (Barr 1998), including relatively large perithecia that form a crust on the substratum, thick perithecial wall (50–100 µm thick vs the wall of *Wegelina s. str.* 20–40 µm), sulcate necks and suballantoid to ellipsoidal, pale brown ascospores before discharge, led Barr (1998) to extend Berlese's concept of *Wegelina*.

The other original species, *C. vestita* and *C. cirrhosa*, are congeneric but not closely related to *C. rostrata*. A phaeoisaria-like anamorph developed in culture. These fungi match the concept of *Ceratostomella sensu* Untereiner (1993) and should be accommodated in *Lentomitella* (Höhnelt 1905). *Lentomitella* is compared here with phenotypically similar species of *Ceratosphaeria*, based on *C. lampadophora*, which formed a harpophora-like anamorph in vitro.

During a survey of perithecial lignicolous ascomycetes in temperate regions of both Northern and Southern Hemispheres, several collections of two fungi phenotypically similar to *Ceratostomella sensu stricto* were encountered. In culture, colonies produced a sterile mycelium. The unknown fungi resemble *Ceratostomella sensu stricto* in having dark, long-beaked perithecia, densely branched ascogenous hyphae, clavate asci floating freely within the centrum at maturity and pigmented ascospores with terminal pores before discharge. The two taxa differ from the core species of *Ceratostomella* in thickness of the perithecial wall, morphology of paraphyses, shape of asci and apical annulus, and shape and arrangement of ascospores. One of these fungi has been described as *Endoxyla avocetta* (Cooke & Ellis) Romero & Samuels (Romero and Samuels 1991) or later as *Phaeognomoniella avocetta* (Cooke & Ellis) Romero (Romero 1999). The examination of the holotype

TABLE I. List of substrates, localities, sources, relevant sexual and asexual states and accession numbers of taxa sequenced in this study

Teleomorph	Anamorph	Locality and substrate	Source ^a	GenBank LSU SSU
<i>Ceratospheeria lampadophora</i>	<i>Harpophora</i> sp.	France, Pyrénées Atlantiques, wood of <i>Populus tremula</i>	CBS 117555	AY761084 AY761088
<i>Ceratostomella pyrenaica</i>	Unknown	Czech Republic, Southern Moravia, wood of <i>Acer campestre</i>	CBS 117116	DQ076323 DQ076324
<i>Lentomitella cirrhosa</i>	Unknown	New Zealand, wood of <i>Podocarpus totara</i>	ICMP 15131	AY761085 AY761090
<i>Lentomitella crinigera</i>	<i>Phaeoisaria</i> sp.	New Zealand, wood of <i>Nothofagus</i> sp.	CBS 113655	AY761086 —
<i>Xylomelasma sordida</i>	Unknown	Czech Republic, Southern Moravia, wood of <i>Alnus glutinosa</i>	CBS 116000	AY761087 AY761089

^aCBS = Centraalbureau voor Schimmelcultures, Utrecht, the Netherlands; ICMP = International Collection of Microorganisms, Landcare Research, Auckland, New Zealand.

material of *Sphaeria avocetta* Cooke & Ellis and herbarium material, on which the cited combinations were based, revealed two distinct perithecial ascomycete genera. *Sphaeria avocetta* is a species of *Endoxyla* and it is identical to *E. operculata* (Fr. : Fr.) Sacc, while one of the unknown fungi is conspecific with *E. avocetta sensu* Romero and Samuels (1991); its relationship and evolutionary history are examined here. The second unknown fungus differs from *E. avocetta sensu* Romero and Samuels (1991) in size, shape and color of the ascospores and size of the asci.

To reveal the systematic and phylogenetic relationships of *Ceratostomella*, *Ceratospheeria*, *Lentomitella* and the unknown fungi, sequences of nuclear small- and large-subunit ribosomal DNA (SSU and LSU nrDNA) of their type species were analyzed in two independent sequence datasets using maximum parsimony and Bayesian analyses.

MATERIALS AND METHODS

Herbarium material and fungal strains.—Dried herbarium specimens were rehydrated in water and studied in Melzer's reagent or 90% lactic acid. All measurements were made in Melzer's reagent. Means \pm standard errors (SE) for asci and ascospores are given, based on 20–25 measurements. The length/width ratios (L/W) for asci are given. Images were captured in Melzer's reagent with differential interference microscopy (DIC) and phase contrast (PC) and processed using Adobe Photoshop 6.0 CE.

Single- and mass-ascospore isolates were obtained from fresh material with the aid of a single-spore isolator (Meopta, Czech Republic). Cultures were grown on potato-carrot agar (PCA, Gams et al 1998). Colony characters were taken from cultures grown on PCA for 21 d at room temperature (24 C) under UV light. Cultures are maintained at the Institute of Botany, Academy of Sciences in Průhonice; Centraalbureau voor Schimmelcul-

tures, Utrecht (CBS); and Landcare Research, Auckland (ICMP). Type material is preserved in Landcare Research, Auckland (PDD), National Museum, Prague (PRM), other herbarium specimens with *M.R.* numbers are preserved at the Institute of Botany, Průhonice (PRA). The isolates used in this study and their sources are listed (TABLE I).

DNA extraction, amplification and sequencing.—Methods for DNA extraction, amplification and sequencing of the LSU and SSU nrDNA of *Ceratostomella pyrenaica* Réblová & Fournier and *Xylomelasma sordida* Réblová are identical to those described by Mostert et al (2004). The LSU and SSU nrDNA sequences of other taxa newly sequenced in this study were generated by methods identical to those described by Réblová and Seifert (2004).

Sequence data analyses.—Phylogenetic relationships were examined using 52 LSU nrDNA and 43 SSU nrDNA sequences from 15 or 14 different orders or families of Sordariomycetes, respectively. Members of the Dothideomycetes were used as outgroups in all analyses. New LSU and SSU nrDNA sequences were obtained for these taxa (TABLE I): the ascospore isolates of *Ceratospheeria lampadophora*, *Ceratostomella pyrenaica* Réblová & Fournier, *Lentomitella cirrhosa* (Pers. : Fr.) Réblová, *L. crinigera* (Cooke) Réblová and *Xylomelasma sordida* Réblová. Homologous LSU and SSU nrDNA sequences from other 88 taxa were retrieved from GenBank; accession numbers are given (FIGS. 1, 2).

All sequences were aligned manually in BioEdit 5.0.9 Hall (1999). Predicted models of the secondary structure of the LSU and SSU rRNA molecules of *Saccharomyces cerevisiae* Meyen ex E.C. Hansen (Gutell 1993, Gutell et al 1993) were used to improve the alignment. The models of the secondary structure of the LSU and SSU rRNA were highly consistent in all taxa. The insertion positions in the SSU nrDNA sequences are named for the 5' flanking nucleotide and correspond to the positions of *Escherichia coli* (Migula) Castell. & Chalm. (Gargas et al 1995).

The alignments are available in TreeBASE as SN2349.

The phylogenetic analyses were performed with PAUP v.

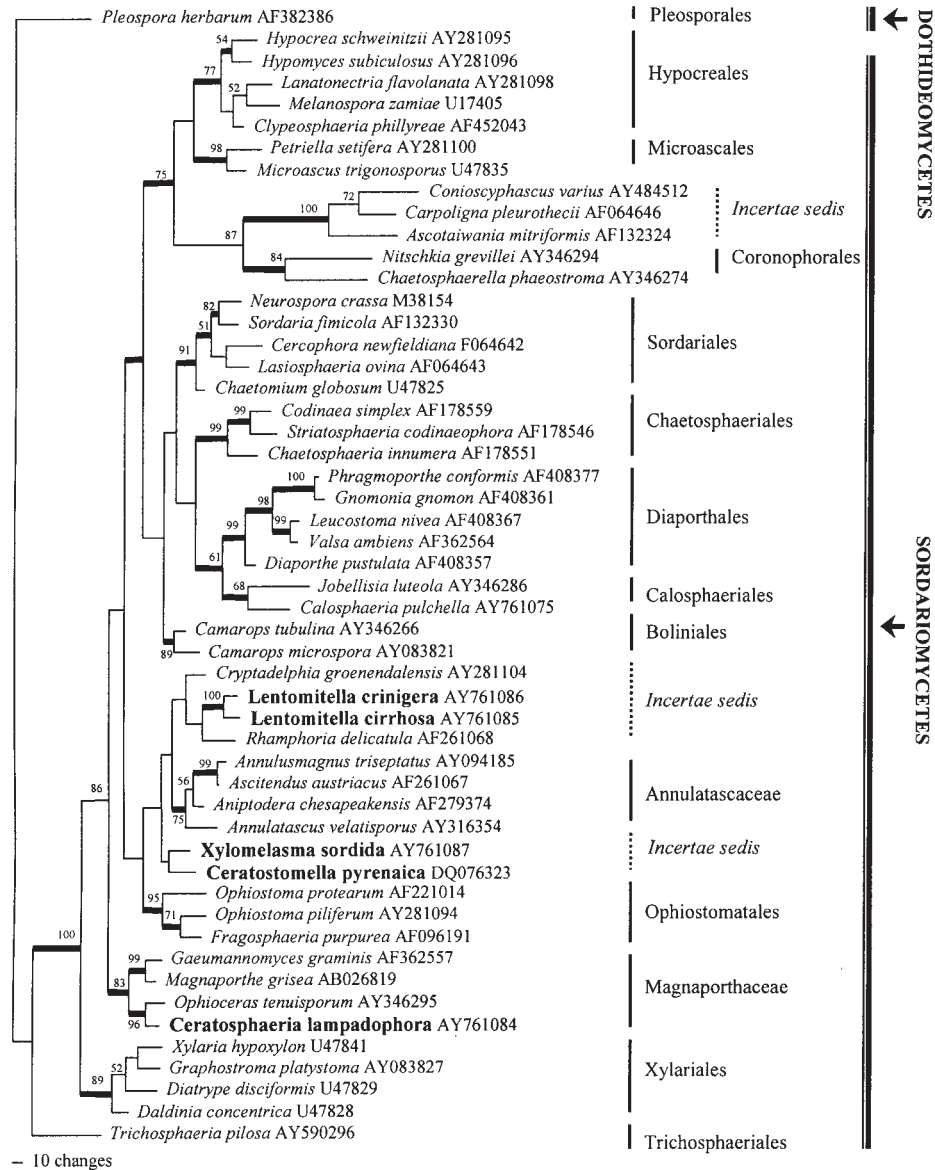


FIG. 1. Phylogram of the most parsimonious tree from a heuristic analysis (MP1) of LSU rDNA sequences from 14 ascomycetous orders. Bootstrap values = 50% from 1000 replicates are included at the nodes. Thickened branches indicate posterior probabilities = 95%. Branch lengths are drawn to scale.

4.0b10 (Swofford 2002) using maximum parsimony; heuristic search with stepwise-addition option with 1000 random taxon addition replicates and branch swapping (tree bisection-recognition, TBR). All characters were unordered and given equal weight during the analysis. For all analyses ambiguously aligned positions were excluded. Gaps were treated as missing data. Branch support was estimated by performing 1000 bootstrap replicates with a full heuristic search consisting of 10 random-addition replicates for each bootstrap replicate.

The model of evolution that fits the data best was determined by MODELTEST 3.5 (Posada and Crandall 1998), showing that the best-fit model for the LSU sequence dataset was GTR+I+G model (Lanave et al 1984) with variable base frequencies (freqA = 0.2221, freqC = 0.2425,

freqG = 0.3131, freqT = 0.2223), different rates for transitions and transversions R(a) [A-C] = 1.0263, R(b) [A-G] = 2.3442, R(c) [A-T] = 1.5809, R(d) [C-G] = 0.8755, R(e) [C-T] = 6.7847, R(f) [G-T] = 1.0000, an estimated proportion of invariable sites of 0.3137 and a gamma shape parameter for the rates of variable sites of 0.4790. The best-fit model for the SSU sequence dataset was determined as GTR+I+G model with variable base frequencies (freqA = 0.2420, freqC = 0.2281, freqG = 0.2840, freqT = 0.2459), different rates for transitions and transversions R(a) [A-C] = 1.4452, R(b) [A-G] = 3.5075, R(c) [A-T] = 1.3198, R(d) [C-G] = 0.9220, R(e) [C-T] = 7.2559, R(f) [G-T] = 1.0000, an estimated proportion of invariable sites of 0.5264 and a gamma shape parameter for the rates of variable sites of 0.6233.

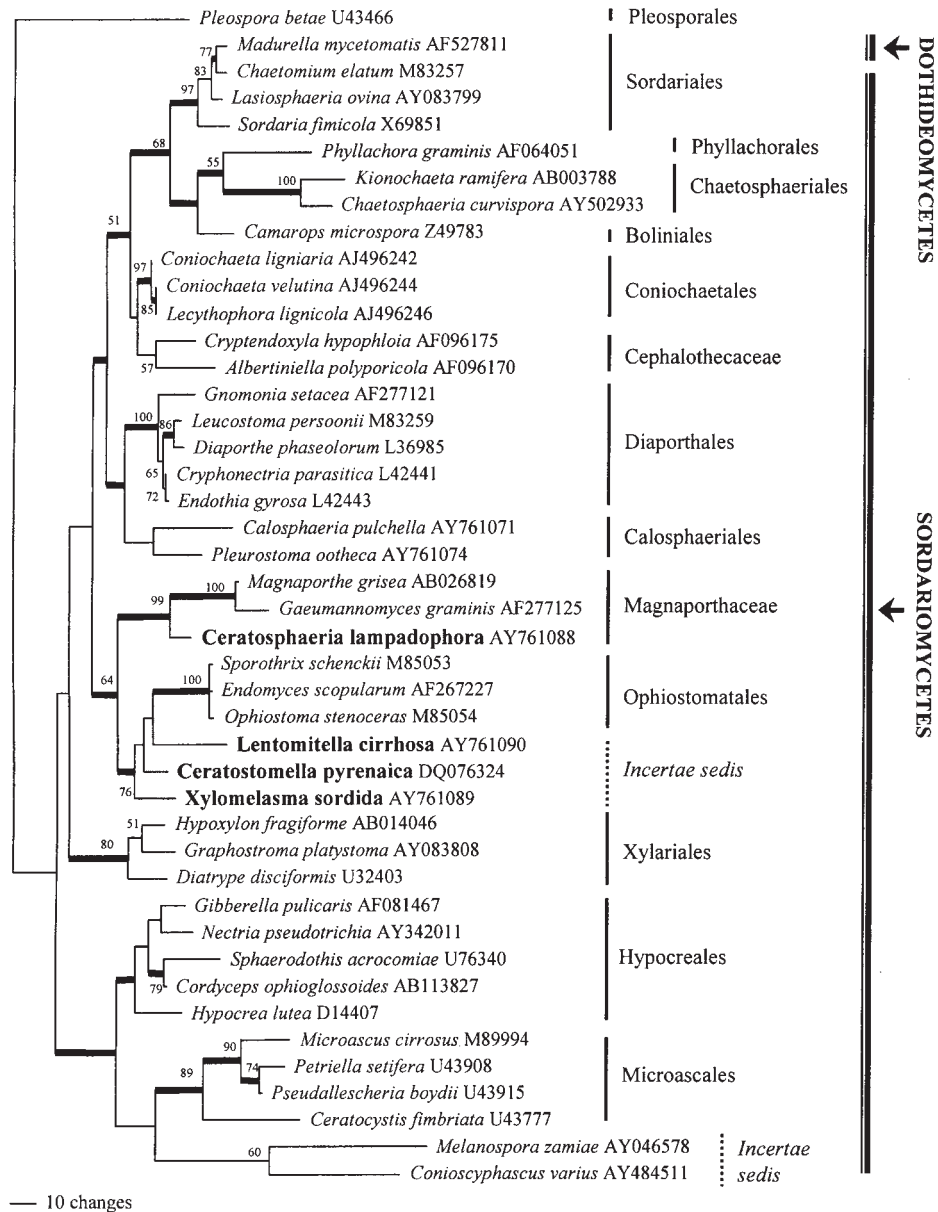


FIG. 2. Phylogram of one of the four equally parsimonious trees from a heuristic analysis (MP2) of SSU rDNA sequences from 15 ascomycetous orders. Bootstrap values = 50% from 1000 replicates are included at the nodes. Thickened branches indicate posterior probabilities = 95%. Branch lengths are drawn to scale.

Bayesian analyses were performed with MrBayes v. 3.0b4 (Huelsenbeck and Ronquist 2001) to reconstruct phylogenetic trees. The above models of evolution were implemented and Bayesian analyses for both LSU and SSU sequence datasets were conducted with the number of rate categories set to six, rates set to gamma and all remaining parameters estimated from the default prior probabilities. 5 000 000 generations were sampled every 100th generation resulting in 50 000 trees. The first 20 000 trees, which represented the burn-in phase of the analysis (number of trees to be discarded after the likelihoods of the trees have converged on a stable value), were discarded, and the remaining 30 000 trees were used for calculating posterior probabilities

in the consensus tree. Posterior probabilities = 95% are indicated as thickened branches in the trees.

