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A monograph of *Fusicladium* s.lat. (Hyphomycetes)

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Abstract: SCHUBERT, K., RITSCHEL, A. & BRAUN, U.: A monograph of *Fusicladium* s.lat. (Hyphomycetes). Schlechtendalia **9**: 1–132.
The genus *Fusicladium* s.lat. is monographed. *Pollaccia* and *Spilocaea* are reduced to synonymy with *Fusicladium*. The latter genus has been proposed to be conserved. The history, phylogeny, taxonomy, circumscription and delimitation of this genus are discussed in detail, a key to *Fusicladium* and morphologically similar genera and a key-like list of *Fusicladium* species by host genera are included. Individual species are then described, illustrated and discussed. Doubtful, ill-defined and excluded taxa are listed and discussed at the end of the paper. The new species *Fusicladium asperatum, F. caulicola*, *F. junci* and *F. nashicola* are described and the new combinations *F. ahmadii, F. byrsonimatis*, *F. catenosporum, F. elegans, F. mandshuricum, F. nebulosum, F. oleagineum, F. phillyreae, F. radiosum* var. *lethiferum*, *F. radiosum* var. *populi-albae* and *Pseudocladosporium caruanianum* are introduced.

Zusammenfassung: SCHUBERT, K., RITSCHEL, A. & BRAUN, U.: Monographie der Gattung *Fusicladium* s.lat. (Hyphomyceten). Schlechtendalia **9**: 1–132.
Die Gattung *Fusicladium* s.lat. wird monographisch bearbeitet. *Pollaccia* und *Spilocaea* werden als Synonyme von *Fusicladium* betrachtet. *Fusicladium* wurde zur Konservierung vorgeschlagen. Geschichte, Phylogenie, Taxonomie, Umschreibung und Abgrenzung der Gattung werden im Detail diskutiert. Ein Schlüssel zu *Fusicladium* und ähnlichen Gattungen und eine schlüsselartige Liste zu den Arten, auf Grundlage der Wirtsgattungen, werden geboten. Die einzelnen Arten werden ausführlich beschrieben, abgebildet und diskutiert. Zweifelhafte, unklare und ausgeschlossene Taxa werden am Ende dieser Arbeit aufgelistet und diskutiert. Die neuen Arten *Fusicladium asperatum, F. caulicola*, *F. junci* und *F. nashicola* werden beschrieben und die neuen Kombinationen *F. ahmadii, F. byrsonimatis*, *F. catenosporum, F. elegans, F. mandshuricum, F. nebulosum, F. oleagineum, F. phillyreae, F. radiosum* var. *lethiferum*, *F. radiosum* var. *populi-albae* und *Pseudocladosporium caruanianum* werden eingeführt.

Contents

1. Introduction 2
2. Materials and methods 2
3. History of *Fusicladium, Pollaccia* and *Spilocaea* 3
3.1. *Spilocaea* 3
3.2. *Fusicladium* 3
3.3. *Pollaccia* 4
4. Molecular examinations and phylogeny 5
5. The taxonomic value of morphological features 6
6. Taxonomy based on morphology and molecular data 8
7. The species concept 9
8. Key to *Fusicladium* emend. and similar genera 10
9. Index/key to *Fusicladium* species by host genera 11
10. The species of *Fusicladium* emend. 15
10.1. Abbreviations 15

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10.2. Descriptions of species ... 17
11. Doubtful and unclear species of *Fusicladium* s.lat. ... 109
12. Excluded species ... 112
13. References ... 118
14. Acknowledgements ... 125
15. Index ... 126
15.1. Index of fungal names ... 126
15.2. Index of host genera ... 131

1. Introduction

The genera *Fusicladium* Bonord., *Pollaccia* E. Bald. & Cif. and *Spilocaea* Fr. (Hyphomycetes) are, as far as known, anamorphs of *Venturia* Sacc. (Ascomycota, Venturiaceae E. Müll. & Arx ex M.E. Barr). These fungi are plant pathogens causing characteristic leaf spots, necroses and scab diseases as well as leaf and fruit deformations. They overwinter as mycelia in fallen fruits, leaves and twigs, where they form pseudothecia with asci and ascospores in the following spring. Mature two-celled ascospores are forcibly ejected after dehiscence of the apical ascus wall and are dispersed by the wind. They germinate on suitable host organs, form germ tubes which enter the host through stomata or directly through the cuticle. Intramatrical mycelia then develop and new infections become established. First symptoms are often visible as small leaf discolorations or spots, which are later covered by dark punctiform to effuse fungal colonies, composed of conidiophores, conidiomata and conidia. Conidia are spread throughout the whole growing season by rain and wind, and are transferred to healthy fruit, leaves and twigs, where they cause new infections.

The anamorphs are the phytopathologically relevant and diagnostically important phases in the life cycles of these fungi. Since monographs of these fungi do not exist, comprehensive examinations of *Fusicladium, Pollaccia* and *Spilocaea* species by means of molecular, morphological and scanning electron microscopic methods have recently been carried out, with the aim to elucidate the phylogenetic and taxonomic significance of these anamorphs for *Venturia*. All taxa assigned to these genera have been considered and reassessed, i.e., either excluded from or recognised in *Fusicladium* s.lat. The latter species are keyed out, redescribed, illustrated and supplemented with host range and distribution data, so that this work can be considered a monograph of this fungal genus.

2. Materials and methods

Collections from numerous herbaria (BRA, DAVFP, G, HAL, HBG, IMI, JE, K, LE, M, NTU-PPE (TAI), NY, PAD, PC, PDD, TLF, WIS, VPRI) and some fresh specimens were examined by standard light microscopy (oil immersion). Drawings and photomicrographs were also made where necessary from prepared material, including type collections. Electronmicrographs were prepared at the "Interdisziplinäres Wissenschaftliches Zentrum für Materialwissenschaften" at the Martin-Luther-University, Halle, using an Environmental Scanning Electron Microscope (ESEM). Molecular investigations were carried out at the "Botanische Staatssammlung" (Munich). Detailed results of these studies will be published separately.

3. History of *Fusicladium, Pollaccia* and *Spilocaea*

3.1. *Spilocaea*

The name *Spilocaea* was introduced by FRIES (1819) in connection with *Spilocaea pomi*, the type species of this genus, but the first detailed description dates back to FRIES (1825). LINK (1825) added *Spilocaea scirpi*, described from stems of *Scirpus* sp. CORDA (1829) redescribed the latter species, but its generic affinity and the status of *Spilocaea* was not discussed. In 1832, FRIES described *Spilocaea epiphylla* from leaves of *Malus* and *Pyrus* species and mentioned *S. scirpi* in a foot-note. *S. epiphylla* and *S. scirpi* have not been recorded or otherwise considered since. SACCARDO (1886) assigned *Spilocaea* (with *S. concentria* Schwein., *S. epiphylla* Fr., *S. pomi* Fr., *S. opuntiae* Rabenh. and *S. scirpi* Link) to a list of doubtful and excluded genera ("Genera dubia vel excludenda"). SACCARDO (1897), ADERHOLD (1896, 1897), LINDAU (1907) and FERRARIS (1912) treated *Spilocaea pomi* as a synonym of *Fusicladium dendriticum* (Wallr.) Fuckel. LIND (1913) proposed the combination *Fusicladium pomi* (Fr.) Lind, although *S. pomi* was the type species of the older genus *Spilocaea*. For a long time, *Spilocaea* had been a forgotten name. Most species morphologically belonging to the *Spilocaea* type were treated under *Fusicladium* or other names like *Cladosporium* Link and *Cycloconium* Castagne (VASSILJEVSKY & KARAKULIN 1937). In 1953, HUGHES re-introduced *Spilocaea* for *Venturia* anamorphs with annellate conidiogenous cells, reduced *Cycloconium* Castagne (CASTAGNE 1845) and *Basiascum* Cavara (CAVARA 1888) to synonymy with this genus, and confined *Fusicladium* to taxa with sympodially proliferating conidiogenous cells. Most subsequent authors followed his new taxonomic concept (e.g., BARR 1968; ELLIS 1976; SIVANESAN 1977, 1984a).

3.2. *Fusicladium*

Fusicladium was introduced by BONORDEN (1851) as a monotypic hyphomycetous genus with *F. virescens* Bonord. on apple leaves as type species. Based on *Malus* as type host, HÖHNEL (1923) considered *F. virescens* to be identical with *F. dendriticum* (= *Spilocaea pomi*), although BONORDEN (1851) described and depicted denticulate (sympodial) conidiogenous cells. SACCARDO (1897) and LINDAU (1907) reduced *F. virescens* to a synonym of *F. pyrorum* (Lib.) Fuckel. HUGHES (1953) later suggested that the type host of the former species could have been misidentified. Type material of Bonorden´s species is not preserved, so it is not possible now to check the identification of the host. Since *Fusicladium pyrorum* and *Spilocaea pomi* are pathogens of *Malus* spp. as well as *Pyrus* spp., it is irrelevant if *F. virescens* had been described from apple or pear leaves. The identity of this species can only be proven on the basis of the morphological features of the conidiophores given in the original description. SACCARDO (1897), LINDAU (1907), FERRARIS (1912) and other previous authors used *Fusicladium* s.lat. for taxa with sympodial (denticulate) as well as percurrent (annellate) conidiogenous cells, including *Pollaccia*-like species, e.g., *F. radiosum* (Lib.) Lind, and *Spilocaea*-like taxa, e.g., *F. dendriticum*. BALDACCI & CIFERRI (1937) excluded *Fusicladium radiosum* and placed it in the new genus *Pollaccia*. VIENNOT-BOURGIN (1949) introduced the new genus

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Megacladosporium for *Fusicladium*-like species with denticulate (sympodial) conidiogenous cells and confined *Fusicladium* s.str. to taxa with annellate conidiogenous cells, being undoubtedly influenced by HÖHNEL´s (1923) treatment of *F. virescens*, the type species of *Fusicladium*, as a synonym of *F. dendriticum*. *Megacladosporium* was introduced without indicating a type species and has to be considered a superfluous name since the type species of *Fusicladium* was included in the protologue of its original description. Based on BONORDEN´s (1851) original description and illustration, HUGHES (1953) confined *Fusicladium* s.str. to species with sympodially proliferating conidiogenous cells and more or less denticle-like conidiogenous loci, and placed all taxa with distinctly annellate conidiogenous cells in *Spilocaea*. Several authors assigned *Fusicladium* species with catenate conidia to *Cladosporium*, e.g., *F. carpophilum* (Thüm.) Oudem., *F. cerasi* (Rabenh.) Erikss. and *F. effusum* G. Winter [as *Cladosporium caryigenum* (Ellis & Langl.) Gottwald] (BENSANDE & KEITT 1928; ELLIS 1976; GOTTWALD 1982). Previous authors, e.g., SACCARDO (1897) and LINDAU (1907), treated these species under *Fusicladium* s.lat. HÖHNEL (1923) and VASSILJEVSKY & KARAKULIN (1937) excluded some species with catenate conidia from *Fusicladium* as well as *Cladosporium* and introduced the new genera *Hormocladium* and *Fusicladiopsis*, respectively. The latter name, which is a younger homomyn of *Fusicladiopsis* R. Maire, 1906, was replaced by *Karakulinia* nom. nov. (GOLOVINA 1964). ONDŘEJ (1971) retained species with catenate conidia in *Fusicladium*, but placed these taxa in the new subgenus *Pseudofusicladium*. BATISTA (1957) described the new genus *Ramalia* with *R. veronicae* Bat. as type species. SUTTON & PASCOE (1988) re-examined type material of this species and reduced *Ramalia* to synonymy with *Fusicladium*. *Ramalia veronicae* is also characterised by having catenate conidia. PARTRIDGE & MORGAN-JONES (2003) described the new genus *Fusicladosporium* [type species: *F. carpophilum* (Thüm.) Partridge & Morgan-Jones, ≡ *Cladosporium carpophilum* Thüm., *Fusicladium carpophilum*] for *Venturia* anamorphs with catenate conidia. They discussed *Karakulinia* N.P. Golovina and *Megacladosporium* Vienn.-Bourg., but failed to take into consideration that the older genera *Hormocladium* and *Ramalia* had also been introduced for *Fusicladium*-like anamorphs with catenate conidia.

3.3. *Pollaccia*

BALDACCI & CIFERRI (1937) described the monotypic genus *Pollaccia* for *P. radiosa* (Lib.) E. Bald. & Cif. (≡ *Oidium radiosum* Lib., *Fusicladium radiosum*) distinguished from *Fusicladium* species by having short, monoblastic, determinate to percurrent, annellate conidiogenous cells. SERVAZZI (1939) distinguished two *Pollaccia* species on *Populus* leaves, viz., *P. radiosa*, which he considered the anamorph of *Venturia tremulae* Aderh., and *P. elegans* Servazzi, the anamorph of *V. populina* (Vuill.) Fabric. HUGHES (1953) recognised *Pollaccia* as a separate genus well-distinguished from *Fusicladium* and *Spilocaea*, and most subsequent authors followed his taxonomy (e.g., BARR 1968; ELLIS 1971, 1976; SIVANESAN 1977, 1984a; BRANDENBURGER 1985). MORELET (1972, 1985) and MORELET & SIGAUD (1996) published important contributions to biology and taxonomy of *Pollaccia* species.

4. Molecular examinations and phylogeny

SCHNABEL et al. (1999) were the first to publish molecular analyses (rDNA, ITS) of *Venturia* species. Their analyses, which were restricted to species that occur on rosaceous hosts, were later supplemented by KASANEN et al. (2001) who examined *Venturia ditricha* (Fr.) P. Karst., *V. populina* and *V. tremulae*. Sequence data deposited at the NCBI (National Center for Biotechnology Information) have been used for a new, more comprehensive molecular analysis of *Venturia* species and their anamorphs together with additional sequences of *Fusicladium, Pollaccia* and *Spilocaea* species obtained during the course of molecular examinations carried out in Munich. The research group there used *Cladosporium* [*C. cladosporioides* (Fresen.) G.A. de Vries], often confused with *Fusicladium*, as the outgroup, and included data of "human pathogenic *Cladosporium* species" (= *Cladophialophora* Borelli) and *Botryosphaeria dothidea* (Moug.) Ces. & de Not. The data coming out of these studies are still limited, so only preliminary conclusions are possible. The detailed results of these examinations will be published in a separate paper. A cladogram based on all the data mentioned above provides the first comprehensive molecular results for *Venturia* and its anamorphs and a first insight into phylogenetic connections. In any case, *Venturia* species and its anamorphs (Venturiaceae) have been proven to form a monophyletic clade. This was confirmed by BRAUN et al. (2003) who put rDNA ITS data of cladosporioid *Venturia* anamorphs in a more comprehensive context of *Cladosporium*-like fungi, i.e., dematiaceous hyphomycetes with amero- to phragmosporous conidia formed in acropetal chains.

The cladogram published by SCHNABEL et al. (1999) is less useful for phylogenetic analyses and taxonomic interpretations since "*Cladosporium caryigenum*" was taken to serve as the outgroup. The latter species is, however, a true anamorph of the Venturiaceae and this has been confirmed by molecular analysis and a study of the morphology of the fungus.

The *Venturia* clade is composed of several small subclades, which, at least partly, seem to indicate tendencies of co-evolutions between hosts and *Venturia* species. *V. asperata* Samuels & Sivan., *V. carpophila* E.E. Fisher and *V. cerasi* Aderh. form a subclade of closely allied species on various hosts of the Rosaceae that are characterised by having anamorphs with catenate conidia. The Rosaceae also appear to have been colonised by *Venturia* on several different occasions. *Venturia inaequalis* (Cooke) G. Winter s.lat. as well as *Venturia pyrina* Aderh. and *V. nashicola* S. Tanaka & S. Yamam. form separate subclades. Another group is formed by species with *Pollaccia* anamorphs on hosts of the Salicaceae. Various morphological features of *Venturia* anamorphs, e.g., conidia formed singly or in chains and proliferation of conidiogenous cells percurrently or sympodially, have probably been acquired several times in the past in separate lineages in co-evolution with several groups of hosts. However, a clear separation of the *Venturia* clade into uniform subclades based on morphological features of the anamorphs is not evident. Species with sympodial conidiogenous cells occur in several subclades, and taxa with percurrent proliferations form two different groups separated by a subcluster with *Fusicladium* anamorphs (sympodial conidiogenous cells). Species with catenate conidia are also not confined to a single subcluster.

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These results also show that *Fusicladium convolvularum* Ondřej and *F. effusum*, two species with unknown teleomorphs, are true members of the Venturiaceae. The treatment of *Venturia pyrina* and *V. nashicola* as two distinct species is also supported by the present molecular data.

5. The taxonomic value of morphological features

Fusicladium, Pollaccia and *Spilocaea* are characterised by having immersed, subcuticular to intraepidermal mycelia, often forming radiating strands or loose to dense stromatic aggregations, which give rise to conidiogenous cells or conidiophores penetrating the cuticle. A superficial (secondary) mycelium is rarely formed, but is present, for example, in *Fusicladium veronicae* (Bat.) B. Sutton & Pascoe, *F. scillae* (Deighton) U. Braun & K. Schub. and *Spilocaea oleaginea* (Castagne) S. Hughes. In *Spilocaea pomi*, a superficial mycelium is usually absent, but in a single collection some external hyphae have been observed. The conidiophores are usually erumpent through the cuticle, but in *Fusicladium levieri* Magnus, *F. junci* Sawada ex K. Schub. & U. Braun and *F. convolvularum* they are, at least partly, fasciculate and emerge through stomata. In *Pollaccia* species, superficial hyphae are unknown.

The arrangement of the conidiophores within the three anamorphic genera of the Venturiaceae is fairly variable, ranging from conidiophores formed singly or in loose to dense fascicles, to distinct sporodochia. In *Spilocaea nebulosa* (Ellis & Everh.) S. Hughes & Piroz., all conidiophores are formed singly and are erumpent through the cuticle, in *S. oleaginea* they are solitary to fasciculate, and *S. pomi* is characterised by having loosely to densely fasciculate conidiophores. In *Fusicladium* species, the conidiophores are usually formed singly (e.g., *F. caricinum* Bres., *F. veronicae*) or in fascicles (e.g., *F. pyrorum*), but some taxa with sporodochial conidiomata are also known (e.g., *F. fraxini* Aderh., *F. romellianum* Ondřej). In *F. martianoffianum* (Thüm.) K. Schub. & U. Braun, all kinds of conidiophore arrangements, ranging from solitary conidiophores to sporodochia, can be observed. *Pollaccia* species are usually characterised by having conidiophores in fascicles or sporodochia. Hence, the arrangement of conidiophores and the location of the mycelium are not suitable for the differentiation of *Fusicladium, Pollaccia* and *Spilocaea*. These genera have been traditionally distinguished by the mode of proliferation of the conidiogenous cells, viz., *Fusicladium* with sympodial proliferation, *Pollaccia* with monoblastic, determinate to percurrent conidiogenous cells (with few rather inconspicuous annellations) and *Spilocaea* with percurrent proliferation and numerous conspicuous annellations. However, there are numerous transitional cases, e.g., in *Fusicladium obducens* Pat. and *F. veronicae*, two species with sympodial proliferations which are occasionally mixed with some annellations caused by percurrent proliferations. The conidiogenous cells of *Fusicladium caulicola* U. Braun & K. Schub. and *F. romellianum* are usually monoblastic, determinate. In *F. fraxini*, the conidiogenous cells range from being unilocal, percurrent to multilocal, sympodial and sometimes even mixed in the same collection. *Pollaccia* and *Spilocaea* species possess unilocal, determinate to percurrent (annellate) conidiogenous cells, except for *Spilocaea oleaginea* and *S. nebulosa* in which conidiogenous cells with several loci had been observed (HUGHES 1953). The differences between *Pollaccia* and *Spilocaea* are weak and only gradual, so that a separation of these genera cannot be maintained. Both genera have monoblastic (unilocal) conidiogenous cells, frequently determinate or only with few annellations in *Pollaccia* and usually with numerous annellations in *Spilocaea*. The discrimination of *Fusicladium* on the one hand and *Pollaccia/Spilocaea* on the other hand, based on the presence of percurrent and sympodial conidiogenous cells, is also not tenable. This can be demonstrated by the existence of numerous taxa with mixed types of conidiogenous cells. This phenomenon has also been observed in various other hyphomycetous genera, e.g., in cercosporoid *Mycosphaerella* anamorphs. CROUS et al. (2000, 2001) showed that combinations of sympodially and percurrently proliferating conidiogenous cells are not uncommon in *Pseudocercospora*, and that the separation of the latter genus and *Cercostigmina* U. Braun is not tenable. This view is also supported by data from molecular studies of these genera. Percurrent and sympodial conidiogenous cells are also known to occur together in *Septoria* Sacc. species (VERKELEY 1997).

Different structures of the conidiogenous loci, reflecting differences in the mode of conidiogenesis, proved to be meaningful for genera of cercosporoid anamorphs (CROUS et al. 2000, 2001; CROUS & BRAUN 2003). The conidiogenous loci and conidial hila of *Fusicladium, Pollaccia* and *Spilocaea* species have been examined by means of light and scanning electron microscopy (RITSCHEL 2001; SCHUBERT 2001). The basic structure of the loci and hila is, however, rather uniform by being more or less truncate, unthickened or almost so and non-pigmented to slightly darkened–refractive. These scars agree well with those of *Pseudocercospora* species. There are not any fundamental differences in the structures of the conidiogenous loci and conidial hila of *Fusicladium, Pollaccia* and *Spilocaea* species. The conidiogenous loci of *Fusicladium* species are often more or less denticle-like, and there are gradual differences in the width of loci and hila, which are mostly somewhat narrower in *Fusicladium* and wider in *Pollaccia* and *Spilocaea*, although there are numerous exceptions and transitions, e.g., in *Fusicladium caricinum* with relatively broad loci.

The conidiogenesis in all *Venturia* anamorphs is consistently holoblastic, and the structures of the conidiogenous loci and conidial hila are uniform, and, consequently, these features cannot be used to separate these genera.

The conidia of *Fusicladium, Pollaccia* and *Spilocaea* species are also fairly uniform by being amero-, didymo- to phragmosporous and pigmented. They are usually ellipsoid–ovoid to fusiform and more or less smooth, although there are some taxa with verruculose conidia [e.g., *Fusicladium psoraleae* (Ellis & Barthol.) S. Hughes & Piroz. and *F. pisicola* Linford].

It has been suggested that the formation of the conidia in chains or singly is a feature that could be used to separate *Fusicladium* into smaller units (HÖHNEL 1923, GOLOVINA 1964, ONDŘEJ 1971, see chapter 3.2.). Taxa with catenate conidia occur in *Fusicladium* as well as *Pollaccia*, viz., *P. catenospora* Butin, and there are even some species in which the conidia are formed singly as well as in chains, e.g., *F. cerasi*. Conidial formed in chains or singly is a good, useful feature for differentiating between species, but is is not one that can be used at the generic level. This is also true with other groups of hyphomycetes, e.g., *Ramularia* Unger (BRAUN 1998) and cercosporoid genera (CROUS et al. 2000, 2001). A separation of species with catenate conidia from *Fusicladium* is not tenable and this is also supported by molecular data.

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6. Taxonomy based on morphology and molecular data

The results of the examinations recently carried out by RITSCHEL (2001) and SCHUBERT (2001) have shown that, within the *Venturia* anamorphs (*Fusicladium, Pollaccia* and *Spilocaea*), features such as the type and growth of the mycelium, arrangement of the conidiophores (solitary, fasciculate and sporodochial), proliferation of conidiogenous cells (percurrent and sympodial), structure of the conidiogenous loci and shape and size and formation of conidia (solitary, catenate) cannot be used to define the various genera. These features are only useful for distinguishing between species. RITSCHEL (2001) and SCHUBERT (2001) using molecular analyses has also demonstrated that *Venturia* species form a monophyletic clade. These two sets of results mean that the separation of *Venturia* anamorphs into several genera cannot be maintained and that *Fusicladium, Pollaccia* and *Spilocaea* must be merged into a single anamorph genus. The conidiogenesis and structure of the conidiogenous loci and conidial hila are uniform in these genera and resemble those found in *Pseudocercospora* and allied genera (*Mycosphaerella* anamorphs). The situation in the Venturiaceae reminds one of the Erysiphales (powdery mildew fungi), which is characterised by the anamorph genus *Oidium* Link. There is, however, a nomenclatural problem since the less known, smaller genus *Spilocaea* (five recognised species) is older than the much larger genus *Fusicladium* with 40 recognised species. *Fusicladium* is well-known to mycologists and phytopathologists and readily associated with *Venturia*. Merging the three anamorph genera of *Venturia* under the oldest name *Spilocaea* would result in more than 40 new combinations. Therefore, it has been proposed to maintain the well-known genus *Fusicladium* (BRAUN et al. 2002). In doing so, the old wide concept of *Fusicladium*, including all kinds of *Venturia* anamorphs (see chapter 2.2.), is reintroduced. The new circumscription of *Fusicladium* can be given as follows:

Fusicladium Bonord., Handb. Mykol.: 80 (1851), emend.
(nom. cons. prop., anamorphs of *Acantharia* Theiss. & Syd., *Apiosporina* Höhn., *Protoventuria* Berl. & Sacc., *Venturia* Sacc., Venturiaceae).
Type species: *F. virescens* Bonord. (= *F. pyrorum*).
= *Spilocaea* Fr., Novit. fl. svec. 5: 79 (1819), nom. rej. prop., type species: *S. pomi* Fr.
= *Cycloconium* Castagne, Cat. pl. Marseille: 220 (1845), nom. rej. prop., type species: *C. oleagineum* Castagne.
= *Napicladium* Thüm., Hedwigia 14: 3 (1875), type species: *N. sorauerí* Thüm.
= *Basiascum* Cavara, Atti Ist. Bot. Univ. Pavia, Ser. 2, 1: 433 (1888), type species: *B. eriobotryae* Cavara.
= *Hormocladium* Höhn., Ber. Deutsch. Bot. Ges. 37: 156 (1919), type species: *Fusicladium kaki* Hori & Yoshino.
= *Fusicladiopsis* Karak. & Vassiljevsky, in Vassiljevsky & Karakulin, Parazitnye nesovershennye griby, Ch. 1. Gifomitsety: 209 (1937), nom. illeg. (homonym), type species: not indicated.
= *Pollaccia* E. Bald. & Cif., Atti Ist. Bot. "Giovanni Briosi" 10: 71 (1937), type species: *P. radiosa* (Lib.) E. Bald. & Cif.
= *Megacladosporium* Vienn.-Bourg., Les champignons parasites des plantes cultivées 1: 489 (1949), nom. superfl.

= *Ramalia* Bat., Revista Biol. (Lisbon) 1: 111 (1957), type species: *R. veronicae* Bat.
= *Karakulinia* N.P. Golovina, Novosti Sist. Nizsh. Rast. 1: 213 (1964), type species: *K. cerasi* (Rabenh.) N.P. Golovina.
= *Fusicladosporium* Partridge & Morgan-Jones, Mycotaxon 85: 360 (2003), type species: *F. carpophilum* (Thüm.) Partridge & Morgan-Jones.

On leaves, fruits and twigs, causing leaf spots, scab diseases, necroses and deformations. Colonies punctiform, scattered, caespitose or dendritic, olivaceous, olivaceous-brown, dingy grey to blackish. Mycelium internal, subcuticular, intraepidermal to intercellular, sometimes substomatal, often forming expanded radiating hyphal or stromatic strands or plates, rarely external, superficial. Stromata lacking to well-developed, pseudostromatic, composed of rounded to isodiametric swollen hyphal cells, pigmented, wall often somewhat thickened. Conidiophores solitary, arising from internal or rarely external hyphae or stromatic hyphal aggregations, or fasciculate, arising from internal hyphae or stromata, erumpent, occasionally emerging through stomata, sometimes forming well-developed sporodochial conidiomata, conidiophores often reduced to conidiogenous cells or composed of several cells, erect, cylindrical, pyriform, subclavate, narrowly obclavate, slightly to distinctly geniculate–sinuous, unbranched or occasionally branched, continuous to pluriseptate throughout, pigmented, pale olivaceous to dark brown, tips often paler, smooth to verruculose, wall thin to somewhat thickened. Conidiogenous cells integrated, terminal or intercalary or conidiophores reduced to single conidiogenous cells, unilocal (monoblastic), determinate to multilocal (polyblastic), proliferation percurrent or sympodial, occasionally occurring together; conidiogenous loci terminal or lateral, often denticle-like, somewhat protuberant, apex truncate to slightly convex, wall unthickened or almost so, non-pigmented or slightly darkened–refractive. Conidia solitary or catenate, in simple or branched acropetal chains, amero-, didymo- to phragmosporous, ellipsoid–ovoid, obovoid, fusiform, obclavate–subcylindrical, straight to curved, 0–3(–4)-euseptate, subhyaline to medium brown, but mostly olivaceous, usually non-constricted at the septa, smooth to verruculose, ends pointed or rounded to truncate, wall thin to somewhat thickened, hila unthickened or almost so, occasionally somewhat darkened–refractive.

7. The species concept

Venturia species and their anamorphs are, as far as known, host specific, mostly confined to a single host genus or at least allied host genera in a single host family. Plurivorous taxa are unknown and this has been confirmed by preliminary molecular examinations. Hence, the morphological differentiation between and keys to the species concerned can be based on host plant families. The following features are useful and applicable at species rank:

- Symptoms, lesions.
- Mycelium (internal, external).
- Arrangement of conidiophores (solitary, fasciculate, in sporodochia).
- Shape, length and septation of conidiophores.
- Conidiogenous cells (terminal, intercalary, conidiophores reduced to conidiogenous cells; determinate or proliferation percurrent, sympodial; number of loci, width).

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- Conidia (formation, solitary or catenate; shape, size, septation, wall smooth or verruculose).

The following characteristics are either more or less uniform within *Venturia* anamorphs or very variable and thus less appropriate for the discrimination of species:

- Structure of the mycelium.
- Width of the conidiophores.
- Structure of the conidiogenous loci (uniform).
- Degree of pigmentation of conidiophores and conidia.

8. Key to *Fusicladium* emend. and similar genera

1 Conidiophores and conidia colourless; conidiogenous loci conspicuous, somewhat thickened and darkened; conidia solitary or catenate, hila also slightly thickened and darkened ……..…. *Ramularia*

1* Conidiophores and conidia pigmented …….....…….. 2

2 Conidiogenous loci inconspicuous or denticle-like, but wall of the loci always unthickened …….…….…….. 3

2* Conidiogenous loci conspicuous, thickened and darkened ……..…..……. 6

3 Mycelium and stromata usually subcuticular to intraepidermal, hyphae often radiating, forming hyphal or stromatic strands or plates, membranous (*Fusicladium*-like growth), rarely substomatal; conidiophores solitary, fasciculate or in sporodochial conidiomata, usually erumpent through the cuticle, rarely emerging through stomata or arising from superficial hyphae; conidia amero-, didymo- to phragmosporous …….....……... 4

3* Mycelium not *Fusicladium*-like, immersed or superficial, neither radiating nor forming hyphal plates; stromata usually substomatal; conidiophores usually emerging through stomata ……...…….....……...…….. 5

4 Mycelium and stromata membranous; older conidiophores usually curved by having unequally thickened walls; conidiogenous cells unilocal (monoblastic), usually determinate, rarely percurrent, conidiogenous loci distinctly thickened and darkened; conidia solitary, 1-septate, broad (6–14 µm) ……..…..…. *Fusicladiella*

4* Mycelium and stromata usually radiating; conidiogenous cells uni- to multilocal (mono- to polyblastic), but wall of the conidiophores equally thickened, not distinctly curved, percurrent or sympodial; loci always unthickened, at most somewhat darkened–refractive; conidia solitary or catenate, amero- to phragmosporous, 0–2(–4)-septate, < 10 µm …… *Fusicladium* emend.

5 Conidia scolecosporous, usually pluriseptate ……..……... *Pseudocercospora*

5* Conidia amero- to phragmosporous, 0–1(–3)-septate …….. *Denticularia*

6 Conidiogenous loci more or less protuberant, coronate (with a central convex ‘dome’ surrounded by a raised rim, i.e., *Cladosporium* type) ……. *Cladosporium*

6* Conidiogenous loci uniformly thickened and darkened, more or less truncate (planate), without raised rim ……..……. 7

7 Conidia formed singly, coarsely verrucose–echinulate …… *Asperisporium*

7* Conidia formed singly or in chains, smooth to faintly rough-walled …… *Passalora*

9. Index/key to *Fusicladium* species by host genera

This list contains all species of *Fusicladium* emend., including *Pollaccia* and *Spilocaea* species. The host genera are alphabetically arranged under the names of their host families.

Aceraceae:
On *Acer*, ***Fusicladium humile***

Apiaceae:
On *Angelica*, ***Fusicladium peucedani***
On *Cicuta*, ***Fusicladium peucedani***
On *Glehnia*, ***Fusicladium peucedani***
On *Lomatium*, ***Fusicladium peucedani***
On *Peucedanum*, ***Fusicladium peucedani***
On *Sphaenosciadium*, ***Fusicladium peucedani***

Asteraceae:
On *Solidago*, ***Fusicladium virgaureae***

Betulaceae:
On *Betula*

1 Conidiophores yellowish brown to dark brown; loci unthickened, not darkened; conidia consistently solitary; on different species of *Betula* ..… ***Fusicladium betulae***

1* Conidiophores olivaceous to pale brown; loci unthickened, but darkened; conidia solitary or sometimes in short chains; on *B. populifolia* .... ***Fusicladium scribnerianum***

Convolvulaceae:
On *Calystegia*, ***Fusicladium convolvularum***
On *Convolvulus*, ***Fusicladium convolvularum***

Corylaceae:
On *Carpinus*, ***Fusicladium carpineum***

Crassulaceae:
On *Sedum*, ***Fusicladium caulicola***

Cyperaceae:
On *Carex*, ***Fusicladium caricinum***

Dipsacaceae:
On *Succisa*, ***Fusicladium consors***

Ebenaceae:
On *Diospyros*, ***Fusicladium levieri***

Euphorbiaceae:
On *Euphorbia*

1 Conidiophores in small, loose fascicles, arising from hyphae, 37–175 × 4–5 µm; conidia 8.5–16 × (3–)4–6.5 µm, mostly aseptate, rarely with a single septum ……..…….....……...….. ***Fusicladium fasciculatum***

1* Conidiophores in dense fascicles, arising from stromata, shorter, 10–90 × 4–6 µm; conidia longer, 10–22(–40) × 3–6 µm, 0–3 septa 2

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2 Conidia solitary or in short, unbranched chains, rarely in branched chains, 0–2(–3)-septate; conidiophores thin-walled; on different *Euphorbia*-species, not on *Euphorbia brittingeri* ..... ***Fusicladium euphorbiae***
2* Conidia solitary, 0–1-septate, lower cell mostly larger than the upper cell, rarely with 3 septa; stromatic cells and conidiophores darker (olivaceous-brown) and wall thicker; on *Euphorbia brittingeri* ..... ***Fusicladium fautreyi***

On *Hevea*, ***Fusicladium heveae***

Fabaceae:
On *Astragalus*, ***Fusicladium brevipes***
On *Lathyrus*, ***Fusicladium lathyrinum***
On *Pisum*, ***Fusicladium pisicola***
On *Psoralea*, ***Fusicladium psoraleae***

Fagaceae:
On *Quercus*, ***Fusicladium***-state of ***Acantharia echinata***

Juglandaceae:
On *Carya*, ***Fusicladium effusum***

Juncaceae:
On *Juncus*, ***Fusicladium junci***

Liliaceae:
On *Scilla*, ***Fusicladium scillae***

Malpighiaceae:
On *Byrsonima*, ***Fusicladium byrsonimatis***

Oleaceae:
On *Fraxinus*
1 Conidiophores solitary, effuse, subglobose to ampulliform, campanulate, 5–12 × 5–7 µm, yellowish brown; proliferation percurrent; conidia verruculose or minutely echinulate ..... ***Fusicladium nebulosum***
1* Conidiophores in loose to dense fascicles, sometimes sporodochial, subcylindrical to conical, 12–35 × 3–5 µm, pale olivaceous; proliferation sympodial and percurrent; conidia smooth ..... ***Fusicladium fraxini***

On *Olea*, ***Fusicladium oleagineum***
On *Phillyrea*, ***Fusicladium phillyreae***
On *Syringa*, ***Fusicladium diedickeanum***

Rosaceae:
On *Amelanchier*
1 Conidiophores 30–225 × 4 µm; proliferation sympodial; anamorph immediately formed on the teleomorph; North America ..... ***Fusicladium***-state of ***Apiosporina collinsii***
1* Conidiophores 10–23 × 5–6 µm; proliferation percurrent; anamorph separately formed from the teleomorph; Europe, New Zealand ..... ***Fusicladium pomi***

On *Aronia*,
1 Proliferation sympodial; loci 1–3 µm wide ..... ***Fusicladium pyrorum***
1* Proliferation percurrent; loci 4–5 µm wide ..... ***Fusicladium pomi***

On *Chaenomeles*, ***Fusicladium pyrorum***
On *Cotoneaster*, ***Fusicladium pomi***
On *Crataegus*, ***Fusicladium crataegi***
On *Docynia*, ***Fusicladium pomi***

On *Eriobotrya*,
1 Proliferation sympodial; loci 1–3 µm wide ..... ***Fusicladium pyrorum***
1* Proliferation percurrent; loci 4–5 µm wide ..... ***Fusicladium pomi***

On *Heteromeles*, ***Fusicladium pomi***
On *Kageneckia*, ***Fusicladium pomi***

On *Malus*,
1 Conidiogenous cells sympodial 2
1* Conidiogenous cells percurrent; conidia solitary, not catenate, 12–30 × 6–10 µm; cosmopolitan ..... ***Fusicladium pomi***

2 Conidia solitary, 10–34 × 5–11 µm; cosmopolitan ..... ***Fusicladium pyrorum***
2* Conidia solitary or in short, sometimes branched chains, 9.5–17 × 3–5 µm; New Zealand, North America..... ***Fusicladium asperatum***

On *Photinia*, ***Fusicladium pomi***

On *Prunus*,
1 Conidiogenous cells percurrent ..... ***Fusicladium pomi***
1* Conidiogenous cells sympodial 2

2 On twigs of the host plant, anamorph formed on the teleomorph; conidia ovoid, obovoid, ellipsoid or irregular, 4–19 × (2–)3–6 µm, often laterally fused in pairs; North America ..... ***Fusicladium***-state of ***Apiosporina morbosa***
2* On leaves and fruits, anamorph formed separately from the teleomorph; conidia mostly fusiform, cylindrical or obclavate, larger, 9–30 × 4–7(–10) µm, not fused in pairs 3

3 Colonies consistently formed on leaves, dendritic; conidiophores 40–120 × 6–8 µm; conidia solitary, hila 2–4.5 µm wide; South America; on *Prunus capollin* and *P. serotina* ..... ***Fusicladium obducens***
3* Colonies formed on fruits and leaves, velvety, caespitose; conidiophores narrower, 3–6(–7) µm wide; conidia solitary or in chains, hila 1–2(–2.5) µm wide 4
4 Conidia solitary, rarely in chains; conidiophores (10–)20–40(–60) × (3–)4–6(–7) µm, on a few hosts only, mostly on *Prunus cerasus* ..... ***Fusicladium cerasi***
4* Conidia consistently catenate; conidiophores 25–100 × 3–6 µm; with a wide host range, but very rarely on *Prunus cerasus* ..... ***Fusicladium carpophilum***

On *Pyracantha*, ***Fusicladium pomi***

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On *Pyrus*,
1 Conidiogenous cells percurrent 2
1* Conidiogenous cells sympodial 3

2 Conidia obclavate, 25–45 × 6–8 µm, 1(–2)-septate; on *P. pashia*; Pakistan ..... ***Fusicladium ahmadii***
2* Conidia obpyriform to clavate, shorter and wider, 12–30 × 6–10 µm, 0–1-septate; cosmopolitan ..... ***Fusicladium pomi***

3 Conidia 9–20(–28) × 5.5–10 µm; on Chinese and Japanese species of *Pyrus* ..... ***Fusicladium nashicola***
3* Conidia significantly longer, 10–34 × 5–11 µm; only on European species of *Pyrus* ..... ***Fusicladium pyrorum***

On *Rubus*, ***Fusicladium grayianum***
On *Sorbus*, ***Fusicladium pomi***
On *Spiraea*, ***Fusicladium spiraeae***

Salicaceae:
On *Populus*,
1 Conidiogenous cells polyblastic, with a single to several conidiogenous loci, subdenticulate, 5–35 × 3–10 µm ..... ***Fusicladium martianoffianum***
1* Conidiogenous cells mostly monoblastic (unilocal), not or only slightly denticulate, shorter and narrower, 5–25 × 2–5 µm 2

2 Conidiophores monoblastic, rarely with two or several conidiogenous loci, loci 1–3 µm wide; conidia solitary or in unbranched or branched chains 3
2* Conidiophores always monoblastic, loci ca. 5 µm wide; conidia always solitary 4

3 Conidiomata mostly sporodochial; conidiogenous cells sympodial, not percurrent, loci 1–2 µm wide; conidia aseptate, very rarely with a single septum ..... ***Fusicladium romellianum***
3* Conidiophores in small to large fascicles, rarely sporodochial; conidiogenous cells sympodial as well as often percurrent with a single to several annellations, loci 1.5–3 µm wide; conidia (0–)1(–3)-septate ..... ***Fusicladium subsessile***

4 Conidia relatively large, 23–39 µm long 5
4* Conidia smaller, up to 28 µm long (*Fusicladium radiosum* s.lat.) 6

5 Conidia often curved, fusiform to obclavate, 7–10 µm wide, (0–)2–3(–4)-septate; on *P. simonii* × *P. nigra*; China ..... ***Fusicladium mandshuricum***
5* Conidia straight, rarely curved, ellipsoid to broadly fusiform, 9–14 µm, (0–)2(–3)-septate; on *P. balsamifera* and *P. nigra*; Europe, North America ... ***Fusicladium elegans***
6 Conidia (0–)1(–2)-septate, 8–10 µm wide; on *P. alba*; Europe, North Africa ..... ***Fusicladium radiosum*** var. ***populi-albae***
6* Conidia mostly 1–2-septate, narrower, 5–8 µm wide 7

7 Conidia straight, rarely curved, on various species of *Populus,* but not on *P. grandidentata* and *P. tremuloides* ..... ***Fusicladium radiosum*** var. ***radiosum***

7* Conidia often curved; occurring on various species of *Populus*, incl. *P. alba*, *P. grandidentata* and *P. tremuloides*; North America ..... ***Fusicladium radiosum*** var. ***lethiferum***

On *Salix*,
1 Conidiogenous cells polyblastic, sympodial 2
1* Conidiogenous cells monoblastic or percurrent 3

2 Conidiophores 40–95(–130) × 3–5 µm, arising from stromata; conidia (10–)12–20 × 3–4(–5) µm ..... ***Fusicladium* sp. (1)**
2* Conidiophores arising as short lateral branchlets from hyphae; conidia 20–25 × 5–8 µm ..... ***Fusicladium* sp. (2)**

3 Conidia in unbranched, rarely branched chains, mostly 0(–2)-septate ..... ***Fusicladium catenosporum***
3* Conidia solitary, 1–2-septate ..... ***Fusicladium saliciperdum***

Scrophulariaceae:
On *Parahebe*, ***Fusicladium veronicae***

Verbenaceae:
On *Vitex*, ***Fusicladium viticis***

10. The species of *Fusicladium* emend.

The species of *Fusicladium* emend. (incl. *Pollaccia* and *Spilocaea*) are alphabetically arranged. References to the original descriptions, type material, synonyms, teleomorphs (as far as known), references to important descriptions and illustrations in literature, exsiccatae, comprehensive descriptions, host range and distribution, material examined and notes are given for each species. The drawings, mostly based on type or other original material, have been prepared at a ration of 1 : 100 (bar = 10 µm). The exsiccatae cited have generally been examined. If only few collections have been examined (up to five), all of them are listed, whereas numerous specimens (more than five) are not cited in order to save space. In the latter case, the acronyms of the herbaria, in which the numerous collections examined are housed, are mentioned. Herbarium acronyms are based on HOLMGREN et al. (1990), abbreviations of author names follow BRUMMITT & POWELL (1992), and those of journals agree with the system introduced by LAWRENCE et al. (1968), supplemented by BRIDSON & SMITH (1991). The names of European countries are symbolised by the international standard abbreviations for the particular countries that are used for vehicles. Abbreviations of the particular states of the USA follow FARR et al. (1989), and those of Canadian provinces and territories are based on GINNS (1986). Names of all other countries are given in full.

10.1. Abbreviations

General: auct. = auctorum, ca. = circa, comb. nov. = new combination, comb. superfl. = superfluous combination, fig. = figure, herb. = herbarium, incl. = inclusive, l.c. = locus citatus, nom. cons. = nomen conservandum, nom. illeg. = nomen illegitimum, nom. inval. = nomen invalidum, nom. nov.

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= nomen novum, nom. nud. = nomen nudum, p.p. = pro parte, s.lat. = sensu lato, s.str. = sensu stricto, spp. = species. CMI Descr. = CMI Descriptions of Pathogenic Fungi and Bacteria, IMI Descr. = IMI Descriptions of Fungi and Bacteria.

European countries: A = Austria, AL = Albania, B = Belgium, BG = Bulgaria, CH = Switzerland, CS = former Czechoslovakia (incl. Czech Republic and Slovakia), CZ = Czech Republic, D = Germany, DK = Denmark (incl. Bornholm), E = Spain, EW = Estonia, F = France (incl. Corsica and, on geographical grounds, the Channel Islands and Monaco,), FR = Faeroe Islands, GB = United Kingdom (with all islands, but excluding Northern Ireland and the Channel Islands), GR = Greece, H = Hungary, HR = Croatia, I = Italy (with Sardinia and Sicily), IRL = Ireland (the whole island, north and south), LT = Lithuania, LV = Latvia, N = Norway, NL = the Netherlands, P = Portugal (incl. Azores), PL = Poland, RO = Romania, RUS = Russia, S = Sweden, SF = Finland, SK = Slovakia, SLO = Slovenia, TR = Turkey (European part), Ukr. = Ukraine, YU = former Yugoslavia (incl. Slovenia, Croatia, Serbia, etc.). Byelorussia and Moldavia are not abbreviated. Older records have often been published from Yugoslavia and Czechoslovakia. Sometimes it is difficult or even impossible to refer such records to the particular succeeding countries, so the old names have to be maintained. They are to be understood as summarising abbreviations.

USA: AL = Alabama, AK = Alaska, CA = California, CO = Colorado, CT = Connecticut, DE = Delaware, FL = Florida, GA = Georgia, IA = Iowa, ID = Idaho, IL = Illinois, KS = Kansas, KY = Kentucky, LA = Louisiana, ME = Maine, MD = Maryland, MA = Massachusetts, MI = Michigan, MN = Minnesota, MS = Mississippi, MO = Missouri, MT = Montana, NE = Nebraska, NH = New Hampshire, NJ = New Jersey, NM = New Mexico, NY = New York, NC = North Carolina, ND = North Dakota, NV = Nevada, OH = Ohio, OK = Oklahoma, OR = Oregon, PA = Pennsylvania, SC = South Carolina, SD = South Dakota, TN = Tennessee, TX = Texas, UT = Utah, VA = Virginia, VT = Vermont, WA = Washington, WI = Wisconsin, WY = Wyoming.

Canada: NWT = Northwest Territories, BC. = British Columbia, Alta. = Alberta, Sask. = Saskatchewan, Man. = Manitoba, Ont. = Ontario, Que. = Quebec, NB. = New Brunswick, NS. = Nova Scotia, PEI = Prince Edward Island, Nfld. = Newfoundland, Yukon = Yukon Territory. (Labr. = Labrador).

Exsiccata:
Allesch. & Schn., F. bavar. = Allescher & Schnabl, Fungi bavarici.
Barthol., F. Columb. = Bartholomew, Fungi Columbiani.
Brenckle, F. Dakot. = Brenkle, Fungi Dakotenses.
Briosi & Cav., F. paras. = Briosi & Cavara, I funghi parassiti delle piante coltivate od utili, essicati, delineati e descritti.
Calif. F. = California Fungi (distributed by the herbarium of the University of California).
Cooke, F. brit. exs. = Cooke, Fungi britannici exsiccati.
Crypt. exs. = Cryptogamae exsiccatae editae a Museo Hist. Nat. Vindobonensi.
Ellis or Ellis & Everh., N. Am. F. = Ellis or Ellis & Everh., North American Fungi, Ser. I or Ser. II.
Ellis & Everh., F. Columb. = Ellis & Everh., Fungi Columbiani.
Erb. Critt. Ital. = Erbario Crittogamico Italiano.
Erikss., F. paras. scand. = Eriksson, Fungi parasitici scandinavici exsiccati.
Fl. bav. = Starcs, Flora bavarica.
Fl. Suec. = Flora Suecica.
Fuckel, F. rhen. = Fuckel, Fungi rhenani.
F. est. = Fungi estonici.
F. latv. exs. = Smarods, Fungi latvici exsiccati.
Fl. Gall. Germ. exs. = Flora Gallici Germaniae exsiccatae.
Fl. Hung. exs. = Flora Hungarica exsiccata.
Fl. Olten. exs. = Flora Oltenia exsiccata.
Griffiths, West Am. F. = Griffiths, West American Fungi.
Herb. Mycol. Rom. = Herbarium Mycologicum Romanicum.
Jaap, F. sel. exs. = Jaap, Fungi selecti exsiccati.
Kab. & Bub., F. imp. exs. = Kabát & Bubák, Fungi imperfecti exsiccati.
Kellerm., Ohio Fungi = Kellerman, Ohio Fungi.
Kellerm. & Sw., Kans. F. = Kellerman & Swingle, Kansas Fungi.

Krieger, F. sax. = Krieger, Fungi saxonici.
Krypt. exs. = Kryptogamae exsiccatae.
Lib., Pl. crypt. ard. = Libert, Plantae cryptogamicae guas in Arduenna collegit.
Lin., F. hung. = Linhart, Fungi hungarici.
Migula, Crypt. Germ. Austr. Helv. exs. = Migula, Cryptogamae Germaniae, Austriae et Helveticae exsiccatae.
Mycoth. Fenn. = Liro, Mycotheca Fennica.
Mycoth. Ross. = Tranšel' et al., Mycotheca Rossica.
Neger, Forstschäd. P. = Neger, Forstschädliche Pilze.
Oudem., F. neerl. exs. = Oudemans, Fungi neerlandici exsiccati.
Petr., F. alban. bosn. exs. = Petrak, Fungi albanici et bosniae exsiccati.
Petr., F. polon. = Petrak, Fungi polonici.
Petr., Fl. Bohem. Morav. exs. = Petrak, Flora Bohemica et Moravica exsiccata.
Petr., Mycoth. gen. = Petrak, Mycotheca generalis.
Pilzfl. Sib. = Pilzflora Sibiriens.
Rabenh., F. eur. = Rabenhorst, Fungi europaei exsiccati (also Rabenhorst & Winter, F. eur. or Rabenhorst, Winter & Pazschke, Fungi eur. et extraeur.).
Rabenh., Herb. mycol. = Rabenhorst, Herbarium mycologicum.
Rehm, Ascomyc. = Rehm, Ascomyceten.
Reliqu. Petrak. = Reliquiae Petrakianae.
Romell, F. exs. = Romell, Fungi exsiccati.
Roum., F. gall. exs. = Roumeguère, Fungi gallici exsiccati.
Roum., F. sel. exs. = Roumeguère, Fungi selecti gallici exsiccati.
Sacc., Mycoth. ital. = Saccardo, Mycotheca italica.
Sacc., Mycoth. Ven. = Saccardo, Mycotheca Veneta.
Schmarotzerp. Ruhrg. = Schmarotzerpilze des Ruhrgebiets.
Seym. & Earle, Econ. F. = Seymour & Earle, Economic Fungi.
Siem., F. bialow. exs. = Siemaszko, Fungi bialowiezenses exsiccati.
Solh., Mycofl. Sax. exs. = Solheim, Mycoflora Saximontanensis exsiccatae.
Syd., F. exot. exs. = H. Sydow, Fungi exotici exsiccati.
Syd., Mycoth. germ. = H. & P. Sydow, Mycotheca germanica.
Syd., Mycoth. march. = P. Sydow, Mycotheca marchica.
Thüm., F. austr. = de Thümen, Fungi austriaci.
Thüm., Herb. myc. oec. = de Thümen, Herbarium mycologicum oeconomicum.
Thüm., Mycoth. univ. = de Thümen, Mycotheca universalis.
Vestergr., Micromyc. rar. sel. exs. = Vestergren, Micromycetes rariores selecti exsiccati.
Westend. & Wall., Herb. crypt. belg. = Westendorp & Wallays, Herbier cryptogamique belge.

10.2. Descriptions of species

10.2.1. *Fusicladium ahmadii* (M.B. Ellis) Ritschel & U. Braun **comb. nov.** Fig. 1

≡ *Spilocaea ahmadii* M.B. Ellis, More Dematiaceous Hyphomycetes: 114 (1976).
Holotype: on *Pyrus pashia*, Pakistan, Swat, Mingora, 10 Aug. 1952, S. Ahmad (IMI 81091).
Teleomorph: Unknown.
Ill.: ELLIS (1976: 113, Fig. 81).

On living leaves, leaf spots amphigenous, subcircular to irregular, 5–10 mm diam., whitish, surrounded by a brown, shinning margin. Colonies amphigenous, punctiform, aggregated in the centre, olivaceous to dark brown. Mycelium immersed. Stromata subcuticular, composed of subcircular to slightly angular, pale to medium olivaceous-brown, somewhat thick-walled cells, 5–8 µm diam. Conidiophores loosely to densely fasciculate, arising from the upper cells of the stromata, erumpent through

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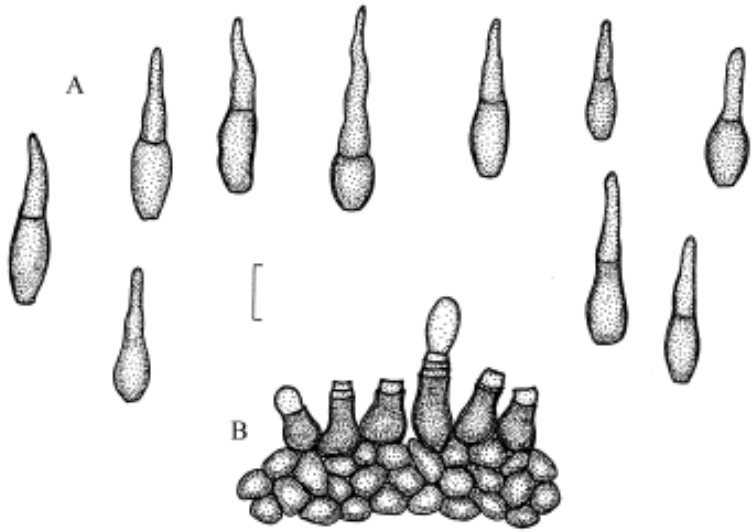

Fig. 1: *Fusicladium ahmadii*. A – conidia, B – loose fascicle of conidiogenous cells with one to several conspicuous annellations, scale = 10 µm, A. Ritschel del.

the cuticle, erect, straight to slightly flexuous, cylindrical to ampulliform, unbranched, 15–60 × 5–6 µm, 0–1-septate, pale to medium olivaceous-brown, smooth, thick-walled. Conidiogenous cells integrated, terminal, with a single conidiogenous locus, proliferation percurrent, with up to eight conspicuous annellations at the distal end, loci 4–5 µm wide, unthickened, not darkened. Conidia solitary, obclavate, straight to slightly curved, (23–)25–38 × 6–8 µm, 1(–2)-septate, septum median or somewhat in the lower half, more or less constricted at the septum, pale to medium olivaceous-brown, smooth, walls of the lower cells somewhat thicker than those of the upper one, apex narrowly pointed, base truncate, hila 4–5 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Pyrus* spp. (Rosaceae), Asia – *Pyrus pashia* (Pakistan).

