

CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA
(COELOMYCETES) VI – 1

Section *Phyllostictoides*: Characteristics and nomenclature of its type species
Phoma exigua

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A description is given of the morphological characters of *Phoma* section *Phyllostictoides* and its taxonomical position is discussed. A key is provided for the varieties of the type species *Phoma exigua* Desm., followed by a host-fungus and a fungus-host index. Two new varieties are proposed: *Phoma exigua* var. *forsythiae* (Sacc.) comb. nov. and *Phoma exigua* var. *noackiana* (Allesch.) comb. nov. The synonymy, selected literature, a representative culture and data on ecology and distribution are given for all varieties.

Previous papers of this series deal with the section *Phoma* (De Gruyter & Noordeloos, 1992; De Gruyter et al., 1993, 1998), *Peyronellaea* (Boerema, 1993), *Plenodomus* (Boerema et al., 1994, 1996 and Boerema & de Gruyter, 1999), *Heterospora* (Boerema et al., 1997, 1999) and *Sclerophomella* (Boerema & de Gruyter, 1998).

The section *Phyllostictoides* was introduced by Van der Aa et al. (1990). The infrageneric name was adopted from a cultural study by Žerbele (1971), who proposed it as a provisional name of a 'group-like section' without a Latin description (personal information from Dr. V.A. Mel'nik, St. Petersburg). The section name was formally validated by Boerema: *Phoma* sect. *Phyllostictoides* Žerbele ex Boerema (Boerema, 1997). It comprised species with pycnidia similar to those of the section *Phoma*: thin-walled, pseudoparenchymatous, glabrous but sometimes with hyphal outgrowths, a predetermined opening or ostiole, but sometimes remaining closed for a long time with final formation of a pore. The conidia have a broad range of shapes and sizes and are mainly aseptate in vitro, but in vivo the larger conidia often become two or even more celled by secondary septation (see Fig. 1). The percentage of septate conidia depends on environmental conditions and may vary in vivo between 5 and 95 (Van der Aa & van Kesteren, 1979). Under normal laboratory conditions the majority of conidia always remain aseptate in vitro, but usually some two- or more-celled conidia also occur.

Section *Phyllostictoides* includes species with and without chlamydospores; if present they are unicellular, solitary or formed in series or complexes. Many species of this section are anamorphs of species of *Didymella* Sacc. The type species of section *Phyllostictoides* is *Phoma exigua* Desm. Žerbele (1971) used the synonym *Ascochyta althaeina* Sacc. & Bizz., see Van der Aa & van Kesteren (1971).

Phoma exigua is a plurivorous species, very common in Eurasia but also reported repeatedly from Australasia and the Americas. The fungus has frequently been redescribed as a new species since the middle of the nineteenth century, supposedly specific for at least every

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Table I. Differential criteria of the infraspecific taxa of *Phoma exigua* in vitro.

variety (item)	Margin colony OA, MA	Growth-rate OA MA CA	E Aerial mycelium OA	Colony OA	Reverse OA	Colony MA	Reverse MA
<i>exigua</i> (1)	irregular	(25-)50-85	variable	variable	variable	variable	variable
<i>linicola</i> (2)	irregular	20-45	velvety to floccose, white to olivaceous grey	olivaceous grey/olivaceous black	olivaceous grey/olivaceous black	olivaceous grey/olivaceous black	olivaceous grey/olivaceous black
<i>heteromorpha</i> (3)	irregular	40-50	floccose, white, or pale olivaceous grey/glaucous grey	grey olivaceous to olivaceous grey/olivaceous black	grey olivaceous to olivaceous grey/olivaceous black	grey olivaceous to olivaceous grey/olivaceous black	leaden grey/lead black, partly grey olivaceous, sometimes salmon near margin
<i>populi</i> (4)	irregular	40-65	floccose, pale olivaceous grey to glaucous grey	colourless to grey olivaceous at centre	colourless to pale olivaceous/olivaceous at centre	grey olivaceous, citrine to greenish olivaceous at margin	leaden grey to olivaceous black, greenish olivaceous/ grey olivaceous near margin
<i>diversispora</i> (5)	regular to slightly irregular	65-80	velvety to floccose/woolly, pale olivaceous grey/grey olivaceous	grey olivaceous to olivaceous	olivaceous to leaden grey	buff, to grey olivaceous/olivaceous black	leaden grey to olivaceous black, or umber/honey to olivaceous
<i>noackiana</i> (6)	regular to slightly irregular	75-85	velvety to floccose, olivaceous grey, with compact tufts of white aerial mycelium	olivaceous to iron grey, or grey olivaceous to olivaceous	olivaceous to leaden grey/lead black	greenish olivaceous to olivaceous	leaden grey to olivaceous black, olivaceous at margin
<i>lilacis</i> (7)	regular, on MA irregular	60-80	typical compact tufts, white	greenish olivaceous	greenish olivaceous	greenish olivaceous/ grey olivaceous, olivaceous near margin	olivaceous, leaden grey
<i>viburni</i> (8)	regular to slightly irregular	65-85	tufted velvety to finely floccose, white to (pale) olivaceous grey	colourless to grey olivaceous/olivaceous grey	olivaceous grey	olivaceous grey, sometimes with buff to saffron	leaden grey/grey olivaceous at margin
<i>forsythiae</i> (9)	regular	65-85	velvety finely floccose/woolly, white to (pale) olivaceous grey, partly tufted	colourless to grey olivaceous	olivaceous grey	olivaceous grey	leaden grey, grey olivaceous at margin

new host genus, and placed in the coelomycetous genera *Phoma*, *Phyllosticta* and *Ascochyta*, due to the rigid application of criteria used in the Saccardoan system for anamorph genera. In this contribution nomenclature and synonymy of this species and a number of infraspecific taxa is given and their characters in vivo and in vitro are described. The subspecific taxonomy is supported by Amplified Fragment Length Polymorphism studies (AFLP), which will be published separately (Abeln et al., in press).

MATERIAL AND METHODS

Methods are as described in De Gruyter & Noordeloos (1992) and De Gruyter et al. (1993). In combination with other characteristics, the presence (+) or absence (–) of a colourless metabolite known as ‘antibiotic E’ is a useful diagnostic criterium for species of *Phoma*. The production of ‘E’ was first described from ubiquitous strains of *Phoma exigua* (E is derived from *exigua*), see Boerema & Höweler (1967). It can be demonstrated by adding a drop of concentrated NaOH to the margin of colonies on MA which produces an initial blue-green colour reaction, turning to brownish-red (oxidation reaction). Logan & O’Neill (1970) showed the metabolite to have bactericidal and fungicidal properties. The production of ‘antibiotic E’ is stimulated by light, so that the NaOH-test is best examined after the plates have been exposed to daylight for several days.

Isolates and original samples studied are present in herbarium and culture collections of CBS, Baarn and the Plant Protection Service, PD, Wageningen.

Synonyms in the respective genera *Phoma*, *Ascochyta* and *Phyllosticta* are listed in chronological order, and within the year in alphabetical order. The bulk of the synonyms was originally described in the genus *Phyllosticta*; this fits well with the name of the section. The synonyms described in the genus *Phyllosticta* are only briefly explicated, usually without information about host plant and the type specimen. All will be treated in more detail by Van der Aa, who will publish a revision of all species described in the genus *Phyllosticta* Pers. s.l. Herbaria and culture collections are abbreviated according to the codes in the Index Herbariorum (Holmgren et al., 1981).

It should be noted that only synonyms which have not been published previously are included. A complete synonymy will be published later in the monograph of the genus *Phoma* by Boerema et al.

KEY TO THE VARIETIES OF PHOMA EXIGUA s. l. — Table I

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| 1a. NaOH oxidation reaction positive, green, later red (E ⁺ reaction) | 2 |
| b. NaOH oxidation reaction negative or varying | 3 |
| 2a. Growth-rate variable on OA and MA, (25–)50–85 mm; colonies colourless or with various grey to greenish tinges, or olivaceous to olivaceous black; plurivorous wound and weakly parasitic fungus ⁴ | 1. <i>P. exigua</i> var. <i>exigua</i> |
| b. Growth-rate relatively slow on OA and MA, 20–45 mm; colonies compact, olivaceous grey to olivaceous black; seed-borne pathogen of <i>Linum usitatissimum</i> | 2. <i>P. exigua</i> var. <i>linicola</i> |

4) The concept of *Phoma exigua* may also include plurivorous wound and weak parasitic E[–] strains, see Addendum under var. *inoxydabilis*.

