VERTICILLIUM CHLAMYDOSPORIUM, FUNGAL PARASITE OF *MELOIDOGYNE ARENARIA FEMALES.*

G. Morgan-Jones, G. Godoy and R. Rodríguez-Kábana
Department of Botany, Plant Pathology and Microbiology, Auburn University Agricultural Experiment Station, Auburn, Alabama 36849, U.S.A.

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ABSTRACT

Morgan-Jones, G., G. Godoy and R. Rodríguez-Kábana. 1981. *Verticillium chlamydosporium,* fungal parasite of *Meloidogyne arenaria* females. Nematropica 11: 115-120.

Verticillium chlamydosporium Goddard is reported as a parasite of females and eggs of the root-knot nematode *Meloidogyne arenaria* (Neal) Chitwood in an Alabama peanut-field soil.

Additional key words: nematode pathology, soil fungi, biological control.

RESUMEN

Morgan-Jones, G., G. Godoy, y R. Rodríguez-Kábana. *Verticillium chlamydosporium,* un parásito fungoso de hembras de *Meloidogyne arenaria.* Nematrópica 11: 115-120.

El trabajo informa sobre la presencia de *Verticillium chlamydosporium* Goddard como parásito de hembras y huevos del nematodo nodulador *Meloidogyne arenaria* (Neal) Chitwood en un suelo de un campo de maní en Alabama.

Palabras claves adicionales: patología de nematodos, hongos del suelo, control biológico.

INTRODUCTION

The hyphomycete *Verticillium chlamydosporium* Goddard, which was originally isolated from clay loam garden soil at Ann Arbor, Michigan (6), has been repeatedly encountered in Alabama as an endogenous parasite of females and eggs of the root-knot nematode *Meloidogyne arenaria.* The fungus, judging from available literature reports, appears to be quite widespread in geographical distribution but it is evidently not common in most soils. Petch (10) encountered it as mycelium forming a thin powdery film over

the eggs of the snail *Achatina fulica* in Sri Lanka (then Ceylon) where it reportedly interfered with breeding experiments and described it under the name *Stemphyliopsis ovorum* Petch. Kamyschko (7) recorded it from soil in the U.S.S.R. and named it *Diheterospora heterospora* Kamyschko. It acquired another name, *Pochonia humicola* Batista and Fonseca, when these authors reported its occurrence in soil in several states in northeastern Brazil (2) and yet another, *Dictyoarthriniopsis kelleyi* Dominik and Majchrowicz, when isolated from soil in Guinea, Africa (4). Barron and Onions (1) reported isolates from rhizosphere of wheat in England, from pasture soil in New Zealand and from soil in British Columbia, Canada. Gams (5) added records from soils in France and West Germany. More recently Willcox and Tribe (13), Bursnall and Tribe (3) and Tribe (12) reported *V. chlamydosporium* to be a principal egg parasite of the cyst nematode *Heterodera schachtii* Schmidt in a number of European countries while Stirling (11) noted the fungus [as *Diheterospora chlamydosporia* (Goddard) Barron and Onions] to occur in brown cysts of *Heterodera avenae* Wollenweber collected during the summer in south Australia.

MATERIALS AND METHODS

Dothan sandy loam soil infested with root-knot nematode (*M. arenaria*) was collected from a field at the Wiregrass Substation, Headland, Alabama. The field had been in peanut monoculture for the preceeding eight years. The soil was brought into a greenhouse and potted. Pots were planted with Rutgers tomato and after a period of two months roots were collected from the pots. Galls from roots were removed, rinsed in running tap water for 24 hours followed by three serial washings in sterile distilled water. Galls were then carefully split open with sterile, sharp-pointed forceps to fully expose females which lay within and subsequently plated on 2% colloidal chitin agar containing mineral salts (Rodríguez-Kábana and Morgan-Jones, unpublished) with added streptomycin sulphate (100 ug/ml) in Petri dishes. Plates were incubated at 25 C for three days and examined for growth of fungal hyphae. Females from agar plates where fungal growth was evident were removed to a drop of lactophenol-cottonblue on a microscope slide and gently pulled apart between needles followed my microscopic examination.

RESULTS

Of twelve female-containing galls plated out on chitin agar, nine yielded colonies of *Verticillium chlamydosporium*. The fungus was in all cases readily identified by its production of highly distinctive dictyochlamydospores as well as verticillate chlamydospores (Fig. 1). Microscopic examination of females from galls which produced fungal colonies showed abundant endogenous hyphae and chlamydospores to be present. The majority of their eggs were infected and fully engorged by fungal hyphae. Some eggs appeared convoluted with their walls at least partially lysed and chlamydospores were

