

## NOTE

### Complex populations of minor pathogens associated with roots from barley plants infected by barley yellow mosaic virus<sup>1</sup>

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#### Abstract

The purpose of the present contribution is to describe the main fungi associated with roots of BaYMV infected barley.

*Polymyxa graminis* Led. is a vector of several soil-borne viruses of cereals and weeds, including barley yellow mosaic virus (BaYMV) (INOUE and SAITO, 1975). *P. graminis* was shown to be closely associated with other fungi found in young rootlets, root hairs and superficial cortical cells of wheat (NOLT *et al.*, 1981) or grasses, including *Lolium perenne* (LABRUYERE, 1979). These fungi cause little visual damage and have been called «minor pathogens». Although minor root pathogens may interact with the infection process of other pathogenic agents (SALT, 1979), and despite their possible role in BaYMV transmission, they attracted little attention so far.

The inoculation of the zoosporic fungus was done by planting 3-day-old seedlings of winter barley (cv. Gerbel) in a mixture (2:1) of sand and naturally infected soil (loam collected from a field where barley expressed characteristic BaYMV symptoms in the spring).

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Four seedlings disinfected by treatment for 2 min in  $\text{HgCl}_2$  (0.1%) and Manoxol OT (BDH; 2 ppm), were planted in each pot, soil moisture being kept saturated with water. Plants were maintained between 17°C and 22°C under natural light in a greenhouse.

Roots from the greenhouse inoculated plants and from BaYMV-infected plants from the field, were collected, washed in running tap water, and stained by boiling for 2 min in 0.033% cotton blue in lactophenol; they were then dipped for one day in lactophenol before microscopic observations.

Zoospores contained in a droplet of water in which infected roots had been soaked, were fixed by exposure to a solution of osmic acid (1% w./v.), dried, and then stained by adding an equal volume of a cristal violet solution (0,005%).

Three species of zoosporic fungi were most frequently observed in the roots of barley seedlings placed in naturally BaYMV-contaminated soil, or in the roots of BaYMV-infected plants collected from the field: *Polymyxa graminis*, *Olpidium brassicae* (Wor.) Gang and *Lagena radicola* Vanderpool and Led.

Zoosporangia and vegetative plasmodia of *P. graminis* were observed after staining with cotton blue, in roots of seedlings grown in contaminated soil, but not in sterilized soil (Fig. 1). Clusters of resting spores of *P. graminis* were observed in unstained root cells of the plants about 20 days after potting in contaminated soil (Fig. 2), as in those of the plants directly collected from the field. When rootlets of plants with zoosporangia or mature resting spores of *P. graminis* were kept in water, they released biflagellate zoospores (Fig. 3) which could be confused with the zooflagellate *Cercobodo* (HOLLANDE, 1952).

With *O. brassicae*, infection of roots of either seedlings, or BaYMV-infected plants from the field, resulted in the formation of stellate resting spores (Fig. 4), about 25  $\mu\text{m}$  in diameter, often closely packed in the host cells.

The zoosporic fungi *Rhizophidium graminis* Led. and *Ligniera pilorum* Fron. and Gaillat, were occasionally observed. *L. pilorum* induced a swelling of infected root hairs in a number of seedlings (Fig. 5). *R. graminis* was observed as zoosporangia outside host cells, as well as resting spores attached to swollen empty cells, as described by Ledingham (1936).

The Oomycete *L. radicola* showed thalli which were attached to the point of penetration by a collar (Fig. 6); such infection resulted in the formation of a zoospore.

Finally, dark sclerotia of a Deuteromycete identified as *Phialophora radicola* Cain (Fig. 7) were often present in (or near) vascular tissues of the barley roots, in close association with lignitubers (Fig. 8).

Our observations show the complexity of the populations of minor pathogens associated with roots of field BaYMV-infected barley plants, and of barley seedlings grown in a contaminated soil.

Although barley yellow mosaic is recognized as a fungus transmitted soil-borne viral disease, there is no experimental proof concerning the identity of its vector(s). Indeed, the obligate parasite nature of *P. graminis* has hampered undubious demonstration of its involment as BaYMV vector. Because of the lack of pure or axenic culture of the fungus, evidence for its role as vector had been deduced from correlations between fungal and virus infection (INOUE and SAITO, 1975). The high water soil content required for optimal BaYMV transmission explains why zoosporic fungal parasites were considered as possible vector, since these fungi are commonly found in cool moist condition, in association with barley roots of infected plants.

