

CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA
(COELOMYCETES)–I

3. Section *Phoma*: Taxa with conidia longer than 7 µm

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Eighteen species in section *Phoma* capable of producing conidia longer than 7 µm are keyed out and described according to their characteristics in vitro. A new combination *Phoma aliena* (Fr.: Fr.) v.d. Aa & Boerema is proposed. Indices of host-fungus and fungus-host relations and short comments on their ecology and distribution are given.

This is a continuation of Contributions I–1 (de Gruyter & Noordeloos, 1992) and I–2 (de Gruyter et al., 1993), referring to species with smaller conidia.

Phoma Sacc. sect. *Phoma* includes species which only produce one-celled conidia. However, septation may occur preceding germination. Pycnidia with only continuous conidia can also be found in some species of other sections of *Phoma*, such as sect. *Peyronellaea*, which is differentiated by the production of multicellular chlamydospores (Contr. II; Boerema, 1993) and sect. *Plenodomus*, which is characterized by the ability to produce scleroplectenchyma in the pycnidial wall (Contr. III–1/III–2; Boerema et al., 1994, 1996). In some species of sect. *Heterospora*, which is distinguished by a large-sized *Ascochyta/Stagonospora*-like conidial dimorph, the *Phoma*-phenotype may produce only one-celled conidia (Contr. IV; Boerema et al., 1997).

In species of sect. *Phoma* the conidial dimensions vary considerably, especially in vivo. The present paper deals with species, able to produce conidia longer than 7 µm. In some of these species most mature conidia in a pycnidium remain shorter than this but in other species the majority of mature conidia become longer.

MATERIALS AND METHODS

The isolates and herbarium specimens were studied as described in the previous Contributions I–1 and I–2 of this series (de Gruyter & Noordeloos, 1992 and de Gruyter et al., 1993). As mentioned in one of our previous Contributions (de Gruyter et al., 1993), the conidiogenous cells are rather variable, in young pycnidia more or less globose later becoming bottle-shaped, which means doliiform to ampulliform or lageniform. The growth-rate has been indicated by diameter of the colony.

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KEY TO THE SPECIES TREATED IN THIS PAPER

- 1a. Growth-rate very slow on OA, up to 25 mm in one week 2
 b. Growth-rate moderate to fast on OA, at least 35 mm in one week 4
- 2a. NaOH causing a red-brown discoloration especially on MA, colonies dull green to greenish glaucous, conidia 5–7.5(–10.5) × 2–4 µm, on fruits and leaves of *Olea europaea* 1. *P. fallens*
 b. NaOH reaction negative 3
- 3a. Colonies dark herbage green on OA, conidia cylindrical, 3.5–8.5 × 1–2 µm, saprophyte on leaves of Gramineae, New Zealand, probably also Australia 2. *P. pratorum*
 b. Colonies smoke grey to grey olivaceous/dull green on OA, conidia oblong to ellipsoidal, 5–7(–8) × 2.5–4.5 µm, hyaline with a greenish/yellow tinge, a pathogen of *Nerium oleander* 3. *P. glaucispora*
- 4a. Colonies producing a diffusible pigment on MA, staining the agar yellowish or ochre 5
 b. Colonies not producing a diffusible pigment on MA 8
- 5a. On MA diffusible pigment staining the agar yellowish to greenish 6
 b. On MA diffusible pigment staining the agar ochre 7
- 6a. Yellow-green crystals are formed on MA, NaOH reaction on OA and MA rosy vinaceous to coral (not an E+ reaction), growth-rate moderate, 40–60 mm in one week, conidia 7–12 × 2.5–4 µm, soil fungus in North and South America
 4. *P. humicola*
 b. Crystals absent, NaOH reaction negative on OA, weak greenish-yellow on MA, (not an E+ reaction), growth-rate fast, 60–80 mm in one week, conidia 3.5–10.5 × 2–4 µm, necrophyte on *Daucus carota* (Europe), but also on *Spinacia oleracea*
 5. *P. obtusa*
- 7a. NaOH reaction on OA greenish, then red (E+ reaction), on MA an orange discoloration of the original ochraceous pigment also occurs, conidia 4–8.5 × 2–4 µm, a pathogen of *Dracaena* and *Cordyline* spp. 6. *P. draconis*
 b. NaOH reaction on OA and MA red, then blue (not E+ reaction), conidia 4–12 × 2.5–4.5 µm, a saprophyte in South America, also recorded in New Zealand
 7. *P. huancayensis*
- 8a. NaOH causing initially a yellow-green discoloration, gradually changing to red (E+ reaction) 9
 b. NaOH reaction negative 10
- 9a. Growth-rate very fast, completely filling a Petri dish in one week, with coarsely floccose to woolly, white to olivaceous grey aerial mycelium on OA and MA, pycnidia scattered, mostly (partly submerged) in the agar, saprophyte or weak wound parasite on Gramineae (*Paspalum*, *Dactylis* and *Lolium* spp.) New Zealand .. 8. *P. paspali*
 b. Growth-rate fast, 60–80 mm in one week, with powdery to finely floccose, white to pale olivaceous grey aerial mycelium on OA and MA, pycnidia abundant both on and in the agar, after three weeks the colony on OA discolours to saffron as pycnidia ripen, pathogen of *Lotus* spp., New Zealand 9. *P. lotivora*
- 10a. Growth-rate fast on OA, 70–85 mm in one week 11
 b. Growth-rate moderate on OA, 40–60 mm in one week 12

- 11a. Chlamydospores abundant on OA, mainly in the aerial mycelium, with a typical distinct 'envelope', saprophyte, Eurasia and North America, recorded as probably weakly parasitic on *Heterodera glycines* eggs 10. *P. heteroderae*
 b. Chlamydospores absent, saprophyte, New Zealand, probably also Australia
 11. *P. nigricans*
- 12a. Average $Q > 3.5$, conidia $7.5-12.5 \times 1.5-3.5 \mu\text{m}$, average $8-10 \times 2-2.5 \mu\text{m}$, on stems of *Astragalus* spp. 12. *P. astragali*
 b. Average $Q < 3.5$ 13
- 13a. Colonies on OA mainly colourless, with darker zones due to the development of pycnidia, sometimes with some dark herbage green sectors 14
 b. Colonies on OA distinct greenish or greyish 15
- 14a. Colonies on MA colourless to luteous due to concentric zones of yellow-brown pycnidia, reverse similar, a saprophytic fungus in North America . . . 13. *P. herbicola*
 b. Colonies on MA olivaceous buff to greenish olivaceous, reverse olivaceous buff honey with olivaceous black sectors at centre, pseudothecia may be present, on dead stems of species of *Urtica*, esp. *U. dioica* 14. *P. urticicola*
- 15a. On MA growth-rate rather fast, 60-70 mm, colonies greenish, with rosy buff-honey sectors at the margin, on CA colonies olivaceous to vinaceous buff-fawn, conidia $4-12 \times 2.5-4.5 \mu\text{m}$, average $6.3-8.2 \times 3.0-3.5 \mu\text{m}$, an opportunistic parasite on various woody plants, e.g. *Buxus* spp. and *Berberis vulgaris* 15. *P. aliena*
 b. On MA growth-rate 25-50 mm, colonies on MA and CA greenish, brownish or greyish 16
- 16a. Growth-rate on OA and MA similar, 40-50 mm 17
 b. Growth-rate on OA 35-45 mm, but less on MA, 25-37 mm, conidia $4.5-10.5 \times 2-4 \mu\text{m}$, average about $6.2 \times 2.9 \mu\text{m}$, an opportunistic parasite of *Vitis vinifera*
 16. *P. negriana*
- 17a. Colonies on OA colourless to grey olivaceous, without or with sparse grey olivaceous aerial mycelium, on MA olivaceous buff-greenish olivaceous to olivaceous, reverse similar, growth-rate on CA 40-50 mm, similar as those on OA and MA, conidia $3.5-8 \times 1.5-3 \mu\text{m}$, average $4.8-5.5 \times 2.1-2.4 \mu\text{m}$, plurivorous saprophyte or opportunistic parasite in New Zealand and Australia 17. *P. plurivora*
 b. Colonies on OA grey olivaceous to dull green, with appressed-felted to finely floccose, white to olivaceous grey aerial mycelium, on MA dull green, reverse leaden grey with grey olivaceous-dull green tinges, growth-rate rather slow on CA, 29-35 mm, (on OA and MA 40-45 mm) conidia $5-10 \times 1.5-3 \mu\text{m}$, average $6.7 \times 2.2 \mu\text{m}$, seed borne pathogen on *Aubrietia* hybrids, Europe 18. *P. aubrietiae*

HOST/SUBSTRATUM-FUNGUS INDEX

Plurivorous (but sometimes with a favoured host, see below): *P. aliena* (no. 15), *P. herbicola* (13), *P. heteroderae* (10), *P. humicola* (4), *P. nigricans* (11), *P. plurivora* (17).

