FUNGI ASSOCIATED WITH CYSTS OF *HETERODERA GLYCINES* IN THE CAUCA VALLEY, COLOMBIA

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RESUMEN

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Resultados de un reconocimiento de los hongos asociados con quistes de *Heterodera glycines* Ichinohe en el valle del Cauca en Colombia, región donde no se conocía el nematodo antes de 1982, señalaron la presencia de una micoflora relativamente reducida en número de especies. Los quistes para el estudio se obtuvieron de suelos de campos con soya (*Glycine max* (L.) Merr.) asi como de otros con frijol (*Phaseolus vulgaris* L.), todos en las cercanias de Palmira. Las especies fungosas de más predominancia fueron: *Fusarium equiseti* (Corda) Sacc., *F. lateritium* Nees, *F. moniliforme* Sheld., *F. oxysporum* Schlecht., *F. solani* (Mart.) Sacc., *Geotrichum candidum* Link, *Gliocladium catenulatum* Gilman & Abbott, *G. roseum* Bain., *Paecilomyces lilacinus* (Thom) Samson, *Phoma medicaginis* Malbr. & Roum. var. *pinodella* (L. K. Jones) Boerema, *Memnoniella echinata* (Riv.) Galloway y *Trichocladium asperum* Harz. También se observó la presencia de *Stagonospora heteroderae* Morgan-Jones in ed., especie que ya había sido encontrada con anterioridad en asociacion con quistes de *H. glycines* en los E.E.U.U. Mas de un tercio de los quistes examinados estaban colonizados por hongos.

Palabras claves adicionales: combate biologico, manejo de plagas, ecologia de nematodos, dinamica poblacional.

The soybean cyst nematode, *Heterodera glycines* Ichinohe, was recently reported for the first time from South America by Tovar and Medina (10). It was found to occur in relatively high densities in soils on soybean and dry bean producing farms in the vicinity of the towns of Candelaria and Palmira, located in the Cauca Valley, Colombia. It occurred at lower densities in other locations elsewhere in the valley between Cali and Bugalagrande. It is assumed that the nematode was inadvertently introduced to this geographical area, possibly through seed transportation. The nematode is now clearly well established and there

is evidence that it is spreading throughout the Cauca Valley, an area where some 47,000 ha are under soybean and 3,000 under dry bean cultivation.

Surveys conducted in the southeastern United States and elsewhere (2,5,6,7,11,12) have documented the association of a taxonomically diverse mycoflora of opportunistic soil fungi, belonging mainly to the form-class Hyphomycetes, with females, cysts, and eggs of species of *Heterodera* Schmidt. Cysts of *H. avenae* Wollenw., *H. glycines,* and *H. schachtii* Schmidt are known to be regularly colonized by a restricted group of fungi and assumptions have been made that these play a role in regulating cyst nematode population levels. The fact that the composition of the associated mycofloras is much the same, irrespective of cyst nematode host and geographical location, leads us to deduce the presence of some measure of specialization. The surveys reported to date have been based on cysts derived from soils where the nematode and indigenous fungi had co-existed for a relatively long period of time. Whether or not lengthy co-habitation of the same ecosystem, and/or selection pressures related to capacity to colonize cysts, result in the predominance of particular fungi, or biotypes of individual species, is unknown. The Colombian circumstances, where a cyst-nematode had recently been introduced, provided an opportunity to determine if elements of the autochthonous soil mycoflora could colonize its cysts a short time after its arrival.