- Forsythia* hybrids (Oleaceae)
(Disease: Shoot Blight)
no. 9: *P. exigua* var. *forsythiae*
[known from weakened shrubs in Europe]
- Linum usitatissimum* (Linaceae)
(Disease: Damping-off, Foot Rot)
no. 7: *P. exigua* var. *lilacis* [only occasionally isolated]
no. 2: *P. exigua* var. *linicola*
[seed-borne pathogen known from Europe and New Zealand]
- Lonicera* sp. (Caprifoliaceae)
no. 8: *P. exigua* var. *viburni*
[only occasionally isolated]
- Nerium oleander* (Apocynaceae)
(Disease: Dieback; Leaf Necrosis)
no. 3: *P. exigua* var. *heteromorpha*
[pathogen recorded in Europe and North America]
- Phaseolus vulgaris* (Leguminosae)
(Disease: Black Node Disease)
no. 5: *P. exigua* var. *diversispora*
[pathogen known from Europe and East Africa]
no. 6: *P. exigua* var. *noackiana*
[pathogen recorded in S and C America]
- Populus* spp., esp. *P. nigra* and
P. (×) euramericana (Salicaceae)
(Disease: Necrotic Black Lesions)
no. 4: *P. exigua* var. *populi*
[pathogen found in Europe]
- Salix* sp. (Salicaceae)
no. 4: *P. exigua* var. *populi*
[only occasionally isolated]
- Syringa vulgaris* (Oleaceae)
(Disease: Damping-off; Leaf Necrosis, Dieback of Shoots)
no. 7: *P. exigua* var. *lilacis*
[pathogen known from Europe, North America and New Zealand]
- Viburnum* spp. (Caprifoliaceae)
(Disease: Leaf Spot; Stem Lesions, Shoot Blackening)
no. 8: *P. exigua* var. *viburni*
[pathogen recorded in Eurasia and North America]
- Vigna unguiculata* (Leguminosae)
(Disease: Black Node Disease)
no. 5: *P. exigua* var. *diversispora*
[pathogen indigenous to Africa]
- Vinca* spp., esp. *V. minor* (Apocynaceae)
(Disease: Stem Blight, Leaf Spot)
no. 3: *P. exigua* var. *heteromorpha*
no. 10: *P. exigua* 'var. *inoxydabilis*'
[applied to different E⁻ strains from Europe and North America; identity doubtful, type lost]

FUNGUS-HOST INDEX

- '*P. exigua* var. *capsici*' (11)
(not valid; identity doubtful)
P. exigua var. *diversispora* (5)
P. exigua var. *forsythiae* (9)
P. exigua var. *heteromorpha* (3)
Capsicum annuum
(Solanaceae)
Phaseolus vulgaris, *Vigna unguiculata*
(Leguminosae)
Forsythia hybrids
(Oleaceae)
Nerium oleander
Vinca minor
(Apocynaceae)

<i>P. exigua</i> 'var. <i>inoxydabilis</i> ' (10) (type lost; identity doubtful)	<i>Vinca</i> spp., esp. <i>V. minor</i> (Apocynaceae)
<i>P. exigua</i> var. <i>lilacis</i> (7)	<i>Syringa vulgaris</i> <i>Forsythia</i> hybr. (occasionally) (Oleaceae)
<i>P. exigua</i> var. <i>linicola</i> (2)	<i>Linum usitatissimum</i> (Linaceae)
<i>P. exigua</i> var. <i>noackiana</i> (6)	<i>Phaseolus vulgaris</i> (Leguminosae)
<i>P. exigua</i> var. <i>populi</i> (4)	<i>Populus</i> spp., esp. <i>P. nigra</i> and <i>P. (×) euramericana</i> <i>Salix</i> sp. (occasionally) (Salicaceae)
<i>P. exigua</i> var. <i>viburni</i> (8)	<i>Viburnum</i> spp. <i>Lonicera</i> sp. (occasionally) (Caprifoliaceae)

DESCRIPTIVE PART

1. *Phoma exigua* Desm. var. *exigua* — Fig. 1

Phoma exigua Desm., Anns Sci. nat., Bot. III, 11 (1849) 282, var. *exigua* [varietal name originally differentiated as 'Var. *a*' (p. 282), against 'Var. *b, minor*' (p. 283) = *Phoma herbarum* Westend., sect. *Phoma* (De Gruyter et al., 1993)].

Phoma niesslii Sacc., *Michelia* 2 (1882) 618 [cf. holotype, PAD].

Phoma catalpicola Oud., Ned. kruidk. Archf III, 2 (3) (1902) 737 [cf. holotype, L].

Ascochyta potentillarum Sacc., *Michelia* 1 (2) (1878) 170 [cf. description and collections sub *Phyllosticta argentinae* auct.].

Ascochyta adzamethica Shoshiashvili, Izv. Gruzinsk. Opytyn. Stantsii Rast., A. [Phitopathol.] 2 (1940) 272 [cf. Mel'nik (1977: 'synonymous with *Ascochyta phaseolorum* Sacc.'].]

Phyllosticta cynarae Westend., Bull. Acad. Roy. Sci. Belgique, Cl. Sci., II, 2 (1857) 568. — *Ascochyta cynarae* (Westend.) H. Zimm., Verh. Naturf. Vereins Brünn 52 (1913) 100 = *Ascochyta cynarae* Died., Krypt. Fl. Mark Brandenb. 9 [Pilze 7, Heft 2] (1912 '1915') 381 = *Diplodina cynarae* Killian & Maire, Bull. Soc. Hist. Nat. Afrique N. 19 (1928), 22 [cf. holotype, BR and several isotypes in Westendorp exsicc. 1140, BR; synonymy partly adopted from Mel'nik, 1977].

Phyllosticta daturae Westend., Herbar L. Pire, Herbarium name, 1860 [cf. material on which the name was based, BR; living culture from type host *Datura stramonium*, CBS 587.67].

Phyllosticta alismatis Sacc. & Speg., *Michelia* 1 (2) (1878) 144. — *Ascochyta boydii* Grove, J. Bot. 56 (1918) 315, replaced name [cf. description and several secondary collections, in vivo and in vitro (CBS 476.69); (holo-)type not available and probably not preserved].

Phyllosticta calycanthi Sacc. & Speg., *Michelia* 1 (2) (1878) 139 [cf. holotype, PAD].

Phyllosticta capparis Sacc. & Speg., *Michelia* 1 (2) (1878) 139 [cf. holotype, PAD].

Phyllosticta capsulicola Sacc. & Speg., *Michelia* 1 (2) (1878) 152 [cf. holotype, PAD].

Phyllosticta celosiae Thüm., J. Sci. Math. Phys. Nat., Sér. 1, 6, 24 (1878) 230 [cf. topotype, S; holotype not available].

Phyllosticta filipendulae Sacc. & Speg., *Michelia* 1 (2) (1878) 150. — *Phyllosticta filipendulina* Sacc. & Speg., *Michelia* 1 (2) (1878), corrigenda after p. 275, replaced name; not *Phyllosticta filipendulae* Sacc., *Michelia* 1 (2) (1878) 145 [type not available (not in PAD); cf. description and cf. Wollenweber & Hochapfel (1936; sub *Ascochyta pirina* Pegl. ['(Fr.) Pegl.']) = *Phoma exigua* Desm. fide Boerema & Dorenbosch, 1973].

Phyllosticta glechomae Sacc., *Michelia* 1 (2) (1878) 151. — *Ascochyta glechomae* (Sacc.) Baudyš & Picb., *Práce Morav. Přír. Společn.* 3 (2) (1926) 30 [cf. holotype, PAD, and several sec. collections, confirmed in vitro].

Phyllosticta gomphrenae Sacc., *Michelia* 1 (2) (1878) 151 [cf. holotype, PAD].

Phyllosticta erythraeae Sacc. & Spæg., *Michelia* 1 (2) (1878) 152 [cf. holotype, PAD].

Phyllosticta lappae Sacc., *Michelia* 1 (2) (1878) 151. — *Ascochyta lappae* (Sacc.) Jaap, *Annl. mycol.* 12 (1914) 26. — *Ascochyta lappae* (Sacc.) Petr., *Annl. mycol.* 18 (1920) 119 = *Ascochyta lappae* Kabát & Bubák, *Hedwigia* 47 (1908) 357; further synonyms, see Mel'nik, 1977: 99 [cf. holotype, PAD].

Phyllosticta sonchi Sacc., *Michelia* 1 (2) (1878) 141. — *Ascochyta sonchi* (Sacc.) Grove, *J. Bot.* 40 (1922) 48; further synonyms listed by Mel'nik (1977: 102) [cf. holotype, PAD].

Phyllosticta tropaeoli Sacc. & Spæg., *Michelia* 1 (2) (1878) 152. — *Ascochyta tropaeoli* (Sacc. & Spæg.) Bond.-Mont., *Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Akad.Nauk S.S.S.R.* 4 (1938) 42 [cf. description; type not available; not in PAD].

Phyllosticta verbasci Sacc., *Michelia* 1 (2) (1879) 531 [cf. holotype, PAD and secondary collections, confirmed in vitro, CBS449.81].

Phyllosticta eupatorina Thüm., *Hedwigia* 19 (1880) 179 [cf. isotype ex herb. Sydow, S].

Phyllosticta juliae Spæg., *An. Soc. cient. arg.* 10 (1880) 28 [cf. holotype, LPS].