Soil borne: *P. heteroderae* (10), *P. humicola* (4), *P. paspali* (8).

On seeds and fruits: *P. aliena* (15).

Isolated from water: *P. herbicola* (13).

Frequently found on particular plants:

| | |
|--|--|
| Agavaceae (<i>Cordyline</i> and <i>Dracaena</i> spp.) | <i>P. draconis</i> (6) |
| <i>Astragalus</i> spp. (Leguminosae) | <i>P. astragali</i> (12) |
| <i>Aubrietia</i> hybrids (Cruciferae) | <i>P. aubrietiae</i> (18) |
| Berberidaceae (<i>Berberis vulgaris</i> and <i>Mahonia aquifolium</i>) | <i>P. aliena</i> (15) |
| <i>Buxus sempervirens</i> (Buxaceae) | <i>P. aliena</i> (15) |
| <i>Chenopodium quinoa</i> (Chenopodiaceae) | <i>P. huancayensis</i> (7) |
| <i>Daucus carota</i> (Umbelliferae) | <i>P. obtusa</i> (5) |
| <i>Euonymus europaeus</i> (Celastraceae) | <i>P. aliena</i> (15) |
| Gramineae e.g. <i>Dactylis</i> , <i>Lolium</i> and <i>Paspalum</i> spp. | <i>P. paspali</i> (8), <i>P. pratorum</i> (2) |
| <i>Humulus lupulus</i> (Cannabaceae) | <i>P. aliena</i> (15) |
| <i>Lonicera</i> spp. (Caprifoliaceae) | <i>P. aliena</i> (15) |
| <i>Lotus</i> spp. (Leguminosae) | <i>P. lotivora</i> (9) |
| <i>Nerium oleander</i> (Apocynaceae) | <i>P. glaucispora</i> (3) |
| <i>Olea europaea</i> (Oleaceae) | <i>P. fallens</i> (1) |
| <i>Paspalum dilatatum</i> (Gramineae) | <i>P. huancayensis</i> (7) |
| <i>Solanum</i> spp. series <i>Tuberosa</i> (Solanaceae) | <i>P. huancayensis</i> (7) |
| <i>Spinacia oleracea</i> (Chenopodiaceae) | <i>P. obtusa</i> (5) |
| <i>Urtica dioica</i> (Urticaceae) | <i>P. urticicola</i> (14) |
| <i>Vitis vinifera</i> (Vitaceae) | <i>P. negriana</i> (16) |

FUNGUS-HOST INDEX

| | |
|---|--|
| <i>P. aliena</i> (15) | <i>Berberis vulgaris</i> and <i>Mahonia aquifolium</i> (Berberidaceae), <i>Buxus sempervirens</i> (Buxaceae), <i>Euonymus europaeus</i> , (Celastraceae), <i>Humulus lupulus</i> (Cannabaceae) |
| <i>P. astragali</i> (12) | <i>Astragalus</i> spp. (Leguminosae) |
| <i>P. aubrietiae</i> (18) | <i>Aubrietia</i> hybrids (Cruciferae) |
| <i>P. draconis</i> (6) | <i>Cordyline</i> and <i>Dracaena</i> spp. (Agavaceae) |
| <i>P. fallens</i> (1) | <i>Olea europaea</i> (Oleaceae) |
| <i>P. glaucispora</i> (3) | <i>Nerium oleander</i> (Apocynaceae) |
| <i>P. huancayensis</i> (7) | <i>Chenopodium quinoa</i> (Chenopodiaceae), <i>Solanum</i> spp. series <i>Tuberosa</i> (Solanaceae), <i>Paspalum dilatatum</i> (Gramineae) |
| <i>P. lotivora</i> (9) | <i>Lotus</i> spp. (Leguminosae) |
| <i>P. negriana</i> (16) | <i>Vitis vinifera</i> (Vitaceae) |
| <i>P. obtusa</i> (5) | <i>Daucus carota</i> (Umbelliferae), <i>Spinacia oleracea</i> (Chenopodiaceae) |
| <i>P. paspali</i> (8), <i>P. pratorum</i> (2) | Gramineae (<i>Paspalum</i> , <i>Dactylis</i> and <i>Lolium</i> spp.) |
| <i>P. urticicola</i> (14) | <i>Urtica dioica</i> (Urticaceae) |

DESCRIPTIVE PART

Section Phoma

1. *Phoma fallens* Sacc. — Fig. 1

Phoma fallens Saccardo, Sylloge Fung. 10 (1892) 146.

Description in vitro

OA: growth-rate 18–20 mm, (14 days: 35–40 mm), somewhat irregular, with velvety, pale olivaceous grey aerial mycelium, colony dull green to greenish glaucous; reverse similar.

MA: growth-rate 15–20 mm, (14 days: 30–35 mm), regular or with undulating margin, with velvety, dull green aerial mycelium; colony dull green; reverse greenish olivaceous to olivaceous.

CA: growth-rate 18–20 mm, (14 days: 35–40 mm), with felted to finely floccose, greenish glaucous aerial mycelium; colony dull green, sometimes with flesh tinges; reverse dull green with flesh or fulvous tinges.

Pycnidia scattered, mainly in centre of colony, on or partly in the agar, 100–210 µm diam., globose to irregularly shaped, solitary or confluent, glabrous, with 1 papillate ostiole, citrine to honey, later olivaceous to olivaceous black; walls made up of 2–5 layers of cells, outer layer(s) pigmented; conidial exudate white. Conidiogenous cells 3–6 × 3–6 µm, globose or bottle-shaped. Conidia 5–7.5(–10.5) × 2–4 µm, av. 6.1 × 2.8 µm, Q = 1.7–2.8, av. Q = 2.2, oblong to ellipsoidal, with or without several indistinct guttules.

Chlamydo-spores absent.

NaOH spot-test: weak red on OA, distinct red-brown on MA (not E+ reaction).

Crystals absent.

Ecology and distribution. Probably widespread in olive-growing (*Olea europaea*) regions of the world, particularly southern Europe. Occurs in association with spots on fruits and leaves, but so far no pathogenicity tests have been done.

Culture studied. CBS 161.78 (LEV 11302) ex *Olea europaea* (Oleaceae), New Zealand.

2. *Phoma pratorum* Johnston & Boerema — Fig. 2

Phoma pratorum Johnston & Boerema, N. Z. J. Bot. 19 (1981) 395–396.