Notes: This species seems to be closely allied to *F. pomi*, but differs in having significantly longer and narrower conidia. Conidiogenous cells illustrated by ELLIS (1976) seem to show up to two loci, which could not be confirmed by a re-examination of type material.

10.2.2. *Fusicladium asperatum* K. Schub. & U. Braun **sp. nov.** Fig. 2

Holotype: on *Malus sylvestris* 'Dougherty', New Zealand, Distr. Auckland Prov., Waitemata Co., Oratia, Experimental Station, Sept. 1973, P.J. Brook (PDD 31846), anamorph only.
Teleomorph: *Venturia asperata* Samuels & Sivan., New Zealand J. Bot. 13: 646 (1975).
Lit.: Fungi Canadenses (No. 291), SIVANESAN (1977: 38–39; 1984a: 608).
Ill.: Fungi Canadenses (No. 291, Fig. 5), SAMUELS & SIVANESAN (1975: Figs 11, 12; Pl. 8, E), SIVANESAN (1977: 39, Fig. 12 C, D; 1984a: 608, Fig. 365).

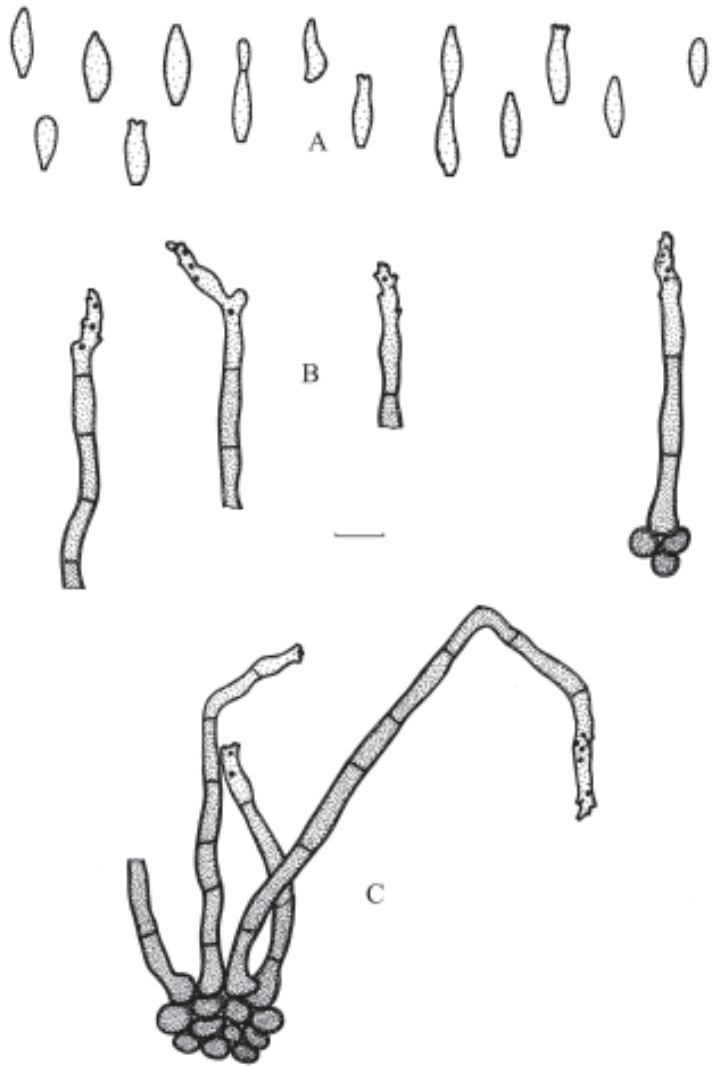

Fig. 2: *Fusicladium asperatum*. A – conidia, B – conidiogenous cells. C – small fascicle of conidiophores, scale = 10 µm, K. Schubert del.

Maculae saepe epiphyllae, griseo-brunneae, margine irregulari. Coloniae caespitosae, atro-brunneae vel nigrae. Hyphae subcuticulares. Stromata 35–60 µm diam., ex cellulis olivaceis vel brunneis, crassitunicatis, pseudoparenchymaticis composita. Conidiophora solitaria vel subfasciculata, pauca,

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erecta vel flexuosa, non-ramosa, 30–150 × 4–5 µm, pluriseptata, olivacea vel brunnea, apicem versus pallidiora, levia, leniter crassitunicata, basi leniter inflata. Cellulae conidiogenae integratae, terminales, sympodiales. Cicatrices conidiales terminales, aggregatae, denticulatae, 1–2 µm latae, non-incrassatae, non-fuscatae–refractivae. Conidia solitaria vel catenata, fusiformes vel cylindrica, recta, 9.5–17 × 3–5 µm, 0(–1)-septata, flavissima vel pallide olivacea, levia vel verruculosa, leniter crassitunicata, apice rotundato vel truncato, basi truncata, 1–2 µm lata, non-incrassata, non- vel leviter fuscata–refractiva.

On living leaves causing distinct leaf spots, sometimes almost symptomless, spots epiphyllous, greyish brown, margin irregular. Colonies caespitose, dark brown to black. Hyphae subcuticular. Stromata 35–60 µm diam., composed of olivaceous to brown, thick-walled, pseudoparenchymatous cells. Conidiophores solitary or in small groups, straight, erect to flexuous, unbranched, 30–150 × 4–5 µm, pluriseptate, olivaceous to brown, paler towards the apex, smooth, with somewhat thickened walls, sometimes base somewhat swollen. Conidiogenous cells integrated, terminal, with several denticle-like conidiogenous loci, mostly crowded at the apex, proliferation sympodial, loci 1–2 µm wide, unthickened, slightly darkened–refractive. Conidia solitary or catenate, in short, simple or sometimes branched chains, fusiform to cylindrical, straight, 9.5–17 × 3–5 µm, 0(–1)-septate, yellowish to pale olivaceous, sometimes subhyaline, smooth to verruculose, walls somewhat thickened, apex rounded or truncate, base truncate, hila 1–2 µm wide, unthickened, not or very slightly darkened–refractive.

Hosts and Distribution: on *Malus* spp. (Rosaceae), New Zealand, North America – *Malus pumila* (New Zealand), *M. sylvestris* (New Zealand; North America, Canada, Ont.).

Notes: In culture this fungus grows *Cladosporium*-like. The conidiophores are often determinate and form conidia in short, branched chains (Fungi Canadenses No. 291). The type material of *F. asperatum* is also paratype material of *Venturia asperata*. Since the anamorph may occur independently of the teleomorph, we prefer to propose a separate name for this stage.

10.2.3. ***Fusicladium betulae*** Aderh., Centralbl. Bakteriol., 2. Abth., 2: 57 (1896) and Hedwigia 36: 80 (1897) Fig. 3

Neotype: on *Betula pendula* (= *Betula alba*), Germany, Berlin, Grunewaldmoor, 13 Jul. 1923, Laubert (B), selected here.
Teleomorph: *Venturia ditricha* (Fr.) P. Karst., Mycol. fenn. 2: 188 (1873).
Lit.: Lindau (1907: 778), Vassiljevsky & Karakulin (1937: 13), Barr (1968: 813–814), Sivanesan (1977: 61–63; 1984a: 613–614), Sagdullaeva (1990: 54).
Ill.: Karsten (1873: 188, Figs 29, 30; Pl. 1, A), Aderhold (1897: Tab. 4, Fig. 1), Sivanesan (1977: 62, Fig. 30; 1984a: 614, Fig. 370 B).
Exs.: Krieger, F. sax. 232 b; Rehm, Ascomyc. 597; Siem., F. bialow. exs. 197; Syd., Mycoth. march. 982; Thüm., Mycoth. univ. 350.

On living leaves, occasionally also on petioles, spots amphigenous, subcircular to somewhat irregular, punctiform, 1–4 mm wide, scattered, brown, later darker to black, sometimes with a paler margin or a paler centre. Colonies amphigenous, punctiform, scattered, black. Mycelium subcuticular, radiating, hyphae 3–4 µm wide, septate, hyaline to pale yellowish, stroma composed of thick-walled, brown cells, forming up to three layers. Conidiophores solitary or in loose fascicles, arising from stromata,

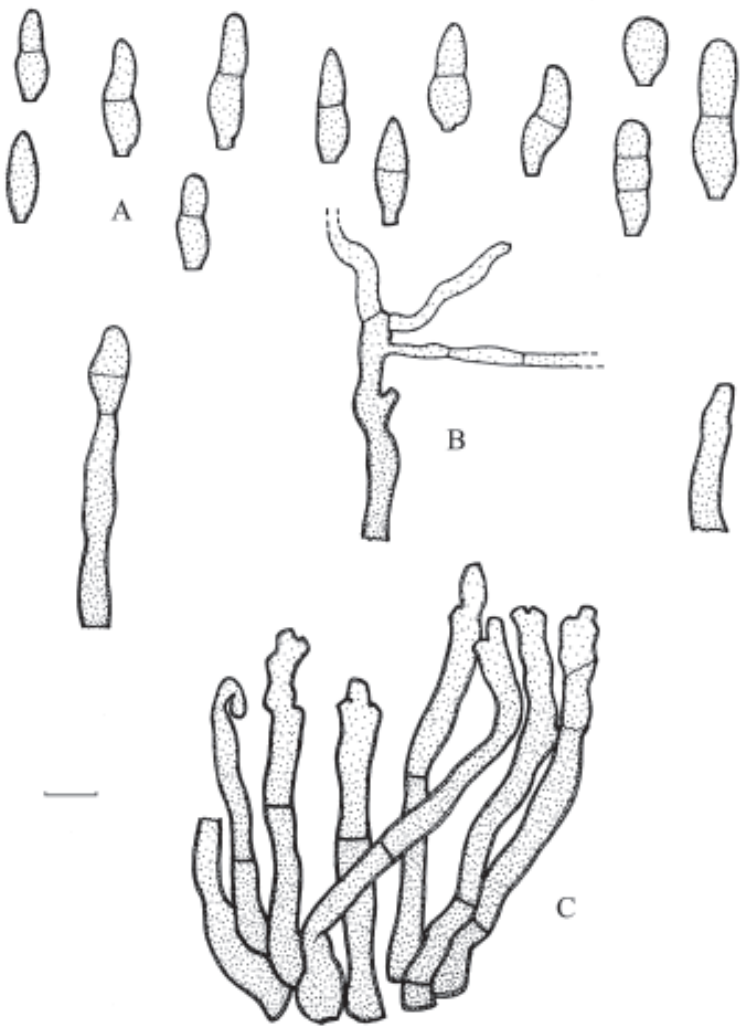

Fig. 3: *Fusicladium betulae*. A – conidia, B – conidiophore germinating with hyphae, C – fasciculate conidiophores, scale = 10 µm, K. Schubert del.

erumpent through the cuticle, erect, straight to flexuous, unbranched, 25–100 × (3–) 4–6 µm, 0(–1)-septate, yellowish brown to dark brown, paler towards the apex, apex sometimes subhyaline, smooth, later occasionally rough-walled, wall somewhat thickened, base mostly swollen, up to 10 µm. Conidiogenous cells integrated, terminal, with a single or several conidiogenous loci, subdenticulate, proliferation sympodial,

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loci unthickened, not darkened–refractive, 2–3 µm wide. Conidia solitary, fusiform to obclavate or clavate, straight to slightly curved, 12–30(–34) × 5–9 µm, yellowish to pale olivaceous, (0–)1(–2)-septate, often constricted at the septa, septum mostly somewhat in the upper half, smooth to verruculose, apex obtuse, rounded to pointed, base often elongated, hila truncate or slightly convex, unthickened, not darkened, 2–3 µm wide.

Hosts and Distribution: on *Betula* spp. (Betulaceae), Asia, Caucasus, Europe, North America – *Betula glandulosa* (North America, Canada, Que.), *B. litwinowii* (Caucasus, Georgia), *B. nana* (Europe, DK, N, RO), *B. papyrifera* (North America, Canada, Ont.), *B. pendula* (Asia, Kazakhstan, Uzbekistan; Europe, A, D, DK, GB, PL, RO, RUS, Ukr.), *B. populifolia* (North America, USA, ME, NY), *B. pubescens* (Europe, D, DK, S), *Betula* spp. (Asia, Kirghizia, Uzbekistan; Caucasus, Armenia; Europe, D, EW, GB, H, RUS, Byelorussia; North America, Canada, Ont., Que.).

Material examined: collections from B, LE.

Notes: Parts of Aderhold's herbarium, previously housed at the "Biologische Bundesanstalt Berlin" (BBA), were transferred to the herbarium of the "Botanical Garden Berlin-Dahlem" (B), but the type material of *Fusicladium betulae* unfortunately was not preserved. Consequently, it is necessary to propose a neotype for this species.
SIVANESAN (1977) reduced *Asteroma betulae* Roberge ex Desm., Ann. Sci. Nat. Bot. 19: 349 (1843), to synonymy with *Fusicladium betulae*. The examination of lectotype material (Desm., Pl. Crypt. N. France, 1346; PC) showed that only immature ascomata of the teleomorph, *Venturia ditricha*, with setae, stromata and some remnant of conidiophores were present, but conidia could not be traced. Hence, *Asteroma betulae* should rather be considered a synonym of *Venturia ditricha*.
In one collection, conidiophores germinating with hyphae have been seen.
LIND (1937) described *Venturia ditricha* from *Alnus incana* and cited STRASSER (1907: 314), who also recorded it from *Berberis vulgaris*. These records are very doubtful.

10.2.4. *Fusicladium brevipes* Ellis & Everh., J. Mycol. 5: 69 (1889) Fig. 4

Holotype: on *Astragalus hypoglottis*, USA, Colorado, Musie Pass, Sangre de Christo Range, 16 Jul. 1888, C.H. Demetrio (NY).
Teleomorph: Unknown.
Lit.: SACCARDO (1892: 598).

On living leaves, lesions inconspicuous or causing diffuse discolorations. Colonies hypophyllous, variable in shape and size, effuse, dense, sometimes confluent, dark greyish brown to blackish. Mycelium internal, forming well-developed, loose to dense stromatic hyphal aggregations in thin layers, subcuticular to intraepidermal, cells oblong to subglobose, 2–15 µm diam., at first subhyaline, pale yellowish-greenish, later brown. Conidiophores arising from stroma cells, solitary, in loose to dense fascicles or in effuse layers, erumpent, erect, straight, subcylindrical, conical to flexuous, somewhat geniculate–sinuous, unbranched, 5–25(–30) × 3–9 µm, 0–1-septate, pale to medium brown, smooth, thin-walled, conidiophores usually reduced to conidiogenous cells, unilocal, determinate, occasionally with 2–3 loci, proliferation sympodial, loci subtruncate to convex, 2–4 µm wide, unthickened, not darkened. Conidia solitary, ellipsoid to ovoid, oblong, 15–35 × 7–13 µm, aseptate (according to the original description later with 1–2 septa), pale olivaceous to olivaceous-brown, almost smooth to finely asperulate, apex broadly rounded, base subtruncate to rounded, hila unthickened, not darkened.

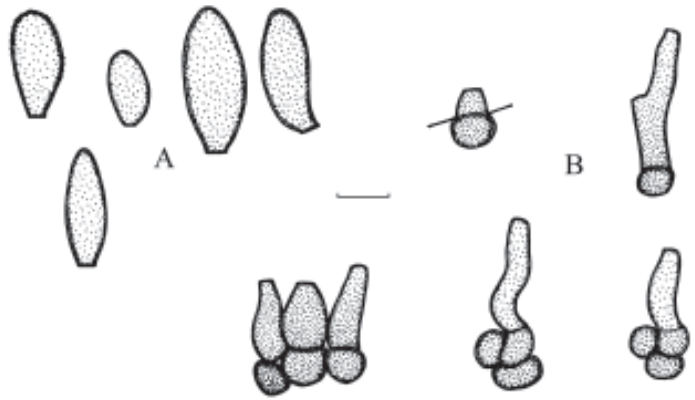

Fig. 4: *Fusicladium brevipes*. A – conidia, B – conidiogenous cells, scale = 10 µm, K. Schubert del.

Hosts and Distribution: on *Astragalus* spp. (Fabaceae), North America, in the western parts of the USA – *Astragalus bisulcatus* (USA, MT), *A. canadensis* (USA, WA), *A. hypoglottis* (USA, CO).

10.2.5. *Fusicladium byrsonimatis* (U. Braun & Mouch.) U. Braun **comb. nov.** Fig. 5

≡ *Ramalia byrsonimatis* U. Braun & Mouch., Mycol. Res. 104(8): 1010 (2000); holotype: on *Byrsonima* sp., Brazil, Minas Gerais, Belo Horizonte, 8 Sept. 1913, A. Maublanc, Fungi Brasilienses 180 p.p. (PC, ex herb. 'Station Centrale de Pathologie Végétale, Versailles', mixed infection with *Pseudocercospora byrsonimatis*).
Teleomorph: Unknown.
Ill.: BRAUN & MOUCHACCA (2000: 1010, Figs 4–5).

Leaf spots amphigenous, subcircular to slightly angular–irregular, small, 0.5–2 mm wide, grey, greyish brown, margin narrow, blackish brown, somewhat raised. Colonies mainly hypophyllous, punctiform, dense, medium to dark brown. Mycelium internal, subcuticular to intraepidermal. Stromata well-developed, composed of swollen hyphal cells, 2–8 µm wide, yellowish to medium brown. Conidiophores solitary or in small loose groups, arising from stromata, erect to decumbent, straight, subcylindrical to somewhat geniculate–sinuous, subnodulose, apically subdenticulate to conspicuously denticulate, unbranched, 20–100 × 3–7 µm, pluriseptate, pale to medium brown, smooth, wall somewhat thickened, paler and thin-walled towards the apex. Conidiogenous cells integrated, terminal, proliferation sympodial, 10–30 µm long, subdenticulate to denticulate, denticles minute, conically truncate, wall of the loci neither thickened nor darkened. Conidia solitary or catenate, occasionally in branched chains, solitary conidia obovoid, catenate conidia ellipsoid–fusiform, straight, 8–18 × 4–7 µm, 0–1-septate, light brown, smooth, wall thin or somewhat thickened,

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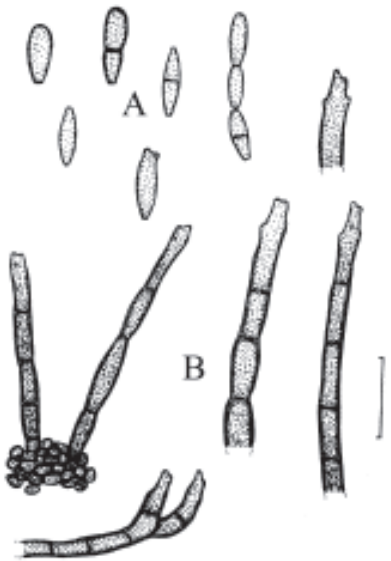

Fig. 5: *Fusicladium byrsonimatis*. A – conidia, B – conidiophores, scale = 20 µm, U. Braun del.

apex broadly rounded or obconically truncate, base obconically truncate, 1–2.5 µm wide, hila unthickened, not darkened.

Hosts and Distribution: only known from the type.

10.2.6. ***Fusicladium caricinum*** Bres., in P. Syd., Mycoth. march., Cent. XLI, No. 4065 (1894) Fig. 6

Lectotype: on *Carex acutiformis*, Germany, Berlin, near Zehlendorf, Sept. 1893, P. Sydow, Mycoth. march. 4065 (HBG), selected here; isolectotypes: on "*Carex ampullacea*", Germany, Berlin, between Zehlendorf and Klein-Machnow, 1893, P. Sydow (B) and Syd., Mycoth. march. 4065.
Teleomorph: Unknown.
Lit.: SACCARDO (1895: 618), LINDAU (1907: 775), IMI Descr. (No. 1511).
Ill.: IMI Descr. (No. 1511, Figs A–B).
Exs.: Fl. bav. 2831; Rabenh., F. eur. 4294; Syd., Mycoth. march. 4065.

Leaf spots amphigenous, elliptical–oblong to irregular, 2–5 × 1–5 mm, pale yellowish-olivaceous, brownish, surrounded by a narrow, medium to dark brown or blackish margin. Colonies amphigenous, effuse, punctiform, dark, fructification mostly sparse. Conidiophores solitary or up to three in small fascicles, erumpent, erect, straight to slightly curved, subglobose, broadly ampulliform to short cylindrical, unbranched, 8–23 × (6–)10–19 µm, aseptate, medium to dark brown, smooth, walls thin to somewhat thickened, broadly truncate at the apex, conidiophores reduced to conidiogenous cells, unilocal, determinate, conidiogenous loci truncate to slightly convex, occasionally rounded, 3–5 µm wide, unthickened, not or only very slightly darkened–refractive. Conidia solitary, fusiform to broadly obclavate, straight to flexuous, (20–)30–50(–57) × 10–15(–17) µm, (0–)1(–2)-septate, sometimes slightly constricted at the septa, septa more or less median or often in the lower half, pale olivaceous to pale brown, smooth, wall thin to somewhat thickened, pointed at the apex, base mostly slightly oblique, hila 3–6(–7) µm wide, unthickened, not darkened.

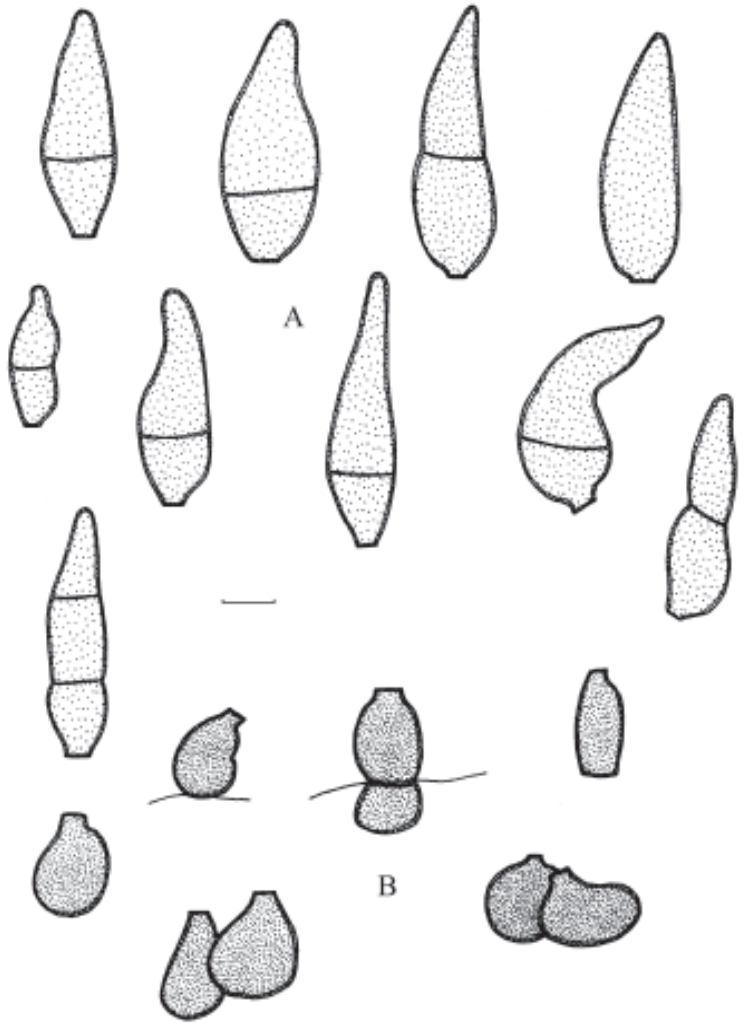

Fig. 6: *Fusicladium caricinum*. A – conidia, B – conidiogenous cells, scale = 10 µm, K. Schubert del.

Hosts and Distribution: on *Carex* spp. (Cyperaceae), Europe – *Carex acutiformis* (D, LV), *C. riparia* (D), *C. vesicaria* (LV), *Carex* spp. (H).

Material examined: collections from B, HBG, JE, LE, M.

Notes: In the original diagnosis, the conidiophores were described as hyaline but the examination of type material showed that they are medium to dark brown.

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10.2.7. ***Fusicladium carpineum*** (Ellis & Everh.) U. Braun & K. Schub., IMI Descriptions of Fungi and Bacteria 152, No. 1512 (2002) Fig. 7

≡ *Fusicladium effusum* [G. Winter] var. *carpineum* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1891: 91 (1891); lectotype: on *Carpinus americana*, Canada, London, Oct. 1889, J. Dearness (NY), selected here; isolectotypes: DAOM, M.

≡ *Cladosporium caryigenum* [(Ellis & Langl.) Gottwald] var. *carpineum* (Ellis & Everh.) Gottwald, Mycologia 74(3): 389 (1982), comb. inval.

Teleomorph: Unknown.
Lit.: SACCARDO (1892: 598).
Ill.: IMI Descr. (No. 1512, Figs A–B).
Exs.: Ellis & Everh., N. Am. F. 2793.

Leaf spots mainly epiphyllous, subcircular to angular–irregular, 1–5 mm wide, dingy yellowish to greyish brown, scattered. Colonies punctiform to subeffuse, dark brown. Mycelium internal, mainly subcuticular, hyphae about 2 µm wide, septate, hyaline to pale yellowish. Stromata variable, small to large, up to 150 µm diam., composed of swollen hyphal cells, 5–12 µm diam., brown, thick-walled. Conidiophores in loose fascicles, arising from stromata, erect, straight to curved or somewhat geniculate–sinuous, unbranched, 90–300(–340) × 5–7(–8) µm, pluriseptate, brown, paler towards the apex, smooth, thick-walled, occasionally with a percurrent proliferation which is not connected with conidiogenesis. Conidiogenous cells integrated, terminal, 10–40 µm long, with a single or several inconspicuous to subdenticulate conidiogenous loci, 1.5–3 µm wide, wall of the loci unthickened, not darkened. Conidia catenate, in simple or branched chains, pyriform, ellipsoid, fusiform, straight to slightly curved, 10–21× (5–)6–8(–10) µm, aseptate, pale olivaceous to pale brown, smooth, thin-walled, attenuated towards apex and base, apex rounded, pointed or truncate, base truncate, hila 1.5–3 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Carpinus* spp. (Corylaceae), North America – *Carpinus americana* (Canada), *C. caroliniana* (USA, GA, WI).

Material examined: collections from B, M, NY.

Notes: This fungus is morphologically closely allied to *Fusicladium effusum* G. Winter on *Carya* species (Juglandaceae), but differs in its occurrence on unrelated hosts (on *Carpinus* species, Corylaceae), distinct lesions, much longer and wider conidiophores with pale tips and less conspicuous conidiogenous loci. Based on these differences, and since *Venturia* species with phytopathogenic anamorphs are generally confined to related hosts of a single host plant family, *F. effusum* var. *carpineum* is considered a separate species.
Fusicladium carpini Osipyan (OSIPYAN 1971), described from Armenia on *Carpinus caucasica*, is a quite distinct species with very short conidiophores (10–17 × 3.5–7.5 µm) and narrower, 0–1-septate conidia (18.1–26.4 × 4.9–6 µm).

10.2.8. ***Fusicladium carpophilum*** (Thüm.) Oudem., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk. 1900: 388 (1900) Fig. 8

≡ *Cladosporium carpophilum* Thüm., Oesterr. Bot. Z. 27: 12 (1877); syntype: on *Prunus persica* (= *Persica vulgaris*), Austria, Wien, 1877, Thüm., Herb. myc. oec. 599 (LE).

≡ *Megacladosporium carpophilum* (Thüm.) Vienn.-Bourg., Les champignons parasites des plantes cultivées 1: 489 (1949).

≡ *Fusicladosporium carpophilum* (Thüm.) Partridge & Morgan-Jones, Mycotaxon 85: 362 (2003).

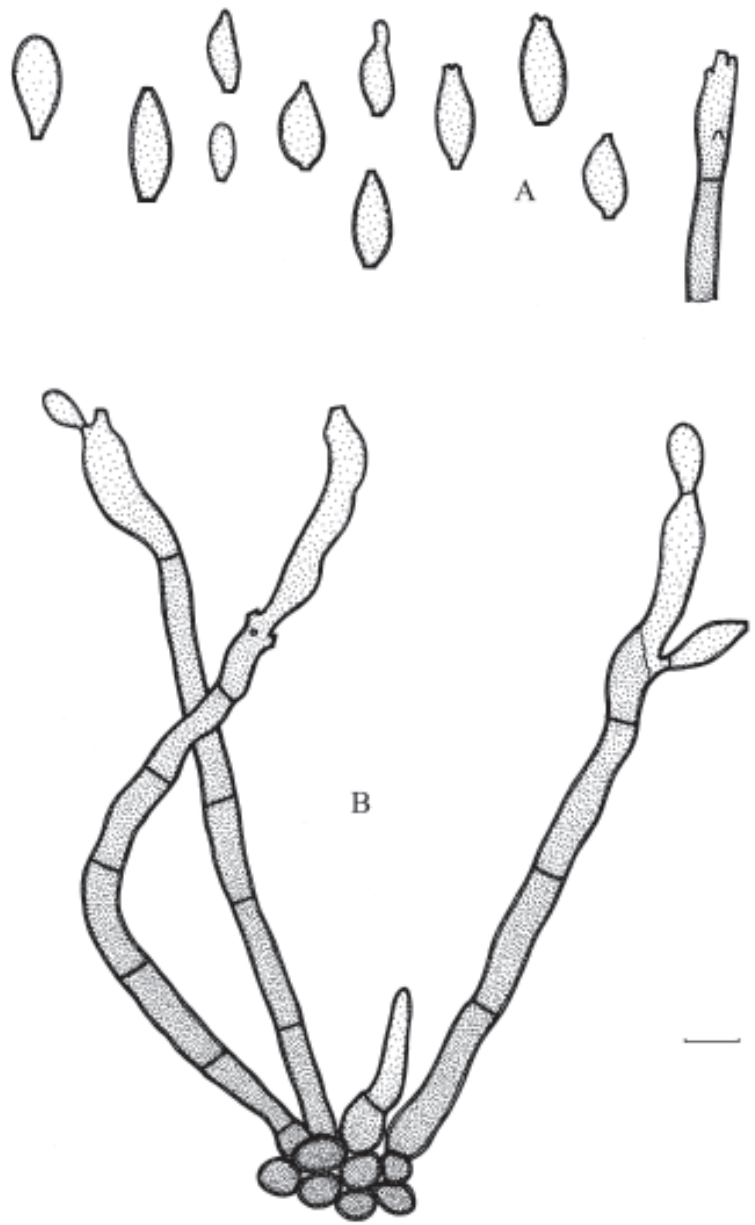

Fig. 7: *Fusicladium carpineum*. A – conidia, B – small fascicle of conidiophores, scale = 10 µm, K. Schubert del.

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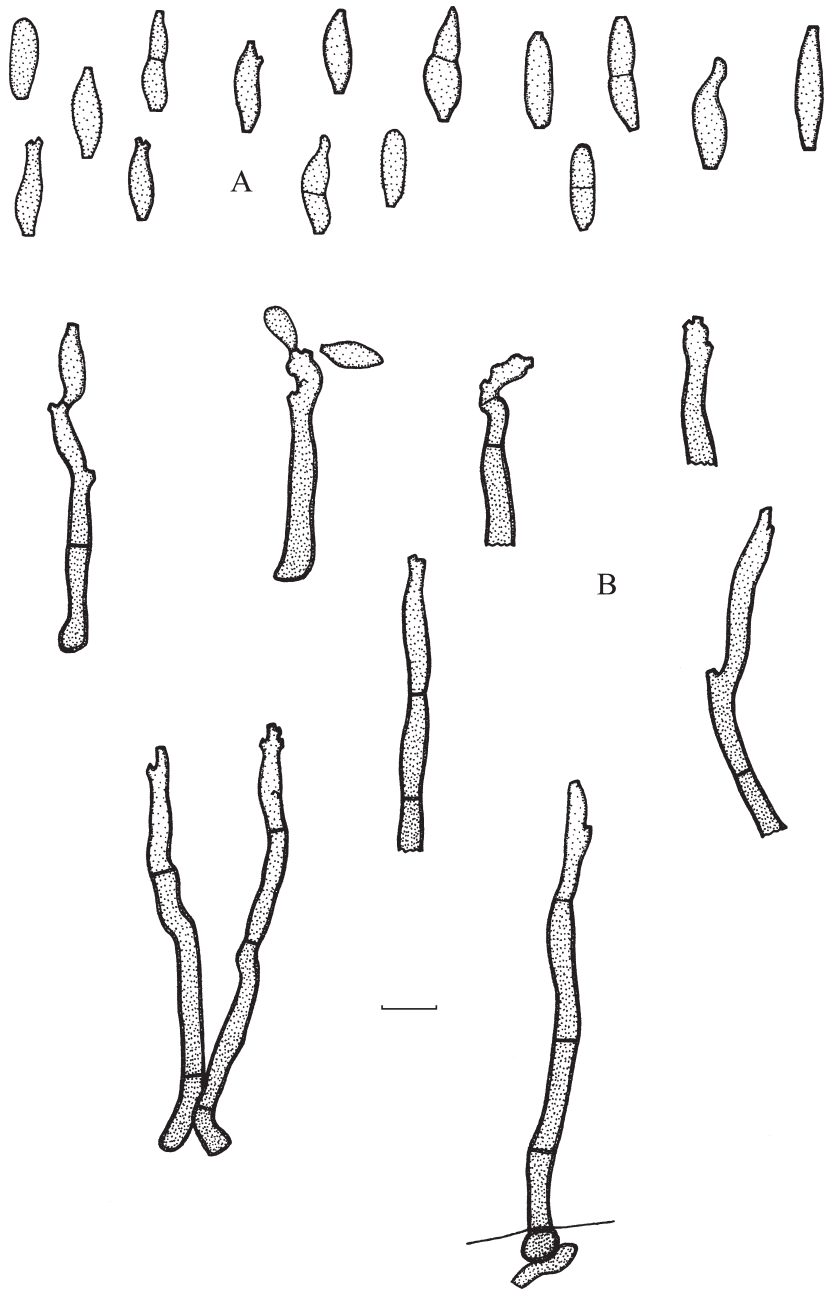

Fig. 8: *Fusicladium carpophilum*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

= *Fusicladium pruni* Ducomet, Thèse Fac. Sci. Paris: 137 (1907); type: on fruits of *Prunus domestica* var. "Ente", France, Villeneuve (not seen).

= *Fusicladium amygdali* Ducomet, Ann. École Natl. Agric. Rennes 4: 11 (1911); type: on *Prunus dulcis* (= *Amygdalus communis*), France, prope Ecole Nat. Agric. Rennes (not seen).

Teleomorph: *Venturia carpophila* E.E. Fisher, Trans. Brit. Mycol. Soc. 44: 339 (1961).

Lit.: BENSANDE & KEITT (1928: 313–329), HUGHES (1953: 568–569), ELLIS (1971: 315–317), ONDŘEJ (1971: 167–168), CMI Descr. (No. 402), SUBRAMANIAN (1971: 235), SIVANESAN (1977: 45–47; 1984a: 609), PARTRIDGE & MORGAN-JONES (2003: 362).

Ill.: HUGHES (1953: 569, Fig. 9), SCHWEIZER (1958: 80, Fig. 20), ELLIS (1971: 316, Fig. 218), ONDŘEJ (1971: 167, Fig. 1), CMI Descr. (No. 402, Figs D, E), SIVANESAN (1977: 46, Fig. 18; 1984a: 609, Fig. 366), PARTRIDGE & MORGAN-JONES (2003: 361, Fig. 1).

Exs.: Barthol., F. Columb. 2009; Ellis & Everh., F. Columb. 1164; Ellis & Everh., N. Am. F. 3588; Roum., F. gall. exs. 3991; Thüm., Herb. myc. oec. 559.

On leaves, fruits and twigs, patches on the fruits superficial, on the exposed surface, circular to oval, small, brown, often confluent, forming large, brown areas, leaf spots hypophyllous, brown. Colonies effuse or punctiform, dark olivaceous, velvety. Mycelium subcuticular or subepidermal. Hyphae branched, 3–6 µm wide, septate, olivaceous, forming a pseudoparenchymatous layer below the cuticle, stromatic cells thick-walled. Conidiophores solitary or in loose fascicles, erumpent, erect, straight or somewhat flexuous, unbranched or occasionally branched, 25–100 × 3–6 µm, septate, slightly constricted at the septa, olivaceous or medium to dark brown, paler towards the apex, smooth, sometimes swollen at the base, walls somewhat thickened. Conidiogenous cells integrated, terminal or intercalary, 10–25 µm long, with one to several denticulate loci, (1–)1.5–2(–2.5) µm wide, unthickened, not darkened. Conidia mostly in simple or branched chains, rarely solitary, cylindrical to fusiform, sometimes short obclavate, straight, (9–)12–20(–30) × (3–)4–5(–6) µm, 0(–1)-septate, then slightly constricted at the septum, pale olivaceous, smooth to verruculose, hila truncate, (1–)1.5–2(–2.5) µm wide, unthickened, not darkened.

Hosts and Distribution: on *Prunus* s.lat. (Rosaceae), Asia, Caucasus, Europe, Africa, North America, South America, Australia, New Zealand (cosmopolitan) – *P. americana* (North America, USA, FL), *P. angustifolia* (USA, FL), *P. armeniaca* [Asia, China, Kirghizia; Caucasus, Armenia, Azerbaijan, Georgia; Europe, GB, RUS; Africa, Morocco, Rhodesia (Zimbabwe), South Africa; North America, USA, CA, FL, OK, TX; South America, Chile; Australia, Queensland, Tasmania, Victoria; New Zealand], *P. capollin* (South America, Columbia), *P. caroliniana* (North America, USA, FL), *P. cerasifera* (New Zealand), *P. cerasus* (Asia, Uzbekistan; North America, USA, IA, NJ, NY), *P. domestica* (Asia, Afghanistan; Caucasus, Armenia; Europe, F, GB, RO; Africa, Kenya, Morocco; North America, USA, CA, FL, IA; South America; Australia, New South Wales), *P. dulcis* (Asia, Lebanon, Kazakhstan, Kirghizia, Uzbekistan; Caucasus, Armenia, Azerbaijan; Europe, F, GB, Moldavia, RO; Africa, Libya, Morocco; North America, USA, CA, CT, OR, WA; South America, Chile; New Zealand), *P. laurocerasus* (North America, USA, FL), *P. mahaleb* (Asia, Lebanon), *P. mandshurica* (Asia, China), *P. mume* (Asia, China, Guangdong Prov., Taiwan, Japan; New Zealand), *P. munsoniana* (North America,

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USA, FL, IA), *P. padus* (North America, USA, AK), *P. persica* [Asia, Afghanistan, Jordan, Lebanon, Uzbekistan, China, India, Japan, Korea, Taiwan; Caucasus, Georgia; Europe, A, F, GB; Africa, Ethiopia, Kenya, Morocco, Mozambique, Zambia, Rhodesia (Zimbabwe), South Africa; North America, Canada, Ont., USA, AL, CA, CT, DE, IL, NC, NY, PA, TX; Central America, Guatemala; South America, Chile, Columbia, Uruguay; Australia, Queensland, Tasmania, Victoria; New Zealand], *P. salicina* (Africa, South Africa; South Australia; New Zealand), *P. serotina* (North America, USA, FL), *P. serrulata* (North America, USA, MS), *P. spinosa* (Europe, GB; South America), *Prunus* spp. (Asia, Japan; Europe, H; North America, Canada, Que., USA, OK; South America).

Material examined: collections from JE, HBG, LE.

Notes: Previous authors, e.g., ELLIS (1976) and SIVANESAN (1977), often referred *Fusicladium carpophilum* to *Cladosporium*. However, this species is an anamorph of *Venturia* with fusicladioid conidiogenous loci and conidial hila, which has also been confirmed by molecular data. Records of *F. carpophilum* from various other hosts are very doubtful, e.g., on species of *Potentilla*, *Filipendula* and *Rosa* from Kazakhstan (SHVARTSMAN et al. 1975), *Salix* sp. from Romania (BONTEA 1985), *Bromus inermis* and *Hordeum vulgare* from Estonia (JÄRVA et al. 1998) and species of *Acacia*, *Cheirodendron* and *Metrosideros* from the USA (FARR et al. 1989). Records from South America are also uncertain because *Fusicladium carpophilum* and *Coryneum carpophilum* (*Clasterosporium carpophilum*) have often been confused in this area (VIÉGAS 1961).

10.2.9. *Fusicladium catenosporum* (Butin) Ritschel & U. Braun **comb. nov.** Fig. 9

≡ *Pollaccia catenospora* Butin, Mycol. Res. 96(8): 658 (1992); holotype: on *Salix triandra*, Germany, Berlin, Eberswalde-Finow, 8 Jul. 1990, Butin (IMI 349857).
= *Fusicladium salicis* Moesz & Smarods, in herb.
Teleomorph: Unknown.
Ill.: BUTIN (1992: 659, Figs 1–6).
Exs.: Krieger, F. sax. 2090.

Leaf spots amphigenous, scattered, at first subcircular, later irregular, 2–10 mm wide, reddish brown, margin dark brown to blackish, often causing distortions at the leaf margin, incurved or entire leaves bent, on young twigs forming punctiform, pale brown swellings. Colonies amphigenous, dense, oblong or circular, medium olivaceous-brown, sometimes confluent. Mycelium immersed, subcuticular, forming colourless, circular hyphal plates. Stroma 100–300 µm diam., composed of pale brown, thick-walled cells, 4–8 µm diam., 15–25 µm deep. Conidiophores in dense fascicles, arising from the upper cells of the stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, ovoid to doliiform, unbranched, 10–16 × 6–8 µm, aseptate, medium olivaceous-brown, smooth, walls somewhat thickened, conidiophores reduced to conidiogenous cells, unilocal, determinate or rarely percurrent, with up to two inconspicuous annellations, loci truncate or slightly convex, (2–)3–4(–5) wide, not to slightly thickened, not darkened. Conidia catenate, in unbranched or rarely branched chains, ellipsoid, limoniform or fusiform, straight to sometimes slightly curved, 10–21(–27) × 5–9 µm, mostly aseptate, rarely 1–2-septate, pale olivaceous-brown, smooth, walls not or only slightly thickened, truncate at the apex and base, hila (2–)3–4(–5) µm wide, unthickened to occasionally very slightly thickened, not darkened.

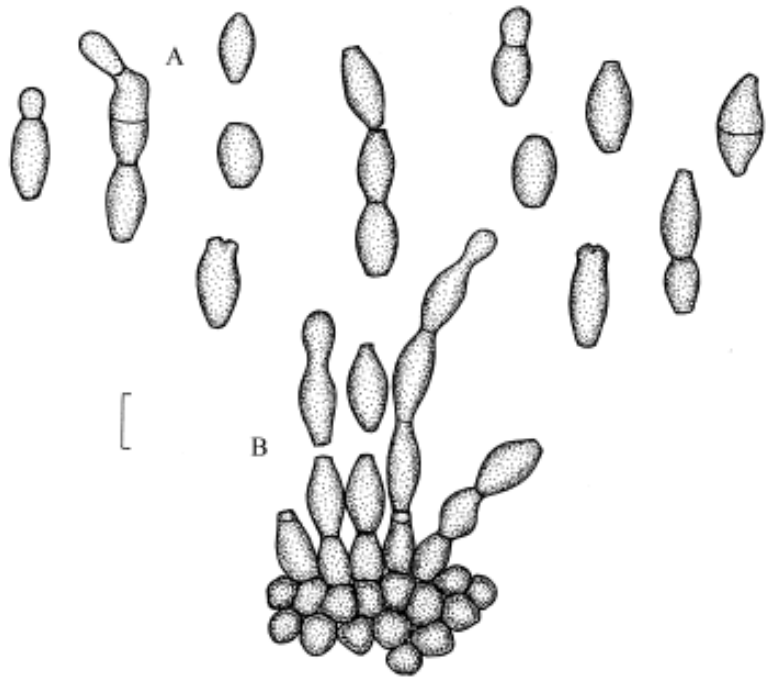

Fig. 9: *Fusicladium catenosporum*. A – conidia, B – conidiogenous cells with catenate conidia arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

Hosts and Distribution: on *Salix* spp. (Salicaceae), Europe – *Salix amygdalina* (D), *S. purpurea* (LV), *S. triandra* (D).

Material examined: on *Salix purpurea*, Latvia, Kandara, May 1936, Smarods (M), as *Fusicladium salicis* Moesz & Smarods.

Notes: BUTIN (1992) described conidiogenous cells with only a few, inconspicuous annellations. In Fig. 1 (drawing) and Fig. 3 (micrograph), conidiogenous cells possibly with two conidiogenous loci are shown, indicating an affinity to species of *Fusicladium* s.str. with catenate conidia. During the course of monographic studies, carried out by RITSCHEL (2001), conidiogenous cells with up to two annellations were found, but two loci were not observed.
ONDŘEJ (1973) described *Fusicladium* sp. from *Salix purpurea*, characterised by having catenate conidia, but this fungus was distinguished by having longer, pluriseptate conidia and longer, narrower conidia formed in unbranched chains.

10.2.10. *Fusicladium caulicola* U. Braun & K. Schub. **sp. nov**. Fig. 10

Holotype: on dry stems of *Sedum maximum*, Germany, Bavaria, Gerolzhofen, May 1906, herb. P. Magnus (HBG).
Teleomorph: Unknown.

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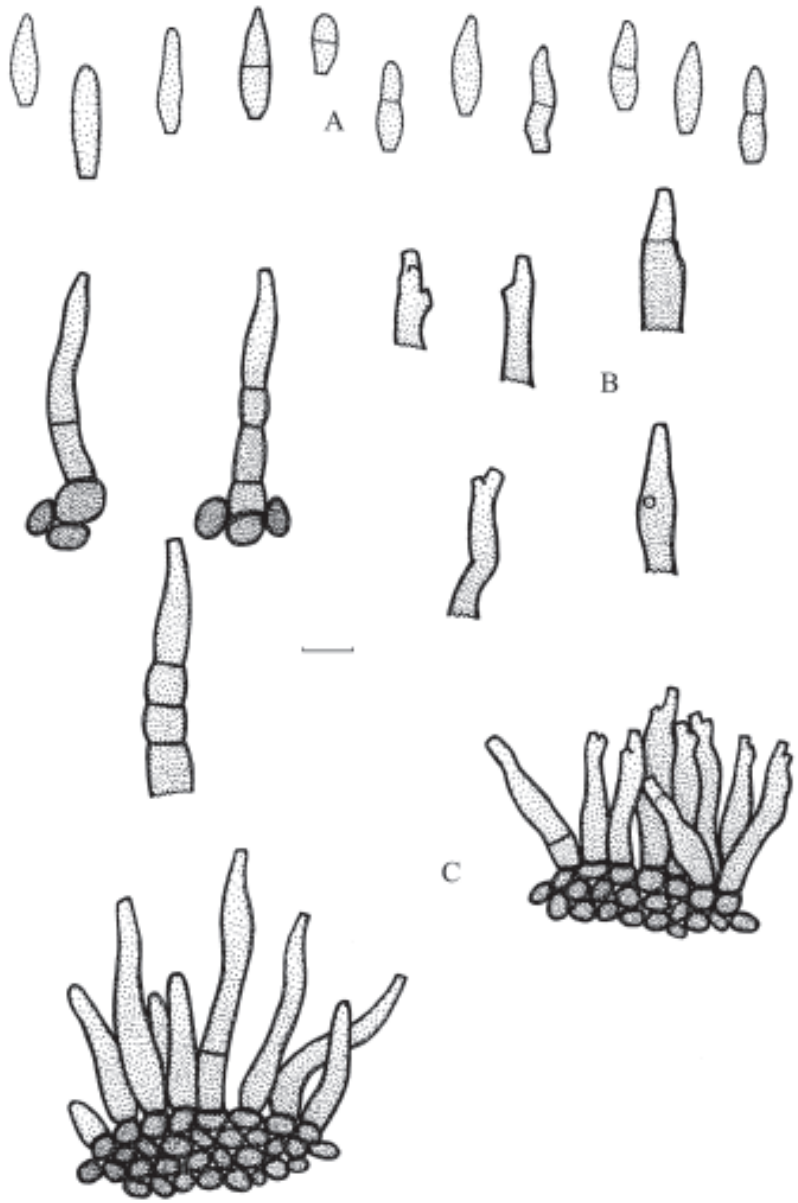

Fig. 10: *Fusicladium caulicola*. A – conidia, B – conidiogenous cells with a single or two loci, C – dense fascicles of conidiophores, scale = 10 µm, K. Schubert del.

Ad caules siccos, sine lesionibus. Coloniae punctiformes, effusae, dispersae vel confluentes. Stromata 30–120 µm diam. vel confluentes, modice vel atro-brunnea, ex cellulis subglobosis vel angularis–irregularis, 3–15 µm latis, crassitunicatis composita. Conidiophora laxe vel dense fasciculata, pauca vel numerosa, conidiomata sporodochiales vel conidiophora dispersa, caespitosa, recta, cylindrica vel flexuosa, geniculata–sinuosa, apicem versus saepe attenulata, non-ramosa, 10–50 × 4–8 µm, septata, pallide vel modice brunnea, apicem versus saepe pallidiora, apice interdum subhyalino, levia, leniter crassitunicata; cellulae conidiogenae integratae, terminales, saepe monoblasticae, determinatae vel polyblasticae, sympodiales; loci truncati vel leniter convexi, 2–3 µm lati, non-incrassati, non- vel interdum lenissime fuscati–refractivi. Conidia solitaria, ellipsoidea, ovoidea, obovoidea, recta, 14–22 × (3–)4–6 µm, 0–1-septata, ad septa non- vel leniter constricta, apice obtuso vel subacuto, basi truncata vel subconvexa, 2–3 µm lata, hila non-incrassata, non-fuscata.

On dry stems without conspicuous lesions or discolorations. Colonies punctiform, effuse, scattered to confluent, black. Stromata 30–120 µm diam. or confluent and larger, sometimes forming expanded layers, medium to dark brown, cells subcircular to angular–irregular in outline, 3–15 µm diam., thick-walled. Conidiophores in small to large, loose to dense fascicles, sporodochial or spread, caespitose, forming layers; conidiophores straight, subcylindrical to flexuous, geniculate–sinuous, usually attenuated, unbranched, 10–50 × 4–8 µm, septate, septa mostly in the lower half, pale to medium brown throughout or usually paler towards the apex, tips sometimes very pale, subhyaline, smooth, walls somewhat thickened. Conidiogenous cells integrated, terminal, mostly unilocal (monoblastic), determinate, sometimes with two or three loci (polyblastic, sympodial), loci flat, truncate to slightly convex, 2–3 µm wide, unthickened or almost so, not darkened, occasionally somewhat refractive or slightly darkened. Conidia solitary, ellipsoid, ovoid, obovoid, straight, 14–22 × (3–)4–6 µm, 0–1-septate, not or only slightly constricted at the septum, pale olivaceous or brownish, verruculose, thin-walled to slightly thickened, apex blunt to somewhat pointed, base truncate to slightly convex, hila 2–3 µm wide, unthickened, not darkened.

Hosts and Distribution: only known from the type collection.

10.2.11. *Fusicladium cerasi* (Rabenh.) Erikss., Meddeland. Kongl. Lantbruksakad. Exp.-fält 1: 73 (1885) Figs 11, 12

≡ *Acrosporium cerasi* Rabenh., in A. Braun, Verh. Vereins Beförd. Gartenbaues Königl. Preuss. Staaten 1: 176 (1853); type: on fruits of *Prunus cerasus*, Borussia [Iconotype: Braun (l.c.: Pl. 1, B, 1–2)].
≡ *Fusicladium cerasi* (Rabenh.) Sacc., Syll. Fung. 4: 346 (1886), comb. superfl.
≡ *Cladosporium cerasi* (Rabenh.) Aderh., Centralbl. Bakteriol., 2. Abth., 7: 656 (1901).
≡ *Fusicladiopsis cerasi* (Rabenh.) Karak. & Vassiljevsky, in Vassiljevsky & Karakulin, Parazitnye nesovershennye griby, Ch. I. Gifomitsety: 210 (1937).
≡ *Megacladosporium cerasi* (Rabenh.) Vienn.-Bourg., Les champignons parasites des plantes cultivées 1: 537 (1949).
≡ *Karakulinia cerasi* (Rabenh.) N.P. Golovina, Novosti Sist. Nizsh. Rast. 1: 213 (1964).

Teleomorph: *Venturia cerasi* Aderh., Landw. Jahrb. 29: 541 (1900).

Lit.: LINDAU (1907: 783–784), ONDŘEJ (1971: 168–169), CMI Descr. (No. 706), SIVANESAN (1977: 50–53; 1984a: 610–611).

Ill.: ADERHOLD (1900: Pl. 9, Fig. 22), VASSILJEVSKY & KARAKULIN (1937: 210, Fig. 18), HUGHES (1953: 568, Fig. 7), SCHWEIZER (1958: Figs 5–13, 16, 20), ONDŘEJ (1971: 167, Fig. 2), CMI Descr. (No. 706, Figs), SIVANESAN (1977: 51, Fig. 22; 1984a: 610, Fig. 367).

Exs.: Petr., Fl. Bohem. Morav. exs. 578; Vestergr., Micromyc. rar. sel. exs. 138.

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Fig. 11: *Fusicladium cerasi*. Iconotype (from BRAUN 1853). 1 – conidiophores with conidia, 2 – conidia.

