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CONTRIBUTIONS TOWARDS A MONOGRAPH OF PHOMA (COELOMYCETES) IV – SUPPLEMENT

An addition to section Heterospora: Phoma schneiderae spec. nov., synanamorph Stagonosporopsis lupini (Boerema & R. Schneid.) comb. nov.

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Study in vivo and in vitro of the '*Ascochyta*'-pathogen of lupin, indigenous to America, showed its conidial dimorphism. The phomoid phenotype developing in vitro and sometimes also in vivo is described as a new species of *Phoma* sect. *Heterospora*. The ascochytoid-stagonosporoid phenotype commonly occurring in association with disease symptoms is transferred to *Stagonosporopsis*.

In Contribution IV (Boerema et al., 1997) the section *Heterospora* was introduced for *Phoma* species producing apart from mainly aseptate, phomoid conidia also distinctly larger conidia, which may become one or more septate, 'ascochytoid or stagonosporoid'. Most of these fungi are pathogens specific to particular hosts. The two types of conidia apparently play different roles in the life cycle. The large, septate conidial phenotypes may be dominant in association with disease symptoms and are referred to *Stagonosporopsis* Died. The phomoid, aseptate conidia are sometimes only produced on dead host material. Humidity and temperature are apparently important co-factors which determine the conidial type. Both types may occur successively in the same pycnidium.

In vitro on standard agar media, the conidia are generally mainly aseptate-phomoid, but occasionally in vitro, several large, septate conidia develop as well; this possibly occurs when growth conditions are fluctuating.

So far, eleven species of *Phoma* studied in culture have been classified in section *Heterospora*. They have been connected with nine *Stagonosporopsis* synanamorphs in vivo, mostly originally described as *Ascochyta* species.

The American, seed-borne pathogen of lupins treated in this supplement to section *Heterospora* was formerly also classified in *Ascochyta* (Boerema, 1984), as *A. lupini* Boerema & R. Schneid. The original drawings of the conidia made by Dr. Roswitha Schneider (BBA, Berlin-Dahlem)[4] show large, septate conidia in vitro, which argues for the classification in *Ascochyta*. However, this has appeared to be exceptional: a fresh isolate (1998) as well as the preserved isolates made by Dr. Schneider produce mainly relatively small, aseptate conidia in vitro. In addition, in a letter dated 1-11-1978, Dr. Schneider had already noted the

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4) Roswitha Schneider was born on May 19, 1917, and worked at the 'Institut für Mikrobiologie', BBA from 1948 until 1979. Among her many publications we would especially refer to her monograph 'Die Gattung *Pyrenochaeta* De Notaris' (Schneider, 1979).

occurrence of only small, aseptate conidia in pure culture on lupin stems! Therefore we have named the phomoid anamorph of the lupin pathogen after Dr. R. Schneider. The ascochytoid-stagonosporoid synanamorph has been placed in *Stagonosporopsis* and the cultural characteristics of the fungus are described in the usual way. The key and indices of *Phoma* sect. *Heterospora* are supplemented.

SUPPLEMENT TO THE KEY OF PHOMA SECT. HETEROSPORA (characteristics in vitro)

Replace in 11b. 'also 1-septate up to 16 × 6 µm' with 'elongated and 1-septate [they may reach double the length of aseptate conidia, but not three times the length as with the ascochytoid-stagonosporoid conidia in vivo].'

Insert 15c.:

15c. Colony with relatively scarce aerial mycelium on OA, pycnidia non-papillate or papillate, conidia mainly aseptate, 5.5–13.5 × 2.5–3.5 µm, 1-septate conidia 9.5–15(–21) × 2.5–4 µm; pathogen of *Lupinus* spp. [in vivo conidia sometimes all relatively small, 0–1-septate, but usually very large conidia predominate, 1–3-septate, mostly 15–30 × 5–9 µm, synanam. *Stagonosporopsis lupini*] ..... *P. schneiderae*

ADDITIONS TO THE INDICES

HOST–FUNGUS INDEX

Leguminosae
Lupinus spp. (esp. American species) (Disease: Leaf Spot and Blight)

Phoma schneiderae: o + θ + (O+) Θ + Θ- (synanam. *Stagonosporopsis lupini*) [seed-borne pathogen known from North and South America; occasionally also recorded in the UK]

FUNGUS–HOST INDEX

Phoma schneiderae (synanam. *Stagonosporopsis lupini*)

Lupinus spp., esp. the American species *L. mutabilis*, *L. perennis* and *L. polyphylla*, are well-known hosts but Eurasian species, such as *L. albus* are also susceptible

DESCRIPTIVE PART

Phoma schneiderae Boerema, de Gruyter & van de Graaf, *spec. nov.* — Figs 1, 2

Conidial dimorph large, 1(oc. 2)-septate. Ascochytoid-stagonosporoid: *Stagonosporopsis lupini*, see below.