RESULTS

Insertions in the SSU rDNA.—In the SSU six insertions from *Xylomelasma sordida* were identified (i.e. 64-nt, 369-nt, 492-nt, 71-nt, 135-nt and 64-nt) along with two insertions of *Ceratostomella pyrenaica* (i.e. 196-nt and 129-nt). The insertions are located at 330, 925, 1052, 1220, and 1384 5' flanking nucleotide positions of *X. sordida*, corresponding

to the positions 330, 786, 904, 1072, 1184 and 1230 of *E. coli* SSU nrDNA (Gargas et al 1995). The insertions of *C. pyrenaica* located at 393 and 1424 5' flanking nucleotide positions correspond to the positions 396 and 1086 of *E. coli* SSU nrDNA (Gargas et al 1995). The first five insertions of *X. sordida* and both insertions of *C. pyrenaica* are the group I intron, the sixth insertion of *X. sordida* represents the spliceosomal intron with the 5'-GT donor and AG-3' acceptor splice sites. These insertions were excluded from all analyses.

Phylogenetic analyses of the LSU rDNA sequence data.—A maximum parsimony analysis (MP1) was performed with 372 phylogenetically informative characters in an alignment including 1256 nt from 52 taxa. The first 75 positions in the alignment that are ambiguous were excluded. Two most parsimonious trees (MPT) were obtained (tree length 2299, consistency index [CI] = 0.375, retention index [RI] = 0.553, homoplasy index [HI] = 0.625) (FIG. 1). The only source of polytomy was a clade containing the Annulatasceae, the putative terrestrial Trichosphaeriaceae and the fungi newly sequenced within this project. The two trees differed in position of *C. pyrenaica* and *X. sordida*; *C. pyrenaica* was shown either as a sister to *Cryptadelphia groenendalensis* (Sacc. et al) Réblová & Seifert or to *X. sordida* with no bootstrap support.

The consensus tree consisted of six major and well supported phylogenetic lineages of the Sordariomycetes (viz. a lineage [75% bootstrap support/100% posterior probability] consisting of four well supported orders or groups), the Hypocreales (77/100) and the Microascales (98/100) clade, which is sister to a clade (87/100) of the Coronophorales (84/100) and *Ascotaiwania/Conioscyphascus/Carpoligna* group (100/100); a lineage (64/100) consisting of subgroupings of five orders, the Sordariales (91/100), the Chaetosphaeriales (99/100), the Diaporthales (99/100), the Calosphaeriales and the Boliniales (89/100); other major lineages were the well supported Xylariales (89/100) and the Magnaporthaceae (83/100). *Ceratospaeria lampadophora* nested on a well supported branch with *Ophioceras tenuisporum* Shearer et al (96/0) within the Magnaporthaceae. *Trichosphaeria pilosa* (Pers.:Fr.) Fuckel, representing the Trichosphaeriaceae, is shown basal to all other unitunicate ascomycetes in the tree.

In the sixth major lineage four separate clades were discerned. In one of the two phylogenetic trees (FIG. 1), these clades were the Ophiostomatales (95/100), which were a sister to the larger unsupported clade consisting of *X. sordida* and *C.*

pyrenaica on one branch and the Annulatasceae (75/100) subclade and the *Cryptadelphia* Réblová & Seifert, *Lentomitella* and *Rhamphoria* Niessl subclade on the other branch. The two *Lentomitella* species (100%), *Rhamphoria delicatula* Niessl and *C. groenendalensis* represent a terrestrial sister to the freshwater Annulatasceae. The Annulatasceae are represented in the phylogeny by *Annulusmagnus triseptatus* J. Campbell & Shearer, *Ascitendus austriacus* (Réblová et al) J. Campbell & Shearer, *Annulatasceus velatissporus* K.D. Hyde and *Aniptodera chesapeakeensis* Shearer & M.A. Mill. *Xylomelasma sordida* and *C. pyrenaica* reside on a basal branch of this large clade with no branch support.

In the consensus tree inferred from Bayesian analysis the main topology of the six major lineages was retained; the only lineage that did not receive any support was the one containing the Ophiostomatales, the Annulatasceae, *Cryptadelphia*, *Rhamphoria* and the newly sequenced taxa. Within this lineage three clades were discerned (viz. a clade of *C. pyrenaica*, *X. sordida* and *R. delicatula* [98 posterior probability], *Cryptadelphia* and *Lentomitella* clade [67] and a clade [97] containing the Annulatasceae [100] as a sister to the Ophiostomatales [100]).

Phylogenetic analysis of the SSU rDNA sequence data.—A maximum parsimony analysis (MP2) was performed with 260 phylogenetically informative characters in an alignment including 1724 nt from 44 taxa. The first 27 positions in the alignment that are ambiguous were excluded. Four MPT were obtained, one of which is shown (FIG. 2) (tree length 1092, CI = 0.503, RI = 0.632, HI = 0.497). The trees differed in grouping of the Sordariales, the Chaetosphaeriales and the Coniochaetales within a single larger clade. Five major lineages of the Sordariomycetes were discerned in the MP2 analysis, (viz. a robust lineage [51/100] consisting of subgroupings of six orders or families, the Coniochaetales [97/100], which are a sister to the unsupported clade containing the Cephalothecaceae on one branch and the Sordariales [97/100], the Boliniales, the Phyllachorales and the Chaetosphaeriales [100/100] on the other branch; a lineage of the Diaporthales [100/100] and the Calosphaeriales; a lineage of the Xylariales [80/100] and a larger lineage of the Hypocreales and Microascales [89/100]; and a lineage consisting of members of the Magnaporthaceae [99/100], which are sister to a clade of the Ophiostomatales [100/100] with *Ceratostomella*, *Lentomitella* and *Xylomelasma* residing on separate basal branches, respectively).

Anamorph-teleomorph connection.—Single ascospores

were isolated from *L. cirrhosa*, *L. crinigera*, *C. lampadophora*, *C. pyrenaica* and *X. sordida*. The cultures derived from *L. crinigera* and *C. lampadophora* sporulated in 21 d on potato-carrot agar at room temperature under UV light. *Lentomitella crinigera* formed a phaeoisaria-like anamorph and *C. lampadophora* formed a harpophora-like anamorph in vitro. The cultures derived from *C. pyrenaica*, *L. cirrhosa* and *X. sordida* never sporulated, although the cultural characters of *L. cirrhosa* otherwise were identical with those of the culture derived from a morphologically similar *L. crinigera*. Because the cultures of *L. crinigera* and *L. cirrhosa* have identical appearance and the LSU sequence data suggest their close relationship within a strongly supported monophyletic clade, it is most likely explanation that a phaeoisaria-like anamorph is also part of the life history of *L. cirrhosa*.

TAXONOMY

Taxonomic affinities of Ceratostomella rostrata.—The lectotype species *Ceratostomella rostrata* was cited by Clements and Shear (1931). Although von Arx (1952) considered *C. vestita* as type species of *Ceratostomella* the lectotypification proposed by Clements and Shear (1931) must be accepted because even though it was not actually formally combined in *Ceratostomella* at the time, it is clear that Saccardo (1878) intended to include *Ceratostoma rostratum* in *Ceratostomella* (P. Kirk, pers comm).

Tode (1791:14, Tab. IX, Fig. 79.) described *Sphaeria rostrata* with two varieties (viz. α . *atra* [perithecia black, tuberculate] and β . *nigro-fusca* [perithecia brown to black, glabrous]). No type or other authenticated material of *S. rostrata* is available because none of Tode's original collections are preserved. The illustration accompanying the original description is the only surviving original element (FIG. 22). The protologue does not include critical features and the illustrations of var. α and β show only dark tuberculate or glabrous perithecia with long central necks, respectively. Persoon (1801:58) cited the name *S. rostrata* var. α . and referred to the Tode's description. Fries (1823:473) based the description of *S. rostrata* Tode:Fr. on material distributed in his exsiccate collection *Scleromyceti Sueciae* 116 with a reference to Tode (1791) and Persoon (1801). Later Saccardo (1878) accepted *S. rostrata* in *Ceratostomella*. The examination of the specimens of *Scleromyceti Sueciae* 116 by the present author revealed that *S. rostrata* is not congeneric with *C. cirrhosa*, *C. vestita* or other species currently attributed to

Ceratostomella sensu Untereiner (1993). *Sphaeria rostrata* differs from *C. cirrhosa* and *C. vestita* in having suballantoid to ellipsoid to reniform ascospores that are pale brown before discharge. Ascogenous hyphae are branching, producing terminal and lateral, aseptate cells, from each of which one ascus arises. The asci are clavate, short-stipitate, tapering toward the base from the sporiferous portion, floating freely within the centrum at maturity. The apical annulus is shallow, indistinct and nonamyloid. Paraphyses are broad-celled, constricted at the septa and tapering.

The generic name *Ceratostomella* is reported frequently for species found on wood in late stages of decay. The typification by Clements and Shear (1931) and the lectotype species *C. rostrata* are accepted by the present author as valid. Because it never will be possible to know what Tode actually studied, I accept Fries' treatment of *S. rostrata* with a reference to Tode (1791) and Persoon (1801) based on material distributed in *Scleromyceti Sueciae* 116. Several exsiccate collections of *S. rostrata* under *Scleromyceti Sueciae* 116 were studied (C, G, K, PRM, UPS) but only the G and PRM specimens contained many intact mature perithecia in good condition. To avoid confusion I herewith lectotypify the name *S. rostrata* with Tode's original illustration and epitypify with Fries' material distributed in *Scleromyceti Sueciae* 116 (PRM 666367!).

In this study *Ceratostomella* is redescribed based on the lectotype species *C. rostrata*, and three other species are accepted (viz. *C. cuspidata*, *C. pyrenaica* and *C. rhynchophora*). *Wegelina polyporina* is relegated to synonymy of *C. rostrata*. Other species currently attributed to *Ceratostomella sensu lato* that do not match the emended generic concept are under revision by the author.

The generic concept of *Wegelina* based on the lectotype species *W. discreta* (Exsiccate. Mycotheca Veneta 1450: ITALY. Belluno, on decorticated branch of *Acer pseudoplatanus*, autumn 1879, P.A. Saccardo (as *Calosphaeria wahlenbergii*; isotype of *W. discreta*, NY!) should follow Berlese's treatment (Berlese 1900).

The distinction between the core species of *Ceratostomella* and the phenotypically similar unknown fungi are based on these features: thick perithecial wall (ca. [60–]80–110 μ m), clavate asci; broad-celled paraphyses; shallow, indistinct apical annulus, and suballantoid to reniform to irregularly ellipsoidal ascospores 2–3-seriate or in a fascicle within the ascus of *Ceratostomella sensu stricto*, vs thinner perithecial wall (ca. 50–60[–80] μ m); cylindrical asci; cylindrical, slightly constricted paraphyses, distinct apical annulus, and ellipsoidal ascospores, usually obliquely 1-seriate within the ascus of the

unknown fungi. The LSU and SSU molecular data do not support closer relationship between *Ceratostomella*, represented by *C. pyrenaica*, and the unknown fungi. In the consensus tree of the two most parsimonious trees *C. pyrenaica* resides either on a branch together with *C. groenendalensis* as sister to *Lentomitella* and *Rhamphoria* subclade, which is sister to the Annulatasceae subclade, while the unknown fungus is shown on a basal branch of the whole clade, or both *C. pyrenaica* and the unknown fungus are nested on a basal branch of this large clade (FIG. 1). Based on the morphological characters and results from molecular analyses, both taxa are distinct fungi at the genus level. Because no ascomycete genus could be found to match these characteristics, a new genus, *Xylomelasma*, is introduced for the two unknown fungi and the new species *X. novaezealandiae* and *X. sordida* are described. *Xylomelasma sordida* includes taxa formerly known as *E. avocetta* or *P. avocetta* (Romero and Samuels 1991, Romero 1999).

Taxonomic affinities of Ceratostomella cirrhosa and Ceratostomella vestita.—*Sphaeria cirrhosa* Pers. was described and illustrated by Persoon (1800: Tab. 24, Fig. 3; 1801:59) for fungi with immersed to semiimmersed, dark perithecia sparsely covered with short hairs and with sulcate necks. No type has ever been designed for *S. cirrhosa*. Von Arx (1952) reported four collections of *S. cirrhosa* from the Persoon herbarium (L) and said that only one of them was a fungus that matched the description of *S. cirrhosa sensu* Persoon (1801). That collection, according to von Arx (1952), contained few ascospores (8–10 × 3.5 μm). Unfortunately von Arx (1952) did not note which specimen contained ascospores; according to Untereiner (1993) and in my own experience, none of the four collections can be located in Persoon's herbarium.

Von Arx (1952) considered *C. cirrhosa* and *C. vestita* conspecific and cited other 13 synonymous names for *C. cirrhosa*. The examination of the type material of *C. vestita* by the present author revealed a fungus identical to *C. cirrhosa sensu* Persoon (1801) and von Arx (1952). Though the name *S. cirrhosa* was sanctioned by Fries, no suitable herbarium material matching the concept of the species could be located in Fries' herbarium. The only material of *S. cirrhosa* in Fries' herbarium was an exsiccate collection *Scleromyces Sueciae* 346, which represents another fungus, *Lentomitella crinigera* (this study). Because no type or other authenticated material of *S. cirrhosa* could be found, I herewith lectotypify the name *S. cirrhosa* with Persoon's original illustration of this species (Persoon 1800: Tab 24, Fig. 3). The recent collection of this fungus, from which the culture and LSU and SSU

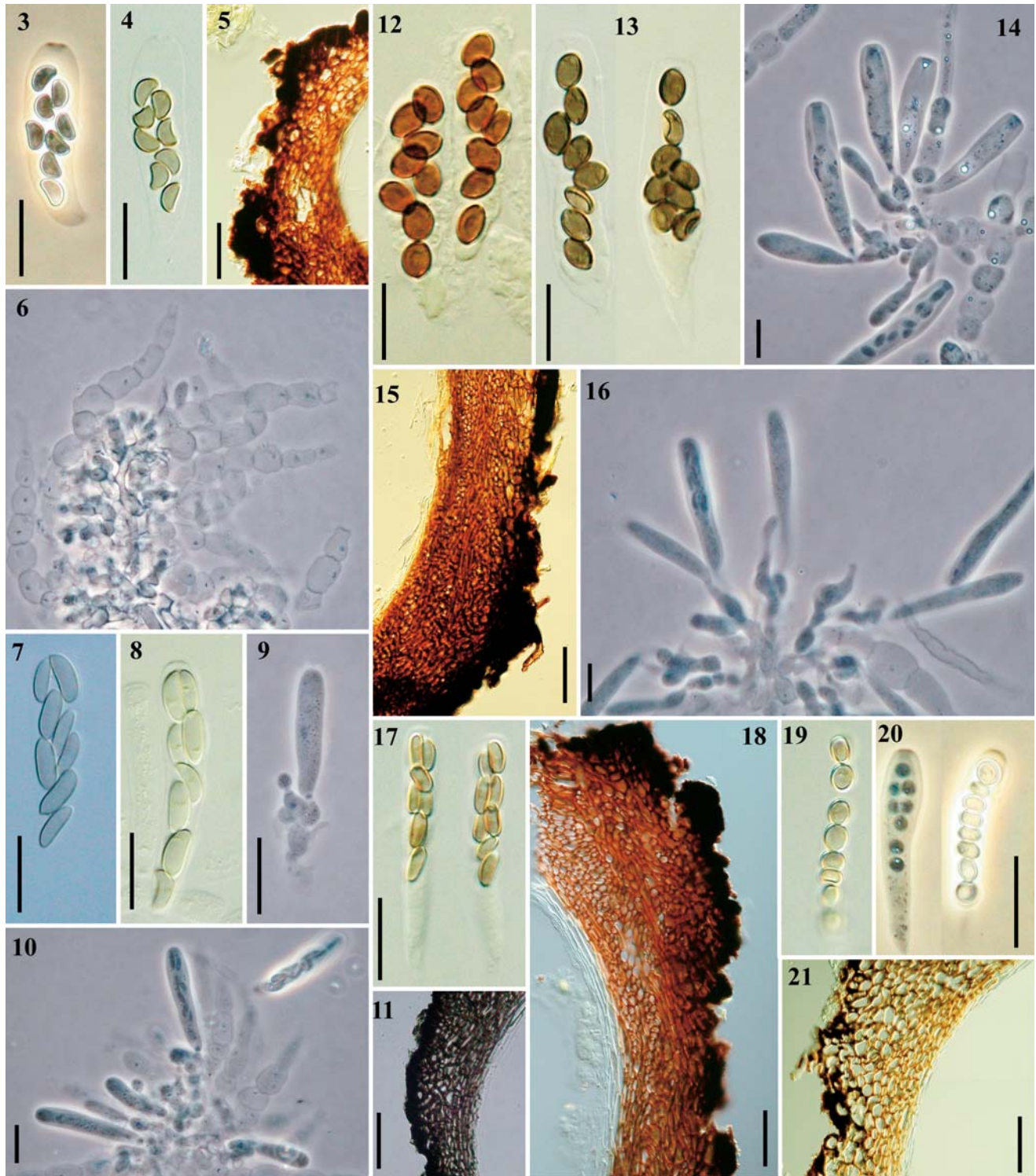
sequences were derived, is designated here as an epitype (PDD 81434!).