At a number of locations, soil samples were collected in November 1983 from fields known to be infested with *H. glycines,* particularly in the vicinity of Palmira, where the highest nematode population densities had previously been encountered (10). Cysts were extracted by suspending air-dry soil in water followed by passage of the suspension through a 100-mesh stainless steel sieve. Cysts were subsequently placed in a Petri dish with water. Undamaged individual brown cysts were carefully picked under a 15X stereoscan microscope with a sharp-pointed fine tissue forceps and transferred to Petri dishes containing sterile distilled water. Cysts derived from a number of soil samples obtained at several sites at La Floresta and Villa Fatima farms were combined to make a total composite of 600 for examination. An additional 300 cysts were selected from several soil samples obtained from Instituto Colombiano Agropecuario (ICA) experimental plots at Molina. All soils had been cropped with soybean and/or dry bean, some in rotation with tobacco and tomato. The cyst batches for study were removed in turn to a Nalgene® (Fisher) membrane filter unit and surface sterilized by the procedure described previously (7). Following this treatment, cysts were plated, four per dish, onto chitin agar (3) with streptomycin (100 μg/ml) in Petri dishes. Following

Table 1. Fungal colonization of cysts of *Heterodera glycines,* Cauca Valley.

Location: La Floresta and Villa Fatima, Palmira; 600 cysts
[379 bore no fungi = 63.17%]

Species	No. colonized cysts	% frequency
Aspergillus niger	4	0.67
Curvularia lunata	8	1.33
Fusarium equiseti	10	1.67
Fusarium lateritium	5	0.83
Fusarium moniliforme	11	1.83
Fusarium oxysporum	42	7.00
Fusarium solani	59	9.83
Geotrichum candidum	13	2.17
Gliocladium catenulatum	9	1.50
Gliocladium roseum	17	2.83
Memnoniella echinata	7	1.17
Paecilomyces lilacinus	13	2.17
Phoma medicaginis var. *pinodella*	4	0.67
Sagenomella levispora	6	1.00
Stagonospora heteroderae	9	1.50
Trichocladium asperum	4	0.67

Location: ICA, Molina; 300 cysts
[181 bore no fungi = 60.30%]

Species	No. colonized cysts	% frequency
Aspergillus fumigatus	6	2.00
Fusarium oxysporum	46	15.33
Fusarium solani	27	9.00
Geotrichum candidum	11	3.67
Gliocladium roseum	14	4.67
Penicillium verrucosum	3	1.00
Scopulariopsis brevicaulis	5	1.67
Stagnonospora heteroderae	7	2.33

incubation for 5 days at 25 C, plates were examined for the presence of fungal colonies.

Nineteen different fungal species were encountered associated with cysts (Table 1). In all instances, where a cyst was colonized, only one fungal taxon appeared to be present, suggesting that once the ecological niche is occupied, entry by a second species is debarred. A similar situation has been noted in a previous study (7). It is possible that two or more fungi might have been present in a single cyst but that one assumed dominance and overgrew others. However no evidence of this was observed in our studies.

The predominance of species of *Fusarium* Link, especially *F. oxysporum* Schlecht., and *F. solani* (Mart.) Sacc., was not unexpected since members of this genus, and these species in particular, have invariably been implicated as cyst colonizers in previous studies (1,2,6,7). *Fusarium oxysporum* and *F. solani* are also known to be capable of colonizing eggs of both *Heterodera* and *Meloidogyne* Goeldi (4,8,9). *Fusarium equiseti* (Corda) Sacc., and *F. lateritium* Nees have been previously recorded as cyst colonizers in the U.S.A. (7), although occurring in low numbers as was the case in this study.

Species of other genera encountered in this study at frequencies of over 2% of the total cysts examined are, likewise, entities previously documented to be associated with cysts elsewhere. It is becoming increasingly noteworthy that the same fungi regularly recur as more studies are conducted. The frequent occurrence of such species as *Geotrichum candidum* Link, *Gliocladium catenulatum* Gilman & Abbot, *G. roseum* Bain., and *Paecilomyces lilacinus* (Thom) Samson indicates that their association with nematode cysts is more than just incidental. The finding of *Stagonospora heteroderae* Morgan-Jones in ed. (a species currently being described) in some of the Colombian cysts is of interest since this was found previously in some quantity in cysts from four separate states of the U.S.A. (7). This again indicates the presence of a mycoflora peculiar to the cyst, irrespective of geographical origin.

The study reported in this research note has suggested that elements of a pre-existing soil mycoflora can become quickly associated with and colonize cysts of a newly introduced nematode.

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