Phyllosticta hualtata [as 'hualtatae'] Spæg., *An. Soc. cient. arg.* 13 (1882) 11 [cf. holotype, LPS].

Phyllosticta gillesii Spæg., *An. Soc. cient. arg.* 13 (1882) 11 [cf. holotype, LPS].

Phyllosticta orontii Ellis & Martin, *Am. Naturalist* 16 (1882) 1002 [cf. holotype, NY].

Phyllosticta solani [as 'iolani', spelling of species name is corrected] Ellis & Martin, *Am. Naturalist* 16 (1882) 1002 [cf. holotype, NY].

Phyllosticta stigmaphylli Spæg., *An. Soc. cient. arg.* 13 (1882) 12 [cf. holotype, LPS].

Phyllosticta chenopodii Sacc., *Syll. Fung.* 3 (1884) 55 [as *Phyllosticta chenopodii* Westend., *Michelia* 1 (2) (1878) 150, misidentification] illegitimate, homonym of *Phyllosticta chenopodii* Westend., l.c. = *Phoma heteromorphospora* Aa & Kesteren, *Persoonia* 10 (1980) 542 [cf. Arx, 1970, 140; holotype not available in PAD].

Phyllosticta filipendulina var. *ulmariae* Sacc., *Syll. Fung.* 3 (1884) 41 [cf. holotype, PAD].

Phyllosticta pentastemonis Cooke, *Grevillea* 14 (1885) 90 [cf. holotype, K].

Phyllosticta potamia Cooke, *Grevillea* 14 (1885) 39 [cf. holotype, K].

Phyllosticta ivaecola Ellis & Everh., *J. Mycol.* 2 (1886) 37 [cf. holotype, NY; sec. collections in Brenckle, *Fungi dakotensis* 338, NY, L].

Phyllosticta mentzeliae Ellis & Everh., *J. Mycol.* 2 (1886) 4 [cf. holotype, NY].

Phyllosticta dahliicola Brunaud, *Bull. Soc. bot. Fr.* 34 (1887) 429 [as 'dahliaecola']. — *Ascochyta dahliicola* (Brunaud) Petr., *Annl. mycol.* 25 (1927) 202 [cf. description; type not known to be in existence].

Phyllosticta fatiscens Peck, *Rep. N.Y. St. Mus. nat. Hist.* 40 (1887) 58 [cf. descriptions based on type material by Peck, l.c., Ellis & Everh. (1900) and Seaver (1922); additional sec. collections, NY, L].

Phyllosticta sagittifoliae [as 'sagittaefoliae'] Brunaud, *Rev. mycol.* 9 (1887) 13 [cf. description; type not known to be in existence].

Phyllosticta zahlbruckneri Bäumler, *Beitr. Kryptog. Flora Pressburger Comitatus* 1 (1887) 7 [cf. description and sec. collections in Petr., *Fungi polon. exsicc.* No. 129, L and Petr., *Flora bohém. morav. exsicc. Sér. 2, Abt. 1 Pilze* No. 1271, L].

Phyllosticta antennariae Ellis & Everh., *J. Mycol.* 5 (1888) 9 [cf. holotype, NY].

Phyllosticta calaminthae Ellis & Everh., *J. Mycol.* 5 (1889) 145 [cf. holotype, NY and isotypes, NY and L].

Phyllosticta orontii Ellis & Martin var. *advena* Ellis & Everh., *J. Mycol.* 5 (1889) 146 [cf. holotype, NY].

Phyllosticta molluginis Ellis & Halst., *J. Mycol.* 6 (1890) 33 [cf. holotype, NY].

Phyllosticta oites Brunaud, *Actes Soc. linn. Bordeaux* 44, Sér. 5, 4 (1890) 242 [cf. description; type not known to be in existence].

Phyllosticta petasitidis Ellis & Everh., *Proc. Acad. Nat. Sci. Philadelphia* (1891) 76 [cf. holotype, NY].

Phyllosticta dircae Ellis & Dearness, *Canad. Rec. Sci.* 5 (1893) 267 [cf. holotype, NY and isotypes in Ellis & Everh. *N. Am. Fungi*, sec. Sér. No. 2838, NY, L and B].

Phyllosticta melampyri Allesch., *Hedwigia* 33 (1894) 70 [cf. holotype, M].

- Phyllosticta alpina* Allesch., Hedwigia 34 (1895) 257 [cf. holotype, M].
- Phyllosticta calthae* Ellis & Everh., Inedit. [cf. Cash, A record of the fungi named by J. B. Ellis, I–III (1952), 300], herbarium name [cf. the material on which the name is based; coll.: 1895, NY].
- Phyllosticta eupatorii* Allesch., Hedwigia 34 (1895) 264 [cf. holotype, M].
- Phyllosticta desertorum* Sacc., Malpighia 10 (1896) 272 [cf. holotype, PAD].
- Phyllosticta helianthemicola* Allesch., Ber. bayer. bot. Ges. 4 (1896) 31 [cf. holotype, M].
- Phyllosticta carpathica* Allesch. in Sydow [often cited as ‘Allesch. & Sydow’], Hedwigia 36 (1897) (157). — *Ascochyta carpathica* (Allesch.) Keissler [as ‘(Allesch. & Sydow) Keissler’], Ann. Naturhist. Mus. Wien 35 (1922) 21 = *Ascochyta carpathica* f. *caulivora* Grove, J. Bot. 60 (1922) 46 [cf. holotype, M; isotypes, B and S].
- Phyllosticta hieracii* Allesch. in Sydow, Hedwigia 36 (1897) 159 [cf. holotype, S, isotypes in Sydow, Mycotheca marchica No. 4473, S and B, and several sec. collections, CBS; identification confirmed in vitro].
- Phyllosticta inulae* Allesch. in Sydow, Hedwigia 36 (1897) 159 [cf. holotype, M, isotypes in Sydow, Mycotheca marchica No. 4475, S and B].
- Phyllosticta lamsanae* Sydow, Hedwigia 36 (1897) 159 [cf. holotype, S and isotype, B].
- Phyllosticta pygmaea* Allesch. in Allesch. & P. Henn., Pilze aus dem Umanakdistrict, in C. Vanhöffen's Botanische Ergebnisse der von der Gesellschaft für Erdkunde zu Berlin unter Leitung Dr. v. Drygalski's ausgesandten Grönlandsexpedition, nach Dr. Vanhöffen's Sammlungen bearbeitet; A, Kryptogamen. Bibliotheca bot. 42 (1897) 10 [cf. description; type not available in herb. Allesch., M and B].
- Phyllosticta spaethiana* Allesch. in Sydow, Hedwigia 36 (1897) 160 [cf. holotype, M and topotypes in Sydow, Mycoth. marchica No. 4482, S and B].
- Phyllosticta adenostylis* Allesch., Rabenh. Krypt-Flora [ed. 2] Pilze 6 [Lief. 60] (1898 [vol. dated ‘1901’]) 99 [cf. holotype, M].
- Phyllosticta mimuli* Ellis & Fautrey, Rev. Mycol. 20 (1898) 59 [cf. holotype, NY].
- Phyllosticta monardae* Ellis & Bartholomew, Trans. Kansas Acad. Sci. 16 (1898) 165 [cf. holotype, NY].
- Phyllosticta nupharis* Allesch., Rabenh. Krypt.-Flora [ed. 2] Pilze 6 [Lief. 61] (1898 ‘1901’) 133. — *Phoma westendorpii* Tosq. in Westend., Bull. Acad. Roy. Sci. Belgique, II, 2 (1857) 564 not *Phyllosticta westendorpii* Thüm., Pilzflora Sibiriens 304 (1880) [cf. holotype, BR and sec. collections; identification confirmed in vitro, CBS].
- Phyllosticta pentastemonis* f. *pentastemonis-azurei* Allesch., Rabenh. Krypt.-Flora [ed. 2] Pilze 6 [Lief. 61] (1898) [vol. dated ‘1901’] 135. — *Phyllosticta pentastemonis* var. *major* Allesch., in correspondence between A. Allesch. and P. Sydow, fide Allesch., l.c. and next in Sydow, Mycotheca marchica No. 4478 (herbarium name). — *Phyllosticta pentastemonis* var. *pentastemonis-azurei* [as ‘*pentastemonis azurei*’] (Allesch.) Cejp, Nova Hedwigia 13 (1967) 192 [cf. holotype, in Sydow, Mycotheca marchica 4478, sub nomen *Phyllosticta pentastemonis* var. *major* Allesch., B].
- Phyllosticta pentastemonis* f. *pentastemonis hybridi* Allesch., Rabenh. Krypt.-Flora [ed. 2] Pilze 6 [Lief. 61] (1898 ‘1901’) 135 [cf. descriptions by Allesch., l.c. and Diedicke, 1912].
- Phyllosticta datiscae* Sydow, Hedwigia 38 (1899) (135) [cf. holotype, B].
- Phyllosticta halophila* Speg., An. Mus. nac. Hist. nat. B. Aires 6 (1899) 313 [cf. holotype, LPS].
- Phyllosticta canescens* Ellis & Everh., Bull. Torrey bot. Club 27 (1900) 54 [cf. holotype, NY].
- Phyllosticta gei* Bres., Hedwigia 39 (1900) 325, illegitimate name; a later homonym of *Phyllosticta gei* Thüm., Byull. Moskovsk. Obshch. Isp. Prir. 56 (1881) 130, which is quite another species [cf. holotype, S].
- Phyllosticta mucunae* Ellis & Everh., The North American Phyllostictas. Vineland, New Jersey (1900) 48 [cf. holotype, NY].
- Phyllosticta nymphaeacea* Ellis & Everh., North American Phyllostictas. Vineland, New Jersey (1900) 73 [cf. holotype, NY].
- Phyllosticta pucciniospila* C. Massal., Atti Ist. Veneto Sci. 59 (1900) 687 [cf. holotype, VER, and cf. Van der Aa & Van Kesteren (1971) and Boerema & Dorenbosch (1973), both under the misspelled name ‘*Phyllosticta pucciniphila*’].
- Phyllosticta ariaefoliae* f. *ulmifolia* Bres. in Krieger, Fungi saxon. No. 1632 (1901) [cf. syntypes, L and M].

