

NOMENCLATORIAL NOTES ON SOME SPECIES OF PHOMA SECT.
PLENODOMUS

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This paper deals with the synonymy of five species of *Phoma* formerly referred to *Plenodomus*: *Phoma astragalina* (Gonz.-Frag.) comb. nov., *Phoma petrakii* nom. nov., *Phoma pezizoides* (Ell. & Ev.) comb. nov., *Phoma ruttneri* (Petr.) comb. nov. and *Phoma sclerotoides* (Preuss) ex Sacc. (in phytopath. literature well known as *Plenodomus meliloti* Dearness & Sanford). Further a review is given of the synonymy of previously treated species of *Phoma* sect. *Plenodomus*.

The pycnidial states belonging to *Phoma* sect. *Plenodomus* (Preuss) Boerema & al. (1981) form a natural group, originally founded as a separate genus *Plenodomus* Preuss (1851), synonyms *Diploplenodomus* Diedicke (1912) and *Leptophoma* Höhnel (1915). They are characterized by their ability to produce more or less thick-walled hyaline cells in the peridium of the pycnidia: scleroplectenchyma. By addition of Lugol's iodine (JKJ) the thickened hyaline walls of this scleroplectenchyma stain red by adsorption of the iodine (blotting-paper effect).

Phoma sect. *Plenodomus* is related to the 'doliolum-group' of the ascomycetous genus *Leptosphaeria* Ces. & de Not. (Holm, 1957), i.e. species in which the perithecia (pseudothecia) also have a scleroplectenchymatous wall structure.

The natural variability in pycnidial shape of species *Phoma* sect. *Plenodomus* and their variation in conidial dimensions has led to much nomenclatural confusion, especially in the case of plurivorous species. A review of the synonymy of the species of section *Plenodomus* treated in the previous studies by Boerema & van Kesteren (1964), Boerema (1976), Boerema & al. (1981), Boerema (1981), Boerema & Loerakker (1981), and Janse (1981) is given in Table I.

This paper covers the nomenclature of five other species of *Phoma* sect. *Plenodomus*.

***Phoma astragalina* (Gonz.-Frag.) Boerema & Kest., comb. nov.**

Basionym: *Ceuthospora astragalina* Gonz.-Frag. in Boln. R. Soc. esp. Hist. nat. 18: 84. 1918. — *Plenodomus astragalinus* (Gonz.-Frag.) Petr. apud Rechinger & al. in Annln naturh. Mus. Wien 50 (1939): 498-499. 1940.

Plenodomus dianthi Bub. in Annln k.k. naturh. Hofmus. Wien (Annln naturh. Mus. Wien) 28: 204. 1914. — *Phoma dianthi* (Bub.) Bub. in Annls mycol. 13: 30. 1915; not *Phoma dianthi* Sacc. & Malbr. in Atti R. Ist. veneto Sci. VI, 1: 1276. 1883; not *Phoma dianthi* Lagière in Annls Éc. natn. Agric. Grignon III, 5: 160. 1946.

Plenodomus khorasanicus Petr. apud Rechinger & al. in Annln naturh. Mus. Wien 50 (1939): 499-500. 1940.

TABLE I. Previously treated species of Phoma sect. Plenodomus with their teleomorphs and the Plenodomus-, Diploplenodomus-, and Leptophoma-names under which they have been described in literature

| Anamorph | Teleomorph | References |
|--|--|--|
| Phoma hoehnelii Kest. (1972) | Leptosphaeria doliolum (Pers. & Hook.) Ces. & de Not. | van Kesteren (1972) |
| subsp. hoehnelii | subsp. doliolum | |
| var. hoehnelii | var. conoidea (de Not.) Sacc. | Boerema (1976) |
| <ul style="list-style-type: none"> ■ Leptophoma doliolum Höhn. (1915) ■ Leptophoma doliolum P. Karst. (not Phoma doliolum P. Karst.) ■ Plenodomus doliolum (Höhn.) Höhn. (1918) ■ Plenodomus doliolum (Höhn.) Petr. (1923 a, b) | | |
| var. urticae Boerema & Kest. (in Boerema, 1976) | var. doliolum | Boerema (1976) |
| <ul style="list-style-type: none"> ■ 'Leptophoma acuta' sensu Höhn. (1915) pro parte ■ 'Plenodomus acutus' sensu Bub. (1915) pro parte ■ 'Plenodomus acutus' sensu Petr. (1921) pro parte (all three rejected ambiguous names) | | |
| subsp. amplicor (Sacc. & Roum.) Boerema & Kest. (in Boerema, 1976) | subsp. pinguicula Sacc. | Boerema (1976) |
| <ul style="list-style-type: none"> ■ Plenodomus microsporus Berl. (1889) ■ Diploplenodomus malvae Died. (1912) ■ Diploplenodomus microsporus (Berl.) Höhn. (1918) ■ Plenodomus labiatarum Petr. (1923) | | Boerema & al. (1981) Boerema & al. (1981) |
| Phoma leonuri Letendre (in Roum., 1884) | Leptosphaeria slovacica Picb. = L. doliolum var. leonuri Sandu-Ville (in Moesz, 1932) | |
| <ul style="list-style-type: none"> ■ Plenodomus leonuri (Letendre) Moesz & Smarodsz (in Moesz, 1932) ■ 'Plenodomus acutus' sensu Bub. (1915) pro parte ■ 'Plenodomus acutus' sensu Petr. (1921) pro parte (both rejected ambiguous names) | | |
| Phoma lingam (Tode ex Schw.) Desm. (1849) | Leptosphaeria maculans (Desm.) Ces. & de Not. | Boerema & van Kesteren (1964) |
| <ul style="list-style-type: none"> ■ Plenodomus lingam (Tode ex Schw.) Höhn. (1911) ■ Plenodomus rabenhorstii Preuss (1851) | | |
| Phoma macedonioidi Boerema (1970) | Leptosphaeria lindquistii Frezzi | Boerema & al. (1981) |