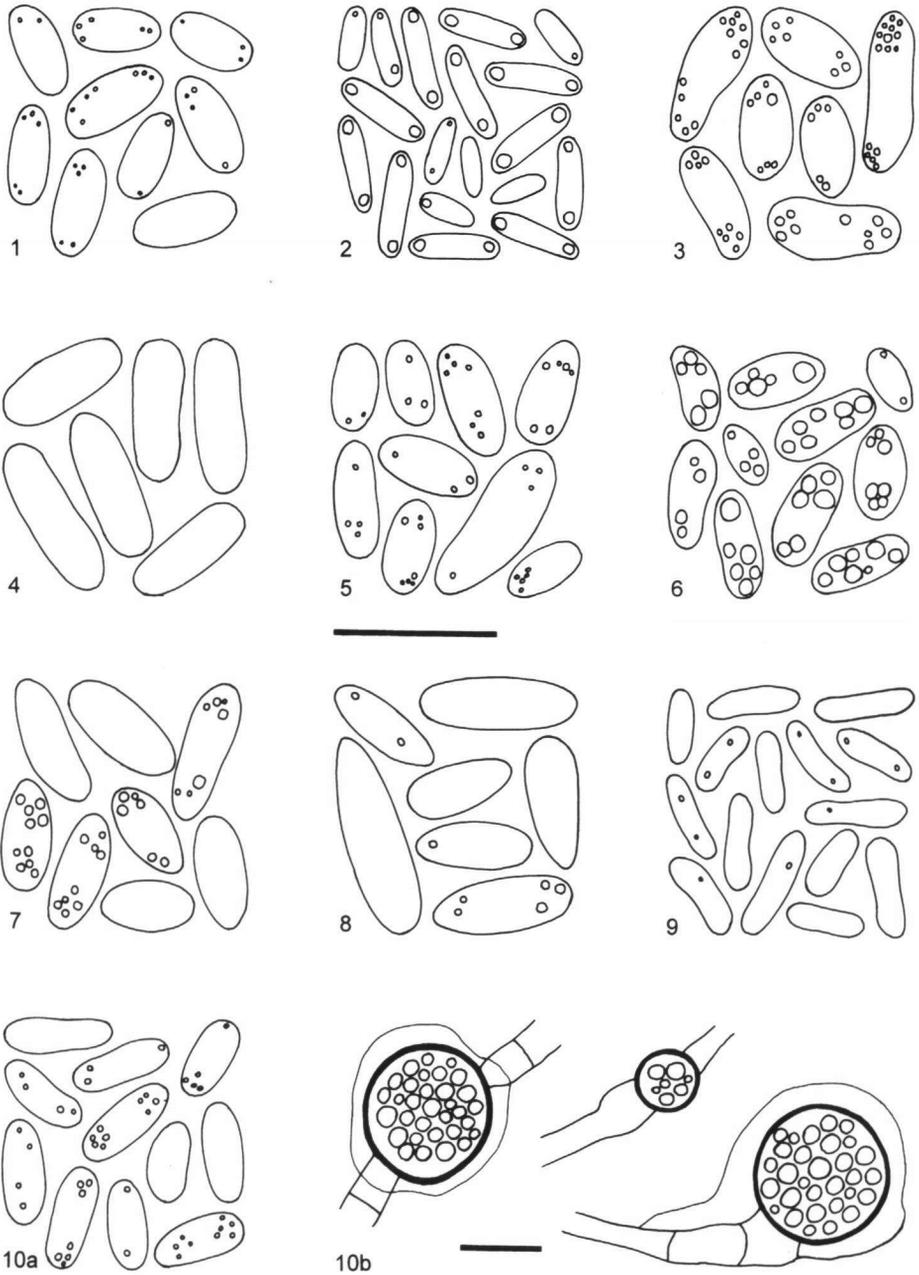
Selected literature. Johnston & Boerema (1981).

Description in vitro

OA: growth-rate 20–23 mm (14 days: 42–51 mm), regular, with felted to finely floccose, white to olivaceous grey aerial mycelium; colony dark herbage green; reverse dull green to olivaceous.

MA: growth-rate 14–20 mm (14 days: 31–32 mm), regular, with compact, finely floccose, white to pale olivaceous grey aerial mycelium; colony pale olivaceous grey to olivaceous grey; reverse olivaceous with buff at margin.

CA: growth-rate 17–20 mm (14 days: 40–41 mm), regular, with finely felted to finely floccose, white to smoke grey aerial mycelium; colony dark herbage green with rosy buff at margin; reverse leaden grey at centre, dark herbage green with rosy buff towards margin.



Figs. 1–10a. Conidia. 1. *Phoma fallens*; 2. *P. pratorum*; 3. *P. glaucispora*; 4. *P. humicola*; 5. *P. obtusa*; 6. *P. draconis*; 7. *P. huancayensis*; 8. *P. paspali*; 9. *P. lotivora*; 10a. *P. heteroderae*. — Fig. 10b. Chlamydospores, *P. heteroderae*. — Bar = 10 μ m.

Pycnidia abundant, mainly immersed in the agar, 90–250 µm diam., globose, solitary or confluent, glabrous, with 1–3 non-papillate or slightly papillate ostioles, buff-honey, later olivaceous to olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate white. Conidiogenous cells 3.7×3.7 µm. Conidia $3.5-7 (-8.5) \times 1-2$ µm, av. $4.1-6.0 \times 1.4-1.6$ µm, $Q = 2.5-4.9$, av. $Q = 2.9-3.9$, cylindrical with distinct, polar guttules.

Chlamydospores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. Frequently isolated from the surface of living leaves of various grasses in New Zealand. This epiphytic saprophyte is probably also common in Australia. The substrates include species of *Dactylis*, *Lolium* and *Paspalum*.

Cultures studied. CBS 445.81 ex *Lolium perenne* and CBS 286.93 (PD 80/1252) ex *Dactylis glomerata* (Gramineae), the Netherlands.

3. *Phoma glaucispora* (Delacr.) Noordel. & Boerema — Fig. 3

Phoma glaucispora (Delacr.) Noordeloos & Boerema, Versl. Meded. plziektenk. Dienst Wageningen 166 (Jaarb. 1987) (1988) 108. — *Phyllosticta glaucispora* Delacroix, Bull. Soc. mycol. Fr. 9 (1893) 266.

Phyllosticta oleandri Gutner, Trudy bot. Inst. Akad. Nauk SSSR Leningrad Ser. II [Plantae Cryptogamae] 1 (1933) 306.

Description in vitro

OA: growth-rate 20–21 mm, (14 days: 40–43 mm), regular, with finely woolly to finely floccose, smoke grey to dull green aerial mycelium; colony smoke grey to grey olivaceous or dull green; reverse similar with olivaceous black sectors.

MA: growth-rate 18–19 mm, (14 days: 29–32 mm), regular or with undulating outline, with compact, finely floccose to finely woolly, white to smoke grey or greenish grey aerial mycelium; colony greenish grey/grey olivaceous to olivaceous/olivaceous grey; reverse iron grey to olivaceous black at centre, buff with small iron grey to grey olivaceous sectors at margin.

CA: growth-rate 15–17 mm, (14 days: 26–27 mm), with crenate margin, and with compact, finely floccose, white to greenish glaucous/greenish grey aerial mycelium; colony greenish glaucous to dark herbage green/grey olivaceous, with white near margin; reverse greyish blue to dark slate blue, with rosy buff at margin.

Pycnidia scattered, more obviously concentrically arranged at margin, partly submerged in the agar, 80–240 µm, globose to subglobose, solitary or confluent, glabrous, non-ostiolate, olivaceous buff to citrine green, later olivaceous to olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate rosy buff. Conidiogenous cells $5-8 \times 4-7$ µm, globose to bottle-shaped. Conidia $5-7(-8) \times 2.5-4.5$ µm, av. 6.2×3.5 µm, $Q = 1.4-2.3$, av. $Q = 1.8$, oblong to ellipsoidal, with several small guttules.

Chlamydospores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. Common and widespread on oleander, *Nerium oleander*, in southern Europe (e.g. Italy, Spain). Leaf Spot. Also reported from glasshouse ornamental cultures (Russia, the Netherlands)

Culture studied. CBS 284.70 (PD 97/2400) ex *Nerium oleander* (Apocynaceae), Italy.

4. *Phoma humicola* Gilman & Abbott — Fig. 4

Phoma humicola Gilman & Abbott, Iowa State Coll. J. Sci. 1 (3) (1927) 266.

Selected literature. Boerema (1985).

Description in vitro

OA: growth-rate 40–45 mm, regular, without aerial mycelium; colony pale luteous due to the release of a diffusible pigment; reverse similar to grey olivaceous.

MA: growth-rate 40–58 mm, regular, with scanty woolly/floccose, olivaceous grey to grey olivaceous aerial mycelium; colony citrine with yellowish marginal zone, due to production of a diffusible pigment; reverse leaden grey and olivaceous at margin.

CA: growth-rate 45–53 mm, irregular, with finely floccose, olivaceous grey aerial mycelium; colony ochraceous, apricot particularly at centre, due to production of a diffusible pigment; reverse similar.