Colonies on fruits as greyish-brownish or black tufts, caespitose, sooty, on leaves mostly epiphyllous, causing small, greyish black spots. Mycelium intra- or intercellular, hyphae 2–3 µm wide, hyaline or yellowish. Stromata subcuticular, composed of unthickened or only slightly thickened polygonal cells, 3–6 µm diam. Conidiophores solitary or in loose fascicles, arising from stromata, erect, straight or somewhat flexuous, unbranched or rarely branched at the base, (10–)20–40(–60) × (3–)4–6(–7) µm, 0–1(–2)-septate, septa in the lower half, pale to medium brown or olivaceous, paler towards the apex, smooth, walls slightly thickened, mostly somewhat swollen at the base. Conidiogenous cells integrated, terminal, with several conidiogenous loci, crowded at the apex, proliferation sympodial, loci denticulate, 1–2(–2.5) µm wide, unthickened, not or only slightly darkened–refractive. Conidia solitary, rarely in short, unbranched or occasionally branched chains, fusiform, subcylindrical, ellipsoid or obclavate, 11–25(–28) × 4–7 µm, 0–1(–3)-septate, constricted at the septa, yellowish to medium brown, smooth or somewhat roughened to wrinkled, pointed or rounded at the apex, truncate at the base, hilum truncate to slightly convex, 1–2(–2.5) µm wide, unthickened, not or only slightly darkened–refractive.

Hosts and Distribution: on species of *Prunus* s.lat. (Rosaceae), Asia, Caucasus, Europe, North America, South America, Australia, New Zealand – *Prunus armeniaca* (Europe, D, RO), *P. avium* (Asia, Kirghizia, Kazakhstan, Uzbekistan; Caucasus, Azerbaijan, Georgia; Europe A, CS, D, DK, I, LV, Moldavia, NL, RO, RUS, SLO, Ukr.; America; Australia, Victoria; New Zealand), *P. capollin* (South America, Columbia), *P. cerasifera* (Europe, RO), *P. cerasus* (Asia, Iran, Kazakhstan, Kirghizia, Uzbekistan; Caucasus, Armenia, Azerbaijan, Georgia; Europe, A, CZ, D, DK, EW, GB, LV, Moldavia, NL, RO, RUS, S, Ukr.; North America, USA, NC, NE, WA; South America, Brazil; Australia, Victoria; New Zealand), *P. domestica* (Asia, Iran), *P. persica* (Europe, D, RO), *Prunus* spp. (Europe, BG, HR, NL, SK, Cyprus; Asia, Japan).

Material examined: collections from B, HBG, JE, LE.

Notes: MENON (1956), ONDŘEJ (1971) and SIVANESAN (1977) described very short conidiophores, up to 20 µm in length. *Fusicladium cerasi* and *F. carpophilum* are two allied species on various hosts of the genus *Prunus* s.lat., but they are morphologically (conidia usually formed singly in *F. cerasi*, always catenate in *F. carpophilum*), physiologically (differences in the temperature tolerance), biologically (BENSANDE & KEITT 1928, differences in the host range) and genetically (SCHUBERT 2001; chapter 3.5) distinguished. Furthermore, they are connected with two different teleomorphs of the genus *Venturia*. The two species have often been confused. FERRARIS (1912) and LIND (1913) even reduced *F. carpophilum* to synonymy with *F. cerasi*.

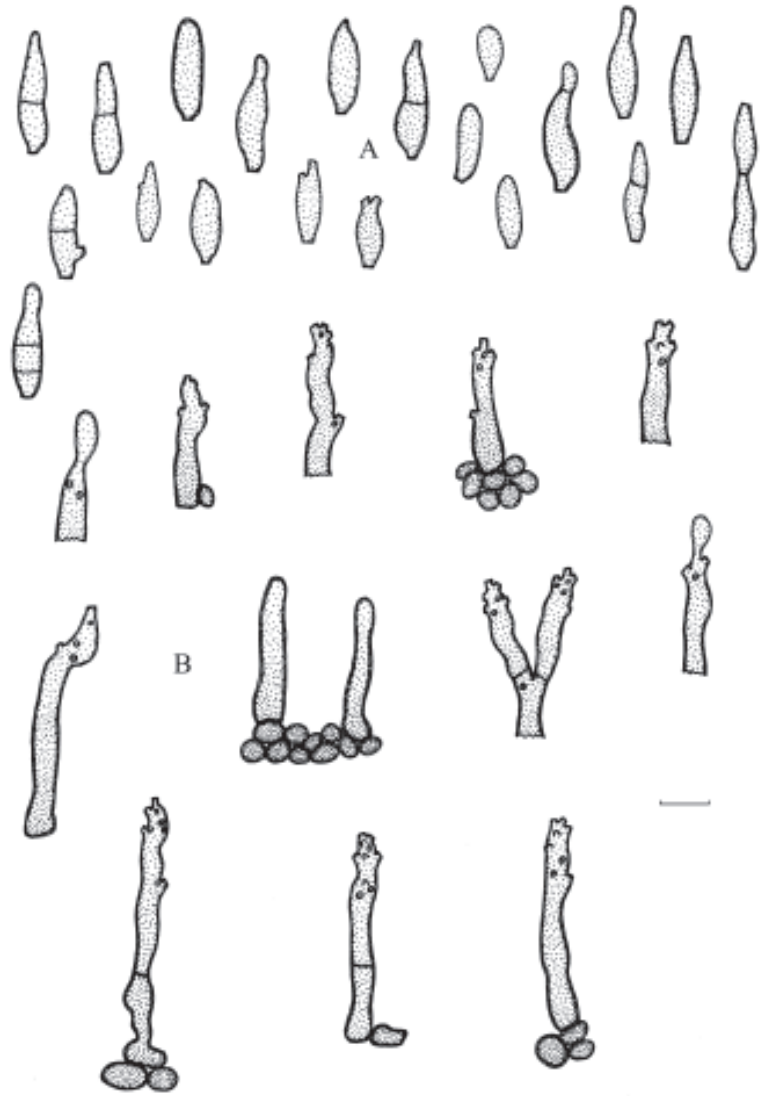

Fig. 12: *Fusicladium cerasi*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

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10.2.12. *Fusicladium consors* Sacc., Ann. Mycol. 4: 491 (1906) Fig. 13

Holotype: on stems of *Succisa pratensis* (= *Scabiosa succisa*), France, Bais de Meudon, May 1900, M. Ludwig, comm. P. Hariot (PC), [together with *Didymosphaeria perexigua*].
Teleomorph: Unknown.
Lit.: SACCARDO (1910: 732; 1913: 1375).

Lesions lacking. Mycelium internal. Hyphae sparingly branched, 2–4 µm wide, septate, pale or pigmented, smooth, often with swollen cells and constrictions at the septa. Conidiophores solitary or in small, loose fascicles, arising from internal hyphae or swollen hyphal cells, erumpent, erect, straight, subcylindrical, barely or only slightly geniculate–sinuous, 10–40 × 3–5 µm, 0(–1)-septate, brownish, wall thin to slightly thickened, smooth or almost so; conidiophores usually reduced to conidiogenous cells, conidiogenous loci subdenticulate, 1.5–2 µm wide, unthickened, not darkened. Conidia formed singly or in short, simple chains, ellipsoid–obovoid, pyriform, 12.5–18 × 3.5–5 µm, (0–)1-septate, pale olivacous-brown, smooth or almost so, wall thin or slightly thickened, apex obtuse, truncate, rarely subacute, base obconically truncate, 1.5–2 µm wide, hila unthickened, but mostly somewhat darkened–refractive.

Hosts and Distribution: only known from the type collection.

Notes: This species is tentatively maintained in *Fusicladium* since it is morphologically indistinguishable from other species of this genus. The biology of *F. consors* is unclear. Lesions are not formed, so that a saprobic habit may be supposed.

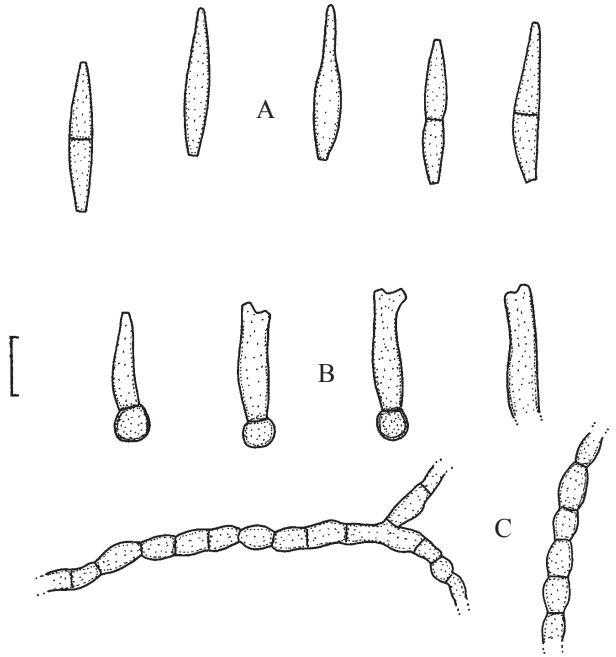

Fig. 13: *Fusicladium consors*. A – conidia, B – conidiophores, C – mycelium, scale = 10 µm, U. Braun del.

10.2.13. *Fusicladium convolvularum* Ondřej, Česká Mykol. 25(3): 171 (1971) Fig. 14

Holotype: on *Convolvulus arvensis*, Czech Republic, Libina, okraj pole pod nadrazim (okr. Sumperk), 7 Sept. 1970, Ondřej (BRA).
Teleomorph: Unknown.
Lit.: IMI Descr. (No. 1513).
Ill.: ONDŘEJ (1971: 170, Fig. 5), IMI Descr. (No. 1513, Figs A–D).

Leaf spots amphigenous, 1–5 mm wide, subcircular, brown, later with greyish brown to greyish white centre and brown margin. Mycelium usually subcuticular. Hyphae brown, forming flat stromatic layers of angular–irregular, subhyaline to brown cells, often radiating. Conidiophores solitary or in small loose groups, arising from stromatic cells or hyphae, mostly erumpent through the cuticle, rarely emerging through stomata, erect, straight or curved at the apex, subcylindrical to geniculate–sinuous, unbranched, 10–60 × 4–7 µm, 0–1(–2)-septate, pale to medium brown, smooth, wall somewhat thickened, but often irregularly thickened, often with a single or occasionally several percurrent proliferations which are not connected with conidiogenesis. Conidiogenous cells integrated, terminal, 10–25 µm long, with a single or several, often denticle-like conidiogenous loci, proliferation sympodial, loci 1.5–3 µm wide, unthickened, not or often somewhat darkened–refractive. Conidia solitary or occasionally in unbranched or branched chains, ellipsoid–ovoid, fusiform, subcylindrical, 10–27 × 3–6 µm, 0–3-septate, mostly constricted at the septa, subhyaline to pale olivaceous, smooth to rough-walled, usually somewhat attenuated towards apex and base, apex rounded, pointed or truncate, base truncate, hila 1.5–3 µm wide, flat, unthickened or almost so, not or somewhat darkened–refractive.

Hosts and Distribution: on *Calystegia* and *Convolvulus* spp. (Convolvulaceae), Europe, New Zealand – *Calystegia sepium* (Europe, CZ), *C. soldanella* (Europe, GB), *Convolvulus arvensis* (Europe, CZ; New Zealand).

Material examined: on *Calystegia soldanella* (= *Convolvulus soldanella*), England, Kent, Camber, 8 Oct. 1963, Sutton and Pirozynski (IMI 102675a); on *Convolvulus arvensis*, Czech Republ., Mlade (Litorel), 5 Sept.1970, M. Ondřej (BRA); on *Convolvulus arvensis*, New Zealand, 7 Nov. 2000, C.F. Hill, dried culture (ex herb. IMI); on *Calystegia sepium*, Czech Republ., Libina, 23 Sept. 1970, M. Ondřej (BRA).

Notes: In the collections examined some conidium-like structures with a length of up to 60 µm have been observed, but it is not quite clear if they belong to the present species. In molecular studies, it has been demonstrated that *F. convolvularum* is a genuine member of *Fusicladium*, since this species clustered near to *F. effusum* within a large monophyletic *Venturia* clade.

10.2.14. *Fusicladium crataegi* Aderh., Ber. Deutsch. Bot. Ges. 20: 200 (1902) Fig. 15

Lectotype: on *Crataegus laevigata* (= *C. oxyacantha* auct.), Germany, Erfurt, 15 Mar. 1902, Aderhold, Syd., Mycoth. germ. 45 (HBG), selected here; isolectotypes: Syd., Mycoth. germ. 45 (e.g., JE, LE).
≡ *Megacladosporium crataegi* (Aderh.) Vienn.-Bourg., Les champignons parasites des plantes cultivées 1: 539 (1949).
Teleomorph: *Venturia crataegi* Aderh., Ber. Deutsch. Bot. Ges. 20: 200 (1902).
Lit.: LINDAU (1907: 778–779), VASSILJEVSKY & KARAKULIN (1937: 199–200), HUGHES (1953: 567–568), SIVANESAN (1977: 59–60; 1984a: 612).

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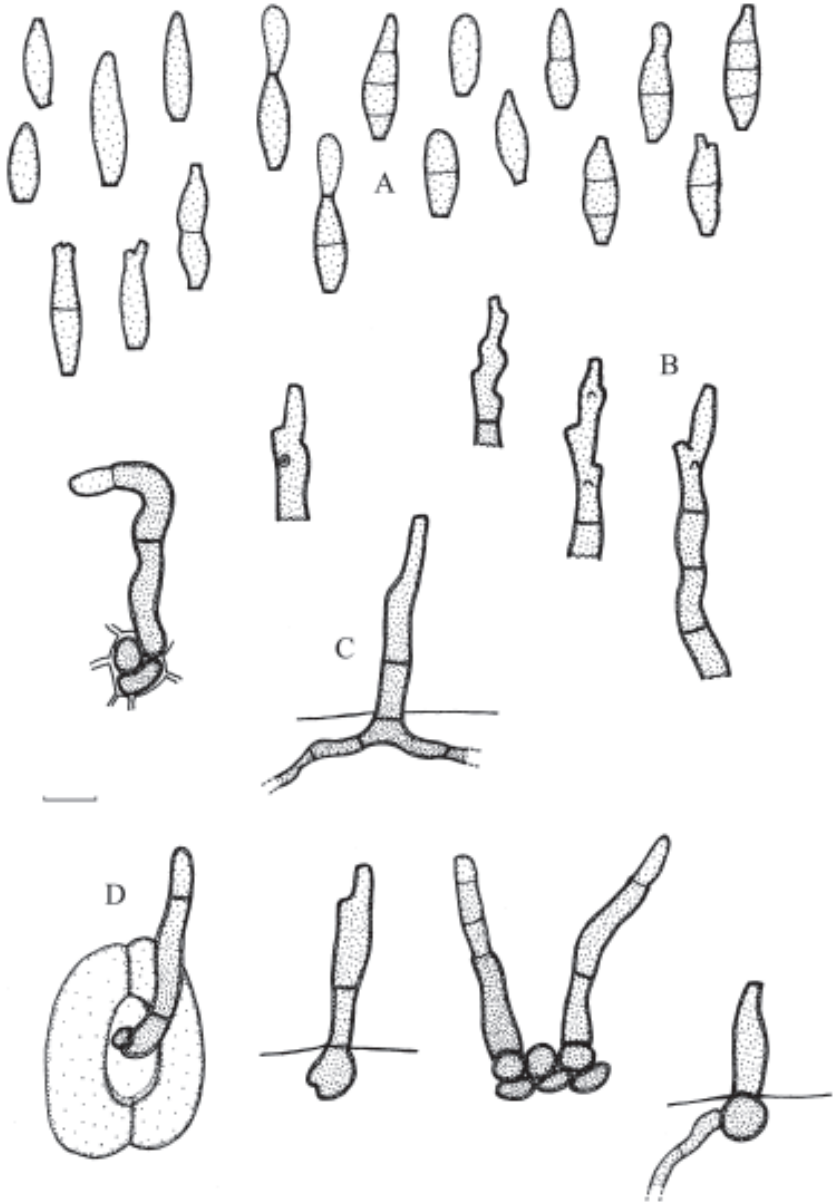

Fig. 14: *Fusicladium convolvularum*. A – conidia, B – conidiogenous cells, C – conidiophore arising from hyphae or swollen hyphal cells, D – conidiophore emerging through a stoma, scale = 10 µm, K. Schubert del.

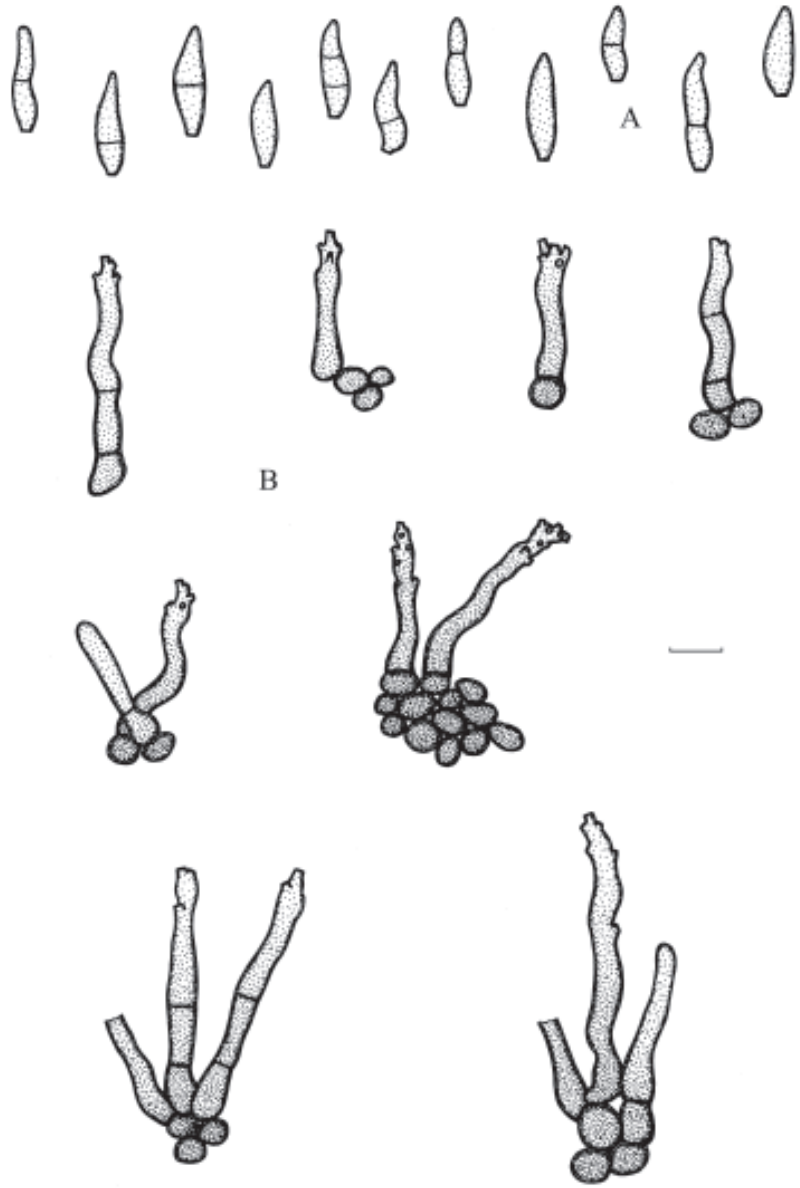

Fig. 15: *Fusicladium crataegi*. A – conidia, B – conidiophores solitary or in small groups, scale = 10 µm, K. Schubert del.

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Ill.: ADERHOLD (1902: Tab. IX), LINDAU (1907: 779, Fig. 680), HUGHES (1953: 568, Fig. 8), SIVANESAN (1977: 59, Fig. 28; 1984a: 613, Fig. 369).
Exs.: Syd., Mycoth. germ. 45.

On living leaves and fruits, dark, crustaceous, small, subcircular spots, 1–2 mm wide or confluent and larger, sometimes covering the entire surface of the leaves or fruits. Colonies brown to blackish. Mycelium immersed, subcuticular, hyphae branched, 2.5–3 µm wide, septate, pale olivaceous. Stromata pseudoparenchymatous, forming few layers, composed of pale olivaceous to brown, thick-walled, polygonal cells, 5–13 µm diam. Conidiophores solitary or in loose to dense fascicles, arising from stromata, erumpent through the cuticle, erect, straight, at the distal end mostly somewhat curved, unbranched, 20–54(–80) × (3.5–)4–5(–6) µm, 0–2-septate, mainly in the lower half, pale olivaceous to chestnut-brown, paler towards the apex, smooth, walls somewhat thickened. Conidiogenous cells integrated, terminal, proliferation sympodial, with a single or several conidiogenous loci, mostly at the apex, denticulate, (1–)1.5–2(–2.5) µm wide, unthickened, not darkened. Conidia solitary, fusiform, obclavate, 10–25 × 4–6(–8.5) µm, pale olivaceous, 0–1-septate, septum more or less median, rarely 2-septate, more or less constricted at the septa, smooth to verruculose, apex usually acute or rounded, truncate at the base, walls only slightly thickened, hila 1.5–2 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Crataegus* spp. (Rosaceae), Asia, Caucasus, Europe, North America, Australia – *Crataegus crenulata* (≡ *Pyracantha crenulata*) (South Australia), *C. laevigata* (= *C. oxyacantha* auct.) (Europe, D, DK, F, RO), *C. monogyna* (Europe, RO), *C. pentagyna* (Asia, Iran), *C. subvillosa* (Europe, RO), *Crataegus* spp. (Caucasus, Armenia, Georgia; Europe, H, LT, RO, RUS, SK; North America, USA, FL).

Material examined: collections from B, HBG, JE, LE, M.

Notes: VIENNOT-BOURGIN (1949) described conidia formed singly as well as in short chains, with one or two septa.

10.2.15. *Fusicladium diedickeanum* U. Braun, Nova Hedwigia 55(1–2): 211 (1992) Fig. 16

Holotype: on *Syringa vulgaris*, Germany, Thuringia, Erfurt, Oct. 1897, Diedicke (JE).
Teleomorph: *Venturia syringae* (Syd.) M.E. Barr, Canad. J. Bot. 46: 815 (1968).
Lit.: SIVANESAN (1977: 106).
Ill.: SIVANESAN (1977: 107, Fig. 57; 1984a: 611, Fig. 368 B); BRAUN (1992: 212, Fig. 2).

Leaf spots amphigenous, subcircular, angular to irregular, often vein-limited, brownish, margin indefinite or centre later often greyish white, with narrow, brown margin, occasionally somewhat raised. Mycelium internal. Stromata almost absent or small, substomatal or intraepidermal composed of swollen hyphae, 3–8 µm diam., pale brown. Conidiophores solitary or in small groups, usually 2–8, erumpent through stomata or the cuticle, erect, geniculate–sinuous, unbranched, 25–100 × 4–7 µm, septate, brown, paler towards the apex, smooth. Conidiogenous cells integrated, terminal or intercalary, 10–30 µm long, proliferation sympodial,

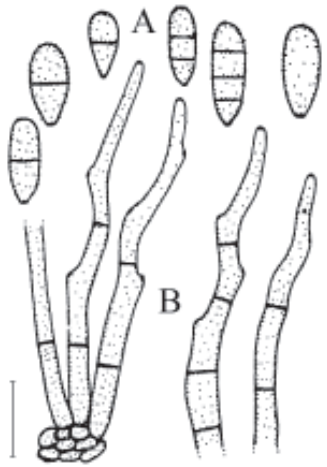

Fig. 16: *Fusicladium diedickeanum*. A – conidia, B – conidiophores, scale = 20 µm, U. Braun del.

with one to several conidiogenous loci, subdenticulate, loci unthickened or almost so, not or only slightly darkened–refractive. Conidia solitary, ellipsoid, ovoid, subcylindrical, 8–18 × 4–7 µm, 0–3-septate, olivaceous to olivaceous-brown, verruculose, apex more or less rounded, often somewhat attenuated towards the base, base more or less truncate, hila unthickened or almost so, not or only very slightly darkened–refractive.

Hosts and Distribution: on *Syringa* spp. (Oleaceae), Europe, North America – *Syringa vulgaris* (Europe, D; North America, USA, MA).

10.2.16. *Fusicladium effusum* G. Winter, J. Mycol. 1: 101–102 (1885) Fig. 17

Holotype: on *Carya tomentosa* (= *Carya alba*), North America, USA, Illinois, Cobden Zels., 1 Oct. 1882, F.S. Earle (B).
≡ *Cladosporium effusum* (G. Winter) Demaree, J. Agric. Res. 37: 186 (1928), homonym, non Berk. & M.A. Curtis, Grevillea 3(27): 106 (1875).
≡ *Fusicladosporium effusum* (G. Winter) Partrigde & Morgan-Jones, Mycotaxon 85: 364 (2003).
= *Fusicladium caryigenum* Ellis & Langl., J. Mycol. 4: 124 (1888); lectotype: on leaves of *Carya illinoensis*, USA, Louisiana, St. Martin, 3 Sept. 1888, A.B. Langlois, Fl. Ludov. 1499 (NY), selected here; isolectotypes: on leaves of *Carya illinoensis* (= *Carya olivaeformis*), USA, Louisiana, St. Martinsville, Sept. 1888, A.B. Langlois (BPI 426315, 426333; M).
≡ *Cladosporium caryigenum* (Ellis & Langl.) Gottwald, Mycologia 74(3): 388 (1982).
Teleomorph: Unknown.
Lit.: SACCARDO (1886: 346), GOTTWALD (1982), IMI Descr. (No. 1514), PARTRIDGE & MORGAN-JONES (2003: 364).
Ill.: GOTTWALD (1982: Figs 1–3), IMI Descr. (No. 1514, Figs A–D), PARTRIDGE & MORGAN-JONES (2003: 363, Fig. 2).
Exs.: Ellis & Everh., N. Am. F. 545; Kellerm. & Sw., Kans. F. 39.

Leaf spots amphigenous, subcircular to angular, 1–3 mm wide, often confluent, diffuse, numerous, mostly spread along leaf veins, dark brown to black, with an irregular margin. Colonies amphigenous, caespitose, dark brown to blackish. Mycelium mainly subcuticular. Stromata variable in size, composed of pale olivaceous to brown, angular to rounded, thick-walled, pseudoparenchymatous cells, 4–8 µm diam., forming up to three layers. Conidiophores solitary or loosely fasciculate, arising from stromata or from hyphae, erect, straight, sometimes flexuous at the apex, unbranched or apically branched, 22–130(–170) × 4–6 µm, septate, pale to dark brown, smooth, with somewhat thickened walls. Conidiogenous cells integrated, terminal or intercalary, or conidiophores reduced to conidiogenous cells, 10–40 µm long, with a single

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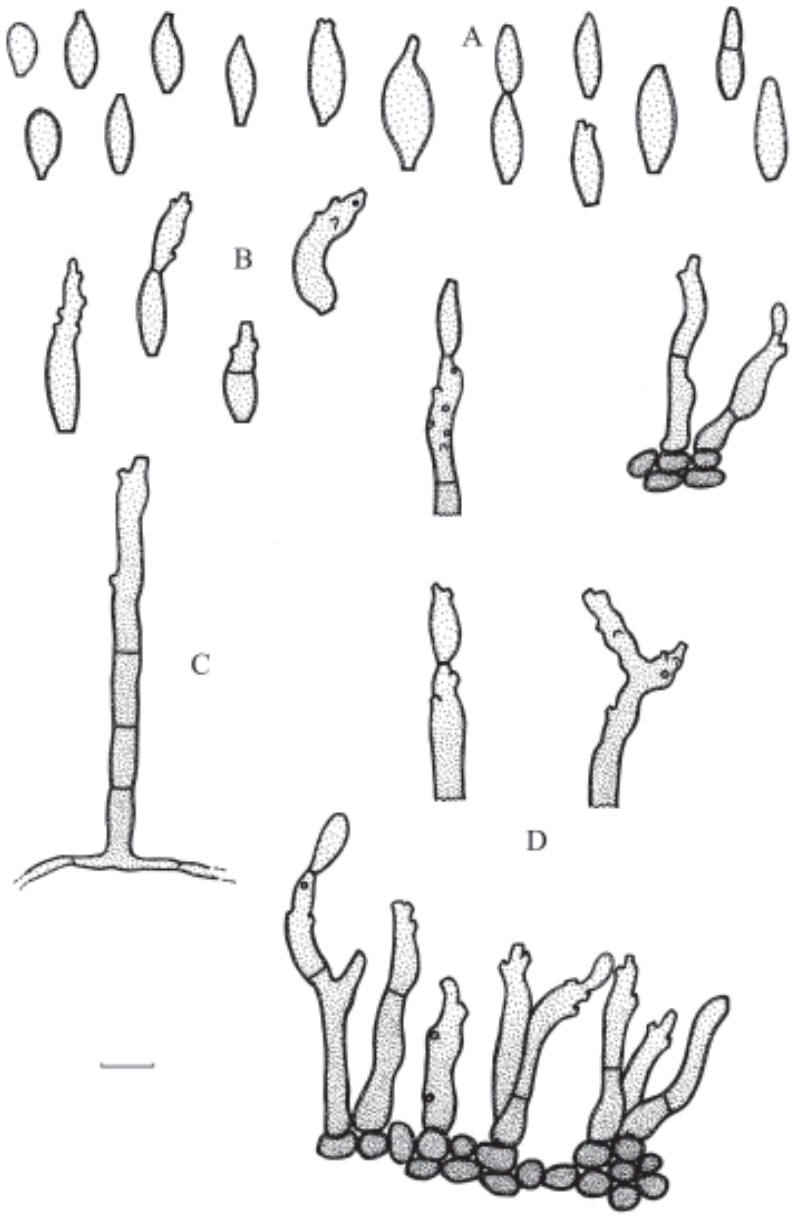

Fig. 17: *Fusicladium effusum*. A – conidia, B – microcyclic conidiogenesis, C – conidiophore arising from a hypha, D – conidiophores in a loose fascicle, scale = 10 µm, K. Schubert del.

or several denticle-like conidiogenous loci, proliferation sympodial, loci unthickened, not or only somewhat darkened–refractive, 1.5–3 µm wide. Conidia in simple or branched chains, pyriform, subcylindrical, ellipsoid, fusiform, (8.5–)10–24 × 5–10 µm, pale brown, 0(–1)-septate, smooth, attenuated towards apex and base, apex mostly truncate, occasionally rounded or pointed, base truncate, hila unthickened, but often somewhat darkened–refractive, 1.5–3 µm wide.

Hosts and Distribution: on *Carya* spp. and ?*Juglans* spp. (Juglandaceae), Africa, North, Central and South America, New Zealand – *Carya aquatica* (North America, USA, FL), *C. cordiformis* (= *C. amara*) (North America, USA, KS, WI), *C. glabra* (North America, USA, FL), *C. illinoensis* (= *C. pecan*, = *C. olivaeformis*) (Africa, South Africa; North America, USA, AL, LA, MO, TX; South America, Brazil; New Zealand), *C. ovata* (North America, USA, WI), *C. tomentosa* (= *C. alba*) (North America, USA, IL, LA, KS), *Carya* spp. (North America, USA, AL, FL, NC, OK; Central America, Mexico; South America, Paraguay), ?*Juglans regia* (South America, Brazil).

Material examined: collections from B, M, NY.

Notes: On account of the catenate conidia, GOTTWALD (1982), assigned *Fusicladium effusum* to *Cladosporium*, but the conidiogenous loci of this species agree well with those of *Fusicladium* in that they are denticle-like and have unthickened walls. The conidiogenous loci in species of *Cladosporium*, described and illustrated in detail by DAVID (1997), are quite distinct. Therefore, *F. effusum* belongs in *Fusicladium*, as has recently been confirmed by molecular studies of rDNA ITS sequences (SCHNABEL et al., 1999; SCHUBERT 2001) in which this species clustered close to various *Venturia* species with *Fusicladium* and *Pollaccia* anamorphs within a monophyletic *Venturia* clade (see chapter 3) In addition to its occurrence on an unrelated host, *Fusicladium effusum* var. *carpineum* Ellis & Everh. on *Carpinus* species (Corylaceae) in North America is distinguished from *F. effusum* on *Carya* species (Juglandaceae) in causing distinct lesions and having much longer and wider conidiophores with paler conidiogenous cells and less conspicuous conidiogenous loci. This variety is now considered to be a separate species of *Fusicladium*. Records on *Juglans regia* from Brazil (MENDEZ et al. 1998) are uncertain (no material seen).

10.2.17. ***Fusicladium elegans*** (Servazzi) Ritschel & U. Braun **comb. nov.** Fig. 18

≡ *Pollaccia elegans* Servazzi, Boll. Lab. Sperim. Osserv. Fitopatol. 15(3–4): 64 (1939); neotype: on *Populus nigra*, Germany, Geesthacht, 10 Jul. 1904, Jaap (B), as *Napicladium asteroma* (Fuckel) Allesch., selected here; isoneotype: H.

= *Fusicladium radiosum* [(Lib.) Lind] var. *balsamiferae* Davis, Trans. Wisconsin Acad. Sci. 20: 402 (1922); lectotype: on *Populus balsamifera*, USA, Wisconsin, Sturgeon Bay, 23 Jun. 1913, J.J. Davis (WIS); topotype: on *Populus balsamifera*, USA, Wisconsin, Sturgeon Bay, 19 Jul. 1918, J.J. Davis (WIS).

≡ *Pollaccia balsamiferae* (Davis) M. Morelet, Bull. Soc. Sci. Nat. Archéol. Toulon Var 4: 3 (1972).

= *Fusicladium tremulae* A.B. Frank, Hedwigia 22: 127 (1883) p. p.

= *Napicladium tremulae* auct. p.p.

= *Stigmina radiosa* auct. p.p.

= *Fusicladium radiosum* auct. p.p.

Teleomorph: *Venturia populina* (Vuill.) Fabric., Jahresber. Neuerung Pflanzenkrankh. 5: 282 (1902).

Lit.: DANCE (1961: 875–890), ONDŘEJ (1972: 145), CMI Descr. (No. 483), ELLIS (1976: 110), SIVANESAN (1977: 89–93; 1984a: 619–620), BRANDENBURGER (1985: 39), ELLIS & ELLIS (1997: 192), KHAN & MISRA (1989).

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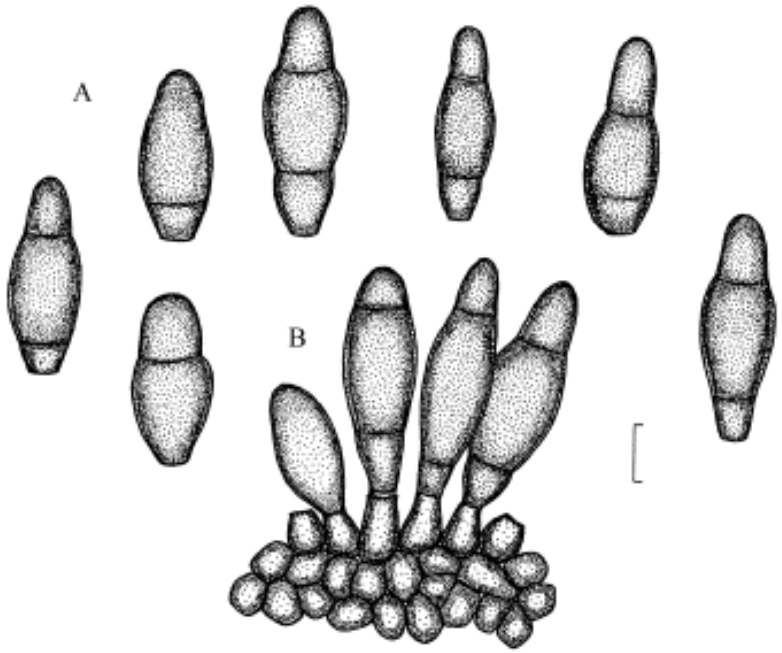

Fig. 18: *Fusicladium elegans*. A – conidia, B – conidiogenous cells arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

Ill.: SERVAZZI (1939: Pl. III, Figs 10–15; Pl. IV, Figs 16–22; Pl. V, Figs 23–25; Pl. VI, Figs 26–31; Pl. VII, Figs 32–36), DANCE (1961: Pl. I, Figs 1–9; Pl. II, 10–18, Figs 1–9), BARR (1968: 805, Fig. 20), ONDŘEJ (1972: 145, Figs 6, 7), CMI Descr. (1976: No. 483, Fig. B), ELLIS (1976: 110, Fig. 77 B), SIVANESAN (1977: 91, Fig. 49; 1984a: 620, Fig. 374 B), LIU, CHEN & SHAO (1981: Pl. II, Fig. 6; 23, Figs 1–2), WU & SUTTON (1995: 985, Fig. 6), ELLIS & ELLIS (1997: Pl. 82, Fig. 850).

Leaf spots amphigenous, subcircular to irregular, 5–20 mm wide, pale brown, surrounded by a narrow, reddish brown, somewhat raised margin, limited by the leaf margin or by veins, later confluent and larger, sometimes covering large leaf segments, occasionally causing distortions of the leaves. Colonies amphigenous, punctiform to confluent, fructification often spread along veins, on the upper leaf surface dark brown to almost black, below pale brown to dark brown, also on twigs. Mycelium immersed. Stroma intraepidermal to subcuticular, composed of subcircular to slightly angular, thick-walled cells, 5–10 µm diam., forming up to three layers. Conidiophores usually in dense fascicles, arising from the upper cells of stromata, forming sporodochial conidiomata, sometimes solitary, erumpent through the cuticle, subglobose to cylindrical, 10–16 × 4–10 µm, 0–2-septate, olivaceous-brown, smooth, relatively thick-walled, conidiophores usually reduced to conidiogenous cells, unilocal, determinate or occasionally percurrent, with a single or two inconspicuous annellations,

loci 4–7 µm wide, not to very slightly thickened, somewhat refractive. Conidia solitary, ellipsoid to broadly fusiform, straight, rarely slightly curved, (21–)25–40(–45) × 9–13(–16) µm, 1–2(–3)-septate, with a large central cell and two smaller cells at the ends with somewhat thinner walls, more or less constricted at the septa, dark olivaceous-brown, smooth, thick-walled, rounded at the apex, base truncate to slightly convex, sometimes oblique, hila 4–7 µm wide, not to very slightly thickened, somewhat refractive.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Asia, Europe, North America – *Populus balsamifera* [Asia, China; Europe, GB; North America, Canada, Alta., BC., Man., NB., Nfld., NS., NWT (Mack.), Ont., PEI, Que., Sask., Yukon, USA, WI], *P.* × *canadensis* (Europe, I; North America, Canada, Ont.), *P. ciliata* (Asia, India), *P. deltoides* (North America, Canada, Que.) *P. nigra* (incl. *P. pyramidalis*) (Asia, India; Europe, CS, D, F, I, SLO; North America, Canada, NB., USA, northern central states, north-eastern states, OR, WA), *P. trichocarpa* (North America, Canada, BC., USA, AK, OR), *Populus* spp. (Europe, CH, GB; North America, Canada, Alta., BC., Man., Nfld., Ont., Sask., USA, northern central states, north-eastern states, WA).

Notes: PRILLIEUX (1892) examined *Fusicladium* on *Populus nigra* from France, compared it with *F. tremulae* (= *Pollaccia radiosa*), and found differences in the conidial shape and size but maintained this fungus under the latter species (as *Napicladium tremulae*). LIND (1905) followed the treatment of PRILLIEUX (1892), but called this species *Fusicladium radiosum*. SERVAZZI (1939) introduced *Pollaccia elegans* and discussed the differences to *P. radiosa* in detail. Unfortunately, type material of *P. elegans* could not be traced and is probably not preserved, so a neotype is proposed in this paper. DANCE (1961) showed that *Venturia populina* only attacked *Populus* species of sect. *Tacamahaca* and sect. *Aigeiros* and this was confirmed during the course of the monographic examinations by RITSCHEL (2001). Records from *Populus* species of sect. *Leuce* (GINNS 1986, ONDŘEJ 1972) have probably been based on misidentifications of the fungi or hosts.

10.2.18. ***Fusicladium euphorbiae*** Karak., Bolezni Rast.13: 132 (1924) Fig. 19

Lectotype: on stems of *Euphorbia virgata*, Russia, prov. Leningrad, Ropsha, 5 Sept. 1924, B.N. Karakulin (LE 40571), selected here; isolectotypes: HAL 1629, IMI 92541, LE 40957, LE 40958.

≡ *Fusicladiopsis euphorbiae* (Karak.) Karak., in Vassiljevsky & Karakulin, Parazitnye nesovershennye griby, Ch. I. Gifomitsety: 209 (1937).

≡ *Karakulinia euphorbiae* (Karak.) N.P. Golovina, Novosti Sist. Nizsh. Rast. 1: 213 (1964).

Teleomorph: Unknown.

Lit.: DEIGHTON (1967: 23–25), ONDŘEJ (1971: 169–170).

Ill.: KARAKULIN (l.c.: Fig. 11), VASSILJEVSKY & KARAKULIN (1937: 209, Figs 16–17), DEIGHTON (1967: 24, Fig. 11), ONDŘEJ (1971: 168, Fig. 3).

On living leaves and stems without conspicuous lesions. Colonies caespitose, varying in shape and size, dark brown to black, scattered. Mycelium both inter- and intracellular, subcuticular. Stromata oblong, 50–150 × 10–50 µm diam., composed of swollen, pale olivaceous to brown, somewhat thick-walled cells, 4–8 µm diam., pseudoparenchymatous, forming few layers. Conidiophores in small to usually large, loose to dense fascicles, arising from stromata, erect, more or less straight, unbranched, 10–90 × (3–)4–6 µm, septate, olivaceous to pale brown, paler towards the apex, smooth, walls relatively thin, occasionally swollen at the base. Conidiogenous cells integrated, terminal or intercalary, with one to several conidiogenous loci, denticulate, prolifera-

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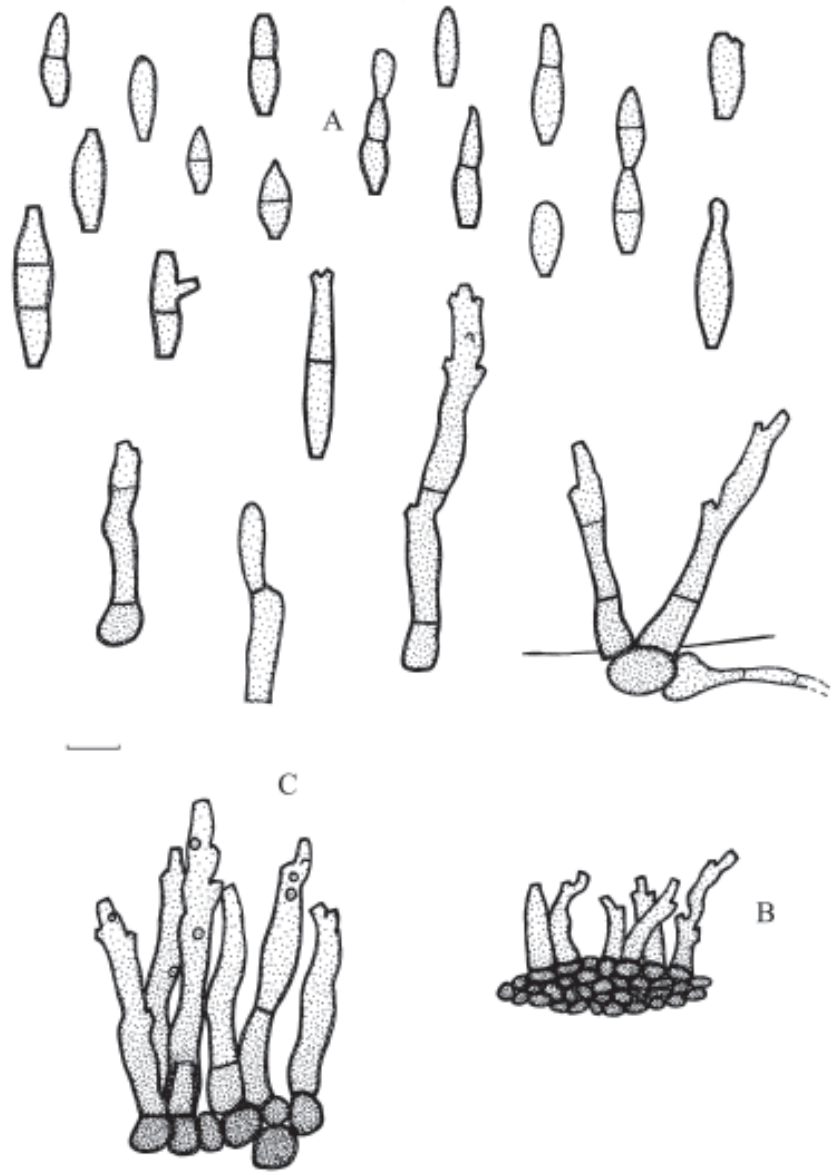

Fig. 19: *Fusicladium euphorbiae*. A – conidia, B – dense fascicle of conidiophores (LE 40957, type), C – dense fascicle of conidiophores (collection from M), scale = 10 µm, K. Schubert del.

tion sympodial, loci flat, truncate or slightly convex, 1.5–3(–4) µm wide, not or only very slightly thickened, not or somewhat darkened–refractive. Conidia solitary or catenate, in short, simple or sometimes branched chains, fusiform, subcylindrical, obclavate or clavate, straight, 10–22(–40) × 3–6 µm, 0–2(–3)-septate, often slightly constricted at the septa, pale olivaceous, smooth to minutely verruculose, walls only slightly thickened, apex more or less obtuse or truncate, sometimes slightly papillate, base truncate, hila 1.5–3(–4) µm wide, unthickened or only very slightly thickened, not or only slightly darkened–refractive.

Hosts and Distribution: on *Euphorbia* spp. (Euphorbiaceae), Asia, Caucasus, Europe – *Euphorbia amygdaloides* (Europe, RO), *E. cyparissias* (Europe, RO), *E. esula* (Europe, CZ), *E. exigua* (Europe, RO), *E. lamprocarpa* (Asia, Kazakhstan; Europe, CZ, RUS), *E. villosa* (Europe, RO), *E. virgata* (Europe, RUS), *Euphorbia* spp. (Asia, Central Asia, Turkmenistan; Caucasus, Armenia; Europe, CZ, RUS).

Material examined: on *Euphorbia* sp., Czech Republic, Mladeč (Litorel), 5 Sept. 1970, M. Ondřej (BRA); on *E.* sp., Czech Republic, H. Libina, near Šumperk, 18 Sept. 1970, M. Ondřej (BRA); on *E. villosa*, RO, Distr. Suceava, Grăniceşti, 26 May 1972, A. Manulin (M).

10.2.19.1. *Fusicladium fasciculatum* Cooke & Ellis, Grevillea 6: 88 (1878) var. *fasciculatum* Fig. 20

Holotype: on stems of *Euphorbia nutans*, USA, New Jersey, Newfield, J.B. Ellis no. 2774 (90098 b) (K); isotype: NY (mixed infection with *Cladosporium chaetomium*).
≡ *Scolecotrichum fasciculatum* (Cooke & Ellis) Shear, Bull. Torrey Bot. Club 29: 499 (1902).
≡ *Passalora fasciculata* (Cooke & Ellis) Earle, Torreya 2: 60 (1902).
≡ *Cercosporidium fasciculatum* (Cooke & Ellis) Höhn., Centralbl. Bakteriol., 2. Abth., 60: 4 (1923).
Teleomorph: Unknown.
Lit.: DEIGHTON (1967: 16–21).
Ill.: DEIGHTON (1967: 20, Fig. 9).
Exs.: Ellis, N. Am. F. 545.

On stems, without conspicuous lesions. Colonies caespitose, effuse, up to 2 cm long, black, velvety, rarely on leaves, amphigenous. Mycelium internal, intercellular, subcuticular, hyphae branched, 1.5–4 µm wide, septate, almost colourless to very pale olivaceous. Conidiophores in small, loose fascicles, up to 6, arising from hyphae, consisting of two or three swollen cells, erumpent through the cuticle, erect or slightly divergent, more or less straight, usually somewhat flexuous, unbranched, very rarely branched, 37–175 × (3–)4–5 µm, septate, septa very thin, not always conspicuous, dark olivaceous, paler towards the apex, smooth, thick-walled, base often slightly swollen, sometimes with percurrent proliferations which are not connected with conidiogenesis. Conidiogenous cells integrated, terminal or intercalary, numerous and often crowded, proliferation sympodial, loci conspicuous and prominent, sometimes situated at the end of short lateral projections, denticulate, 1.5–2 µm wide, wall not or only very slightly thickened, somewhat darkened–refractive. Conidia solitary, fusiform, ellipsoid or subcylindrical, straight, 8.5–16 × (3–)4–6.5 µm, 0(–1)-septate, pale olivaceous, smooth to

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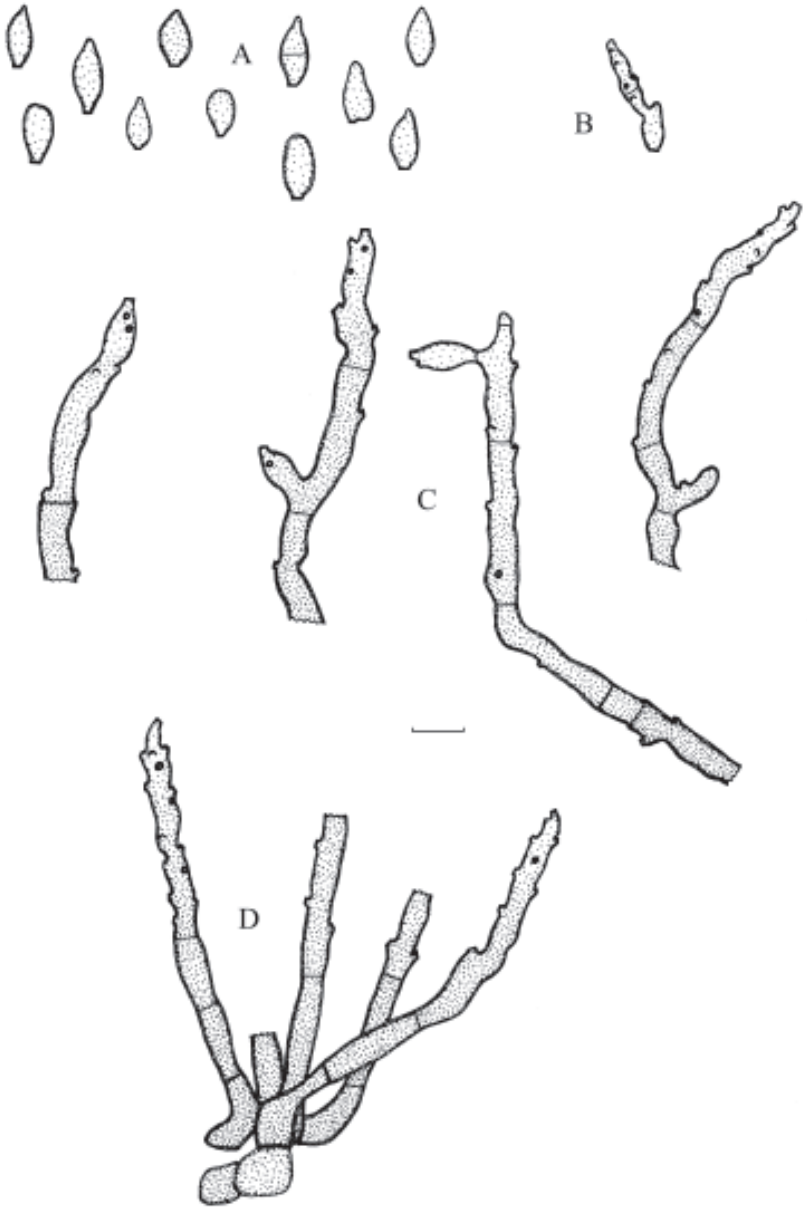

Fig. 20: *Fusicladium fasciculatum* var. *fasciculatum*. A – conidia, B – microcyclic conidiogenesis, C – unbranched and branched conidiophores, D – conidiophores in a small fascicle, scale = 10 µm, K. Schubert del.

verruculose, wall relatively thin-walled, apex rounded or pointed, attenuated at the base, truncate, hila 1.5–2 µm wide, not or only very slightly thickened, but somewhat darkened–refractive.

Hosts and Distribution: on *Euphorbia* spp. (Euphorbiaceae), North America, South America – *Euphorbia corollata* (North America, USA, WI), *E. glyptosperma* (North America, USA, WI), *E. nutans* (North America, USA, NJ), *E. serpyllifolia* (North America, USA, WI), *Euphoria* spp. (North America, USA, KS, MD, NJ; South America, Brazil).

Material examined: collections from B, M.

Notes: FARR et al. (1989) listed species of *Ammophila* and *Alopecurus* as hosts of this species, which is very doubtful.

10.2.19.2. *Fusicladium fasciculatum* [Cooke & Ellis] var. *didymum* Deighton, Mycol. Pap. 112: 23 (1967) Fig. 21

Holotype: on *Euphorbia corollata*, USA, Iowa, Decorah, 5 Aug. 1884, E.W.D. Holway, as *Fusicladium fasciculatum* (NY).
Teleomorph: Unknown.
Ill.: DEIGHTON (1967: 22, Fig. 10).

Leaf spots indefinite or sometimes small, subcircular, up to 3 mm wide, somewhat orange to yellowish brown, or sometimes consisting of dark punctate areas of irregular shape, which may cover a large area of the leaf. Colonies amphigenous, dark, velvety. Mycelium immersed, intercellular; hyphae sparingly branched, 1.5–3 µm wide, septate, almost colourless. Conidiophores solitary or in small groups of 2–3, arising from hyphae, erumpent through the cuticle, erect, more or less flexuous or curved, unbranched or rarely branched near the apex, 65–260 × 2.5–5 µm, septate, dark olivaceous, paler towards the apex, smooth, walls somewhat thickened. Conidiogenous cells integrated, terminal or intercalary, proliferation sympodial, loci numerous, prominent, often on short nodulose projections, denticulate, 1.5–2.5 µm wide, conspicuous, but not or only very slightly thickened, somewhat darkened–refractive. Conidia solitary, broadly fusiform to short clavate, (9–)13–19 × (4.5–)5–7 µm, (0–)1(–2)-septate, usually slightly or distinctly constricted at the septum, sometimes not constricted, pale olivaceous, verruculose, apex rounded or shortly papillate, base attenuate, truncate, hila 1.5–2.5 µm wide, unthickened or only very slightly thickened, not or only slightly darkened–refractive.

Hosts and Distribution: on *Euphorbia* spp. (Euphorbiaceae), North America – *Euphorbia corollata* (USA, IA).

Notes: Var. *didymum* differs from var. *fasciculatum* in having usually 1-septate conidia (more than 90 %).