- Phoma pedicularis* Fuckel (in Heuglin, 1874)
 = *Plenodomus gentianae* (Moesz) Petr. (1925)
 = *Plenodomus prominens* (Bres.) Petr. ex von Arx (1950)
 = *Plenodomus sphaerosporus* Petr. (1942)
 = *Plenodomus helveticus* Petr. (1948)
- Phoma piskozii* (Petr.) Boerema & Loerakker (1981)
 = *Diploplenedomus piskozii* Petr. (1923)
 = '*Leptophoma acuta*' sensu Müller & Tomašević (1957) (rejected ambiguous name)
- Phoma riggenbachii* Boerema & Janse (in Janse, 1981)
 = *Plenodomus corni* Batista & Vital (1957)
 = '*Plenodomus rabenhorstii*' sensu Riggenbach (1956)
- Phoma tubefaciens* Togl. (1953)
- Phoma sublingam* Boerema (1981)
 = *Plenodomus lunariae* Syd. (1924)
 (not *Phoma lunariae* Moesz)
- Phoma sydowi* Boerema & al.
 = *Plenodomus senecionis* (Syd.) Bub. (1915)
 = *Plenodomus senecionis* (Syd.) Petr. (1921)
 (not *Phoma senecionis* Syd.)
 = *Plenodomus rostratus* Petr. (1923)
 (not *Phoma rostrata* O'Gara)
 = '*Leptophoma acuta*' sensu Höhn. (1915) pro parte
 (rejected ambiguous name)
- Boerema & al. (1981)
- Boerema & Loerakker (1981)
- Janse (1981)
- Boerema & al. (1981)
 Boerema (1981)
- Boerema & al. (1981)
- Leptosphaeria acuta (Fuckel) P. Karst.
- Leptosphaeria submaculans Holm
- possibly *Leptosphaeria senecionis* (Fuckel) Winter
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HERBARIUM MATERIAL EXAMINED.—

Ceuthospora astragalina Gonz.-Frag.; on dead stems of *Astragalus erinifolius*, Küh-e Sefid (Elburz Mts., near Dámghān), N. Iran, June 1899, *F. M. de la Escalera* (holotype, MA).

Plenodomus astragalinus (Gonz.-Frag.) Petrak; on dead stems of *Astragalus totschalensis*, Küh-e Dásht, near Karaj, N. Iran, 25 May 1937, *K. H. Rechinger* (ZT); on dead petioles of *Astragalus mitchellianus*, Sabounjou-Kaive, between Izmar and Manisa, W. Turkey, 19 June 1854, B. Balansa (ZT); on dead stems of *Astragalus* sp., Unai mountain-pass, alt. c. 3150 m (Paghman Mts., west of Kabul), E. Afghanistan, 27 July 1951, *A. Isllt* (Herb. Petrak, M).

Plenodomus dianthi (*Phoma dianthi*) Bub.; on dead stems of *Dianthus orientalis*, Nemrut Dağ (Taurus Range), alt. c. 2000–2500 m, near Káhta, Mamuret-ül-Asis district, western Kurdistan, E. Turkey, 12 July 1910, *F. Bubák* (holotype, BPI).

Plenodomus khorasanicus Petrak; on dead stems of an unidentified Rubiaceae, Alamli mountain ridge (Kopet Dağ Range), alt. c. 2000 m, between Quchan and Lotfábád in Khorāsān Prov., N. Iran, 14 July 1937, *K. H. Rechinger* (holotype Herb. Rechinger No. 2467, S).

This fungus has been found on dead stems and occasionally on petioles of various herbaceous plants in the mountainous regions of Southwest Asia (Iran, Turkey, Afghanistan), see Table II. Most host records refer to *Astragalus* spp.