Pycnidia abundant, mainly in the agar, 80–150 µm diam., globose, solitary, rarely confluent, glabrous, with 1–2 non-papillate ostioles, olivaceous to olivaceous black; walls made up of 2–5 layers of cells, outer layer(s) pigmented; conidial exudate white to buff. Conidiogenous cells 4–8 × 5–9 µm, globose to bottle-shaped. Conidia (7–)8–10.5(–12) × 2.5–4 µm, av. 9.5 × 3.3 µm, Q = 2.5–3.3, av. Q = 2.9, oblong to cylindrical, without guttules.

Chlamydospores absent.

NaOH spot test: rosy vinaceous to coral on OA and MA (not an E+ reaction).

Crystals formed on MA, citrine green (anthraquinone pigments).

Ecology and distribution. Soil fungus in North America (Utah, Nevada, Wyoming) and South America (Andes, Peru). Isolated from a variety of organic substrates. A saprophytic fungus which may be an opportunistic pathogen (rotting of potatoes, Boerema, l.c.). It can be distinguished from *Phoma herbicola* in vivo (no. 13) by its broader conidia.

Culture studied. CBS 220.85 (PD 71/1030) ex *Franseria* sp. Nevada, USA.

5. *Phoma obtusa* Fuckel — Fig. 5

Phoma obtusa Fuckel, Jb. Nassau. Ver. Naturk. 23–24 (= Symb. mycol.) (1870) 378.

Phoma carotae Diedicke, Krypt.-Fl. Mark Brandenb. 9, Pilze 7 (1912) 136–137.

Description in vitro

OA: growth-rate 60–70 mm, regular, with or without scarce, finely floccose, white aerial mycelium; colony colourless to rosy buff; reverse similar.

MA: growth-rate 76–79 mm, regular, with velvety-felted to woolly, white aerial mycelium; colony colourless to olivaceous buff due to production of a diffusible pigment; reverse similar.

CA: growth-rate 53–66 mm, regular, with velvety to finely woolly, pale olivaceous grey aerial mycelium; colony olivaceous to fawn; reverse similar.

Pycnidia abundant, on and in the agar, 50–180 µm diam., globose, solitary, covered with mycelial outgrowths, with 1 non-papillate ostiole, citrine-honey, later olivaceous to olivaceous black; walls made up of 2–4 layers of cells, outer layer(s) pigmented; conidial exudate white to sordid white. Conidiogenous cells 4–6 × 4–6 µm, globose. Conidia (3.5–)5–8.5(–10.5) × 2–4 µm, av. 5.3–5.6 × 2.4–3.0 µm, Q = 1.2–3.0, av. Q = 1.9–2.2, ellipsoidal, ovoid, usually with a few, small guttules.

Chlamydospores absent.

NaOH spot test: on OA negative, on MA a weak greenish-yellow discoloration of the exudate.

Crystals absent.

Ecology and distribution. In Europe this fungus is repeatedly recorded on dead stems of *Daucus carota*. Occasionally it has also been isolated from necrotic tissue of *Spinacia oleracea*. In this connection it is worth noting that the carrot-fungus has been interpreted as an overripe stage of a *Phoma* species commonly occurring on Chenopodiaceae (Allescher, 1898).

Cultures studied. CBS 391.93 (PD 80/87) ex *Spinacia oleracea* (Chenopodiaceae); CBS 377.93 (PD 80/976) ex *Daucus carota* (Umbelliferae), the Netherlands.

6. *Phoma draconis* (Berk. ex Cooke) Boerema — Fig. 6

Phoma draconis (Berk. ex Cooke) Boerema, Versl. Meded. plziektenk. Dienst Wageningen 159 (Jaarb. 1982) (1983) 24. — *Phyllosticta draconis* Berkeley, Welw. Crypt. Lusit. (1853) 51 [nomen nudum] ex Cooke, Grevillea 19 (1891) 8. — *Macrophoma draconis* (Berk. ex Cooke) Allescher, Rabenh. Krypt.-Flora (ed. 2) Pilze 7 (Lief. 88) (1903) [misapplied].

Phyllosticta maculicola Halsted, Rep. New Jers. St. agric. Exp. Stn 14 (1894) 412.

Phyllosticta dracaenae Griffon & Maublanc, Bull. Soc. mycol. Fr. 25 (1909) 238; not *Phyllosticta dracaenae* P. Hennings, Hedwigia 48 (1908) 111 [= *Asteromella* sp.].

Selected literature. Boerema (1983).

Description in vitro

OA: growth-rate 50–59 mm, regular, with tufted, finely floccose, white to grey olivaceous aerial mycelium, colony colourless to rosy buff-honey, with weak greenish tinge near margin; reverse similar.

MA: growth-rate 45–53 mm, regular, with velvety to finely floccose, white to dull green aerial mycelium; colony dull green to grey olivaceous, staining the agar ochraceous due to the release of a diffusible pigment, with greenish olivaceous margin; reverse olivaceous black with leaden grey patches, with ochraceous to greenish olivaceous margin.

CA: growth-rate 55–69 mm, regular, with finely woolly, grey olivaceous aerial mycelium; colony olivaceous grey, staining the agar red to scarlet due to the release of a pigment; reverse similar.

Pycnidia abundant, concentrically zoned, mostly partly in the agar, 90–220 µm diam., globose, solitary or confluent, glabrous, with 1(–2) non-papillate ostioles, olivaceous, around ostiole olivaceous black; walls made up of 2–5 layers of cells, outer layer(s) pigmented; conidial exudate white to buff. Conidiogenous cells 4–9 × 4–8 µm, globose to

bottle-shaped. Conidia $4-8.5 \times 2-4 \mu\text{m}$, av. $5.7 \times 2.7 \mu\text{m}$, $Q = 1.7-2.8$, av. $Q = 2.1$, ellipsoidal to ovoid, with numerous, large guttules.

Chlamydospores absent.

NaOH spot test: positive, greenish, then red (E+ reaction), on MA the ochraceous pigment discolours to orange.

Crystals absent.

Ecology and distribution. Recorded from wild *Dracaena* spp. in Africa (Rwanda) and from cultivated species of *Dracaena* in Europe, India and North America. Also reported from *Cordyline* spp. Leaf Spot. Dieback.

Culture studied. CBS 186.83 (PD 82/47) ex *Dracaena* sp. (Agavaceae), Rwanda.

7. *Phoma huancayensis* Turkensteen — Fig. 7

Phoma huancayensis Turkensteen, Fitopatologia 13 (1978) 68 [as 'huancayense'].

Selected literature. Johnston (1981).

Description in vitro

OA: growth-rate 40–57 mm, regular, with finely to coarsely floccose, smoke grey to olivaceous aerial mycelium; colony olivaceous buff to primrose, due to the release of a diffusible pigment, or umber to bay; reverse similar or with peach at the margin.

MA: growth-rate 30–54 mm, irregular, with floccose to woolly, compact, greyish-green to grey olivaceous aerial mycelium; colony ochraceous to fulvous with olivaceous buff to primrose patches due to a diffusible pigment production; reverse primrose to ochraceous and fulvous/bay to sepia.

CA: growth-rate 49–66 mm, regular, with velvety to floccose, grey olivaceous aerial mycelium; colony bay to rust due to a diffusible pigment production; reverse bay to chestnut-rust.

Pycnidia scarce to abundant, both on and in the agar, 95–240 μm diam., globose to irregular, solitary or confluent, glabrous, with 1, sometimes papillate ostiole, occasionally with an elongated neck, honey to sienna, later olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate white to salmon. Conidiogenous cells $4-8 \times 4-6 \mu\text{m}$, globose to bottle-shaped. Conidia $(4-5)-8(-12) \times 2.5-4.5$, av. $7.0-7.1 \times 3.0-3.6 \mu\text{m}$, $Q = 1.5-3.7$, av. $Q = 2.0-2.4$, ellipsoidal to ovoid or subcylindrical, with or without polar guttules.

Chlamydospores absent, chains of swollen cells may occur.

NaOH spot test: positive, on OA and MA a red, then a blue discoloration of the pigment (not E reaction).

Crystals absent.