Pycnidia in vitro 80–320 µm diam., globosa vel subglobosa, solitaria vel confluentia, glabra, 1(–3) ostiolis papillatis vel non-papillatis praedita. Cellulae conidiogenae 5–16 × 5–13 µm, globosae vel lageniformes. Conidia plerumque unicellularia, 5.5–13.5 × 2.5–3.5 µm, eguttulata vel nonnullas guttulas sparsas continentia; conidia uniseptata 9.5–21 × 2.5–4 µm. (In vitro etiam chlamydosporae, 7–18 µm diam., globosae vel oblongae, breviter catenatae vel acervatae, intercalares vel terminales, olivaceae, guttulas viridulas continentes.)

Holotypus: HLB 998.099-105, cultura sicca CBS 101.494 (ADAS AR98/11 = PD 98/5247), isolatus e foliorum maculis in Lupino albo, Mepal-Ely, Cambridgeshire in Britannia, Apr. 1998.

Synanamorph: ***Stagonosporopsis lupini*** (Boerema & R. Schneid.), *comb. nov.*

Ascochyta lupini Boerema & R. Schneid., Versl. Meded. plziektenk. Dienst Wageningen 162 (Jaarb. 1983) (1984) 28 [basionym; holotype PAD No. '3476' as '*Ascochyta pisi* Lib. fm *lupini*'].

Ascochyta pisi var. *lupini* Sacc., Fungi Columb. (E. Bartholomew) (1915) No. 4506 [nomen nudum].

Ascochyta caulicola var. *lupini* Grove, Br. Coelomycetes (1935) 303 [not valid, no Latin description].

Selected literature. Boerema (1984: 28–31).

Description in vitro

OA: growth-rate 54–64 mm, regular to slightly irregular, with scarce, felty, olivaceous grey aerial mycelium; colony colourless to grey olivaceous/olivaceous grey or greenish grey/greenish black; reverse similar.

MA: growth rate 52–60 mm, slightly irregular, with felty, white to olivaceous grey aerial mycelium; colony citrine green/greenish olivaceous to dull green, with greenish black/iron grey at centre, reverse similar or with fawn patches.

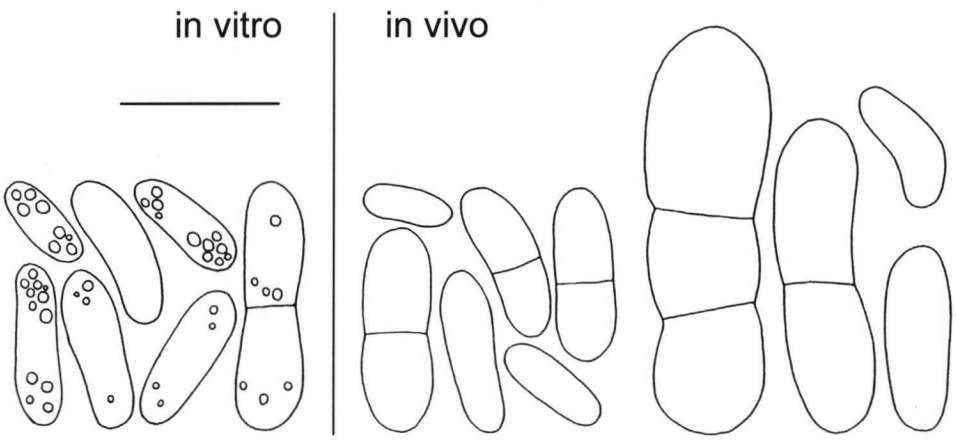

Fig. 1. *Phoma schneiderae.* Conidia in vitro mainly aseptate and variable in shape and size, but always including 1-septate conidia. Pycnidia in vivo may contain rather similar conidia, aseptate and septate, but mostly much larger conidia, usually 1(–2)-septate, synanamorph *Stagonosporopsis lupini.* — Bar = 10 µm. (Drawing conidia in vivo partly after Dr. R. Schneider.)