The fungus can be differentiated from other species of *Phoma* sect. *Plenodomus* on herbaceous plants at once by the extremely small conidia, $2-3 \times 0.5-0.8(-1) \mu\text{m}$. The scleropectenchyma of the papillated globose to ellipsoid pycnidia, $150-300 \times 200-500(-600)$

TABLE II. Records of *Phoma astragalina*

| Matrix | Location* | References |
|--|---|-------------------------|
| <i>Astragalus</i> sp. dead stems | Unai Gardaneh, west of Kabul, E. Afghanistan | Herb. Petrak (M) |
| <i>A. erinifolius</i> dead stems | Küh-e Sefid, near Dámghān, N. Iran | González-Fragoso (1918) |
| <i>A. johannis</i> dead petioles | Küh-e Barf, near Shiraz, S.W. Iran | Petrak (1942) |
| <i>A. mitchellianus</i> dead petioles | Sabounjou-Kaive, between Izmir and Manisa, W. Turkey | Petrak (1942) |
| <i>A. totschalensis</i> dead stems | Küh-e Dásht, near Karaj, N. Iran | Rechinger & al. (1940) |
| <i>Dianthus orientalis</i> dead stems | Nemrut Dağ, near Káhta, W. Turkistan, E. Turkey | Bubák (1914, 1915) |
| <i>Picris</i> sp. dead stems | Olsur, on Van Gölü, near Reşadiye, E. Turkey | Petrak (1942) |
| <i>Zozinia tragioides</i> dead stems | Küh-e Bül, near Eqlíd, S.W. Iran | Petrak (1942) |
| unidentified plant (Rubiaceae) | Afamli Küh, between Quchan and Lotfábát, N. Iran | Rechinger & al. (1940) |

* Dağ (Turk.) = mount, Gardaneh (Afghan.) = pass, Gölü (Turk.) = lake, Küh. (Iran.) = mount.

μm , is not so conspicuous as in most other species of the section. For this reason Bubák (1914, 1915), who was the first to study this fungus, changed his opinion about its classification. In 1914 he called the pycnidia sclerotoid and named the species *Plenodomus dianthi* Bub. In 1915 he deleted the word 'sclerotioidea' in the diagnosis and classified the fungus as a common species of *Phoma*. The name *Phoma dianthi* (Bub.) Bub. (1915), although in accordance with the present classification of the fungus, has to be rejected as it is a later homonym of *Phoma dianthi* Sacc. & Malbr. (1883; holotype PAD); *P. dianthi* Sacc. & Malbr. just as *P. dianthi* Lagière (1946) refers to a species of *Phomopsis*. The proposed new combination *Phoma astragalina* is based on the next oldest name of the fungus, *Ceutospora astragalina*, described by González-Fragoso (1918) from material already collected in 1899. This species was transferred to *Plenodomus* by Petrak (in Rechinger & al., 1940). González-Fragoso's classification of the fungus in the form-genus *Ceuthospora* Grev. was apparently based on the often irregular or plurilocular appearance of the pycnidial cavity. This is a common phenomenon in pycnidia of species of *Phoma* sect. *Plenodomus*, due to thin-walled seriate cellular protusions of the proliferous layer (Boerema & al., 1981). *Plenodomus khorasanicus* has been described by Petrak (in Rechinger & al., 1940) as closely allied to *Plen. astragalinus*, but different by its regular, non-divided pycnidial cavities and more pronounced ostioles. However, all specimens examined bear unilocular as well as plurilocular pycnidia, provided with more or less papillated ostioles. Our conclusion that one plurivorous species is involved, was in fact already reached by Petrak (1942). In the latter study, of oriental fungi, Petrak wrote about 'pleophage Arten', resembling *Plenodomus dianthi*, *Plen. astragalinus* and *Plen. khorasanicus*, which are very difficult to differentiate because of their similarity on quite different hosts.

***Phoma petrakii* Boerema & Kest., nom. nov.**

Plenodomus nieslii Petr. in *Annl. mycol.* 20: 322–323. 1922; not *Phoma nieslii* Sacc. in *Michelia* 2 (3): 618. 1882.

HERBARIUM MATERIAL EXAMINED.—

Plenodomus nieslii Petr.; Fl. Boh. Morav. exs. II, 1, No. 1874, on dead stems of *Melampyrum nemorosum*, Hrabuvka, near Mähr.-Weisskirchen, Czechoslovakia, Sept. 1923, F. Petrak (U, S, ZT; often with *Phoma sylvatica* Sacc., see note).

Characteristic specimens of this fungus are also preserved under the misapplied name *Phoma sylvatica* Sacc. ('*sylvatica*'), e.g. Krieger. *Fungi sax.* No. 2432 on dead stems of *Melampyrum sylvaticum*, near Königstein, Saxony, East Germany, June–July 1913–1917 (U).

This species is known from dead stems of various *Melampyrum* spp. (*M. nemorosum*, *M. pratense*, *M. sylvaticum*, and *M. commutatum*), and has been recorded in Austria, Czechoslovakia, East and West Germany, and Russia (cf. Petrak, 1922, 1931, Rupprecht, 1959, and herbarium material examined). Probably it occurs in Europe wherever the host plants are able to grow.

The typical scleropectenchymatous, papillated, conoid pycnidia of the conidial state, 200–350 μm diam., are described in detail by Petrak (1922) from specimens on *M. nemoro-*

sum collected in May and June 1918 near Rybno, Stanislav = Ivano-Frankovsk, S.E. Galicia, U.S.R.R. (these specimens have not yet been recovered). Petrak (1922) named the species after G. Niessl von Mayendorf because a similar specimen had been collected by Niessl in lower Austria and labelled '*Lept. suffulta*, fungus spermogonicus' (not recovered). Petrak endorsed Niessl's opinion that it belongs to *Leptosphaeria suffulta* (Nees ex Fr.) Niessl, which according to Holm (1957) also only occurs on *Melampyrum* spp. Some of the specimens examined certainly showed scleroplectenchymatous perithecia of *L. suffulta* in close association with the pycnidia, but a metagenetic relation must still be proved by cultural experiments.