Ecology and distribution. A saprophytic fungus, probably indigenous to South America. It is originally described from dead leaves of *Chenopodium quinoa* and a wild species of *Solanum* spp. series *Tuberosa* in the Andes region of Peru (prov. Huancayo). The fungus is further recorded in New Zealand where it has been isolated from necrotic tissue of various dicotyledonous and monocotyledonous plants, e.g. often from *Paspalum dilatatum*, a grass originating from South America.

Cultures studied. CBS 105.80 (PD 75/908) ex *Solanum* sp. series *Tuberosa*; CBS 390.93 (PD 77/1179) ex *Chenopodium quinoa* (Chenopodiaceae), Peru.

8. *Phoma paspali* Johnston — Fig. 8

Phoma paspali Johnston, N. Z. J Bot. 19 (1981) 181.

Description in vitro

OA: growth-rate 42–60 mm after 5 days, regular to irregular, with scanty to abundant, floccose, white to olivaceous grey aerial mycelium; colony colourless with faint green tinge to grey olivaceous; reverse dark herbage green to grey olivaceous.

MA: growth-rate 60–72 mm after 5 days, regular with woolly, white to olivaceous grey aerial mycelium; colony colourless to olivaceous buff with primrose or greenish olivaceous tinges, or olivaceous grey; reverse similar or leaden grey/leaden black.

CA: growth-rate 53–70 mm after 5 days, regular, with woolly, white aerial mycelium; colony olivaceous to vinaceous buff; reverse similar.

Pycnidia scattered, sometimes on the agar, but mostly (partly submerged) in the agar, 100–140 μm diam., solitary, or confluent, up to 1150 μm in diam., globose to irregularly shaped, glabrous, with 1 to many papillate ostiole(s), later often developing an elongated neck, olivaceous black; walls made up of 4–7 layers of cells, outer layer(s) pigmented; conidial exudate white to straw. Conidiogenous cells 4–6 \times 4–6 μm , globose to bottle-shaped. Conidia 5.5–8.5(–11) \times 2.5–4 μm , av. 7.5 \times 3.0 μm , Q = 1.8–3.2, av. Q = 2.5, obclavate-ovoid to ellipsoidal, without guttules.

Chlamydospores absent.

NaOH spot test: positive; green to bluish/green, then red (E+ reaction).

Crystals absent.

Ecology and distribution. Isolated from soil and various grasses (*Paspalum*, *Dactylis* and *Lolium* spp.) in New Zealand. Probably widespread in Australasia. Saprophyte or weak wound parasite.

Culture studied. CBS 560.81 (PDDCC 6614) ex *Paspalum dilatatum* (Gramineae), New Zealand.

9. *Phoma lotivora* Johnston — Fig. 9

Phoma lotivora Johnston, N. Z. J Bot. 19 (1981) 178–179.

Selected literature. Johnston (1981).

Description in vitro

OA: growth-rate 58–80 mm, regular, with finely floccose, white aerial mycelium; colony colourless or with olivaceous grey spots, reverse similar. After three weeks the colony develops a saffron colour due to ripe pycnidia.

MA: growth-rate 60–77 mm, regular or irregular, with powdery to finely floccose, pale olivaceous grey aerial mycelium; colony olivaceous grey at centre, becoming pale olivaceous grey towards margin and finally buff to greenish olivaceous at margin; reverse leaden grey to leaden black with buff to honey tinges margin.

CA: growth-rate 64–69 mm, regular, with compact, powdery to finely floccose olivaceous grey aerial mycelium; colony scarlet to bay, due to the release of a diffusible pigment; reverse similar, with olivaceous centre.

Pycnidia abundant, both on and in the agar, 110–250 μm in diam., globose to irregular, solitary, glabrous, with 1(–2), non-papillate or papillate ostiole(s), honey to saffron,

later olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate white to pale buff. Conidiogenous cells 5–8 × 5–8 μm, globose to bottle-shaped. Conidia 4–7.5(–9) × 1.5–2(–2.5) μm, av. 5.6–5.7 × 1.6–1.7 μm, Q = 2.6–4.6, av. Q = 3.4–3.6, allantoid to subcylindrical, with or without a few, small guttules.

Chlamydospores absent.

NaOH spot test: positive on OA and MA, greenish/blue, then red (E+ reaction).

Crystals absent.

Ecology and distribution. Apparently a common pathogen of *Lotus* spp. in New Zealand. Stem and Leaf Spot. The fungus probably also occurs in Australia. It differs from the European *Phoma loticola* Died. in both cultural appearance and conidial dimensions.

Cultures studied. CBS 562.81 (PDDCC 6884) ex *Lotus pedunculatus* and CBS 628.97 (PDDCC 3870) ex *Lotus tenuis* (Leguminosae), New Zealand.

10. *Phoma heteroderae* Chen, Dickson & Kimbrough — Fig. 10a, b

Phoma heteroderae Chen, Dickson & Kimbrough, Mycologia 88 (6) (1996) 885–891.

Description in vitro

OA: growth-rate 70–82 mm, regular, with or without velvety grey olivaceous aerial mycelium; colony colourless to grey olivaceous/olivaceous or citrine; reverse similar.

MA: growth-rate 80–85 mm, regular, with scanty to abundant finely floccose, grey olivaceous aerial mycelium; colony citrine to olivaceous; reverse olivaceous, sometimes with leaden grey or greenish olivaceous sectors.

CA: growth-rate 80–85 mm, regular, with or without floccose, pale olivaceous grey to olivaceous grey aerial mycelium; colony olivaceous grey to olivaceous; reverse similar with brown vinaceous tinges.

Pycnidia abundant, mainly on, partly also in the agar, 70–250 μm diam., globose to irregular, solitary or confluent, glabrous, or with setae-like hyphal outgrowths (semi-pilose), with 1–4 non-papillate or slightly papillate ostioles, honey to olivaceous, later olivaceous black; walls made up of 2–6 layers of cells, outer layer(s) pigmented; conidial exudate buff to vinaceous buff. Conidiogenous cells 5–8 × 5–8 μm, globose to bottle-shaped. Conidia 3.5–7.5(–12) × 2–3.5(–4.5) μm, av. 5.3–6.5 × 2.4–2.5 μm, Q = 1.5–3.3, av. Q = 2.2–2.7, ellipsoidal to ovoid to cylindrical with or without small, polar guttules.

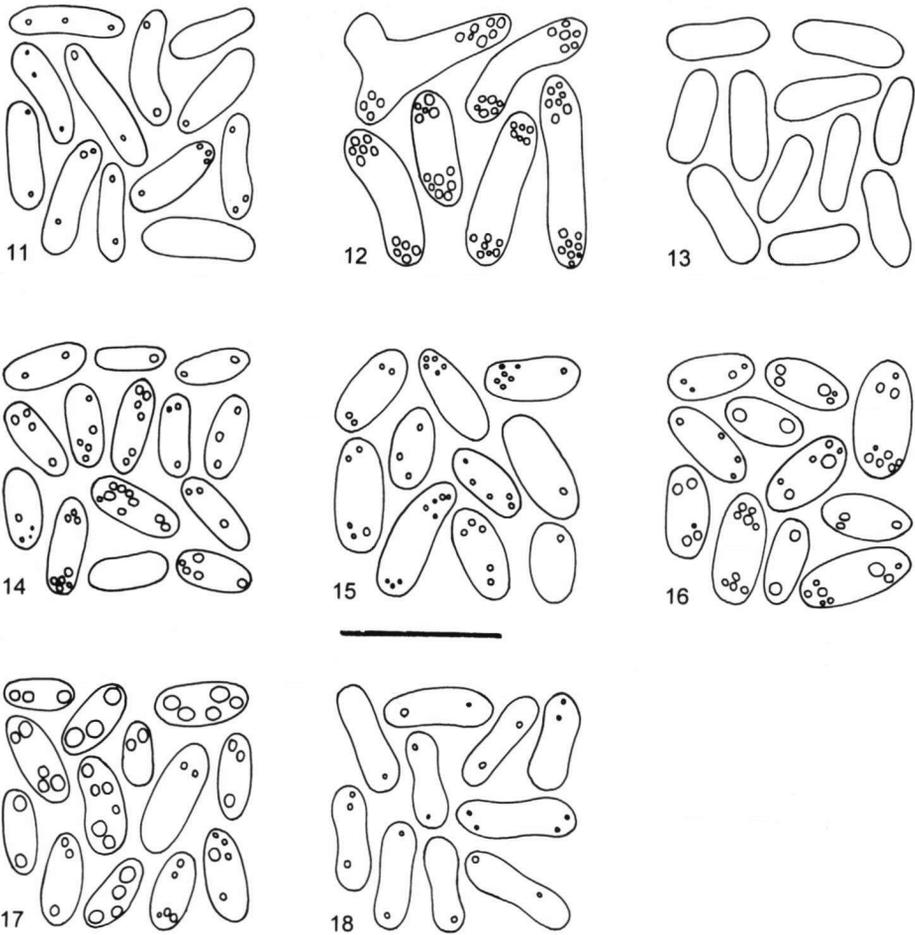
Chlamydospores abundant on OA, mainly in aerial mycelium, globose, intercalary, 7.5–25.5 μm diam., with a distinct 'envelope.'