A complex population of minor pathogens is also present in the roots of wheat plants infected by the wheat spindle streak mosaic virus (SLIJKHUIS and BARR, 1978). In this case, when isolates of each species of the zoosporic fungi were placed in soil surrounding the roots of sap-inoculated wheat plants, the virus was transmitted only by sand mixed with roots from plants infected with *P. graminis* (SLIJKHUIS and BARR, 1978). Such single sporangial or unifungal isolates have not been reported so far for *P. graminis* on barley.

Recently, using immuno-microscopy, LANGENBERG and VAN DER WAL (1986) did not find any virus particles in close relation with either *P. graminis*, or *Lagena sp.*. The results do not so far exclude the latter fungus as a possible vector of BaYMV.

#### Remerciements

Ce travail a été réalisé dans le cadre d'une recherche subventionnée par l'Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture (I.R.S.I.A.).

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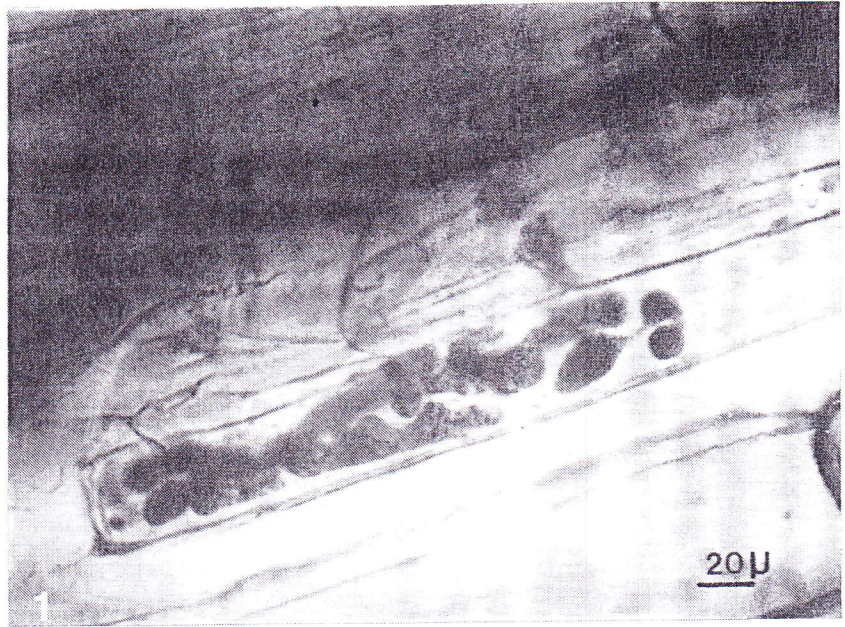


Fig. 1. — Vegetative plasmodia of *Polymyxa graminis*

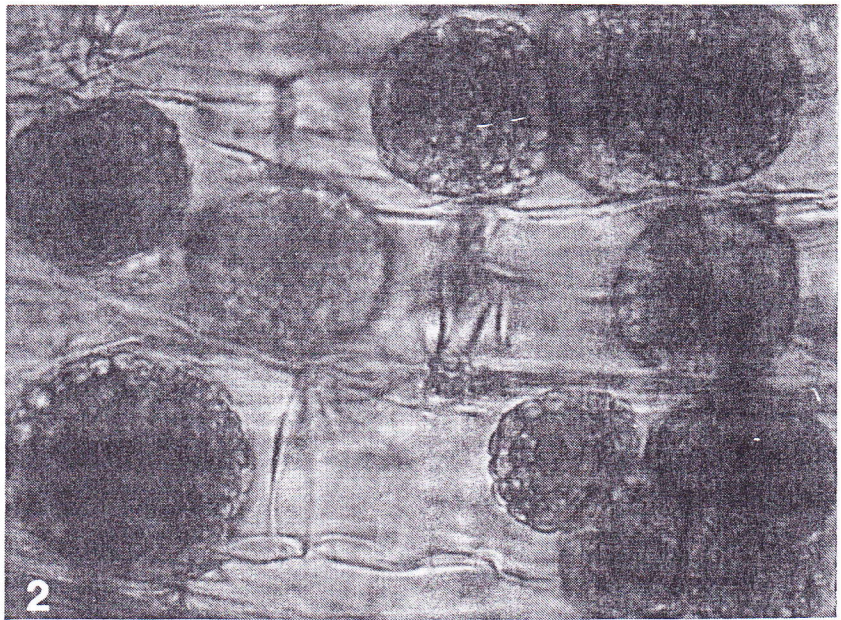


Fig. 2. — Clusters of resting spores of *P. graminis*.