We have renamed the conidial state after F. Petrak, because the transfer of *Plenodomus niesslii* to the genus *Phoma* should result in a later homonym of *Phoma niesslii* Sacc. (1882), a different species described from *Gentiana lutea*.

The conidial dimensions of *Phoma petrakii* vary between $(3.5-4-5 \times (1-1.5-1.8(-2) \mu\text{m})$. Conidia with approximately the same dimensions are produced by *Phoma sylvatica* Sacc. (1881; holotype in PAD), a different pycnidial state which also occurs commonly on dead stems of *Melampyrum* spp., and according to Petrak (1922) belongs to *Didymella winteriana* (Sacc.) Petrak.¹ The pycnidia of *P. sylvatica* are smaller than those of *P. petrakii* and not scleroplectenchymatous, but because of the similar conidial dimensions both species often have been confounded and confused. Even specimens of Petrak's Fl. Boh. Morav. exsiccatae No. 1874, labelled *Plenodomus niesslii* (see specimens examined), often contain only *Phoma sylvatica*, sometimes associated with *Didymella winteriana*. The combination *Plenodomus sylvaticus* (Sacc.) Rupprecht (1959; as '*sylvatica*') was also based on misidentified material. Rupprecht refers e.g. to specimens distributed by Krieger as Fungi sax. No. 2432, which are labelled *Phoma sylvatica* (see specimens examined), but contain *P. petrakii*, often accompanied with perithecia of *Leptosphaeria suffulta*.

***Phoma pezizoides* (Ell. & Ev.) Boerema & Kest., comb. nov.**

Basionym: *Aposphaeria pezizoides* Ell. & Ev. in Proc. Acad. nat. Sci. Philad. 1894: 358. 1894. — *Coniothyrium pezizoides* (Ell. & Ev.) O. Kuntze, Revis. Gen. Pl. 3 (3): 459. 1898.

Aposphaeria salicum Sacc. apud Syd. in Annls mycol. 1: 537-538. 1903; in Sylloge Fung. 18: 276. 1906. — *Plenodomus salicum* (Sacc.) Died. in Annls mycol. 9: 140. 1911.

Phoma wallneriana Allesch. in Rabenh. Krypt.-Fl. ed. 2, Pilze 6 (Lief. 61): 175. 1898 (vol. dated '1901'). — *Plenodomus wallneriana* (Allesch.) Bub. in Annls mycol. 13: 30. 1915.

Plenodomus helicus Curzi & Barbaini in Atti. Ist. bot. Univ. (Lab. crittogam.) Pavia III, 3: 173. 1927.

HERBARIUM MATERIAL EXAMINED.—

Aposphaeria pezizoides Ell. & Ev.; N. Am. Fungi 2, No. 3158, on decorticated wood of *Salix nigra* var. *falcata*, Nuttallburg, West Virginia, U.S.A., April 1894, L. W. Nuttall

¹ The conidial dimensions listed by Müller & von Arx (1962) for the 'phomaartigen Nebenfruchtform' of *Didymella winteriana* are much larger than those of *Phoma sylvatica*. Their data are not based on cultural studies but on observations of herbarium material including *Plenodomus ruttneri* Petr. on *Rhinanthus* spp., which in our opinion certainly does not belong to *Didymella winteriana*. See the discussion under *Phoma ruttneri* (p. 325).

(lectotype FH; isotypes e.g. in FH, L, PAD); Ell. & Ev., Fungi Columb. No. 570 on decorticated wood of *Platanus occidentalis*, Nuttallburg, West Virginia, U.S.A., April 1894, L. W. Nuttall (FH).

Aposphaeria salicum Sacc.; on dead twigs of *Salix viminalis*, Schmilka on the river Elbe, Saxony ('Sax. Switzerland', Ober Lausitz), East Germany, 15 Aug. 1903, P. Sydow (holotype Herb. Sacc., PAD; duplicate Herb. Syd., B); other specimens of this collection distributed as Syd., Mycoth. germ. No. 87, e.g. in B).

Phoma wallneriana Allesch.; on dead petioles of *Aesculus hippocastanum*, Vienna, Austria, Nov. 1872, J. Wallner (holotype Herb. Winter ex Herb. von Thümen, with Bubák's annotation: *Plenodomus wallneriana* (Allesch.) Bub., B).

Characteristic specimens of this fungus have further been preserved under the misapplied name '*Plenodomus rabenhorstii* Preuss' (see discussion): Herb. Preuss No. 838 (B) and Rabenh., Klotzschii Herb. mycol. No. 1282, on old soft decorticated wood ('ad ligna vetusta') of *Ailanthus altissima*, near Hoyerswerda, Ober Lausitz, East Germany (formerly prov. Silesia), no date, G. T. Preuss (e.g. B, M).

This saprophytic species has been found on decorticated stems, branches or twigs, and occasionally petioles of various broadleaved trees or shrubs in the northeast of the United States (West Virginia) and in central and southern Europe (East Germany, Austria, Italy), see Table III. As shown in this table most observations are made in the vicinity of rivers, especially near river banks. The records in the United States refer exclusively to stems of trees damaged by driftwood carried by fast-moving flood water. It is quite possible that man has played a role in the occurrence and distribution of this wood-inhabiting fungus in two different continents.