NaOH spot test: negative, or weakly yellow-green to reddish on OA and MA, not specific.

Crystals absent.

Ecology and distribution. A saprophyte, isolated from various organic and inorganic substrata in Eurasia and North America. Apparently it is a soil-inhabiting fungus (fitting well with the abundant production of chlamydospores). Recorded as a probable weak parasite on eggs of *Heterodera glycines*.

Culture studied. CBS 96/2022 (ATCC 96683, IMI 361196) ex Eggs of *Heterodera glycines*, USA; CBS 875.97 (PD93/1503) ex cold storage chamber, USA.



Figs. 11–18. Conidia. 11. *Phoma nigrificans*; 12. *P. astragali*; 13. *P. herbicola*; 14. *P. urticicola*; 15. *P. aliena*; 16. *P. negriana*; 17. *P. plurivora*; 18. *P. aubrietiae*. — Bar = 10 μ m.

11. *Phoma nigrificans* Johnston & Boerema — Fig. 11

Phoma nigrificans Johnston & Boerema, N. Z. JI Bot. 19 (1981) 394–395.

Selected literature. Johnston & Boerema (1981).

Description in vitro

OA: growth-rate 70–82 mm, regular, with finely floccose, white to pale olivaceous grey aerial mycelium; colony grey olivaceous, rosy buff at margin; reverse similar.

MA: growth-rate 70–82 mm, regular, with grey olivaceous, woolly-floccose aerial mycelium; colony grey olivaceous becoming honey-citrine to greenish olivaceous near margin; reverse olivaceous black with honey to greenish olivaceous margin.

CA: growth-rate 70–78 mm, regular, with velvety to woolly, grey olivaceous to olivaceous grey aerial mycelium; colony olivaceous grey to grey olivaceous; reverse olivaceous black with olivaceous at margin.

Pycnidia abundant, mostly on, but also immersed in the agar, 80–310 µm diam., globose to irregular, solitary to confluent, glabrous, with 1 papillate ostiole, citrine, later olivaceous to olivaceous black; conidial exudate white to saffron; walls made up of 3–5 layers of cells, outer layer(s) pigmented. Conidiogenous cells 4–8 × 5–8 µm, globose to bottle-shaped. Conidia (3.5–)4.5–8(–10) × (1.5–)2–3(–4) µm, av. 4.9–5.9 × 2.4–2.8 µm, Q = 1.3–2.7, av. Q = 2.0–2.1, allantoid to subcylindrical, with or without a few small guttules.

Chlamydo-spores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. Isolated from various woody and herbaceous plants in New Zealand apparently as an ubiquitous saprophyte; probably also common in Australia. The epithet refers to the conspicuous mature black pycnidia.

Culture studied. CBS 444.81 (PDDCC 6546) ex *Actinidia chinensis* (Actinidiaceae), New Zealand.

12. *Phoma astragali* Cooke & Harkn. — Fig. 12

Phoma astragali Cooke & Harkness, *Grevillea* 13 (1885) 111. — *Phoma astragali* Ellis & Kellerman, nomen nudum [herbarium name, Mycol. Coll., NY].

Description in vitro

OA: growth-rate 49–55 mm, regular, with or without scarce, finely floccose, white aerial mycelium; colony colourless to olivaceous grey or greenish grey; reverse similar.

MA: growth-rate 45–55 mm, regular, with floccose-woolly olivaceous grey aerial mycelium; colony greenish black, with dull green margin; reverse leaden grey to greenish black.

CA: growth-rate 45–55 mm, with appressed floccose, pale olivaceous grey aerial mycelium; colony colourless with dull green to greenish black sectors; reverse similar.

Pycnidia scattered all over the colony, on and (partly) in the agar, 80–180 µm diam., mainly globose, sometimes irregular, solitary or confluent, glabrous, with 1 rarely up to 3 non-papillate or papillate ostiole(s), honey to citrine with olivaceous tinges around ostiole; walls made up of 2–5 layers of cells, outer layer(s) pigmented; conidial exudate white to buff. Conidiogenous cells 4–10 × 5–8 µm, globose to bottle-shaped. Conidia 7.5–12.5 × 2–3.5 µm, av. 8.0–10.0 × 2.0–2.5 µm, Q = 2.9–5.0, av. Q = 3.9–4.0, cylindrical to allantoid, distorted shapes occur, with numerous small guttules.

Chlamydo-spores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. This fungus is often recorded in North America (United States, Canada) on stems of various species of *Astragalus*. Probably an opportunistic parasite.

Culture studied. CBS 178.25 ex *Astragalus* sp. (Leguminosae), USA.

13. *Phoma herbicola* Wehm. — Fig. 13

Phoma herbicola Wehmeyer, *Mycologia* 38 (1946) 319–320 [description in accordance with DAOM 120225: herb. Wehmeyer '*Phoma herbicola* nov. sp.', with the indication 'Type' in pencil (original paper packet marked '*Phoma*' written by Wehmeyer); another specimen DAOM 120226, indicated in print with type (original packet marked '*Macrophoma*' by Wehmeyer) is in conflict with the original description: conidia larger, resembling those of *P. humicola*, no. 4].

Phoma pedicularis Wehmeyer, *Mycologia* 38 (1946) 319 [description checked with original collection in herb. Wehmeyer, filed under '*Apiosporella alpina* 1095', DAOM]; not *Phoma pedicularis* Fuckel in Von Heuglin, *Reisen Nordpolarmeer III Beitr. Fauna Fl. Geol.* (1874) 318–319 [as '*pedicularidis*'; belongs to sect. *Plenodomus*, treated in Contribution III-1; Boerema, de Gruyter & van Kesteren, 1994].

Selected literature. Wehmeyer (1946).

Description in vitro

OA: growth-rate 45–52 mm, regular, with scanty, fluffy, white aerial mycelium, particularly in marginal zone; colony colourless with darker concentric zones due to pycnidia; reverse similar.

MA: growth-rate 43–50 mm, irregular with undulating margin, with floccose, white aerial mycelium; colony colourless to luteous due to concentric zones of yellow-brown pycnidia; reverse colourless with pale luteous concentric zones.

CA: growth-rate 40–53 mm, regular, with finely floccose, white aerial mycelium; colony colourless to weak rosy buff; reverse similar.

Pycnidia abundant, on and partly in the agar, 120–340 µm diam., globose to irregular, solitary or confluent, glabrous, with 1–2 ostiole(s), with long elongated neck, citrine to honey, later olivaceous black; walls made up of 3–7 layers of cells, outer layer(s) pigmented; conidial exudate buff to saffron. Conidiogenous cells 3–9 × 5–8 µm, bottle-shaped. Conidia 5–7(–8.5) × 2–3 µm, av. 6.2 × 2.3 µm, Q = 2.4–3.3, av. Q = 2.7, cylindrical to subcylindrical, without guttules.

Chlamydospores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. A saprophytic fungus indigenous to North America. The records so far are from northwestern United States (Montana and Wyoming) and refer to old dead stems of quite different herbaceous plants and to polluted lake water. The conidia *in vivo* are usually longer than those *in vitro* (up to 10.5 µm). Collections of this fungus may have been confused with the cosmopolitan *Phoma herbarum* Westend., the type species of sect. *Phoma*, treated in Contribution I-2, de Gruyter, Noordeloos & Boerema (1993).