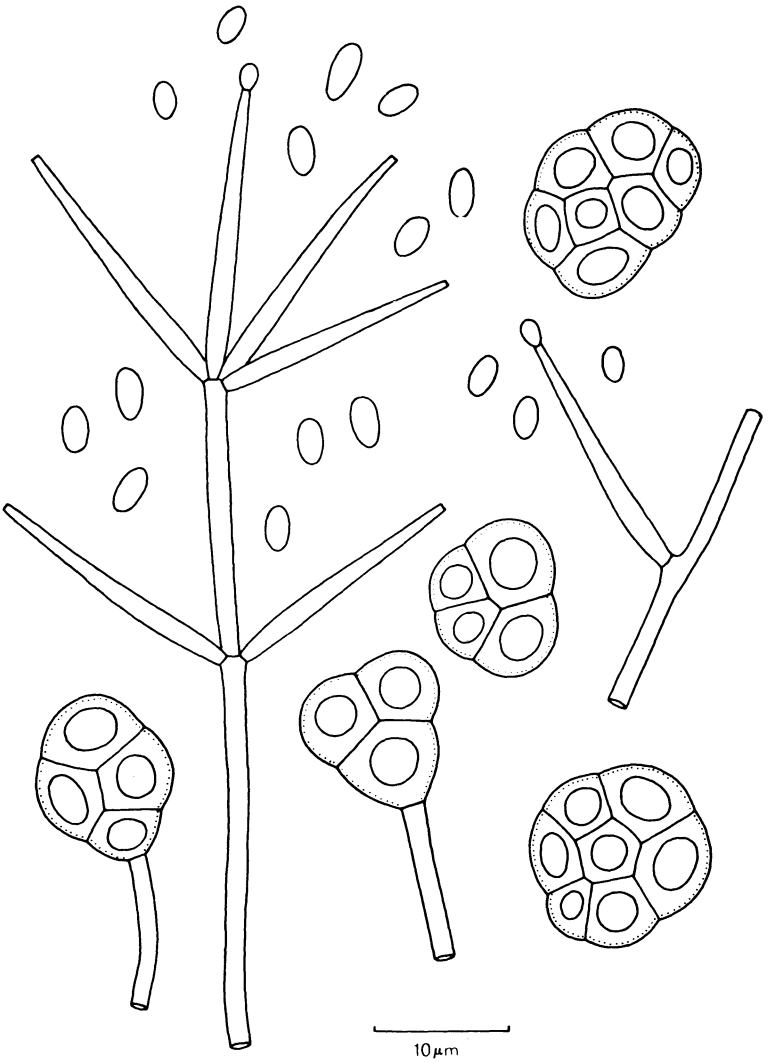

Figure 1. *Verticillium chlamydosporium*. Conidiophores, conidia and chlamydospores.

observed within several. Infected eggs were pale, yellowish-brown in color and in most no trace of a larva could be discerned.

DISCUSSION

It is evident that *V. chlamydosporium* has a pathogenic relationship with invertebrates. It is reported herein as an effective parasite of maturing females and eggs of *Meloidogyne arenaria* for the first time. Its pathogenicity appears to extend to healthy eggs developing within the females although it is by no means easy to determine the prior physiological condition of invaded eggs. At what stage of female maturation penetration occurs is not presently known. In regard to pathogenic potential *V. chlamydosporium* is clearly more effective than is the case with a number of opportunistic fungi that are thought to have capability of infecting eggs predisposed to attack by physiological disorder such as leakage. *V. chlamydosporium* can certainly be considered a fungus which might well be operative as a biological control agent of nematodes in certain soils. It should be noted, however, that Willcox and Tribe (13), although finding the fungus as an endogenous parasite of eggs of *Heterodera schachtii* with some frequency, failed to demonstrate but a limited degree of pathogenicity in experimental infection tests. Bursnall and Tribe (3) reported positive but low degrees of re-infection of *H. schachtii* by *V. chlamydosporium* in potting soil tests. Determination of the exact prerequisite conditions for successful infection is clearly difficult given the number of possible variables; quantity of inoculum supply, condition of plant hosts, presence or absence of potential antagonists, condition of the nematode, and the complexity of the soil habitat.

Repeated attempts have been made by us to extract eggs and egg masses directly from soil samples taken from peanut-field soil at the Wiregrass Substation during winter and spring months. Each time none or very few eggs have been recovered. This is puzzling in view of the fact that relatively high populations of larvae of *M. arenaria* are present during the peanut growing season. We believe that some measure of biological control is in place in such soils. It seems possible that *V. chlamydosporium* may at least play a part in this in the peanut-field soil studied by us.

It is of interest to note that *V. chlamydosporium* has not, as yet, been found to be associated with cysts of *Heterodera glycines* Ichinohe in Alabama and elsewhere in the United States during surveys conducted by Morgan-Jones and Rodríguez-Kábana (8) and Morgan-Jones et al. (9). Since it is now known to occur here this is somewhat surprising. Two other species also belonging to section *Prostrata* W. Gams, of the genus *Verticillium* Nees per Link, *V. lamellicola* (F.E.V. Smith) W. Gams and *V. leptobactrum* W. Gams, have, however, been found in cysts of *H. glycines*. Colonies of all three species are chitinolytically effective in clearing chitin agar plates.

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