Lentomitella (Höhnelt 1905) was segregated from *Ceratostomella* for the single species *C. vestita* Sacc. as *L. vestita* (Sacc.) Höhn. The name *Lentomitella* is available to accommodate taxa that do not match the generic concept of *Ceratostomella* based on *C. rostrata* and that possess hyaline, ellipsoidal ascospores; unitunicate, short-stipitate, sessile asci formed on croziers and with a conspicuous, refractive, nonamyloid apical ring, cylindrical paraphyses and the phaeoisaria-like anamorph. Therefore *Lentomitella* is reinstated and three species are accepted (viz. *L. cirrhosa* with *L. vestita* relegated to its synonymy, *L. crinigera* and *L. tomentosa*). *Lentomitella cirrhosa* and *L. crinigera* formed a strongly supported monophyletic clade in the MPI analysis. They were clearly separated from the phenotypically similar species of *Ceratospheeria*, which resides on a well supported branch with *Ophioceras* Sacc. (96/100) within the Magnaporthaceae. The differences between the sequence data, conidiogenesis (phaeoisaria-like anamorph of *Lentomitella* vs harpophora-like anamorph of *Ceratospheeria*) and ascospore shape warrant the delimitation of the two holomorph genera, *Lentomitella* and *Ceratospheeria*.

KEY TO THE GENERA *CERATOSPHEERIA*, *CERATOSTOMELLA*,
ENDOXYLA, *LENTOMITELLA* AND *XYLOMELASMA*

1. Ascospores hyaline. 2
1. Ascospores dull brown. 3
2. Ascospores ellipsoid; phaeoisaria-like anamorph *Lentomitella*
2. Ascospores cylindrical to fusiform; harpophora-like anamorph. *Ceratospheeria*
3. Ascogenous hyphae ramifying; asci short-stipitate; ascomata without stromatic tissue. 4
3. Ascogenous hyphae no ramifying; asci long-stipitate; ascomata surrounded with reduced stromatic tissue around neck *Endoxyla*
4. Ascospores subballantoid, globose, reniform to irregularly ellipsoidal; 2–3-seriate or in a fascicle in the ascus; paraphyses broad-celled; apical annulus indistinct *Ceratostomella*
4. Ascospores ellipsoid to oblong, obliquely uniseriate in the ascus; paraphyses cylindrical, slightly constricted at the distant septa; apical annulus distinct. *Xylomelasma*

Ceratostomella Sacc., *Michelia* 1:370. 1878, emend.
Réblová
Perithecia solitary to densely crowded, nonstro-



FIGS. 3–21. *Ceratostomella* spp. 3–6. *C. cuspidata*. 3, 4. Asci. 5. Longitudinal section of perithecial wall. 6. Ascogenous hyphae and paraphyses. 7–11. *C. pyrenaica*. 7, 8. Asci. 9. Young ascus on an ascogenous hypha. 10. Ascogenous hyphae and paraphyses. 11. Longitudinal section of perithecial wall. 12–15. *C. rhynchophora*. 12, 13. Asci. 14. Ascogenous hyphae and paraphyses. 15. Longitudinal section of perithecial wall. 16–18. *C. rostrata*. 16. Ascogenous hyphae and paraphyses. 17. Asci. 18. Longitudinal section of perithecial wall. 19–21. *Ceratostomella* sp. 19, 20. Asci. 21. Longitudinal section of perithecial wall. DIC: 4, 5, 7, 8, 11–13, 15, 17–19, 21; PC: 3, 6, 9, 10, 14, 16, 20. FIGS. 3–6 from *M.R. 1813*; 7–11 from *J.F. 04071*; 12, 15 from PAD; 13, 14 from *J.F. 02022*; 16, 18 from DAOM 227786; 17 from *M.R. 1887*; 19–21 from *M.R. 2592*. Bars: 3, 4, 6–10, 12–14, 16, 17, 19–21 = 10 μ m; 5, 11, 15, 18 = 50 μ m.

matic, venter globose to subglobose, superficial, semiimmersed or immersed, glabrous or tuberculate, dark brown to black, surrounded by sparse mycelium; hyphae growing out of the bottom part of the outer perithecial wall. *Necks* protruding separately, central, elongate, cylindrical, straight to slightly flexuous, perpendicular, oblique to almost decumbent toward the substratum, sulcate or glabrous, with periphysate ostiole. *Perithecial wall* leathery to fragile, two-layered. Outer wall of brown, thick-walled cells, *textura prismatica* to *textura angularis* to *textura epidermoidea*, and *textura prismatica* to *porrecta* in the neck; often with a distinct, external crustose layer of heavily pigmented, dark brown cells with opaque walls. Inner layer of thinner-walled, subhyaline to hyaline, elongated and compressed cells. *Ascogenous hyphae* branching, discrete, with croziers, each producing several lateral and terminal, dehiscent cells sequentially and simultaneously, from each of which one ascus arises as an outgrowth. *Paraphyses* abundant, unbranched, septate, hyaline, broad-celled and heavily constricted at the septa, wider near the base, tapering toward the tip, apically free, longer than the asci, dissolving with age. *Asci* unitunicate, clavate to cylindrical-clavate, short-stipitate, truncate to broadly rounded at the apex, tapering toward the base from the sporiferous portion, floating freely within the centrum at maturity, with a shallow, indistinct, nonamyloid apical annulus, 8-spored. Ascus stipe usually containing non-refractive material deposited at the bottom part, visible after ascus dehiscence from the ascogenous hypha. *Ascospores* ranging from suballantoid to irregularly ellipsoid to globose to reniform, straight or curved, often flattened on one side, hyaline when young, pale brown before discharge, aseptate, smooth, sometimes with terminal pores, arranged in a fascicle in the upper part of the ascus or 2–3-seriate in the sporiferous part.

Typus. *Ceratostomella rostrata* (Tode:Fr.) Sacc., Syll. Fung. 1:409. 1882. (Lectotype designated by Clements and Shear [1931].)

Anamorph. Hyphomycetous, dematiaceous; in culture only sterile mycelium seen.

KEY TO THE SPECIES OF *CERATOSTOMELLA*

1. Asci shorter than 30 μm 2
1. Asci longer than 30 μm 3
2. Ascospores suballantoid to reniform, 4–5 \times 2–3 μm *C. cuspidata*
2. Ascospores ellipsoidal to globose, 3–4 \times (2.5–) 3–4 μm *Ceratostomella* sp.
3. Ascospores suballantoid, non-apiculate at the ends, 4.5–6 \times 1.5–2 μm *C. rostrata*
3. Ascospores ellipsoidal to oblong, slightly apiculate at the ends, usually flattened at one side 4
4. Ascospores ellipsoidal, 6–7 \times (3.5–)4–5 μm *C. rhynchophora*
4. Ascospores ellipsoidal to oblong, 7–9 \times 3–4 μm *C. pyrenaica*

Ceratostomella cuspidata (Fr.:Fr.) Réblová, comb. nov. FIGS. 3–6, 23A, B.

Basionym. *Sphaeria cuspidata* Fr.:Fr., Syst. Mycol. 2:220. 1823.

= *Ceratostoma cuspidatum* (Fr.:Fr.) Sacc., Syll. Fung. 1:474. 1882.

Anamorph. Unknown.

Perithecia solitary to densely crowded forming a crust, superficial with base of the venter slightly immersed, subglobose to globose, 400–500 μm high, 380–500 μm diam, glabrous, slightly tuberculate, dark brown, surrounded by dense mycelium, especially at the bottom; hyphae reddish brown, septate, 4.5–6 μm wide; neck central, elongate, straight or slightly flexuous, rounded at the top, sulcate with 4–5 ridges, (250–)400–1000 μm long, 110–130 μm diam. *Perithecial wall* leathery to fragile, *textura prismatica* to *textura angularis*, 55–80 μm thick, up to 90–112 μm thick in places with tubercles, external crustose layer 10–17 μm thick. Some cells in the outer layer with “Munk pores”. *Paraphyses* 6–11 μm wide near the base, tapering to 1.5–2.0 μm at the top. *Asci* cylindrical-clavate, 21–30 \times (5–)6–7 (mean \pm SE = 24.7 \pm 0.4 \times 6.3 \pm 0.1) μm , truncate at the apex, tapering basally, short-stipitate, with an apical annulus, 3–3.5 μm diam, ca. 1 μm high. *Ascospores* suballantoid to reniform, curved, flattened on one side, 4–5 \times 2–3 (mean \pm SE = 4.4 \pm 0.1 \times 2.7 \pm 0.1) μm , pale brown, aseptate, smooth, in a fascicle in the upper part of the ascus or 2–3-seriate in the ascus.

ISOTYPE. Fries’ *Scleromyceti Sueciae* 117, decayed wood (PRM 666203).

Additional specimens examined. CZECH REPUBLIC. SOUTHERN MORAVIA: Valtice, Randevous, decayed wood of *Quercus* sp., 4 Jun 1999, A. Vágner, M.R. 1813 (PRA). NEW ZEALAND. WESTLAND: Mount Aspiring National Park, Makarora Bush Walk, 500 m N of NP Headquarters in Makarora, decayed wood of *Nothofagus* sp., 30 Mar 2005, M. Réblová (PRA).

Habitat. Saprobe on decayed wood of deciduous trees.

Distribution. Czech Republic, New Zealand, Sweden.

Commentary. *Ceratostomella cuspidata* is the most similar to *C. rostrata*, which differs by larger perithecia and narrower suballantoid to somewhat oblong ascospores.

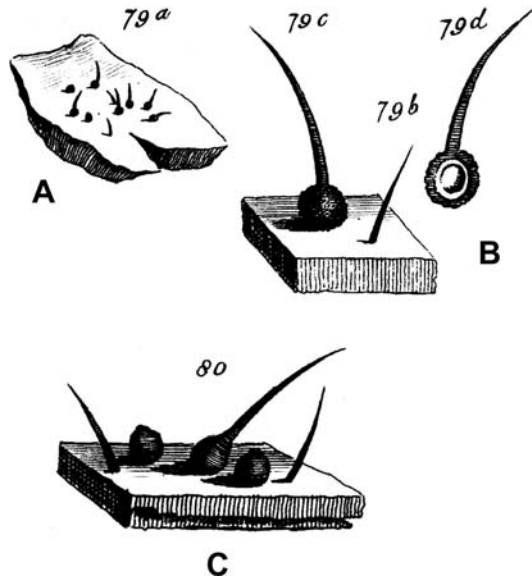


FIG. 22. *Ceratostomella rostrata*. A, B. *Sphaeria rostrata* α . *atra*. A. Habit sketch of perithecia on wood. B. Perithecia with central elongate neck. C. *Sphaeria rostrata* β . *nigrofusca*. Perithecia with central elongate neck. A–C copied from Tode (1791).

Ceratostomella pyrenaica Réblová & Fournier, sp. nov. FIGS. 7–11, 23C, D

Perithecia gregaria, immersa vel semiimmersa, globosa vel subglobosa, brunnea, 400–550 μm diam, 350–550 μm alta, ostiolo centrali elongato, cylindraceo, 600–1130 μm longo, 95–110 μm diam. Paries perithecii 45–65 μm crassus, bistratosus. Paraphyses copiosae, hyalinae. Asci cylindraceo-clavati, (30–)33–40 \times 5.5–7 μm , breviter stipitati, 8-spori. Ascospores ellipsoideae vel oblongae, apiculatae, 7–9 \times 3–4 μm , unicellulares, brunneae.

Anamorph. Hyphomycetous, dematiaceous; in culture only sterile mycelium seen.

Perithecia gregarious, venter immersed to semiimmersed, globose to subglobose, 350–550 μm high, 400–550 μm diam, slightly roughened, dark brown, surrounded by sparse mycelium; hyphae dark brown, septate, flexuous, 4–5 μm wide; neck central, elongate, straight or slightly flexuous, rounded at the apex, sulcate with 4–5 ridges, 600–1130 μm long, 95–110 μm diam. *Perithecial wall* leathery to fragile, *textura prismatica*, 45–65 μm thick, external crustose layer 10–15 μm thick. *Paraphyses* 10–12 μm wide near the base, tapering to 2–2.5 μm at the top. *Asci* cylindrical-clavate, (30–)33–40 \times 5.5–7 (mean \pm SE = 36.2 \pm 0.7 \times 7.3 \pm 0.3) μm , truncate to broadly rounded at the apex, short-stipitate, with an apical annulus ca. 3 μm diam, 0.5–1 μm high. *Ascospores* ellipsoidal to oblong, slightly curved and apiculate at both ends, flattened on one side, 7–9 \times 3–4 (mean \pm SE = 8.2 \pm 0.1 \times 3.1 \pm 0.1) μm , pale brown, aseptate,

smooth, often with two large drops, 2–3-seriate in the ascus or in a fascicle in the upper part of the ascus.

Characteristics in culture. Colonies reaching 10–11 mm diam on PCA, grayish-brown. *Aerial mycelium* well developed, denser in the center of colony; hyphae subhyaline, 3–3.5 μm wide, septate, smooth. *Substrate mycelium* of brown, septate hyphae, 3–4 μm wide, smooth. Sporulation not seen. *Margin* gnawed. *Reverse* dark brown.

HOLOTYPE. FRANCE. PYRÉNÉES ATLANTIQUES: Rimont, Las Muros, Ruisseau de Peyran, decayed wood of a trunk of *Alnus glutinosa*, 8 Sep 2000, J. Fournier J.F. 00195 (PRM 902273).

Additional specimens examined. CZECH REPUBLIC. SOUTHERN MORAVIA: Hodonín district, Skařiny Nature Reserve near Mikulčice, decayed wood of a trunk of *Acer campestre*, 24 Oct 2004, M. Réblová, M.R. 2912 (PRA, culture CBS 117116). FRANCE. PYRÉNÉES ATLANTIQUES: Rimont, Las Muros, Ruisseau de Peyran, decayed wood of a trunk of *A. glutinosa*, 18 Jun 2001, J. Fournier J.F. 01114 (PRA); *ibid.*, Charente Maritime, La Villedieu, Forêt d'Aulnay, decayed basidioma of *Trametes gibbosa* on a dead stump of *Fagus sylvatica*, 30 Apr 2004, J. Fournier J.F. 04071 (PRA).

Etymology. *Pyrenaica* referring to the locality of origin, Pyrénées Atlantiques.

Culture. CBS 117116 ex M.R. 2912.

Habitat. Saprobe on decayed deciduous wood.

Distribution. Czech Republic, France.

Commentary. *Ceratostomella pyrenaica* is characterized by pale brown, smooth, ellipsoidal to oblong ascospores, slightly apiculate at the ends, a shape that is well distinguishable within other *Ceratostomella* species.

Ceratostomella rhynchophora (De Not.) Réblová, comb. nov. FIGS. 12–15, 23E–F

Basionym. *Sordaria rhynchophora* De Not., Comm.

Crittog. Ital. 2:480. 1867.

= *Ceratostoma rhynchophorum* (De Not.) W. Kirschst., Krypt. Fl. Mark Brandenb. 7:249. 1911.

= *Ceratostoma notarisii* Sacc., Fung Ven. Ser. II, p. 308, 1874. (*Illegit. name*, Art. 52)

Anamorph. Unknown.