Phyllosticta stachidis var. *arvensis* Allesch., Rabenh. Krypt.-Flora [ed. 2] Pilze 6 [Lief. 61] (1898 '1901') 151 [cf. holotype, M].

Phyllosticta aloides Oud., Beih. bot. Zbl. (1902) 12 [cf. holotype, L].

Phyllosticta stratiotis Oud., Ned. kruidk. Archf, III, 2 (3) (1902) 747 [cf. holotype, L].

Phyllosticta strelitziae Allesch., Rabenhorst, Krypt.-Flora 1, 7 (1903) 780. — *Phoma strelitziae* var. *major* Tassi, Atti Reale Accad. Fisiocrit. Siena, IV, 8 (1896) 5 [cf. holotype, SIENA].

Phyllosticta tassiana Allesch., Rabenh. Krypt.-Flora [ed. 2] Pilze 1, 7 [Lief. 86] (1903) 757. — *Phoma crassipes* f. *foliicola* Tassi, Bull. Lab. Orto. bot.Reale Univ. Siena 1900 (1900) 17 [cf. holotype, SIENA].

Phyllosticta aricola Bubák, Bull. Herb. Boissier, II, 6 (1906) 403 [cf. description].

Phyllosticta berlesiana Sacc., Anns mycol. 4 (1906) 491 [cf. holotype, PAD].

Phyllosticta scrophulariae-bosniacae Bubák, Bull. Herb. Boissier, II, 6 (1906) 406 [cf. description].

Phyllosticta cinchonae Koord., Verh. K. Akad. Wet. Amst. [Afd. Natuurk.] Sect. 2, 13 (1907) 203 [cf. holotype, B].

Phyllosticta taraxaci Hollós, Ann. Mus. Hist. nat. Hung. 5 (1907) 456. — *Ascochyta taraxaci* (Hollós) Grove, J. Bot. 60 (1922) 48 [cf. description; Herb. Hollós destroyed during second World War and type therefore not available].

Phyllosticta balsaminae Voglino, Atti Accad. Sci. Torino 43 [1907–1908] (1908) 93 [cf. description].

Phyllosticta heterospora Speg., Revista Mus. La Plata 15 (1908) 33 [cf. holotype, LPS and isotype, S].

Phyllosticta abutilonis P. Henn., Hedwigia 48 (1908) 13 [cf. holotype, B and syntype, S].

Phyllosticta bletiae H. Zimm. Verh. Naturf. Vereins Brünn 47 [1908] (1909) 84 [cf. holotype, S].

Phyllosticta stachidis var. *annua* H. Zimm. Verh. Naturf. Vereins Brünn 47 [1908] (1909) 88 [cf. description].

Phyllosticta belgradensis Bubák & Ranoj., Anns mycol. 8 (1910) 381 [cf. holotype, S].

Phyllosticta erodii Speg., An. Mus. nac. Hist. nat. B. Aires III, 20 (1910) 334 [cf. holotype, LPS].

Phyllosticta lychnidis Bondartsev, Izv. glav. bot. Sada SSSR 12 (1912) 102 [cf. holotype, LE-41809].

Phyllosticta sordida Speg., An. Mus. nac. Hist. nat. B. Aires III, 23 (1912) 113 [cf. holotype, LPS].

Phyllosticta bonanseana Sacc., Anns mycol. 11 (1913) 547 [cf. holotype, PAD].

Phyllosticta phlomidis Bondartsev & Lebedeva, Mater. Mikol. Obsl. Rossii 7, 1. Pars. gribi in Prov. Voronezh [collected in 1912] (1914) 53 [cf. holotype, LE-41829; isotype, LEP].

Phyllosticta valerianae Smith & Ramsb., Trans. Br. mycol. Soc. 5 (1915) 158 [cf. holotype, BM].

Phyllosticta polemonii Smith & Ramsb., Trans. Br. mycol. Soc. 5 (1916) 244 [cf. holotype, BM and sec. collections; identification confirmed in vitro, CBS].

Phyllosticta sesami Woron., Věstn. Tiflissk. bot. Sada 3 (1916) 12 [cf. holotype, LEP].

Phyllosticta mercurialicola C. Massal. in Sacc., Fungi veronensis ecc., Madonna Verona (1918), 10; Syll. Fung. 25 (1931) 36 [cf. holotype, VER].

Phyllosticta hydrocotyles A. L. Smith, Trans. Br. mycol. Soc. 6 (1919) 153 [cf. holotype, BM].

Phyllosticta aconitina Petr., Anns mycol. 19 (1921) 87 [cf. isotypes L, S and B].

Phyllosticta crotalariae Speg., An. Mus. nac. Hist. nat. B. Aires 31 (1922) 425 [cf. holotype, LPS].

Phyllosticta sinapi Bond.-Mont., Bolezni Rast. 2 (1923) 70 [cf. holotype LE-41866].

Phyllosticta crinodendri Speg., Revista Chilena Hist. Nat. 27 (1924) 58 [cf. holotype, LPS].

Phyllosticta gueldenstaedtii Murashk., Trudy Sibirsk. Sel'skokhoz. Akad. 5 (1925) 2 [cf. holotype, LEP].

Phyllosticta anagallidis Hollós, Mat. Term. Közlem. [Magy. tudom. Akad.] 35, 1 (1926) 45 [cf. holotype, B].

Phyllosticta bellidis Hollós, Mat. Term. Közlem. [Magy. tudom. Akad.] 35, 1 (1926) 45 [cf. description; type probably not being in existence].

Phyllosticta vernonicida Speg., Boln. Acad. nac. Cienc. Córdoba 29 (1926) 168 [cf. description; type not available in LPS].

Phyllosticta cardaminis-amarae Petr., Anns mycol. 25 (1927) 229 [cf. isotype, S].

Phyllosticta alliicola Lobik, Bolezni Rast. 17 (1928) 165 [cf. description; type not available].

Phyllosticta salviae Lobik, Bolezni Rast. 17 (3–4) (1928) 169 [cf. holotype, LE-41856].

Phyllosticta staticis-gmelini Lobik in Lobik & Volgunov, Mater. Florist. Faunist. Obsl. Tersk. Okr., Pyatigorsk (1928) 38 [cf. holotype, LE-41874].

Phyllosticta suaedae Lobik, Bolezni Rast. 17 (3–4) (1928) 164 [cf. holotype, LE-41876].