Ellis & Everhart (1894) and Sydow & Sydow (1903) have classified this pycnidial state in the genus *Aposphaeria* Berk. emend. Saccardo (1880; = *Coniothyrium* Corda sensu O. Kuntze, 1898), formerly commonly used for *Phoma* species on wood. At present *Aposphaeria* Sacc. and *Coniothyrium* Corda are nomina conservanda with different types, see Sutton (1977).

The typical *Plenodomus*-like pycnidia of the fungus (compare Dedicke, 1911; Bubák, 1915; and Curzi & Barbaini, 1927) are relatively large, (150–)250–500(–750) μm diam., and at maturity are provided with broad papillated ostioles (pori). At length the pycnidia often collapse and become discoid or pezizoid as indicated by the selected epithet *pezizoides*. This phenomenon is also known from species of *Phoma* sect. *Plenodomus* occurring on herbaceous plants, e.g. the crucifer-parasite *Phoma lingam* (Table I; Boerema & van Kesteren, 1964), having large scleroplectenchymatous pycnidia on dead cabbage stems which superficially very much resemble those of *Phoma pezizoides*. This explains why Preuss (1862) misidentified specimens of the latter on wet old wood as *Plenodomus rabenhorstii* = *Phoma lingam*. The wood fragments of this oldest known collection of the fungus (distributed as Rabenh., Klotzschii Herb. mycol. No. 1282) were identified at the Department of Silviculture, Agricultural University in Wageningen, as *Ailanthus altissima*.

Phoma pezizoides may produce two types of one-celled conidia: relatively short conidia, 4.5–6(–7.5) \times 2–3 μm , and/or significant longer conidia, 6–10 \times 2–3 μm . In both cases occasionally two-celled conidia may also occur, 8–10 \times 2–3 μm . Similar variability in conidial dimensions is known from other species of *Phoma* sect. *Plenodomus* (cf. Boerema & al., 1981). The specimens of *Phoma pezizoides* on *Ailanthus altissima* (B, M), which were

TABLE III. Records of *Phoma pezizoides*

| Matrix | Location | References |
|--|---|---|
| <u>Acer</u> sp. decorticated wood of small tree on river bank below high-water level | Nuttallburg, West Virginia, U.S.A. | Ellis & Everhart (1894) |
| <u>Aesculus hippocastanum</u> fallen petioles, with peeled- off epidermis | Vienna, Australia | Allescher (1898), Bubák (1915) |
| <u>Ailanthus altissima</u> wet (soft) decorticated old wood | near Hoyerswerda, Ober Lausitz, East Germany | Rabenh., Klotzschii Herb. mycol. No. 1282 (1849), Preuss (1862) |
| <u>Fraxinus</u> sp. decorticated wood of small tree on river bank below high-water level | Nuttallburg, West Virginia, U.S.A. | Ellis & Everhart (1894), Barneth & Hunter (1972) |
| <u>Hedera helix</u> fallen decorticated twigs | Catignano, on the river Nora, Italy | Curzi & Barbaini (1927) |
| <u>Liquidambar</u> <u>styraciflua</u> decorticated wood of small tree on river bank below high-water level | Nuttallburg, West Virginia, U.S.A. | Ellis & Everhart (1894), Seymour (1929) |
| <u>Platanus</u> <u>occidentalis</u> decorticated wood of small tree on river bank below high-water level | Nuttallburg, West Virginia, U.S.A. | Ellis & Everhart (1894), Ell. & Ev. Fungi Columb. No. 570. (1894) |
| <u>Salix</u> <u>nigra</u> var. <u>nigra</u> <u>nigra</u> var. <u>falcata</u> decorticated wood of small tree on river bank below high-water level | Nuttallburg, West Virginia, U.S.A. | Ellis & Everhart (1894) Ell. & Ev. N. Am. Fungi II, No. 3158 (1894) |
| <u>S. viminalis</u> decorticated twigs of tree on river bank | Schmilka, on the river Elbe, 'Sax. Switzerland', Ober Lausitz, East Germany | Sydow (1903), Syd., Mycoth. germ. No. 87 (1903) |

distributed as '*Plenodomus rabenhorstii*', bear pycnidia with short conidia as well as pycnidia with long conidia. The specimen on *Hedera helix*, described by Curzi & Barbaini (1927) as *Plenodomus helicis*, the specimens of *Aposphaeria pezizoides* on *Salix nigra* var. *falcata* and *Platanus occidentalis* (FH, L, PAD), and the holotype of *Aposphaeria salicis* on *Salix viminalis* (PAD) refer to pycnidia with short conidia. The pycnidia of the duplicate of the type of *Aposphaeria salicis* on *Salix viminalis* (B), and those of the holotype specimen of *Phoma wallneriana* on *Aesculus hippocastanum* contain the longer type of conidia.

***Phoma ruttneri* (Petr.) Boerema & Kest., comb. nov.**

Basionym: *Plenodomus ruttneri* Petr. in Sydowia 8: 582-583. 1955.