Perithecia solitary to gregarious, venter superficial to completely immersed, globose to subglobose, 480–660 μm high, 500–650 μm diam, slightly roughened, dark brown, surrounded by dense mycelium; hyphae dark brown, septate, branching, flexuous, 4–5 μm wide; neck central, elongate, straight or slightly flexuous, sulcate at the apex with 3–4 ridges, 400–2000 μm long, 140–190 μm diam. *Perithecial wall* leathery, *textura prismatica* to *textura epidermoidea*, 75–100 μm thick, external crustose layer 12–17.5 μm thick. *Paraphyses* 8–11 μm wide near the base,

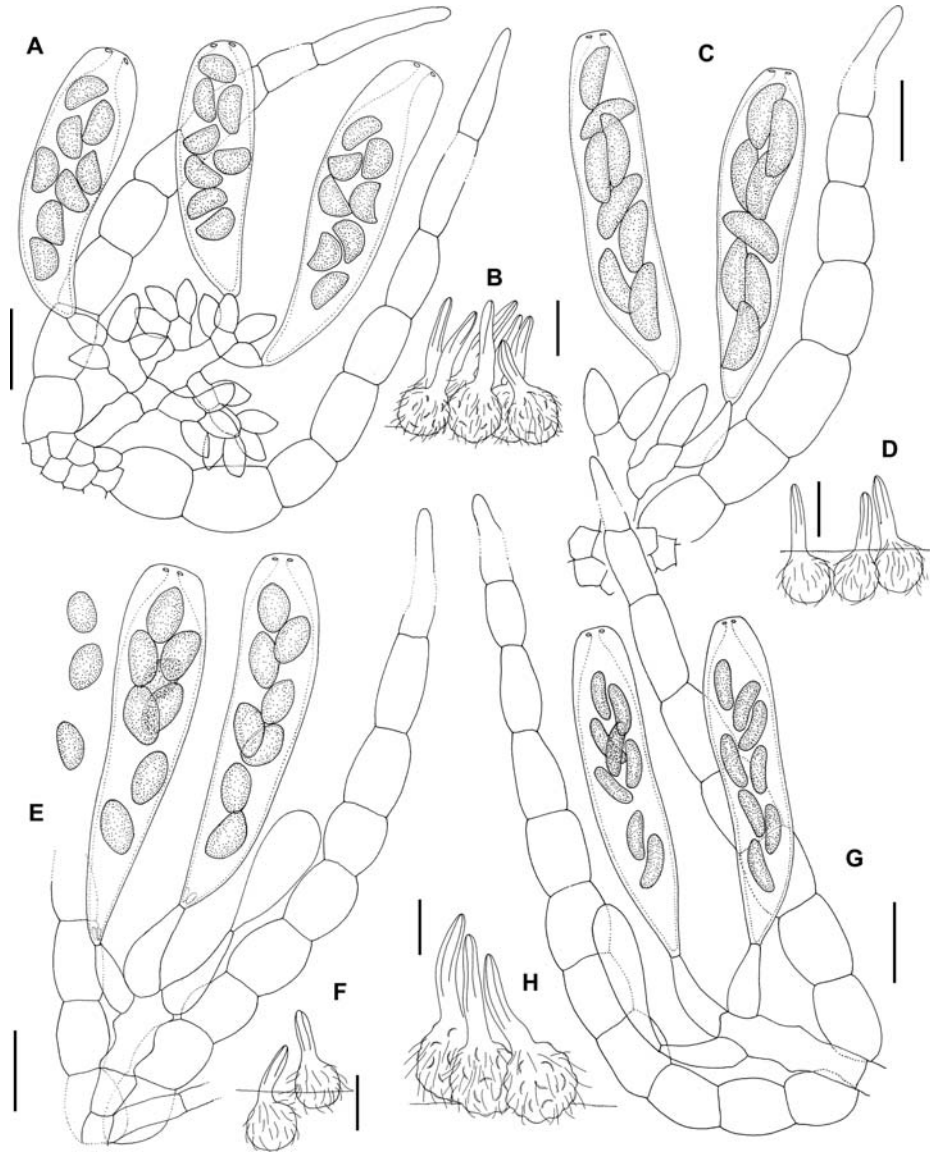


FIG. 23. *Ceratostomella* spp. A, B. *C. cuspidata*. Asci with ascospores, ascogenous hyphae, paraphyses and habit sketches of perithecia. C, D. *C. pyrenaica*. Asci with ascospores, ascogenous hyphae, paraphyses and habit sketches of perithecia. E, F. *C. rhynchophora*. Asci with ascospores, ascogenous hyphae, paraphyses and habit sketches of perithecia. G, H. *C. rostrata*. Asci with ascospores, ascogenous hyphae, paraphyses and habit sketch of perithecia. A, B from M.R. 1813; C, D from PRM 902273; E, F from J.F. 02022; G, H from DAOM 227780. Bars: A, C, E, G = 10 µm; B, D, F, H = 500 µm.

tapering to 2–2.5 µm at the top. Asci cylindrical-clavate, (33–)35–44 × 7–8.5(–10) (mean ± SE = 38.8 ± 0.5 × 8.6 ± 0.2) µm, truncate to broadly rounded at the apex, short-stipitate, with an apical annulus 2.5–3 µm diam, ca. 1 µm high. Ascospores ellipsoidal, sometimes flattened on one side, slightly apiculate at both ends, 6–7 × (3.5–)4–5 (mean ± SE = 6.4 ± 0.1 × 4.3 ± 0.1) µm, midbrown, aseptate, smooth, with a minute pore at each end, 1–2-seriate in the ascus or in a fascicle in the ascus.

NEOTYPE. ITALY. Decayed wood of *Prunus domestica*, P.A. Saccardo (PAD, as *Ceratostoma notarisii*; neotype designated here).

Additional specimens examined. FRANCE. PYRÉNÉES ATLANTIQUES: Rimont, Las Muros, decayed wood of *P. domestica*, 3 Feb 2002, J. Fournier J.F. 02022 (PRA); *ibid.* 21 Apr 2002, J. Fournier J.F. 02070 (PRA).

Habitat. Saprobe on decayed deciduous wood.

Distribution. France, Italy.

Commentary. Saccardo (1874:308) created an obligate synonym *Ceratostoma notarisii* based on *Sordaria rhynchophora* with explanation that the name “*Ceratostoma rhynchophorum*” would have an identical meaning as the already existing name *Ceratostoma rostratum*.

Two specimens of *C. rhynchophora* were found in

PAD under the name *Ceratostoma notarissii*. One contained old and empty, minute, brown perithecia with long, central filiform necks strongly similar to species of *Melanospora*. The second specimen was collected by Saccardo and contained mature perithecia with asci, ascospores and paraphyses that fully match the original description of *S. rhynchophora*. Because no type or authenticated material of *S. rhynchophora* could be found (PAD, RO, MI), the collection from Saccardo's herbarium labeled as *C. notarissii* is chosen as a neotype.

Ceratostomella rostrata (Tode:Fr.) Sacc., Syll. Fung. 1:409. 1882. FIGS. 16–18, 23G, H

Basionym. *Sphaeria rostrata* Tode, Fungi Mecklenb. Sel. 2:14. 1791 : Fries, Syst. Mycol. 2:473. 1823.

= *Ceratostoma rostratum* (Tode:Fr.) Fuckel, Jahrb. Nassau. Ver. Naturk. 23–24:127. 1870.

= *Ceratospheeria rostrata* (Fr.) Sacc., Syll. Fung. 2:227. 1883. (as “[Kickx] Sacc.”)

= *Endoxyla rostrata* (Tode:Fr.) Munk, Dansk Bot. Ark. 17(1):196. 1957.

= *Wegeleina polyporina* M.E. Barr, Cryptogamie, Bryol. Lichénol. 19:170. 1998.

= *Ceratostoma grumsinianum* W. Kirschst., Ann. Mycol. 34:199. 1936.

Anamorph. Unknown.

Perithecia densely aggregated forming a crust on the substratum, venter superficial to semiimmersed, globose to subglobose, 700–750 µm high, 650–750 µm diam, tuberculate, dark brown to black, surrounded by sparse mycelium; hyphae dark brown, septate, flexuous, branching, 6–7 µm wide; neck central, elongate, straight or slightly flexuous, tapering toward the apex and narrowly rounded, sulcate with 4–5 ridges, 800–2500 µm long, 130–170 µm diam. *Perithecial wall* leathery to fragile, *textura prismatica* to *textura angularis*, 62–85 µm thick, 110–125 µm thick in places with tubercules, external crustose layer 12–25 µm thick. Some cells in the outer layer with “Munk pores”. *Paraphyses* 8–12 µm wide near the base, tapering to 2.5–3 µm at the top. *Asci* cylindrical-clavate, (26–)30–39 × 5–6 (mean ± SE = 33.4 ± 0.4 × 5.9 ± 0.1) µm, truncate to broadly rounded at the apex, short-stipitate, with an apical annulus 1.5–2 µm diam, ca. 1 µm high. *Ascospores* allantoid to suballantoid, 4.5–6 × 1.5–2 (mean ± SE = 5.3 ± 0.1 × 1.9 ± 0.1) µm, pale brown, aseptate, smooth-walled, usually in a fascicle in the upper part of the ascus or 2–3-seriate within the ascus.

LECTOTYPE illustration: Tode, Fungi Mecklenburgenses Selecti, Fasc. 2: Tab. IX, Fig. 79. 1791 (lectotype illustration designated here).

EPITYPE. Fries' *Scleromyceti Sueciae* 116, decayed wood (PRM 666367, epitype designated here).

Additional specimens examined. Fries' *Scleromyceti Sueciae* 116, decayed wood (C, G, K 114933, UPS, as *Sphaeria rostrata*). CZECH REPUBLIC. SOUTHERN BOHEMIA: Šumava Mountains National Park, Volary, Medvědice Nature Reserve, decayed wood of *Ulmus glabra*, 26 Oct 2001, M. Réblová M.R. 1887, 1925 (PRA). FINLAND. Wehmersalmi, on hymenium of *Fomes fomentarius*, 12 Aug 1992, U. Söderholm, L. Kasoner 2052 (DAOM 227785). GERMANY. Bredowen Forst, Orthavelland, in hymenium of the decayed basidioma of *F. fomentarius* on *Betula* sp., 6 Oct 1916, W. Kirschstein (B700006552, holotype of *Ceratostoma grumsinianum*). POLAND. W. Siemaszko: Fungi Białowieżenskes exsiccati no. 158, Białystok, Białowieża, National Park Puzcza Białowieszka, in hymenium of the decayed basidioma of *Fomes* sp., Aug 1922, W. Siemaszko (PRM 655803, as *Ceratostoma rhynchophorum*). SWEDEN. Närke, Glanshammar Parish, Skölv, on hymenium of *F. fomentarius*, 20 May 1993, K.G. Nilsson (DAOM 227786, isotype of *Wegeleina polyporina*); Öland, Vickelby Parish, Nature Reserve Vickelby ängar 2 km NW of Vickelby, decayed bracket basidiomata of *F. fomentarius* on *Betula pendulosa*, 4 Jun 2001, N. Lundqvist N.L. 21416.

Habitat. Saprobe on decayed deciduous wood and decayed aphyllorhaceous basidiomata.

Nomenclatural note. Saccardo (1883:227) proposed a new combination *Ceratospheeria rostrata* (Kickx) Sacc. based on *Sphaeria rostrata* Kickx, Fl. Crypt. Flandres 1:338. 1867, where: “*Sphaeria rostrata* Fr., Kx. Rech. Cent. III. p. 17; West. Herb. Crypt. fasc. 11, No. 552; *Dryinosphaera rostrata* Dmtr.—Desm. Pl. Crypt. fasc. 20, No. 973” is given. In Kickx's earlier work cited above (Kickx 1847: 17) “*Sphaeria rostrata* Fr., Desm. Crypt., fasc. 20, no. 973” is given. It is obvious that in both publications, Kickx referred to Fries' concept of *S. rostrata*. It is probable that Saccardo (1883) misinterpreted the name *Sphaeria rostrata* and incorrectly ascribed the name to J. Kickx.

Kirschstein (1911) proposed a new combination for *Ceratostoma rhynchophorum*, however according to its description and comparison to the material of *C. rhynchophora* and *C. rostrata* this species was misidentified; it is *C. rostrata*. No herbarium material of *C. rhynchophorum* could be found in Kirschstein herbarium (B).

Commentary. *Ceratostomella rostrata* is similar to *C. cuspidata* in having tuberculate perithecia with sulcate neck. However size of perithecia, shape and width of ascospores and length of asci clearly distinguish the two taxa; in *C. cuspidata* asci are usually shorter than 30 µm, and ascospores are suballantoid to reniform, 2–3 µm wide.

Untereiner (1993) cited two other taxa in the synonymy of *S. rostrata* (viz. *Endoxyla laevirostris* Munk [Denmark, Jylland, Staksrode near Juelsminde, distr. 24, rotten wood of a branch of *Fagus sylvatica*, 12 Oct 1963, A. Munk, C!] and *Ceratostomella*



FIG. 24. *Ceratosphaeria lampadophora*. Harpophora-like anamorph in vitro. A. Conidiophores. B. Conidia. From CBS 117555 ex J.F. 01065 (PCA, 1 mo). Bar = 10 μ m.

ampullasca [Cooke] Sacc. [U.K. Shere, on rotten wood of *Quercus* sp., Feb 1869, K 84424!]. According to the study of their type material by the present author these two taxa are neither conspecific nor are they species of *Ceratostomella*. Additional culture and molecular data are needed to confirm their systematic position.

Ceratostomella sp. FIGS. 19–21
Anamorph. Unknown.

Perithecia superficial to semiimmersed, sitting densely on wood around the margin of a resupinate basidiomycete, globose to subglobose 530–570 μ m high, 500–550 μ m diam, tuberculate, dark brown, surrounded by dense mycelium; hyphae dark brown, septate, branching, flexuous, 2.5–3 μ m diam; neck central, elongate, straight or slightly flexuous, sulcate with four ridges, 600–1000 μ m long, 110–130 μ m diam. *Perithecial wall* fragile, *textura prismatica* to *textura angularis*, 87–92 μ m thick, 97–125 μ m thick in places with tubercles, external crustose layer 10–12 μ m thick. Some cells in the outer layer with “Munk pores”. *Paraphyses* 6–8 μ m wide near the base, tapering to 2.5–3 μ m at the top. *Asci* clavate, 25–

32 \times 5–6 (mean \pm SE = 28.7 \pm 0.9 \times 5.5 \pm 0.1) μ m, truncate to broadly rounded at the apex, short-stipitate, with an apical annulus 2–2.5 μ m diam, 0.5–1 μ m tall. *Ascospores* ellipsoidal to globose, 3–4 \times (2.5–)3–4 (mean \pm SE = 3.6 \pm 0.1 \times 3.2 \pm 0.1) μ m, pale brown to stramineous, aseptate, smooth-walled, 1–2-seriate in the ascus.

Specimen examined. SWEDEN. SCANIA: Skurup, Svaneholm, near the west shore of the lake, decayed wood of *Fagus sylvatica* in association with *Steccherinum ochraceum*, 10 Nov 2000, S.-Å. Hanson, M.R. 2592.

Habitat. Saprobe on decayed deciduous wood in association with old basidiomata.

Distribution. Sweden.

Commentary. The shape of the ascospores is distinctive and unique within the reported ascospore variability of *Ceratostomella*. However, the material of this fungus is too poor to designate a holotype and additional material is needed for a more detailed study to describe a new species.

Ceratosphaeria lampadophora (Berk. & Broome)
Niessl, Verh. Naturf. Vereins Brünn 14:203. 1876.

FIG. 24

Anamorph. Harpophora-like.

For synonymy, detailed description and illustration refer to Hyde et al (1997).

Characteristics in culture. Colonies reaching 9–11 mm diam on PCA, yellowish, whitish in the center. *Aerial mycelium* scarcely developed in the center of the colony and on the inoculating block; hyphae subhyaline to hyaline 2–3 μ m wide, septate, smooth. Sporulation copious, widespread throughout the colony in 1 mo. Phialides or short conidiophores arising on aerial hyphae, conidial heads slimy, inconspicuous, and transparent. Reverse dark yellow. *Conidiogenous cells* phialidic, terminal or intercalary, hyaline to subhyaline, cylindrical, 14–18 \times 2–2.5 μ m, tapering below the collarette to 1.5 μ m. *Conidia* cylindrical with curvature, hyaline, narrowly rounded at both ends, 9–11(12) \times 1–1.5 μ m, aseptate, smooth.

Culture. CBS 117555 ex J.F. 01065.

HOLOTYPE. UNITED KINGDOM. ENGLAND: Bath, Combe Hay, decayed wood, Apr 1855, C.E. Broome (holotype of *Sphaeria lampadophora*, K).

Additional specimens examined. CZECH REPUBLIC. SOUTHERN BOHEMIA: Šumava Mountains National Park, Mount Spáleníště near Stožec, decayed wood of *F. sylvatica*, 12 Nov 2000, M. Réblová M.R. 1734 (PRA). FRANCE. PYRÉNÉES ATLANTIQUES: Rimont, Ariège, Las Muros, on decorticated wood of *Populus tremula*, 11 Apr 2001, J. Fournier J.F. 01065 (PRA; culture CBS 117555); *ibid.* 18 Jun 2001, J.F. 01115 (PRA). SWITZERLAND. Grange canal near Genève, decayed wood of a trunk, 8 Feb 1859, J. Müller (Herb. Barbey-Boissier 605, G).

Lentomitella Höhn., Ann. Mycol. 3:552. 1905.

Perithecia solitary to gregarious, nonstromatic, venter superficial, semiimmersed or immersed, globose, subglobose to conical, glabrous or roughened, dark brown to black, surrounded by sparse mycelium; hyphae growing out of the bottom part of the outer perithecial wall. *Necks* dark, protruding separately, central, perpendicular or oblique to the substratum, elongate, cylindrical, straight to slightly flexuous, sulcate or glabrous, ostiolum periphysate. *Perithecial wall* leathery, 2-layered. Outer wall of brown, thick-walled cells, *textura prismatica* to *textura angularis*; external layer of heavily melanized cells with opaque walls. Inner layer of thinner-walled, subhyaline to hyaline, elongated and compressed cells. *Ascogenous hyphae* not extensive, proliferating through croziers. *Paraphyses* abundant, cylindrical, tapering toward the tip, septate, slightly constricted at the septa or nonconstricted, hyaline, apically free, longer than the asci, dissolving partly at maturity. *Asci* unitunicate, cylindrical-clavate, short-stipitate, sessile, truncate to broadly rounded at the apex, with a distinct, refractive, nonamyloid apical annulus, 8-spored. *Ascospores* ellipsoidal, hyaline, aseptate or several-septate, smooth or with few longitudinal ridges, obliquely 1-seriate or 1–2-seriate in the ascus.

Typus. *Lentomitella vestita* (Sacc.) Höhn.