- Phyllosticta xanthosomatis* Petr. & Cif., Anns mycol. 28 (1930) 28 [cf. holotype, S].
- Phyllosticta falcata* Ziling, Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 2, 3 (1936) 689 [cf. holotype, LEP].
- Phyllosticta balcanica* Bubák & Picb., Anns mycol 35 (1937) 139 [cf. description].
- Phyllosticta aecidiicola* Hulea, Bul. Sti. Acad. Populare Române Republ. [Sect. Scient.] 22 (1939) 210 [cf. holotype, BUCM].
- Phyllosticta scrophulariaeicola* [as '*scrophulariicola*'] Petr., Anns mycol. 39 (1941) 259 [cf. isotypes, in F. Petrak, Mycoth., gener. No. 1345, W and B].
- Phyllosticta senecionicola* Petr., Anns mycol. 39 (1941) 257 [cf. holotype, S and isotypes, in Cryptog. exs. ed. Mus. Hist. natur. Vindebonensi No. 3550 (PRC, W and L) and F. Petrak Mycoth. gener. No. 292 (W and B)].
- Phyllosticta pogostemonis* Khokhr., Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Akad. Nauk S.S.S.R. 7 (1951) 145 [cf. holotype, LEP].
- Phyllosticta alternantherae* Negru, Contr. Bot. Cluj (1958) 63 [cf. description; type no longer exists: information BUCM]; illegitimate homonym of *Phyllosticta alternantherae* Bat., Bolm Sec. Agric. Ind. Com. Est. Pernambuco 19 (1952) 5 [cf. the description quite another *Phoma* species].
- Phyllosticta elettariae* Chowdhury, Lloydia 21 (1958) 152 [cf. Mathur, 1979 and in accordance with the description].
- Phyllosticta actinidiae* Ablak. & Koval, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 13 (1960) 243 [cf. description].
- Phyllosticta hoveniae* Gucevič, Izv. Akad. Nauk Armyansk. S.S.R., Biol. Nauki 15 (1962) 67 [cf. holotype, LECB].
- Phyllosticta pentastemonitis* Sandu & Serea in Sandu, A. Lažar, Hatmanu & Serea, Lucr. Şti. Inst. Agron. Isasi (1962) 92 [cf. holotype, BUCM].
- Phyllosticta circaeae* Mel'nik, Novosti. Sist. Nizsh. Rast. (1965) 149 [cf. holotype, LE-41742].
- Phyllosticta gerberae* Dzhagal., Novosti. Sist. Nizsh. Rast. (1965) 156 [cf. holotype, LE-41784].
- Phyllosticta bellidicola* Nelen, Novosti. Sist. Nizsh. Rast. (1966) 224 [cf. description].
- Phyllosticta myosotidicola* Nelen, Novosti. Sist. Nizsh. Rast. (1966) 225 [cf. holotype, LE-41816].
- Phyllosticta monardicola* Cejp, Česká Mykol. 20 (1966) 210 [cf. holotype, PRC].
- Phyllosticta caucasica* Cejp, Nova Hedwigia 13 (1967 '1966') 186 [according to the description; type not available].
- Phyllosticta armeniaca* Tasl., Mikol. Fitopatol. 1 (1967) 111 [cf. description].
- Phyllosticta arborea* Cejp, Nova Hedwigia 13 (1967) 184 [cf. description; type not present in herbarium K. Cejp, PRC; pers. information from K. Cejp].
- Phyllosticta caucasica* Tasl., Mikol. Fitopatol. 1 (1967) 111; later homonym of *P. caucasica* Cejp [cf. holotype, LE-41736].
- Phyllosticta daturicola* Cejp, Nova Hedwigia 13 (1967) 188 [cf. the description; type not available, not in PRC (pers. information K. Cejp)].
- Phyllosticta erigerontis* Tasl., Mycol. Fitopatol. 1 (1967) 109 [cf. holotype, ERHM; isotype LE-41769].
- Phyllosticta sisymbrii* Byzova in Byzova et al., Fl. spor. Rast. Kazakh. 5, 1 (1967) 80 [cf. holotype, AA].
- Phyllosticta ballotaecola* Cejp in Cejp, Dolejš & Zavrel, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 143 (1969) 2 [cf. holotype, PRC].
- Phyllosticta torilidis* Cejp in Cejp, Dolejš & Zavrel, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 143 (1969) 12 [cf. holotype, PRC].
- Phyllosticta celosiae* Cejp, Mycol. Pap. 117 (1969) 3; illegitimate, homonym of *P. celosiae* Thüm., 1878, l. c. [cf. isotype, IMI 119661].
- Phyllosticta doellingeriae* Cejp, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 143 (1969) 6 [cf. holotype, PRC].
- Phyllosticta hypericicola* Cejp, Nova Hedwigia 18 (1969) 563 [cf. description; type not available; not in PRC: pers. information K. Cejp].
- Phyllosticta lythri* Cejp, Nova Hedwigia 18 (1969) 564 [cf. description; type not available; not in PRC: pers. information K. Cejp].
- Phyllosticta macrospora* Cejp, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 143 (1969) 8 [cf. holotype, PRC].

Phyllosticta rosae-sinensis Cejp, Mycol. Pap. 117 (1969) 4 [cf. syntype in Exsicc. Dr Karel Cejp, PRC].

Phyllosticta zambiensis Cejp, Mycol. Pap. 117 (1969) 5 [cf. holotype, IMI; isotype, PRC].

Phyllosticta gaillardiae Movss., Nov. Sist. niz. Rast 6 (1970 '1969') 197 [cf. description].

Phyllosticta pimpinellae Cejp, Fassat. & Zavrel, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 153 (1971) 4 [cf. holotype, PRC].

Phyllosticta telekiae Cejp, Fassat. & Zavrel, Zprávy Vlastiv. Ústavu v Olomouci, Císlo 153 (1971) 8 [cf. holotype, PRC].

Phyllosticta magnoliae Shreem., Indian J. Mycol. Pl. Pathol. 3 (1974 '1973') 114. Illegitimate name; later homonym of *Phyllosticta magnoliae* Sacc., Michelia 1 (2) (1878) 139 [cf. type and living culture, IMI 130810].

Phyllosticta carthami Cejp & Dolejš, Fol. Mus. Rerum. Nat. Bohemiae Occid., Bot. 7 (1976) 4 [cf. holotype, PRC].

Phyllosticta coriandri Cejp & Dolejš, Fol. Mus. Rerum. Nat. Bohemiae Occid., Bot. 7 (1976) 5 [cf. holotype in Dr. Karel Cejp, Fungi imperfecti exsiccati, PRC].

Phyllosticta galinsogae Cejp & Dolejš, Fol. Mus. Rerum. Natur. Bohemiae Occid., Bot. 7 (1976) 6 [cf. holotype, PRC].

Previous studies of this fungus added more than a hundred names to its synonymy (Boerema & Höweler (1967), Boerema (1970), Van der Aa & Van Kesteren (1971), Boerema (1972) and Boerema & Dorenbosch (1973)).

The history of the fungus is summarized by Morgan-Jones & Burch (1988). The most striking morphological character of the fungus in vivo is the great variability of size, shape and septation of the conidia. Therefore, the host-specific varieties can only be differentiated according to characters in vitro. They are also recognizable in the AFLP patterns which will be published separately by Abeln et al. (in press).

Description in vitro

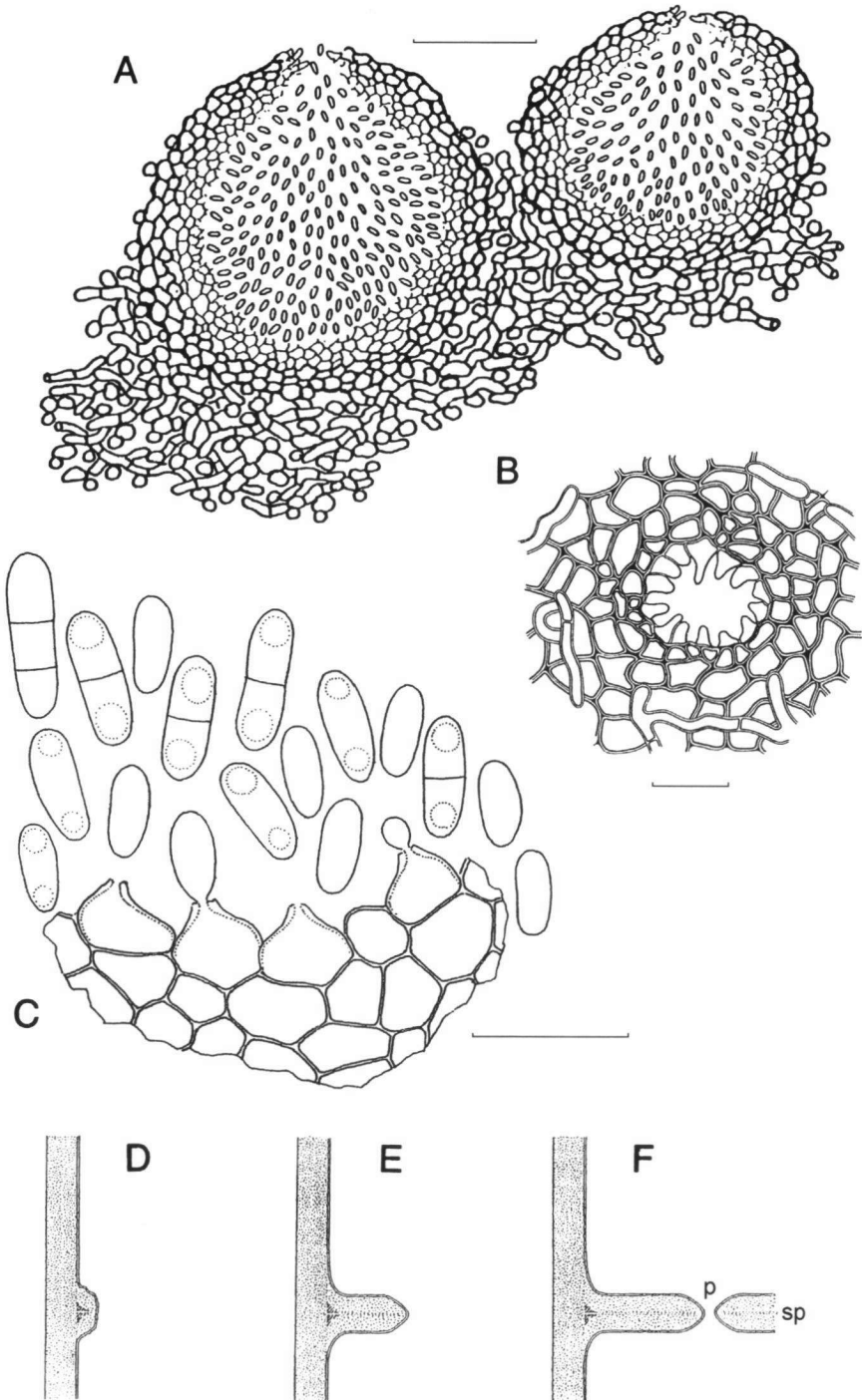
OA: growth-rate (25–)50–85 mm, with irregularly scalloped or lobed margin and with floccose, white to pale olivaceous grey/olivaceous grey aerial mycelium; colony colourless or with various grey greenish tinges, olivaceous grey to greenish olivaceous/grey olivaceous or olivaceous to olivaceous black, usually colourless towards margin; reverse similar.