Culture studied. CBS 629.97 (PD 76/1017) ex water, head of Seeley Lake, Missoula in Montana, USA.

14. *Phoma urticicola* v.d. Aa & Boerema — Fig. 14

Teleomorph: *Didymella urticicola* v.d. Aa & Boerema.

Phoma urticicola van der Aa & Boerema in Boerema, *Trans. Brit. mycol. Soc.* 67 (1976) 303–306.

Selected literature. Boerema (1976).

Description in vitro

OA: growth-rate 55–61 mm, regular, with or without scanty, fluffy, white aerial mycelium; colony colourless, but with grey tinge due to development of pycnidia, sometimes with dark herbage green sectors; reverse similar.

MA: growth-rate 55–69 mm, regular, with compact, floccose to woolly, white aerial mycelium; colony olivaceous buff to greenish olivaceous; reverse olivaceous buff to honey, with olivaceous black sectors at centre.

CA: growth-rate 55–64 mm, regular, with finely floccose, white to pale olivaceous grey aerial mycelium; colony olivaceous grey to grey olivaceous; reverse leaden grey with olivaceous tinges, vinaceous buff towards margin.

Pycnidia abundant, formed on or in the agar, 110–500 µm, globose to bottle-shaped, solitary or confluent, glabrous, with 1–2 papillate ostiole(s), citrine to honey later ochraceous to olivaceous; walls made up of 2–5 layers of cells, outer layer(s) pigmented; with pale buff to saffron conidial exudate. Conidiogenous cells 5–9 × 4–8 µm, globose to bottle-shaped. Conidia (3–)4–6.5(–8.5) × (1.5–)2–3(–3.5) µm, av. 5.6 × 2.2 µm, Q = 1.7–3.4, av. Q = 2.5, ellipsoidal, with or without small guttules.

Chlamydospores absent.

NaOH spot test: negative.

Crystals absent.

Pseudothecia 150–440 × 125–300 µm, subglobose to pyriform. Asci 40–65 × 8–12 µm, 8-spored. Ascospores 12–18 × 5.5–7.5 µm, 2-celled (on ageing rarely 3–4 celled), the lower cell usually slightly tapering to the the base, the upper cell widest near the septum, tapering gradually to a broadly rounded apex.

Ecology and distribution. Common in Europe on dead stems of nettle, especially *Urtica dioica*; usually with simultaneous production of anamorph and teleomorph. In the past, i.e. before 1976, this fungus has always been confused with other species of *Phoma* and *Didymella* occurring on *Urtica* spp.

Culture studied. CBS 121.75 (ATCC 32164, IMI 194767, PD 73/584) ex *Urtica dioica* (Urticaceae), the Netherlands.

15. *Phoma aliena* (Fr.: Fr.) v.d. Aa & Boerema, *comb. nov.* — Fig. 15

Sphaeria aliena Fries, Syst. mycol. 2 [Sect. 2] (1823) 502. — *Perisporium alienum* (Fr.: Fr.) Fries, Syst. mycol. 3 [Sect. 1] (1829) 252. — *Phyllosticta aliena* (Fr.: Fr.) Saccardo, Michelia 2 (2) (1881) 342 [neotype sub *Perisporium alienum* (Fr.) Desm. on branches of *Euonymus europaeus*, Vosges, France, coll.: B.D. Mougeot, in Rouméguière, Fungi gall. exs. No. 765, Herb. P.A. Saccardo, PAD].

Phoma berberidicola Vestergren, Öfvers. K. Svensk Vet.-Akad. Förh. (1897) 38; non *Phoma berberidicola* Brunaud, Act. Soc. Linn. Bordeaux (1898) 12 [= *Phoma enteroleuca* Sacc.; belongs to sect. *Plenodomus*, treated in Contribution III-1; Boerema, de Gruyter & van Kesteren, 1994].

Description in vitro

OA: growth-rate 52–55 mm, regular, with or without scanty floccose, pale olivaceous grey aerial mycelium; colony smoke grey; reverse smoke grey with olivaceous grey tinge.

MA: growth-rate 60–69 mm, regular, with rather coarse, floccose to woolly, white to grey olivaceous aerial mycelium; colony greenish olivaceous to dull green, with rosy buff to honey in sectors and at the margin; reverse similar.

CA: growth-rate 60–70 mm, regular, with velvety to finely floccose, pale olivaceous grey aerial mycelium; colony olivaceous to vinaceous buff/fawn; reverse similar.

Pycnidia on and in the agar, also in aerial mycelium, 80–260 µm diam., globose to irregular, usually solitary, glabrous, without or with 1(–2) non-papillate ostiole(s), citrine to olivaceous, later olivaceous black; walls made up of 3–7 layers of cells, outer layer(s) pigmented; conidial exudate rosy buff to salmon. Micropycnidia also present, 40–80 µm diam. Conidiogenous cells 5–8 × 4–7 µm, globose to bottle-shaped. Conidia (4–)5.5–10.5(–12) × 2.5–4.5 µm, av. 6.3–8.2 × 3.0–3.5 µm, Q = 1.4–3.5, av. Q = 2.1–2.3, ellipsoidal to slightly ovoid, with or without some small guttules.

Chlamydo-spores absent.

NaOH spot test: negative or weakly reddish on MA, not specific.

Crystals absent.

Ecology and distribution. Isolated from quite different woody plants, especially shrubs (including evergreens and conifers) in Europe. The fungus is most frequently encountered on *Buxus* spp., *Berberis vulgaris*, *Euonymus europaeus*, *Mahonia aquifolium*, *Lonicera* spp. and *Humulus lupulus* (commonly growing together as wild plants in the Dutch dunes). Characteristically it is an opportunistic parasite often occurring in association with leaf necrosis and wood discoloration (sometimes flesh-coloured). It is commonly seed-borne on *Berberis* spp. Collections of this fungus are sometimes confused with *Phoma macrostoma* Mont., another opportunistic pathogen of woody plants [sect. *Phyllostictoides*, i.e. always producing some septate conidia].

Cultures studied. CBS 379.93 (PD 82/945) ex *Berberis* sp. (Berberidaceae); CBS 877.97 (PD 94/1401) ex *Buxus sempervirens* (Buxaceae), the Netherlands.

Note: The holotype of the basionym *Sphaeria aliena* Fr.: Fr., 'ad ramos languescentes *Evonymi*. Mougeot (v.s.)' is not known to exist. The designated neotype probably represents an isotype collection.

16. *Phoma negriana* Thümen — Fig. 16

Phoma negriana Thümen, Pilze Weinst. (1878) 185 [as '*negrianum*']. — *Phyllosticta negriana* (Thümen) Allescher, Rabenh. Krypt.-Flora [ed. 2], Pilze 6 [Lief. 60] (1898 [vol. dated '1901']) 135.

Phyllosticta vitis Saccardo, Michelia 1 (2) (1878) 135; not *Phoma vitis* Bonorden, Abh. naturforsch. Ges. Halle 8 (1864) 14.

Selected literature. Boerema & Dorenbosch (1979).

Description in vitro

OA: growth-rate 37–45 mm, regular to irregular, with scanty woolly, pale olivaceous grey aerial mycelium; colony greenish olivaceous with colourless margin at first, later greenish due to the development of pycnidia; reverse similar.

MA: growth-rate 25–37 mm, regular to irregular, with compact, floccose to woolly, dull green to olivaceous grey aerial mycelium; colony dull green to olivaceous grey; reverse leaden grey to olivaceous black with grey olivaceous to dull green margin.

CA: growth-rate 47–50 mm, regular to irregular, with floccose, white to pale olivaceous grey aerial mycelium; colony grey olivaceous to olivaceous, buff at margin; reverse similar.

Pycnidia abundant, in concentric rings, mainly on the agar, sometimes (partly) in the agar, 70–220 μm , globose or irregular, solitary or confluent, glabrous, with 1–2(–4) papillate ostiole(s), citrine-honey to sienna-olivaceous, later olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate saffron to pale vinaceous. Conidiogenous cells 5–8 \times 5–8 μm , globose to bottle-shaped. Conidia 4.5–8.5 (–10.5) \times 2–4 μm , av. 6.2 \times 2.9 μm , Q = 1.7–2.7, av. Q = 2.1, ellipsoidal to oblong, with several, distinct guttules.