Anamorph. Phaeoisaria-like.

KEY TO THE SPECIES OF *LENTOMITELLA*

1. Ascospores longitudinally striate.
1. Ascospores smooth *L. tomentosa*
2. Ascospores shorter than 10 µm, (5.5–)6–9 (–10) × 3–4.5(–5) µm *L. cirrhosa*
2. Ascospores longer than 10 µm, 10–14 × (4–) 5–6 µm *L. crinigera*

Lentomitella cirrhosa (Pers.:Fr.) Réblová, comb. nov.

FIGS. 25–28, 44A–C

Basionym. *Sphaeria cirrhosa* Pers., Syn. Meth. Fung. p. 59. 1801; Fries, Syst. Mycol. 2:475. 1823.

= *Ceratostoma cirrhosum* (Pers.:Fr.) Fuckel, Jahr. Nassau. Ver. Naturk. 23–24:127. 1870.

= *Ceratostomella cirrhosa* (Pers.:Fr.) Sacc., Michelia 1:370. 1878.

= *Endoxyla cirrhosa* (Pers.:Fr.) Arx & E. Müll., Beitr. Krypt-Fl. Schweiz 11(1):355. 1954.

= *Sphaeria investita* Schw., Trans. Amer. Phil. Soc. 2, Vol. 4:216. 1834.

= *Ceratostoma investitum* (Schw.) Ellis & Everh., North Amer. Pyrenom. p. 193. 1892.

= *Ceratostomella investita* (Schw.) Starbäck, Bih. Kongl. Svenska Vet.-Akad. Handl. 19(2):26. 1894.

= *Ceratostomella vestita* Sacc., Michelia 1:370. 1878.

= *Lentomitella vestita* (Sacc.) Höhn., Ann. Mycol. 3:548. 1905.

= *Cerastomis vestita* (Sacc.) Clem., Gen. Fungi p. 259. 1931.

= *Endoxyla vestita* (Sacc.) Munk, Bot. Tidsskr. 61:64. 1965.

= *Ceratostomella vestita* Sacc. var. *varvicensis* Grove, J. Bot. 23:131. 1885.

= *Eriosphaeria conoidea* Feltg., Pilz Flora Luxemb. 3:282. 1903.

Anamorph. Hyphomycetous, dematiaceous; in culture only sterile mycelium seen.

Perithecia solitary or gregarious, venter immersed to superficial, globose to subglobose, 300–410 µm high, 300–400 µm diam, slightly roughened, dark brown, surrounded by sparse mycelium; hyphae brown, 4.5–5 µm wide; neck dark brown, central, elongate, cylindrical, straight to slightly flexuous, sulcate with four ridges at the apex, 300–900 µm long, 100–120 µm diam. *Perithecial wall* leathery, 30–50 µm thick, *textura prismatica* to *textura angularis*; externally with a row of heavily melanized cells with opaque walls. *Paraphyses* 6–8 µm wide near the base, tapering to 2.5–3 µm. *Asci* cylindrical-clavate, truncate to broadly rounded at the apex, (42–)50–74 × 6–7(–8) (mean ± SE = 62.3 ± 1.1 × 7.1 ± 0.1) µm, sessile, with an apical annulus 2.5–3 µm diam, 1–1.5 m high, 8-spored. *Ascospores* ellipsoidal, (5.5–)6–9(–10) × 3–4.5(–5) (mean ± SE = 7.9 ± 0.2 × 3.8 ± 0.1) µm, hyaline, 1(–3)-septate, not constricted at the septa, with few longitudinal ridges, obliquely 1-seriate or 1–2-seriate.

Characteristics in culture. Colonies 8–12 mm diam on PCA, dark brown, cocoa brown in the center. *Aerial mycelium* well developed, densest in the center of the colony, hyphae subhyaline to pale brown, 3–4 µm wide, septate, smooth. *Substrate mycelium* of brown, septate hyphae, 3.5–4 µm wide, septate, smooth. Sporulation not observed. Reverse dark brown.

LECTOTYPE illustration: Persoon, Icones et Descriptiones Fungorum minus Cognitorum. Fasc. 2, Tab. 24, Fig. 3. 1800 (lectotype illustration designated here).

EPITYPE. NEW ZEALAND. WESTLAND: Hokitika, 40 km S of Greymouth, Mananui Point, Lake Mahinapua, Swimmers Beach walks, decayed wood of *Podocarpus totara*, 5 Mar 2003, M. Réblová M.R. 2705 (PDD 81434, culture ICMP 15131; epitype designated here).

Additional specimens examined. CZECH REPUBLIC. SOUTHERN BOHEMIA: Šumava Mountains. National Park, Volary, Spáleníště Mount near Stožec, decayed wood of *Fraxinus excelsior*, 16 Aug 1999, M. Réblová M.R. 1545; *ibid.*, Poydíř National Nature Reserve, Čenkova pila, decayed wood of a trunk of *U. glabra*, 27 Aug 2000, M. Réblová M.R.

1677; *ibid.*, Železná Ruda, glacial cirque of the Čertovo jezero lake, decayed wood of *Picea abies*, 22 Oct 1996, *M. Réblová* M.R. 858/96; *ibid.*, Prášily, Mount Ždanidla, 22 Aug 2000, *M. Réblová* M.R. 2234; Novohradské hory Mountains, Nové Hradý, Žofínský prales National Nature Reserve, decayed wood of *F. sylvatica*, 20 May 1997, *M. Réblová* M.R. 917 (PRA). Moravia: *Flora Bohem. et Morav. exsicc. Lfg. 14, No. 675*, Hranice na Moravě, Podhoří, decayed wood, 24 Mar 1913, *F. Petrak* (PRM 195089). BELGIUM. Decayed wood of *Pyrus communis*, 25 May 1902, *Feltgen* (LUX 043455!, holotype of *Eriosphaeria conoidea*). DENMARK. Snarup Mose SW of Kvaerndrup, inner side of the bark of *Betula* sp., 1 Apr 1999, *J. Vesterholt* J.V. 99-015 (C 45296). SJÆLLAND: Charlottenlund skov, rotten wood, 10 Nov 1964, *A. Munk* (C); *ibid.*, Dyrehaven, rotten wood, 26 Nov 1964, *A. Munk* (C); *ibid.*, Dyrehaven, rotten wood of a stump of *F. sylvatica*, 2 Dec 1963, *A. Munk* (C). FRANCE. PYRÉNÉES ATLANTIQUES: Rimont, Ariège, Las Muros, decayed wood, 9 May 2004, *J. Fournier* J.F. 04084 (PRA). GERMANY. Nassau, decayed wood, autumn 1894, *L. Fuckel* (Herb. Barbey-Boissier 603, as *Ceratostomella rhenana*, G). ITALY. On decayed undetermined wood, Sep 1878. *P.A. Saccardo* (PAD!, holotype of *C. vestita*). SWEDEN. SCANIA: Kattarp distr., Kattarps mosse, on decorticated wood of a branch of *Betula* sp., 21 Apr 2001, *S.-Å. Hanson*. USA. PENNSYLVANIA: Northhampton County, Bethlehem, *L.D. Schweinitz*, S.F. 1621.476 (PH 01016198!, holotype of *Sphaeria investita*).

Culture. ICMP 15131 ex-epitype PDD 81434.

Habitat. Saprobe on decayed wood.

Distribution. Austria, Czech Republic, Belgium, Denmark, France, Italy, New Zealand, Sweden, USA.

Commentary. *Lentomitella cirrhosa* is a common saprobe growing on decayed wood. It is characterized by ellipsoidal, longitudinally striate ascospores with one, rarely three septa and long-necked perithecia with the sulcate top of the neck.

Höhnel (1906) in his revision of Feltgen's original herbarium material distinguished between *C. cirrhosa* and *L. debaryana* and considered them separate taxa. Höhnel (1906) considered *E. conoidea* conspecific with *Lentomita debaryana* (Auersw.) Höhn. (as *de Baryana*) and listed four other species closely related to *L. debaryana*. Von Arx (1952) accepted *L. debaryana* and the four species cited by Höhnel (1906) as synonyms of *C. cirrhosa* and listed other nine synonymous names but without studying their type material. Re-examination of the respective types by the present author revealed: *C. vestita* (= *L. cirrhosa*, PAD!), *C. investita* (= *L. cirrhosa*, PH 01016198!), *E. conoidea* (= *L. cirrhosa*, LUX 043455!), and *Ceratostomella similis* W. Kirschst. (= *C. ampullasca*, B 700009209!). The examination of *C. ampullasca* (K 84424!) revealed that it is not a species of *Lentomitella* and requires additional study. *Ceratostomella rostrata* is not congeneric with *L. cirrhosa* and

it is redescribed under *Ceratostomella sensu stricto* in this study. The type material of *Ceratostomella capilliformis* Bomm. et al, *Ceratostomella albocoronata* (Ellis) Sacc. and *Ceratostomella multirostrata* (Fuckel) Sacc. contained only empty perithecia. The type specimen of *Ceratostomella subpilosa* (Fuckel) Sacc. (*Fungi rhenani* 2251, G!) contained several perithecia with only few ascospores attached to the outer perithecial wall; ascospores ellipsoidal, slightly tapering toward the ends, 8–9 × 4–5 µm, finely verruculose. The fungus is not conspecific with *L. cirrhosa*, but it is likely a member of *Lentomitella* based on the ascospore characters; however, fresh material is needed to clarify its systematics. The type material of *Ceratostomella unedonis* H. Fabre, *Ceratostomella debaryana* (Auersw.) Sacc. and *Ceratostomella lejocarpa* Sacc., which were cited by von Arx (1952) among the synonyms of *C. cirrhosa*, could not be located.

***Lentomitella crinigera* (Cooke) Réblová, comb. nov.**

FIGS. 29–33, 44D–H

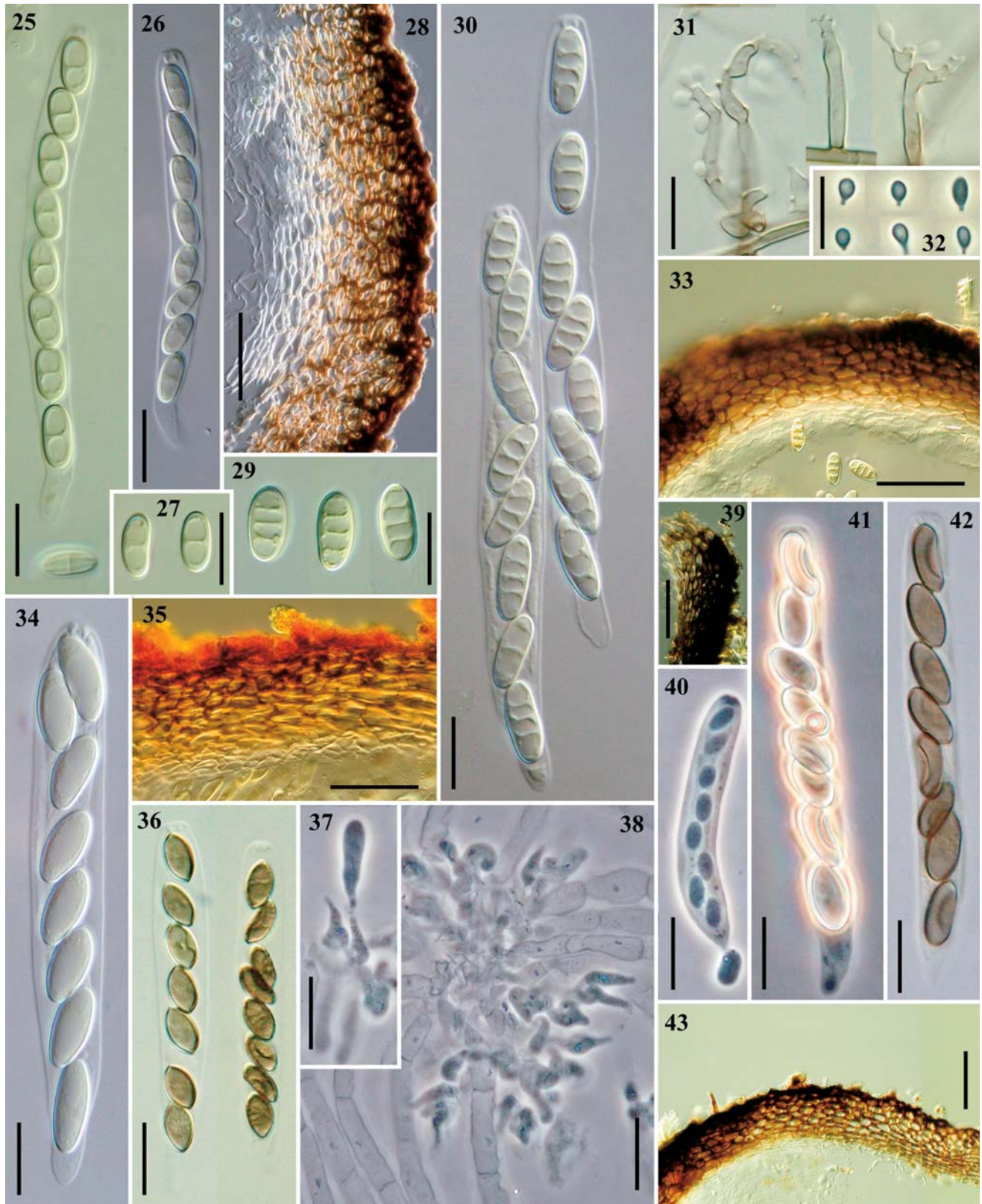
Basionym. *Sphaeria crinigera* Cooke, *Grevillea* 1:156. 1873.

= *Ceratostomella crinigera* (Cooke) Sacc. *Syll. Fung.* 2:227. 1883.

Anamorph. Phaeoisaria-like.

Perithecia solitary or gregarious, venter immersed to superficial, globose to subglobose, 510–700 µm high, 500–600 µm diam, slightly roughened, dark brown, surrounded by sparse mycelium; hyphae brown, 3.5–5 µm wide; neck dark brown, central, elongate, cylindrical, straight to slightly flexuous, sulcate with 4 ridges, 300–1000 µm long, 120–140 µm diam. *Perithecial wall* leathery, 37–50 µm thick, *textura prismatica* to *textura angularis*; externally with a row of heavily melanized cells with opaque walls. *Paraphyses* 6–8 µm wide near the base, tapering to 2.5–3 µm. *Asci* cylindrical-clavate, truncate to broadly rounded at the apex, (65–)78–98(–103) × 7–9(–11) (mean ± SE = 86.7 ± 0.8 × 8.3 ± 0.1) µm, sessile, with an apical annulus 2.5–3.5 µm diam, ca. 1–1.5 µm high. *Ascospores* ellipsoidal, 10–14 × (4–)5–6 (mean ± SE = 12 ± 0.1 × 4.6 ± 0.1) µm, hyaline, 1–3-septate, not constricted at the septa, with few longitudinal ridges, obliquely 1-seriate or 1–2-seriate.

Characteristics in culture. Colonies reaching 8–10 mm diam on PCA, dark brown, cocoa-brown in the center of the colony. *Aerial mycelium* well developed, denser in the center of colony; hyphae subhyaline, 3–4 µm wide, septate, smooth. *Substrate mycelium* of brown, septate hyphae, 3.5–4 µm wide, smooth. Sporulation copious, widespread throughout the colony. Short conidiophores arising from aerial hyphae, conidial heads slimy, inconspicuous, transparent. Reverse dark brown.



FIGS. 25–43. *Lentomitella* spp., *Xylomelasma* spp. 25–28. *L. cirrhosa*. 25, 26. Asci. 27. Ascospores. 28. Longitudinal section of perithecial wall. 29–33. *L. crinigera*. 29. Ascospores. 30. Asci. 31, 32. Conidiophores and conidia of phaeoisaria-like anamorph of *L. crinigera*. Conidiophores and conidia *in vitro*. 33. Longitudinal section of perithecial wall. 34, 35. *L. tomentosa*. 34. Ascus. 35. Longitudinal section of perithecial wall. 36–38. *X. novaezealandiae*. 36. Asci. 37, 38. Ascogenous hyphae and paraphyses.