MA: growth-rate (25–)40–75 mm, with irregularly scalloped or lobed margin and with floccose, grey olivaceous to dull green aerial mycelium; colony grey olivaceous/dull green to olivaceous black, often with saffron/ochraceous to amber patches, and white near margin; reverse similar.

CA: growth-rate 35–50(–70) mm, with irregularly scalloped or lobed margin and with floccose, white to grey olivaceous aerial mycelium; colony grey olivaceous to olivaceous grey; reverse leaden grey to leaden black, often with cinnamon to greyish sepia/chestnut patches; reverse similar.

In general the growth-rate on OA is somewhat faster than those on MA and CA.

Pycnidia scarce to scattered, partly submerged in the agar, 75–200 µm diam., globose to subglobose or irregular, solitary or confluent, glabrous, with usually 1(–2) non-papillate ostioles, olivaceous to olivaceous black; walls made up of 2–5(–7) layers of cells, outer layer(s) pigmented; conidial exudate white to yellowish or rosy buff/salmon or rosy vinaceous. Conidiogenous cells 3–8 × 3–8 µm, globose to bottle shaped. Conidia aseptate, (2.5–)4–7(–12) × 2–3.5 µm, av. 5.5–7.5 × 2.5–3.0, Q = 1.5–4.0, av. Q = 2.3–2.6 or 1(–2) septate, (5.5–)7–10(–13) × 2.5–3.5(–5) µm, variable in shape, subglobose, ellipsoidal to oblong, or allantoid, usually with small guttules.



NaOH spot test: positive on OA and MA: greenish, then red (E⁺ reaction: production of antibiotic E).

Chlamydospores absent, however, swollen olivaceous cells, constricted at the septa, occur.

Crystals absent.

Description in vivo

Pycnidia on leaves and stems of living or withering plants, usually irregularly scattered, seldom arranged concentrically, sometimes on typical leaf spots, but more often on old leaf spots caused by other organisms or on necrotic tips and borders of leaves or on irregular lesions on stem, single or some grown together, globose or somewhat depressed, 100–200 µm in diam., with a roundish ostiolum, lined with papillate subhyaline cells. Pycnidial wall 1–3 outer layers with pale to dark brown, isodiametrical cells, occasionally intermixed with hyphal elements, and 1–3 layers inner cells which are hyaline, isodiametric or somewhat flattened. Conidiogenous cells ampulliform phialids, hardly differentiated from the inner wall cells but with a periclinal thickening of the conidiogenous locus. Blastoconidia ellipsoidal with rounded ends, or irregularly in shape, one celled or 1 (–2)-septate, with or without constrictions at the septae, one-celled conidia 5.5–11.0 × 1.8–4.0 (–6) µm, 2 (–3)-celled conidia 7.5–14.0 (–16.0) × 2.5–4.0 (–6.0) µm. Conidial slime dirty white to pale salmon in colour.

Ecology and distribution. *Phoma exigua* var. *exigua* is a world-wide recorded wound and weak parasitic soil fungus, which in Eurasia has been isolated from more than 200 host genera. The fungus is an opportunistic plant parasite which may cause necroses on leaves and stems, and may produce a rot on fleshy roots and tubers, or at the bases of leaves and stems: Leaf- and Stem Necroses, Pod spot of legumes, Root Rot of carrot, chichory etc., Gangrene of potatoes, Tuber Rot of dahlia, Foot Rot of lettuce etc.

On dying plant substrates, in the close proximity of soil, it is the most common pycnidial fungus found in Europe. The extensive synonymy can be explained by the unlimited plurivorous character of the fungus and its extreme variability in size and septation of conidia. Notable are the many specific 'host-indicating names', formerly described in the genus *Phyllosticta*.

As a producer of notorious cytochalasins A and B (= phomine) the fungus was initially known as '*Phoma* stam S 298'. For literature references see e.g. Boerema & Hamers (1990).

Representative cultures. CBS 431.74 ex *Solanum tuberosum* (Solanaceae), the Netherlands, CBS 101150 (PD 79/118) ex *Cichorium intybus* (Compositae), the Netherlands and CBS 101155 (PD 87/719) ex *Helianthus annuus* (Compositae), France.

Fig. 1. *Phoma exigua* var. *exigua*, type species of *Phoma* sect. *Phyllostictoides*. A. Vertical section of pycnidia and subtending mycelium, from 14-day-old colony; B. superficial view of an ostiolum, lined internally with papillate hyaline cells; C. conidiogenous cells and conidia; D→F. diagrammatic representation of electron-microscope observations on the frequently occurring secondary septation of the conidia. It occurs as an annular ingrowth from the lateral wall, leaving a pore (p) in the centre. The septum consists of a middle lamella, the septal-plate (sp.) at both sides covered with wall-layers which for some distance are 'attached' to the lateral conidial wall. Drawings A, C after Morgan-Jones & Burch (1988; with permission); B after Boerema & Höweler (1967); D, E after Boerema & Bollen (1975). Vertical section, bar 50 µm; ostiolum, conidiogenous cells and conidia, bar 10 µm.

Note. The present concept of the species separates a number of host-specific varieties, which are listed below⁵. In general the varieties of *Phoma exigua* with a specific host relation show in vitro a little variability in general appearance.

2. *Phoma exigua* var. *linicola* (Naumov & Vassiljevsky) Maas

Phoma exigua var. *linicola* (Naumov & Vassiljevsky) Maas, Neth. J. Pl. Path 71 (1965) 118. — *Ascochyta linicola* Naumov & Vassiljevsky, Mater. mikol. Fitopat. Ross. 5 (1926) 3. — *Phoma exigua* f. sp. *linicola* (Naumov & Vassiljevsky) Malc. & E. G. Gray, Trans. Br. mycol. Soc. 51 (1968) 619.

Phoma linicola É.J. Marchal & Verpl., Bull. Soc. r. Belg. 59 (1926) 22; not *Phoma linicola* Bubák, Annln naturh. Mus. Wien 28 (1914) 203 [= *Phoma exigua* Desm. var. *exigua*, no. 1], nor *Phoma linicola* Naumov, Mater. Mikol. Fitopat. Ross. 5 (1926) 3.

Phoma belgica Cash, in Trotter, Sylloge Fung. 26 (1972) 934.

Diplodina lini Moesz & Smarods in Moesz, Magy. bot. Lap. 29 (1930) 35.

Selected literature. Maas (1965), Boerema & Höweler (1967), Boerema (1976).

Differentiating characters. Growth-rate on OA and MA is relatively slow, 20–45 mm; colonies compact, distinct pigmented, olivaceous grey to olivaceous black.

NaOH reaction is positive: production of antibiotic E.

Ecology and distribution. This variety represents a noxious seed-borne pathogen of cultivated flax (*Linum usitatissimum*), causing Damping-Off, Foot Rot and Dead Stalks. Checked records are from East and West Europe and New Zealand. Similar slow-growing E⁺ isolates are occasionally also isolated from other plants. AFLP studies (Abeln et al., in press) indicate a close relation to var. *heteromorpha* (no. 3), pathogen of the oleander (the hosts of both varieties are of mediterranean origin).

Representative culture. CBS 116.76 (ATCC 32332, IMI 197074, PD 75/544) ex *Linum usitatissimum* (Linaceae), the Netherlands.