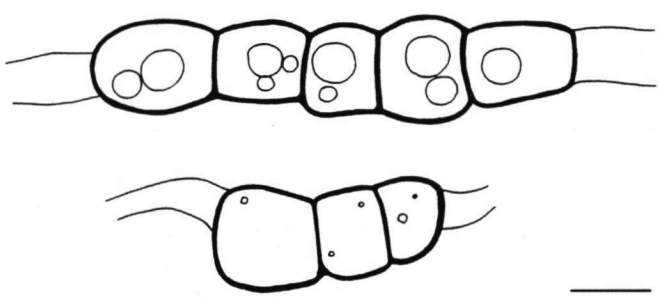

Fig. 2. *Phoma schneiderae.* Chlamydospores in vitro. — Bar = 10 µm.

CA: growth rate 50–62 mm, slightly irregular, with felty to finely woolly, white to olivaceous grey aerial mycelium; colony colourless with greenish olivaceous/dull green to olivaceous/iron grey patches, reverse similar with partly fawn.

Pycnidia 80–320 µm diam., globose to subglobose, solitary or confluent, glabrous, with 1(–3) non-papillate or papillate ostioles, citrine/honey, later olivaceous to olivaceous black; walls made up of 4–8 layers of cells, outer layer(s) pigmented; with white to buff exuded conidial masses; abundant, more or less concentrically arranged, both on and in the agar, and in the aerial mycelium. Conidiogenous cells 5–16 × 5–13 µm, globose to bottle-shaped. Conidia mainly aseptate, (5.5–)7–10(–13.5) × 2.5–3.5 µm, av. 8.1 × 2.8 µm, Q = 1.8–4.2, av. Q = 3.0, ellipsoidal to more or less obclavate, eguttulate or with several small, scattered guttules. Septate conidia (9.5–)11–15(–21) × 2.5–4 µm, av. 13.0 × 3.4 µm, Q = 3.0–5.2, av. Q = 3.9.

Chlamydospores 7–18 µm diam., globose to oblong, in short chains or clustered, intercalary or terminal, olivaceous with greenish guttules.

NaOH spot test: negative.

Crystals absent.

Description in vivo (on *Lupinus albus*)

Pycnidia (subepidermal in concentric rings on reddish-brown leaf spots with dark edges, or scattered on brown lesions on stems or pods), honey to light brown, later dark brown, variable in diameter 100–300 µm, but mostly 200–250 µm, globose to subglobose with one distinct, non-papillate ostiole. Usually, very large conidia predominate, which are 1–3-septate, ascochytoid-stagonosporoid and typical of the synanamorph *Stagonosporopsis lupini*: cylindrical with obtuse ends, mostly 15–30 × 5–9 µm. Some smaller, aseptate, phomoid conidia, 8–14 × 3–5 µm, are normally present as well. Sometimes, only 0–1-septate conidia are formed, which resemble those of *Phoma schneiderae* in vitro. Brown, unicellular chlamydospores can be present as well.

Ecology and distribution. This fungus is a specific, seed-borne pathogen of lupins, causing spots on leaves, stems and pods, and also occurring on roots. In South America, it is a serious problem in the cultivation of *L. mutabilis* (Frey & Yabar, 1983), while in North America it has been regularly found on perennial *Lupinus* spp. (e.g. Jones, 1942, Gordon, 1944 & Savile, 1947). In Europe, this fungus used to be known only from occasional findings on *L. arboreus* in England, but it has recently been isolated from the economically more important *L. albus* as well. The fungus occurred in January 1998 on autumn-sown white lupins cv. 'Lucyane' in Cambridgeshire, associated initially with leaf spots on cotyledons and progressing to cause leaf dieback and a stem base rot. The disease caused death of groups of plants within the crop. In view of this, the fungus should be regarded as a potentially dangerous organism to the cultivation of *L. albus* in continental Europe.

Representative culture. CBS 101494 (ADAS AR98/11, PD 98/5247) ex *Lupinus albus* (Leguminosae), United Kingdom.

Note. So far this pathogen has not been connected with a teleomorph. In the USA, a *Phoma*-anamorph has recently been found on overwintered lupin stems in close association with *Didymella lupini* (Cooke & Harkn.) Berl. & Voglino (Kaiser & Crous, 1998). The conidia of this anamorph show some resemblance with the aseptate conidia normally present together with the ascochytoid-stagonosporoid conidia of *Stagonosporopsis lupini*. However, cultural studies of *D. lupini* and its possible *Phoma*-anamorph have not been made by Kaiser & Crous.

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