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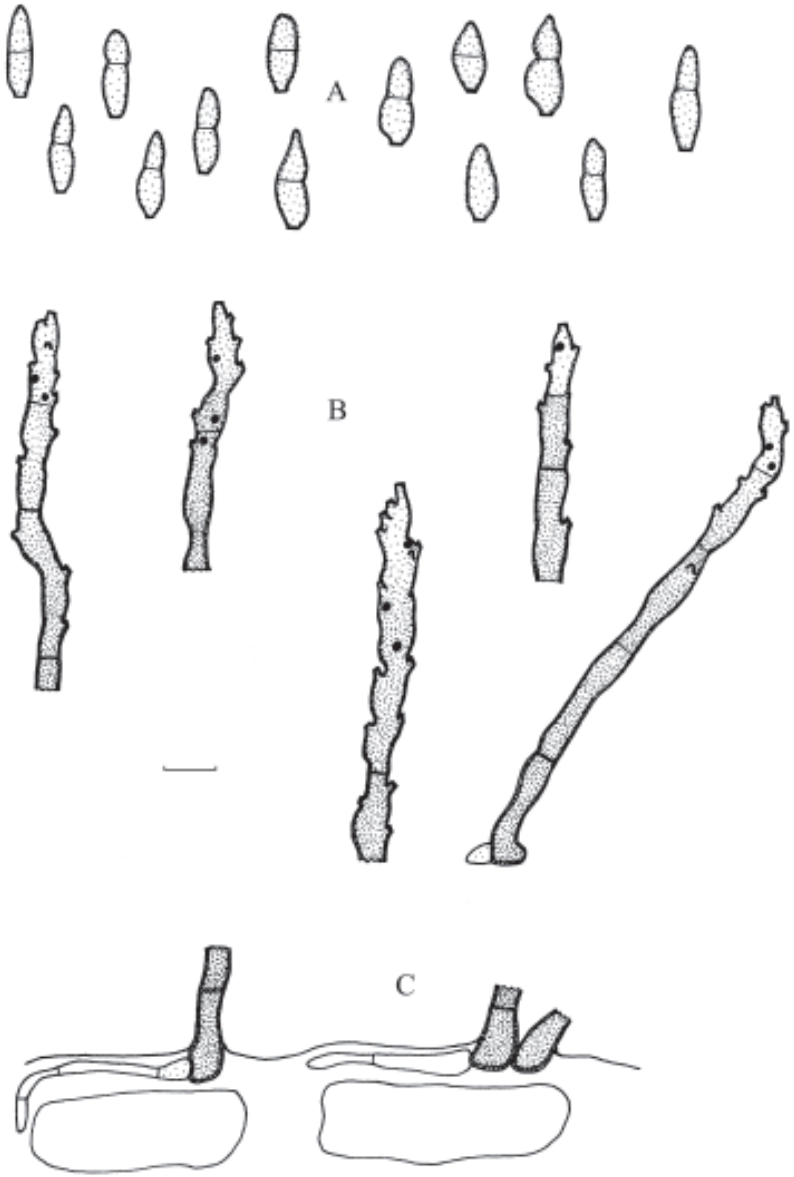

Fig. 21: *Fusicladium fasciculatum* var. *didymum*. A – conidia, B – conidiophores, C – mycelium and base of conidiophores, scale = 10 µm, K. Schubert del.

10.2.20. *Fusicladium fautreyi* Deighton, Mycol. Pap. 112: 25 (1967) Fig. 22

Holotype: on *Euphorbia brittingeri* (= *Euphorbia verrucosa*), France, May 1895, F. Fautrey, Roum., F. sel. exs. 6829 (G).
Teleomorph: Unknown.
Ill.: DEIGHTON (1967: 26, Fig. 12).
Exs.: Roum., F. sel. exs. 6829.

On dry stems, numerous discrete, oblong, greyish brown dots, densely scattered over the whole surface. Colonies forming small blackish tufts on the greyish brown spots. Mycelium subcuticular. Stromata 60–110 µm diam., composed of dark olivaceous-brown, thick-walled cells. Conidiophores densely fasciculate, arising from stromata, erumpent through the cuticle, erect, more or less straight, unbranched, 30–90 × 4–6 µm, septate, dark olivaceous-brown, somewhat paler towards the apex, smooth. Conidiogenous cells integrated, terminal, with a single to several conidiogenous loci, proliferation sympodial, loci conspicuous, slightly prominent, not or only very slightly thickened, not darkened. Conidia solitary, obclavate to fusiform, straight, 11–20.5 × 4–5.5 µm, 0–1-septate, lower cell mostly larger than the upper one, very rarely with three septa, not or only very slightly constricted at the septa, pale olivaceous, slightly verruculose, apex pointed, truncate at the base, hilum truncate to slightly convex, 1.5–2.5 µm wide, unthickened, not darkened.

Hosts and Distribution: only known from the type collection.

Notes: This species resembles *Fusicladium euphorbiae*, but differs in having more robust, thick-walled, darker conidiophores, thick-walled, dark brown stromatic cells and somewhat shorter and wider conidia, consistently formed singly. Additional collections and molecular data are necessary to prove the true status of *F. fautreyi* and its affinity to *F. euphorbiae*.

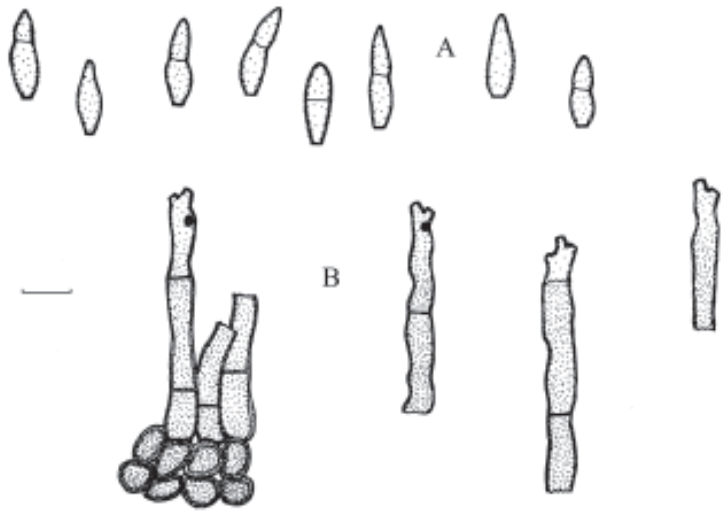

Fig. 22: *Fusicladium fautreyi*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

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10.2.21. ***Fusicladium fraxini*** Aderh., Hedwigia 36: 74, 83* (1897) [*erroneously as *Fusicladium tremulae*] Fig. 23

Neotype: on leaves of *Fraxinus ornus*, Italy, prov. Verona, Tregnago, May 1913, C. Massalongo, Kab. & Bub., F. imp. exs. 794 (B), selected here; isoneotypes: Kab. & Bub., F. imp. exs. 794 (e.g., BPI, W).
≡ *Spilocaea fraxini* (Aderh.) Sivan., Biblioth. Mycol. 59: 65 (1977).
= *Scolecotrichum fraxini* Pass., Erb. Critt. Ital., Ser. II. 1395 (1884); syntype: on leaves of *Fraxinus ornus*, Italy, Parma, Vigheffio, Estate, G. Passerini, Erb. Critt. Ital., Ser II. 1395 (e.g., M).
= *Actinonema fraxini* Allesch., Bot. Centralbl. 2: 44 (1890); syntype: on leaves of *Fraxinus excelsior*, Germany, Munich, Isardamm, Sept. 1897, Allescher (M).
= *Fusicladium granulosum* Pass., in herb. (B).
Teleomorph: *Venturia fraxini* Aderh., Hedwigia 36: 83 (1897).
Lit.: LINDAU (1907: 787, 798), FERRARIS (1912: 326), VASSILJEVSKY & KARAKULIN (1937: 193), SIVANESAN (1984a: 614), SAGDULLAEVA (1990: 54).
Ill.: ADERHOLD (1897: Tab. 4, Fig. 6), SIVANESAN (1977: 67, Fig. 33; 1984a: 615, Fig. 371).
Exs.: Briosi & Cav., F. paras. 297; Erb. Critt. Ital. 1395; Herb. Mycol. Rom. 293; Kab. & Bub., F. imp. exs. 93, 794; Petr., Fl. Bohem. Morav. exs. 782b; Rabenh., F. eur. 943; Syd., Mycoth. march. 2928; Vestergr., Micromyc. rar. sel. exs. 950.

Leaf spots amphigenous, circular, oval to angular–irregular, up to 10 mm wide, ochraceous, yellowish to olivaceous-brown on the upper leaf surface, paler below, surrounded by a medium to dark brown, narrow margin, often marginal and fragile. Colonies amphigenous, punctiform, mainly spread along leaf veins, dark olivaceous to blackish. Stroma subcuticular to intraepidermal, 10–100 µm diam., composed of relatively large, olivaceous to medium brown swollen cells, 2–7 µm diam., forming expanded layers. Conidiophores aggregated in loose to dense fascicles, sometimes sporodochial or solitary, arising from the stromata, mostly erect, straight to geniculate, flexuous, subcylindrical to conical, unbranched, (5–)12–35(–100) × 3–5 µm, 0(–1)-septate, pale olivaceous to medium brown, smooth, often swollen at the base, up to 7 µm wide. Conidiogenous cells integrated, terminal or conidiophores usually reduced to conidiogenous cells, proliferation sympodial with one to several loci, or percurrent with several distinct, transverse annellations or both types of proliferation mixed, loci subdenticulate, 1–2 µm wide, unthickened, not or at most slightly darkened–refractive. Conidia solitary, fusiform to obclavate, straight to slightly curved, 12–28 × 4–6(–7) µm, (0–)1(–3)-septate, not or only slightly constricted at the septa, septa more or less median or somewhat in the lower half, subhyaline, pale olivaceous to olivaceous-brown, walls somewhat thickened, attenuated towards apex and base, apex often oblong–pointed, truncate at the base, hila 1–2 µm wide, unthickened, slightly darkened–refractive.

Hosts and Distribution: on *Fraxinus* spp. (Oleaceae), Asia, Caucasus, Europe, North America – *Fraxinus angustifolia* (Europe, RO), *F. excelsior* (Asia, Central Asia, Uzbekistan; Caucasus, Armenia, Georgia; Europe, CZ, D, EW, GB, LV, RO, RUS, Ukr.), *F. ornus* (Europe, I, RO), *F. raibocarpa* (Asia, Russia, Tadzhikistan), *F. sogdiana* (Central Asia, Uzbekistan), *Fraxinus* spp. (Central Asia, Uzbekistan; Caucasus, Armenia; Europe, EW, H, LV, RO, Ukr.; North America, USA, FL).

Material examined: collections from B, HBG, IMI, LE, M.

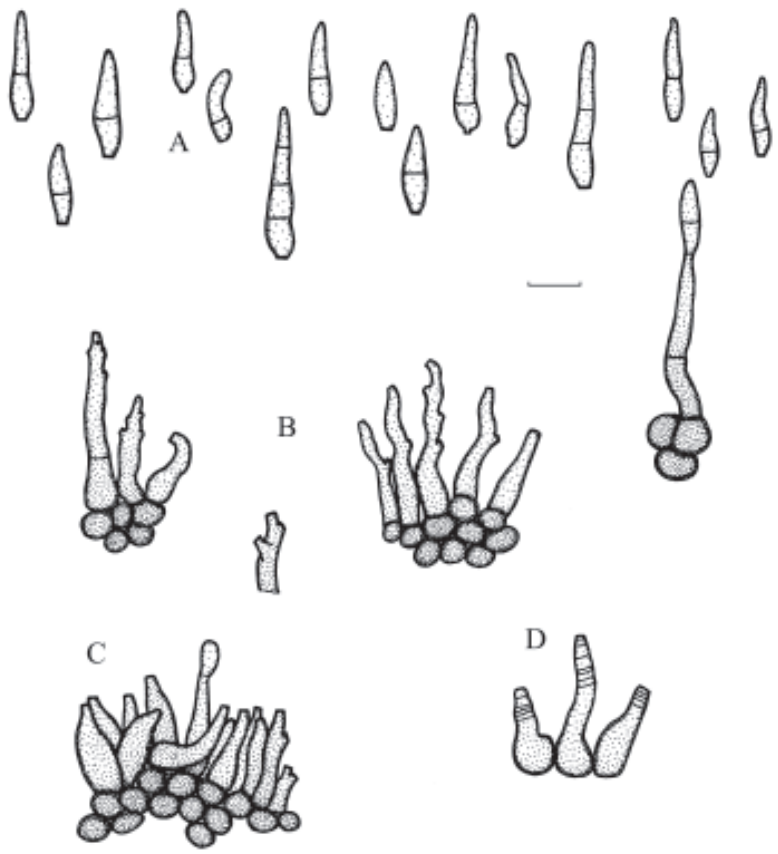

Fig. 23: *Fusicladium fraxini*. A – conidia, B – sympodially proliferating conidiogenous cells, C – conidiophores, arranged in a sporodochium, mostly with a single locus, D – percurrently proliferating conidiogenous cells, scale = 10 µm, K. Schubert del.

Notes: ADERHOLD (1897) described a new species of *Fusicladium* on *Fraxinus* and called it repeatedly (pp. 74–76) *Fusicladium fraxini*, but the original diagnosis was erroneously connected with the name *F. tremulae*, which is a synonym of *Pollaccia radiosa*, a *Venturia*-anamorph occurring on *Populus* spp. This is undoubtedly a correctable mistake. A neotype is proposed since Aderhold´s type material is not preserved. Detailed studies on the structure of the conidiogenous cells and loci showed that percurrent and sympodial proliferations can occur within a single collection, so that this species has to be considered intermediate between *Fusicladium* s.str. and *Spilocaea*. *Fusicladium fraxini* var. *phillyreae* Trotter, in Pamp. (Nuovo Giorn. Bot. Ital. 31: 233, 1924), described on *Phillyrea media* from Libya, is probably not conspecific with *Spilocaea phillyreae*, but type material could not be traced.

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10.2.22. ***Fusicladium grayianum*** (Ellis) Deighton & M.B. Ellis, in Deighton, Mycol. Res. 94(8): 1097 (1990) Fig. 24

≡ *Isariopsis grayiana* Ellis, Bull. Torrey Bot. Club 9: 98 (1882); holotype: on dead stems of *Rubus villosus*, USA, Pa., West Chester, Oct. 1881, J.B. Gray (NY); isotypes: Ell., N. Am. F. 818 (e.g., IMI 92619).

≡ *Phaeoisariopsis grayiana* (Ellis) Ferraris, Ann. Mycol. 7: 280 (1909), as '*grayana*'.

Teleomorph: Unknown.

Ill.: DEIGHTON (1990: 1097, Fig. 1).

Exs.: Ellis, N. Am. F. 818.

Colonies on stems, effuse, tufted, dark blackish brown. Mycelium immersed, hyphae branched, 1.5–3 µm wide, septate, pale brown, wall smooth. Stromata mostly immersed, pseudoparenchymatous, 16–60 µm wide, 20–40 µm high, brown or dark brown. Conidiophores usually aggregated in dense fascicles, arising from the upper cells of the stromata, erect, flexuous, unbranched, 80–280 × 2.5–4 µm, pluriseptate, brown, dark near the base, paler towards the apex, mostly smooth, the upper part occasionally wrinkled or verruculose. Conidiogenous cells integrated, terminal, with a single or several scattered, subdenticulate conidiogenous loci, proliferation sympodial, loci unthickened, not or only very slightly darkened. Conidia solitary, cylindrical to short obclavate, straight or slightly curved, 6–14 × 2.5–4 µm, 0–1-septate, pale olivaceous, smooth to verruculose, rounded at the apex, base 0.5–1 µm wide, hila unthickened, not or only very slightly darkened–refractive.

Hosts and Distribution: on *Rubus* spp. (Rosaceae), North America – *Rubus villosus* (USA, PA), *Rubus* spp. (USA, PA).

Material examined: on *Rubus* sp., USA, Pa., Catoctin, Jun. 1940, J.A. Stevenson (M).

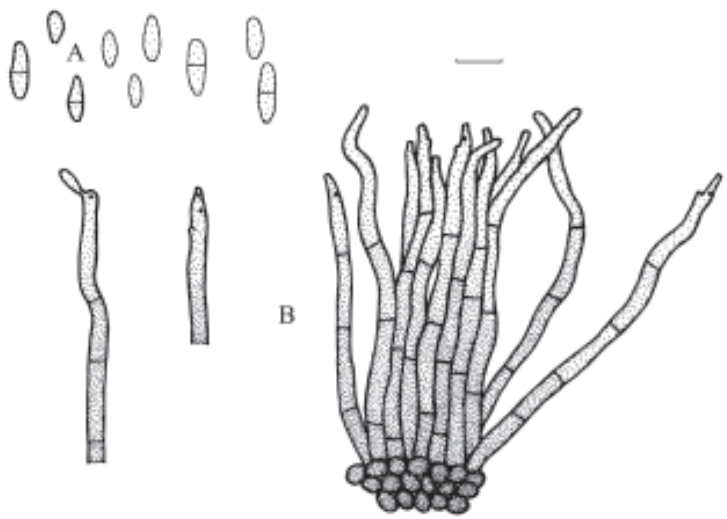

Fig. 24: *Fusicladium grayianum*. A – conidia, B – dense fascicle of conidiophores, scale = 10 µm, K. Schubert del.

10.2.23. ***Fusicladium heveae*** K. Schub. & U. Braun, in Crous & Braun, *Mycosphaerella* and its anamorphs: 1. Names published in *Cercospora* and *Passalora*. CBS Biodiversity Series 1: 481 (2003) Fig. 25

≡ *Fusicladium macrosporum* Kuyper, Recueil Trav. Bot. Néerl. 8: 374 (1911), non *Fusicladium macrosporium* Bonord., 1864; neotype: on *Hevea brasiliensis*, British Guiana, Araka R., Issorora, Feb. 1926, Alison (IMI 18583), selected here.

= ?*Passalora heveae* Massee (nom. nud.) sensu Stahel, Bull. Dept. Landb. Suriname 34: 34 (1917).

Teleomorph: *Microcyclus ulei* (Henn.) Arx, in Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 373 (1962).

Lit.: CMI Descr. (No. 225), ELLIS (1976: 239), SIVANESAN (1984a: 180–182).

Ill.: KUYPER (1912, Fig. 93), STAHEL (1917: Pl. 12, 1–2, Pl. 14, 1–10, Pl. 18, 1, Pl. 25, 1–3), CMI Descr. (No. 225, Fig. A), ELLIS (1976: 240, Fig. 180), SIVANESAN (1984a: 183, Fig. 93).

On leaves, stems, petioles, inflorescences, flowers and young fruits, leaf spots amphigenous, variable in shape and size, up to 15 mm wide, greyish brown, scattered on the leaf surface, occasionally confluent, sometimes somewhat raised. Colonies effuse, greyish, powdery. Mycelium immersed, subepidermal. Stromata composed of loosely to densely aggregated, yellowish brown, thick-walled cells, 6–11 µm diam. Conidiophores loosely to densely fasciculate, arising from stromata, erect, straight or somewhat flexuous, sometimes geniculate, unbranched, 15–140 µm long, but usually less than 50 µm, 4–7 µm wide, at first non-septate with a subglobose base, later septate, pale olivaceous, mostly smooth, rarely somewhat rough-walled. Conidiogenous cells integrated, terminal, with 1–4 loci, proliferation sympodial, loci only slightly denticulate, 2–4 µm wide, often somewhat convex, unthickened, not darkened. Conidia solitary, obclavate, sometimes straight, usually curved to sigmoid, 15–65 × 6–11 µm, usually (0–)1-septate, somewhat constricted at the septa, hyaline to pale olivaceous, smooth to minutely verruculose, walls thin-walled or only slightly thickened, broadest part in the lower third, attenuated towards the apex, truncate at the base, hilum 2–4 µm wide, unthickened, not or only very slightly darkened–refractive.

Hosts and Distribution: on *Hevea* spp. (Euphorbiaceae), South America – *Hevea benthamiana* (Brazil), *H. brasiliensis* (Brazil, British Guiana, Columbia, Peru, Trinidad), *H. guianensis* (CMI Descr. 225: South America), *H. spruceana* (CMI Descr. 225: South America), *Hevea* spp. (South America, Trinidad).

Material examined: on *Hevea* sp., Trinidad, 1 Feb. 1980, Kheng Hoy Chee (IMI 247065); on *Hevea brasiliensis*, Trinidad, 6 Feb. 1969, T. Mungal (IMI 137417); on *Hevea brasiliensis*, Trinidad, 22 Jun. 1962, P. Holliday (IMI 134624); on *Hevea brasiliensis*, Trinidad, Balandra, Mar. 1961, C.L.A. Leakey (IMI 87945).

Notes: Type material of this species could not be traced and is probably not preserved, so that a neotypification is proposed. The epitheta "macrosporum" and "macrosporium" are confusable and must be treated as homonyms (ICBN, Art. 64.2). Therefore, a new name was introduced for *Fusicladium macrosporum* Kuyper. STAHEL (1917) and MÜLLER & ARX (1962) listed *Scolecotrichum heveae* Vincens (Cah. Pathol. Vég. Entomol. Agric. 2: 17, 1915) as synonym, but, according to the original description, the latter name does not agree with *Fusicladium heveae* (conidiophores much longer, 150–200 µm, and conidia formed in chains).
Fusicladium heveae is an unusual species, since its teleomorph, *Microcyclus ulei*, is placed into the Mycosphaerellaceae (KIRK et al. 2001) and not into the Venturiaceae. Additional examinations, including molecular studies, are necessary to find the true affinity of this fungus. The anamorph of *Microcyclus ulei* is tentatively maintained in *Fusicladium* since it is morphologically indistinguishable from other species of this genus.

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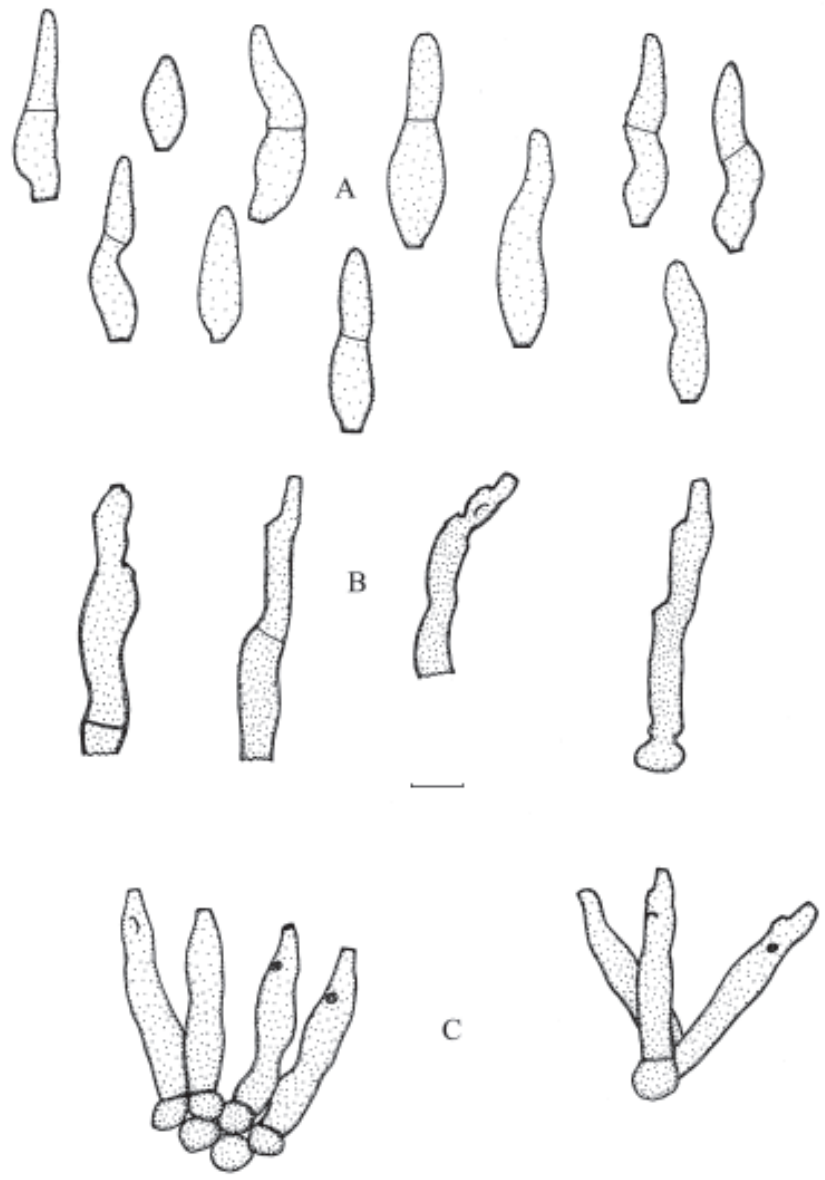

Fig. 25: *Fusicladium heveae*. A – conidia, B – conidiogenous cells, C – conidiophores in loose fascicles, scale = 10 µm, K. Schubert del.

10.2.24. *Fusicladium humile* (Davis) K. Schub. & U. Braun, IMI Descriptions of Fungi and Bacteria 152, No. 1520 (2002) Fig. 26

≡ *Cladosporium humile* Davis, Trans. Wisconsin Acad. Sci. 19: 702 (1919); lectotype: on *Acer rubrum*, USA, Wisconsin, Luck, 25 Aug. 1916, J.J. Davis (WIS), selected here; isolectotype: BPI 427214.
≡ *Fusicladosporium humile* (Davis) Partridge & Morgan-Jones, Mycotaxon 85: 366 (2003).
Teleomorph: *Venturia acerina* Plakidas ex M.E. Barr, Canad. J. Bot. 46: 814 (1968).
Lit.: PLAKIDAS (1942: 35), ELLIS (1976: 340), SIVANESAN (1977: 26–27), PARTRIDGE & MORGAN-JONES (2003: 366).
Ill.: PLAKIDAS (1942: 30, Fig. 2), ELLIS (1976: 340, Fig. 258), SIVANESAN (1977: 26, Fig. 2; 1984a: 607, Fig. 364), IMI Descr. (No. 1520, Figs A–C), PARTRIDGE & MORGAN-JONES (2003: 365, Fig. 3).

Leaf spots (only associated with the anamorph) amphigenous, variable in shape and size, subcircular to angular, 0.5–20 mm wide, dark reddish brown on upper leaf surface, greyish below, sometimes zonate, margin irregular, pale grey. Mycelium internal, hyphae subhyaline to pale brown, rough-walled, septate, forming mainly subcuticular net-like aggregations, effuse. Colonies amphigenous, punctiform to subeffuse, dark. Stromata 35–80 µm diam., composed of thick-walled, brown cells, 4–10 µm wide. Conidiophores solitary, arising from internal or external, superficial hyphae or swollen hyphal cells, or formed in loose fascicles arising from stromata, erect to flexuous, straight to geniculate, unbranched or occasionally branched, 15–70 × 3.5–6 µm, septate, olivaceous to pale brown, smooth, wall somewhat thickened. Conidiogenous cells integrated, terminal or intercalary, with a single or several denticle-like conidiogenous loci, proliferation sympodial, loci unthickened, not or only slightly darkened–refractive. Conidia catenate, in simple or branched chains, cylindrical or fusiform, straight or slightly curved, 10–29 × 4–7 µm, 0–2(–3)-septate, not or somewhat constricted at the septum, pale olivaceous to medium brown, smooth, attenuated towards apex and base, apex pointed or truncate, base truncate, hila 1–3(–3.5) µm wide, unthickened, not darkened.

Hosts and Distribution: on *Acer* spp. (Aceraceae), North America – *Acer negundo* (USA), *A. nigrum* (USA), *A. rubrum* (Canada, NB., Nfld., Ont.; USA, AL, MI, NY, WI), *A. saccharinum* (USA, NC, WI), *A. saccharum* (Canada, Ont.), *A. spicatum* (BARR 1968: USA).

Material examined: collections from WIS.

Notes: The teleomorph was described and illustrated in detail by BARR (1968) and SIVANESAN (1977, 1984a). Due to the structure of the conidiogenous loci and conidial hila, *Cladosporium humile* has to be excluded from *Cladosporium* and assigned to *Fusicladium*, which is consistent with its connection with a *Venturia* teleomorph. The report of *Cladosporium humile* from India (Kashmir) on *Populus* (BEIG & KHAN 1999) probably refers to either *Fusicladium martianoffianum* or *F. romellianum*.

10.2.25. *Fusicladium junci* Sawada ex K. Schub. & U. Braun **sp. nov.** Fig. 27

≡ *Fusicladium junci* Sawada, Rep. Gov. Res. Inst. Formosa 86: 162 (1943), nom. inval. (without Latin diagnosis).
Holotype: on *Juncus prismatocarpus*, Taiwan, K. Sawada (NTU-PPE) [= National Taiwan University, Dept. of Plant Pathology and Entomology].
Teleomorph: Unknown.
Ill.: SAWADA (l.c.: Figs 34–35).

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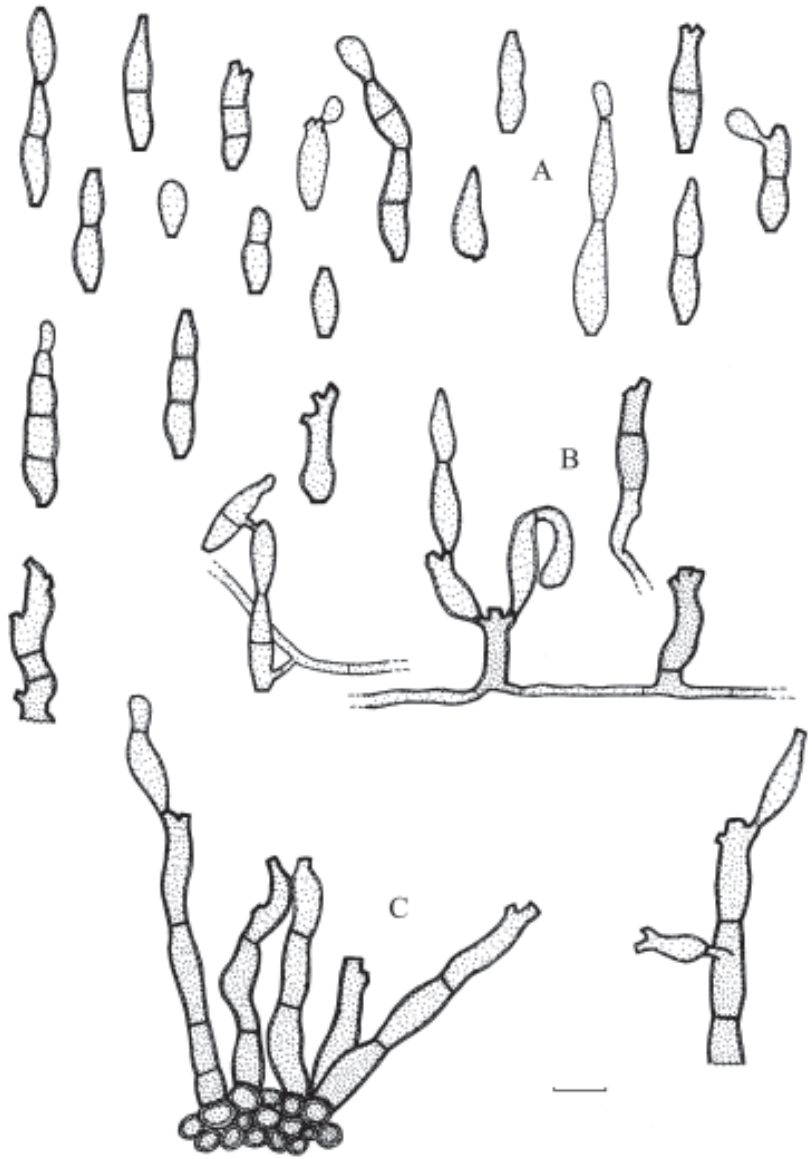

Fig. 26: *Fusicladium humile.* A – conidia, B – conidiophores arising from hyphae, C – loose fascicle of conidiophores arising from stromata, scale = 10 µm, K. Schubert del.

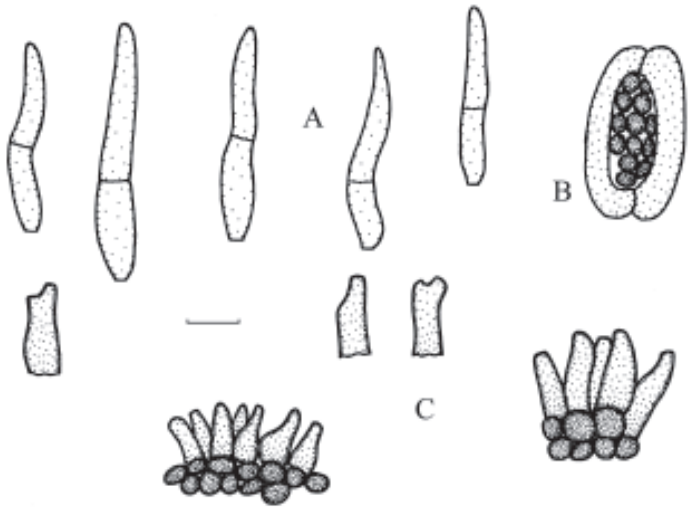

Fig. 27: *Fusicladium junci.* A – conidia, B – stromata substomatal arranged, C – dense fascicles of conidiophores, scale = 10 µm, K. Schubert del.

Maculae indefinitae, diffusae, brunneae. Coloniae amphigenae, punctiformes, brunneae. Mycelium immersum. Stromata nulla vel bene evoluta, substomatalia, oblonga, 20–40 × 10–20 µm, brunnea, ex cellulis, 3–6 µm latis, brunneis, leniter crassitunicatis composita. Conidiophora fasciculata, pauca, per stoma emergentia, cylindrica–conica, recta, erecta, non-ramosa, 5–15(–38) × 4–7(–9) µm, pallide brunnea, levia. Cellulae conidiogenae monoblasticae, determinatae vel polyblasticae, sympodiales; loci truncati, 1.5–2.5 µm lati, non-incrasati, non-fuscati, interdum refractivi. Conidia solitaria, obclavata vel cylindrica, recta, (26–)30–50(–57) × 4–6 µm, 1-septata, leniter constricta, subhyalina vel pallide flavissima-viridula vel olivacea, levia, apice obtuso, rotundato, basi obconice truncata, 1.5–2.5 µm lata, hila non-incrassata, non-fuscata.

On necrotic brown leaves, sheaths and stems, leaf spots indefinite, diffuse, brown. Colonies amphigenous, punctiform, brown. Mycelium internal. Stromata absent to well-developed, substomatal, oblong, 20–40 × 10–20 µm, brown, stromatic cells 3–6 µm diam., brown, with slightly thickened walls. Conidiophores in small, more or less dense fascicles, emerging through stomata, cylindrical–conic, straight, erect, unbranched, 5–15(–38) × 4–7(–9) µm, aseptate, pale brown, smooth, conidiophores usually reduced to conidiogenous cells. Conidiogenous cells unilocal (monoblastic), determinate or with two conidiogenous loci, sympodial, loci flat, 1.5–2.5 µm wide, unthickened, not darkened, but sometimes somewhat refractive. Conidia solitary, obclavate to cylindrical, straight, (26–)30–50(–57) × 4–6 µm, 1-septate, slightly constricted at the septa, subhyaline to very pale yellowish-greenish or olivaceous, smooth, apex obtuse, rounded, base obconically truncate, hila flat, 1.5–2.5 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Juncus* spp. (Juncaceae), Taiwan – *Juncus prismatocarpus* (Taiwan).

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10.2.26. *Fusicladium lathyrinum* (Ellis & Galloway) S. Hughes & Piroz., Canad. J. Bot. 50(12): 2528 (1972) Fig. 28

≡ *Dicoccum lathyrinum* Ellis & Galloway, J. Mycol. 5: 65 (1889), as '*lathyrmum*'; holotype: on *Lathyrus ochroleucus*, USA, Montana, Highwood Mts., Highwood Canyon, 18 Jun. 1888, R.S. Williams, Parasitic Fungi of Montana 301 (NY); isotype: DAOM 130903 (permanent slide).

Teleomorph: Unknown.

Ill.: HUGHES & PIROZYNSKI (1972: 2528, Fig. 3).

Leaf spots amphigenous, on the upper leaf surface forming yellowish discolorations, on the lower side almost white, sunken. Colonies hypophyllous, dense, caespitose, dark yellowish brown, velvety. Mycelium immersed, subcuticular to intraepidermal, composed of irregular, colourless, thin-walled hyphae, branched in the mesophyll, aggregated in the epidermis, and giving rise to widely extended, compact layers of conidiogenous cells. Conidiophores reduced to conidiogenous cells, erumpent through the outer wall of the epidermis and the cuticle, cylindrical, narrowly clavate or ovoid, erect, unbranched, 4–18 × 4–7 µm, aseptate, subhyaline to very pale brown, smooth, thin-walled, except for the apex, which has a thicker brown wall, mostly with two or three loci, proliferation sympodial, loci denticulate, flat, about 3 µm wide, not or only slightly thickened and darkened. Conidia solitary, ellipsoid, subcylindrical to obclavate, straight, 15–28 × 6–10 µm, 0–1-septate, constricted at the septa, septa thin, inconspicuous, at first hyaline, later pale olivaceous, coarsely verrucose, rounded at the base, with a flat, broad, not or only slightly thickened, not or only very slightly darkened hilum, 3 µm wide.

Hosts and Distribution: only known from the type collection.

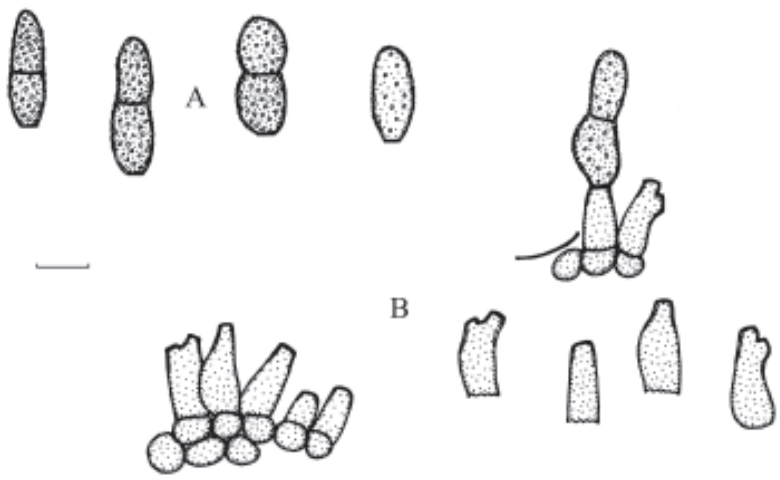

Fig. 28: *Fusicladium lathyrinum*. A – conidia, B – conidiogenous cells, scale = 10 µm, K. Schubert del.

10.2.27. *Fusicladium levieri* Magnus, in Sommier & Lévier, Trudy Imp. S.-Peterburgsk. Bot. Sada 16: 543 (1900) Fig. 29

Holotype: on *Diospyros lotus*, Caucasus, Georgia, Batum, in Silvis litoris Euscini, 16 Jun. 1890 (HBG).

≡ *Ragnhildiana levieri* (Magnus) Vassiljevsky, in Vassiljevsky & Karakulin, Parazitnye nesovershennye griby, Ch. I. Gifomitsety: 373 (1937).

≡ *Cladosporium levieri* (Magnus) Hara, Agric. & Hort. 12: 2706 (1937).

≡ *Phaeoramularia levieri* (Magnus) U. Braun, in Braun & Melnik, Trudy Bot. Inst. Komarova (St. Petersburg) 20: 69 (1997).

= *Fusicladium kaki* Hori & Yoshino, Bot. Mag. (Tokyo) 19: 220 (1905).

= *Fusicladium diospyri* Chona, Munjal & J.N. Kapoor, Indian Phytopathol. 9: 129 (1956); type: on *Diospyros kaki*, India, U. P., Saharanpur (HCIO?).

= *Fusicladium diospyri* Hori & Yoshino in herb. (B).

Teleomorph: Unknown.

Lit.: SACCARDO (1902: 1056), SUBRAMANIAN (1971: 235), SCHOLLER et al. (2003).

Ill.: VASSILJEVSKY & KARAKULIN (1937: 373, Fig. 32), BRAUN & MELNIK (1997: Fig. 38), SCHOLLER et al. (2003: Figs 1–2).

Exs.: Herb. Mycol. Rom. 1195; Kab. & Bub., F. imp. exs. 845.

Leaf spots amphigenous, subcircular to angular–irregular, 1–5 mm wide, centre greenish brown or ochraceous to greyish white, surrounded by a small to fairly broad,

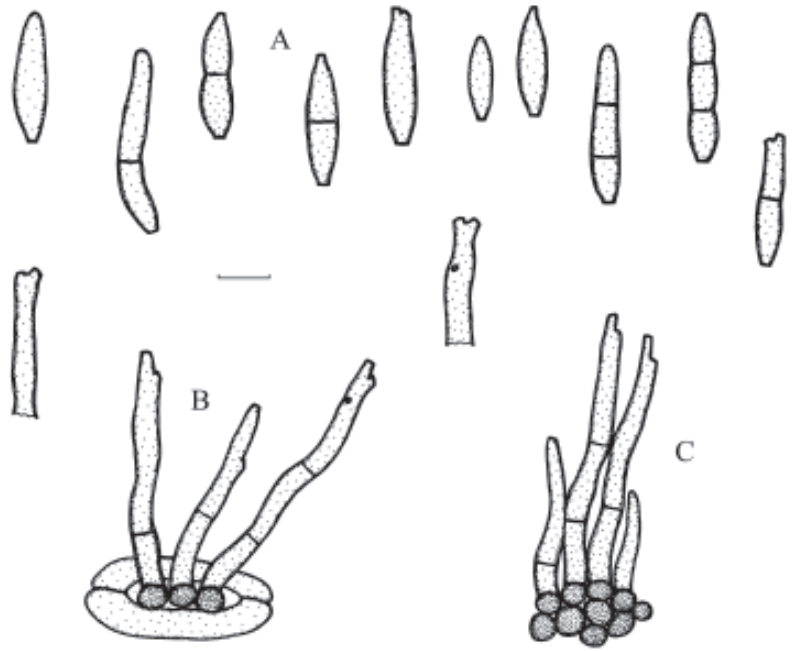

Fig. 29: *Fusicladium levieri*. A – conidia, B – conidiophores emerging through a stoma, C – conidiophores arising from stromatic hyphal aggregations, scale = 10 µm, K. Schubert del.

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dark, often almost blackish margin, sometimes with a wide, somewhat discoloured halo, scattered on the leaf surface. Colonies amphigenous, mainly hypophyllous, inconspicuous to punctiform, dark, fructification mostly sparse. Mycelium internal, immersed, hyphae branched, septate, pigmented. Stromata absent or as small, brown hyphal aggregations, substomatal or intraepidermal. Conidiophores solitary or usually in small, loose to dense fascicles, arising from internal hyphae or stromatic hyphal aggregations, erumpent through the cuticle or emerging through stomata on the lower leaf surface, erect to flexuous, straight to geniculate–sinuous, unbranched or rarely branched, 10–70 × 3–8 µm, 0–3-septate, pale olivaceous to pale brown, smooth, walls somewhat thickened. Conidiogenous cells integrated, terminal, with a single to only few conidiogenous loci, proliferation sympodial, loci 1.5–3 µm wide, inconspicuous, unthickened or almost so, occasionally somewhat darkened. Conidia catenate, in simple, occasionally in branched chains, subcylindrical, ellipsoid to fusiform, straight, 13–40 × 3–7 µm, 0–2-septate, sometimes slightly constricted at the septa, pale olivaceous, smooth, ends obtuse or obconically truncate, hila 1.5–3 µm wide, unthickened or almost so, occasionally somewhat darkened.

Hosts and Distribution: on *Diospyros* spp. (Ebenaceae), Asia, Caucasus, Europe, North America – *Diospyros kaki* (Asia, China, India, Japan; Caucasus, Georgia; Europe, RO), *D. lotus* (Caucasus, Georgia), *D. virginiana* (North America, USA, CT, FL, IN, MS).

Material examined: on *Diospyros kaki*, Japan, Miyazaki, Houzyô-mati, 30 May 1935, M. Ebihara (B); on *Diospyros lotus*, Anbrevsky, 2 Aug. 1915, V. Semaschk (LE 161233); on *Diospyros virginiana,* USA, Indiana, Vigo County, Terre Haute, Persimmon Street, J. Lehman, 26 Jun. 2002 (PUR 1680).

Notes: Höhnel (1919: 156) introduced the new genus *Hormocladium* based on *Fusicladium kaki*. Braun, in Braun & Melnik (1997), transferred *Fusicladium levieri* to *Phaeoramularia*, but detailed examinations of additional collections clearly showed that the fungus from *Diospyros* spp. must be maintained in *Fusicladium*. The conidiogenous loci and conidial hila are occasionally somewhat darkened–refractive, but consistently truncate and unthickened as in other species of *Fusicladium*.

10.2.28. *Fusicladium mandshuricum* (M. Morelet) Ritschel & U. Braun **comb. nov.** Fig. 30

≡ *Pollaccia mandshurica* M. Morelet, Ann. Soc. Sci. Nat. Archéol. Toulon Var 45(3): 218 (1993); holotype: on leaves of *Populus simonii* × *P. nigra*, north-eastern China, Liaoning, 17 Jun. 1992, M. Morelet [PC (PFN 1466)].

= *Pollaccia sinensis* W.P. Wu & B. Sutton, in herb. (IMI).

Teleomorph: *Venturia mandshurica* M. Morelet, Ann. Soc. Sci. Nat. Archéol. Toulon Var 45(3): 219 (1993).

Lit.: Morelet (1993: 218–219), Wu & Sutton (1995: 983–986), Morelet & Sigaud (1996: 11–20).

Ill.: Wu & Sutton (1995: 984, Figs 1–4), Morelet & Sigaud (1996: 16, Fig. 4; 17, Fig. 6).

On living leaves, petioles and twigs, spots circular to irregular, 5–10 mm wide, at first punctiform, later confluent and larger, often vein-limited, at first brown, later silvery white to grey, margin conspicuous, yellowish brown, on the lower leaf surface 3–8 mm wide, grey, margin yellowish brown, infected necrotic tips of shoots often curved, hook-like. Colonies amphigenous, punctiform, scattered to aggregated in groups, dark olivaceous-green to blackish. Mycelium immersed, hyphae branched,

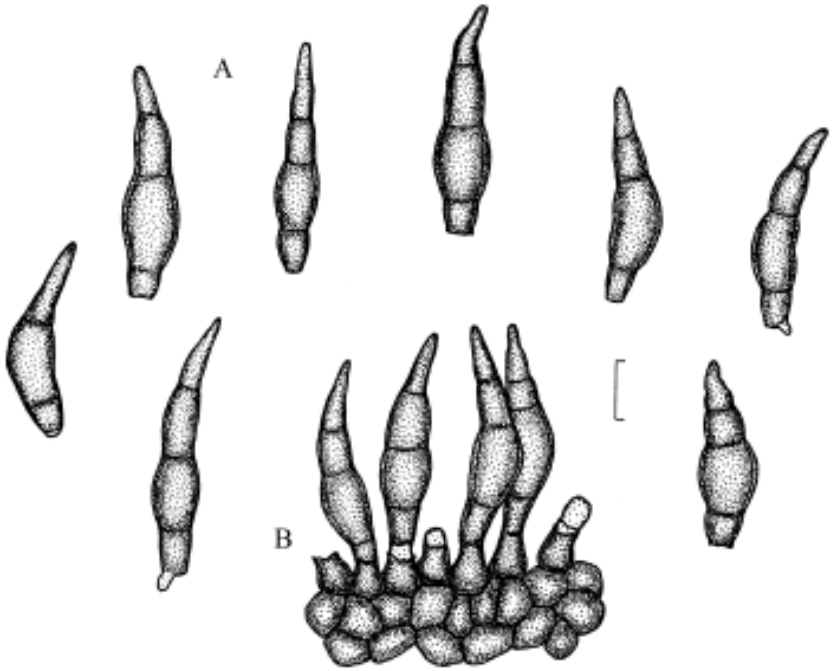

Fig. 30: *Fusicladium mandshuricum*. A – conidia. B – conidiophores with a somewhat irregular rim at the conidiogenous tip, arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

2–3.5 µm wide, septate, brownish. Stroma at first intraepidermal, later subcuticular, 40–80 µm diam., composed of subglobose to slightly angular, brown, relatively thick-walled cells, 4–8 µm diam., aggregated, forming up to three layers. Conidiophores densely fasciculate, arising from the upper cells of the stromata, forming sporodochial conidiomata, erumpent through the cuticle, straight, cylindrical to ampulliform, unbranched, 5–7 × 6–7.5 µm, aseptate, pale to medium olivaceous-brown, smooth, walls somewhat thickened, occasionally swollen at the base, up to 10 µm wide, conidiophores reduced to conidiogenous cells, unilocal, determinate or percurrent, with a single annellation (in culture up to three annellations), annellations with a somewhat irregular, more or less dark rim, loci truncate to slightly convex, 4(–5) µm wide, not to slightly thickened, not darkened. Conidia solitary, fusiform, more or less curved, (27–)30–39(–42) × 6–9(–10) µm, (0–)2–3(–4)-septate, central cell often bulging, more or less constricted at the septa, pale to dark olivaceous-brown, smooth, thick-walled, attenuated towards apex and base, apex pointed, base (hila) truncate to slightly convex, 4(–5) µm wide, not to very slightly thickened, not darkened, occasionally with a small, lateral, subhyaline foot-like projection.

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Hosts and Distribution: on *Populus* spp. (Salicaceae), Asia – *P. simonii* × *P. nigra* and *Populus* spp. (north-eastern China).

Material examined: on *Populus* sp., Asia, China, Waling Shan, 2 Aug. 1986, Wu (IMI 362777), as *Pollaccia sinensis*.

Notes: This species, described as "grey spot disease" of *Populus* spp. in northeast China, was erroneously considered in the older Chinese literature to be *Coryneum populinum* Bres. and the anamorph of *Mycosphaerella mandshurica* Miura. However, MORELET (1993) and MORELET & SIGAUD (1996) examined this fungus in vivo and in vitro and demonstrated that it was an undescribed anamorph of a new species of *Venturia.* WU & SUTTON (1995) depicted the conidiogenous loci with irregular, darkened rims. In the material examined during the course of the present monographic studies, the rims of the loci were less conspicuous. It is to be supposed that this species is more widespread in China and possibly also in the Far East of Russia.

10.2.29. *Fusicladium martianoffianum* (Thüm.) K. Schub. & U. Braun, IMI Descriptions of Fungi and Bacteria 152, No. 1515 (2002) Fig. 31

≡ *Cladosporium martianoffianum* Thüm., Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 55(1): 74 (1880); lectotype: on *Populus laurifolia*, Russia, Siberia, Minussinsk, near river Jenissei, Aug. 1879, N. Martianoff (M), selected here; isolectotype: on *Populus laurifolia*, Russia, Siberia, Minussinsk, Aug. 1879, N. Martianoff, Thüm., Mycoth. univ. 2067 (HAL).

= *Fusicladium asiaticum* Ondřej, Česká Mykol. 27(4): 237 (1973); holotype: on *Populus* sp., Turkmenistan, Tashkentskij U., 1914, Zaprometov (LE 161361).

Teleomorph: Unknown.

Ill.: ONDŘEJ (1973: 238, Fig. 6), IMI Descr. (No. 1515, Figs A–C).

Exs.: Pilzfl. Sib. 474, 653; Thüm., Mycoth. univ. 2067.

Leaf spots amphigenous, subcircular to somewhat angular–irregular, 1–10 mm wide, dirty greenish to dark brown by abundant fructification, margin indefinite. Colonies epiphyllous, punctiform, scattered to dense, sometimes confluent, dark brown. Mycelium subcuticular to intraepidermal, forming swollen, yellowish-brownish, thick-walled cells, 3–10 µm diam., which form conidiophores. Conidiophores solitary or in loose to dense sporodochial aggregations, often confluent, forming dense fascicles or layers, cylindrical to conical or irregularly shaped, erect, straight, 5–35 × 3–10 µm, 0(–1)-septate, olivaceous or medium brown, smooth, wall thin to somewhat thickened, conidiophores mainly reduced to conidiogenous cells. Conidiogenous cells with a single or several conidiogenous loci, subdenticulate, proliferation sympodial, loci 1.5–2.5(–4) µm wide, apex truncate to slightly convex, unthickened, not or only very slightly darkened–refractive. Conidia solitary (primary conidia) or mostly in short, sometimes branched chains, ellipsoid to ovoid, obovoid, subglobose to irregular, 10–22 × (4–)5–9 µm, 0–1(–3)-septate, pale olivaceous to olivaceous, smooth, rarely somewhat rough-walled, thin-walled, attenuated towards apex and base, apex rounded, truncate or pointed, base obconically truncate, with a single hilum, apex with one or two hila, 1–3 µm wide, unthickened, not or only very slightly darkened–refractive.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Asia – *Populus afghanica* (Tadzhikistan), *P. alba* (Kazakhstan, India), *P. ciliata* (India), *P. deltoides* (Kazakhstan, India), *P. italica* (Kazakhstan), *P. laurifolia* (Russia, Siberia), *P. nigra* (Kazakhstan), *P. pruinosa* (Tadzhikistan), *P. suaveolens* (Russia, Siberia), *P. tremula* (Kazakhstan), *Populus* spp. (Kazakhstan, Kirghizia, Uzbekistan, Turkmenistan).

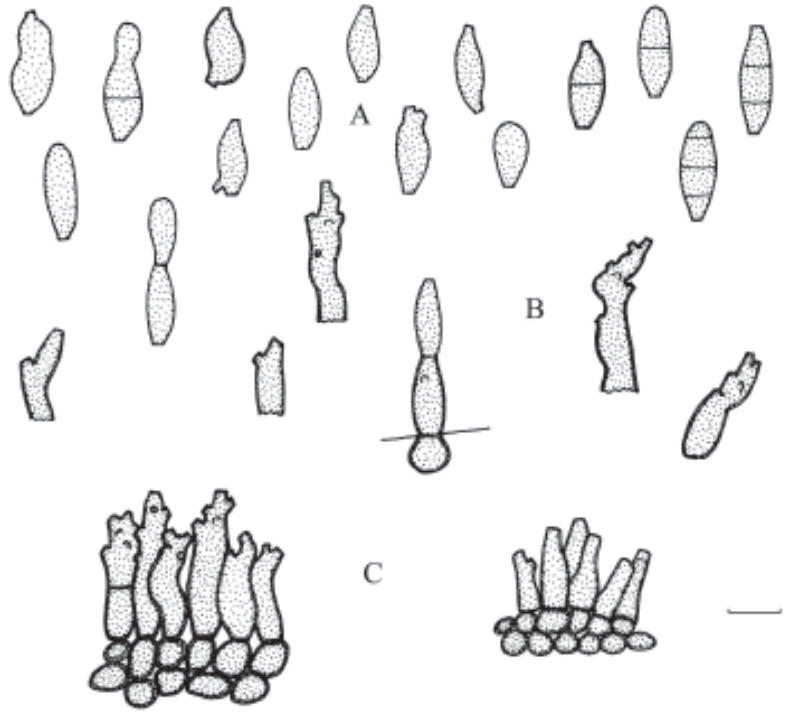

Fig. 31: *Fusicladium martianoffianum*. A – conidia, B – conidiogenous cells, C – dense fascicles of conidiophores, scale = 10 µm, K. Schubert del.