HERBARIUM MATERIAL EXAMINED.—

Plenodomus ruttneri Petr.; on dead stems of a *Rhinanthus* (*Alectorolophus*) sp., pass foot Scheillingsstein, near Lunz, Austria, June 1943 (holotype and isotype Herb. Petrak, M).

There are so far only two records of this conidial state: the type material on dead stems of an unidentified *Rhinanthus* (= *Alectorolophus*) species collected near Lunz, Austria (see specimens examined), and a specimen on dead stems of *Rhinanthus serotinus* (= *Alectorolophus major*) collected near Siegen, West Germany (Rupprecht, 1959, as '*Plenodomus sylvaticus* (*silvatica*)', see below).

The papillated conoid to subglobose pycnidia of *Phoma* (*Plenodomus*) *ruttneri*, 250–350 μm , have a typical scleropectenchymatous wall structure and contain, at maturity, cylindrical conidia $5\text{--}7 \times 1.5\text{--}2 \mu\text{m}$. On the type substratum (dead stems of *Rhinanthus* sp.) the pycnidia occur together with perithecia of different Ascomycetes: e.g. *Didymella ruttneri* Petrak and *Leptosphaeria affinis* P. Karst.

Petrak (1955) considered *Didymella ruttneri* as the perfect state of *Phoma* (*Plenodomus*) *ruttneri*. This statement, however, is not reliable in our opinion. *Didymella ruttneri* according to Müller & von Arx (1962) is a later synonym of *D. winteriana* (Sacc.) Petr. described from *Melampyrum* spp. On these hosts the perithecia often occur in close association with the non-scleropectenchymatous pycnidia of *Phoma sylvatica* Sacc., see the discussion under *Phoma petrakii* (p. 321).

A metagenetic relation between *Leptosphaeria affinis* and *Phoma* (*Plenodomus*) *ruttneri* is plausible, but not yet proved by cultural experiments. *L. affinis* produces typical scleropectenchymatous perithecia and is widespread in Europe on *Rhinanthus minor* (Holm, 1957).

Rupprecht (1959) has treated the species of *Phoma* sect. *Plenodomus* occurring on *Rhinanthus* and *Melampyrum* spp. as conspecific. He overlooked that the conidia of *Phoma* (*Plenodomus*) *ruttneri* on *Rhinanthus* are significant longer (5–7 μm) than those of *P. petrakii* (= *Plenodomus niessli*) on *Melampyrum* (max. 5 μm ; see p. 322). At present there are no indications that one species with variable conidial dimensions is involved. The fact that both conidial states occur in association with two different species of *Leptosphaeria* is also an argument to maintain them as separate species.

Rupprecht (l.c.) introduced for his 'Scrophulariaceae-*Plenodomus*' the combination *Plenodomus sylvaticus* (Sacc.) Rupprecht (as '*silvatica*'). However, this combination was based on misidentified material: *Phoma sylvatica* Sacc. refers to a non-scleropectenchymatous pycnidial state, probably related to *Didymella winteriana*, see above and the discussion under *Phoma petrakii* (p. 321).

PHOMA SCLEROTIOIDES (Preuss) ex Sacc.—Figs 1, 2

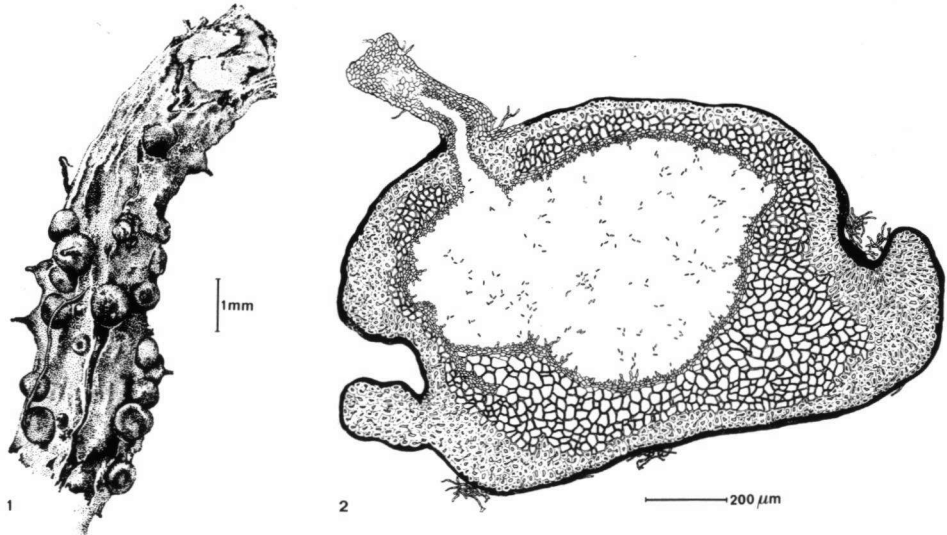
Plenodomus sclerotioides Preuss in Rabenh., Klotzschii Herb. mycol. No. 1281. 1849 (nomen nudum). — *Phoma sclerotioides* (Preuss) ex Sacc., Fung. Herb. Brux. 21. 1892; in Sylloge Fung. 11: 492. 1895.

Plenodomus meliloti Mark.-Let. in Bolez. Rast. 16: 195. 1928.

