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Microcosm experiments on the development of different plant parasitic nematode fauna in two soils from the Soudanese-Sahelian zone of West Africa

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Abstract To test the hypothesis that the structure of plant parasitic nematode communities is affected by soil charac-
teristics, experiments were conducted in a greenhouse with

Introduction

The host plant is the most important determinant of the

Table 1 Physicochemical characteristics of the two soils (0–10 cm depth stratum)

Parameters	Fine-textured soil (fallow soil)	Coarse-textured soil (cultivated soil)
pH (H_2O)	5.7	6.0

[redacted]

Fi(FC)/10–autoclaved fine-textured soil inoculated with 1/10 of total nematode fauna of the fallow plus 1/10 of total nematode fauna of the field

FiT–autoclaved fine-textured soil inoculated with *Tylenchorhynchus gladiolatus*

For the coarse-textured soil, the treatments will be named, respectively, Cc, CiC, CiF, Ci(FC)/10, CiT.

[redacted]

Results

Final structure of the nematode fauna

Whereas the free-living nematodes were dominant in the original nematode fauna (more than 75% of the total nematode number), plant parasitic nematodes were more abundant than free-living nematodes in five of the eight treatments after 56 days (Table 3).

The final structure of the whole nematode fauna from the fallow did not differ in the two soils: the final total density of plant parasitic nematodes, minor plant feeder nematodes and free-living nematodes was similar in treatments FiF and CiF (Table 3). However, for the other three inocula, a greater abundance of the three ecological nematode categories was obtained in the coarse-textured soil when compared to the fine-textured soil.

Multiplication rates of the plant parasitic nematodes

H. dihystera failed to reproduce in any of the treatments:

Mixture of fallow and cultivated inoculum		Pot culture of *T. gladiolatus*	
Fine textured Fi(Fc)/10	Coarse textured Ci(FC)/10	Fine textured FiT	Coarse textured CiT
28	22 NS	0	0
0.49	0.37 NS		
3.76	0.64 *	0.00	0.00
45	75	0	0
0.78	1.33 *		
6.04	2.20	0.00	0.00
670	3320 *	3185	17965 **
96	474 *	36	202
89.9	97.2	100.0	100.0
745	3415 *	3185	17965 **
165	405 *	0	0
1580	4790 **	2180	5650 **

ot significant

[redacted]

number of *S. cavenessi* was not different in the two soils, but the number of *T. gladiolatus* was about 40 times higher in the coarse-textured soil.

When *S. cavenessi* and *H. dihystera* were inoculated together in low density with *T. gladiolatus* (treatments Fi(FC)/10 and Ci(FC)/10), the final number of *H. dihystera* did not differ in the two soils, whereas the number of *T. gladiolatus* and *S. cavenessi* were higher in the coarse-textured soil than in the fine-textured soil (Table 3).

Influence of the different nematodes assemblages on millet production

In the control without nematodes the mean dry weight of millet shoots in the cultivated soil was 48% of that in the fallow soil (Table 4). In the fallow soil, the only nematode fauna that resulted in a decrease in total millet dry weight when compared to the control was the pure *T. gladiolatus* population. All nematode communities (except the nematode fauna from the fallow soil) caused reduced millet dry weight in the coarse-textured soil. The reduction of total plant weight in the coarse-textured soil was mainly due to the decrease in root weight. *T. gladiolatus*, inoculated alone, induced nearly identical yield loss in the fallow and cultivated soil relative to the control (Table 4), while the final density of this species was significantly lower in the fine-textured soil, one-fifth of the density in the coarse-textured soil.

Discussion

Soil characteristics and plant-feeding nematodes final densities

In this experiment, we tested the influence of two soils on the transformation of different nematode fauna during a cropping cycle with a test plant. The differences in the soil characteristics resulted from management effects but above all from the position of the two plots in the toposequence; consequently the effects of the soils on the nematodes fauna are to be related to physical and chemical characteristics more than to anterior management practices. However, the original nematode communities used were linked to the natural vegetation present.

A critical difference between the two soils was the soil texture. The clay content was threefold higher in the fallow soil than in the cultivated soil. Carbon and nutrient contents were also higher in the fallow soil. Soil organic matter and nutrient content are usually correlated with clay content because organic matter is associated with clays, forming a stable organomineral complex (Feller et al. 1991).

Soil texture can influence nematode populations by facilitating or restricting the movement of nematodes toward roots or, in the case of amphimictic species, toward a mate (Norton 1989; Hassink et al. 1993). Differences in textural and nutrient properties of soil may consequently affect the quality of roots for nematode feeding. Differences in root quality may include different penetration rates (affecting the availability of feeding sites) and different nutritive contents (affecting the quality of feeding sites). Such differences may modify the quantity and quality of resources

Our results that we obtained with three species, *S. cavenessi* (amphimictic, migratory endoparasite), *T. gladiolatus* (amphimictic, migratory ectoparasite) and *H. dihystera* (parthenogenetic, ectoparasite), suggest that differences in [redacted]

fine-textured soil allowed higher total plant production than the coarse-textured soil. Higher available nutrient and organic matter contents explained these different potentialities.

[redacted]

cies of plant parasitic nematodes. Furthermore, these results apply only to the microcosm experiment where no microarthropodes, protozoans, fungi and bacteria had been inoculated.

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