Material examined: on *Populus deltoides*, India, Kashmir, 14 Jul. 1979, A.M. Shah (IMI 240137); on *Populus alba*, India, Chogul, 16 Jun. 1985, A.K. Kuul (IMI 304892).

Notes: The examination of type material of *Cladosporium martianoffianum* and *Fusicladium asiaticum* showed that the two taxa are conspecific. The conidiogenous loci are quite distinct from those of *Cladosporium* species, described and illustrated in detail by DAVID (1997), in that they are denticle-like with an unthickened, non-pigmented wall. SAGDULLAEVA et al. (1990) described '*C. martianoffianum*' with very long conidiophores, up to 110 µm, but the material on which this description was based is undoubted not the present species.

10.2.30. *Fusicladium nashicola* K. Schub. & U. Braun **sp. nov.** Fig. 32

Holotype: on leaves of *Pyrus pyrifolia*, Japan, Tsukuba, Ibaraki, Orchard of the National Institute of Agro-Environmental Sciences, 18 Aug. 2000, H. Ishii (HAL 1749).

Teleomorph: *Venturia nashicola* S. Tanaka & S. Yamam., Ann. Phytopathol. Soc. Japan 29: 136 (1964).

Lit.: ISHII et al. (1992: 293–298), ISHII et al. (1997: 130–133), ISHII & YANASE (2000: 755–759).

Ill.: ISHII & YANASE (2000: 757, Figs 1–2).

Differt a F. pyrorum conidiis brevioribus.

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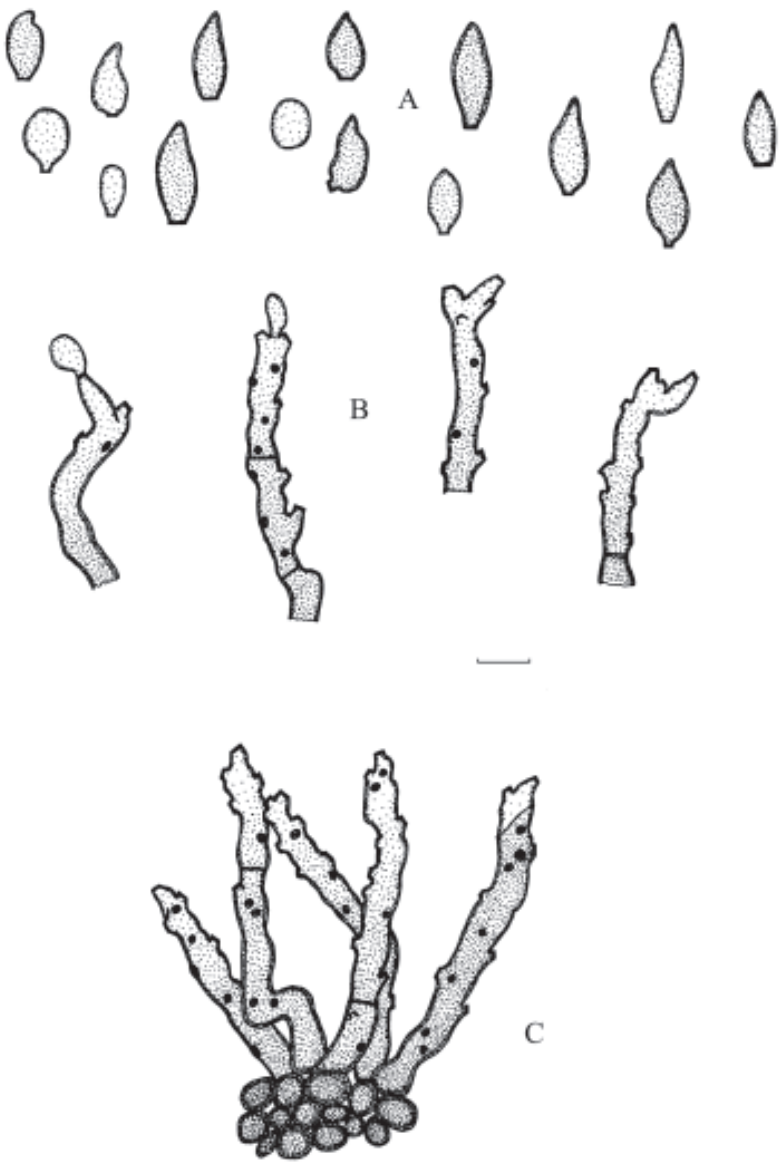

Fig. 32: *Fusicladium nashicola*. A – conidia, B – conidiogenous cells, C – fasciculate conidiophores, scale = 10 µm, K. Schubert del.

Leaf spots amphigenous, pale brown to dark brown, even blackish by abundant fructification. Colonies mostly smaller than 1 mm, but confluent and finally sometimes covering the entire surface of the leaves, often occurring along leaf veins. Mycelium subcuticular. Stromata composed of brown, thick-walled cells, 4–8 µm diam., forming few layers, hyphae branched, 2–3 µm wide, septate, subhyaline to pale olivaceous. Conidiophores loosely to densely fasciculate, arising from stromata, erect to flexuous, geniculate–subnodulose, sinuous, unbranched or rarely branched, 20–70 × 4–6.5 µm, continuous or septate, brown, paler towards the apex, smooth, thick-walled. Conidiogenous cells integrated, terminal or intercalary, with numerous conidiogenous loci, proliferation sympodial, loci denticulate, 1.5–3 µm wide, truncate to slightly convex, unthickened, somewhat darkened–refractive, sometimes with a single percurrent proliferation which is not connected with conidiogenesis. Conidia solitary, subcircular to fusiform, sometimes cylindrical, straight or slightly curved, 9–20(–28) × 5.5–10 µm, aseptate, pale brown, smooth, apex rounded or obtuse to pointed, base truncate or slightly convex, hilum 1.5–3 µm wide, unthickened, somewhat darkened–refractive.

Hosts and Distribution: on leaves of *Pyrus* spp. (Rosaceae), Asia – *Pyrus betulaefolia* (Asia, China), *P. bretschneideri* (China), *P. lindleyi* (China, Taiwan), *P. pyrifolia* (China, Japan, Korea, Taiwan), *P. ussuriensis* (China).

Material examined: on leaves of *Pyrus lindleyi* (= *P. sinensis*), Japan, Tokyo, Shirai, as *F. dentriticum* (B).

Notes: SIVANESAN (1977, 1984a) reduced *Venturia nashicola* to a synonym of *V. pyrina*, but ISHII et al. (1992, 1997) and ISHII & YANASE (2000) found clear morphological, pathological and physiological differences between the fungi on Asian and European pears. *Venturia nashicola* differs from *V. pyrina* in having significantly shorter conidia and shorter, narrower lower cells of the ascospores. The two taxa are also biologically differentiated. *V. nashicola* is confined to Asian pears, and *V. pyrina* occurs on European pears. Molecular data obtained by SCHNABEL et al. (1999) showed that these two taxa are closely allied. However, the data available are not sufficient to determine whether the fungi are two distinct species or two races of a single species. The morphological differences between the two taxa on pears were confirmed during the course of the present monographic studies and, therefore, we prefer to follow the taxonomy of ISHII & YANASE (2000) in keeping two separate species. The anamorph of *Venturia nashicola* has not yet been denominated formally. Since it occurs independently from the teleomorph, we prefer to introduce a separate name for this anamorph.

10.2.31. *Fusicladium nebulosum* (Ellis & Everh.) Ritschel & U. Braun **comb. nov.** Fig. 33

≡ *Dicoccum nebulosum* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1893: 463 (1893); holotype: on *Fraxinus americana*, USA, Wisconsin, Kinosha, 10 Sept. 1893, Davis (NY); isotype: BPI 423603.

≡ *Spilocaea nebulosa* (Ellis & Everh.) S. Hughes & Piroz., Canad. J. Bot. 50(12): 2530 (1972).

Teleomorph: Unknown.

Lit.: SACCARDO (1895: 616).

Ill.: HUGHES & PIROZYNSKI (1972: 2529, Figs 4, 8).

Leaf spots hypophyllous, formed as irregular discolorations. Colonies punctiform, irregular, effuse, confluent, 1–5 mm wide, often formed along veins, at first pale olivaceous-brown, later dark greyish brown to blackish. Mycelium immersed, subcuticular or intraepidermal, hyphae colourless. Conidiophores solitary, erumpent through

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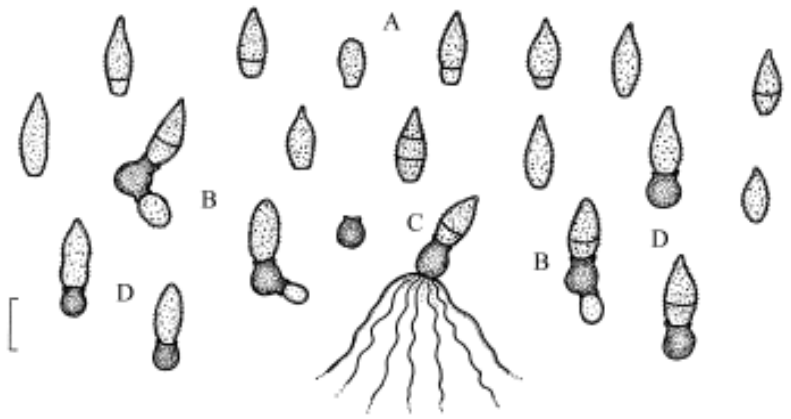

Fig. 33: *Fusicladium nebulosum*. A – conidia, B – sympodially proliferating conidiogenous cell with two loci, C – conidiogenous cell with a single locus erumpent through the epidermis, D – conidiogenous cells, scale = 10 µm, A. Ritschel del.

the cuticle, subglobose, broadly ampulliform to campanulate, 5–12 × 5–7 µm, 0–1-septate, medium olivaceous-brown, smooth, somewhat thick-walled. Conidiophores reduced to conidiogenous cells or conidiogenous cells integrated, terminal, with a single, rarely with two conidiogenous loci, proliferation percurrent, producing a succession of up to 10 single conidia, but annellations not very conspicuous because the conidia may arise and secede at about the same level or even at progressive lower levels. Conidia solitary, fusiform to navicular, straight to somewhat curved, (10–)12–15(–16) × (4–)5–6 µm, 0–1(–2)-septate, septum near the base, pale olivaceous-brown, verruculose to minutely echinulate, pointed at the apex, truncate to somewhat convex at the base, hila (3–)4 µm wide, unthickened, not or only slightly darkened.

Hosts and Distribution: on *Fraxinus* spp. (Oleaceae), North America – *Fraxinus americana* (USA, WI).

Material examined: on *Fraxinus americana*, USA, Wisconsin, Domers, 10 Sept. 1893, J.J. Davis (NY).

Notes: HUGHES & PIROZYNSKI (1972) described conidiogenous cells with up to two conidiogenous loci with percurrent proliferation and this was confirmed during the re-examination of the type material. In this respect, *F. nebulosum* is intermediate between *Fusicladium* s.str. (multilocal, sympodial) and *Spilocaea* (unilocal, percurrent).

10.2.32. *Fusicladium obducens* Pat., Bull. Soc. Mycol. France 9: 161 (1893) Fig. 34

Type: on leaves of *Prunus serotina* (= *P. salicifolia*), South America, Ecuador, Cotocollao, Lagerheim (not seen).
Teleomorph: Unknown.
Lit.: SACCARDO (1895: 618), IMI Descr. (No. 1516).
Ill.: IMI Descr. (No. 1516, Figs A–C).
Exs.: Syd., F. exot. exs. 1234.

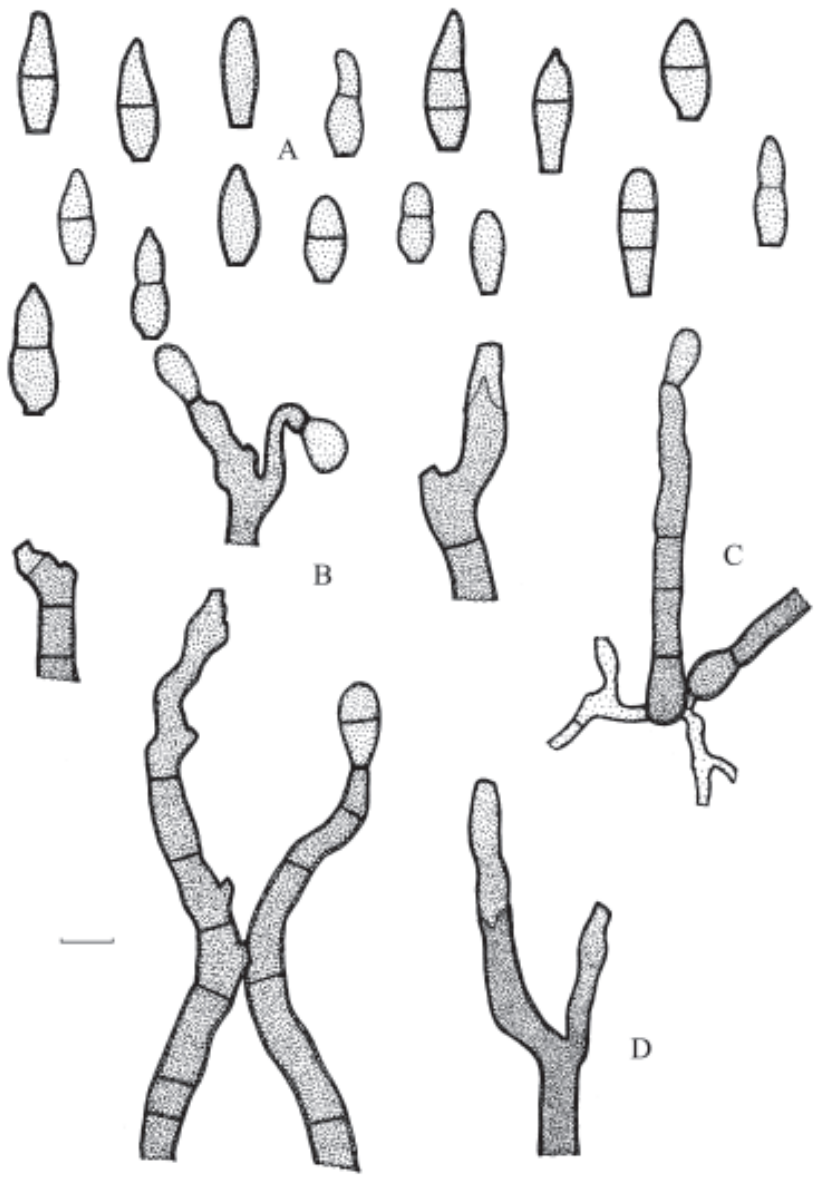

Fig. 34: *Fusicladium obducens*. A – conidia, B – conidiogenous cells, C – conidiophores arising from hyphae, D – branched conidiophore, scale = 10 µm, K. Schubert del.

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Leaf spots lacking or almost so. Colonies epiphyllous, effuse, dendritic, olivaceous-brown to blackish. Mycelium immersed, subcuticular, hyphae branched, 2–3 µm wide, septate, hyaline. Stromata composed of relatively small brown, thick-walled, rough-walled cells, 5–7 µm diam. Conidiophores in loose fascicles arising from stromatic cells or from hyphae, erect, mostly somewhat flexuous or geniculate, unbranched or branched, 40–120 × 6–8 µm, septate, olivaceous to brown, paler towards the apex, smooth, wall somewhat thickened, often with percurrent proliferations which are not connected with conidiogenesis. Conidiogenous cells integrated, terminal or intercalary, proliferation sympodial, with a single or several conidiogenous loci, subdenticulate, 2–4.5 µm wide, wall unthickened, slightly convex, non-pigmented, often with percurrent proliferations which are not connected with conidiogenesis. Conidia solitary, fusiform, obovoid, ellipsoid, straight, (9.5–)12–26 × 6–10 µm, pale to medium brown, 0–1(–2)-septate, not or only slightly constricted at the septa, smooth, apex obtuse, rounded or pointed, obconically truncate at the base, hila 2–4.5 µm wide, unthickened, non-pigmented.

Hosts and Distribution: on *Prunus* spp. (Rosaceae), South America – *Prunus capollin* (Ecuador), *P. serotina* (South America).

Material examined: some duplicates of 'Syd., F. exot. exs. 1234' from herb. B, HBG, M.

Notes: Type material of this species could not be traced at either FH or PC. The present description and illustration are based on duplicates of 'Sydow, Fungi exotici exsiccati 1234' from B, HBG and M.

10.2.33. *Fusicladium oleagineum* (Castagne) Ritschel & U. Braun **comb. nov.**

Fig. 35

≡ *Cycloconium oleagineum* Castagne, Cat. pl. Marseille: 220 (1845), as '*oleaginum*'; lectotype: on leaves of *Olea europaea*, France, Marseille, Castagne (STR), selected here; isolectotypes: on leaves of *Olea europaea*, France, Marseille, Castagne (M; IMI 69757, slide).

≡ *Spilocaea oleaginea* (Castagne) S. Hughes, Canad. J. Bot. 31: 564 (1953).

Teleomorph: Unknown.

Lit.: Briosi & Cavara (F. paras. 223, 1893), Saccardo (1886: 343; 1892: 596; 1895: 616), Lindau (1907: 769–772), Gonzáles Fragoso (1927: 176–179), Ellis (1971: 143), Brandenburger (1985: 489).

Ill.: Briosi & Cavara (F. paras. 223, Fig.), Lindau (1907: 771, Figs 1–4), Gonzáles Fragoso (1927: 177, Fig. 36; 178, Fig. 37), Hughes (1953: 564, Fig. 4), Ellis (1971: 142, Fig. B).

Exs.: Briosi & Cav., F. paras. 223; Kab. & Bub., F. imp. exs. 144.

On living leaves, fruit stalks and fruits, leaf spots amphigenous, subcircular, 5–10 mm wide, pale to greyish brown. Colonies mainly epiphyllous, punctiform or radiating, 3–10 mm wide, below punctiform, 0.1–0.5 mm wide, grey to blackish. Mycelium intraepidermal to mostly subcuticular or superficial, hyphae occasionally branched, 2.5–8 µm wide, septate, hyaline to medium brown, thin-walled, sometimes slightly thick-walled. Conidiophores solitary, arising from hyphal cells, erumpent through the cuticle, subglobose, 8–10 µm diam, or ampulliform, 10–25(–30) × 5–7 µm, or up to 15 µm wide at the base, erect, straight, unbranched, mostly aseptate, medium to dark brown, paler towards the apex, sometimes smooth, usually rough-walled, thick-walled, conidiophores reduced to conidiogenous cells, with a single or

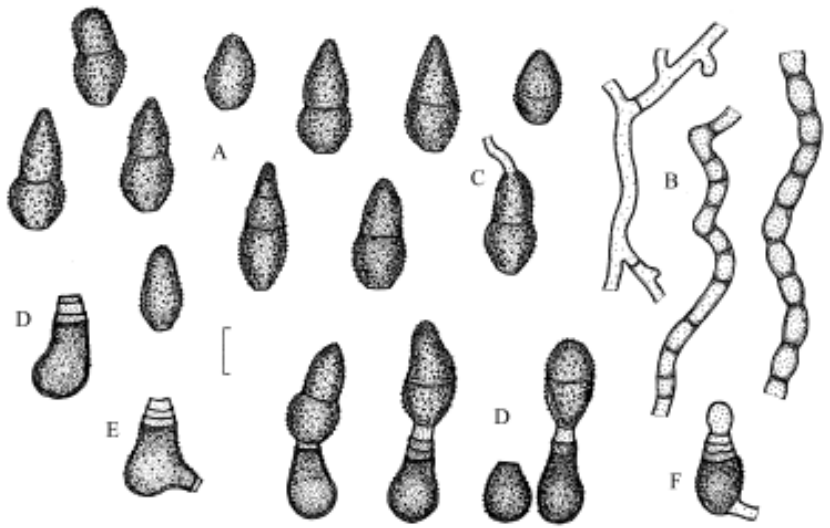

Fig. 35: *Fusicladium oleagineum*. A – conidia. B – superficial septate hyphae, C – germinating conidium, D – conidiogenous cells with several conspicuous annellations, E – percurrently proliferating conidiogenous cell with two loci, F – conidiogenous cell arising from a hypha, scale = 10 µm, A. Ritschel del.

rarely with two or three conidiogenous loci, proliferation percurrent, with up to seven conspicuous annellations, loci 5 µm wide, unthickened, not darkened. Conidia solitary, obclavate, straight or occasionally slightly curved, (15–)18–25(–28) × (9–)10–11(–12) µm, 1-septate, septum median or somewhat in the lower half, sometimes 2-septate, often slightly constricted at the septum, medium to dark olivaceous-brown, verrucose, thick-walled, apex pointed to rounded, truncate at the base, hila 5 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Olea* spp. (Oleaceae), Asia, Europe (Mediterranean), Africa, North America, South America, New Zealand – *Olea europaea* [Asia, India, Iran, Israel (Palestine), Jordan, Lebanon, Turkey; Europe, E, F, I, Malta, Cyprus; Africa, Egypt, Algeria, Libya, Morocco, Somalia, South Africa, Tunisia; North America, USA, CA; South America, Chile; New Zealand].

Material examined: on *Olea europaea,* Italy, Siena (1889), Como (1892), Briosi & Cav., F. paras. 223 (HAL, M); Italy, Verona, Tregano, May 1903, Massalongo, Kab. & Bub., F. imp. exs. 144 (M); USA, California, Berkeley, Feb. 1895, Berletti (M).

Notes: *Fusicladium oleagineum* differs from almost all other *Spilocaea*-like *Fusicladium* species in having more than one conidiogenous locus. "Striate" conidia described by Hughes (1953) have not been observed in the collections examined. The occurrence of this fungus on fruits and stalks was described by Lindau (1907).

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10.2.34. ***Fusicladium peucedani*** Ellis & Holw., Bull. Lab. Nat. Hist. Iowa State Univ. Ia, 3(3): 42 (1895) Fig. 36

Holotype: on leaves of *Peucedanum simplex* (= *Lomatium simplex*), USA, California, Modoc Co., 13 Jun. 1894, Nutting (NY).

≡ *Asperisporium peucedani* (Ellis & Holw.) Maubl., Lavoura 16: 207, 211 (1913) and Bull. Soc. Mycol. France 29: 357 (1913).

≡ *Pollaccia peucedani* (Ellis & Holw.) Deighton, in Deighton & Piroz., Mycol. Pap. 101: 41 (1965).

Teleomorph: Unknown.

Lit.: SACCARDO (1895: 618; 1913: 1375), ELLIS (1976: 110).

Ill.: DEIGHTON & PIROZYNSKI (1965: 42, Figs 17 A–D), ELLIS (1976: 110, Fig. 77 A).

Exs.: Solh., Mycofl. Saximont. exs. 499.

Leaf spots amphigenous, more or less angular, 2–7 mm wide, grey to pale brownish, vein-limited. Colonies amphigenous, punctiform, dark olivaceous-brown, in most collections (but not the type collection) associated with black, densely arranged pycnidia. Mycelium immersed, hyphae branched, septate, colourless, densely intricated. Stromata intraepidermal to subcuticular, up to 100 µm diam., forming two to four layers. Conidiophores in dense fascicles, arising from the upper cells of the stromata, forming sporodochial conidiomata, at first subcuticular, later erumpent through the cuticle, protruding, 5.5–6.5 µm wide, attenuated towards the apex, about 4 µm wide above, erect, straight to slightly flexuous, cylindrical, unbranched, 10–30 × 5–8 µm, aseptate, at first more or less colourless, with a slightly greenish tinge, and smooth, later pale to medium olivaceous-brown, loosely verrucose, walls barely thickened, conidiophores reduced to conidiogenous cells, unilocal, determinate or proliferation percurrent, with up to six conspicuous annellations, loci slightly convex, 3–5 µm wide, unthickened, not darkened. Conidia solitary, oblong–ellipsoid, straight, 20–29 × (7–)9–11 µm, 0–1-septate, with a median septum, usually somewhat constricted in the middle, pale olivaceous, loosely verrucose, walls somewhat thickened, apex rounded, hilum slightly convex, 3–5 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Angelica*, *Cicuta*, *Glehnia*, *Lomatium* and *Sphaenosciadium* spp. (Apiaceae), North America – *Angelica arguta* (Canada, Alta., BC.), *A. breweri* (USA, CA), *Angelica* spp. (USA, WA, WY), *Cicuta douglasii* (USA, ID), *C. occidentalis* (USA, ID), *Glehnia leiocarpa* (USA, WA), *G. litoralis* (Canada, BC., USA, CA), *Lomatium brandegei* (Canada, BC., USA, WA), *L. macrocarpum* (Canada, Alta.), *L. martindalei* (Canada, BC.), *L. nudicaule* (USA, ID, OR, WA), *L. simplex* (= *Peucedanum simplex*) (USA, CA), *L. triternatum* (USA, OR), *Sphaenosciadium capitellatum* (USA, NV).

Notes: Based on percurrent conidiogenous cells, Deighton, in DEIGHTON & PIROZYNSKY (1965) placed *Fusicladium peucedani* Ellis & Holw. in *Pollaccia.* He supposed that pycnidia, often found in association with sporodochia of *F. peucedani*, may belong into the life cycle of this species. Records on *Peucedanum decursivum* from Japan [e.g., SHIRAI & HARA (1927)] have to be excluded since they belong to *Fusicladium peucedani* Syd. [≡ *Passalora depressa* (Berk. & Broome) Sacc.].

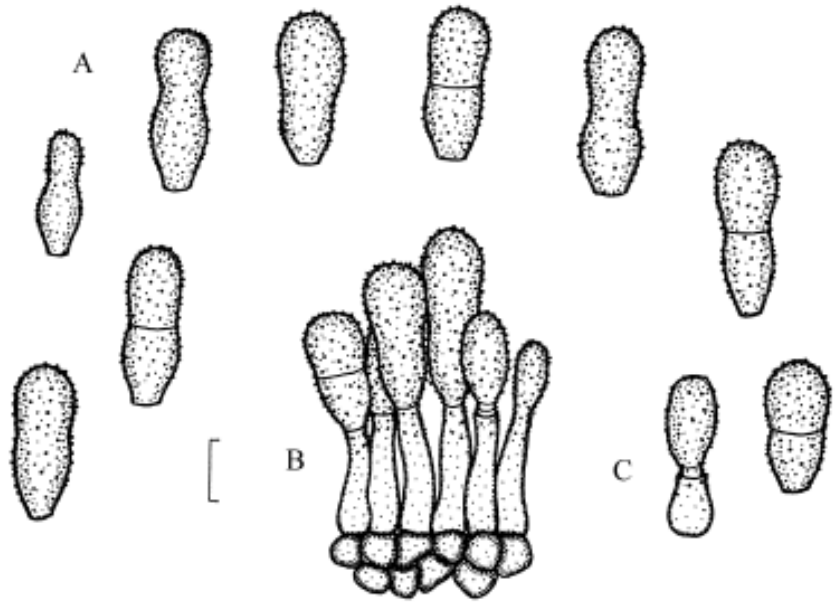

Fig. 36: *Fusicladium peucedani*. A – conidia, B – conidiogenous cells, one with several conspicuous annellations, arranged in a sporodochium, C – solitary conidiophore, scale = 10 µm, A. Ritschel del.

10.2.35. ***Fusicladium phillyreae*** (Nicolas & Aggéry) Ritschel & U. Braun **comb. nov.** Fig. 37

≡ *Cycloconium phillyreae* Nicolas & Aggéry, Bull. Soc. Mycol. France 44: 303 (1928); type: on *Phillyrea angustifolia*, France.

≡ *Spilocaea phillyreae* (Nicolas & Aggéry) M.B. Ellis, More Dematiaceous Hyphomycetes: 111 (1976).

Teleomorph: Unknown.

Ill.: ELLIS (1976: 111, Fig. 78).

On living leaves and petioles, spots amphigenous, subcircular, 1–4 mm wide, on the upper leaf surface medium brown and somewhat shinning, below pale brown. Colonies punctiform, diffuse, olivaceous to blackish brown. Mycelium subcuticular. Stromata composed of loosely aggregated, subcircular, pale to dark olivaceous-brown cells, 6–9 µm diam. Conidiophores solitary or in small groups, arising from the upper cells of the stromata, erumpent through the cuticle, ampulliform or doliiform, erect, straight to slightly flexuous, unbranched, 10–30 × 5–7 µm, aseptate, medium to dark olivaceous-brown, smooth, thick-walled, swollen at the base, up to 11 µm wide, conidiophores usually reduced to conidiogenous cells, unilocal, proliferation percurrent, with up to six conspicuous annellations, loci truncate, 5–6 µm wide, unthickened, not darkened. Conidia solitary, navicular to broadly ovate or obclavate,

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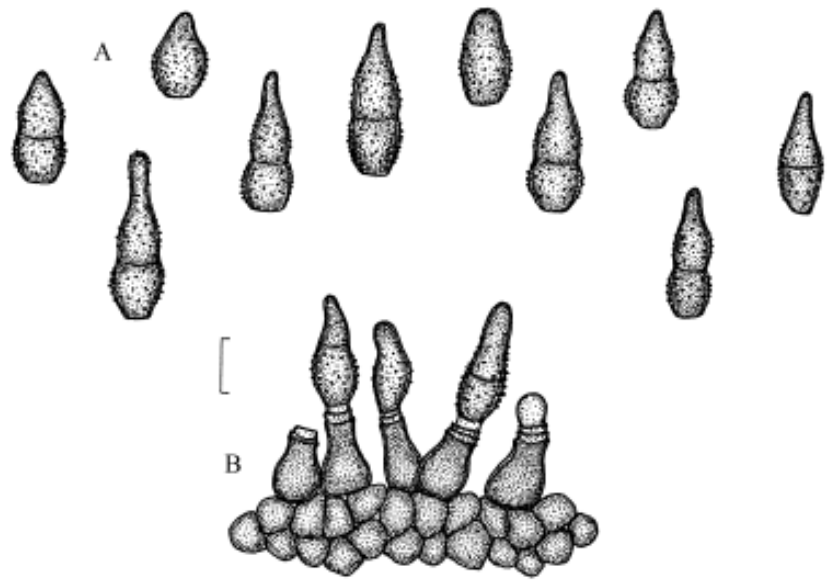

Fig. 37: *Fusicladium phillyreae*. A – conidia, B – aggregated conidiophores with several conspicuous annellations, scale = 10 µm, A. Ritschel del.

straight to slightly curved, 17–40 × 7–11 µm, (0–)1(–3)-septate, septum median or somewhat in the lower half, often slightly constricted at the septa, medium to dark olivaceous-brown, verruculose, thick-walled, apex pointed or somewhat rounded, truncate at the base, hilum 5–6 µm wide, not or only very slightly thickened and darkened.

Hosts and Distribution: on *Phillyrea* spp. (Oleaceae), Europe – *Phillyrea angustifolia* (F), *P. media* var. *ligustrifolia* (CH).

Material examined: on *Phillyrea media* var. *ligustrifolia*, Europe, Switzerland, Brissago, Lago Maggiore, Ticino, 15 May 1966, Deighton (IMI 119435).

Notes: Type material of this species could not be traced, but a collection from Switzerland has been examined. According to the original diagnosis, *Fusicladium fraxini* var. *phillyreae* Trotter, described from galls of *Braueriella phillyreae* on *Phillyrea media*, differs from *F. phillyreae* in having much smaller conidia (11–12 × 4–5.5 µm) and seems to be quite distinct. However, type material of this variety could not be traced and examined.

10.2.36. *Fusicladium pisicola* Linford, Phytopathology 16(8): 549 (1926) Fig. 38

Lectotype: on *Pisum sativum*, USA, Utah, Exp. Station Logan, 21 Aug. 1923, M.R. Linford (M), as *F. brevipes* Ellis & Everh., selected here; isolectotypes: BPI 424334 A, B.
Teleomorph: Unknown.
Ill.: LINFORD (1926: Pl. 27, C).

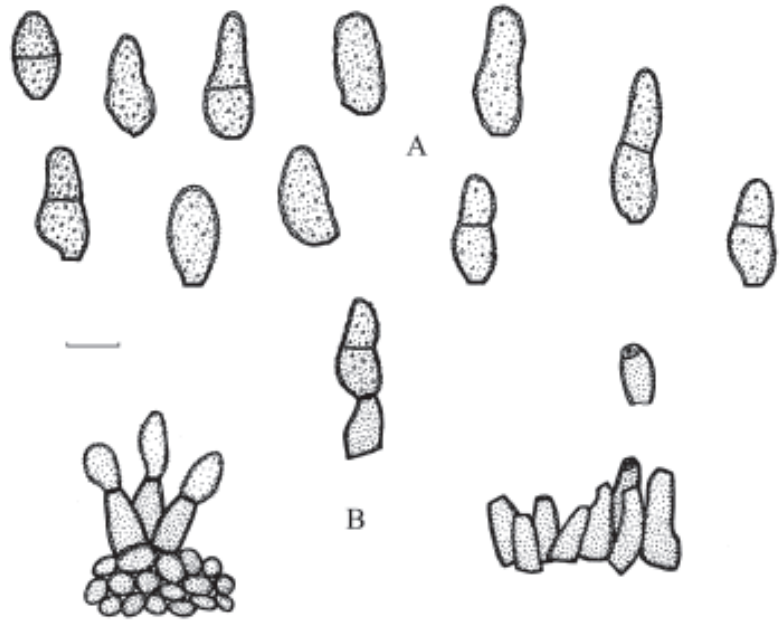

Fig. 38: *Fusicladium pisicola*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

On leaflets, stipules and tendrils, leaf spots hypophyllous, varying in shape and size, irregular to oblong, up to 10 mm wide, pale to dark brown, dark grey, sometimes sooty black, paler on the upper leaf surface, yellowish grey to pale brown, sometimes confluent, vein-limited, without conspicuous margin. Colonies hypophyllous, rarely amphigenous, dark, velvety. Mycelium intercellular, subcuticular to intraepidermal, hyphae branched, 3–5 µm wide, septate, subhyaline to pale olivaceous. Stromata composed of slightly thick-walled, rough-walled cells, 5–8 µm diam., forming stromatic layers. Conidiophores scattered to aggregated, but not fasciculate, erumpent through the cuticle, very short, conical, erect, unbranched, 5–24 × (4–)6–8 µm, aseptate, olivaceous to brown, smooth, walls somewhat thickened, slightly swollen at the base, truncate at the apex, conidiophores usually reduced to conidiogenous cells, unilocal, determinate, with a single, subdenticulate locus, flat to slightly convex, 2–4 µm wide, unthickened or almost so, somewhat darkened–refractive. Conidia solitary, ellipsoid–ovoid, obovoid to short cylindrical, 12–28(–32) × 6–10(–14) µm, 0–1-septate, more or less constricted at the septum, septa more or less median or somewhat in the upper half, asperulate, coarsely verrucose to echinulate, walls somewhat thickened, apex broadly rounded, base rounded to truncate, hila 2–4 µm wide, unthickened or almost so, somewhat darkened–refractive.

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Hosts and Distribution: on *Pisum* spp. (Fabaceae), North America – *Pisum sativum* (USA, ID, UT).

Notes: The lectotype is a part of the material cited in the original publication.

10.2.37. *Fusicladium pomi* (Fr.) Lind, Dan. fung.: 521 (1913) Fig. 39

≡ *Spilocaea pomi* Fr., Novit. fl. svec. 5: 79 (1819); syntypes: on *Malus sylvestris*, Sweden, Fr., Scler. exs. 260 (e.g., B, UPS).
≡ *Spilocaea pomi* Fr.: Fr., Syst. mycol. 3: 504 (1832).
= *Actinonema crataegi* Pers., Mycol. eur. 1: 52 (1822); type: on *Crataegus torminalis* (= *Sorbus torminalis*), Switzerland, Neuchâtel (L).
≡ *Capillaria crataegi* (Pers.) Link, in Willd., Sp. pl. ed. 4, T. 6(1): 22 (1824).
≡ *Phlyctidium crataegi* (Pers.) Wallr., Fl. crypt. Germ. 2: 418 (1833).
≡ *Asteroma crataegi* (Pers.) Rabenh., Deutschl. Krypt.-Fl. 1: 139 (1844).
≡ *Spilocaea crataegi* (Pers.) S. Hughes, Canad. J. Bot. 36: 807 (1958).
= *Fumago mali* Pers., Mycol. eur. 1: 9 (1822).
= *Helminthosporium pyrorum* Lib. (p.p. in *Pyri mali*), Lib., Pl. crypt. ard., Fasc. 2, 188 (1832).
= *Cladosporium dendriticum* Wallr., Fl. crypt. Germ. 2: 169 (1833); syntypes: B, STR.
≡ *Fusicladium dendriticum* (Wallr.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 357 '1869' (1870).
≡ *Passalora dendritica* (Wallr.) Sacc., Mycoth. ven., Cent. XII, 1246, Padua 1876 [Michelia 1: 265 (1878)].
= *Asteroma mali* Desm., Ann. Sci. Nat. Bot., Sér. 2, 15: 141 (1841).
= *Asteroma crataegi* var. *pomi* Desm., Ann. Sci. Nat. Bot. Sér. 3, 8: 36 (1846).
= *Asteroma crataegi* var. *sorbi* Desm., Ann. Sci. Nat. Bot. Sér. 3, 8: 35 (1846).
= *Actinonema pomi* Lév., Ann. Sci. Nat. Bot. Sér. 3, 9: 260 (1847).
= *Cladosporium orbiculatum* Desm., Ann. Sci. Nat. Bot., Sér. 3, 11: 275 (1849); lectotype: on living leaves of *Sorbus domestica*, herb. Desmazières (PC).
≡ *Fusicladium orbiculatum* (Desm.) Thüm., Fungi austr., Cent. VIII, 774, Teplitz 1873.
≡ *Passalora dendritica* var. *orbiculata* (Desm.) Berk., in Sacc., Mycoth. ven., Cent. XII, 1246, Padua 1876 [Michelia 1: 265 (1878)].
≡ *Fusicladium dendriticum* var. *orbiculatum* (Desm.) Sacc., Syll. fung. 4: 345 (1886).
= *Scolecotrichum venosum* Bonord., in Rabenh., Fungi eur., Cent. VI, 582, Dresden 1863; lectotype: on leaves of *Malus* sp., Germany, Westphalia, Rabenh., F. eur. 582 (HAL, M).
= *Passalora pyracanthae* G.H. Otth, Mitth. Naturf. Ges. Bern 1868: 66 (1868).
≡ *Fusicladium pyracanthae* (G.H. Otth) Vienn.-Bourg., Rev. Mycol. (Paris) 6: 155 (1941).
≡ *Spilocaea pyracanthae* (G.H. Otth) Arx, Tijdschr. Plantenziekten 63: 198 (1957).
= *Fusicladium dendriticum* var. *opuli* Thüm., Fungi austr., Cent. XI, 1091, Bayreuth 1874, nom. nud.
= *Napicladium soraueri* Thüm., Mycoth. univ., Cent. I, 91, Bayreuth 1875.
≡ *Fusicladium dendriticum* var. *soraueri* (Thüm.) Sacc., Syll. fung. 4: 346 (1886).
= *Actinonema crataegi* f. *sorbi-torminalis* Thüm., Herb. myc. oec., Fasc. XI, 527, Klosterneuburg 1877, nom. nud.
= *Fusicladium pirinum* var. *pyracanthae* Thüm., Mycoth. univ., Cent. IX, 874, Klosterneuburg 1877.
= *Actinonema crataegi* var. *arachnoideum* f. *sorbi-torminalis* Thüm., Mycoth. univ., Cent. XV, 1487, Klosterneuburg 1879, nom. nud.
= *Actinonema crataegi* f. *sorbi ariae* Thüm., Mycoth. univ., Cent. XIV, 1372, Klosterneuburg 1879, nom. nud.
= *Fusicladium dendriticum* var. *pyracanthae* Thüm., Hedwigia 18: 155 (1879).
= *Cladosporium dendriticum* var. *heteromeles* Harkn. (1881), in herb.
= *Fusicladium pirinum* var. *amelanchieris* Sacc., Syll. fung. 4: 346 (1886).

= *Basiascum eriobotryae* Cavara, Atti Ist. Bot. Univ. Pavia 2(1): 433 (1888); neotype: on leaves of *Eriobotrya japonica*, Italy (Caserto) and Portugal (Lisbona), 1891, J. Verissimo d' Almeida, Briosi & Cav., F. paras. 186 (IMI 7582), selected here; isoneotypes: H, HAL, LE, M.
≡ *Fusicladium eriobotryae* (Cavara) Cavara, in Briosi & Cav., F. paras. 186 (1892).
≡ *Fusicladium melanconioides* Ferraris, Ann. Mycol. 7: 284 (1909) (nom. nov.).
≡ *Spilocaea eriobotryae* (Cavara) S. Hughes, Canad. J. Bot. 31: 563 (1953).
= *Fusicladium dendriticum* f. *microsperma* Roum., Fungi sel. exs., Cent. LXI, 5592, Toulouse 1891.
= *Fusicladium dendriticum* var. (ã) *eriobotryae* Scalia, Boll. Accad. Gioenia Sci. Nat. Catania 1901: 5 (1901).
= *Fusicladium dendriticum* var. *sorbinum* Sacc., Ann. Mycol. 3: 170 (1905); syntype: on leaves of *Sorbus aucuparia*, Italy, Selva (Treviso), Aug. 1904, Sacc., Mycoth. ital. 1582 (B).
= *Fusicladium dendriticum* var. *sorbinum* f. *fruticola* Ferraris, Fl. Ital. Crypt., Pars I. Fungi, Fasc. 6: 879 (1910).
= *Fusicladium photinicola* McClain, Phytopathology 15: 181 (1925); syntypes: on *Photinia* (= *Heteromeles*) *arbutifolia*, USA, California, Riverside, McClain (M, NY).
≡ *Spilocaea photinicola* (McClain) M.B. Ellis, More Dematiaceous Hyphomycetes: 112 (1976).
= *Fusicladium lalandi* É.J. Marchal & Verpl., Bull. Soc. Roy. Bot. Belgique 59: 24 (1926).
= *Fusicladium dendriticum* var. *sorbi-torminalis* Săvul. & Sandu, Hedwigia 73: 24 (1933).
= *Coniosporum mali* Dearn. & A.C. Foster, Canad. J. Res., Sect. C, Bot. Sci. 16: 274 (1938); type: DAOM.
= *Spilocaea amelanchieris* I.C. Harv., in I.C. Harv. & Braithwaite, New Zealand J. Agric. Res. 25 (3): 441 (1982); holotype: on *Amelanchier* sp., New Zealand, Canterbury, 10 Nov. 1978, Harvey (IMI 233721).

Teleomorph: *Venturia inaequalis* (Cooke) G. Winter, Hedwigia 36: 81 (1897).

Lit.: Saccardo (1884: 206; 1886: 345, 346, 348; 1895: 617; 1906: 579; 1913: 1376), Aderhold (1886: 876–913; 1897: 67–63), Lindau (1907: 779–783), Ferraris (1912: 315–317, 318–319), Gonzáles Fragoso (1927: 184–186), Vassiljevsky & Karakulin (1937: 194–195, 196–199), Barr (1968: 808–809), Ellis (1971: 143; 1976: 111–113), Subramanian (1971: 361–363), Raabe & Gardener (1972: 914–916), Fungi Canadenses (No. 35), Osipyan (1975: 433–439, 441), Shvartsman et al. (1975: 118–120, 140), CMI Descr. (No. 401), Sivanesan (1977: 71–76; 1984a: 615–616), Brandenburger (1985: 256, 258), Melnik & Popuschoi (1992: 176), Ellis & Ellis (1997: 164).

Ill.: Aderhold (1886: Pl. XXIX, Figs 1, 2, Pl. XXX, Figs 1, 2 a, b, c, 5, 6, 10, 11; 1897: Pl. IV, Fig. 4), Lindau (1907: 780, Fig.), McClain (1925: 181, Fig. 1; 182, Fig. 2 A, B), Vassiljevsky & Karakulin (1937: 194, Fig. 12), Arx (1952: 263, Fig. 2), Barr (1968: 805, Fig. 18), Ellis (1971: 142, Fig. 95 A), Subramanian (1971: 362, Fig. 260), Fungi Canadenses (No. 35, Figs 2, 4, 6, 7), Shvartsman et al. (1975: 119, Fig. 59), CMI Descr. (No. 401, Figs D, E), Ellis (1976: 112, Figs 79, 80), Sivanesan (1977: 74, Fig. 38 A, B; 1984a: 617, Fig. 372 B), Brandenburger (1985: 1109, Fig. 287), Melnik & Popuschoi (1992: 177, Fig. 130 a, b), Ellis & Ellis (1997: Pl. 85, Fig. 882).

Exs.: Allesch. & Schn., F. bavar. 594; Barthol., F. Columb. 3326; Briosi & Cav., F. paras. 140, 186; Calif. F. 636; Cooke, F. brit. exs. 645; Ellis, N. Am. F. 2792; Fuckel, F. rhen. 115, 456; F. latv. exs. 600; Jaap, F. sel. exs. 513; Kab. & Bub., F. imp. exs. 45, 46; Krieger, F. sax. 198, 1748; Krypt. exs. 1190, 1473; Lib., Pl. crypt. ard. 188; Migula, Crypt. Germ. Austr. Helv. exs. 63; Mycoth. Fenn. 297; Mycoth. Ross. 100; Neger, Forstschäd. P. 163; Oudem., F. neerl. ex. 190, 198; Petr., F. polon. 49; Rabenh., F. eur. 582, 1168, 1764, 3997; Rabenh., Herb. mycol. Ed. II, 766; Reliqu. Petrak. 2566; Roum., F. gall. exs. 322, 323, 438; Roum., F. sel. exs. 5592; Sacc., Mycoth. ital. 1582; Sacc., Mycoth. Ven. 1067, 1246; Seym. & Earle, Econ. F. 38; Syd., Mycoth. germ. 2249; Syd., Mycoth. march. 1494, 2790, 3793; Thüm., F. austr. 277, 774, 1091; Thüm., Herb. myc. oec. 42, 128, 178, 527, 722; Thüm., Mycoth. univ. 91, 261, 802, 874, 1174, 1372, 1487, 1891; Vestergr., Micromyc. rar. sel. exs. 1242; Westend. & Wall., Herb. crypt. belg. 695, 1090.

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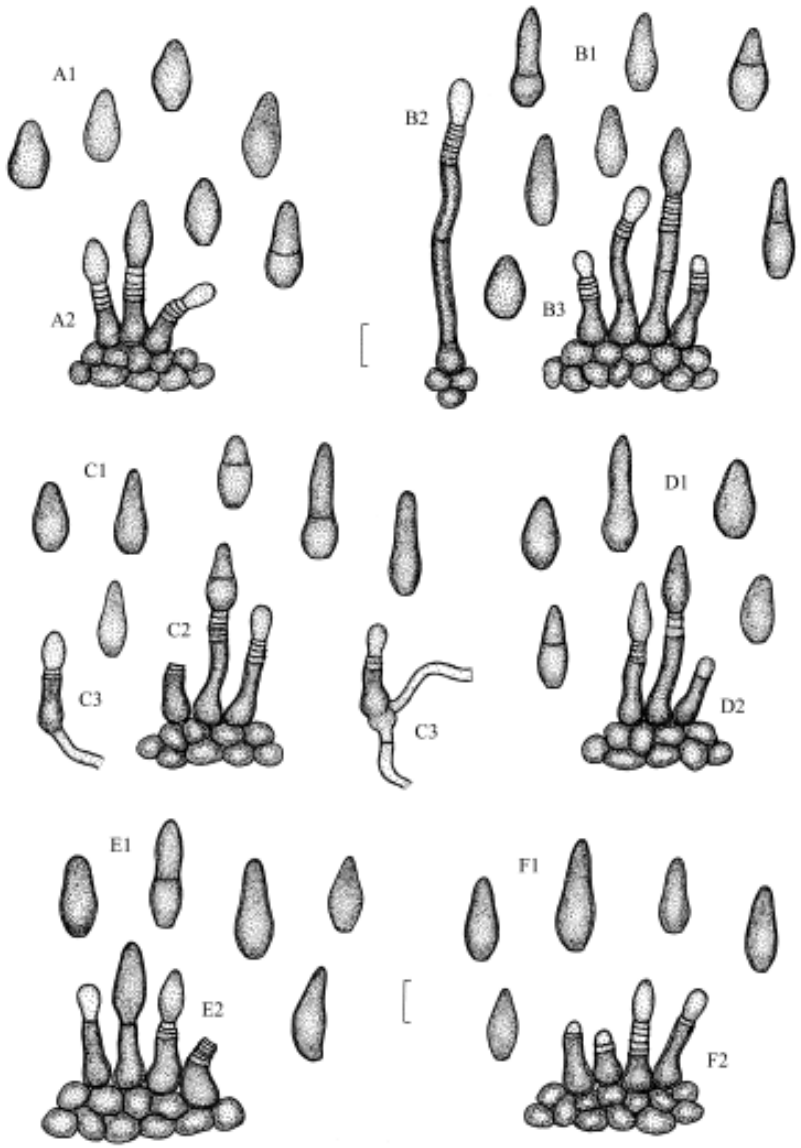

Fig. 39: *Fusicladium pomi*. A – on *Pyracantha* sp., A1 – conidia, A2 – dense fascicle of conidiophores with several annellations, B – on *Malus* sp., B1 – conidia, B2 – long septate conidiophore, B3 – conidiophores, C – on *Sorbus* sp., C1 – conidia, C2 – conidiophores, C3 – conidiophore arising from superficial hyphae, D – on *Eriobotrya japonica*, D1 – conidia, D2 – conidiophores, E – on *Heteromeles arbutifolia,* E1 – conidia, E2 – conidiophores, F – on *Amelanchier* sp., F1 – conidia, C2 – conidiophores, scale = 10 µm, A. Ritschel del.

On living leaves, petioles, twigs and fruits, spots amphigenous, subcircular to irregular, 1–10 mm wide, at first pale olivaceous-brown, later greyish black, on leaves sometimes with a brown, slightly raised margin, confluent, occasionally covering large leaf segments, on fruits forming small, circular to larger and than irregular spots, margin indefinite to whitish. Colonies amphigenous, in the center of the spots densely caespitose, at the margin dendritic, radiating, olivaceous-brown to blackish, on young twigs blister-like. Mycelium immersed, very rarely superficial, then conidiophores solitary, arising from superficial hyphae. Stromata more or less well-developed, subcuticular, composed of subglobose cells, 5–10 µm diam., olivaceous-brown, relatively thick-walled. Conidiophores mostly in loose to dense fascicles, arising from the upper cells of the stromata, erumpent through the cuticle, erect, straight to slightly flexuous, cylindrical to ampulliform, unbranched, 10–50(–90) × 5–6 µm, variable in length, depending on the age of the conidiophores, 0–1-septate, rarely pluriseptate, pale to dark olivaceous-brown, paler towards the apex, smooth, walls thickened, often swollen at the base, up to 10 µm wide. Conidiogenous cells integrated, terminal, with a single locus, proliferation percurrent, with a few to many conspicuous annellations, loci truncate, 4–5(–6) µm wide, unthickened, not darkened. Conidia solitary, shape variable, ovoid to obpyriform or obclavate, straight, (11–)14–23(–32) × (4–)7–10(–13) µm, 0–1(–2)-septate, more or less constricted at the septa, pale to medium olivaceous-brown, smooth, walls somewhat thickened, narrowly pointed or broadly rounded at the apex, truncate at the base, hilum truncate, 4–5(–6) µm wide, unthickened to occasionally very slightly thickened, not darkened.

Hosts and Distribution: on species of *Amelanchier*, *Aronia*, *Cotoneaster*, *Docynia*, *Eriobotrya*, *Heteromeles*, *Kageneckia*, *Malus*, *Prunus*, *Pyracantha*, *Pyrus*, *Sorbus* (Rosaceae), cosmopolitan – *Amelanchier* sp. (Europe, F; New Zealand), *Aronia prunifolia* (= *Pyrus floribunda*) (Europe, D), *Cotoneaster aitchisoni* (Asia, India), *C. integerrimus* (Europe, CH), *C. suavis* (Caucasus, Georgia), *Docynia indica* (Asia, India), *Eriobotrya japonica* [Asia, China, Israel (Palestine), Iran, Japan, Jordan, Lebanon, Russia, Turkey, Uzbekistan; Caucasus, Armenia, Georgia; Europe, CH, D, E, GB, GR, F, I, P, RUS, SLO, Cyprus; Africa, Libya, Morocco, South Africa; North America, USA, CA, FL, OH, WA; South America, Chile; Australia, New South Wales, Tasmania; New Zealand], *Heteromeles arbutifolia* (= *Photinia arbutifolia*) (North America, USA, CA), *Heteromeles* sp. (= *Photinia* sp.) (Europe, GB; Australia, Tasmania), *Kageneckia oblonga* (North America, USA, CA), *Malus domestica* (incl. all of the cultivars) (Asia, Afghanistan, China, India, Iran, Kazakhstan, Russia, Turkey, Turkmenistan, Uzbekistan; Caucasus, Armenia; Europe, CS, D, I, E, EW, GB, H, RO, RUS, S, SF, Cyprus; North Africa, Libya; North America, Canada, Alta., BC., Man., NB., Nfld., NS., Ont., PEI, Que., Sask., USA, AK, CA, GA, FL, IL, MA, WI, VA; South America, Chile), *M. sylvestris* (= *Pyrus malus*) [Asia, China, India, Israel (Palestine), Jordan, Nepal, Pakistan, Russia, Turkey, Turkmenistan, Uzbekistan; Europe, A, BG, CS, D, DK, E, EW, GB, GR, I, IRL, LV, RO, RUS, S, SF, SLO, Cyprus; Africa, Ethiopia, Libya, Madagascar, Morocco, Mozambique, South Africa; North America, USA, AK, AL, CA, CT, DE, FL, ID, KS, MI, MS, MT, NC, ND, NE, OK, OR, SD, TN, WA, WI; South America, Argentina, Chile, Columbia, Peru; Australia,

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New South Wales, Queensland, Tasmania, Victoria; New Zealand], *Malus* sp. (Asia, Afghanistan, China, India, Iran, Iraq, Japan, Jordan, Kazakhstan, Korea, Pakistan, Russia, Saudi-Arabia, Syria, Taiwan; Caucasus, Armenia, Azerbaijan, Georgia; Europe, B, BG, CH, D, DK, EW, F, FR, GB, H, I, LT, LV, RO, Ukr., YU; Africa, Egypt, Ethiopia, Libya, Zimbabwe; North America, Canada, Alta., BC., NB., NS., Ont., Que., Sask., USA, CT, MA, NC, NH, OH, PA, RI, SD, WI; Central America, Panama; South America; New Zealand), *Prunus* spp. (Europe, GB), *Pyracantha angustifolia* (New Zealand), *P. coccinea* (incl. cv. *lalandei*) (Caucasus, Georgia; Europe, B, D, DK, F, GB, NL, RO, SLO, TR, Ukr.; South Africa; North America, Canada, BC., USA, AL, CA, DE, FL, GA, NC, OK, OR, WA), *P. crenato-serrata* (North America, USA, IL), *Pyracantha* spp. (Europe, F; North America, Canada, BC., USA, FL, MO, NC; Australia, New South Wales), *Pyrus communis* (Europe, D, EW, GB, TR), *P. serotina* (Asia, Korea), *P. sinensis* (Asia, Korea), *Pyrus* spp. (Asia, Pakistan; North America, USA, WI), *Sorbus americana* (North America, USA, IL, MN, NY, WA), *S. aria* (Asia, Russia, Turkmenistan; Europe, A, CH, D, GB, SLO), *S. aucuparia* (Asia, Russia; Europe, CS, D, DK, EW, I, SLO; North America, USA, CT, IL), *S. boissieri* (Caucasus, Armenia), *S. chamaemespilus* (Europe, CH), *S. domestica* (Europe, D, E, F, I, LV, SLO, TR), *S. intermedia* (= *Pyrus suecica*, = *S. scandica*) (Europe, D, EW, FR), *S. lanata* (Asia, India), *S. persica* (Asia, Kazakhstan, Uzbekistan), *S. tianschanica* (Asia, Kazakhstan, Uzbekistan), *S. torminalis* (Asia, Russia; Caucasus, Armenia, Georgia; Europe, A, CS, D, GB, RO), *Sorbus* spp. (Asia, Russia; Caucasus, Armenia, Georgia; Europe, CS, GB, H, RO, RUS, TR; North America, USA, WA).