3. *Phoma exigua* var. *heteromorpha* (S. Schulz. & Sacc.) Noordel. & Boerema

Phoma exigua var. *heteromorpha* (S. Schulz. & Sacc.) Noordel. & Boerema, Versl. Meded. plziektenk. Dienst Wageningen 166 (Jaarboek 1987) (1988) 109 [erroneously without page indication of the basionym; reference added in printed Errata slip]. — *Phoma heteromorpha* S. Schulz. & Sacc., Hedwigia 23 (1884) 107. — *Ascochyta heteromorpha* (S. Schulz. & Sacc.) Curzi, Boll. Reale Staz. Patol. veg. 13 (1933) 399.

Phoma oleandrina Delacr., Bull. Soc. mycol. Fr. 21 (1905) 190.

Selected literature. Curzi (1933), Mercier & Metay (1977), Keim (1979), Noordeloos & Boerema (1988).

Differentiating characters. Differs from the type variety *exigua* mainly by its extreme morphological variability ('*heteromorpha*'). Growth-rate is moderate on OA, 40–50 mm, and relatively slow on MA and CA, 20–25 (–30) mm; colonies are relatively dark, grey olivaceous to olivaceous black, with often white aerial mycelium.

Usually no demonstrable production of antibiotic E, but some strains showed on MA a slight positive reaction with NaOH.

5) It should be noted that two specific pathogens formerly classified as varieties of *Phoma exigua*, on account of additional comparative studies now are placed (again) in species rank: *P. exigua* var. *foveata* (Foister) Boerema = *Phoma foveata* Foister; *P. exigua* var. *sambuci-nigrae* (Sacc.) Boerema & Höweler = *Phoma sambuci-nigrae* (Sacc.) Monte et al. Both species will be treated in Contribution VI-2.

Ecology and distribution. This fungus is known as a noxious pathogen of oleander (*Nerium oleander*) in production nurseries: Dieback (Canker) and Leaf Necrosis.

Confirmed records are from France, Italy and the United States, but probably the pathogen occurs everywhere the host is commercially grown. Natural infection appeared to occur only through wounds. The fungus has been also isolated from necrotic stems and leaves of *Vinca minor* (also Apocynaceae).

Genetically var. *heteromorpha* belongs to the same group as var. *linicola* (no. 2), pathogen of flax (Abeln et al., in press).

Representative culture. CBS 443.94 (PD 98/2328) ex *Nerium oleander* (Apocynaceae), Italy.

4. *Phoma exigua* var. *populi* De Gruyter & Scheer

Phoma exigua var. *populi* De Gruyter & Scheer, J. Phytopathol. 146(1998) 413.

Selected literature. Butin (1957), Magnani (1966, 1969), De Gruyter & Scheer (1998).

Differentiating characters. Growth-rate on OA 41–66 mm, on MA and CA relatively slow, 20–40 mm.

No production of antibiotic E (NaOH reaction is negative).

Ecology and distribution. This opportunistic pathogen of poplars causes distinct necrotic bark lesions; especially cultivars of *Populus nigra* and *Populus* (×) *euramericana* proved to be susceptible. In European literature before 1998 the disease has been ascribed to *Phoma urens* Ellis & Everh., but De Gruyter & Scheer (l.c.) established that the American holotype of that species contained a quite different species of *Sclerophoma*.

The disease symptoms resemble Canker of poplar caused by *Cryptodiaporthe populea* (Sacc.) Butin ex Butin [anam. *Chondroplea populea* (Sacc.) Kleb.]. *Phoma exigua* var. *populi* has also been isolated from a species of *Salix*.

The fungus on poplars is so far recorded in Germany, the Netherlands and Italy.

Representative culture. CBS 100167 (PD 93/217) ex *Populus* (×) *euramericana* 'Robusta' (Salicaceae), the Netherlands.

5. *Phoma exigua* var. *diversispora* (Bubák) Boerema

Phoma exigua var. *diversispora* (Bubák) Boerema in Boerema & Kesteren, Gewasbescherming 11 (1980) 122. — *Phoma diversispora* Bubák, Österr. bot. Z. 55 (1905) 78.

Selected literature. Boerema et al. (1981), Boerema et al. (1993).

Differentiating characters. Growth-rate fast on OA and CA, 60–85 mm, on MA moderate, 35–60 mm; on OA with velvety to floccose/woolly, pale olivaceous grey/grey olivaceous aerial mycelium; reverse usually dark olivaceous black.

Unicellular conidia vary more widely in width than those of the type variety *exigua* ('*diversispora*').

Chlamydospores may be formed, best observed on water agar (WA), 10–25 µm diam. No production of the antibiotic E (NaOH reaction is negative).

Ecology and distribution. The primary host of variety *diversispora* is probably cowpea (*Vigna unguiculata*), originally native of Central and West Africa. However, in Western

Europe and East Africa var. *diversispora* is particularly known as seed-borne pathogen of dwarf beans or snap beans (*Phaseolus vulgaris*). The African genus *Vigna* and the American genus *Phaseolus* are closely related and generally susceptible to their mutual pathogens. Affected hosts show a black discolouration of stem nodes and petioles: Black Node Disease.

Representative culture. CBS 102.80 (IMI 331907, PD 79/61) ex *Phaseolus vulgaris* (Leguminosae), Kenya.

Note. In South America similar disease symptoms on beans are caused by the related var. *noackiana*, see below. The plurivorous weak parasite var. *exigua* may produce brown specks on mature bean pods (Speckle Disease).

6. *Phoma exigua* var. *noackiana* (Allesch.) Aa, Boerema & de Gruyter, *comb. nov.*

Phyllosticta noackiana Allesch., Bolm. Inst. agron. Campinas 9 (1898) 85 [basionym; holotype on leaf of *Phaseolus*, coll. F. Noack, Campinas, Brasil, B].

Selected literature. Obando-Rojas (1989).

Differentiating characters. This var. *noackiana* may be called an American nephew of the African var. *diversispora* (no. 5). It differs only little in cultural characters: growth-rate fast on OA, MA and CA, 65–85 mm; on OA with compact tufts of white aerial mycelium, as well as velvety to floccose olivaceous grey aerial mycelium.

Chlamydospores may be formed, best observed on water agar (WA), up to 20 µm diam. No production of antibiotic E (NaOH reaction is negative).

Obando-Rojas (1989) proved that var. *noackiana* and var. *diversispora* are distinctly different in enzyme composition. Both varieties are genetically different, but belong to the same group (Abeln et al., in press).

Ecology and distribution. This variety is in South- and Central America repeatedly found on beans (*Phaseolus vulgaris*) with disease symptoms resembling the Black Node Disease, in (eastern) Africa and (western) Europe caused by *Phoma exigua* var. *diversispora* (no. 5). Study of herbarium material showed that in the 19th century the fungus has been described as a separate species of *Phyllosticta*, found on leaves of bean, collected in Brazil. The occurrence of large necrotic spots on the leaves is one of the symptoms of the disease, which usually starts at the nodes and at leaf junctions.

Representative culture. CBS 100353 (PD 87/718) ex *Phaseolus vulgaris* (Leguminosae), Guatamala.

7. *Phoma exigua* var. *lilacis* (Sacc.) Boerema

Phoma exigua var. *lilacis* (Sacc.) Boerema, Phytopathol. Medit. 18 (1980 '1979') 105. — *Phoma herbarum* f. *lilacis* Sacc., Michelia 2 (1880) 93.

Selected literature. Boerema (1980).

Differentiating characters. Cultures of this variety on OA, MA and CA can easily be differentiated from var. *exigua* by a rather fast growth-rate, 60–80 mm diam. Colonies on OA have abundant, compact tufted, white aerial mycelium, covering the entire greenish olivaceous colony.

No production of antibiotic E (NaOH reaction is negative).

Ecology and distribution. This variety is known as a pathogen of lilac (*Syringa vulgaris*), causing Damping-Off of seedlings, Leaf Necroses and Dieback of shoots. The fungus is also found on seed capsules which indicates the possibility of transmission by seeds. It is probably not always a primary pathogen and may follow Bacterial Blight caused by *Pseudomonas syringae* v. Hall. Occasionally *Phoma exigua* var. *lilacis* has been isolated from necrotic tissue of a *Forsythia* hybrid (also Oleaceae).

Confirmed records on lilac are from France, Germany, Italy, the Netherlands, USA and New Zealand. The fungus probably occurs wherever the host, originally native of Central and South-East Europe, is cultivated.

Representative culture. CBS 569.79 (IMI 331909, PD 72/741) ex *Syringa vulgaris* (Oleaceae), the Netherlands.

8. *Phoma exigua* var. *viburni* (Roum. ex Sacc.) Boerema

Phoma exigua var. *viburni* (Roum. ex Sacc.) Boerema in De Gruyter & Scheer, J. Phytopathology 146 (1998) 414. — *Phyllosticta viburni* Roum., Fungi gall. exs. Cent. 21 (1882) No. 2036; Revue mycol. 4 (1882) 99 [nomen nudum]. — *Ascochyta viburni* (Roum.) ex Sacc., Syll. fung. 3 (1884) 387; not *Ascochyta viburni* Lasch, Fungi europ. exs./Klotzschii Herb. mycol. Cont. [ed. Rabenh.] Cent. 14 (1850), No. 1354 [nomen nudum = *Phoma macrostoma* Mont. var. *macrostoma*, to be treated in Contrib. VI–2]. — *Phoma viburni* (Roum. ex Sacc.) Boerema & Griffin, Trans. Br. mycol. Soc. 63 (1974) 110.