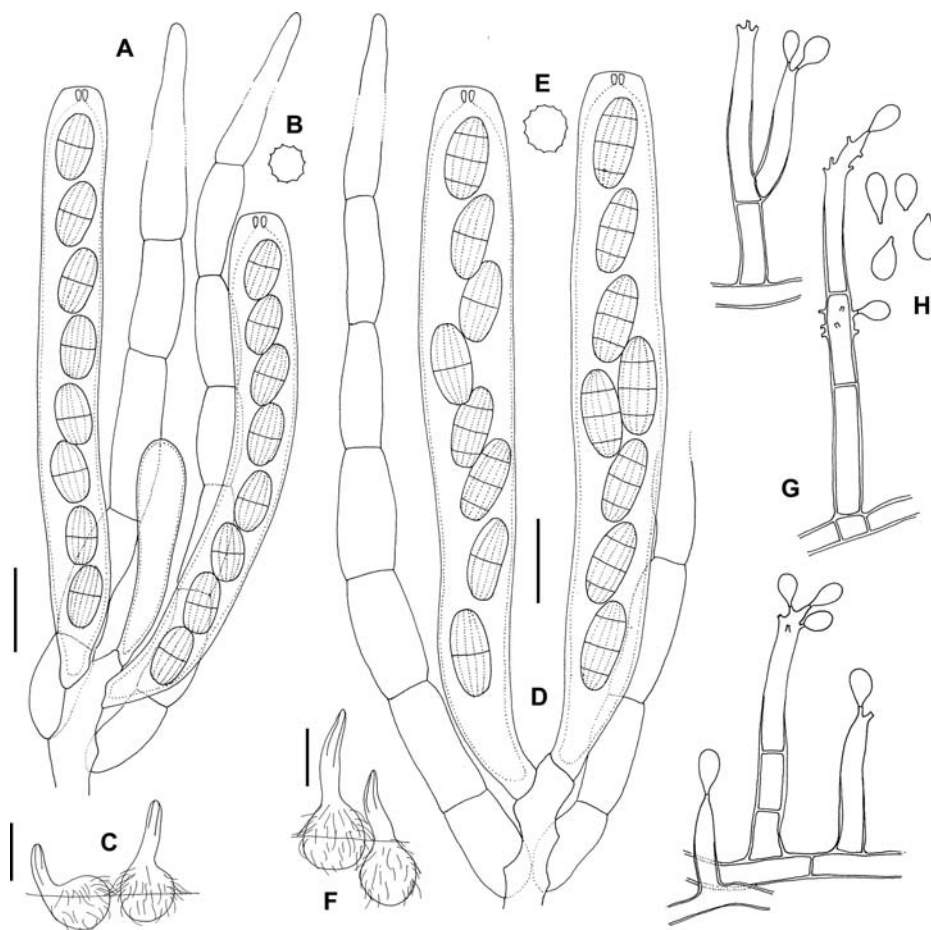


FIG. 44. *Lentomitella* spp. A-C. *L. cirrhosa*. Ascus, ascogenous hyphae, paraphyses, transverse section of ascospore and habit sketches of perithecia. D-H. *L. crinigera*. Ascus, ascogenous hyphae, paraphyses, transverse section of ascospore and habit sketches of perithecia. G, H. Conidiophores and conidia of the phaeoisaria-like anamorph of *L. crinigera* in vitro. A-C from PDD 81434. D-F from PDD 81435, G, H from CBS 113655 ex PDD 81435 (PCA, 14 d). Bars: A, B, D, E, G, H = 10 µm; C, F = 500 µm.

Conidiophores macronematous, mononematous, arising terminally or laterally, hyaline, $24-45 \times 2-2.5$ µm. *Conidiogenous cells* terminal or intercalary, hyaline, cylindrical, tapering toward the apex, $9-20(-25) \times 2-2.5$ µm, bearing 2-6 hyaline denticles $0.5-1$ µm wide, $0.5-1$ µm long. *Conidia* ellipsoidal to globose, apiculate at the base, $4-6 \times 2-2.5$ (mean \pm SE = $5.2 \pm 0.2 \times 2.2 \pm 0.3$) µm, hyaline, aseptate, smooth.

HOLOTYPE. UNITED KINGDOM. ENGLAND: Norfolk, King's Lynn, decayed wood, *C.B. Plowright* (holotype of *Sphaeria crinigera*, K 84422!).

Additional specimens examined. CZECH REPUBLIC.

SOUTHERN BOHEMIA: Šumava Mountains National Park, Železná Ruda, glacial cirque of the Čertovo jezero Lake Nature Reserve, decayed wood of *Abies alba*, 28 Aug 1997, *M. Réblová* M.R. 997, M.R. 1034; *ibid.*, 12 Aug 1999, *M. Réblová* M.R. 1544, M.R. 1585; *ibid.*, 21 Aug 2000, *M. Réblová* M.R. 1672; *ibid.*, glacial cirque of the Černé jezero Lake Nature Reserve, decayed wood of *A. alba*, 13 Aug 1999, *M. Réblová* M.R. 1526, M.R. 1546; *ibid.*, Prášily, Mount Ždanidla, 24 Aug 2000, decayed wood of *F. sylvatica*, *M. Réblová* M.R. 1671; *ibid.*, Boubínský prales Nature Reserve, decayed wood of *P. abies*, 17 Aug 1999, *M. Réblová* M.R. 1611; *ibid.*, Modrava, Ptačí nádrž, decayed wood of *P. abies*, 14 Aug 1999, *M. Réblová* M.R. 1457; *ibid.*, Modrava, Modravské slatě, Pytlácký roh, decayed wood of a trunk of

←

39. Longitudinal section of perithecial wall. 40-43. *X. sordida*. 40-42. Ascus. 43. Longitudinal section of perithecial wall. DIC: 25-31, 33-36, 39, 41-43; PC: 32, 37, 38, 40. FIGS. 25, 27 from PDD 81434; 26 from M.R. 2234; 29, 30, 33 from PDD 81435; 31, 32 from CBS 113655 ex PDD 81435 (PCA, 14 d); 34, 35 from PRM 902274; 36-39 from PDD 81433; 40-42 from PRM 902275; 43 from *K.K. 236* (C). Bars: 25-27, 29-32, 34, 36-38, 40-42 = 10 µm 28, 33, 35, 39, 43 = 50 µm.

P. abies, 14 Aug 1999, M. Réblová M.R. 1652 (PRA). DENMARK. Silkeborg, Vesterskov, decayed wood of *F. sylvatica*, 24 Mar 1954, A. Munk (C). NEW ZEALAND. WESTLAND: Victoria National Park, Reefton, 90 km NE of Greymouth, Lake Stream track, 30 km SE of Reefton, decayed wood of a trunk of *Nothofagus* sp., 27 Feb 2003, M. Réblová M.R. 2659 (PDD 81435; cultures CBS 113655, ICMP 15124). SWEDEN. Fries' *Scleromyceci Sueciae* No. 346, decayed wood (UPS).

Cultures. CBS 113655, ICMP 15124, both isolates ex PDD 81435.

Habitat. Saprobe on decayed wood.

Distribution. Czech Republic, Denmark, New Zealand, Sweden, U.K.

Commentary. *Lentomitella crinigera* is characterized by ellipsoidal, longitudinally striate, 1–3-septate ascospores. The related *L. cirrhosa* is distinguished from *L. crinigera* by shorter ascospores and asci and smaller perithecia.

***Lentomitella tomentosa* Réblová & J. Fournier, sp. nov.**

FIGS. 34, 35, 45A, B

Perithecia gregaria, immersa vel superficialia, globosa vel subglobosa, brunnea, rubro tomentosa, 400–500 µm alta, 350–600 µm diam, ostiolo centrali elongato, cylindraceo, 200–450 µm longo, 120–180 µm diam. Paries perithecii 40–50 µm crassus, bistratosus. Paraphyses copiosae, hyalinae. Asci cylindraceo-clavati, (75–)80–98 × (9–)10–11 µm, breviter stipitati, 8-sporei. Ascosporeae ellipsoideae, apiculatae, 13–16(–17) × (5–)6–7 µm, continuae, hyalinae, laeves.

Anamorph. Unknown.

Perithecia gregarious, venter immersed to entirely superficial, globose to subglobose, 400–500(–600) µm high, 350–600 µm diam, dark brown, collapsed laterally on drying, surrounded by sparse hyphae 4–5 µm wide, growing out of the outer perithecial wall; neck dark brown, central, perpendicular to slightly decumbent toward the substratum, elongate, cylindrical, straight to slightly flexuous, sulcate with 3–4 ridges, 200–450 µm long, 120–180 µm diam. *Perithecial wall* leathery, laterally 40–50 µm thick, 35–37 µm thick at the bottom, *textura prismatica* to *textura angularis*; externally with a row of heavily melanized cells with opaque walls. On the outer perithecial wall a red waxy layer, 8–18 µm thick attached to the surface of melanized cells; granules of red pigment also attached to the surface of the perithecial hairs and also staining the surrounding substratum. Outer perithecial wall of brown, thick-walled cells, inner layer of thinner-walled, subhyaline to hyaline, elongated and compressed cells. *Paraphyses* 4–6 µm wide near the base, tapering to 3–3.5 µm, longer than the asci. *Asci* cylindrical-clavate, truncate to broadly rounded at the apex, (75–)80–98 × (9–)10–11 (mean ± SE = 84.8 ± 1.4 × 10.6 ± 0.1) µm, sessile, with an

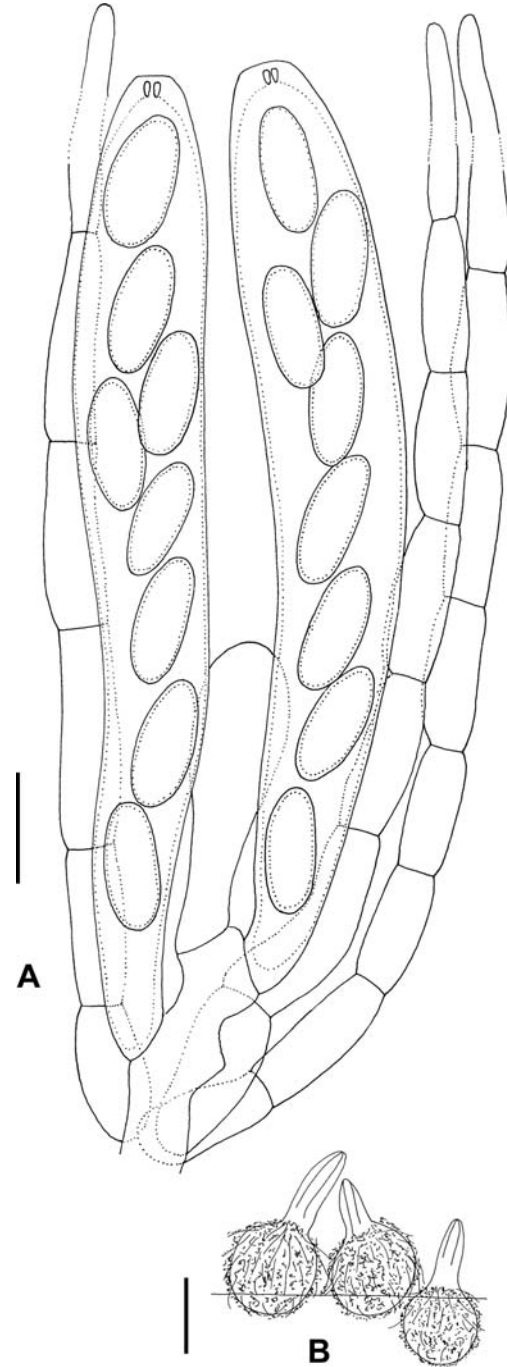


FIG. 45. *Lentomitella tomentosa*. Asci, ascogenous hyphae, paraphyses and habit sketches of perithecia. From PRM 902274. Bars: A = 10 µm; B = 500 µm.

apical annulus 2.5–3.5 µm diam, ca. 1.5 µm high. *Ascospores* ellipsoidal, 13–16(–17) × (5–)6–7 (mean ± SE = 14.4 ± 0.2 × 5.9 ± 0.1) µm, hyaline, aseptate, smooth, obliquely 1-seriate or 1–2-seriate.

HOLOTYPE. FRANCE. Finistère, Plohars, Forêt de Carnoët, Pont Douar, 40 m a.s.l., decorticated wood of *F. sylvatica*, 26 Oct 2002, J. Fournier J.F. 02196 (PRM 902274).

Additional specimen examined. DENMARK. SJÆLAND: Dyrehaven, decayed wood of a stump, 3 Oct 1964, A. Munk (C); *ibid.*, 20 Mar 1965, A. Munk (C); *ibid.*, Silkeborg, Spring area near Almindsø, decayed wood of *A. glutinosa*, 4 Sep 1953, A. Munk (C).

Etymology. *Tomentosus* (L), tomentose, refers to the felted appearance of the surface of the perithecia.

Habitat. Saprobe on decayed wood.

Distribution. Denmark, France.

Commentary. *Lentomitella tomentosa* is characterized by aseptate, ellipsoidal, smooth ascospores and perithecia with stout, sulcate, black neck in contrast to the finely tomentose venter with a red waxy layer covering the surface of the wall and hairs; the red pigment dissolves in KOH and stains the nearby wood reddish.

Xylomelasma Réblová, gen. nov.

Perithecia solitaria usque gregaria, superficialia usque immersa, globosa vel subglobosa, atro-brunnea, ostiolo centrali elongato, cylindraco. Paries perithecii bistratosus. Paraphyses copiosae, hyalinae, cylindraco-clavate, breviter stipitati, 8-spori. Ascospores ellipsoideae usque oblongae, apiculatae, unicellulares vel raro 1-septatae, brunneae dum in asco.

Perithecia solitary to gregarious, nonstromatic, venter globose to subglobose, superficial, semiimmersed or immersed, glabrous or roughened, dark brown to black, surrounded by sparse mycelium; hyphae growing out of the bottom part of the outer perithecial wall. *Necks* protruding separately, central, elongate, cylindrical, straight to slightly flexuous, perpendicular, oblique to almost decumbent toward the substratum, sulcate or glabrous, ostiolum periphysate. *Perithecial wall* leathery to fragile, two-layered. Outer wall of brown, thick-walled cells, *textura prismatica*; externally with dark brown cells with opaque walls but without any distinct crustose layer. Inner layer of thinner-walled, subhyaline to hyaline, elongated and compressed cells. *Ascogenous hyphae* sparsely branching, discrete, each sequentially and simultaneously producing several lateral and terminal dehiscent cells, each forming one ascus arises. *Paraphyses* abundant, branching, septate, hyaline, cylindrical, slightly constricted, slightly tapering toward the tip, apically free, longer than the asci. *Asci* unitunicate, cylindrical, short-stipitate, truncate to broadly rounded at the apex, narrowly rounded at the base, floating freely within the centrum at maturity, with a distinct, refractive, nonamyloid apical annulus, 8-spored. Ascus stipe usually containing a non-refractive material deposited at the bottom part, visible after ascus dehiscence from the ascogenous hyphae. *Ascospores* ellipsoidal to oblong, hyaline when young,

pale brown before discharge, aseptate or some developing a median septum, smooth or finely verruculose, sometimes with terminal pores, obliquely 1-seriate in the ascus.

Typus. *Xylomelasma sordida* Réblová.

Anamorph. Hyphomycetous, dematiaceous; in culture only sterile mycelium seen.

Etymology. *Xylon* (Gr) = wood; *melas* (Gr) black, referring to the dark, opaque perithecia.

KEY TO THE SPECIES OF *XYLOMELASMA*

1. Ascospores 9–12 µm long. *X. sordida*
1. Ascospores 7–8 µm long *X. novaezealandiae*

Xylomelasma novaezealandiae Réblová, sp. nov.

FIGS. 36–38, 46A, B

Perithecia solitaria usque gregaria, immersa vel partim erumpentia, globosa vel subglobosa, brunnea, 310–340 µm diam, 350–400 µm alta, ostiolo centrali elongato, cylindraco, 95–115 µm diam, 225–375 µm longo. Paries perithecii 52–62 µm crassus, bistratosus. Paraphyses copiosae, hyalinae. Asci cylindraco-clavati, 50–60(–65) × 7–8(–9) µm, breviter stipitati, 8-spori. Ascospores ellipsoideae, 7–8 × (3.5–)4–5 µm, continuae, brunneae.

Anamorph. Unknown.

Perithecia solitary to gregarious, venter immersed or partly erumpent, globose to subglobose, 350–400 µm high, 310–340 µm diam, smooth to slightly roughened, dark brown, surrounded by sparse mycelium; hyphae brown, septate, sparsely branched, 3–4 µm wide; neck central, elongate, straight or slightly flexuous, rounded at the top, not sulcate, 225–375 µm long, 95–115 µm diam. *Perithecial wall* leathery to fragile, *textura prismatica*, 52–62 µm thick; external crustose layer 11–14 µm thick. *Paraphyses* 6–7 µm wide near the base, tapering to 2.5–3 µm at the top. *Asci* cylindrical-clavate, 50–60(–65) × 7–8(–9) (mean ± SE = 53.2 ± 0.9 × 7.7 ± 0.2) µm, truncate at the apex, short-stipitate, with an apical annulus 2.5–3 µm diam, 1–1.5 µm high. *Ascospores* ellipsoidal, tapering toward both ends, narrowly rounded and slightly apiculate, 7–8 × (3.5–)4–5 (mean ± SE = 6.7 ± 0.3 × 4.1 ± 0.1) µm, pale brown, aseptate or rarely with one median septum at maturity, smooth-walled, with two large drops; mature ascospores become finely verruculose and dark brown, with a minute pore at each end, 1-, rarely 1–2-seriate in the ascus.

HOLOTYPE. NEW ZEALAND. WESTLAND: Haast, 300 km SW of Greymouth, Jackson River valley, track to the Lake Ellery, S 43°52.9559', E 169°02.6211', rotten wood of a stump of *Nothofagus* sp., 10 Mar 2003, M. Réblová M.R. 2787 (PDD 81433).