Material examined: collections from herb. B, HAL, HBG, IMI, JE, LE, M, NY, PC.

Notes: *Spilocaea pomi* was originally used for the anamorph of *Venturia inaequalis* on *Pyrus* spp. SIVANESAN (1977, 1984a) recorded the latter species from *Cotoneaster integerrimus*, *Malus*, *Pyracantha*, *Pyrus* and *Sorbus* species. Morphologically very similar fungi occur on some other hosts of the Rosaceae (*Amelanchier*, *Heteromeles*, *Eriobotrya*, *Kageneckia*). Some of them have been considered to be distinct species. Detailed morphological examinations of *Spilocaea pomi*-like fungi have been carried out by RITSCHEL (2001). Collections from *Malus*, *Sorbus* and *Amelanchier* species are indistinguishable from each other. There are no differences in the conidial shape and size (RITSCHEL 2001). Conidia from *Eriobotrya* and *Pyracantha* species are slightly shorter on an average, and collections from *Heteromeles* are somewhat larger in general, but these differences are not significant. Therefore, *Spilocaea amelanchieris, S. eriobotryae, S. photinicola* and *S. pyracanthae* are reduced to synonym with *Fusicladium pomi*. *Spilocaea ahmadii* on *Pyrus pashia* is the only species in this complex which is morphologically clearly distinct from *F. pomi* by having much longer and narrower conida. RAABE & GARDENER (1972) carried out inoculation experiments with collections from *Eriobotrya*, *Kageneckia*, *Heteromeles* and *Pyracantha*, and proposed to refer all of them to *Spilocaea pyracanthae*. Based on inoculation experiments, MENON (1956) proposed some "formae speciales" of *Venturia inaequalis* for races on *Pyrus malus*, *Sorbus aucuparia*, *Cotoneaster integerrimus* and *Crataegus oxyacantha* (the latter one was misapplied and referred to *Venturia crataegi* Aderh.). Molecular examinations carried out during the course of monographic studies (RITSCHEL 2001) showed that *V. inaequalis* and *Spilocaea pyracanthae* are very closely allied or even indistinguishable. Collections from *Sorbus* species are also indistinguishable from *F. pomi*. The fungus on *Eriobotrya* was originally described as *Basiascum eriobotryae* Cavara. HUGHES (1953) proposed the combination *Spilocaea eriobotryae*, and RAABE & GARDENER (1972) reduced it to synonymy with *Spilocaea pyracanthae*.
HUGHES (1958) examined type material of *Spilocaea pomi* from UPS. Type material of *Fusicladium lalandi* É.J. Marchal & Verpl. could not be traced but, according to the original description, this

species seems to be the same as *Fusicladium pomi*. The name of the type host "*Crataegus lalandi*" does not exist and seems to refer to *Pyracantha coccinea* "Lalandiae" (cv. *lalandei*).
Records of this species from *Docynia indica* are from BILGRAMI, JAMALUDDIN & RIZWI (1991). RAABE & GARDENER (1972) recorded *Kageneckia oblonga* as host of this species. The record of *Arum korolkovi* (Araceae) as host in SAGDULLAEVA et al. (1990) is undoubtedly wrong, and records from *Viburnum opulus* (e.g., *Fusicladium dendriticum* var. *opuli* Thüm., F. austr. 1091) have been checked and proved to be based on misidentifications of the hosts.

10.2.38. ***Fusicladium psoraleae*** (Ellis & Barthol.) S. Hughes & Piroz., Canad. J. Bot. 50(12): 2532 (1972) Fig. 40

≡ *Dicoccum psoraleae* Ellis & Barthol., in Ellis & Everh., Fungi Columb. 1820 (1903); lectotype: on *Psoralea tenuiflora*, USA, Kansas, Stockton, 27 Jun. 1903, E. Bartholomew 3044, ex herb. Ellis (NY), selected here; isolectotype: DAOM and F. Columb. 1820 (BPI 423604, NY).
Teleomorph: Unknown.
Ill.: HUGHES & PIROZYNSKI (1972: 2532, Fig. 6).
Exs.: Ellis & Everh., F. Columb. 1820.

Colonies on discoloured areas of leaves, petioles and stems, dense, effuse, olivaceous, velvety. Mycelium immersed, composed of branched, colourless, thin-walled hyphae. Stromata subcuticular, sometimes intraepidermal, punctiform to effuse, pseudoparenchymatous, composed of rounded to polygonal, pale brown, thin-walled cells, 5 µm diam., few layers thick. Conidiophores solitary or in loose to dense groups,

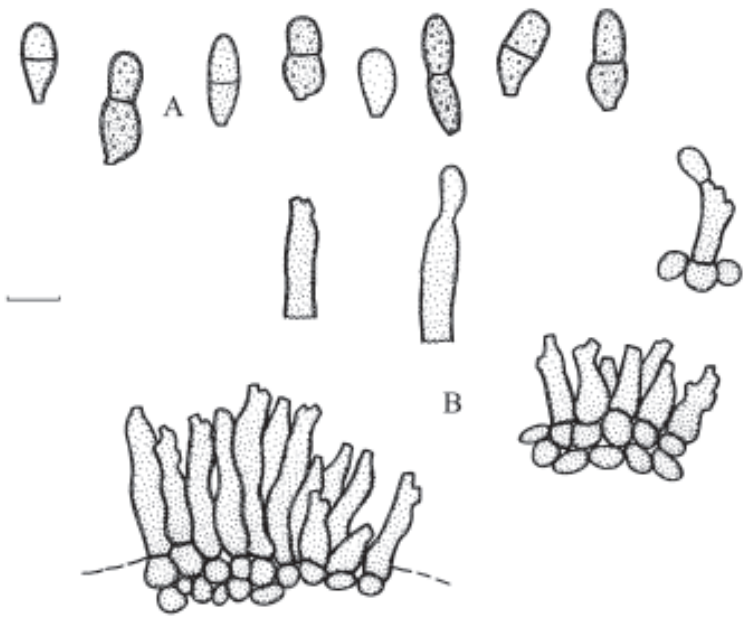

Fig. 40: *Fusicladium psoraleae*. A – conidia. B – dense fascicles of conidiophores, scale = 10 µm, K. Schubert del.

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sometimes sporodochial, forming large expanded layers, arising from stromata, cylindrical to narrowly ovoid or obpyriform, 6–40 × 3–5 µm, aseptate, thin-walled, pale brown, smooth to verruculose, mainly in the upper half of the conidiophores, conidiophores usually reduced to conidiogenous cells. Conidiogenous cells unilocal, determinate or with two or only few conidiogenous loci, proliferation sympodial, loci flat, truncate, 2–3 µm wide, unthickened, not darkened. Conidia solitary, broadly ellipsoid, ovoid to clavate, straight, sometimes slightly curved, 10–27(–34) × 6–10(–11) µm, 0–1(–3)-septate, not or only slightly constricted at the septa, at first hyaline, becoming pale brown, smooth to coarsely verrucose, rugose, rounded at the apex, hila flat, truncate, 2–3 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Psoralea* spp. (Fabaceae), North America – *Psoralea argophylla* (Canada, Man.), *P. tenuiflora* (USA, KS).

Material examined: on *Psoralea tenuiflora* (= *P. floribunda*), USA, Kansas, Reley Co., 19 Jun. 1951, C.T. Rogerson (NY).

10.2.39. ***Fusicladium pyrorum*** (Lib.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 357 '1869' (1870), as '*Fusicladium pyrinum*' Fig. 41

≡ *Helminthosporium pyrorum* Lib. (p.p.), Pl. crypt. ard., Fasc. 2, 188 (1832); lectotype: on leaves of *Pyrus communis*, Pl. crypt. ard. 188 (DAOM).
≡ *Passalora 'pyrina'* (Lib.) Sacc., Michelia 1: 537 (1879).
≡ *Megacladosporium pyrorum* (Lib.) Vienn.-Bourg., Les Champignons parasites des plantes cultivées 1: 489 (1949), as '*Megacladosporium pirinum'*.
= *Arthrinium pyrinum* Wallr., Fl. crypt. Germ. 2: 163 (1833); holotype: herb. Wallroth (STR); isotype: IMI 68300.
= *Fusidium pyrinum* Corda, Icon. fung. 1: 3 (1837); type: PR.
= *Fusicladium virescens* Bonord., Handb. Mykol.: 80 (1851); iconotype: Bonorden, l.c.: Fig. 94.
= *Cladosporium polymorphum* Peyl, Lotos 15: 18 (1865).
= *Fusicladium fuscescens* Rabenh., Bot. Zeitung (Berlin) 15: 430 (1857); syntypes: on leaves of *Malus domestica* (= *Pyrus malus*), Germany, Dresden, autumno, L. Rabenhorst, Herb. mycol. 588 (HAL, HBG).
= *Passalora pomi* G.H. Otth, Mitth. Naturf. Ges. Bern 1868: 66 (1868); type: on leaves of *Pyrus coronarius*, Swiss, Bern.
= *Fusicladium pyrorum* [(Lib.) Fuckel] var. *cladophilum* Ellis & Everh., North Am. Fungi 2791 (1892); syntypes: on twigs of *Pyrus communis*, USA, Wisconsin, Pewankee, May 1890, Geo P. Pfeiffer, Ellis & Everh., N. Am. F. 2791 (M, NY).
= *Cercospora porrigo* Speg., Anales Mus. Nac. Buenos Aires. II. 3: 341 (1899); holotype: on fruits of *Malus domestica* (= *Pyrus malus*), Argentina, prov. Buenos Aires, La Plata, Nov. 1894, C. Spegazzini, no. 934 (LPS).
= *Fusicladium pyrorum* [(Lib.) Fuckel] f. *carpophila* Sacc., Mycoth. ital. 992 (1901); syntype: on fruits of *Pyrus communis*, Italy, Selva, Treviso, Aug. 1901, D. Saccardo, Mycoth. ital. 992 (B).
= *Acrotheca dearnessiana* Sacc., Ann. Mycol. 10: 314 (1912); syntype: on *Aronia melanocarpa* (= *Pyrus melanocarpa*), Canada, Ont., London, Aug. 1910, J. Dearness, Barthol., F. Columb. 5001 (IMI 7073).
≡ *Fusicladium dearnessianum* (Sacc.) M.B. Ellis, in herb.

Teleomorph: *Venturia pyrina* Aderh., Landw. Jahrb. 25: 875 (1896), as '*pirina*'.

Lit.: Lindau (1907: 781–782), Ferraris (1912: 313), Vassiljevsky & Karakulin (1937: 195–196), Hughes (1953: 566–567; 1958: 768), Barr (1968: 811–812), Subramanian (1971: 234), Fungi Canadenses (No. 36), CMI Descr. (No. 404), Sivanesan (1977: 94–99; 1984a: 620–621).

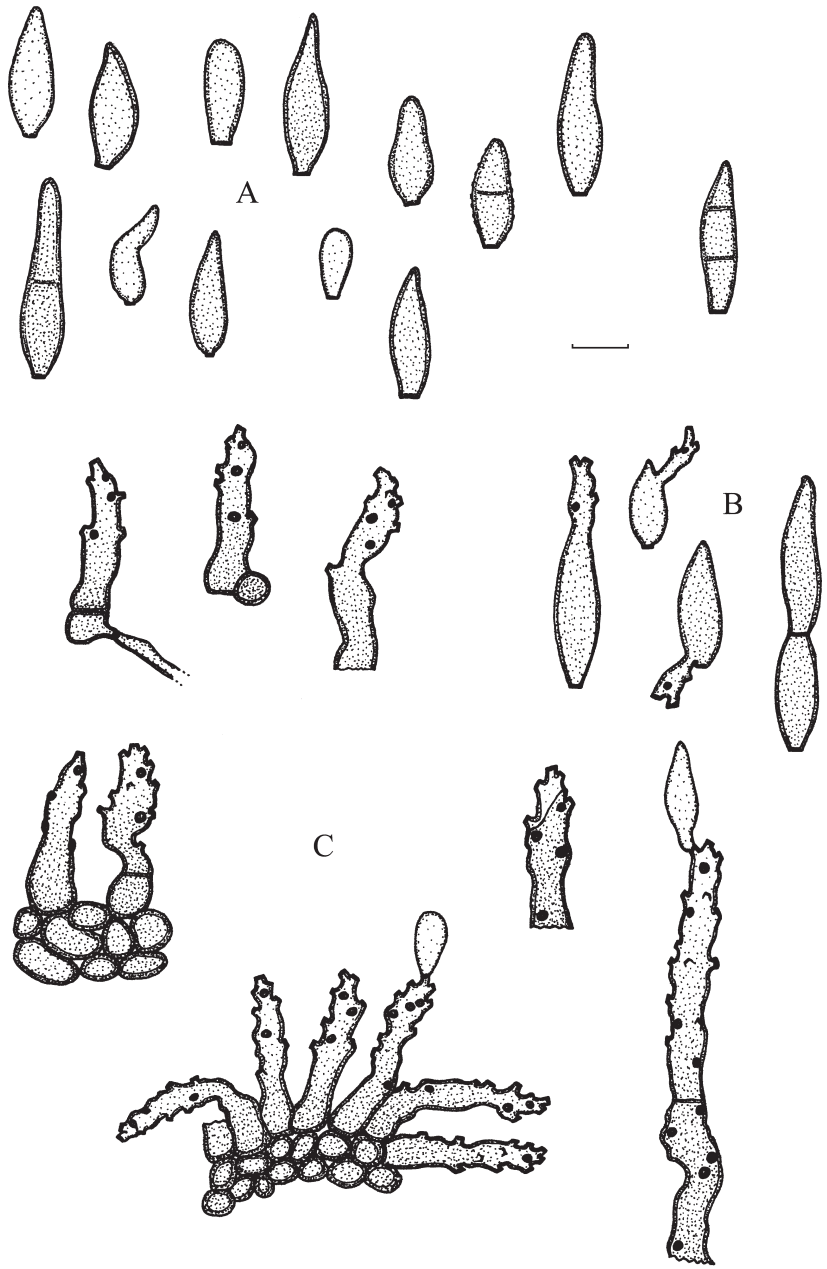

Fig. 41: *Fusicladium pyrorum*. A – conidia, B – microcyclic conidiogenesis, C – solitary or fasciculate conidiophores, scale = 10 µm, K. Schubert del.

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Ill.: BONORDEN (1851: 80, Fig. 94), ADERHOLD (1896: Figs 51–53, Pl. 1, E & F), BRIOSI & CAVARA (F. paras. 43, Figs 1–3), FERRARIS (1910: 313, Fig. 99), VASSILJEVSKY & KARAKULIN (1937: 196, Fig. 13), HUGHES (1953: 565, Fig. 5; 567, Fig. 6), BARR (1968: 805, Fig. 21), ELLIS (1971: 272, Fig. 186), SUBRAMANIAN (1971: 234, Fig. 203), Fungi Canadenses (No. 36), CMI Descr. (No. 404: 1, Figs D, E), SIVANESAN (1977: 98, Fig. 53; 1984a: 621, Fig. 375), ARX (1987: 59, Fig. 28), SAGDULLAEVA et al. (1990: 52, Fig. 6).
Exs.: Barthol., F. Columb. 4700, 5001; Briosi & Cav., F. paras. 43; Crypt. exs. 4104; Ellis, N. Am. F. 372; Ellis & Everh., N. Am. F. 2791; Erb. Critt. Ital. 696; Fl. Gall. Germ. exs. 597; Fl. Olten. exs. 568; Fuckel, F. rhen. 1517; F. est. 28825; Herb. Mycol. Rom. 1196, 1457; Jaap, F. sel. exs. 683; Krieger, F. sax. 344, 2447; Krypt. exs. 1496, 4104; Lin., F. hung. 293; Migula, Crypt. Germ. Austr. Helv. exs. 382; Petr., F. alban. bosn. exs. 13; Rabenh., F. eur. 1168; Rabenh., Herb. mycol. 588; Reliqu. Petrak. 2159; Roum., F. gall. exs. 1868; Sacc., Mycoth. ital. 992; Sacc., Mycoth. Ven. 585; Schmarotzerp. Ruhrg. 58, 114; Seym. & Earle, Econ. F. 39; Syd., Mycoth. germ. 1782; Syd., Mycoth. march. 800; Thüm., F. austr. 276; Thüm., Herb. myc. oec. 224.

On leaves and fruits, rarely on young twigs and buds, leaf spots scab-like, amphigenous, diffuse, subcircular, olivaceous to dark brown or almost black, surrounded by a paler brown halo. Colonies amphigenous, caespitose, velvety, dark brown to olivaceous-brown. Mycelium subcuticular, hyphae branched, 3 µm wide, septate, pale brown. Stroma almost lacking to well developed, stromatic cells 4–11 µm diam., dark brown, thick-walled. Conidiophores solitary or in loose fascicles, arising from stromata, erect, straight to flexuous, geniculate–subnodulose, unbranched, 11–70(–90) × 4–11 µm, 0–1-septate, olivaceous to dark brown, paler towards the apex, smooth, slightly rough-walled with age, thick-walled. Conidiogenous cells integrated, terminal or intercalary, with numerous conidiogenous loci, proliferation sympodial, loci denticulate, short cylindrical, truncate or somewhat convex, 1–3 µm wide, walls unthickened or almost so, slightly darkened–refractive. Conidia solitary, very rarely in unbranched chains, fusiform to pyriform, ellipsoid to obovoid, straight to slightly curved, 10–34 × 5–11 µm, 0–1(–2)-septate, olivaceous to pale brown, smooth, later somewhat rough-walled, pointed at the apex, truncate at the base, hila 1–3(–4) µm wide, unthickened or slightly thickened, somewhat darkened–refractive.

Hosts and Distribution: on *Aronia*, *Chaenomeles*, *Eriobotrya*, *Malus* and *Pyrus* spp. (Rosaceae), cosmopolitan – *Aronia melanocarpa* (North America, Canada, Ont.), *Chaenomeles speciosa* (North America, USA, OK), *Eriobotrya japonica* (Europe, GB), *Malus domestica* (Europe, D; South America, Argentina), *Pyrus amygdaliformis* (Europe, F, TR), *P. bucharica* (Central Asia, Tadzhikistan, Uzbekistan), *P. caucasica* (Caucasus, Georgia), *P. communis* (= *P. sativa*) (Asia, Israel, Lebanon, Iran, Iraq, Afghanistan, Russia, Kazakhstan, Kirghizia, Uzbekistan, Turkmenistan, Tadzhikistan, China, India, Korea, Japan, Taiwan; Caucasus, Armenia, Azerbaijan, Georgia; Europe, A, AL, BG, CH, CZ, D, DK, EW, F, GB, H, I, LT, LV, P, RO, RUS, SLO, TR, Ukr., YU, Byelorussia, Moldavia, Malta, Cyprus; Canary Islands; Africa, Libyan, Morocco, Mozambique, South Africa, Madagascar; North America, Canada, BC., NB., NS., Ont., Que., PEI, USA, FL, MA, WI; South America, Columbia, Argentina, Chile; Australia, New South Wales, Queensland, Tasmania, Victoria; New Zealand;), *P. coronarius* (Europe, CH), *P. korshinskyi* (Central Asia, Uzbekistan), *P. mamorensis* (Africa, Morocco), *P. pyraster* (Europe, RO), *Pyrus* spp. (Asia, China; Europa, EW).

Material examined: on *Eriobotrya japonica*, Europe, Great Britain, Surrey, Wisley, 23 Dec. 1966, A.V. Brook (IMI 123946), on *Pyrus* spp. collections from B, G, HBG, IMI, J, LE, M.

Notes: In a few cases, conidia forming secondary conidiophores and conidia by microcyclic conidiogenesis have been found. This phenomenon usually occurs under high humidity. BONTEA (1985) recorded *Sorbus domestica* as host of this species. *Malus* spp. are also known to be hosts of *Fusicladium pyrorum*, e.g., in the types of *F. fuscescens* and *Cercospora porrigo*, but the correct determinations of these hosts could not be proven.

10.2.40.1. *Fusicladium radiosum* (Lib.) Lind, Ann. Mycol. 3: 430 (1905) var. *radiosum* Fig. 42

≡ *Oidium radiosum* Lib., Pl. crypt. ard., Fasc. 3, 285 (1834); lectotype: on *Populus tremula*, Belgium, Belgian Ardennes, 1834, Libert (BR), selected by MORELET 1985; isolectotypes: Lib., Pl. crypt. ard., Fasc. 3, 285.
≡ *Fusicladium radiosum* (Lib.) Lindau, in Rabenh., Krypt.-Fl., ed. 2, 1(8): 777 (1907).
≡ *Stigmina radiosa* (Lib.) Goid., Ann. Bot. (Rome) 21: 11 (1936).
≡ *Pollaccia radiosa* (Lib.) E. Bald. & Cif., in E. Bald., Atti Ist. Bot. "Giovanni Briosi" 10: 61 (1937).
≡ *Venturia radiosa* (Lib.) Ferd. & C.A. Jørg., Skovtraeernes Sygdomme 1: 125 (1938) (nom. anamorph.).
= *Cladosporium ramulosum* Roberge ex Desm., Ann. Sci. Nat. Bot. Sér. 2, 18: 361 (1852), non Reisseck 1851; holotype: on *Populus alba*, France, Paris, Parc du Libisy, May 1851, Roberge (PC 1518); isotype: herb. Desmazières 2135 (PC).
≡ *Fusicladium ramulosum* Rostr., Tidsskr. Skovbr. 6: 294 (1883), nom. nov., as '(Roberge, in Desm.) Rostr.'.
≡ *Pollaccia ramulosa* (Rostr.) Ondřej, Eur. J. Forest Pathol. 2: 143 (1972), nom. nov., as '(Desm.) Ondřej'.
= *Cladosporium asteroma* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 355 '1869' (1870).
≡ *Napicladium asteroma* (Fuckel) Allesch., Ber. Bayer. Bot. Ges. 5: 25 (1897).
≡ *Napicladium asteroma* (Fuckel) Sacc., Malpighia 17: 421 (1902).
= ? *Cladosporium asteroma* [Fuckel] var. *macrosporum* Sacc., Michelia 2: 126 (1882).
= *Fusicladium tremulae* A.B. Frank, Hedwigia 22: 127 (1883); type: on *Populus tremula*, Germany, Berlin, Tegel, A.B. Frank (B).
≡ *Napicladium tremulae* (A.B. Frank) Sacc., Syll. fung. 4: 482 (1886).
= ? *Cladosporium asteroma* [Fuckel] var. *microsporum* Sacc., Syll. fung. 4: 357 (1886).
≡ *Fusicladium radiosum* [(Lib.) Lindau] var. *microsporum* (Sacc.) Lindau, in Rabenh. Krypt.-Fl., ed. 2, 1(8): 777 (1907).
= *Fusariella populi* Garb., Bull. Soc. Mycol. France 33: 89 (1917).
Teleomorph: *Venturia tremulae* Aderh., Hedwigia 36: 81 (1897) var. *tremulae* [MORELET (1985: 108)].
Lit.: ADERHOLD (1897: 81), SACCARDO (1886: 357; 1913: 1376), LINDAU (1907: 777, 778), GONZÁLES FRAGOSO (1927: 188–190), SERVAZZI (1939: 49–153), VASSILJEVSKY & KARAKULIN (1937: 200), ELLIS (1971: 142), ONDŘEJ (1972: 142), SIVANESAN (1977: 80), BRANDENBURGER (1985: 39), ELLIS & ELLIS (1997: 192).
Ill.: ADERHOLD (1897: Pl. IV, Fig. 3), VASSILJEVSKY & KARAKULIN (1937: 201, Fig. 14), SERVAZZI (1939: Pl. IX, Figs 44–47, Pl. X, Figs 48–53, Pl. XI, Figs 54–57), ELLIS (1971: 141, Fig. 94), SUBRAMANIAN (1971: 86, Fig. 69), ONDŘEJ (1972: 142, Figs 1, 2), BRANDENBURGER (1985: 1101, Fig. 273), SIVANESAN (1984a: 618, Fig. 373 B), MORELET (1985: 111, Fig. 5), WU & SUTTON (1995: 985, Fig. 5), ELLIS & ELLIS (1997: Pl. 82, Fig. 849).
Exs.: Allesch. & Schn., F. bavar. 597; Crypt. exs. 3625, 1499; Erikss., F. paras. scand. 298, 399; Fuckel, F. rhen. 2208; Krieger, F. sax. 194; Lib., Pl. crypt. ard. 285; Mycoth. Ross. 247 a; Petr., Mycoth. gen. 1381; Romell, F. exs. 50; Syd., Mycoth. germ. 1783; Syd., Mycoth. march. 3095; Thüm., F. austr. 536; Thüm., Herb. myc. oec. 340; Thüm., Mycoth. univ. 1170.

On living leaves, petioles and twigs, spots amphigenous, circular to irregular, 5–20 mm wide, sometimes confluent, covering large parts of the leaf, at first olivaceous to medium brown, later reddish brown with a black-brown, narrow to broad margin,

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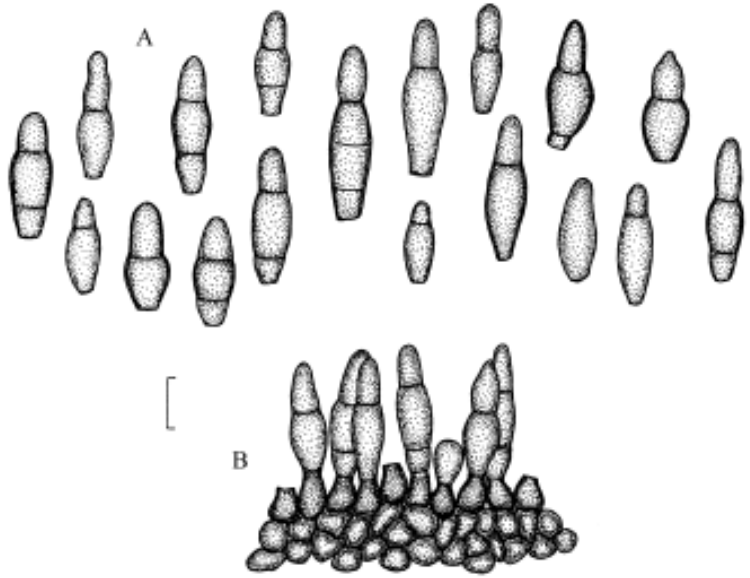

Fig. 42: *Fusicladium radiosum* var. *radiosum*. A – conidia, B – conidiogenous cells arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

sometimes leaf margin incurved, twigs often becoming necrotic, causing twig dieback. Colonies amphigenous, pale to dark olivaceous-brown, fructification at first formed in the center of the leaf spots, dendritically expanding. Mycelium immersed, hyphae branched, septate, smooth. Stromata intraepidermal to subcuticular, composed of rounded to somewhat angular, pale to medium olivaceous-brown, relatively thick-walled cells, 5–8 µm diam. Conidiophores densely fasciculate, arising from the upper cells of the stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, cylindrical to doliiform or somewhat ampulliform, unbranched, short, 10–17 × 4–6(–8) µm, usually aseptate, medium olivaceous-brown, smooth, walls somewhat thickened, conidiophores reduced to conidiogenous cells, unilocal, determinate or occasionally percurrent, with up to two inconspicuous annellations, loci (2–)3–4(–5) µm wide, neither thickened nor darkened. Conidia solitary, ellipsoid to obovoid, straight, sometimes slightly curved, (13–)18–26(–37) × 5–8 µm, mostly 1-septate, septum in the upper third, to 2-septate, second septum in the lower third, rarely aseptate, more or less constricted at the septum, pale to dark olivaceous-brown, smooth, wall somewhat thickened, rounded to pointed at the apex, obconically truncate at the base, hilum truncate, (2–)3–4(–5) µm wide, unthickened, not darkened.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Asia, Caucasus, Europe – *Populus alba* (Europe, F), *P.* × *canescens* (Europe, F), *P. tremula* (Asia, Russia, Turkmenistan, Uzbekistan; Caucasus, Armenia, Europe, BG, CS, D, DK, E, F, GB, I, LT, LV, N, PL, RO, RUS, S, SF, Ukr., YU), *P. tremula* × *P. alba* (Europe, F), *P. tremula* × *P. tremuloides* (Europe, F).

Material examined: collections from herb. B, HAL, HBG, JE, M, PC.

Notes: *Pollaccia* species on poplars were often confused in the past, since it was unknown that different species of *Populus* are inhabited by allied, but morphologically distinct species of this genus. ADERHOLD (1897) found the teleomorph of *Fusicladium tremulae* and described it as *Venturia tremulae*. LIND (1905) discussed the synonymy of this fungus, adopted the oldest valid name and introduced the combination *Fusicladium radiosum*. BALDACCI & CIFERRI (1937) described the new genus *Pollaccia* with *P. radiosa* as type species. SERVAZZI (1938) recognised differences between *Pollaccia* collections on *Populus tremula* and *P. nigra*, and introduced the name *Pollaccia elegans* for the latter fungus. MÜLLER & ARX (1950) considered *P. radiosa* the anamorph of *Venturia macularis* (Fr.) E. Müll. & Arx, a species on *Populus* spp. of sect. *Leuce*. MORELET (1985) pointed out that three *Venturia* species occur on *Populus* spp. of this section, and that *F. radiosum* has to be considered the anamorph of *Venturia tremulae*.
Older records of *Pollacia radiosa* in the literature must be considered with caution. They often refer to *P. radiosa* s.lat., making it impossible to assign them to any one of the varieties of *F. radiosum*. Also, the identifications of the hosts are often uncertain and doubtful.

10.2.40.2. *Fusicladium radiosum* var. *lethiferum* (Peck) Ritschel & U. Braun **comb. nov.** Fig. 43

≡ *Cladosporium lethiferum* Peck, Rep. (Annual) New York State Mus. Nat. Hist. 40: 64 (1887); holotype: on *Populus tremuloides*, USA, New Hampshire, Keene, Jun. 1887, Peck (NYS); isotype: BPI 427241.
≡ *Pollaccia lethifera* (Peck) M. Morelet, Bull. Soc. Sci. Nat. Archéol. Toulon Var 34 (219): 12 (1978).
≡ *Pollaccia radiosa* [(Lib.) E. Bald. & Cif.] var. *lethifera* (Peck) M. Morelet, Cryptog. Mycol. 6: 113 (1985).
= *Clasterosporium populi* Ellis & Everh., J. Mycol. 7: 134 (1892), non Saccardo 1886; types: on *Populus tremuloides*, Canada, London, Dearness (DAOM, NY).
≡ *Stigmina populi* Pound & Clem., Bull. Geol. Nat. Hist. Surv. 9: 662 (1896), nom. nov., as '(Ellis & Everh.) Pound & Clem.'.
≡ *Stigmina populi* Peck, Bull. New York State Mus. Nat. Hist. 157: 34 (1912), nom. nov., as '(Ellis & Everh.) Peck'.
= *Dicoccum populinum* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1893: 462 (1894); holotype: on *Populus grandidentata*, USA, Iowa, Iowa City, Jun. 1889 (NY).
= *Fusicladium lageniforme* Solheim & Hadfield, in Hadfield, Univ. Wyoming Publ. 1946: 18–19 (1946), nom. inval.
= *Pollaccia americana* Ondřej, Eur. J. Forest Pathol. 2: 144 (1972); holotype: on *Populus grandidentata*, Canada, Kentville, 16 Jun. 1952, Creelman (DAOM), as *Fusicladium radiosum* (Lib.) Lind.

Teleomorph: *Venturia tremulae* [Aderh.] var. *grandidentatae* M. Morelet, Cryptog. Mycol. 6: 113 (1985) [≡ *Venturia moreletii* Rulamort, Bull. Soc. Bot. Centre-Ouest, N.S., 17: 191 (1986)].
Lit.: SACCARDO (1892: 604; 1895: 621; 1899: 1083), ONDŘEJ (1972: 144), MORELET (1978: 12; 1985: 113–115).
Ill.: ONDŘEJ (1972: 143, Fig. 3; 144, Fig. 5), MORELET (1985: 114, Fig. 7).

On living leaves, petioles and twigs, spots circular to irregular, 5–20 mm wide, yellowish brown, surrounded by a pale to later dark brown margin. Colonies amphigenous, pale to dark olivaceous-brown, sometimes almost black, dendritically spreading. Mycelium immersed. Stromata intraepidermal to subcuticular, composed of subglobose, pale to dark olivaceous-brown, relatively thick-walled cells, 4–9 µm diam. Conidiophores in dense fascicles, arising from the upper cells of stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, short cylindrical to

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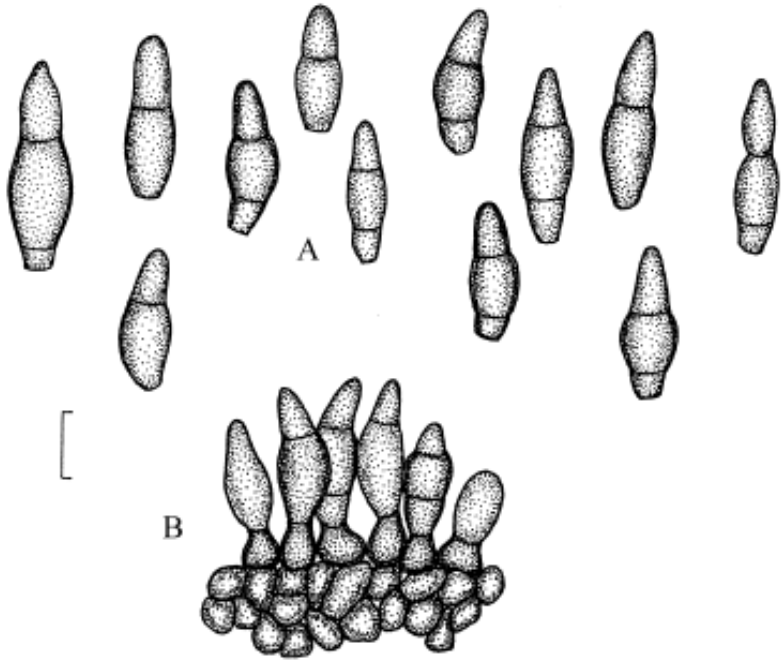

Fig. 43: *Fusicladium radiosum* var. *lethiferum*. A – conidia, B – conidiogenous cells arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

doliiform or ampulliform, unbranched, 8–12 × 4–6 µm, aseptate, pale to medium olivaceous-brown, smooth, walls thickened, conidiophores reduced to conidiogenous cells, unilocal, determinate or occasionally percurrently proliferating, with a single or two inconspicuous annellations, loci truncate, (2–)3–4(–5) µm wide, neither thickened, nor darkened. Conidia solitary, oblong–ellipsoid to fusiform, often slightly curved, sometimes straight, 17–26(–33) × (5–)6–8(–10) µm, mostly 1-septate, septum in the upper third, to 2-septate, second septum in the lower third, rarely aseptate, often more or less constricted at the septa, pale to medium olivaceous-brown, smooth, walls somewhat thickened, apex pointed or rounded, truncate at the base, sometimes somewhat oblique, hila truncate to slightly convex, (2–)3–4(–5) µm wide, not or only slightly thickened, not darkened.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Europe, North America – *Populus alba* (North America, Canada, Ont.), *P. alba* × *P. grandidentata* (North America, Canada, Ont.), *P. alba* × *P. jackii* (North America, Canada, Que.), *P. grandidentata* (North America, Canada, NB., NS., Ont., PEI, USA, MD, NY, WI), *P. tremuloides* (Europe, BG, GB; North America, Canada, Alta., BC., Labr., Man., NB., Nfld., NS., Ont., PEI, Que., Sask., USA, AK, ID, ME, MT, NH, NY, PA, SD, WI).

Material examined: on *Populus grandidentata*, Canada, Nova Scotia, New Glasgow, 26 Aug. 1908 (NYS), as *Cladosporium lethiferum* Peck; on *Populus grandidentata*, USA, Maryland, Prince George's, 26 Jun. 1951, Waterman (B), as *Fusicladium tremulae* A.B. Frank.

Notes: Based on the original diagnosis, SERVAZZI (1937) considered *Cladosporium lethiferum* to be a species probably belonging in *Pollaccia*, but he did not introduce a formal combination. ONDŘEJ (1972) described this fungus as *Pollaccia americana*, and MORELET (1978) published the combination *P. lethifera*. In 1985, MORELET found the teleomorph of this North American species which he considered a variety of *Venturia tremulae* (var. *grandidentatae*), and he introduced the combination *Pollaccia radiosa* var. *lethifera* for its anamorph. RULAMORT (1986) reintroduced *Pollaccia lethifera* and proposed the new name *Venturia moreletii* for the teleomorph. However, this re-assessment was not based on any new examinations or any other new data.
Morphological analyses of the whole *Fusicladium radiosum* complex (RITSCHEL 2001) showed that the conidial sizes of var. *radiosum* and var. *lethiferum* are not significantly distinct. The conidia in var. *lethiferum* are only distinguished from those of var. *radiosum* by being frequently curved. These minor differences are not sufficient to treat this taxon as a separate species. We prefer to follow MORELET (1978) and maintain its status as a variety. A molecular approach would be the only way to re-assess the whole *F. radiosum* complex with all taxa included.

10.2.40.3. *Fusicladium radiosum* var. *populi-albae* (M. Morelet) Ritschel & U. Braun **comb. nov.** Fig. 44

≡ *Pollaccia radiosa* [(Lib.) E. Bald. & Cif.] var. *populi-albae* M. Morelet, Cryptog. Mycol. 6: 112 (1985); holotype: on living leaves of *Populus alba* var. *bolleana*, Poland, Dabroszyn (the former "Tamsel", ca. 5 km north-east of Kostrzyn), 21 Sept. 1904, Sydow (PAD), as *Cladosporium asteroma* [Fuckel] var. *microsporum* Sacc.
≡ *Pollaccia populi-albae* (M. Morelet) Rulamort, Bull. Soc. Bot. Centre-Ouest, N.S., 17: 191 (1986).
= *Napicladium asteroma* var. *microsperma* Sacc., in herb.
Teleomorph: *Venturia tremulae* [Aderh.] var. *populi-albae* M. Morelet, Cryptog. Mycol. 6: 112 (1985).
Lit.: SACCARDO (1886: 357), ONDŘEJ (1972: 143, 144), MORELET (1985: 112–113).
Ill.: ONDŘEJ (1972: 143, Figs 3, 4), MORELET (1985: 112, Fig. 6).
Exs.: Petr., Mycoth. gen. 1744; Petr., Fl. Bohem. Morav. exs. 1456; Syd., Mycoth. germ. 444.

On living leaves, petioles and twigs, leaf spots circular to irregular, 10–30 mm wide, or confluent and larger, pale to reddish brown, with a dark brown, narrow to broad margin, sometimes causing twig dieback. Colonies amphigenous, pale to later dark olivaceous-brown, on the upper leaf surface often dendritic. Mycelium immersed. Stromata intraepidermal to subcuticular, composed of subglobose, thick-walled cells, 5–9 µm diam. Conidiophores in loose to dense fascicles, arising from the upper cells of stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, straight to slightly flexuous, cylindrical to ampulliform or doliiform, unbranched, short, 6–10 × 6–7(–7.5) µm, aseptate, medium olivaceous-brown, smooth, walls somewhat thickened, swollen at the base, up to 15 µm wide, conidiophores reduced to conidiogenous cells, unilocal, determinate or sometimes percurrent, with up to two inconspicuous annellations, loci truncate, 3–6 µm wide, unthickened, not darkened. Conidia solitary, ellipsoid to pyriform, straight, 12–21(–25) × (6–)7–9(–12) µm, (0–)1(–2)-septate, septum in the upper third, often constricted at the septa, pale to medium olivaceous-brown, smooth, walls slightly thickened, apex rounded to pointed, truncate at the base, hilum truncate, 3–6 µm wide, unthickened, not darkened.

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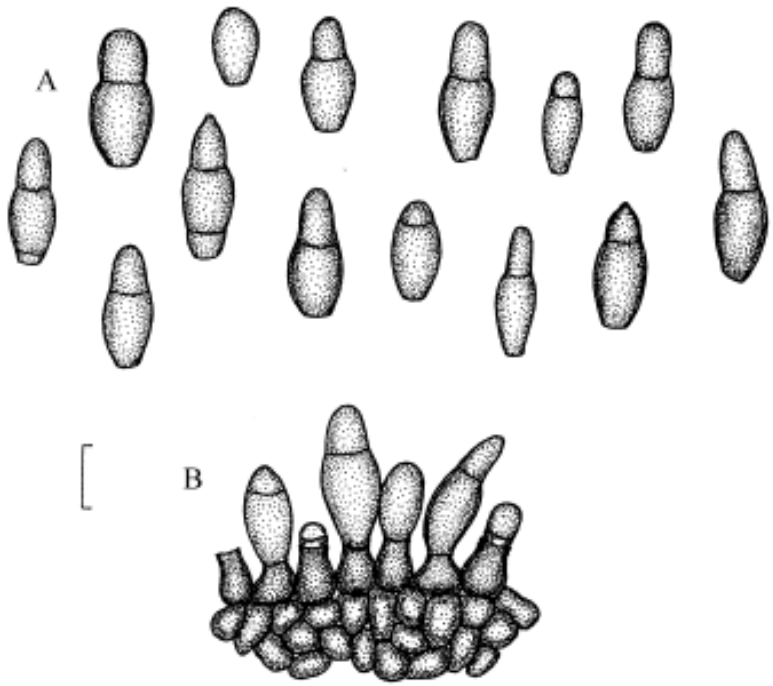

Fig. 44: *Fusicladium radiosum* var. *populi-albae*. A – conidia, B – conidiogenous cells arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Europe, North America – *Populus alba* (Europe, CH, CS, D, DK, H, F, I, LV, PL; North America, USA, NY).

Material examined: collections from herb. B, H, JE, M, PAD.

Notes: ONDŘEJ (1972) used the name *Cladosporium ramulosum* for this fungus from *Populus alba,* but this name is a synonym of *Pollaccia radiosa* var. *radiosa*. MORELET (1985) introduced the name *P. radiosa* var. *populi-albae* for this taxon, which was later raised to species rank by RULAMORT (1986). Morphological and morphometric examinations, carried out by RITSCHEL (2001), confirmed the observations of MORELET (1985) that the conidial size in collections from *Populus alba* is only slightly different from those of other varieties of *P. radiosa*. Therefore, we prefer to follow MORELET´s (1985) taxonomy, in which this fungus was treated as variety of the latter species. Furthermore, it is noteworthy that *Populus alba* is infected by all varieties of this species, i.e., a strict host separation is not evident.

10.2.41. *Fusicladium romellianum* ONDŘEJ, Česká Mykol. 27(4): 237 (1973) Fig. 45

≡ *Torula maculicola* Romell & Sacc., in Sacc., Grevillea 21: 69 (1893), non *Fusicladium maculicola* (Ellis & Kellerm.) Ondřej; lectotype: on *Populus tremula*, Sweden, Nacka Vikdalen, L. Romell, 24 Jun. 1890 (S), selected by SUTTON (1970); isolectotypes: WINF(M) 11082 (slide), IMI 17008 and 'ad Holmiae Cap.' 1890/1891, Romell (PAD).

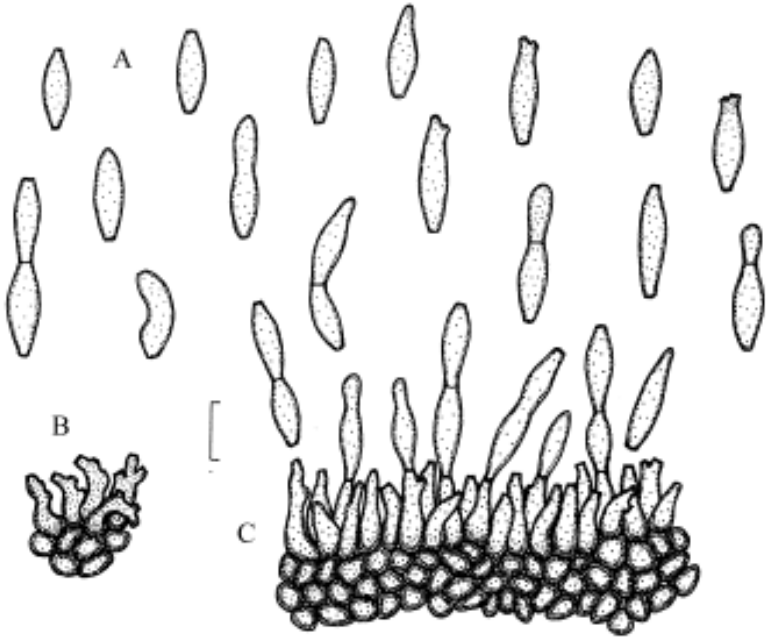

Fig. 45: *Fusicladium romellianum*. A – conidia, B – conidiogenous cells with few conidiogenous loci, C – conidiophores arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

≡ *Phaeoramularia maculicola* (Romell & Sacc.) B. Sutton, Canad. J. Bot. 48: 471 (1970).
≡ *Cladosporium maculicola* (Romell & Sacc.) M. Morelet, Bull. Soc. Sci. Nat. Archéol. Toulon Var 201: 4 (1972).
= *Pollaccia borealis* A. Funk, Canad. J. Bot. 67: 776 (1989); holotype: on leaves of *Populus tremuloides*, Canada, BC., Cassier, 13 Sept. 1987, A. Funk (DAVFP 23609).
Teleomorph: *Venturia borealis* A. Funk, Canad. J. Pl. Pathol. 11: 355 (1989).
Lit.: ELLIS (1976: 322).
Ill.: ONDŘEJ (1973: 238, Fig. 4), ELLIS (1976: 323, Fig. 243 A), FUNK (1989a: Figs 1–8).
Exs.: Fl. Suec. 17688; Mycoth. Ross. 247; Reliqu. Petrak. 328; Syd., Mycoth. germ. 2248.

Leaf spots more or less circular, 1.5–3 mm wide, brown, later with a whitish to pale grey centre, often surrounded by a dark reddish brown, sometimes somewhat raised margin. Colonies mainly hypophyllous, pale brownish, fructification spread over the whitish centre. Mycelium immersed, hyphae branched, septate, brown. Stromata intraepidermal, olivaceous to yellowish brown, 20–100 µm diam., composed of loosely aggregated cells. Conidiophores in dense fascicles, arising from stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, straight or flexuous, cylindrical to conical, unbranched, 5–25 × 2–4 µm, aseptate, pale brown, olivaceous, smooth, conidiophores usually reduced to conidiogenous cells, unilocal, determinate or with two or only few conidiogenous loci, subdenticulate, unthickened, not or only

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very slightly darkened–refractive. Conidia solitary or catenate, in simple or branched chains, oblong, cylindrical or ellipsoid, straight or slightly curved, (7–)11–21(–28) × 3–7 µm, 0(–1)-septate, pale brown, sometimes subhyaline, smooth, walls thin to somewhat thickened, attenuated towards apex and base, apex pointed or truncate, base truncate, hila 1–2 µm wide, unthickened, not or only very slightly darkened–refractive.

Hosts and Distribution: on *Populus* spp. (Salicaceae), Asia, Europe, North America – *Populus alba* (Asia, Kazakhstan), *P. cataracti* (Asia, Kazakhstan), *P. deltoides* (Asia, India), *P. grandidentata* (North America, Canada, Ont., Que.), *P. italica* (Asia, Kazakhstan), *P. laurifolia* (Asia, Kazakhstan), *P. nigra* (Asia, Kazakhstan), *P. pilosa* (Asia, Kazakhstan), *P. pruinosa* (Asia, Kazakhstan), *P. talassica* (Asia, Kazakhstan), *P. tremula* (Asia, Kazakhstan; Europe, D, LV, S, SF), *P. tremuloides* (North America, Canada, Alta., BC., Man., Nfld., NWT, Ont., Que., Sask., USA, CO, UT, WI), *P. trichocarpa* (North America, Canada, BC.), *Populus* spp. (Asia, Kazakhstan; North America, Canada, Ont., USA, AK).

Material examined: collections from B, DAVFP, HBG, M.

Notes: *Fusicladium romellianum* has often been confused with *Pollaccia radiosa*, the anamorph of *Venturia tremulae*. Both species can easily be distinguished by their symptoms and the morphology of the conidia. *Pollaccia radiosa* causes irregular, large, blackish leaf spots on species of *Populus*. The conidia are formed singly, they are larger than those of *F. romellianum* (15–42 × 6–11 µm) and often septate (with 1–2 septa). *Pollaccia borealis* is morphologically indistinguishable from *F. romellianum*. The teleomorph, *Venturia borealis*, has only been found and proven in connection with *Pollaccia borealis* (FUNK 1989b).

10.2.42. ***Fusicladium saliciperdum*** (Allesch. & Tubeuf) Tubeuf, Arbeiten Biol. Reichsanst. Land-Forstw. 2: 568 (1902) Fig. 46

≡ *Septogloeum saliciperdum* Allesch. & Tubeuf, in Allesch. & Schn., Fungi bavar. 485 (1895); lectotype: on *Salix bicolor* (= *S. laurina*), Germany, Bavaria, Tutzing, Jun. 1895, Tubeuf (M), selected here; isolectotypes: Allesch. & Schn., F. bavar. 485.
≡ *Fusicladium saliciperdum* (Allesch. & Tubeuf) Lind, Ann. Mycol. 3: 430 (1905).
≡ *Pollaccia saliciperda* (Allesch. & Tubeuf) Arx, Tijdschr. Plantenziekten 63: 233 (1957).
Teleomorph: *Venturia saliciperda* J. Nüesch, Phytopathol. Z. 39: 349 (1960).
Lit.: ADERHOLD (1897: 82–83, as '*Fusicladium ramulosum* Rostr.'), SACCARDO (1899: 1031; 1913: 1376), LINDAU (1907: 776), VASSILJEVSKY & KARAKULIN (1937: 201–203), CMI Descr. (No. 482), ELLIS (1976: 110), SIVANESAN (1977: 102–105; 1984a: 622), Fungi Canadenses (No. 247), BRANDENBURGER (1985: 45), ELLIS & ELLIS (1997: 246).
Ill.: ADERHOLD (1897: Pl. IV, Fig. 4), VASSILJEVSKY & KARAKULIN (1937: 201, Fig. 14; 202, Fig. 15), ONDŘEJ (1973: 238, Fig. 8), CMI Descr. (No. 482, Fig.), ELLIS (1976: 110, Fig. 77 C), Fungi Canadenses (No. 247, Figs 1–3), SIVANESAN (1984a: 618, Fig. 373 C).
Exs.: Allesch. & Schn., F. bavar. 485; Kab. & Bub., F. imp. exs. 642; Mycoth. Ross. 146; Petr., Fl. Bohem. Morav. exs. 925; Petr., Mycoth. gen. 735; Syd., Mycoth. germ. 2796.

On living leaves, petioles and twigs, spots mostly hypophyllous, but also epiphyllous along leaf veins, irregularly shaped, 1–3 mm wide, brown, surrounded by a dark brown, somewhat raised, shining margin, often causing lateral distortions and necroses as well as twig dieback. Colonies amphigenous, punctiform, scattered to dendritic, mainly along leaf veins, dark brown to blackish. Mycelium immersed, pale to medium olivaceous-brown. Stromata intraepidermal to subcuticular, 10–60 µm wide and 10–

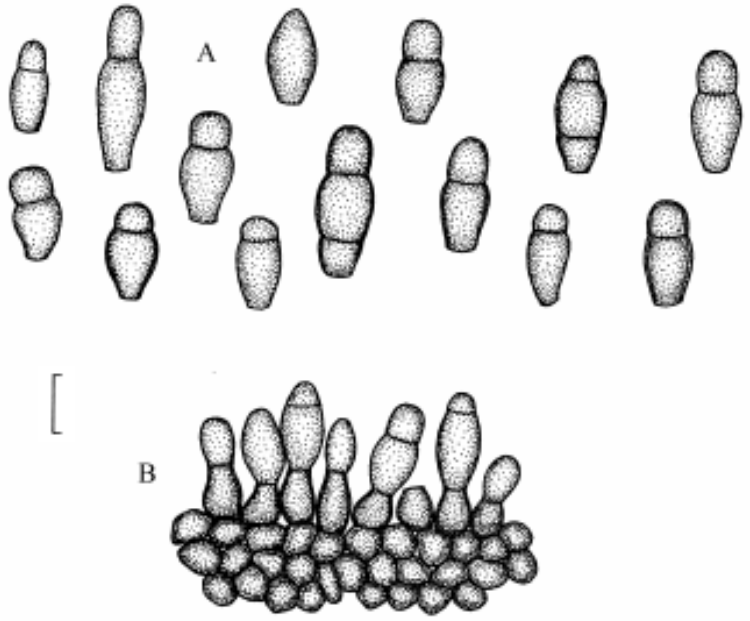

Fig. 46: *Fusicladium saliciperdum*. A – conidia, B – conidiogenous cells arranged in a sporodochium, scale = 10 µm, A. Ritschel del.