Chlamydospores absent.

NaOH spot test: on MA a weak reddish-brown discoloration, not specific.

Crystals absent.

Ecology and distribution. A common opportunistic pathogen of vine (*Vitis vinifera*) in southern Europe. It may be associated with disease symptoms on leaves, fruits or stems. On stems it has often been misidentified as *Phoma viticola* Sacc., a name referring to a quite different pathogen of vine: *Phomopsis viticola* (Sacc.) Sacc., believed by some workers to be the cause of Dead arm disease.

Culture studied. CBS 358.71 ex *Vitis vinifera* (Vitaceae), Germany.

17. *Phoma plurivora* Johnston — Fig. 17

Phoma plurivora Johnston, N. Z. J. Bot. (1981) 181.

Selected literature. Johnston (1981).

Description in vitro

OA: growth-rate 40–50 mm, regular, with or without sparse, grey olivaceous aerial mycelium; colony colourless to grey olivaceous; reverse similar.

MA: growth-rate 40–50 mm, regular, with or without floccose, white to greenish olivaceous aerial mycelium; colony olivaceous buff-greenish olivaceous to olivaceous; reverse similar.

CA: growth-rate 40–50 mm, regular, with scanty, floccose, white to greenish olivaceous aerial mycelium; colony pale olivaceous to greenish olivaceous; reverse olivaceous mixed with fawn and hazel.

Pycnidia abundant, both on and (partly submerged) in the agar, 80–260 μm diam., globose to irregular, solitary to confluent, glabrous, with 1 papillate ostiole, honey-citrine, later olivaceous black; walls made up of 3–6 layers of cells, outer layer(s) pigmented; conidial exudate buff to pale saffron. Conidiogenous cells 5–9 \times 4–8 μm , globose to bottle-shaped. Conidia 3.5–6(–8) \times 1.5–2.5(–3) μm , av. 4.8–5.5 \times 2.1–2.4 μm , Q = 1.7–2.9, av. Q = 2.2–2.3, ellipsoidal to oblong, usually with several, distinct guttules.

Chlamydospores absent.

NaOH spot test: negative.

Crystals absent.

Ecology and distribution. Typically a plurivorous saprophyte or opportunistic parasite, probably indigenous to Australasia. In New Zealand it has been isolated from various dicotyledonous and monocotyledonous herbaceous plants, as well as from trees and shrubs.

Cultures studied. CBS 558.81 (PDDCC 6873) ex *Setaria* sp. (Gramineae), New Zealand; CBS 284.93 (PD 75/907) ex *Medicago sativa* (Leguminosae), Australia.

18. *Phoma aubrietiae* (Moesz) Boerema — Fig. 18

Phoma aubrietiae (Moesz) Boerema in Boerema & Valckx, *Gewasbescherming* 1 (1970) 66. — *Sclerophomella aubrietiae* Moesz, *Balkan-Kutat. Tud. Eredm.* 3 (1926) 144–145.

Selected literature. Boerema & Valckx (1970).

Description in vitro

OA: growth-rate 42–44 mm, regular, with appressed-felted to finely floccose, white to olivaceous grey aerial mycelium; colony grey olivaceous to dull green; reverse similar.

MA: growth-rate 40–45 mm, regular, with compact, felted-velvety dull green aerial mycelium; colony dull green with grey olivaceous marginal zone; reverse leaden grey with grey olivaceous or dull green tinges.

CA: growth-rate 29–35 mm, regular, with finely velvety, white to dull green aerial mycelium; colony dull green to greenish olivaceous at the margin; reverse leaden grey to grey olivaceous or dull green.

Pycnidia abundant, mainly on the agar, 80–160 µm diam., globose to subglobose, solitary, glabrous, with 1 non-papillate or papillate ostiole, citrine to olivaceous, later olivaceous black; walls made up of 3–5 layers of cells, outer layer(s) pigmented; conidial exudate white. Conidiogenous cells 6–10 × 6–11 µm, globose to bottle-shaped. Conidia (5–) 6–7.5(–10) × 1.5–3 µm, av. 6.7 × 2.2 µm, Q = 2.3–3.9, av. Q = 3.1, cylindrical to allantoid, with some small, polar guttules.

Chlamydo-spores absent, typical hyphal swellings may be formed.

NaOH spot test: negative or weakly reddish on OA, not specific.

Crystals absent.

Ecology and distribution. A common seed borne pathogen of *Aubrietia* hybrids in Europe. The fungus causes Damping-off of seedlings and Decay of stems and leaves of older plants.

Cultures studied. CBS 383.67 (PD 65/223) and CBS 627.97 (PD 70/714) ex *Aubrietia* hybrid (Cruciferae), the Netherlands.

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REFERENCES

- Allescher, A. 1898–1901. *Fungi imperfecti: Hyalin-sporige Sphaerioideen*. Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz [ed. 2] Pilze 6: 1–1016.
- Boerema, G.H. 1976. The *Phoma* species studied in culture by Dr. R.W.G. Dennis. *Trans. Brit. Mycol. Soc.* 67: 289–319.
- Boerema, G.H. 1983. Mycologisch-taxonomisch onderzoek. *Versl. Meded. plziektenk. Dienst Wageningen* 159 (Jaarb. 1982): 21–27.
- Boerema, G.H. 1985. Mycologisch-taxonomisch onderzoek. *Versl. Meded. plziektenk. Dienst Wageningen* 163 (Jaarb. 1984): 34–40.
- Boerema, G.H. 1993. Contributions towards a monograph of *Phoma* (Coelomycetes) – II. Section *Peyronellaea*. *Persoonia* 15 (2): 197–221.
- Boerema, G.H. & M.M.J. Dorenbosch. 1979. Mycologisch-taxonomisch onderzoek. *Versl. Meded. plziektenk. Dienst Wageningen* 153 (Jaarb. 1978): 17–21.

- Boerema, G.H., J. de Gruyter & H.A. van Kesteren. 1994. Contributions towards a monograph of *Phoma* (Coelomycetes) III-1. Section *Plenodomus*: Taxa often with a *Leptosphaeria* teleomorph. *Persoonia* 15 (4): 431-487.
- Boerema, G.H., J. de Gruyter & M.E. Noordeloos. 1997. Contributions towards a monograph of *Phoma* (Coelomycetes) - IV. Section *Heterospora*: Taxa with large sized conidial dimorphs, in vivo sometimes as *Stagonosporopsis* synanamorphs. *Persoonia* 16 (3): 335-371.
- Boerema, G.H., W.M. Loerakker & M.E.C. Hamers. 1996. Contributions towards a monograph of *Phoma* (Coelomycetes) III-2. Misapplications of the type species name and the generic synonyms of section *Plenodomus* (Excluded species). *Persoonia* 16 (2): 141-190.
- Boerema, G.H. & A.G.M. Valckx. 1970. Enkele bijzondere schimmelaantastingen III (Mycologische Waarnemingen no. 15). *Gewasbescherming* 1 (4): 65-68.
- Gruyter, J. de & M.E. Noordeloos. 1992. Contributions towards a monograph of *Phoma* (Coelomycetes) I-1. Section *Phoma*: Taxa with very small conidia in vitro. *Persoonia* 15 (1): 71-92.
- Gruyter, J. de, M.E. Noordeloos & G.H. Boerema. 1993. Contributions towards a monograph of *Phoma* (Coelomycetes) I-2. Section *Phoma*: Additional taxa with very small conidia and taxa with conidia up to 7 μ m long. *Persoonia* 15 (3): 369-400.
- Johnston, P.R. 1981. *Phoma* on New Zealand grasses and pasture legumes. *N. Z. JI Bot.* 19: 173-186.
- Johnston, P.R. & G.H. Boerema. 1981. *Phoma nigricans* sp. nov. and *P. pratorum* sp. nov., two common saprophytes from New Zealand. *N. Z. JI Bot.* 19: 393-396.
- Wehmeyer, L.E. 1946. Studies on some fungi from Northwestern Wyoming. II. Fungi imperfecti. *Mycologia* 38: 306-330.