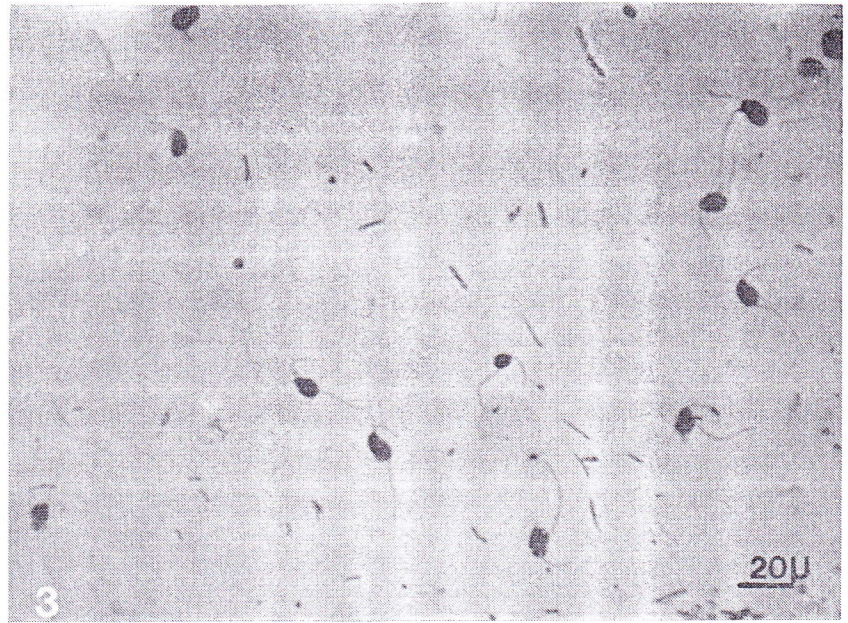


Fig. 3. — Biflagellate zoospores released from roots infected with zoosporangia or mature resting spores of *P. graminis*

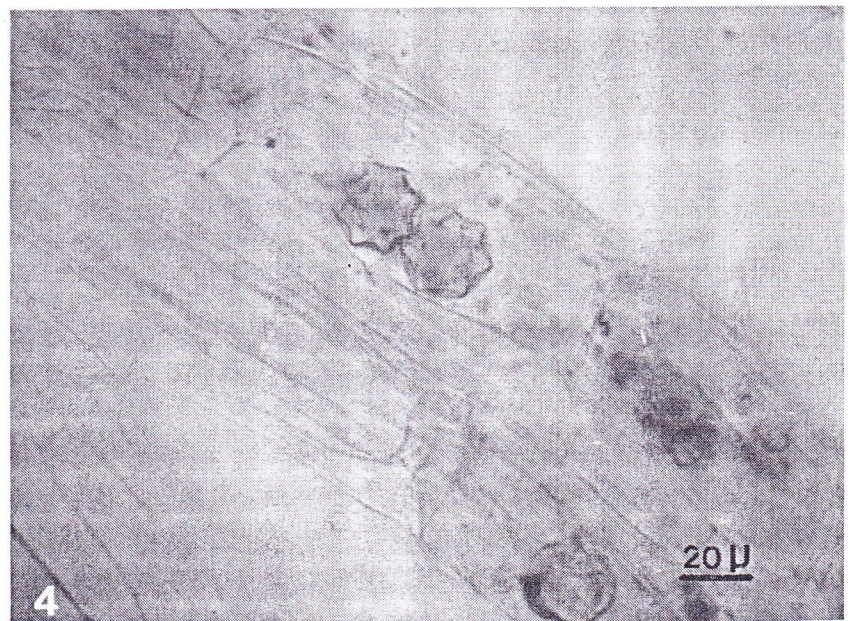


Fig. 4. — Stellate resting spores of *Olpidium brassicae*.