30 µm deep, composed of subcircular to slightly angular, somewhat thick-walled cells, 5–10 µm diam. Conidiophores in dense fascicles, arising from the upper cells of stromata, forming sporodochial conidiomata, erumpent through the cuticle, erect, cylindrical to slightly ampulliform, unbranched, short, 8–15 × 5–8 µm, aseptate, pale to medium olivaceous-brown, smooth, walls somewhat thickened, conidiophores usually reduced to conidiogenous cells, unilocal, determinate or occasionally percurrently proliferating, with a single or two, more or less conspicuous annellations, loci truncate, 3–6 µm wide, unthickened. Conidia solitary, cylindrical to ellipsoid, often inflated in the middle, straight, sometimes slightly curved, (12–)16–23(–30) × (5–)7–9(–11) µm, mostly 1-septate, septum in the upper half, occasionally aseptate or with a second septum in the lower half, often slightly constricted at the septa, olivaceous to yellowish brown, smooth, walls somewhat thickened, apex rounded, base (hilum) truncate to slightly convex, 3–6 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Salix* spp. (Salicaceae), Asia, Caucasus, Europe, North America – *Salix alba* (Europe, CZ, DK, GB, RUS, RO; north-eastern North America), *S. americana* (Europe, D, PL), *S. alba* (incl. var. *pendula*) (North America, Canada, NS., Que., USA, CT, MA, ME, NH, NY), *S. alba* × *S. babylonica* (Europe, D), *S. amygdalina* (Europe, D, RUS), *S. aurita* (Europe, GB, DK), *S. babylonica* (Europe, D, GB, RUS; North America, Canada, BC., NB., NS., Que., USA, CT, MA, NY, PA),

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S. bicolor (= *S. laurina*) (Europe, D), *S. blanda* (Europe, RUS; North America, Canada, NS.), *S. caprea* (Europe, D, DK), *S. cinerea* (Asia, Kazakhstan; Europe, DK, RUS), *S. cordata* (North America, Canada, Que.), *S. cuspidata* (Europe, DK), *S. discolor* (North America, Canada, Que.), *S. fragilis* (Europe, D, DK, RO; North America, Canada, NS., USA, MA, NY), *S. fragilis* × *S. pentandra* (Europe, DK), *S. gracilis* (Europe, D), *S. japonica* (Europe, D), *S. lucida* (North America, USA, CT, ME), *S. mollissima* (Europe, DK), *S. nigra* (North America, Canada, NS., USA, CT, MA, NY), *S. pentandra* (Europe, D; North America, Canada, Que.), *S. purpurea* (incl. var. *nana*) (Europe, RO, RUS; North America, Canada, Que.), *S. sericea* (North America, USA, CT, NY), *S. silesiaca* (Europe, RO), *S.* × *smithiana* (North America, Canada, BC.), *S. viminalis* (Europe, RUS), *S. vitellina* (Europe, D; North America, Canada BC., NS.), *Salix* spp. (Asia, Japan, Russia, Uzbekistan; Caucasus, Armenia, Azerbaijan, Georgia; Europe, CZ, D, DK, GB, LT, LV, NL, RUS; North America, Canada, BC., Man., NB., Nfld., NS., Ont., PEI, Que., USA, north-eastern states, NC, PA, WA).

Material examined: collections from B, HBG, JE, M.

Notes: ROSTRUP (1883) used the name *Fusicladium ramulosum* for collections on species of *Salix* as well as *Populus*, suggesting that they were the same as *Cladosporium ramulosum*, described by Desmazières from *Populus alba*. ADERHOLD (1897) disagreed, assigned the fungus from *Populus* spp. to *Fusicladium tremulae* and confined the name *Fusicladium ramulosum* to the species on *Salix*, which he erroneously considered to be the anamorph of *Venturia chlorospora*. The first valid description of the *Fusicladium* on *Salix* spp. dates back to Allescher & Tubeuf, in ALLESCHER & SCHNABL, Fungi bavarici 485, 1895, who introduced *Septogloeum saliciperdum*, which was later transferred to *Fusicladium* by TUBEUF (1902). NÜESCH (1960) examined this fungus in vitro, found the teleomorph and described it as *Venturia saliciperda*.

10.2.43. ***Fusicladium scillae*** (Deighton) U. Braun & K. Schub., IMI Descriptions of Fungi and Bacteria 152, no. 1518 (2002) Fig. 47

≡ *Cladosporium scillae* Deighton, in Laundon, New Zealand J. Bot. 8: 55 (1970); holotype: on *Scilla peruviana*, New Zealand, Levin, 21 Dec. 1965, G.F. Laundon (IMI 116997).

Teleomorph: Unknown.

Ill.: LAUNDON (1970: 57, Fig. 4), IMI Descr. (No. 1518, Figs A–D).

Leaf spots amphigenous, elliptical, small or occasionally up to 10 × 5 mm, dark brown, finally greyish brown, margin indefinite. Colonies epiphyllous, effuse, brown, loose to dense. Primary mycelium internal, inter- and intracellular in the mesophyll and epidermal cells, composed of pale olivaceous, septate, sparingly branched hyphae, 1.5–2 µm wide, and subcuticular swollen hyphal cells, 8–12 × 4–8 µm, aggregated, forming expanded subcuticular radiating strands, stromatic hyphal aggregations variable, almost lacking to well-developed. Secondary mycelium superficial, almost lacking to well-developed, hyphae creeping, septate, sparingly branched, 1.5–2.5 µm wide, pale olivaceous, smooth. Conidiophores in small to large fascicles (up to 100 or even more), loose to moderately dense, often caespitose, arising from internal hyphae or stromatic hyphal aggregations, erumpent through the cuticle, sometimes emerging through stomata, occasionally solitary, arising from creeping superficial hyphae, erect, straight, subcylindrical to flexuous, geniculate–sinuous, usually unbranched, rarely branched, 19–70(–120) × (1.5–)2–4 µm, septate, pale olivaceous, smooth, wall thin

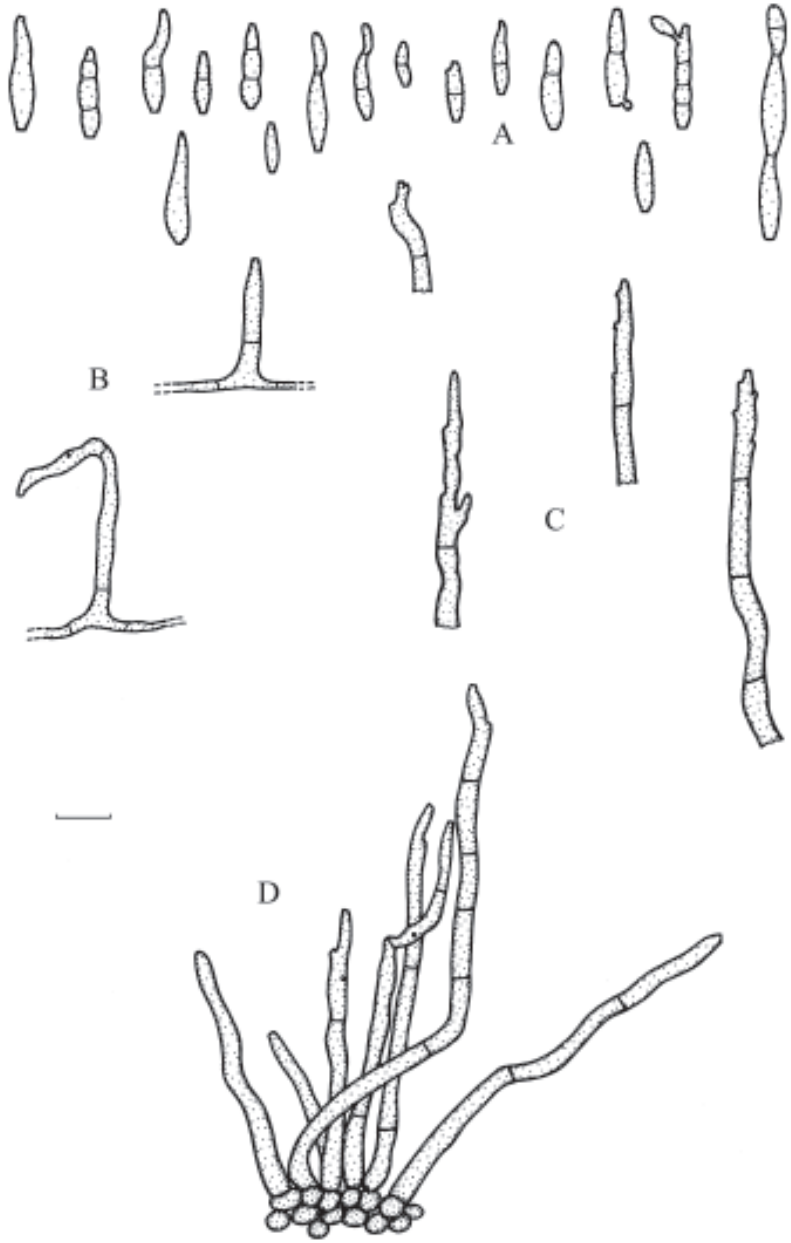

Fig. 47: *Fusicladium scillae*. A – conidia, B – solitary conidiophores arising from creeping hyphae, C – conidiophores and conidiogenous cells, D – fasciculate conidiophores, scale = 10 µm, K. Schubert del.

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to slightly thickened. Conidiogenous cells integrated, terminal, 10–25 µm long, with a single or several conidiogenous loci, subdenticulate, proliferation sympodial, loci 1–1.5 µm wide, wall unthickened, non-pigmented, at most somewhat refractive. Conidia catenate, in simple or branched chains, subcylindrical, ellipsoid–ovoid (–fusiform), 7–22 × 2.5–4 µm, 0–3-septate, often somewhat constricted at the septa, pale olivaceous, occasionally subhyaline, smooth to faintly rough-walled, apex obtuse in primary conidia, truncate in secondary conidia, base obconically truncate, hila 1–1.5 µm wide, unthickened, not darkened.

Hosts and Distribution: on *Scilla* spp. (Liliaceae), New Zealand – *Scilla peruviana* (New Zealand).

Material examined: on *Scilla peruviana*, New Zealand, Levin, 27 May 1965, E.A. Way (IMI 115480).

Notes: The conidiogenous loci in this species are quite distinct from those of *Cladosporium* species, described in detail by DAVID (1997), and agree with *Fusicladium* by being subdenticulate, unthickened and not darkened. Based on the structure of the conidiogenous loci and the features of the conidia, *Cladosporium scillae* was transferred to *Fusicladium*.

10.2.44. ***Fusicladium scribnerianum*** (Cavara) M.B. Ellis, More Dematiaceous Hyphomycetes: 238 (1976) Fig. 48

≡ *Cladosporium scribnerianum* Cavara, Hedwigia 31: 143 (1892) and in Briosi & Cavara, F. paras. 187 (1892); syntype: on *Betula populifolia*, Italy, Pavia, 1890, F.L. Scribner, Briosi & Cavara, F. paras. 187 (HAL).
Teleomorph: Unknown.
Lit.: FERRARIS (1912: 340).
Ill.: BRIOSI & CAVARA (F. paras. 187, Figs 1–4), ELLIS (1976: 238, Fig. 178).
Exs.: Briosi & Cavara, F. paras. 187.

Leaf spots amphigenous, numerous, subcircular, 3–8 mm wide, on the upper leaf surface olivaceous-greyish to dark brown, pale greenish below, centre of the spots darker as the surrounding halo, sometimes confluent, spreading over the leaf veins. Colonies only epiphyllous, effuse, velvety, olivaceous. Mycelium subcuticular, hyphae 2–3 µm wide, septate, pale olivaceous. Stromata composed of brown, thick-walled cells, 5–8 µm diam. Conidiophores solitary or loosely to densely fasciculate, arising from stromata, erumpent through the cuticle, erect, straight to slightly flexuous, unbranched, 18–90 × 4–5.5 µm, 0–1-septate, septa not very conspicuous, olivaceous to pale brown, paler towards the apex, smooth, walls somewhat thickened. Conidiogenous cells integrated, terminal, with a single to several conidiogenous loci, proliferation sympodial, loci 2–3 µm wide, unthickened, but somewhat darkened–refractive, sometimes with percurrent proliferations which are not connected with conidiogenesis. Conidia solitary or sometimes catenate, in unbranched or branched chains, fusiform to obclavate or cylindrical, straight, 11.5–29.5 × 4.5–7 µm, 0–3-septate, slightly constricted at the septum, pale olivaceous, smooth to verruculose, truncate at the base, hila 2–3 µm wide, unthickened, but somewhat darkened–refractive.

Hosts and Distribution: on *Betula* spp. (Betulaceae), Asia, Europe – *Betula pendula* (Asia, Kazakhstan; Europe, D, I), *B. populifolia* (Europe, I).

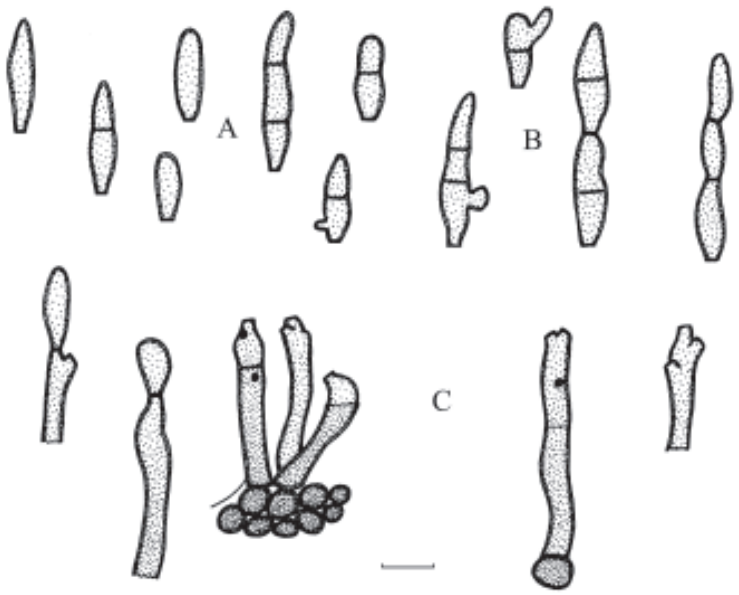

Fig. 48: *Fusicladium scribnerianum*. A – conidia, B – catenate conidia, C – conidiophores, scale = 10 µm, K. Schubert del.

Notes: Branched conidiophores, as described by FERRARIS (1912), have not been observed. *Fusicladium scribnerianum* is morphologically close to the anamorph of *Venturia ditricha*, but differs in having conidia formed singly and in chains as well as darkened–refractive conidiogenous loci and hila. Additional collections from *Betula* spp. and molecular data would be helpful to find the true taxonomic position and affinity of *F. scribnerianum*.

10.2.45. ***Fusicladium spiraeae*** Karak., Mater. Mikol. Obsl. Rossii 2: 82 (1915) Fig. 49

Lectotype: on leaves of *Spiraea crenifolia*, Russia, Bashkortostan, Sterlitamak, 23 Jul. 1913, Karakulin (LE), selected here.
≡ *Scolecotrichum spiraeae* (Karak.) Karak., in Vassiljevsky & Karakulin, Parazitnye nesovershennye griby. Ch. I. Gifomitsety 1: 214 (1937).
≡ *Pollaccia spiraeae* (Karak.) Ondřej, Česká Mykol. 38(1): 46 (1984).
Teleomorph: Unknown.
Lit.: SHVARTSMAN et al. (1975: 132–133), BRANDENBURGER (1985: 226).
Ill.: ONDŘEJ (1984a: 47, Fig.).

Leaf spots amphigenous, irregular, 3–5 mm diam., reddish brown, with a somewhat darker, slightly raised, shining margin, sometimes confluent. Colonies epiphyllous, punctiform, scattered, dark brown to blackish. Mycelium immersed. Stroma subcuticular, 50–80 µm diam., composed of subcircular, olivaceous-brown cells, 5–10 µm diam. Conidiophores in dense fascicles, arising from the upper cells of stromata, form-

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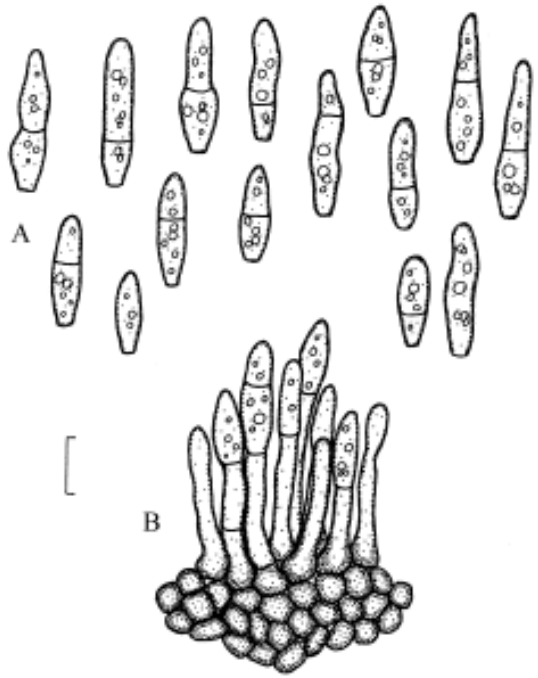

Fig. 49: *Fusicladium spiraeae*. A – conidia, B – dense fascicle of conidiophores, scale = 10 µm, A. Ritschel del.

ing sporodochial conidiomata, erumpent through the cuticle, erect, straight to sometimes slightly flexuous, cylindrical, unbranched, 5–15(–30) × 3–4 µm, 0–1-septate, subhyaline, pale yellowish to pale olivaceous-brown, smooth, walls slightly thickened, often swollen at the base, up to 7 µm wide. Conidiogenous cells integrated, unilocal, determinate or occasionally percurrently proliferating, with a single, inconspicuous annellation, locus truncate, (2–)3–4 µm wide, unthickened, not darkened. Conidia solitary, narrowly cylindrical to obclavate, (15–)18–29(–35) × (3.5–)5–6(–7) µm, 0–1-septate, sometimes slightly constricted at the septum, subhyaline, pale yellowish to pale olivaceous-brown, smooth, walls somewhat thickened, apex pointed or rounded, base (hilum) truncate, (2–)3–4 µm wide, not or only slightly thickened, not darkened.

Hosts and Distribution: on *Spiraea* spp. (Rosaceae), Europe – *Spiraea crenifolia* (RUS), *S. hypericifolia* (RUS), *Spiraea* spp. (RUS).

Material examined: on leaves of *Spiraea hypericifolia*, Russia, Bashkortostan, Micher., 24 May 1916, Poreunij (LE); on leaves of *Spiraea crenifolia*, Russia, Bashkortostan, Saratova, 9 Aug. 1919, Karakulin (LE).

Notes: Karakulin, in VASSILJEVSKY & KARAKULIN (1937) described amphigenous colonies with fasciculate conidiophores emerging through stomata, which could not be confirmed during the course of the present monographic studies. The conidiophores observed were epiphyllous, erumpent through the cuticle, which was also confirmed by examinations of ONDŘEJ (1984).

10.2.46. *Fusicladium subsessile* (Ellis & Barthol.) K. Schub. & U. Braun, IMI Descriptions of Fungi and Bacteria 152, No. 1519 (2002) Fig. 50

≡ *Cladosporium subsessile* Ellis & Barthol., Erythea 4: 83 (1896); lectotype: on leaves of *Populus deltoides* ssp. *monilifera* (= *Populus monilifera*), USA, Kansas, 18 Sept. 1894, Bartholomew (NY), selected here; isolectotypes: on leaves of *Populus deltoides* ssp. *monilifera*, USA, Kansas, Rockport, Sept. 1894, E. Bartholomew, Ellis & Everh., N. Am. F. 3288 (M, NY).

≡ *Cladosporium brevipes* Ellis & Barthol., Erythea 4: 27 (1896), homonym, non Peck, 1887.

Teleomorph: Unknown.

Ill.: IMI Descr. (No. 1519, Figs A–C).

Exs.: Ellis & Everh., N. Am. F. 3288.

Leaf spots amphigenous, subcircular to irregular, 2–10 mm wide, sometimes confluent, greyish brown, margin darker brown, narrow. Colonies amphigenous, punctiform, dark brown to blackish, scattered. Mycelium internal, hyphae sparingly branched, 1.5–2 µm wide, septate, olivaceous. Stromata variable in size and shape, composed of swollen hyphal cells, 4–7 µm diam., pale olivaceous, thick-walled. Conidiophores aggregated in loose to dense fascicles or caespitose, rarely forming sporodochial conidiomata, arising from stromatic hyphal aggregations, erect, straight, subcylindrical–conical, slightly geniculate–sinuous, unbranched, (3–)9–26 × 3.5–5

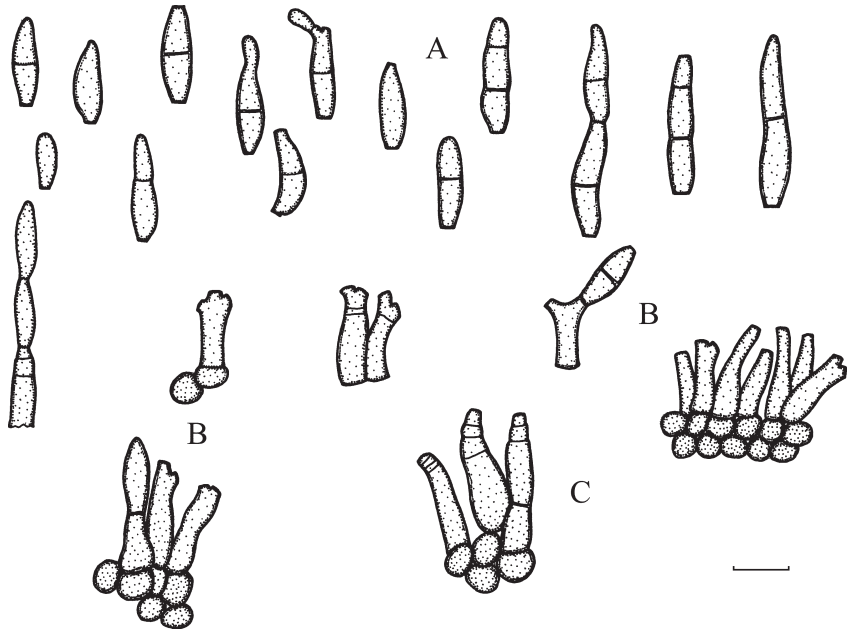

Fig. 50: *Fusicladium subsessile*. A – conidia, B – solitary and fasciculate conidiophores and sympodially proliferating conidiogenous cells, C – fasciculate conidiophores and percurrently proliferating conidiogenous cells, scale = 10 µm, K. Schubert del.

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µm, 0(–1)-septate, pale olivaceous, smooth to faintly rough-walled, wall thin to slightly thickened. Conidiogenous cells integrated, terminal or conidiophores usually reduced to conidiogenous cells, with 1–3, rarely more conidiogenous loci, subdenticulate, proliferation sympodial as well as percurrent with 1–3 fine annellations, conidiogenous loci often denticle-like, 1.5–2.5 µm wide, but wall of the loci unthickened, not darkened or at most slightly darkened–refractive. Conidia solitary or catenate, in simple or occasionally branched chains, fusiform–subcylindrical, straight to somewhat curved, 9–24(–36) × 3.5–5(–6) µm, (0–)1(–3)-septate, pale olivaceous, smooth or faintly rough-walled, wall thin to slightly thickened, attenuated towards apex and base, apex rounded or truncate, base truncate or somewhat convex, hila 1.5–3 µm diam., unthickened, not darkened.

Hosts and Distribution: on *Populus* spp. (Salicaceae), North America – *Populus deltoides* ssp. *monilifera* (= *Populus monilifera*) (USA, KS).

Notes: This species was reduced to synonymy with *Phaeoramularia maculicola* (Romell. & Sacc.) B. Sutton (≡ *Fusicladium romellianum* Ondřej) by SUTTON (1970) and ELLIS (1976). However, *F. romellianum* differs from *F. subsessile* in having conidiophores, which are usually formed in sporodochial conidiomata, smaller conidiogenous loci and conidial hila (1–2 µm wide) and conidia, which are usually aseptate, rarely 1-septate. *F. romellianum* occurs on a wide range of *Populus* species, whereas *F. subsessile* is, as far as known, confined to *Populus deltoides* var. *monilifera*. It may be supposed that the latter species has often been confused with other species of *Fusicladium* and *Pollaccia* on *Populus* species. It is probably much more common than indicated under 'hosts and distribution'.

10.2.47. ***Fusicladium veronicae*** (Bat.) B. Sutton & Pascoe, Austral. Syst. Bot. 1: 81 (1988) Fig. 51

≡ *Ramalia veronicae* Bat., Revista Biol. (Lisbon) 1(2): 111 (1957); holotype: on *Parahebe derwentiana*, Australia, Clyde Mtn., N.S.W., Jan. 1937, L. Fraser (DAR 3568).
Teleomorph: *Protoventuria parahebicola* Pascoe & B. Sutton, Austral. Syst. Bot. 3: 281 (1990).
Ill.: SUTTON & PASCOE (1988: 81–85, Figs 1–7).

On leaves, petioles and stems, leaf spots amphigenous, mainly hypophyllous, subcircular, variable in size, up to 5 mm wide, dark olivaceous-brown, margin darker, scattered over the leaf surface, frequently confluent, sometimes covering the entire surface. Primary mycelium immersed, epidermal and subcuticular, in the upper epidermal cells intracellular, hyphae branched, 1–3 µm wide, septate, hyaline, between the cuticle and upper epidermal wall plates of fan-like, hyaline, septate hyphae, forming one cell-layer, composed of irregularly lobed cells, 2.5–6.5 µm wide. Secondary (superficial) mycelium not extensively developed, when present composed of irregularly branched, 3–5 µm wide, pale to medium brown, thin- or thick-walled, smooth hyphae. Stromata absent. Conidiophores solitary, arising from the subcuticular mycelium, erumpent through the cuticle, erect, straight or slightly curved, flexuous, cylindrical, unbranched, 25–60(–70) × 5–8 µm, 1–5-septate, pale to medium brown, paler towards the apex, verruculose, thick-walled, slightly attenuated towards the apex. Conidiogenous cells integrated, terminal, with 1–2, rarely more loci, proliferation sympodial, loci 2–4 µm wide, unthickened or almost so, not darkened, often with 1–3 percurrent proliferations which are not connected with conidiogenesis. Conidia

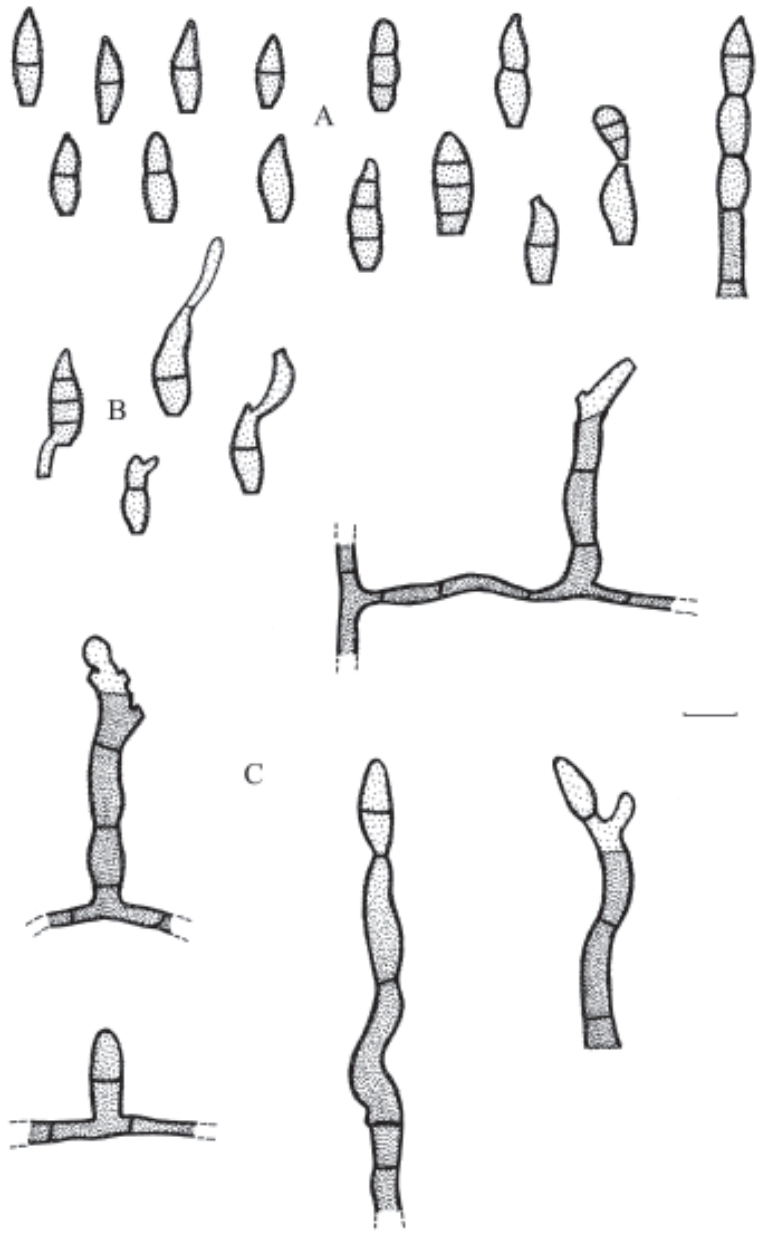

Fig. 51: *Fusicladium veronicae*. A – conidia, B – germinating conidia and secondary conidia (microcyclic conidiogenesis), C – conidiophores arising from hyphae, scale = 10 µm, K. Schubert del.

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solitary or catenate, in unbranched, short chains, fusiform, straight, 11.5–20 × 4.5–8 µm, 0–3-septate, mostly with one septum, slightly constricted at the septum, pale brown, verruculose, attenuated to a conical apex and to a truncate base, hila 2–4 µm wide, unthickened or almost so, not darkened.

Hosts and Distribution: on *Parahebe* spp. (Scrophulariaceae), Australia – *Parahebe derwentiana*, *P. formosa*, *P. perfoliata*.

Material examined: on *Parahebe perfoliata*, Australia, Victoria, Burnley, P. R. I. Gardens, 4 Jun. 1986, H.Y. Yip (VPRI 13987); on *P. perfoliata*, Australia, Victoria, Burnley, P. R. I., 5 Dec. 1985, S. Isaacs (VPRI 13120, DAR 55930).

10.2.48. ***Fusicladium virgaureae*** Ondřej, Česká Mykol. 25(3): 170 (1971) Fig. 52

Holotype: on *Solidago virgaurea*, Moravia, Hrubý Jesenik, Červenohorské, 29 Jul. 1969, M. Ondřej (BRA).
Teleomorph: Unknown.
Ill.: ONDŘEJ (1971: 168, Fig. 4).

Leaf spots amphigenous, shape and size variable, irregular, varying from small spots, 2–3 mm wide, to large blotches, 10–30 mm wide or oblong, up to 50 mm, yellowish, olivaceous to brown, sometimes purple-brown. Stromata absent, only with small subcuticular aggregations of swollen hyphae. Conidiophores solitary or in small, loose fascicles, erect, straight to somewhat flexuous, subcylindrical to slightly sinuous, unbranched or rarely branched, 20–100 × 3–6 µm, septate, yellowish or olivaceous-

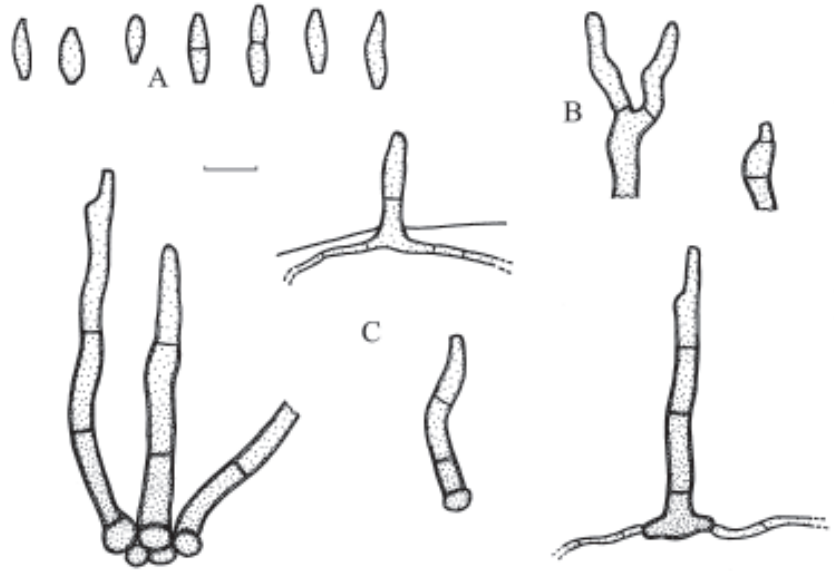

Fig. 52: *Fusicladium virgaureae*. A – conidia, B – branched conidiophore, C – conidiophores, scale = 10 µm, K. Schubert del.

brown to medium brown, paler towards the apex, smooth, occasionally minutely rough-walled, walls somewhat thickened. Conidiogenous cells integrated, terminal, with a single or up to four loci, proliferation sympodial, loci truncate to slightly convex, 1–1.5 µm wide, neither thickened nor darkened, rarely with percurrent proliferations, which are not connected with conidiogenesis. Conidia in unbranched chains, cylindrical to fusiform or obclavate, straight, 8–16 × 3–6 µm, 0–1-septate, not or only slightly constricted at the septum, yellowish or olivaceous-brown, smooth, hila truncate to slightly convex, 1–1.5 µm wide, neither thickened nor darkened.

Hosts and Distribution: on *Solidago* spp. (Asteraceae), Europe – *Solidago gigantea* (A), *S. virgaurea* (CZ, SK).

Material examined: on *Solidago virgaurea*, Moravia, Hrubý Jesenik, 16 Aug. 1981, M. Ondřej (BRA); on *S. virgaurea*, Slovakia, Slovensko Vysoke Tatry, 7 Sept. 1974, M. Ondřej (BRA); on *Solidago gigantea*, Austria, Steiermark, Grazer Feld, S of Graz, Kaiserwald, near Wundschuh, 16 Aug. 1995, P. Zwetko (GZU), see SCHEUER (2003).

10.2.49. ***Fusicladium viticis*** M.B. Ellis, More Dematiaceous Hyphomycetes: 238 (1976) Fig. 53

Holotype: on leaves of *Vitex cienkowskii*, Uganda, Mulanga Grassland, Sept. 1919, R.A. Dummer 4269 (IMI 102079b).
Teleomorph: Unknown.
Ill.: ELLIS (1976: 237, Fig. 177).

Definite leaf spots lacking or only with irregular discolorations, dark brown to greyish brown. Colonies hypophyllous, effuse, dark brown, often spread along leaf veins. Mycelium internal, subcuticular, hyphae branched, 2–3 µm wide, septate,

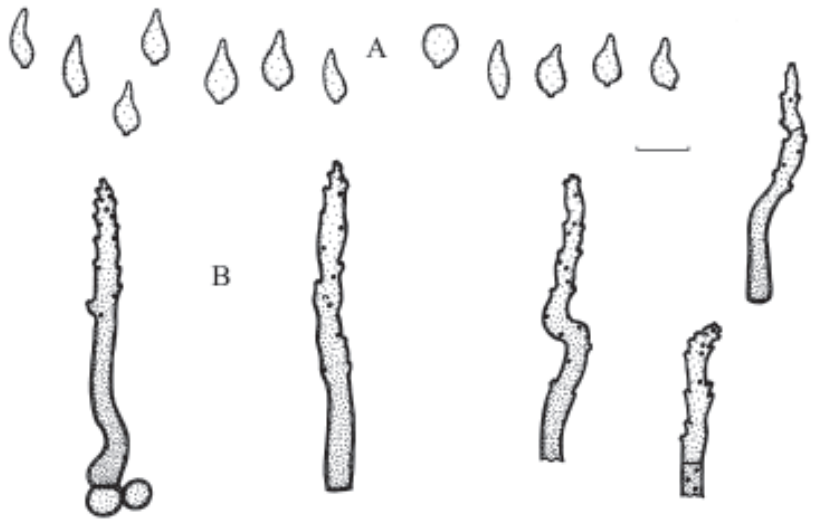

Fig. 53: *Fusicladium viticis*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

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pale olivaceous. Stroma with flat, only one-layered aggregations of swollen, pale brown, thick-walled cells, 3–6 µm diam., forming layers or radially spreading. Conidiophores solitary or fasciculate, arising from stromata, erect, straight or slightly flexuous, unbranched, 40–100 × 3–5 µm, 0–1-septate, brown, paler towards the apex, smooth, thick-walled. Conidiogenous cells integrated, terminal or intercalary, with numerous, small conidiogenous loci, crowded at the apex, proliferation sympodial, loci denticulate, 1 µm wide, unthickened, somewhat darkened–refractive. Conidia solitary, fusiform or limoniform, 8–14 × 5–7 µm, aseptate, yellowish to pale olivaceous, smooth to minutely verruculose, attenuated towards apex and base, apex pointed, base truncate, hila 1 µm wide, unthickened, somewhat darkened–refractive.

Hosts and Distribution: on *Vitex* spp. (Verbenaceae), Africa – *Vitex cienkowskii* (Uganda).

10.2.50. *Fusicladium*-state of *Acantharia echinata* (Ellis & Everh.) Theiss. & Syd. Fig. 54

Teleomorph: *Acantharia echinata* (Ellis & Everh.) Theiss. & Syd., Ann. Mycol. 16: 15 (1918).
Ill.: SIVANESAN (1984b: 508–510, Figs 1–3).

On leaves, mycelium superficial, setose, composed of olivaceous-brown, densely branched, septate hyphae up to 8.5 µm thick, sometimes forming a multicellular compact mass of hyphopodium-like structures functioning as anchoring organs on the leaf. Stromata subcuticular, composed of thick-walled, dark brown cells, eventually bursting through the cuticle. Conidiophores and setae arise from the stromata as well as from the base and outer wall of the ascostromata. Setae simple, 70–210 × 6.5–9

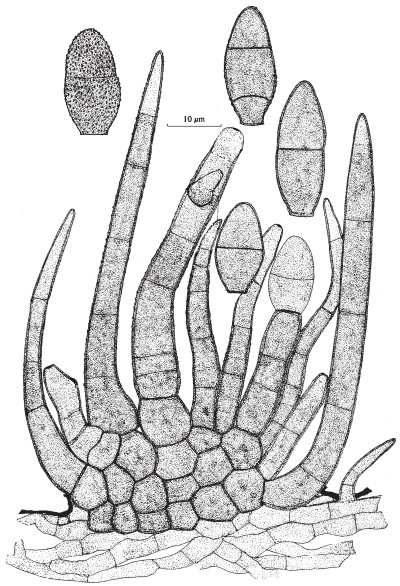

Fig. 54: *Fusicladium*-state of *Acantharia echinata* (from SIVANESAN 1984b).

µm, septate, dark brown, smooth to rough-walled, thick-walled. Conidiophores simple, occasionally branched, 16–46 × 5.5–5.8 µm, septate, brown, paler towards the apex, smooth to rough-walled. Conidiogenous cells integrated, terminal, holoblastic, proliferation sympodial, cicatrised. Conidia solitary, dry, blastic, broadly fusiform to broadly ellipsoid, 15–23 × 8–10 µm, 0–2-septate, commonly with one septum, brown, smooth to rugulose, tapering towards the apex, truncate at the base.

Hosts and Distribution: on *Quercus* spp. (Fagaceae), North America – *Quercus chrysolepis* (USA, CA), *Q. vacciniifolia* (USA, CA).

Notes: SIVANESAN (1984b) described the anamorph of *Acantharia echinata* as *Fusicladium* sp. Material of this fungus has not been examined, and the descriptions and illustration are based on SIVANESAN (1984b). It is not quite clear if the position of this anamorph in *Fusicladium* is correct. The setae formed on the host are very unusual in the latter genus. Additional material should be examined, and molecular data would also help any re-assessment of this fungus.

10.2.51. *Fusicladium*-state of *Apiosporina collinsii* (Schwein.) Höhn. Fig. 55

Teleomorph: *Apiosporina collinsii* (Schwein.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 119: 439 (1910).
Lit.: BARR (1968: 855), SIVANESAN (1984a: 598).
Ill.: BARR (1968: 854, Fig. 94), SIVANESAN (1984a: 599, Fig. 360).
Exs.: Barthol., F. Columb. 2927, 2320, 5013; Brenckle, F. Dakot. 505; Ellis, N. Am. F. 488a (as *Sphaeria collinsii*); Ellis & Everh., F. Columb. 1431; Griffiths, West Am. F. 177; Kellerman, Ohio Fungi 182; Rabenh., F. eur. 3541; Seym. & Earle, Econ. F. 125a, 125b; Thüm., Mycoth. univ. 849 (as *Dimerosporium collinsii*).

On leaves the teleomorph causes crustaceous layers, mainly on the lower surface, anamorph only formed on the teleomorph, caespitose, brown. Conidiophores arising from superficial hyphae of the subiculum, hyphae branched, 3–5 µm wide, pale olivaceous. Conidiophores erect, straight to flexuous, cylindrical, unbranched or sometimes branched, 30–225 × 4 µm, septate, somewhat constricted at the septa, medium to dark brown, verruculose, walls only slightly thickened. Conidiogenous cells integrated, terminal or intercalary, with several conidiogenous loci, proliferation sympodial, loci denticulate, apex truncate, 1–2 µm wide, unthickened, slightly darkened, refractive. Conidia in short, unbranched or branched chains, ellipsoid, ovoid to subcircular, straight, 8–18 × 5–9 µm, aseptate, olivaceous to pale brown, verruculose, walls somewhat thickened, often with 2–3 denticles at the distal end, truncate at the base, hila 1–2 µm wide, unthickened, slightly darkened–refractive.

Hosts and Distribution: on *Amelanchier* spp. (Rosaceae), North America – *Amelanchier alnifolia* (Canada, Alta., BC., Man., NWT, Ont., Sask.; USA, ID, ND, NV, WY), *A. canadensis* (Canada, NB., NS., Ont.; USA, CT, MA, WI), *A. pallida* (USA, OR), *A. pumila* (USA, NM), *A. utahensis* (North America), *Amelanchier* spp. (Canada, Alta., Man., NB., NS., Nfld., Ont., Sask.; USA, ID, MA, VA).

Material examined: collections from M.

Notes: This anamorph was usually referred to *Cladosporium* sp., but on account of the structure of the conidiogenous loci and conidial hila and its connection to *Apiosporina collinsii* (Venturiaceae), it has to be placed in *Fusicladium*. Since this anamorph is strictly confined to and connected with the teleomorph, it is not necessary to propose a separate, formal name for it.

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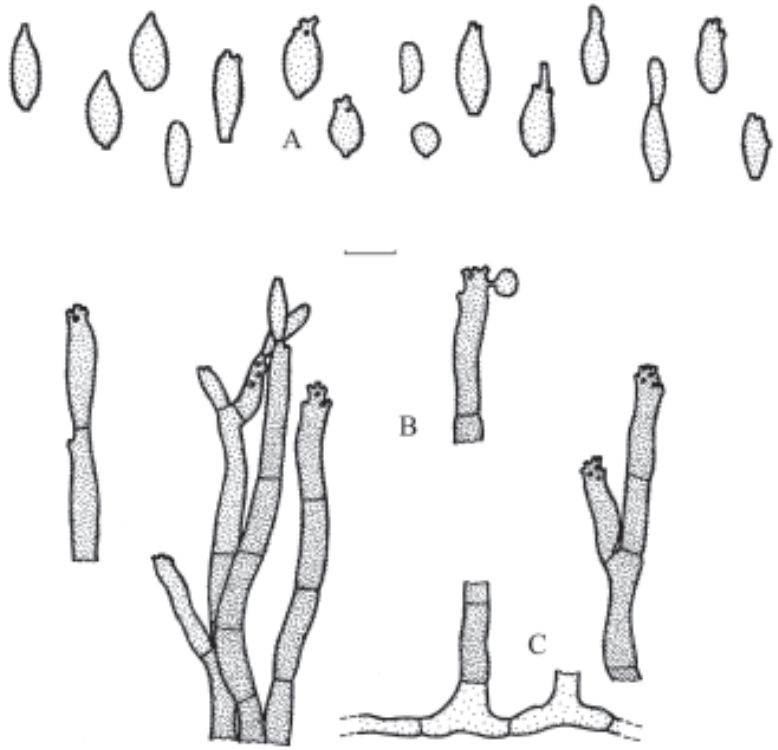

Fig. 55: *Fusicladium*-state of *Apiosporina collinsii*. A – conidia, B – conidiophores, C – base of conidiophore arising from superficial hyphae, scale = 10 µm, K. Schubert del.

10.2.52. *Fusicladium*-state of *Apiosporina morbosa* (Schwein.) Arx Fig. 56

Teleomorph: *Apiosporina morbosa* (Schwein.) Arx, Acta Bot. Neerl. 3: 86 (1954).
Lit.: BARR (1968: 855–856), ELLIS (1976: 238–239), Fungi Canadenses (No. 84), SIVANESAN (1984a: 599–600).
Ill.: ARX (1954: 86, Figs 17, 95), ELLIS (1976: 239, Fig. 179), Fungi Canadenses (No. 84, Fig. 4), SIVANESAN (1984a: 600, Fig. 361).
Exs.: Barthol., F. Columb. 4336; Brenckle, F. Dakot. 97, 410; Syd., F. exot. exs. 515.

Stromata on twigs, erumpent, variable in shape and size, at first olivaceous-green, later blackish and firm, consisting of fungal hyphae on the surface and a mixture of hyphae and host cells inside, sometimes anamorph abundant, forming brown covers on the blackish surface of the teleomorph, colonies effuse to caespitose, brown, stromatic cells 4–12 µm diam., pale to medium brown, thick-walled. Conidiophores arising from the upper cells of stroma, in loose to dense fascicles, erect, flexuous, geniculate or apex curved, unbranched or branched at the base, 20–95 × 3–6(–7) µm, septate,

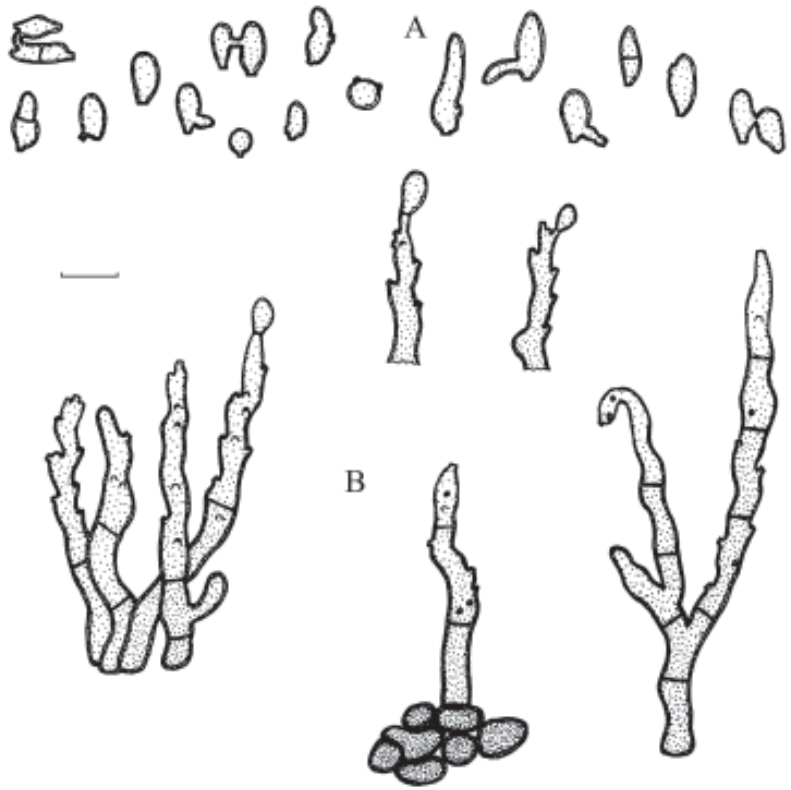

Fig. 56: *Fusicladium*-state of *Apiosporina morbosa*. A – conidia, B – conidiophores, scale = 10 µm, K. Schubert del.

pale olivaceous to pale brown, paler towards the apex, smooth, thick-walled, somewhat swollen at the base. Conidiogenous cells integrated, terminal or intercalary, with several conidiogenous loci, proliferation sympodial, loci denticulate, 1–1.5 µm wide, unthickened, somewhat darkened–refractive. Conidia solitary or rarely in short chains, often laterally fused in pairs, ovoid, obovoid, ellipsoid or irregular, 4–19 × 3–6 µm, 0–1-septate, pale olivaceous, smooth, thick-walled, hilum 1–1.5 µm wide, unthickened, slightly darkened–refractive.

Hosts and Distribution: on *Prunus* spp. (Rosaceae), North America – *Prunus americana* (USA, AL, FL, MS, NC, ND, OK), *P. angustifolia* (USA, FL, GA), *P. armeniaca* (Canada, BC.; USA, CO, FL, IA, NY), *P. avium* (Canada, BC., Nfld.; USA, NC, NE, TX), *P. besseyi* (USA, ND), *P. cerasus* (Canada, BC., NB., PEI, Que.; USA, GA, NC and the eastern states), *P. domestica* (Canada, BC., NB., NS., Nfld., Ont., PEI, Que.; USA, FL, KY, MI, MS, NC, OH), *P. dulcis* (Canada, BC.), *P.*

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emarginata (USA, ID, MT, OR, WA), *P. maritima* (USA, AL, MA, NY, OR), *P. munsoniana* (USA, AL, FL, GA, MS), *P. nigra* (Canada, NS., Ont.), *P. padus* (Canada, Alta., Man., NWT), *P. pensylvanica* (Canada, Alta., Man., NB., NS., Nfld., NWT, Ont., PEI, Que., Sask.; USA, NC), *P. persica* (Canada, NS.), *P. pumila* (USA, MI, ND, WI), *P. serotina* (Canada, NB., NS., Ont., PEI, Que.; USA, GA, MS, NC, VA, WI), *P. spinosa* (Canada, BC.), *P. subcordata* (Canada, BC.; USA, OR), *P. umbellata* (USA, GA), *P. virginiana* (Canada, Alta., BC., Man., NB., NS., Nfld., NWT, Ont., PEI, Que., Sask.; USA, CA, CO, ID, MS, MT, NC, SC, SD, WA, WI), *Prunus* spp. (Canada, Alta., BC., Man., NB., NS., Nfld., NWT, Ont., PEI, Que., Sask.; USA, GA, MA, MD, NC, ND, OK, SD, VT, WI).

Material examined: all collections from IMI.

Notes: This anamorph is always associated with the teleomorph and does not occur separately. Therefore, we decline to propose a formal, separate name for it.

10.2.53. *Fusicladium* sp. (1) Fig. 57

Teleomorph: Unknown.
Lit.: ONDŘEJ (1973: 239).
Ill.: ONDŘEJ (1973: 238, Fig. 7).

Leaf spots on fading or mainly necrotic leaves, irregular, brown, often confluent. Mycelium internal, subepidermal. Conidiophores solitary or in small groups of up to 6, arising from stromata, erumpent through the cuticle, straight, simple or rarely branched, 40–95(–130) × 3–5 µm, septate, dark coloured. Conidiogenous cells integrated, terminal, with a single or up to three conidiogenous loci, proliferation sympodial. Conidia catenate, in unbranched or branched chains, cylindrical or fusiform, (10–)12–20 × 3–4(–5) µm, 0–1(–2)-septate, dark, pigmented.

Hosts and Distribution: on *Salix* spp. (Salicaceae), North America – *Salix purpurea* (USA, NY).

Notes: ONDŘEJ (1973) described this fungus based on material from North America (on *Salix purpurea,* USA, NY, 22 Jun. 1949), which was originally identified as *Fusicladium saliciperdum*. Since this material could not be traced, it was impossible to re-assess this fungus. The anamorph of *Venturia chlorospora* [*Fusicladium* sp., NÜESCH (1960) and SIVANESAN (1977)] is probably allied, but distinguished by having broader conidia.

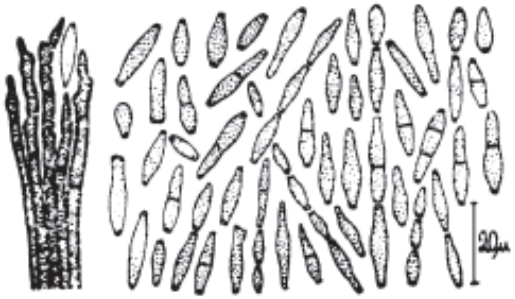

Fig. 57: *Fusicladium* sp. (from ONDŘEJ 1973).

10.2.54. *Fusicladium* sp. (2)

Teleomorph: *Venturia chlorospora* (Ces.) P. Karst., Mycol. fenn. 2: 189 (1873).
Lit.: SIVANESAN (1977: 55).

On leaves. Conidiophores arising as lateral branches of brown hyphae. Conidiogenous cells terminal or intercalary, with numerous conidiogenous loci, proliferation sympodial. Conidia in unbranched chains, ellipsoid to cylindrical, 20–25 × 5–8 µm, mostly 1-septate, truncate at the base.

Hosts and Distribution: on *Salix* spp. (Salicaceae), Europe – *Salix acutifolia* (RUS, SF), *S. alba* (D, I), *S. caprea* (D), *S. cinerea* (D), *S. fragilis* (PL), *S. triandra* (I), *S. viminalis* (D), *Salix* spp. (D).

Notes: This anamorph, which has not yet been observed in nature, was found by NÜESCH (1960) in cultures isolated from ascospores of *Venturia*. Based on conidia formed in chains, SIVANESAN (1977) considered it to be a species of *Cladosporium*.

11. Doubtful and unclear species of *Fusicladium* s.lat.

Type material of the following species could not be traced or was not available and other collections have not yet been found, so that the generic affinity and taxonomic status of these taxa could not be proven.

Fusicladium aconiti Bres., Ann. Mycol. 18: 58 (1920).

Type: on leaves of *Aconitum clusii* (Ranunculaceae), Hungary, Tatra, Greschik.
Original description (SACCARDO 1931: 802): Caespitulis dense gregariis, in macula fusca, epiphylla nidulantibus, hyphis unicellularibus, cylindraceis, olivaceis, 45–50 × 7–9 µm; conidiis olivaceis, 1-septatis, subclavatis, basi truncata, ad septa subconstrictis, 40–48 × 8–10 µm.

Fusicladium aplectri Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1894: 378 (1894).

Type: on leaves of *Aplectrum hyemale* (Orchidaceae), USA, Delaware, Commons.
Original description (ELLIS & EVERHART l.c.): Spores irregular, whitish, with a shaded, purple border, 1cm diam. Hyphae fasciculate, olivaceous, simple, 2–3-septate, 65–75 × 5–6 µm, mostly twisted or abruptly bent at the tip, olive-brown. Conidia terminal, elliptical, greenish, granular, continuous at first, becoming 1-septate, 12–15 × 6–7 µm.