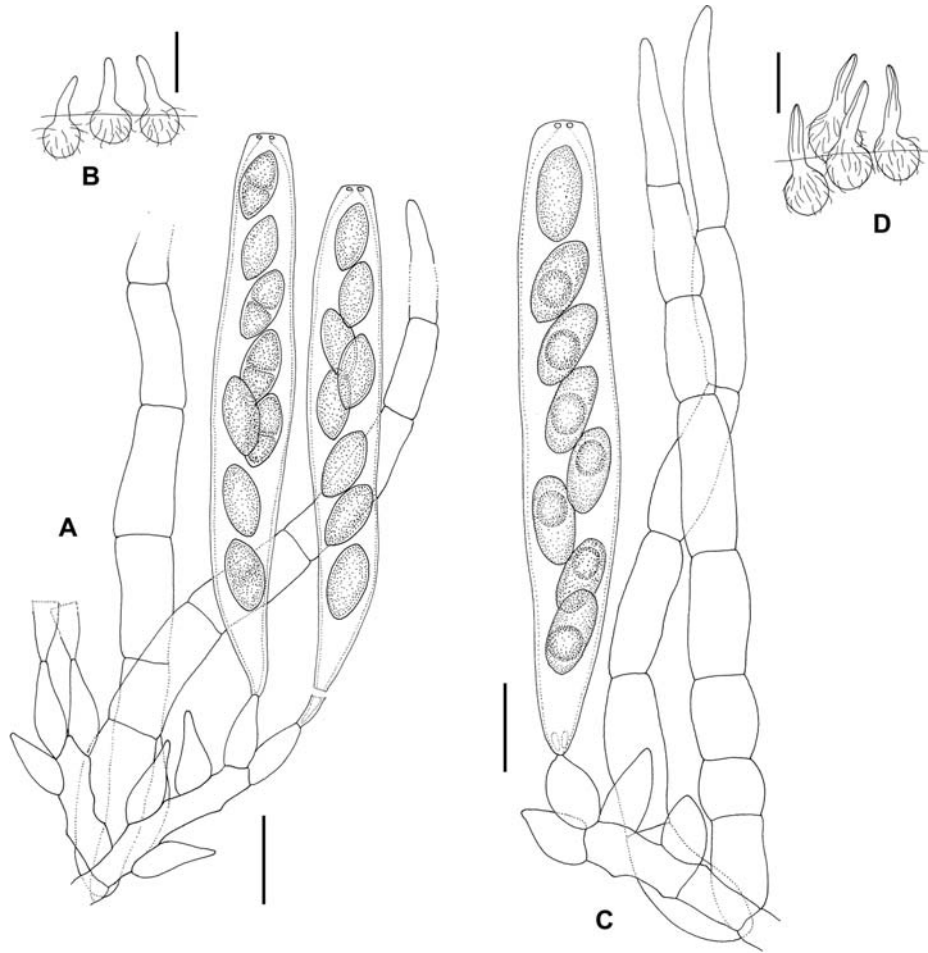


FIG. 46. *Xylomelasma* spp. A, B. *X. novaezealandiae*. Asci, ascogenous hyphae, paraphyses and habit sketches of perithecia. C, D. *Xylomelasma sordida*. Asci, ascogenous hyphae, paraphyses and habit sketch of perithecia. A, B from PDD 81433; C, D from PRM 902275. Scale bars: A, C = 10 μm ; B, D = 500 μm .

Etymology. *Novaezealandiae* refers to country of origin, New Zealand.

Habitat. Saprobe on decayed deciduous wood.

Commentary. Attempts to germinate ascospores of the cited specimen were unsuccessful.

Although *Xylomelasma* and *Ceratostomella* are readily distinguishable in the main characteristics of asci, apical annulus, ascospores and perithecial wall, *X. novaezealandiae* could be confused with *C. rhynchophora* because of the similar ascospore shape; but the ascospores are regularly ellipsoidal, not flattened on a side and shorter in *X. novaezealandiae*. *Ceratostomella rhynchophora* differs from *X. novaezealandiae* also in having shorter asci, ascospores 2–3-seriately arranged in the asci and larger perithecia with a thicker wall.

***Xylomelasma sordida* Réblová, sp. nov.**

FIGS. 40–43, 46C, D

Perithecia solitaria usque gregaria, superficialia usque immersa, globosa vel subglobosa, brunnea, 490–550 μm

diam, 450–600 μm alta, ostiolo centrali elongato, cylindraceo, 120–150 μm diam, 950–1500 μm longo. Paries perithecii 55–62(–80) μm crassus, bistratosus. Paraphyses copiosae, hyalinae. Asci cylindraceo-clavati, (58–)60–76(–81) \times 7–10(–13) μm , breviter stipitati, 8-spори. Ascosporae ellipsoideae, apiculatae, 9–12 \times 4–6 μm , unicellulares, brunneae.

Anamorph. Hyphomycetous, dematiaceous; in culture only sterile mycelium seen.

Perithecia solitary to gregarious, venter superficial to immersed, globose to subglobose, 490–550 μm diam, 450–600 μm high, slightly roughened, dark brown, surrounded by sparse mycelium; hyphae dark reddish brown, septate, slightly flexuous, 5–6 μm wide; neck central, elongate, slightly roughened, sometimes unevenly thickened, rounded at the top, sulcate with four ridges, 950–1500 μm long, 120–150 μm diam. *Perithecial wall* leathery to fragile, *textura prismatica* to *textura angularis*, 55–62(–80) μm thick, external crustose layer 7–12 μm thick. Some cells in the outer layer with “Munk pores”. *Paraphyses* 6–10 μm wide near the base, tapering to 2–

3 µm at the top. *Asci* cylindrical-clavate, (58–)60–76 (–81) × 7–10(–13) (mean ± SE = 72.4 ± 1.1 × 8.2 ± 0.1) µm, truncate to broadly rounded at the apex, short-stipitate, with an apical annulus 2–2.5 µm diam, ca. 1 µm high. *Ascospores* ellipsoidal, sometimes slightly apiculate at both ends, 9–12 × 4–6 (mean ± SE = 10 ± 0.1 × 5 ± 0.1) µm, pale brown, aseptate, smooth, with a minute germ pore at each end, with 1(–2) oil drops, 1–2-seriate in the ascus.

Characteristics in culture. Colonies on PCA reaching 12–14 mm diam in 14 d, dark olivaceous brown, grayish in the center. *Aerial mycelium* scarcely developed, densest in the center of colony; hyphae subhyaline to pale brown, 3–3.5 µm wide, septate, smooth. *Substrate mycelium* of dark brown, septate hyphae, 3–4 µm. Sporulation absent. Margin discrete, somewhat gnawed. Reverse dark brown.

HOLOTYPE: FRANCE. PYRÉNÉES ATLANTIQUES: Ariège, Lescure, Bois du Pas du Baup, 500 m a.s.l., rotten wood of *A. glutinosa*, 24 Feb 2004, *J. Fournier 04020* (PRM 902275, culture CBS 116000).

Additional specimens examined. ARGENTINA. BUENOS AIRES PROVINCE: Pdo. San Pedro, Gdor. Castro, *Eucalyptus viminalis*, May 1982, *A. Romero 9, 19* (BAFC 32028, BAFC 32030, BAFC 32031); *ibid.*, Aug 1982, *A. Romero 10* (BAFC 51316); *ibid.*, decayed wood, Aug 1981, *A. Romero 6/22-8* (BAFC 32027); *ibid.* decayed wood, Feb 1982, *A. Romero 38* (BAFC 32029). CZECH REPUBLIC. SOUTHERN MORAVIA: Břeclav district, obora Soutok near Lanžhot, on decayed deciduous wood. 23 Oct 2004, *M. Réblová M.R. 2904, 2911* (PRA). DENMARK. SJÆLLAND: Dyrehaven, Distr. 45a, decayed wood, 5 Apr 1963, *G. Carroll* (C, as *Endoxyla parallela*); *ibid.* Rude Skov, decayed wood of a stump of *F. sylvatica*, 4 Feb 1964 (C, as *Endoxyla parallela*). HUNGARY. Bükk National Park in NE Hungary, decayed wood of *F. sylvatica*, Oct 2000, *K. Kovács K.K. 215, K.K. 236* (C).

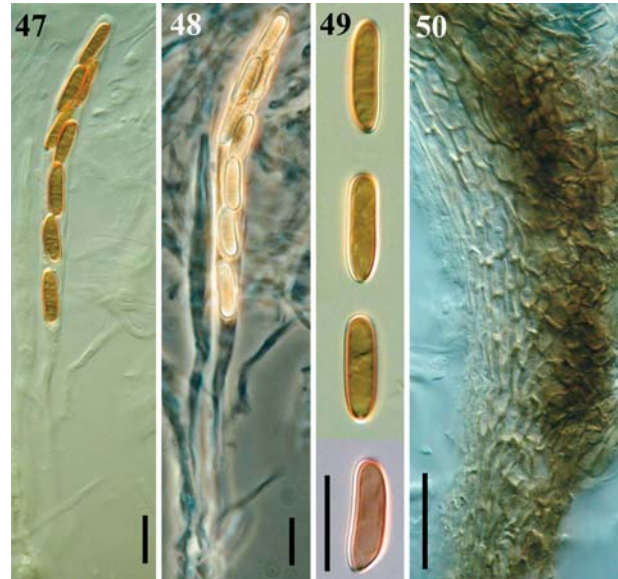
Culture. CBS 116000 ex-type PRM 902275.

Etymology. *Sordidus* (L), dull, refers to the dull brown ascospores.

Habitat. Saprobe on decayed wood.

Distribution. Argentina, Denmark, France, Hungary.

Commentary. Romero and Samuels (1991:43, Pl. 3m–p, Pl. 6g–j) reported a fungus identical with *X. sordida* from Argentina, but they considered it to be conspecific with *Sphaeria avocetta* Cooke & Ellis and proposed a new combination *Endoxyla avocetta*. They based their identification on the comparison with isotype material of *S. avocetta* (BPI, as *Ceratostoma avocettum*). Untereiner (1993) concluded that *E. avocetta* could not be classified in *Endoxyla* based on the description and illustration by Romero and Samuels (1991) and suggested its placement in the Diaporthales. Romero (1999) introduced a new genus *Phaeognomoniella* Romero for *S. avocetta* in this sense.



FIGS. 47–50. *Endoxyla parallela*. 47, 48. Asci. 49. Ascospores. 50. Longitudinal section of perithecial wall. DIC: 47, 49, 50; PC: 48. From K 114931 (holotype of *Sphaeria avocetta*). Scale bars: 47–49 = 10 µm; 50 = 50 µm.

The revision of the holotype material of *S. avocetta* (FIGS. 47–50; USA. NEW JERSEY: Newfield, undetermined decayed wood, Jan 1876, *J.B. Ellis*, K 114931!, as *Ceratostoma avocettum*) by the present author revealed a fungus that possesses immersed, dark, conical, glabrous, monostichous perithecia with short, stout, cohering necks protruding just above the substrate surface, with remnants of stromatic tissue surrounding the projecting necks; paraphyses filiform, hyaline, septate, apically free, ca. 2 µm wide, longer than the asci; asci unitunicate, cylindrical, long-stipitate, rounded apically, floating free within the centrum, 66–88 µm long in *pars sporifera*, 6–7 µm wide, stipe 35–52 µm long, dissolving at maturity; with a nonamyloid indistinct apical annulus; ascospores ellipsoidal to subcylindrical, 11–13 × (3–)3.5–4 µm, aseptate, dull brown before discharge, with a minute pore at one end and slightly tapering toward this end, smooth, 1-seriate in the ascus. These characteristics of *S. avocetta* as seen on the holotype material are typical of members of *Endoxyla* (Untereiner 1993). *Sphaeria avocetta* is conspecific with *Endoxyla operculata* and should be relegated to its synonymy. *Phaeognomoniella*, although based on misidentified material, becomes a generic synonym of *Endoxyla*. For full synonymy of *Endoxyla* and *E. operculata* I refer to Untereiner (1993). The sizes of ascospores and asci in *pars sporifera* of *X. sordida* and *S. avocetta* are similar and might be confusing but in all other respects both fungi represent two distinct genera.

DISCUSSION

Although morphological similarities among ascomycetes can lead to incorrect phylogenies, in this case the DNA sequence data join phenotype characters to indicate that *Ceratostomella* and *Xylomelasma* are close relatives. *Xylomelasma* resembles *Ceratostomella* in having pigmented ascospores before discharge, asci floating within the centrum at maturity and similar branching pattern of ascogenous hyphae, but it differs from it in the thickness of the perithecial wall; paraphyses that are cylindrical and only slightly constricted at the septa, and cylindrical and generally larger asci with a distinct, refractive apical annulus, and ellipsoidal ascospores that are obliquely uniseriate within the ascus.

Among comparatively well known ascomycetes, species of *Ceratostomella* and *Xylomelasma* can be compared with some phenotypically similar taxa of the Ceratostomataceae (e.g. *Melanospora* Corda or *Arxiomyces* P. Cannon & D. Hawksw.) especially because of the long-beaked perithecia and dull brown, aseptate ascospores with terminal pores. However, based on morphology of the asci, ascogenous system and interthelial filaments, none of the species attributed to *Ceratostomella* or *Xylomelasma* are melanosporaceous. According to molecular analyses of ribosomal DNA and RPB2, the phylogenetic affinity of *Melanospora* and other members of the Ceratostomataceae lie with the Hypocreales (Zhang and Blackwell 2002). In all recent analyses *Melanospora* takes this position. *Ceratostomella* bears also some resemblance to *Cannonia* Taylor & K.D. Hyde with the single species *C. australis* (Speg.) J. Taylor & K.D. Hyde in dark perithecia with immersed subglobose venter, separately projecting necks and brown ellipsoidal ascospores. *Cannonia* differs from *Ceratostomella* in ascospores that have a full-length germ slit, filiform paraphyses, presence of rudimentary stroma and a dark clypeus around the base of the neck (Taylor and Hyde 1999).

Lentomitella encompasses segregates from *Ceratostomella sensu lato* with hyaline, ellipsoidal, septate or aseptate ascospores; unitunicate, short-stipitate, sessile asci formed on croziers with a conspicuous, refractive, nonamyloid apical ring, cylindrical paraphyses and the phaeoisaria-like anamorph. Based on the LSU and SSU nrDNA sequence data (FIGS. 1, 2), *Lentomitella* has no obvious affinity to the Diaporthales, which originally were suggested to accommodate the genus (as *Ceratostomella*) (von Arx 1952; von Arx and Müller 1954; Müller and von Arx 1973; Munk 1952, 1957, 1965). Members of the Diaporthales have perithecia embedded in a stroma or only partly surrounded by reduced stromatic tissue;

short-stipitate, basally rounded asci floating free within the centrum; the centrum is paraphysate, the tissue deliquesce early in development; anamorphs are phialidic coelomycetous with occasionally annelate conidiogenous cells indicating percurrent proliferation, and most of the taxa have phytopathogenic lives. Also another preliminary placement of *Lentomitella* in the Lasiosphaeriaceae (Untereiner 1993) or the Clypeosphaeriaceae (Barr 1990, Eriksson et al 2003) could not be confirmed in either MP1 or MP2 analyses. The Lasiosphaeriaceae were shown to form a well supported clade within the Sordariales (Huhndorf et al 2004) and *Clypeosphaeria phillyreae* Sousa da Câmara representing the Clypeosphaeriaceae was nested within the Hypocreales in MP1.

In the MP1 analysis, *Lentomitella* resides in a larger unsupported clade containing the Ophiostomatales and members of the Annulatascaceae (viz. *A. triseptatus*, *A. austriacus*, *A. chesapeakeensis* and *A. velatisporus*) and a group of terrestrial perithecial ascomycetes (viz. *C. groenendalensis* and *R. delicatula*) tentatively placed in the Trichosphaeriaceae (Réblová and Seifert 2004). In the MP2 analysis *Lentomitella* together with *Ceratostomella* and *Xylomelasma* takes a basal position in relation to the Ophiostomatales, but on three separate branches within a single clade. While the anamorphs of the Annulatascaceae are generally unknown, the anamorphs of *Cryptadelphia* and *Rhamphoria* are hyphomycetous, dematiaceous with holoblastic denticulate conidiogenesis and have been linked to *Brachysporium* Sacc. and *Phaeoisaria* Höhn., respectively (Müller and Samuels 1982, Réblová and Winka 2001, Réblová and Seifert 2004). *Lentomitella* shares with *Ceratostomella* only dark, long-beaked perithecia with the top of the neck sulcate, and with *Xylomelasma* ellipsoidal ascospores arranged obliquely 1-seriately in the ascus; cylindrical, short-stipitate asci and cylindrical paraphyses; *Xylomelasma* differs from *Lentomitella* by ascospores with terminal pores, pigmented before discharge, asci floating freely within the centrum and characteristic ramification of ascogenous hyphae. Although the cultures of *X. sordida* and *C. pyrenaica* remained sterile, their grouping near *Lentomitella*, the Ophiostomatales and other taxa with holoblastic denticulate conidiogenesis in both phylogenies is suggestive of a similar conidiogenous pattern.