Plenodomus meliloti Dearn. & Sanford in Annl. mycol. 28: 324–325. 1930.

Plenodomus sorghi Morochkovskii in Trudy bot. Inst. Akad. Nauk S.S.S.R. 1: 277–278. 1933.

Plenodomus karii Petr. in Annl. mycol. 34: 453–455. 1936.



Figs. 1, 2. *Phoma sclerotioides*, scleroplectenchymatous pycnidia as seen in vivo and in vitro. — 1. Surface view on dead root of red clover. — 2. Vertical section of pycnidium in culture on oatmeal agar (somewhat simplified).

MATERIAL EXAMINED

HERBARIUM MATERIAL.—*Plenodomus sclerotioides* Preuss; on decorticated roots and basal stems of an unidentified herbaceous plant, near Hoyerswerda, Ober Lausitz, East Germany (formerly Silesia Prov.), no date, *G. T. Preuss* [holotype on roots: Herb. Preuss No. 839, B; specimen on stem: Herb. Preuss No. 840 (labelled with only the genus name *Plenodomus*), B; other small specimens of Preuss collection 'ad caules herbarum elatiorum' distributed as Rabenh., Klotzschii Herb. mycol. No. 1281, e.g. in B, BR].

Plenodomus meliloti Dearn. & Sandford; on roots of *Melilotus albus*: Lacombe, Alberta, Canada, 10 May 1968, *W. B. Berkenkamp* (LAC, L); on roots of *Trifolium hybridum*: Lacombe, Alberta, Canada, 6 June 1967, *W. B. Berkenkamp* (LAC, L); on roots of *Trifolium pratense*: Inari, Muddusniemi, Finnish Lapland, 10 June 1961, *A. Salonen* (HPP, L), Lacombe, Alberta, Canada, 13 May 1971, *W. B. Berkenkamp* (LAC, L).

LIVING CULTURES.—CBS 353. 34, isolated from roots of *Melilotus albus*, western Canada, 1933 by *G. B. Sanford*; three isolates from roots of *Medicago sativa*: Manitoba, Canada, 1951 by *W. C. McDonald*, Mile 1019, Yukon, Canada, May 1963 by *N. Colotelo*, Duck Lake, Saskatchewan, Canada, July 1979 by *J. Drew Smith*; two isolates from roots of *Trifolium pratense*: Inari, Muddusniemi, Finnish Lapland, 10 June 1961 by *A. Salonen*, Zenon Park, Saskatchewan, Canada, July 1979 by *J. Drew Smith*; four isolates from roots of *Triticum aestivum*: Lacombe, Alberta, Canada, May 1964 by *A. W. Henry*; Lacombe, Alberta, Canada, Nov. 1979, by *J. Drew Smith*; Three Hills, Alberta, Canada, Nov. 1979, by *J. Drew Smith*; Melfort, Saskatchewan, Canada, Nov. 1979, by *J. Drew Smith*; one isolate from roots of an unidentified grass, Saskatoon, Saskatchewan, Canada, June 1979, by *J. Drew Smith*; two isolates from soil: Saskatoon, Saskatchewan, Canada, 1968, by *R. A. A. Morrall*; Mt. Allen, Kanaskis Range, Alberta, Canada, 1972, by *J. Bissett*.

This plurivorous fungus is known from areas with severe winters (continental climate) in Europe (Finland, Russia, East Germany) as well as in North America (Alaska, Canada), see

Table IV. In western Canada, Finland, and Russia it is recorded as a destructive pathogen of herbage legumes ('Brown Root Rot'), especially following the winter dormancy period (Sanford, 1933; Cormack, 1934; Rodigin, 1935; McDonald, 1955; Mead, 1962; Salonen, 1962). It may also be pathogenic to other plants which have been exposed to low temperature (Robertson, 1931; Lebeau & Logsdon, 1958; Henry & Berkenkamp, 1965).

A typical character of the fungus is that the pycnidia (Fig. 1) are produced on the roots of the host (4–20 cm below soil surface), and only occasionally on the stems of dead host plants, and then mainly at or near ground level, comp. Table IV.² The relatively large subglobose to conoid pycnidia, (200–)350–650(–800) μm diam. may occur singly, but are usually closely clustered. At maturity the ostioles (pori) develop directly on the surface of the pycnidia as short papillae, but usually long tubular outgrowths (beaks) of various lengths develop. The conidia, (4–)4.5–6.5(–8) \times 2–3(–3.5) μm , are produced on cone-shaped conidiogenous cells (Netolitzky & Colotelo, 1965). If environmental conditions become unfavourable for the development of the fungus, sterile 'pyncosclerotia' (cf. Boerema & van Kesteren, 1964) are produced (Salonen, 1962). These pyncosclerotia have also been found in soil (Sanford, 1933: possibly surviving and spreading in dry soils).