Fusicladium butyrospermi Griffon & Maubl., Bull. Soc. Mycol. France 29: 249 (1913).

Type: on leaves of *Butyrospermum parkii* (Sapotaceae), Africa, Koulikoro, Vuillet.
Original description (SACCARDO 1931: 803): Maculis rotundatis vel angulosis, 2–3 mm diam. amphigenis, superne brunneis inferne fulvis, margine atropurpureo cinctis; caespitulis obscure brunneis, amphigenis, minutis, in centro macularum dense gregariis; hyphis fertilibus, caespitosis, simplicibus, cylindraceis apice rotundatis vel paulum attenuatis, continuis vel uniseptatis, fuligineis, 15–20 × 4–5 µm; conidiis acrogenis, ovoideis, medio septatis et subinde constrictulis, fuligineis, 10 × 6 µm; mycelio in epidermide evoluto, cellulis globosis vel ellipticis formato.

Fusicladium carpini Osipyan, Mikol. Fitopatol. 5(1): 88 (1971).

Type: on leaves of *Carpinus caucasica* (Corylaceae), Caucasus, Armenia, Goris-Kafan, 30 Jul. 1954, A. Grossh. (ERCB).

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Description (OSIPJAN 1971): Maculae amphigenae, irregulares, 2–6 mm in diam., initio flavae, deinde fuscescentes, saepe centro aquilae, diffusae, interdum nervis, subtus haud raro nigrescentibus limitatae. Pruina conidialis vix evoluta. Conidiophora in fasciculos compactos vix prominentes pulviniformes congesta, levia, pallide olivacea, irregulariter cylindrica, vix clavata, erecta, eseptata, non ramosa, 10–17 × 3.5–7.2 µm. Conidia catenulata, pallide olivacea, fusiformia, vix obclavata, interdum unilateralia, medio vix angustata, unicellularia vel uniseptata, ad septum subconstricta, extremitatibus late obtusatis, 18.1–26.4 × 4.9–6 µm.

Fusicladium cephalanthi Speg., Anales Mus. Nac. Buenos Aires 6: 339 (1899).

Type: on twigs, leaves and buds of *Cephalantus sarandi*, Uruguay, Montevideo; Argentina, pr. Quilmes et La Plata.
Original description (SACCARDO 1902: 1056): Rami-foliicolum, late denseque effusum, olivaceum; caespitulis superficialibus, densissime gregariis, ex hyphis paucis, 5–12 µm, efformatis; hyphis e basi sclerotiacea parenchymatico-olivacea matrici innata orientibus, chlorinis, subteretibus, 40–50 × 3–4 µm, apice vix attenuatis, 1–5-septatis, non constrictis; conidiis acrogenis, cylindraceis, non v. vix clavulatis, magnitudine ludentibus, 10–30 × 3–5 µm, chlorinis, 1-septatis, non constrictis.

Fusicladium chanousii Ferraris, Malpighia 16: 474 (1902).

Type: on anthers of *Gentiana lutea*, Italy, Picollo S. Bernardo.
Original description (FERRARIS l.c.): Caespitulis, minutis, velutinis, effusis, olivaceis, hyphis fuscis, erectis, simplicibus, non vel 1-septatis, apice subdenticulatis, 35–50 × 4.5–6 µm; conidiis olivaceis, ellipticis, continuis, dein. 1-septatis non constrictis, 14–19 × 6–7 µm.

Fusicladium ephedrae Cruchet, Bull. Soc. Vaud. Sci. Nat. 55: 157 (1925).

Type: on *Ephedra* sp., Switzerland, Montagny provenant de Sion (Valais), D. Cruchet.
Teleomorph: *Venturia ephedrae* Cruchet, l.c.
Ill.: CRUCHET (1925: 158, Fig. 2/1).
Original description (CRUCHET l.c.): Spores fusiformes, peu arquées, arrondies atténuées deux extrémités, unibiseptées, légèrement resserrées à la choison, très nombreuses, brunes, se détachant fascilement de basides fasciculées, cylindriques, ténues, peu apparantes, presquet hyalines, entourant les périthèces.

Fusicladium fici Bacc., Ann. Bot. (Rome) 4: 277 (1906).

Type: on leaves of *Ficus* sp., Eritrea, Valle Catalaben, Mensa 1900, Pappi.
Original description (BACCARINI 1906): Maculis orbicularibus amphigenis, supra pallidis et rubro-cinctis, subtus rufo-ferrugineis; caespitulis amphigenis punctiformibus; hyphis fertilibus simplicibus, continuis, brevibus, fuscidulis, ad apicem pallidioribus; conidiis piriformibus, fuscidulis, septatis, 20 × 10 µm.

Fusicladium fraxini var. ***phillyreae*** Trotter, in Pamp., Nuovo Giorn. Bot. Ital. 31: 233 (1924).

Original material is missing. This variety is very probably not conspecific with *Spilocaea phillyreae*.

Fusicladium gardeniae F.X. Chao & P.K. Chi, in Chi, Fungal Diseases of Cultivated Medicinal Plants in Guangdong Province: 171 (1994).

Type: on leaves of *Gardenia jasminoides*, China, Prov. Guangdong, Qujiang, Oct. 1988, leg. F.X. Chao No. 024.
Ill.: CHI (l.c.: Fig. 178).
Original description (CHI l.c.): Maculae orbiculares, flavo-brunneae, margine distinctae, 0.4–0.8 mm diam., annulatae, leviter depressae. Caespituli epiphylli, nigri; stromata subcuticulares, 30–220 µm diam.; conidiophora spanofasciculata, simplicia, sursum 0–1 geniculata, 1–4 septata, 13–24 × 3–4 µm, cellulae conidiogenae sympodiales, ad apicem conico–truncatae, pallido-brunneae, cicatricosa conspicua; conidia singularia, raro catenulata, longiovoidea, pallido-brunnea, 1-septata, utrinque attenuata, ad basin obconico–truncata, 7–8 × 3–4 µm.

Fusicladium hippophaës Vasyag. & Byzova, in Shvartsman et al., Flora Sporovych Rastenij Kazachstana 8(2): 142 (1975).

Type: on leaves and twigs of *Hippophaë rhamnoides*, Russia, Kazakhstan, region Alma-Ata, in promontoriis Ala-Tau Transiliensis, prope pagum Saty, 23 Jul. 1956, B.K. Kalymbetov (AA).
Ill.: SHVARTSMAN et al. (l.c., Fig. 63).
Original description (SHVARTSMAN et al. l.c.): Conidiophora 0–3-septata, interdum subconstricta, cylindrica, recta, rarius, incurvata, apice late rotundata vel obtusata, edenticulata, indivisa, 16.8–73.5 × 5.2–11.5 µm, brunneo-fusca, pellucida, solitaria, raro fasiculata. Conidia acrogena, transverse 1–3-septata, constricta, cylindrica, obclavata, fusiformia, obpyriformia, recta, interdum incurvata, 22.5–90.3 × 3.4–14.7 µm, brunneo-fusca, pellucida, solitaria vel catenulata. Caespituli orbiculares, irregulares, angulati, haud dense velutini vel pulveracei, epiphylli pro more secus nervos dispositi, in ramulis convexi, compacti, atro-brunnei vel nigrescenti-olivacei, saepe confluentes. Maculae epiphyllae, plerumque subinconspicuae.

Fusicladium lini Sorauer, Z. Pflanzenkrankh. 5: 104 (1895).

Type: on leaves and stems of *Linum usitatissimum*, Belgium, Ardoye, Nijpels, 1894.
Lit.: LINDAU (1907: 784), VASSILJEVSKY & KARAKULIN (1937: 207).
Original description (translation based on SORAUER's, l.c., and LINDAU´s (1907) descriptions in German): Leaf spots oval to oblong, brown. Caespituli on the leaf spots, 0.75–1 mm long, almost black. Conidiophores fasciculate, dense, geniculate–sinuous, more or less greenish brown at the base, hyaline towards the apex, ca. 30 µm long, 3 µm wide. Conidia terminal, solitary, ovoid to oblong, almost hyaline, 8 mm long, 4 µm wide, also with some longer conidia, 14–18 µm long.

Fusicladium lonicerae Vasyag., Izv. Akad. Nauk Kazahsk. SSR, Ser. Biol. 1(13): 101 (1957).

Holotype: on *Lonicera tatarica*, Kazakhstan, Karaganda, botanical garden, 4 Aug. 1951, M.P. Vasyagina (AA).
Original description (VASYAGINA l.c.): Maculis rotundatis, albo-fuscis, solitariis, confluentibus. Conidiophoris fasciculatis, hypophyllis, rectis vel curvatis, fuscis, apice hyalini, numerosis denticulatis, 30–44 × 3 µm. Conidiis ovatis vel piroideis, uniseptatis vel unicellularibus, rarius 2 septatis, albo-fuscis, 12.8–19 × 5–6.5 µm.

Fusicladium stuckertii (Speg.) M.B. Ellis, in herb. (IMI).

≡ *Napicladium stuckertii* Speg., Anales Mus. Nac. Buenos Aires 8: 87 (1902).
≡ *Sporhelminthium stuckertii* (Speg.) Speg., Physis (Buenos Aires) 4(17): 292 (1918).
Type: on living cladodes of *Baccachis trimera*, Argentina, Córdoba.
Original description (SACCARDO 1906): Superficiale, late effusum, olivaceum; hyphis repentibus matrici arctiuscule adnatis, araneosulis, dense ramuloso-intricatis atque anastomosantibus, torulosis, articulis a globoso subcuboideis 5–10 µ diam., olivaceis; hyphis fertilibus hinc indeerectis, gracilibus, simplicinus, 3–5-septatis, 50–200 × 5–6, olivascentibus, apicem versus pallidioribus, parce septulatis, superne noduloso–geniculatis; conidiis cylindraceis v. subfusoideis, continuis v. 1–3-septatis, levibus, 15–30×5–6, acro-pleurogenis, chlorinis.

Fusicladium tenue Bonord., Abh. Mykol. 2: 93 (1870).

Type: on stems of *Phaseolus vulgaris*, Germany, Westphalia.
Original description (SACCARDO 1886: 347): Caespitulis sparsis aut densis, ex cinereo-viridibus; hyphis erectis, simplicibus, parce septatis, apice obtusis, viridibus et fasciculato–conjunctis; conidiis oblongo–fusiformibus, dilute viridibus.

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Fusicladium theae Hara, Tea J. 14: 16 (1919); Mycologia 12: 330 (1920).

Type: on leaves of *Camellia thea* (= *Thea sinensis*), Japan.
Original description (SACCARDO 1931: 803): Acervulis amphigenis, vellutinis, nigris; conidiophoris filiformibus rectis v. curvis basi incrassatis continuis v. 3-septatis infra brunnescentibus supra pallide coloratis et incurvatulis, 40–70 × 4–5 µm; conidiis terminalibus, cylindraceis v. ovato oblongis sub medio uniseptatis non v. parum constrictis, apice obtusis, basi subacutatis, rectis v. curvis, hyalinis v. flavescentibus, 15–28 × 5–6 µm.

Fusicladium vanillae Zimm., Centralbl. Bakteriol., 2 Abth., 8: 480 (1902).

Type: on leaves of *Vanilla* sp., Java, Buitenzorg.
Original description (SACCARDO 1906: 580): Hyphis sterilibus foliorum superficiei adpressis, rarius liberis, brunneolis; conidiophoris erectis, rectiusculis, apice acutis, continuis, brunneolis, 25–30 µm longis; conidiis ovato–oblongis, basi acutiusculis, apice rotundatis, bicellularibus, 8 × 4 µm.

Spilocaea concentrica Schwein., Trans. Amer. Philos. Soc., Ser. 2, 4(2): 297 (1832).

Type: In cortice Peponum putridorum, Bethl. Optime aut evoluta mense Octobri prope Philadelphia in talibus.
Notes: Listed by SACCARDO (1886: 761) under doubtful and excluded species.

Spilocaea epiphylla Fr., Syst. Mycol. 3: 504 (1832).

Type: Plures tales formationes in foliis Pyri, Mali etc. misit Levieux, omnes e Gallia occid.
Original description (Fries): Maculis epidermide bullata circumscissa secedente minutis sparsis nigris. Epidermidis valde relaxatae bullae ½ unc. circiter latae, haud rumpuntur, sed in ambitu integrae in squamam aeque latam integram solvuntur. Tum sub hac conspicitur macula interrupta s. plures maculae sparsae nigrae, folio arctae adnatae, nec pulverulentae, quae non sine difficultate a matrice separatae characteres datos monstrant.

Spilocaea opuntiae Rabenh., Flora 33: 625 (1850).

Type: "Auf unreif abgefallenen Früchten der indischen Feige, auf Capri."
Original description (RABENHORST l.c.): Maculis aureo-fuscescentibus saepius obliteratis rugoso-constatis, spor. subconglobatis ovoideis pallide roseis demum expallentibus ab epidermide tectis, episporio crassiusculo ruguloso.

Spilocaea scirpi Link, in Willd., Sp. pl., vol. 6(2): 87 (1825).

Type: Habitat in caulibus Scirporum siccis in Europa, nec non Aegypto.
Original diagnosis (Link): Maculas format in Scirporum majorum caulibus frequentissimas aggregatas interdum confluentes, ita ut caulis inde saepe quasi marmoratus appareat. Maculae istae planae sunt supra caulem minime eminentes. Sporidia minutissima intra caulem recondita seriatim juncta. Sp. acervis oblongis effusis, epidermide non rumpente, sporidiis minutis fuscis.
Notes: Two samples from M (Botanische Staatssammlung München), deposited under *Spilocaea scirpi*, have been examined, but no traces of *Spilocaea*-like structures have been found.

12. Excluded species

Fusicladium alopecuri Ellis & Everh., J. Mycol. 4: 53 (1888).

Holotype: on leaves of *Setaria polystachya* (= *Alopecurus geniculatus*), USA, Columbia, Montana, 20 May 1887, B.T. Galloway (NY).
≡ ***Cladosporium alopecuri*** (Ellis & Everh.) U. Braun, Schlechtendalia 5: 32 (2000).

Fusicladium alopecuri Sawada, Rep. Gov. Res. Inst. Formosa 85: 93 (1943), nom. inval.

Fusicladium anethi Nevod., Griby rossii (Russian fungi) IV, No. 191 (1917).

Type: on leaves of *Peucedanum graveolens* (= *Anethum graveolens*), Georgia, Prov. Tiflis, Distr. Gori, near Skra, in horto Pridonov, 23 Jul. 1912, G.S. Nevodovskij, Griby ross. 191 (e.g., B, IMI 1423, K, LE).
= ***Passalora punctum*** (Delacr.) S. Petzoldt, in Arx, Plant Pathogenic Fungi: 288 (1987).
Lit.: CROUS & BRAUN (2003: 343).

Fusicladium angelicae Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1891: 87 (1891).

Types: on leaves of *Archangelica atropurpurea* (= *Angelica atropurpurea*), USA, Wisconsin, Racine, Sept. 1890, J.J. Davis (NY; Ellis & Everh, N. Am. F. 2790, e.g. M, NY).
≡ ***Passalora angelicae*** (Ellis & Everh.) U. Braun, Nova Hedwigia 55(1–2): 214 (1992).
Lit.: CROUS & BRAUN (2003: 437).

Fusicladium aronici Sacc., Michelia 2: 171 (1880).

Numerous collections (HBG, JE, M) have been examined.
= ***Fusicladiella melaena*** (Fuckel) S. Hughes, Mycol. Pap. 49: 21 (1952).

Fusicladium ascyrinum Ellis & Everh., J. Mycol. 4: 53 (1888).

Holotype: on leaves of *Ascyrum hypericoides*, USA, Louisiana, Natchitoches, 26 Sept. 1886, A.B. Langlois (NY).
This is a hyphomycete of unclear affinity.

Fusicladium bambusicola (Sawada) Deighton, in herb.

≡ *Cercosporidium bambusicola* Sawada, Taiwan Agric. Res. Inst. Rep. 87: 77 (1944), as '*bambusicolum*', nom. inval.
≡ ***Pseudospiropes bambusicola*** Goh & W.H. Hsieh, in Hsieh & Goh, *Cercospora* and similar fungi from Taiwan: 147 (1990).

Fusicladium bicolor C. Massal., Nuovo Giorn. Bot. Ital. 21: 170 (1889) and Atti Accad. Agric. Art. Comm. Verona, 3. Ser., 65: 115 (1889).

Isotype: on leaves of *Chaerophyllum* cf. *hirsutum*, Italy, prov. Verona, Mt. Lobia, 31 Aug. 1887, C. Massalongo (HBG).
≡ ***Fusicladiella bicolor*** (C. Massal.) U. Braun, Schlechtendalia 5: 38 (2000).

Fusicladium butleri Syd., Ann. Mycol. 14: 260 (1916).

Holotype: on *Jasminum arborescens*, India, U.P., Orai, Bandlekhand, 27 Feb. 1907, E.J. Butler, No. 1710 (S).
≡ ***Pseudocercospora butleri*** (Syd.) U. Braun, Schlechtendalia 5: 42 (2000).
Lit.: CROUS & BRAUN (2003: 91).

Fusicladium caricae Sacc., Atti Congr. Bot. Palermo 1902: 58 (1902).

Type: on leaves of *Carica papaya*, Paraguay, Guarapi, Feb. 1881, B. Balansa 2739 (LPS). Other authentic material (Balansa 3855) at B.
= ***Asperisporium caricae*** (Speg.) Maubl., Lavoura 16: 212 (1913).

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Fusicladium caruanianum Sacc., Ann. Mycol. 11: 20 (1913), basionym Fig. 58

≡ ***Pseudocladosporium caruanianum*** (Sacc.) U. Braun **comb. nov.**
Holotype: on dead leaves of *Magnolia grandiflora,* Malta, Balzan, leg. Caruano Gatto (PAD).
Lit.: SACCARDO (1931: 801).
On dead leaves, saprobic, lesions lacking. Colonies hypophyllous, effuse, loose to dense, forming small to large patches, confluent, velutinous, brown, sooty. Mycelium internal and external, superficial, hyphae creeping, often aggregated, forming ropes or aggregations of swollen hyphal cells, sparingly branched, 2–6 µm wide, septate, often with constrictions and swellings, pale olivaceous to medium dark brow or olivaceous-brown. Conidiophores solitary, arising from swollen hyphal cells or from creeping hyphae, lateral, occasionally terminal, erect, straight and subcylindrical to geniculate–sinuous, unbranched, 10–30 × 2–4 µm, (0–)1–3(–4)-septate, pale to medium dark brown, smooth, wall thin or slightly thickened. Conidiogenous cells integrated, terminal, 10–20 µm long, conidiogenous loci denticle-like, mostly with several denticles, tips truncate, wall unthickened, not darkened or occasionally slightly darkened–refractive. Conidia catenate, often in branched chains, ellipsoid–ovoid, fusiform, subcylindrical, 5–18 × 2–4 µm, 0–1-septate, pale olivaceous or olivaceous-brown, yellowish brown, smooth to faintly rough-walled, apex of primary conidia obtuse, rounded, hila (1–3, rarely up to 5) short obconically truncate, unthickened, not darkened.
Notes: This species fits well into the concept of *Pseudocladosporium* U. Braun (BRAUN 1998). It is distinguished from *Pseudocladosporium hachijoense* (Matsush.) U. Braun by having well-developed, longer, septate conidiophores and usually aseptate conidia. *Pseudocladosporium brevicatenatum* (U. Braun & Feiler) U. Braun differs from *P. caruanianum* in having (0–)1–2-septate conidia. The long, septate conidiophores of the latter species resemble those of *Pseudocladosporium* sp. (BRAUN 1998), described from Japan, but the conidia in the latter fungus are septate.
Together with *Anungitea* B. Sutton, *Fusicladium, Polyscytalum* Riess and similar genera, *Pseudocladosporium* belongs to a group of acroblastosporic hyphomycetes (Acroblastosporae, KIFFER & MORELET 1999). The taxonomy within this assemblage of genera is unsettled and uncertain. Monographic studies and molecular data are necessary to get a system of well-defined natural genera.

Fusicladium cecropiae (Stev.) Toro, Sci. Surv. Porto Rico & Virgin Islands 8: 224 (1932).

≡ ***Pseudocercospora cecropiae*** (Stev.) Deighton, Mycol. Pap. 140: 70 (1976).

Fusicladium chlorinum Ellis & Kellerm., in herb.

= ***Ramularia asteris*** var. ***latispora*** U. Braun, A Monograph of *Cercosporella*, *Ramularia* and allied genera, Vol. 2: 98 (1998).

Fusicladium cynanchi Reichert, Bot. Jahrb. Syst. 56: 720 (1921).

Holotype: on leaves of *Cynanchum acutum*, Egypt, near Damiettam, 20 Mar. 1921, C. Ehrenberg (B).
= ***Cercospora punctiformis*** Sacc. & Roum., Rev. Mycol. (Toulouse) 3: 29 (1881).
Lit.: CROUS & BRAUN (2003: 343).

Fusicladium depressum (Berk. & Broome) Roum., Fungi gall. exs. 86 (1879).

≡ ***Passalora depressa*** (Berk. & Broome) Sacc., Nuovo Giorn. Bot. Ital. 8: 187 (1876).
Lit.: CROUS & BRAUN (2003: 157).

Fusicladium depressum f. *petroselini* Sacc., Rev. Mycol. (Toulouse) 19: 53 (1897).

= ***Passalora punctum*** (Delacr.) S. Petzoldt, in Arx, Plant Pathogenic Fungi: 222 (1987).
Lit.: CROUS & BRAUN (2003: 343).

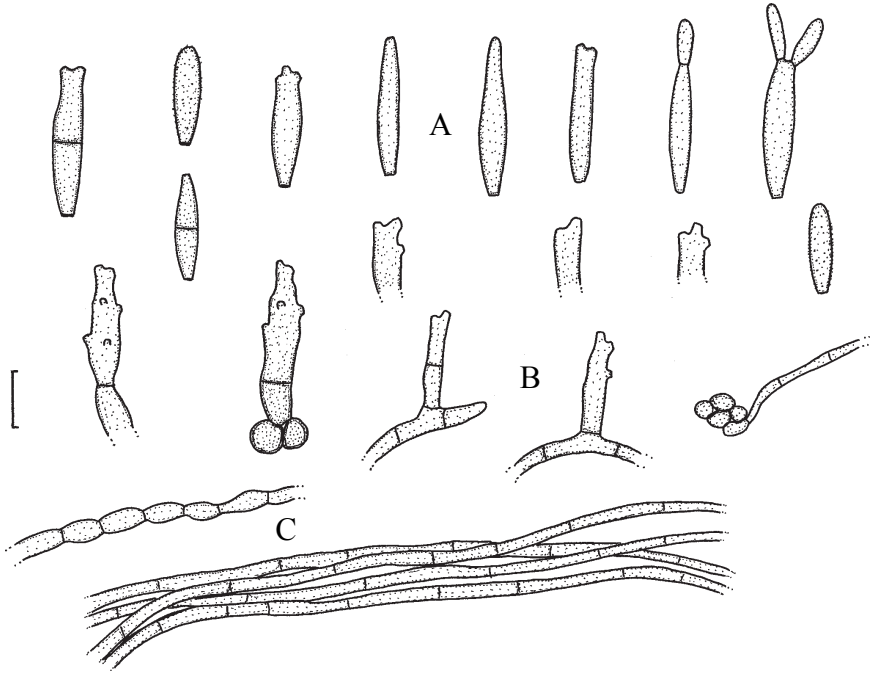

Fig. 58: *Pseudocladosporium caruanianum*. A – conidia, B – conidiophores, C – mycelium, scale = 10 µm, U. Braun del.

Fusicladium depressum var. *platysporum* (Ellis & Holw.) Davis, Paras. fungi Wisconsin: 113 (1942).

≡ ***Passalora platyspora*** (Ellis & Holw.) U. Braun, in Braun & Rogerson, Sydowia 47: 145 (1995).
Lit.: CROUS & BRAUN (2003: 328).

Fusicladium depressum var. *sii* (Ellis & Everh.) Davis, Paras. fungi Wisconsin: 113 (1942).

≡ ***Passalora sii*** (Ellis & Everh.) U. Braun, Nova Hedwigia 55: 214 (1992).
Lit.: CROUS & BRAUN (2003: 377).

Fusicladium depressum var. *tommasiniae* C. Massal., Atti Reale Ist. Veneto Sci. Lett. Arti 59(2): 685 (1900).

= ***Passalora*** sp., status unclear.

Fusicladium destruens Peck, Rep. (Annual) New York State Mus. Nat. Hist. 43: 30 (1890).

Material examined: on leaves of *Avena sativa*, Canada, London, Jul. 1907, J. Dearness, Barthol., F. Columb. 2431 (HBG).
= ***Cladosporium macrocarpum*** Preuss, in Sturm, Deutschl. Fl. 3(6): 27–28 (1848).

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Fusicladium dubiosum Speg., Anales Soc. Ci. Argent. 22: 211 (1886).

Syntypes: on leaves of *Digitaria* sp., Pl. du Paraguay 3517, Guarapi, Dez. 1882, Balansa (B, PC).
= ***Pyricularia grisea*** Sacc., Michelia 2: 20 (1880).

Fusicladium elasticae Koord., Bot. Unters. Java: 231 (1907).

The type at B consists of a drawing and some notes, but without any material. Based on the drawing, this species can be excluded from *Fusicladium*, but its status and generic affinity are unclear.

Fusicladium euonymi-japonici Hori (TAI 1979), nom. nud.

Fusicladium fagopyri Oudem., Verh. Kon. Ned. Akad. Wetensch., Aft. Natuurk., Tweede Sect., 1897: 88 (1897).

Type: on leaves of *Fagopyrum esculentum*, Netherlands, Amsterdam, Jun. 1897, Oudemans (L 66363).
The type consists of various saprobic hyphomycetes, incl. *Alternaria* and *Cladosporium*. Some conidia agreeing with the original description of this species belong to *Cladosporium herbarum* s.lat.

Fusicladium fici Achundov, Novosti Sist. Nizsh. Rast. 16: 32 (1979), nom. illeg., homonym.

Fusicladium fuliginosum Kalchbr. & Cooke, Grevillea 1884: 24 (1884).

Syntype: on leaves of an unknown host plant, Africa, Port. Natal, Luanda, J.M. Wood (B).
Host plant unknown. This is a hyphomycete of unknown affinity.

Fusicladium gnaphaliatum Bonar, Mycologia 57: 392 (1965).

Holotype: on leaves of *Gnaphaliatum stramineum* (= *G. chilense*), USA, California, Lake Merced, San Francisco Co., 9 Sept. 1934, L. Bonar (UC 532308); paratypes: on *G. stramineum*, USA, California, San Francisco, Golden Gate Park, 16 Oct. 1925, L. Bonar (UC 257214); USA, California, Humboldt Co., Hors-Linto Creek, 4 Sept. 1938, L. Bonar (UC 640690).
≡ ***Asperisporium gnaphaliatum*** (Bonar) U. Braun, Schlechtendalia 5: 32 (2000).

Fusicladium hariotianum Sacc., Ann. Mycol. 6: 560 (1908).

Holoype: on leaves of *Atropis borreri* (= *Glyceria borreri*), France, Paris, Eatihou, Sept. 1907, leg. P. Hariot (PC).
Original description (SACCARDO 1913: 1376): Caespitulis punctiformibus, nigricantibus, dense seriatis, epiphyllis, superficialibus, 125–130 µm diam.; hyphis fertilibus dense fasciculatis, paliformibus, simplicibus, continuis, atro-olivaceis, 70 × 5.5–6 µm, apice obtusulis; conidiis tereti–oblongis, basi truncatis, apice rotundatis, 1-septatis, non constrictis, 30 × 8 µm, olivaceis.
= ***Cladosporium*** sp.
Notes: Long, brown, septate conidiophores with somewhat thickened walls and large solitary conidia, 16–30 × 8–11 µm, 0–3-sepate, olivaceous-brown, with somewhat thickened, echinulate walls. This is a species of *Cladosporium* morphologically close to *C. phlei* (C.T. Greg.) G.A. de Vries.

Fusicladium heterosporum Höhn., Ann. Mycol. 3: 337 (1905).

Types: on leaves of *Epilobium parviflorum*, Austria, Wiener Wald, near Winten, 7 Jun. 1905, v. Höhnel (B) and Kab. & Bub., F. imp. exs. 293 (e.g., BPI 424286, FH, K.)
≡ ***Passalora heterospora*** (Höhn.) Höhn., Centralbl. Bakteriol., 2. Abth., 60: 1 (1923).
Lit.: CROUS & BRAUN (2003: 455).

Fusicladium livistoniae P. Karst., Hedwigia 30: 302 (1891).

Holotype: on dead petioles of *Livistona chinensis*, Russia, Karelia, Vyborg, Liimatta, Sept. 1891, A. Thesleff (H 4252).
Notes: This species does not belong in *Fusicladium*, status unclear (BRAUN 2000).

Fusicladium macrosporium Bonord., Hedwigia 3(5): 74 (1864).

= ***Monotospora ovata*** Sacc., Syll. fung. 4: 299 (1886).

Fusicladium maculicola (Ellis & Kellerm.) Ondřej, Česká Mykol. 27(4): 237 (1973).

Lectotype: on leaves of *Phragmites australis*, USA, Manhattan, Kansas, Jun. 1887, W.A. Kellerman No. 934 (NY).
≡ *Scolecotrichum maculicola* Ellis & Kellerm., J. Mycol. 3: 103 (1887), as '*maculicolum*'.
≡ ***Passalora maculicola*** (Ellis & Kellerm.) U. Braun, Schlechtendalia 5: 39 (2000).

Fusicladium minutulum Sacc., Nuovo Giorn. Bot. Ital. 27: 85 (1920).

Isotype: on leaves of *Vitis californica*, USA, Sants Pars, Chryon., Sept. 1916, J.R. Weir (M).
≡ ***Asperisporium minutulum*** (Sacc.) Deighton, in Ellis, More Dematiaceous Hyphomycetes: 243 (1976).

Fusicladium peucedani Syd. & P. Syd., Ann. Mycol. 5: 340 (1907), nom. illeg., homonym of *F. peucedani* Ellis & Holw., 1895.

Types: on leaves of *Peucedanum decursivum*, Japan, Tokio, N. Nambu (B, S).
= ***Passalora depressa*** (Berk. & Broome) Sacc., Nuovo Giorn. Bot. Ital. 8: 187 (1876).
Lit.: CROUS & BRAUN (2003: 157).

Fusicladium pongamiae Syd., Ann. Mycol. 11: 328 (1913).

≡ ***Asperisporium pongamiae*** (Syd.) Deighton, in Ellis, More Dematiaceous Hyphomycetes: 241 (1976).

Fusicladium poricola Bonar, Mycologia 57: 393 (1965).

Holotype: on *Phellinus ferrea*, on trunks of *Alnus* sp., USA, California, Humboldt Co., Van Duzen River, 31 Mar. 1931, H.E. Parks 2726 (UC 1272179); isotype: California Fungi 1251 (PC, UC 568840).
≡ ***Porophilomyces poricola*** (Bonar) U. Braun, Schlechtendalia 5: 42 (2000).

Fusicladium praecox Niessl, in Rabenh., Fungi eur., Ed. Nov., Ser. II, No. 1166 (1868) and Hedwigia 7: 124 (1868).

Syntypes: on leaves of *Tragopogon orientalis*, Czech Republic, pr. Bistenz ad Brunnam Moraviae, May, G. de Niessl, Rabenh., F. eur. 1166 (e.g., B, HBG, HAL, LE, M).
≡ ***Cladosporium praecox*** (Niessl) U. Braun, Schlechtendalia 5: 34 (2000).

Fusicladium punctiforme G. Winter, in Rabenh., Fungi eur., Fasc. 16 (32), No. 3582 (1886), non *Passalora punctiformis* G.H. Otth, 1868.

Syntypes: on leaves of *Pimpinella integerrima* (= *Zizia integerrima*), USA, Missouri, near Perryville, Aestate 1885, C.H. Demetrio, Rabenh., F. eur. 3582 (e.g., HAL, M).
= ***Passalora platyspora*** (Ellis et Holw.) U. Braun, in Braun & Rogerson, Sydowia 47: 145 (1995).
Lit.: CROUS & BRAUN (2003: 328).

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Fusicladium rhamni Fuckel, in herb.

Fusicladium robiniae Shear, Bull. Torrey Bot. Club. 29: 452 (1902).

Syntype: on leaves of *Robinia pseudacacia*, USA, Maryland, Glen Sligo, 3 May 1899, C.L. Shear, Barthol., F. Columb. 1619 (HBG).
≡ ***Passalora robiniae*** (Shear) S. Hughes, Canad. J. Bot. 31: 572 (1953).
Lit.: CROUS & BRAUN (2003: 468).

Fusicladium ruthenicum Petr., Ann. Mycol. 19: 78 (1921).

Syntypes: Petr., F. polon. 638 (e.g., K, W).
= ***Passalora galii*** (Ellis et Holw.) Arx, Proc. Kon. Ned. Akad. Wetensch. C 86(1): 45 (1983).
Lit.: CROUS & BRAUN (2003: 193).

Fusicladium schnablianum Allesch., Fungi bavar. exs. 397 (1894).

Lectotype: on leaves of *Carduus personata*, Germany, Bavaria, Oberammergau, 1894, Allescher (M), selected here; isolectotype: on *Carduus personata*, Germany, Bavaria, Oberammergau, Aug. 1894, Allescher, Allesch. & Schn., F. bavar. 397 (B).
= ***Fusicladiella melaena*** (Fuckel) S. Hughes, Mycol. Pap. 49: 21 (1952).

Fusicladium sorghi Pass., Hedwigia 16: 122 (1877).

Isotype: on leaves of *Sorghum halepense*, Italy, Pavia, Estate 1893, Briosi & Cavara, F. paras. 240 (HAL).
= ***Hadrotrichum sorghi*** Ferraris & C. Massal., Ann. Mycol. 10: 297 (1912).

Fusicladium statices Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1894: 378 (1894).

Holotype: on leaves of *Limonium vulgare* (= *Statice limonium*), USA, New Jersey, Cape May, 13 Sept. 1894, A. Commons (NY).
= ***Cladosporium*** cf. ***herbarum*** (Pers.: Fr.) Link.

Fusicladium transversum Sacc., Ann. Mycol. 3: 170 (1905).

Syntype: on dead leaves of *Ophiopogon japonicum*, Italy, Padova, botanical garden, Feb. 1905, P.A. Saccardo, Mycoth. ital. 1738 (M).
= ***Cladosporium* sp.**

Spilocaea proteae (Marasas et al.) Arx, Genera of Fungi Sporulating in Pure Culture, ed. 3: 280 (1981).

≡ ***Batcheloromyces proteae*** Marasas et al., J. S. African Bot. 41(1): 43 (1975).

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15. Index

15.1. Index of fungal names

Acantharia 8
acerina Venturia **57**
aconiti Fusicladium 109
ahmadii Fusicladium 1, 14, **17**, 18
ahmadii Spilocaea 17, 80
alopecuri Cladosporium 112
alopecuri Fusicladium 112, 113
Alternaria 116
amelanchieris Spilocaea 77, 80
americana Pollaccia 87, 89
amygdali Fusicladium 29
anethi Fusicladium 113
angelicae Fusicladium 113
angelicae Passalora 113
Anungitea 114
Apiosporina 8
aplectri Fusicladium 109
aronici Fusicladium 113
ascyrinum Fusicladium 113
asiaticum Fusicladium 64, 65
asperata Venturia 5, **18**, 20
asperatum Fusicladium 1, 13, **18**, 19, 20
Asperisporium 10
asteris var. *latispora Ramularia* 114
asteroma Cladosporium 85
asteroma var. *macrosporum Cladosporium* 85
asteroma var. *microsporum Cladosporium* 85, 89
asteroma Fusicladium 85
asteroma Napicladium 43, 85
asteroma var. *microsperma Napicladium* 89
balsamiferae Pollaccia 43
bambusicola Cercosporidium 113
bambusicola Fusicladium 113
bambusicola Pseudospiropes 113
bambusicolum Cercosporidium 113
Basiascum 3, 8
betulae Asteroma 22
betulae Fusicladium 11, **20**, 21, 22
bicolor Fusicladiella 113
bicolor Fusicladium 113
borealis Pollaccia 91, 92
borealis Venturia **91**, 92
brevicatenatum Pseudocladosporium 114
brevipes Cladosporium 99
brevipes Fusicladium 12, **22**, 23, 74
butleri Fusicladium 113
butleri Pseudocercospora 113
butyrospermi Fusicladium 109
byrsonimatis Fusicladium 1, 12, **23**, 24
byrsonimatis Pseudocercospora 23
byrsonimatis Ramalia 23
caricae Asperisporium 113
caricae Fusicladium 113
caricinum Fusicladium 6, 7, 11, **24**, 25
carpineum Fusicladium 11, **26**, 27
carpini Fusicladium 26, 109
carpophila Venturia 5, **29**
carpophilum Cladosporium 4, 26
carpophilum Clasterosporium 30
carpophilum Coryneum 30
carpophilum Fusicladium 4, 13, **26**, 28, 30, 34, 35
carpophilum Fusicladosporium 4, 9, 26
carpophilum Megacladosporium 26
caruanianum Fusicladium 114
caruanianum Pseudocladosporium 1, 114, 115
caryigenum Cladosporium 4, 5, 41
caryigenum var. *carpineum Cladosporium* 26
caryigenum Fusicladium 41
catenospora Pollaccia 7, 30
catenosporum Fusicladium 1, 15, **30**, 31
caulicola Fusicladium 1, 6, 11, **31**, 32
cecropiae Fusicladium 114
cecropiae Pseudocercospora 114
cephalanthi Fusicladium 110
cerasi Acrosporium 33
cerasi Cladosporium 33
cerasi Fusicladiopsis 33
cerasi Fusicladium 4, 7, 13, **33**, 34, 35
cerasi Karakulinia 9, 33
cerasi Megacladosporium 33
cerasi Venturia 5, **33**
Cercostigmina 7
chaetomium Cladosporium 47
chanousii Fusicladium 110

chlorinum Fusicladium 114
chlorospora Venturia 94, 108, **109**
Cladophialophora 5
cladosporioides Cladosporium 5
Cladosporium 3, 4, 5, 10, 20, 30, 43, 57, 65, 96, 105, 109, 116, 118
collinsii Apiosporina **105**
collinsii Dimerosporium 105
collinsii Sphaeria 105
concentrica Spilocaea 3, 112
consors Fusicladium 11, **36**
convolvularum Fusicladium 6, 11, **37**, 38
crataegi Actinonema 76
crataegi f. *sorbi ariae Actinonema* 76
crataegi f. *sorbi-torminalis Actinonema* 76
crataegi var. *arachnoideum* f. *sorbi-torminalis Actinonema* 76
crataegi Asteroma 76
crataegi var. *pomi Asteroma* 76
crataegi var. *sorbi Asteroma* 76
crataegi Capillaria 76
crataegi Fusicladium 13, **37**, 39
crataegi Megacladosporium 37
crataegi Phlyctidium 76
crataegi Spilocaea 76
crataegi Venturia **37**, 80
Cycloconium 3, 8
cynanchi Fusicladium 114
dearnessiana Acrotheca 82
dearnessianum Fusicladium 82
Denticularia 10
dentritica Passalora 76
dentritica var. *orbiculata Passalora* 76
dentriticum Cladosporium 76
dentriticum var. *heteromeles Cladosporium* 76
dentriticum Fusicladium 3, 4, 67, 76
dentriticum f. *microsperma Fusicladium* 77
dentriticum var. *eriobotryae Fusicladium* 77
dentriticum var. *opuli Fusicladium* 76, 81
dentriticum var. *orbiculatum Fusicladium* 76
dentriticum var. *pyracanthae Fusicladium* 76
dentriticum var. *soraueri Fusicladium* 76
dentriticum var. *sorbinum Fusicladium* 77
dentriticum var. *sorbinum* f. *fruticola Fusicladium* 77
dentriticum var. *sorbi-torminalis Fusicladium* 77
depressa Passalora 72, 114, 117
depressum Fusicladium 114
depressum f. *petroselini Fusicladium* 114
depressum var. *platysporum Fusicladium* 115
depressum var. *sii Fusicladium* 115
depressum var. *tommasiniae Fusicladium* 115
destruens Fusicladium 115
diedickeanum Fusicladium 12, **40**, 41
diospyri Fusicladium 61
ditricha Venturia 5, **20**, 22, 97
dothidea Botryosphaeria 5
dubiosum Fusicladium 116
echinata Acantharia **104**, 105
effusum Cladosporium 41
effusum Fusicladium 4, 6, 12, 26, 37, **41**, 42, 43
effusum var. *carpineum Fusicladium* 26, 43
effusum Fusicladosporium 41
elasticae Fusicladium 116
elegans Fusicladium 1, 14, **43**, 44
elegans Pollaccia 4, 43, 45, 87
ephedrae Fusicladium 110
ephedrae Venturia 110
epiphylla Spilocaea 3, 112
eriobotryae Basiascum 8, 77, 80
eriobotryae Fusicladium 77
eriobotryae Spilocaea 77, 80
euonymi-japonici Fusicladium 116
euphorbiae Fusicladiopsis 45
euphorbiae Fusicladium 12, **45**, 46, 51
euphorbiae Karakulinia 45
fagopyri Fusicladium 116
fasciculata Passalora 47
fasciculatum Cercosporidium 47
fasciculatum Fusicladium 11, 49
fasciculatum var. ***fasciculatum Fusicladium*** **47**, 48, 49
fasciculatum var. ***didymum Fusicladium*** **49**, 50
fasciculatum Scolecotrichum 47
fautreyi Fusicladium 12, **51**

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fici Fusicladium 110, 116
fraxini Actinonema 52
fraxini Fusicladium 6, 12, **52**, 53
fraxini var. *phillyreae Fusicladium* 53, 74, 110
fraxini Scolecotrichum 52
fraxini Spilocaea 52
fraxini Venturia **52**
fuliginosum Fusicladium 116
fuscescens Fusicladium 82, 85
Fusicladiella 10
Fusicladiopsis 4, 8
Fusicladium 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 15, 31, 36, 37, 43, 45, 53, 55, 57, 62, 68, 71, 94, 96, 100, 105, 108, 109, 114, 116, 117
Fusicladium-state of ***Acantharia echinata*** 12, **104**
Fusicladium-state of ***Apiosporina collinsii*** 12, **105**, 106
Fusicladium-state of ***Apiosporina morbosa*** 13, **106**, 107
Fusicladosporium 4, 9
galii Passalora 118
gardeniae Fusicladium 110
gnaphaliatum Asperisporium 116
gnaphaliatum Fusicladium 116
granulosum Fusicladium 52
grayana Phaeoisariopsis 54
grayiana Isariopsis 54
grayiana Phaeoisariopsis 54
grayianum Fusicladium 14, **54**
grisea Pyricularia 116
hachijoense Pseudocladosporium 114
hariotianum Fusicladium 116
herbarum Cladosporium 116, 118
heterospora Passalora 116
heterosporum Fusicladium 116
heveae Fusicladium 12, **55**, 56
heveae Passalora 55
heveae Scolecotrichum 55
hippophaës Fusicladium 111
Hormocladium 4, 8, 62
humile Cladosporium 57
humile Fusicladium 11, **57**, 58
humile Fusicladosporium 57
inaequalis Venturia 5, **77**, 80
junci Fusicladium 1, 6, 12, **57**, 59
kaki Fusicladium 8, 61, 62
Karakulinia 4, 9
lageniforme Fusicladium 87
lalandi Fusicladium 77, 80
lathyrinum Dicoccum 60
lathyrinum Fusicladium 12, **60**
lathyrmum Dicoccum 60
lethifera Pollaccia 87, 89
lethiferum Cladosporium 87, 89
levieri Cladosporium 61
levieri Fusicladium 6, 11, **61**, 62
levieri Phaeoramularia 61
levieri Ragnhildiana 61
lini Fusicladium 111
livistoniae Fusicladium 117
lonicerae Fusicladium 111
macrocarpum Cladosporium 115
macrosporium Fusicladium 55, 117
macrosporum Fusicladium 55
macularis Venturia 87
maculicola Cladosporium 91
maculicola Fusicladium 90, 117
maculicola Passalora 117
maculicola Phaeoramularia 91, 100
maculicola Scolecotrichum 117
maculicola Torula 90
maculicolum Scolecotrichum 117
mali Asteroma 76
mali Coniosporum 77
mali Fumago 76
mandshurica Mycosphaerella 64
mandshurica Pollaccia 62
mandshurica Venturia **62**
mandshuricum Fusicladium 1, 14, **62**, 63
martianoffianum Cladosporium 64, 65
martianoffianum Fusicladium 6, 14, 57, **64**, 65
Megacladosporium 4, 8
melaena Fusicladiella 113, 118
melanconioides Fusicladium 77
minutulum Asperisporium 117
minutulum Fusicladium 117
morbosa Apiosporina **106**
moreletii Venturia 87, 89
Mycosphaerella 7, 8
Napicladium 8

nashicola Fusicladium 1, 14, **65**, 66
nashicola Venturia 5, 6, **65**, 67
nebulosa Spilocaea 6, 67
nebulosum Dicoccum 67
nebulosum Fusicladium 1, 12, **67**, 68
obducens Fusicladium 6, 13, **68**, 69
Oidium 8
oleaginea Spilocaea 6, 70
oleagineum Cycloconium 8, 70
oleagineum Fusicladium 1, 12, **70**, 71
oleaginum Cycloconium 70
opuntiae Spilocaea 3, 112
orbiculatum Cladosporium 76
orbiculatum Fusicladium 76
ovata Monotospora 117
parahebicola Protoventuria **100**
Passalora 10, 115
perexigua Didymoshaeria 36
peucedani Asperisporium 72
peucedani Fusicladium 11, **72**, 73, 117
peucedani Pollaccia 72
Phaeoramularia 62
phillyreae Cycloconium 73
phillyreae Fusicladium 1, 12, **73**, 74
phillyreae Spilocaea 53, 73, 110
phlei Cladosporium 116
photinicola Fusicladium 77
photinicola Spilocaea 77, 80
pirina Venturia 82
pirinum var. *amelanchieris Fusicladium* 76
pirinum var. *pyracanthae Fusicladium* 76
pirinum Megacladosporium 82
pisicola Fusicladium 7, 12, **74**, 75
platyspora Passalora 115, 117
Pollaccia 1, 2, 3, 4, 5, 6, 7, 8, 11, 15, 43, 72, 87, 89, 100
polymorphum Cladosporium 82
Polyscytalum 114
pomi Actinonema 76
pomi Fusicladium 3, 12, 13, 14, 18, **76**, 78, 80, 81
pomi Passalora 82
pomi Spilocaea 3, 6, 8, 76, 80
pongamiae Asperisporium 117
pongamiae Fusicladium 117
populi Clasterosporium 87
populi Fusariella 85
populi Stigmina 87
populi-albae Pollaccia 89
populina Venturia 4, 5, **43**, 45
populinum Coryneum 64
populinum Dicoccum 87
poricola Fusicladium 117
poricola Porophilomyces 117
porrigo Cercospora 82, 85
praecox Cladosporium 117
praecox Fusicladium 117
proteae Batcheloromyces 118
proteae Spilocaea 118
Protoventuria 8
pruni Fusicladium 29
Pseudocercospora 7, 8, 10
Pseudocladosporium 114
Pseudofusicladium 4
psoraleae Dicoccum 81
psoraleae Fusicladium 7, 12, **81**
punctiforme Fusicladium 117
punctiformis Cercospora 114
punctiformis Passalora 117
punctum Passalora 113, 114
pyracanthae Fusicladium 76
pyracanthae Passalora 76
pyracanthae Spilocaea 76, 80
pyrina Passalora 82
pyrina Venturia 5, 6, 67, **82**
pyrinum Arthrinium 82
pyrinum Fusicladium 82
pyrinum Fusidium 82
pyrorum Fusicladium 3, 6, 8, 13, 14, 65, **82**, 83, 85
pyrorum f. *carpophila Fusicladium* 82
pyrorum var. *cladophilum Fusicladium* 82
pyrorum Helminthosporium 76, 82
pyrorum Megacladosporium 82
radiosa Pollaccia 4, 8, 45, 53, 85, 87, 90, 92
radiosa var. *lethifera Pollaccia* 87, 89
radiosa var. *populi-albae Pollaccia* 89, 90
radiosa var. *radiosa Pollaccia* 90
radiosa Stigmina 43, 85
radiosa Venturia 85
radiosum Fusicladium 3, 4, 14, 43, 45, 85, 87, 89
radiosum var. *balsamiferae Fusicladium* 43

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radiosum var. ***lethiferum Fusicladium*** 1, 15, **87**, 88, 89
radiosum var. ***populi-albae Fusicladium*** 1, 14, **89**, 90
radiosum var. *microsporum Fusicladium* 85
radiosum var. ***radiosum Fusicladium*** 14, **85**, 86, 89
radiosum Oidium 4, 85
Ramalia 4, 9
Ramularia 7, 10
ramulosa Pollaccia 85
ramulosum Cladosporium 85, 90, 94
ramulosum Fusicladium 85, 92, 94
rhamni Fusicladium 118
robiniae Fusicladium 118
robiniae Passalora 118
romellianum Fusicladium 6, 14, 57, **90**, 91, 92, 100
ruthenicum Fusicladium 118
saliciperda Pollaccia 92
saliciperda Venturia **92**, 94
saliciperdum Fusicladium 15, **92**, 93, 108
saliciperdum Septogloeum 92, 94
salicis Fusicladium 30, 31
schnablianum Fusicladium 118
scillae Cladosporium 94, 96
scillae Fusicladium 6, 12, **94**, 95
scirpi Spilocaea 3, 112
scribnerianum Cladosporium 96
scribnerianum Fusicladium 11, **96**, 97
Septoria 7
sii Passalora 115
sinensis Pollaccia 62
soraueri Napicladium 8, 76
sorghi Hadrotrichum 118
sorghi Fusicladium 118
Spilocaea 1, 2, 3, 4, 5, 6, 7, 8, 11, 15, 53, 68, 71, 112
spiraeae Fusicladium 14, **97**, 98
spiraeae Pollaccia 97
spiraeae Scolecotrichum 97
statices Fusicladium 118
stuckertii Fusicladium 111
stuckertii Napicladium 111
stuckertii Sporhelminthium 111
subsessile Cladosporium 99
subsessile Fusicladium 14, **99**, 100
syringae Venturia **40**
tenue Fusicladium 111
theae Fusicladium 112
transversum Fusicladium 118
tremulae Fusicladium 43, 45, 52, 53, 85, 87, 89, 94
tremulae Napicladium 43, 45, 85
tremulae Venturia 4, 5, 87, 92
tremulae var. ***grandidentatae Venturia*** **87**, 89
tremulae var. ***populi-albae Venturia*** **89**
tremulae var. ***tremulae Venturia*** **85**
ulei Microcyclus **55**
vanillae Fusicladium 112
venosum Scolecotrichum 76
Venturia 2, 3, 4, 5, 7, 8, 9, 10, 26, 30, 35, 37, 43, 53, 57, 64, 87, 109
veronicae Fusicladium 6, 15, **100**, 101
veronicae Ramalia 4, 9, 100
virescens Fusicladium 3, 4, 8, 82
virgaureae Fusicladium 11, **102**
viticis Fusicladium 15, **103**

2.2.2.3. Index of host genera

Acacia 30
Acer 11, 57
Aconitum 109
Alnus 22, 117
Alopecurus 49, 112
Amelanchier 12, 77, 78, 79, 80, 105
Ammophila 49
Amygdalus 29
Anethum 113
Angelica 11, 72, 113
Aplectrum 109
Archangelica 113
Aronia 13, 79, 82, 84
Arum 81
Ascyrum 113
Astragalus 12, 22, 23
Atropis 116
Avena 115
Baccachis 111
Berberis 22
Betula 11, 20, 22, 96, 97
Bromus 30
Butyrospermum 109
Byrsonima 12, 23
Calystegia 11, 37
Camellia 112
Carduus 118
Carex 11, 24, 25
Carica 113
Carya 12, 26, 41, 43
Carpinus 11, 26, 43, 109
Cephalantus 110
Chaenomeles 13, 84
Chaerophyllum 113
Cheirodendron 30
Cicuta 11, 72
Convolvulus 11, 37
Cotoneaster 13, 79, 80
Crataegus 13, 37, 40, 76, 80, 81
Cynanchum 114
Digitaria 116
Diospyros 11, 61, 62
Docynia 13, 79, 81
Ephedra 110
Epilobium 116
Eriobotrya 13, 77, 78, 79, 80, 84, 85
Euphorbia 11, 12, 45, 47, 49, 51
Fagopyrum 116
Ficus 110
Filipendula 30
Fraxinus 12, 52, 53, 67, 68
Gardenia 110
Gentiana 110
Glehnia 11, 72
Glyceria 116
Gnaphaliatum 116
Heteromeles 13, 77, 78, 79, 80
Hevea 12, 55
Hippophaë 111
Hordeum 30
Jasminum 113
Juglans 43
Juncus 12, 57, 59
Kageneckia 13, 79, 80, 81
Lathyrus 12, 60
Limonium 118
Linum 111
Livistonia 117
Lomatium 11, 72
Lonicera 111
Magnolia 114
Malus 3, 13, 18, 20, 76, 78, 79, 80, 82, 84, 85, 112
Metrosideros 30
Olea 12, 70, 71
Ophiopogon 118
Parahebe 15, 100, 102
Persica 26
Peucedanum 11, 72, 113, 117
Phaseolus 111
Phillyrea 12, 53, 73, 74
Photinia 13, 77, 79
Phragmites 117
Pimpinella 117
Pisum 12, 74, 76
Populus 4, 14, 15, 43, 45, 53, 57, 62, 64, 65, 85, 86, 87, 88, 89, 90, 91, 92, 94, 99, 100
Potentilla 30
Prunus 13, 26, 29, 30, 33, 34, 68, 70, 79, 80, 107, 108
Psoralea 12, 81, 82
Pyracantha 13, 40, 78, 79, 80, 81

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Pyrus 3, 14, 17, 18, 65, 67, 76, 79, 80, 82, 84, 85, 112
Quercus 12, 105
Robinia 118
Rosa 30
Rubus 14, 54
Salix 15, 30, 31, 92, 93, 94, 108, 109
Scabiosa 36
Scilla 12, 94, 96
Scirpus 3, 112
Sedum 11, 31
Setaria 112
Solidago 11, 102, 103
Sorbus 14, 76, 77, 78, 79, 80, 85
Sorghum 118
Sphaenosciadium 11, 72
Spiraea 14, 97, 98
Statice 118
Succisa 11, 36
Syringa 12, 40, 41
Thea 112
Tragopogon 117
Vanilla 112
Viburnum 81
Vitex 15, 103, 104
Vitis 117
Zizia 117