The anamorph of *Lentomitella crinigera* obtained in vitro is hyphomycetous, dematiaceous, with subhyaline to pale brown, denticulate conidiogenous cells. It is difficult to satisfactorily place the anamorph of *L. crinigera* in any of the known hyphomycetous genera. Several dematiaceous hyphomycetous genera such as *Sporothrix* Hektoen & Perkins, *Rhinochlaediella* Nannf., *Ramichloridium* Stahel ex de Hoog or *Tritirachium*

Limber produce similar holoblastic denticulate conidia, of which the latter has strongly geniculate proliferations, but the three latter have been linked to phylogenetically unrelated ascomycetes. *Tritirachium* has been linked to *Trichosphaerella ceratophora* (Höhn.) E. Müll. (*Tritirachium oryzae* [Vincens] de Hoog; Müller and Samuels 1982) of the Niessliaceae (Hypocreales). *Rhinocladiella* is known as an anamorph of *Capronia* Sacc. of the Herpotrichiellaceae (Chaetothiales), while most of the *Ramichloridium* species (particularly the common *R. schulzeri* [Sacc.] de Hoog) are asexual and do not belong there. However phenotypically similar anamorphs are reported also for the perithecial ascomycete *Calosphaeria fagi* Samuels & Candoussau (ramichloridium-like and sporothrix-like synanamorphs, Samuels and Candoussau 1993), *Rhamphoria* (phaeoi-saria-like anamorph, Müller and Samuels 1982) and some *Ophiostoma* species that also possess sporothrix-like anamorphs (Hoog 1974, Samuels and Müller 1979). The *Lentomitella* anamorph is most similar to the anamorphs of *C. fagi*, *Rhamphoria* or some *Ophiostoma* species; the two latter genera were close relatives to *Lentomitella* in both phylogenetic analyses; unfortunately, no molecular data are available for *C. fagi*. The Ophiostomatales are clearly distinguishable from *Lentomitella* by minute ascospores with filiform beaks, evanescent asci without any discharge mechanism and minute, reniform to crescent-shaped ascospores arranged in a fascicle. The teleomorphs of *Lentomitella* and *C. fagi* differ significantly in the morphology of ascospores (ellipsoidal vs allantoid), asci (cylindrical-clavate, short-stipitate, sessile vs clavate, long-stipitate, floating free within the centrum), ascogenous system (ascogenous hyphae not branched, proliferating shortly through formation of croziers vs ascogenous hyphae branching in several levels), and habitat of perithecia (separately growing with separately projecting vertical necks vs forming circinate groups with long, cohering necks often perpendicular to the substratum). The perithecia of *Rhamphoria* are conical and superficial, asci are long cylindrical-clavate and ascospores are irregularly ellipsoidal-fusiform, muriform, producing secondary minute ellipsoidal spores as outgrowths from cells of primary ascospores within the ascus.

Ceratospaeria lampadophora, the type species of the genus, is a lignicolous perithecial ascomycete possessing immersed nonstromatic perithecia with globose semi- or entirely immersed venter and elongate, separately protruding necks; long-cylindrical, short-stipitate asci arising from croziers, containing a distinct, refractive, nonamyloid apical annulus and eight hyaline, 5–8-septate, cylindrical to cylindrical-fusiform 2–3-seriate ascospores. According to the

present phylogenies *C. lampadophora* resides on a strongly supported branch within the Magnaporthaceae (96/100 in MP1 and 100/100 in MP2) without close relationship with *Lentomitella*. The placement of the exclusively saprobic *C. lampadophora* in the Magnaporthaceae is of interest because the family was erected (Cannon 1994) for important plant pathogens specialized as necrotrophic parasites with a preference for Gramineae and Cyperaceae. The ordinal affiliation of the Magnaporthaceae has not yet been resolved within the Sordariomycetes (Cannon 1994, Kirk et al 2001, Eriksson et al 2003). In MP1 and MP2 phylogenies the Magnaporthaceae were shown as a well supported clade. The anamorphs that have been linked to the Magnaporthaceae form either pycnothyrial conidiomata producing phialidic conidia (*Mycocleptodiscus* Ostazeski, *Pseudotracylla* B. Sutton & Hodges), or they are hyphomycetous, with conidiogenesis being either holoblastic denticulate with rhexolytic secession (*Nakataea* Hara, *Pyricularia* Sacc.), or holoblastic with schizolytic secession (*Clasterosporium* Schwein.), or hyphomycetous with phialidic conidiogenesis (*Harpophora* W. Gams).

The genus *Harpophora* was erected for phialophora-like fungi associated with *Gaeumannomyces* Arx & D.L. Olivier and *Magnaporthe* R.A. Krause & R.K. Webster species (Scott and Deacon 1983, Landschoot and Jackson 1989, Gams 2000) producing more or less pigmented phialides and cylindrical, hyaline, strongly curved conidia aggregated in slimy heads. Despite the similarity in the anamorphs, the teleomorphs of *C. lampadophora* and *Magnaporthe* are rather different. *Magnaporthe* species have erumpent perithecia with elongate necks and produce lightly pigmented, allantoid, 3-septate ascospores (Barr 1978). The two different types of conidiogenesis associated with *Magnaporthe* (*Harpophora*, *Nakataea* and *Pyricularia*) are suggestive of some heterogeneity in the generic concept. The anamorphs of *Gaeumannomyces* and *Ophioceras* of the Magnaporthaceae clade are also phialophora-like. Their overall teleomorphic similarity with *C. lampadophora* lies in dark, long-beaked perithecia with cylindrical to scolecosporous, septate, hyaline ascospores.

Trichosphaeria pilosa, representing the Trichosphaeriaceae in the phylogeny, takes a basal position in relation to all other unitunicate ascomycetes in the MP1 analysis (FIG. 1). The BLAST search of the *T. pilosa* LSU nrDNA sequence (Campbell and Shearer 2004) revealed that the closest relatives are members of the Dothideomycetes (viz. *Raciborskiomyces* Siemaszko [Capnodiales], *Cladosporium* Link, *Dothidea* Fr. or *Mycosphaerella* Johanson [Dothideales]). The delimitation of the Trichosphaeriales has not yet been resolved because of high degree of phenotype

convergence and because of the absence of molecular data of *T. pilosa*, the representative taxon of the order. *Trichosphaeria pilosa* traditionally was accepted as a unitunicate perithecial ascomycete (von Arx and Müller 1954, Réblová et al 1999) but placement of the sequence in the tree is suggestive of its affinity to the ascolocular ascomycetes. The examination and comparison of the type and herbarium material, from which the sequence was derived, will be necessary to reveal the true systematic position of the fungus.

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LITERATURE CITED

- Barr ME. 1978. The Diaporthales in North America with emphasis on *Gnomonia* and its segregates. *Mycologia Mem* 7:1–232.
- . 1985. Notes on the Calosphaeriales. *Mycologia* 77: 509–565.
- . 1990. Prodrromus to nonlichenized, pyrenomycetous members of class Hymenoascomycetes. *Mycotaxon* 39:43–184.
- . 1998. *Wegelina* a reinstated genus in the Calosphaeriales. *Cryptogamie, Bryol Lichénol* 19:169–173.
- , Rogers JD, Yu YM. 1993. Revisionary studies in the Calosphaeriales. *Mycotaxon* 48:529–535.
- Berlese AN. 1900. *Icones Fungorum ad usum Sylloges Saccardianae adcommodatae*. 3. Sphaeriaceae allantoporaee. Padova, 120 p.
- Campbell J, Shearer CA. 2004. *Annulusmagnus* and *Ascitendus*, two new genera in the Annulatascaceae. *Mycologia* 96:822–833.
- Cannon PF. 1994. The newly recognized family Magnaporthaceae and its relationships. *Syst Ascom* 13:25–42.
- Clements FE, Shear CL. 1931. *The genera of fungi*. HW Wilson: New York, 496 p.
- Elliott JA. 1925. A cytological study of *Ceratostomella fimbriata* (E & H) Elliott. *Phytopathology* 16:417–422.
- Eriksson OE, Baral HO, Currah RS, Hanser K, Kurtzman CP, Rambold G, Laessøe T., eds. 2003. *Outline of the Ascomycota 2003*. *Myconet* 9:1–89.
- Fries EM. 1823. *Systema Mycologicum*. Vol 2., Lund, Sweden, 620 p.
- Gams W. 2000. *Phialophora* and some similar morphologically little-differentiated anamorphs of divergent Ascomycetes. *Stud Mycol* 45:187–199.
- , Hoekstra ES, Aptroot A. 1998. *CBS Course of Mycology, Centraalbureau voor Schimmelcultures: Baarn, The Netherlands*. 165 p.
- Gargas A, DePriest PT, Taylor JW. 1995. Positions of multiple insertions in SSU rDNA of lichen-forming fungi. *Mol Biol Evol* 12:208–218.
- Gilman JC, Tiffany LH, Lewis RM. 1959. Iowa ascomycetes III. Diaporthaceae. *Iowa State Coll J Sci* 33:325–393.
- Gutell RR. 1993. Collection of small subunit (16S- and 16S-like) ribosomal RNA structures. *Nucl Acids Res* 21: 3051–3054.
- , Gray MW, Schnare MN. 1993. A compilation of large subunit (23S and 23S-like ribosomal RNA structures. *Nucl Acids Res* 21:3055–3074.
- Hall TA. 1999. BioEdit 5.0.9: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucl Acids Symp Ser* 41:95–98.
- Höhnelt F von. 1905. *Mykologische Fragmente*. *Ann Mycol* 3: 548–560.
- . 1906. Revision von 292 der von J. Feltgen aufgestellten Ascomycetenformen auf Grund der Originalexemplare. *Sitz Kais Akad Wiss Wien, Math-Naturw Kl I* 115:1189–1327.
- . 1918. *Mykologische Fragmente*. CXCIV. Über die Gattung *Parodiopsis* Maublanc. *Ann Mycol* 7:1–84.
- Hoog GS de. 1974. The genera *Blastobotrys*, *Sporothrix*, *Calcarisporium* and *Calcarisporiella* gen. nov. *Stud Mycol* 7:1–84.
- Huelsenbeck JP, Ronquist F. 2001. MrBayes: Bayesian inference of phylogenetic trees. *Bioinformatics* 17: 754–755.
- Huhndorf SM, Miller AN, Fernández FA. 2004. Molecular systematics of the Sordariales: the order and the family Lasiosphaeriaceae redefined. *Mycologia* 96:368–387.
- Hunt J. 1956. Taxonomy of the genus *Ceratocystis*. *Lloydia* 19:1–58.
- Hyde KD, Read SJ, Jones EBG, Moss ST. 1997. Tropical Australian Freshwater Fungi. XII *Rivulicola incrustata* gen. et sp. nov. and notes on *Ceratospheeria lampadophora*. *Nova Hedw* 64:185–196.
- Kickx J. 1847. Recherches pour servir à la flore cryptogamique des Flandres. *Cent.* 3:1–51. In: Kirk PM, Cannon PF, David JC, Stalpers JA, eds. (2001). *Ainsworth and Bisby's dictionary of the fungi*. 9th ed. CABI Publishing: Wallingford, U.K.
- Kirschstein W. 1938. Kryptogamenflora der Mark Brandenburg. *Ascomycetes, Sphaeriales* 7(2):164–304.
- Lanave C, Preparata G, Saccone C, Serio G. 1984. A new method for calculating evolutionary substitution rates. *J Mol Evol* 20:86–93.
- Landschoot PJ, Jackson N. 1989. *Magnaporthe poae* sp. nov., a hyphopodiate fungus with a *Phialophora* conidial state from grass roots in the United States. *Mycol Res* 93: 59–62.
- Moreau C. 1952. Coexistence des formes *Thielaviopsis* et *Graphium* chez une souche de *Ceratocystis major* (van Beyma) comb. nov. *Rev Mycol Suppl Colon* 17:17–25.

- Mostert L, Groenewald JZ, Summerbell RC, Robert V, Sutton DA, Padhye AA, Crous PW. 2004. Species of *Phaeoacremonium* associated with human infections and environmental reservoirs in infected woody plants. *J Clin Microbiol* (In press).
- Müller E, Arx JA von. 1962. Die Gattungen der didymosporenen Pyrenomyceten. *Beitr Kryptogamenfl Schweiz* 11(2):1–922.
- , ———. 1973. Pyrenomycetes: Meliolales, Coronophorales, Sphaeriales. In: Ainsworth GC, Sparrow FK, Sussman AS, eds. *The fungi, an advanced treatise*. Vol. IVA Academic Press: New York, p 87–132.
- , Samuels GJ. 1982. Anamorphs of pyrenomycetous ascomycetes I. *Rhamphoria* Niessl and *Trichosphaerella* Bommer, Rousseau & Saccardo. *Sydowia* 35:143–149.
- Munk A. 1952. The system of Pyrenomycetes. *Dansk Bot Ark* 15(7):1–163.
- . 1957. Danish Pyrenomycetes. *Dansk Bot Ark* 17(1):1–491.
- . 1965. On some species of *Endoxyla* recently found in Denmark. *Bot Tidsskr* 61:56–70.
- Niessl G von. 1876. Notizen über neue und kritische Pyrenomyceten. *Verh Naturf Ver Brünn* 14:165–218.
- Persoon CH. 1800. *Icones et descriptiones fungorum minus cognitorum*. Fasc 2:27–60. Pl. 8–14.
- . 1801. *Synopsis methodica Fungorum*. Gottingae, 706 p.
- Posada D, Crandall KA. 1998. MODELTEST: testing the model of DNA substitution. *Bioinformatics* 14:817–818.
- Rébllová M, Barr ME, Samuels GJ. 1999. Chaetosphaeriaceae, a new family for *Chaetosphaeria* and its allies. *Sydowia* 51:49–70.
- , Seifert KA. 2004. *Cryptadelphia* (Trichosphaeriales), a new genus for holomorphs with *Brachysporium* anamorphs, and clarification of the taxonomic status of *Wallbrothiella*. *Mycologia* 96:343–367.
- , Winka K. 2001. Generic concepts and correlations in ascomycetes based on morphological and molecular data: *Lecythothecium duriligni* gen. et sp. nov. with *Sporidesmium* anamorph and *Ascolacicola aquatica* sp. nov. *Mycologia* 93:478–493.
- Romero A. 1999. Contribution al estudio los hongos xilofidos de la Argentina. VI. Ascomycotina en *Eucalyptus viminalis* (Myrtaceae). *Bot Soc Argent Bot* 34:75–83.
- , Samuels GJ. 1991. Studies on xylophilous fungi from Argentina. VI. Ascomycotina on *Eucalyptus viminalis* (Myrtaceae). *Sydowia* 43:228–248.
- Saccardo PA. 1874. *Fungi Veneti novi vel critici*. *Nuovo Giorn Bot Ital* 7:299–329.
- . 1878. *Fungi Veneti novi vel critici*. Series IX. *Michelia* 1:361–445.
- . 1882. *Sylloge Fungorum omnium hucusque cognitorum*. Vol. 1. Padova, Italy, 768 p.
- . 1883. *Sylloge Fungorum omnium hucusque cognitorum*. Vol. 2. Padova, Italy. 813 p.
- Samuels GJ, Candoussau F. 1993. Heterogeneity in the Calosphaeriales: a new *Calosphaeria* with *Ramichloridium*- and *Sporothrix*-like synanamorphs. *Nova Hedw* 62:47–60.
- , Müller E. 1979. Life-History Studies of Brazilian Ascomycetes 5. Two new species of *Ophiostoma* and their *Sporothrix* anamorphs. *Sydowia* 31:169–179.
- Scott DB, Deacon JW. 1983. *Magnaporthe rhizophila* sp. nov., a dark mycelial fungus with a *Phialophora* conidial state, from cereal roots in South Africa. *Trans Br Mycol Soc* 81:77–81.
- Swofford DL. 2002. PAUP*. Phylogenetic analysis using parsimony (*and other methods). Version 4. Sunderland, Massachusetts: Sinauer Associates.
- Sydow H, Sydow P. 1919. *Mykologische Mitteilungen*. *Sydowia* 1:33–47.
- Taylor JE, Hyde KD. 1999. *Cannonia* gen. nov., from palms in the Southern Hemisphere. *Mycol Res* 103:1398–1402.
- Tode HJ. 1791. *Fungi Mecklenburgenses selecti*. Fasc. 2, 64 p., 17 pl.
- Tsuda M, Ueyama A. 1977. Studies on the descriptions and specimens of genus *Ceratospaeria* Niessl. *Trans Mycol Soc Jap* 18:413–427.
- Untereiner WA. 1993. A taxonomic revision of the genus *Endoxyla*. *Mycologia* 85:294–310.
- von Arx JA. 1952. Über die Ascomycetengattung *Ceratostomella* Sacc., *Ophiostoma* Syd. und *Rostrella* Zimmermann. *Antonie van Leuwenhoek* 18:201–213.
- , Müller E. 1954. Die Gattungen der amerosporenen Pyrenomyceten. *Beitr Kryptogamenfl Schweiz* 11(1): 1–434.
- Zhang N, Blackwell M. 2002. Molecular phylogeny of *Melanospora* and similar pyrenomycetous fungi. *Mycol Res* 106:148–155.