White sweet clover (*Melilotus albus*) is apparently the most susceptible host of the fungus. It has been described from this plant independently in Russia and Canada as *Plenodomus meliloti* (Markova-Letova, 1928; Dearness & Sanford, 1930). However, a comparative study of herbarium material has shown that the fungus had already been described in 1892 by Saccardo as *Phoma sclerotoides*, based on material of '*Plenodomus sclerotoides* Preuss' (nomen nudum) in 1849 (!) distributed as Rabenh. Klotzschii Herb. mycol. No. 1281. The host is indicated as a large herbaceous plant ('herbarum elatiorum'). The bulk of this material is preserved in Preuss's herbarium (B): e.g. the selected lectotype specimen, labelled *Plenodomus sclerotoides* in Preuss's hand-writing, which consists of some branched roots of the unidentified host covered with pycnidia and pyncosclerotia of the fungus. Preuss generally collected his fungi in the locality of Hoyerswerda (Ober Lausitz, E. Germany; formerly Silesia), which includes mountainous regions with low winter temperature (continental climate).

In the thirties the fungus was twice described as new, viz. *Plenodomus sorghi* Morochkovskii (1933), the name of which refers to a specimen on dead roots of a species of *Sorghum*, collected in the garden of the Polytechnic Institute in Kiev, U.S.S.R., and *Plenodomus karii* Petr. (1936), based on typical specimens on the basal stem parts of *Achillea millefolium*, collected near Inari, Finnish Lapland, where the fungus also has been recorded by Salonen (1962).

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² The phenomenon of underground pycnidial production in darkness has been studied by Zafar & Colotelo (1978, 1979).

TABLE IV. Records of *Phoma sclerotioides*

| Matrix | Location* | References |
|--|---|--|
| <u>Achillea millefolium</u> stems at ground level | reg. Inari (Laanila Kaunispaää), Lapland, Finland | Petrak (1936) |
| <u>Althaea rosea</u> roots | prov. Alta (Calgary), Canada | Robertson (1931) |
| <u>Amaranthus retroflexus</u> roots | prov. Alta/Sask, Canada | Dearness & Sanford (1930), Sanford (1933) |
| <u>Avena sativa</u> roots | prov. Alta/Sask, Canada | Sanford (1933) |
| <u>Axaris amaranthoides</u> roots | prov. Alta/Sask, Canada | Dearness & Sanford (1930), Sanford (1933) |
| <u>Chenopodium</u> sp. roots | prov. Alta/Sask, Canada | Dearness & Sanford (1930) |
| <u>Festuca rubra</u> roots | state Alaska (Fairbanks), U.S.A. | Lebeau & Logsdon (1958) |
| <u>Hedysarum mackenzii</u> roots | terr. Yukon, Canada | Lebeau & Logsdon (1958) |
| <u>Lotus ceniculatus</u> roots | prov. Alta, Canada | Berkenkamp & Baenziger (1969) |
| <u>Medicago sativa</u> subsp. <u>sativa</u> roots stems | prov. Alta, prov. Man, prov. Sask and terr. Yukon (Mile 1019), Canada | Dearness & Sanford (1930), Sanford (1933), McDonald (1955), Lebeau & Logsdon (1958), Colotelo & Netolitzky (1964) |
| subsp. <u>falcata</u> and <u>varia</u> roots | prov. Ulyanovskaya (Ulyansk), U.S.S.R. Terr. Yukon (Mile 1019), Canada | Rodigin (1935), Tsukamoto (1965) |
| <u>Melilotus</u> <u>albus</u> roots | prov. Alta (Athabasca, Beaver- lodge, Edmonton, Lacombe), prov. Sask (Prince Albert, Waldheim, Wakau, and terr. Yukon (Mile 1019), Canada | Dearness & Sanford (1930), Sanford (1933), Cormack (1934), Lebeau & Logsdon (1958) Netolitzky & Colotelo (1965), Mead (1962), Berkenkamp & Baenziger (1969) |
| stems at ground level | prov. Leningradskaya (Luga) prov. Ulyanovskaya (Ulyansk) U.S.S.R. | Markova-Letova (1928) Rodigin (1935) |
| <u>M. officinalis</u> roots | prov. Alta (Lacombe), Canada | Berkenkamp & Baenziger (1969) |
| <u>Poa pratensis</u> roots | state Alaska (Palmer), U.S.A. | Lebeau & Logsdon (1958), |
| <u>Sorghum</u> sp. roots | prov. Oekraïne (Kiev), U.S.S.R. | Morochkovskii (1933) |
| <u>Trifolium hybridum</u> | prov. Alta, prov. Sask, Canada state Alaska (College), U.S.A. | Dearness & Sanford (1930), Lebeau & Logsdon (1958) |
| <u>T. pratense</u> roots | prov. Alta, prov. Sask and terr. Yukon (Mile 970), Canada reg. Inari (Muddusniemi), Lapland, Finland | Sanford (1933), Lebeau & Logsdon (1958), Salonen (1962) |
| <u>Triticum aestivum</u> roots | prov. Alta (Lacombe), Canada | Henry & Berkenkamp (1965) |
| Unidentified plant roots stems at ground level | reg. Ober Lausitz (area Hoyers- werda), East Germany | Herb. Preuss (B), Rabenh., Klotzschii Herb. mycol. No. 1281 (1849), Saccardo (1892) |

* The Canadian provinces Alberta, Manitoba and Saskatchewan are abbreviated as Alta, Man and Sask.

(U.S.A.), Edmonton, Helsinki, Lacombe, Leyden, Madrid, Munich, Ottawa, Padova, Saskatoon, Stockholm, Utrecht, Vienna, Winnipeg and Zürich.

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