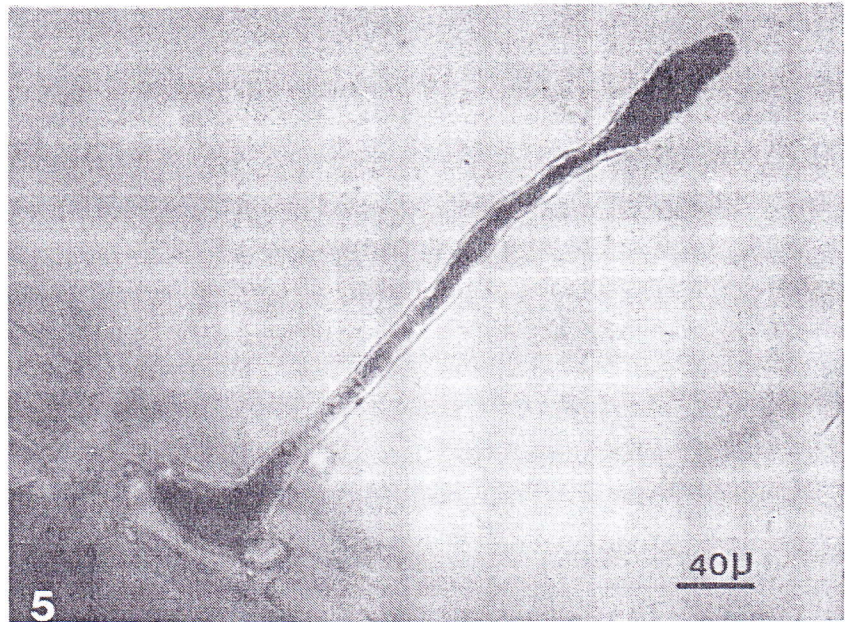


Fig. 5. — Swelling of a root hair induced by *Ligniera pilorum*

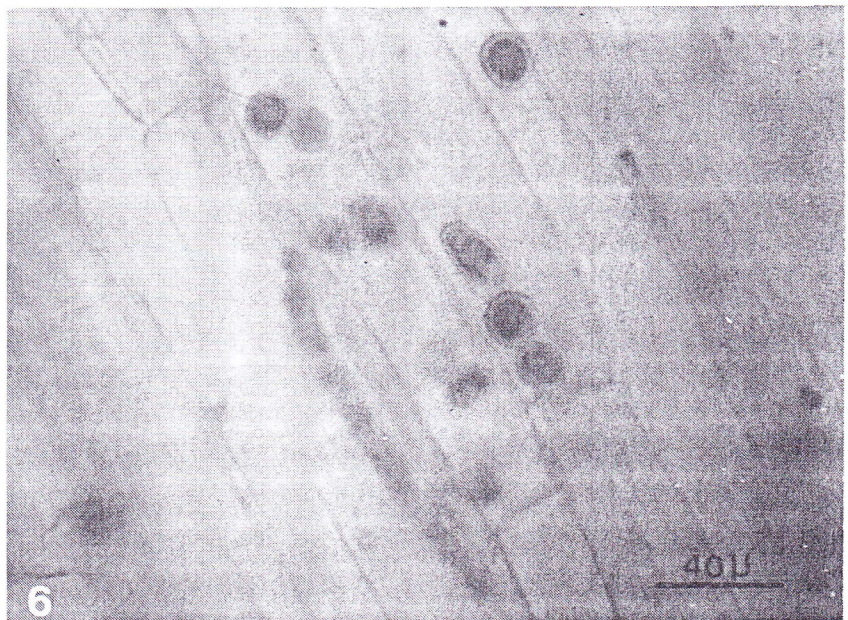


Fig. 6. — Thallus and oospores of *Lagena radiceola*

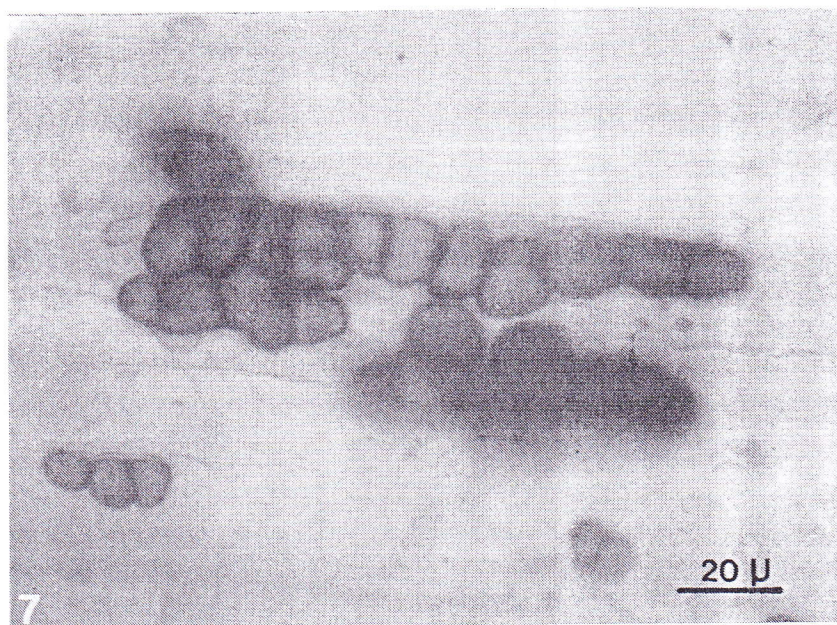


Fig. 7. — Dark sclerotia of *Phialophora radicicola*

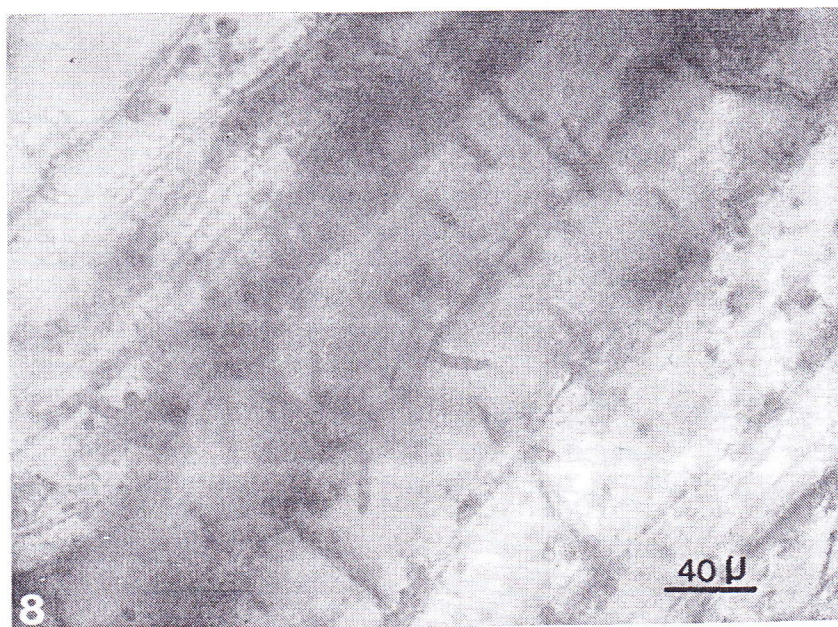


Fig. 8. — Lignitubers associated with infection of roots with *P. radicicola*.



## Divers — Varia

### NEDERLANDSE TERMINOLOGIE OP HET GEBIED VAN GEWASBESCHERMING

In het recente verleden zijn twee terminologielijsten verschenen op het terrein van de gewasbescherming.

1° « Lijst van gewasbeschermingskundige termen » uitgegeven door de « Commissie voor terminologie van de Nederlandse Plantenziektkundige Vereniging » (64 pagina's).

2° « Terminologie op het gebied van de onkruidkunde voor het Nederlandse taalgebied » (COTONT)(22 pagina's). De beide brochures zijn verkrijgbaar resp. bij :

1° de Nederlandse Plantenziektkundige Vereniging, postbus 31-6700 AA Wageningen (Nederland)

2° COTONT per adres CABO, postbus 16, Wageningen (Nederland).

Naast deze lijsten over terminologie zijn er ook lijsten verschenen over Nederlandse namen van plantenziekten:

- bij landbouwgewassen (verschenen in n° 10/1 van Gewasbescherming januari 1979)
- bij bloembolgewassen (verschenen als supplement n° 1 van Gewasbescherming 18 juli 1987)
- bij gekweekte houtgewassen (verschenen als onderdeel n° 2 van Gewasbescherming 1972)
- bij fruitgewassen (verschenen als onderdeel n° 1 van Gewasbescherming 1973)

Deze laatste vier lijsten zijn eveneens nog verkrijgbaar bij de Nederlandse Plantenziektkundige Vereniging.

De V.O.Fy.To.Z./A.E.R.Z.A.P. wenst de bekendheid van deze lijsten zoveel mogelijk te stimuleren. Hierdoor willen we het gebruik van de juiste terminologie in ons vakgebied bevorderen en ongewenste terminologie vermijden.

De termen in de lijsten zijn gerangschikt in alfabetische volgorde en na elke term bevindt zich de nodige uitleg. Ook ongewenste termen zijn in de lijsten opgenomen. De namenlijsten zijn hoofdzakelijk per waardplant gerangschikt met bijkomende registers achteraan.

In beide commissies kwam de terminologielijst tot stand door een samenwerking van Nederlanders en Vlamingen.

De Voorzitter v.d. V.O.Fy.To.Z.

O. KAMOEN

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