Phyllosticta roumegueri Sacc., Michelia 2 (1880) 88 [as 'Roumeguerri']; not *Phoma roumegueri* Sacc., Michelia 2 (1880) 89.

Phyllosticta lantanoides Peck, Rep. N. Y. State Mus. 38 (1885) 94.

Phyllosticta viburnicola Roum., Revue mycol. 7 (1885) 89; not *Phoma viburnicola* Oudem., Versl. gewone Vergad. wis- en natuurk. Afd. K. Akad. Wet. Amst. 9 (1900) 298 [sect. *Phoma* (de Gruyter & Noordeloos, 1992)].

Phyllosticta punctata Ellis & Dearness, Canad. Rec. Sci. 5 (1893) 268.

Selected literature. Boerema & Griffin (1974), Rai & Rajak (1993), De Gruyter & Scheer (1998).

Differentiating characters. Apart from the specific host relation this variety differs only little in cultural characters from var. *forsythiae* (no. 9). Growth-rate on OA, MA and CA relatively fast, 65–85 mm, regular, on OA with tufts of velvety to finely floccose, white to pale olivaceous grey aerial mycelium; slower growing colony sectors may occur.

No production of antibiotic E (NaOH reaction negative).

Var. *viburni* is genetically distinct from var. *forsythiae* (Abeln et al., in press).

Ecology and distribution. A common pathogen of cultivated *Viburnum* spp. Occasionally it has been isolated from *Lonicera* sp. (also Caprifoliaceae) and some other woody plants (mostly in the neighbourhood of *Viburnum* plants). The disease is known as Leaf Spot, Stem Lesions and Shoot Blackening. Most conspicuous are the necrotic leaf spots with a purplish margin. The variability of the conidia explains the various synonyms in the genus *Phyllosticta* sensu Sacc.. When treating it as a species of *Phoma*, Boerema & Griffin (1974) noted the difficulty of distinguishing it from E⁻-isolates of *P. exigua*.

The records of this fungus are from Europe (Germany, Great Britain, the Netherlands, France) and North America (Canada, United States); but probably it may be found everywhere the hosts are cultivated.

Representative culture. CBS 100354 (PD 84/448) ex *Viburnum opulus* (Caprifoliaceae), the Netherlands.

9. *Phoma exigua* var. *forsythiae* (Sacc.) Aa, Boerema & de Gruyter, *comb. nov.*

Phyllosticta forsythiae Sacc., *Michelia* 1 (1) (1877) 93 [basonym; lectotype on leaf spot, on *Forsythia suspensa* 'Fortunei' (as *F. fortunei*), Paris, France, coll. P.A. Hariot, 1914, PAD (with handwritten note and drawing by P.A. Saccardo; holotype on withering leaves of *F. suspensa* apparently not preserved)]. — *Ascochyta forsythiae* (Sacc.) Höhn. in H. Zimmer., *Verh. Naturf. Vereins Brünn* 47 (1909 '1908') 36.

Ascochyta forsythiae Died., *Krypt.-Fl. Mark Brandenb.* 9 [Pilze 7, Heft 2] (1912) [vol. dated '1915'] 383, fide Mel'nik, 1977.

Differentiating characters. Growth-rate fast on OA, MA and CA, 65–85 mm after 7 days, on OA and MA regular, on CA lobed; on OA velvety to finely floccose/woolly, partly tufted, mainly (pale) olivaceous grey aerial mycelium.

No production of antibiotic E (NaOH reaction is negative).

The cultural characteristics of this variety resemble very much those of var. *viburni*, see no. 8.

Ecology and distribution. This variety is frequently isolated from weakened and badly growing shrubs of *Forsythia* hybrids in Europe. The fungus has been found on dead leaves and may occur in association with circular leaf spots, but most characteristic are dead flower buds encircled by brown bark lesions and with discolouration of the wood. The identity of this variety with Saccardo's *Phyllosticta forsythiae* has been based on comparison with the lectotype and various secondary collections on the type host in PAD and CBS.

Representative culture. CBS 101213 (PD 92/959) ex *Forsythia* sp. (Oleaceae), the Netherlands.

ADDENDUM

Doubtful infraspecific taxa of *Phoma exigua* (incorporated in index).

10. *Phoma exigua* 'var. *inoxydabilis* Boerema & Vegh'

Phoma exigua 'var. *inoxydabilis* Boerema & Vegh', in Vegh, Bourgeois, Bousquet & Velastegui, *Bull. trimest. Soc. Mycol. Fr.* 90 (1974) 130 [as manuscript name referred to as '*nonoxydabilis*' Boerema & Vegh, cf. Bousquet & Barbier, *Phytopath. Z.* 75 (1972) 364 and Boerema & Dorenb., *Stud. Mycol.* 3 (1973) 27].

Phoma herbarum f. *vincae* Brunaud, *Actes Soc. Linn. Bordeaux* 40 [= Sér. IV, 10] (1886) 75.

Phyllosticta vincae-majores Allesch., *Rabenh. Krypt.-Flora* [ed. 2] Pilze 6 [Lief. 61] (1898) [vol. dated '1901'] 155.

Phyllosticta vincae-minores Bres. & Krieger, *Hedwigia* 39 (1901) 325.

The authors of this variety noticed that European and American isolates of *P. exigua* obtained from Stem Blight and Leaf Spot of *Vinca minor* (Apocynaceae) did not show the oxidation reaction with NaOH ('*inoxydabilis*'): no production of the antibiotic E. However, in the early seventies it was still not known that various strains or varieties of *P. exigua* do not produce the metabolite E.

Additional studies of *P. exigua* isolates from *Vinca* have shown that they do not represent one cultural type, but include strains quite different in growth-rate and other cultural as well as genetic characteristics (Abeln et al., in press).

The French type culture of var. *inoxydabilis*, PC 2198, has been lost (information Dr. J. Mouchacca, PC). A very similar slow growing Dutch isolate, CBS 101205 (= PD 77/434),

showed genetic similarity with the E⁻ variety *heteromorpha*, no. 3 (pathogen of *Nerium oleander*, also Apocynaceae!).

The cultural characteristics of the Dutch isolate CBS 372.75 deposited in 1975 (PD 75/01, ATCC 32161, IMI 194763) fully agree with those of a *P. exigua* isolate (E⁻) from *Phlox*, CBS 101201, as does a recent Dutch isolate of *P. exigua* (E⁻) from *Vinca*, CBS 101204 (PD 98/2324). These isolates belong indeed to one separate group when studied by AFLP (Abeln et al., in press).

In summary, Stem Blight and Leaf Spot of *Vinca* is not associated with one host-specific 'inoxydabilis'-variety of *P. exigua*. The listed synonyms may also refer to different strains of *P. exigua*. This conclusion agrees with the experimental study of the *Vinca* disease by Jansen (1965). She obtained the typical leaf spots and dieback of shoots after inoculating with isolates from *Vinca* spp., as well as with an arbitrary isolate of *P. exigua* (from *Dahlia* tuber rot). She supposed that the relevant disease of *Vinca* is primarily induced by unfavourable environmental conditions.

11. *Phoma exigua* 'var. *capsici* L.Z. Liang'

Phoma exigua 'var. *capsici* L.Z. Liang', Acta Microbiol. sin. 31 (2) (1991) 161 [nom. inval.].

This infraspecific taxon, based on pathogenic *Phoma* isolates from seeds of *Capsicum annuum* in Beijing, China, was introduced without a Latin description and type indication. Therefore this varietal name is not validly published (ICBN Arts 36.1, 37.1–5).

In the English summary of the Chinese paper by Liang (l.c.) the cultures of the fungus were characterized as black tinged, relatively fast growing with a regular margin, and showing no colour reaction with NaOH (no production of antibiotic E). Further is noted that the fungus "does not agree with any of the 5 described varieties of *P. exigua* by Boerema & Höweler (1967), except for morphological similarity of conidia". In pathogenicity tests it "could produce round or irregular lesions on leaves". The annotation that the fungus "was found in 21 seed samples of *Capsicum annuum* out of 30 tested with infection ranging from 0.5–65.5%", points to a true pathogen. Without a representative culture it is difficult to give a justified opinion on the identity of the pathogen. However, it should be noted that seeds of *Capsicum annuum* may be severely infected by *Phoma destructiva* Plowr. (Neergaard, 1956), a fungus often confused with *P. exigua* (e.g. in Japan), see Boerema & van Kesteren (1981). *Phoma destructiva* produces also dark colonies with a regular margin and gives no colour reaction with NaOH. It may cause foliar lesions and fruit rot (source of seed infection).

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