

THE *PHOMA* ORGANISMS CAUSING GANGRENE OF POTATOES¹

De Phoma-organismen die het gangreen bij aardappels veroorzaken

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It is confirmed that the pigment-producing and pigment-free *Phoma* isolates of potato gangrene, known respectively as *Phoma foveata* and *Phoma exigua* (= *P. solanicola* = *P. tuberosa*), are morphologically indistinguishable. Having regard to the principles of classification in the Deuteromycetes and the reported greater pathogenicity to potato of the pigment-producing isolates it is proposed to designate this type of isolate as a separate variety: *Phoma exigua* var. *foveata* comb. nov. In the Netherlands this variety has been found only occasionally.

INTRODUCTION

In the last few years *Phoma* dry rot of potatoes, known as gangrene, has often been confirmed in the Netherlands (compare BOEREMA & VAN KESTEREN, 1962).

Some of our isolates of *Phoma* from gangrene lesions have shown a yellowish brown to reddish brown discoloration of the agar medium, e.g. malt agar, as described for *Phoma foveata* Foister. This pigment production is associated in old cultures with the appearance of yellow crystals. In Scotland, and also in Australia, gangrene is mainly caused by this pigment-producing organism.

Numerous other Dutch *Phoma* isolates from gangrene lesions, however, have not shown any pigment production or crystal formation. These pigment-free isolates are known under the synonyms *Phoma solanicola* Prill. & Del. and *Phoma tuberosa* Melhus *et al.* They occur not only on potatoes but also very commonly on all kinds of weak or wounded plants. MAAS (1965) has pointed out that the oldest valid name of this ubiquitous soil-borne organism is *Phoma exigua* Desm.

SIMILARITIES AND DIFFERENCES BETWEEN THE TWO KINDS OF ISOLATES

By comparing the pigment-producing and pigment-free *Phoma* isolates of potato gangrene in Britain and the United States, MALCOLMSON (1958) concluded that the two types cannot be satisfactorily distinguished by the characteristics of pycnidia and spores. Recently J. M. TODD, of the Department of Agriculture and Fisheries for Scotland, has confirmed MALCOLMSON's conclusion that the two types are microscopically identical (personal communication). Similarly in our own comparisons of the Dutch isolates of both types no morphological differences have been found. In Germany KRANZ (1963), on the other hand, considered it possible to distinguish the two types morphologically. He stated that the wall structure of the pigment-producing isolates (*P. foveata*) was prosenchymatous, while that of the pigment-free isolates (*P. solanicola* = *P. exigua*) was pseudoparenchymatous. We have found, however, that the wall structure is not a useful criterion, being highly influenced by the substratum and other growth conditions. This difficulty was also noted by KRANZ (l.c.),

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as he described the wall structure of *P. foveata* on potato haulm from the field as pseudoparenchymatous, and on isolated pieces of haulm ("Stengelstückchen") as prosenchymatous! Cultures of the two types show minor differences in growth habit, but this also appears to be variable and not a workable differentiating criterion. Thus *P. foveata* can be separated from *P. exigua* only by the pigment production and crystal formation in culture.

Recently BICK & RHEE (1966) have pointed out that the *foveata* pigment is composed of several anthraquinone pigments, viz. pachybasin, chrysophanol, emodin and phomarin. In our own experimental study it has been confirmed that the discoloration of the agar medium and the formation of crystals in cultures of *P. foveata* are due to the production of anthraquinone pigments. In acid conditions this complex of pigments becomes yellow and in alkaline conditions red. The presence of these pigments could not be demonstrated in cultures of *P. exigua*. Nevertheless the pigment and crystal production appeared to be a variable character: some colonies obtained by MALCOLMSON (l.c.) from (mono) spores out of a single picnidium of *P. foveata* did not produce any pigment. When we, also, subcultured the pigment-producing isolates through mycelial fragments or complete pycnidia the ability to produce pigment was often lost and the *foveata*-isolates could then no longer be distinguished from *P. exigua*.

In a comparative study TODD (see above) found that the *foveata*-isolates, besides producing pigment and crystals, differ from *P. exigua* in temperature requirements and pathogenicity. The pigment-producing isolates (*P. foveata*) are more pathogenic to potato tubers and more tolerant of low temperatures than the pigment-free isolates (*P. exigua*). The results of our own experiments are in conformity with the findings of TODD.

TAXONOMY AND NOMENCLATURE

We are dealing here with the artificial system of the Deuteromycetes (Imperfect fungi). The purpose of this artificial morphological system is to provide a practical method for identifying and naming the asexual states of fungi (form-species). This means, in our opinion, that a form-species must be based on clear, stable and workable characters. Such a form-species concept is thus rather broad. However, chaos is bound to arise if form-species are based on minor differences alone. If it is desirable to distinguish units with such minor differences we have to make use of an infraspecific taxon.

Therefore we think that it is in accordance with the principle of classification in the Deuteromycetes to consider the pigment-producing isolates (*P. foveata*) as a variety of the ubiquitous pigment-free *P. exigua*: Morphologically there are no substantial differences, but in culture the two types can generally be separated. The greater pathogenicity to potato of the pigment-producing isolates and the dominance of these isolates in certain potato-growing regions, make it desirable to distinguish these isolates nomenclatorically.

PHOMA EXIGUA Desm. var. *EXIGUA*

in Ann. Sci. nat. (Bot.) III, 11: 282-283. 1849; see also MAAS in Neth. J. Pl. Path. 71: 116-118. 1965.

syn. e.g.: *Phoma solanicola* Prill. & Del. in Bull. Soc. mycol. Fr. 6:179. 1890.

Phoma tuberosa Melhus, Rosenb. & E. S. Schultz in J. agric. Res. 7: 251. 1961.

Other synonyms of this organism will be published later in the mycological journal Persoonia.

Habitat: Ubiquitous soil-borne fungus occurring on all kinds of plants and in association with gangrene of potatoes.

PHOMA EXIGUA Desm. var. *FOVEATA* (Foister) Boerema comb. nov.

basionym: *Phoma foveata* Foister in Trans. Proc. bot. Soc. Edinb. 33: 66. 1940.

synonym: *Phoma solanicola* Prill. & Del. f. *foveata* (Foister) Malcolmson in Ann. appl. Biol. 46: 639. 1958.

Habitat: Associated with gangrene of potatoes. Occasionally also isolated from other plants.

SAMENVATTING

De pigment vormende en pigmentvrije *Phoma*-isolaties van gangreen bij aardappel, respectievelijk bekend als *Phoma foveata* en *Phoma exigua* (= *P. solanicola* = *P. tuberosa*), bleken morfologisch niet te kunnen worden onderscheiden.

Het pigmentvrije type (*P. exigua*) kan behalve van aardappel ook geïsoleerd worden van allerlei andere planten en kan gekarakteriseerd worden als een algemeen in de grond voorkomend organisme. Het pigment vormende type daarentegen is in zijn voorkomen blijkbaar min of meer beperkt tot de aardappel.

Uitgaande van het principe dat bij het kunstmatig systeem van de Deuteromycetes (Fungi Imperfecti) de soorten (vorm-soorten) gebaseerd moeten zijn op duidelijke morfologische kenmerken, zijn de beide typen te rekenen tot één en dezelfde soort. Mede vanwege de grotere pathogeniteit, die de pigment vormende stammen ten opzichte van aardappel vertonen, is voorgesteld dit fysiologisch afwijkend type aan te duiden als een aparte variëteit:

Phoma exigua var. *foveata* comb. nov.

In Nederland is deze variant tot nu toe slechts incidenteel bij aardappelgangreen aangetroffen.

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