LESION NEMATODE INVOLVEMENT IN POTATO EARLY DYING DISEASE

Richard M. Riedel and Randall C. Rowe

Abstract

Ohio field studies in microplots in the past 6 years have demonstrated a synergistic interaction of the lesion nematode Pratylenchus penetrans with Verticillium dahliae in potato early dying. Tests with various populations of P. penetrans and V. dahliae, alone and in combinations, have shown that disease occurs when both pathogens are present at populations which individually have little or no effect. Yield loss is not necessarily associated with foliar symptom development, but occurs with the addition of high temperature stress during tuberization. Comparative studies with two other species of Pratylenchus commonly found in Ohio potato soils have shown that P. crenatus does not interact with V. dahliae and that P. scribneri interacts only slightly. Since all three species feed and reproduce well on potato, Verticillium interactions probably are not due to wounding. The involvement of Pratylenchus with V. dahliae in potato early dying is an important factor that must be considered in the development of future crop-loss predictive systems.

Resumen

Estudios de campo, en microparcelas, en Ohio han demostrado una interacción sinérgica entre el nematodo de la lesión radicular Pratylenchus penetrans y Verticillium dahliae en la muerte prematura de la papa (MPP). En pruebas con varias poblaciones de P. penetrans y V. dahliae, solos o en combinaciones, se ha demostrado que la enfermedad ocurre cuando ambos patógenos están presentes en densidades de población que separadamente tendrían poco o ningún efecto. La pérdida de rendimiento no está necesariamente asociada con el desarrollo de síntomas foliares, pero ocurre cuando se presenta estrés por temperatura alta durante la tuberización. En estudios comparativos con otras dos especies de Pratylenchus comúnmente encontrados en suelos donde se cultiva papa en Ohio, se ha demostrado que P. crenatus no interactúa con V. dahliae y que P. scribneri interactúa levemente. Como las tres especies se alimentan y reproducen bien en papa, las interacciones con Verticillium probablemente no se deben a las lesiones.

1Department of Plant Pathology, The Ohio State University, Columbus, OH 43210 and Wooster, OH 44691.

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Las vinculaciones entre *Pratylenchus* y *V. dahliae* en la MPP son un factor importante que debe ser considerado en el desarrollo futuro de sistemas para predecir pérdidas en el cultivo.

Field experiments demonstrating control of potato early dying disease (PED) with fumigant and non-fumigant nematicides (4, 14, 16), neither group of chemicals having marked fungicidal activity, have suggested that vascular infection by *Verticillium* spp. is not the sole cause of this disease. Activity of nematicides, and studies which have implicated nematodes, particularly lesion nematodes (*Pratylenchus* spp.), in predisposing host plants to vascular wilt fungi (7, 11, 12, 13), have led to the supposition that PED is a complex disease involving interactions of *Verticillium* and *Pratylenchus* species.

The primary elements for such an interaction are commonly available in most soils regularly cropped to potato in the eastern U.S. and Canada. Surveys of potato soils (3, 5, 8) have commonly reported lesion nematodes, *Pratylenchus penetrans* being the most prevalent species. *Pratylenchus crenatus* and *P. scribneri* are also commonly found; others, including *P. neglectus, P. alleni,* and *P. vulnus,* are less common. A recent survey of Ohio potato soils for *Verticillium dahliae* found this fungus commonly distributed, but at populations rarely exceeding 10 cfu/g of air-dried soil (15). *Verticillium* spp. are widely distributed in most potato production soils because the pathogen is readily carried on seed potatoes and increased with regular cropping (9).

Detailed studies on potato early dying were initiated in Ohio in the late 1970’s to evaluate the interaction of these two organisms and their effects on potato yield. Earlier greenhouse studies (12) had demonstrated the ability of *P. penetrans* to hasten the onset of *Verticillium* wilt in pot-grown potatoes, but the nature of these experiments precluded determination of yield effects. For our studies, which are still in progress, we chose a field microplot technique allowing us to evaluate this interaction under field conditions while maintaining maximum control over pathogen variables.

Prior to establishment of microplots each spring, plot areas are fumigated in early May, 3-4 weeks before planting, with a 3:2 mixture of methyl bromide:chloropicrin. The fumigant (465 Kg/ha) is injected under continuous plastic tarp when soil temperature at 20-cm injection depth has reached a minimum of 13 C. Tarps are removed 10-14 days later to allow soil aeration.

Following tarp removal, fumigated soil is collected and returned to the laboratory for controlled infestation. Unglazed, clay field tiles (25 cm ID × 30 cm long) are then set by hand at plow depth (25 cm), leaving ca. 5 cm exposed above the soil line. Previously collected, fumigated soil is infested in the laboratory with known populations of nematodes, *Verticillium*