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Host preferences of plant parasitic nematodes associated with growth variability problem of groundnut in Niger

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Abstract. A host suitability study of the important and widely distributed species (*Scutellonema clathricaudatum*, *Xiphinema parasetariae*, *Tylenchorhynchus* spp. and *Paralongidorus bullatus*) was conducted in Sahelian zone of West Africa. Thirteen crop species: bamabara groundnut (*Voandezeia subterranea*), cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogaea*), maize (*Zea mays*), pearl millet (*Pennisetum glaucum*), pigeonpea (*Cajanus cajan*), sesame (*Sesamum indicum*), sorghum (*Sorghum bicolor*), stylo (*Stylosanthes fruticosa*, *S. hamata*), sunflower (*Helianthus annuus*), *Vigna aconitifolia* and *Vigna radiata*. All the plant species tested were host of *S. clathricaudatum*; pearl millet was an excellent host whereas sorghum and *Stylosanthes hamata* were poor hosts. Based on the nematode densities in soil at harvest, sorghum and maize were the two preferred hosts of *Tylenchorhynchus*. Populations of *Xiphinema parasetariae* were greatest on sesame and pigeonpea. *Stylosanthes* spp. had the lowest infestation by this species and were poor hosts. *Paralongidorus bullatus* populations increased on pearl millet, groundnut, cowpea, sunflower, bambara groundnut, pigeonpea, maize and sesame. The total number of plant parasitic nematodes at harvest was greatest in plots planted to pigeonpea. Maize was another crop conducive to increase in their populations. *S. hamata* was the least suitable crop for reproduction of the identified plant parasitic nematodes.

Keywords. Cereal and legume crops, host preference, Niger, plant parsitic nematodes, population dynamics.

INTRODUCTION

More than 60 species of plant parasitic nematodes have been reported in association with cereals and legumes in the Sahelian zone of West Africa (Baujard, 1994) of which some adversely affect the growth of these crops (Baujard, 1994; Baujard and Bernard, 1993, 1995; Germani *et al.*, 1984). Surveys conducted by ICRISAT scientists revealed that *Scutellonema clathricaudatum*, *Xiphinema parasetariae* and *Tylenchorhynchus* spp. were widespread in sandy soils (Sharma *et al.*, 1990, 1991). Growth of groundnut in patches of these soils was stunted (Sharma *et al.*, 1990). The role of nematodes in affecting the growth and yield of groundnut was investitgated (Sharma *et al.*, 1992). Soil application of carbofuran and DBCP (dibromochloropropane) markedly reduced the nematode population and significantly enhanced the growth and yield of groundnut (Subramanyam *et al.*, 1993). The objectives of the present investigation were to assess the host preferences of the pathogenic nematodes and identify plant species which markedly suppress or enhance the population density of these nematode species.

MATERIALS AND METHODS

Trials were conducted in a nematode infested field during the rainy season at the research farm of the ACRISAT Sahelian Center (Sharma *et al.*, 1990a). Thirteen crop species, comprising traditionally grown plant species as well as new ones, were examined for their host suitability to *Scutellonema clathricaudatum*, *Xiphinema parasetariae* and *Tylenchorhynchus* spp. The crops were bamabara groundnut (*Voandezeia subterranea*), cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogaea*), maize (*Zea mays*), pearl millet (*Pennisetum glaucum*), pigeonpea (*Cajanus cajan*), sesame (*Sesamum indicum*), sorghum (*Sorghum bicolor*), stylo (*Stylosanthes fruticosa*, *S. hamata*), sunflower (*Helianthus annuus*), *Vigna aconitifolia* and *Vigna radiata*.

Seeds of these plant species were sown in 4 m×4 m plots. Row-to-row spacing was 50 cm. A split plot design with three applications was employed. Each plot was divided into two subplots; one subplot in each plot was treated with carbofuran at 10 kg a.i. per ha. Population densities of plant parasitic nematodes were assessed at planting and at harvest. The experiment was repeated in the next crop season.

Soil samples were collected randomly from each plot with a 25 cm long steel shovel at planting and at harvest. The samples were protected from direct heat and sunlight, and stored in polythene bags at room temperature (25°C). A thoroughly mixed 100 cm^3 subsample of each sample was processed by decanting and sieving. The nematode populations were extracted from soil samples by suspending them in water and pouring them through 850, 180 and 45-μm pore sieves and placing the residues from 180 and 45-μm sieve on modified funnels (Schindler, 1961).

The nematodes were extracted from plant roots 60 days after sowing. Roots were carefully washed, cut into small pieces of 0.5-1.0 cm length and nematodes were extracted as described by Baujard (1995) to assess the host status. The nematode density in soil and root samples of different plant species and varieties were statistically compared using the least significant difference method.

RESULTS AND DISCUSSION

Nematode community

The nematode species present in the soil were *S. clathricaudatum*, *X. parasetariae*, *Paralongidorus bullatus*, *Tylenchorhynchus* spp., *Telotylenchus indicus*, *Pratylenchus* spp., *Hoplolaimus pararobustus*, and *Helicotylenchus* spp. At planting time, the mean nematode density of different species ranged between 0 and 220 nematodes per 1000 cm^3 of soil, and there was no significant difference between the plots, indicating that the nematode populations were uniform across plots.

Scutellonema clathricaudatum. All plant species tested were hosts of *S. clathricaudatum* but there were significant differences (P=0.01) in the host status of different plant species (Fig. 1). Nematode population dynamics were a function of the plant species grown: pearl millet which harboured more than 3000 nematodes in 100 g roots in plots not treated with carbofuran was an excellent host. Bambara groundnut, groundnut, pigeonpea and sunflower were relatively better hosts than other plant species but less good than pearl millet. The two varieties of sesame markedly differed in their response and the number of nematodes in roots of the local variety was about 6 times lower than that in the improved variety. Sorghum was an unattractive host (Fig. 2).

Soil samples collected in the root zone of pigeonpea, pearl millet, cowpea, bambara groundnut, and maize had 3 to 5 times greater population than in samples from other plant species. Samples from plots planted to pigeonpea had the greatest population density, and those planted to *Stylosanthes hamata* had the lowest density (Fig. 1). Application of carbofuran significantly reduced the nematode density in soil and root, the effect was less evident in good hosts (e.g. pigeonpea) than on poor hosts (e.g. local sesame). Interaction between plant species and carbofuran application was not significant except for total nematodes in 1000 cm^3 of soil. Nematode poulations were reduced in all the treated plots for all plant species.

***Tylenchorhynchus* species.** The nematode population increase greatly varied (P=0.01) with the plant species. Sorghum, maize and millet were preferred hosts with 1357, 953 and 395 nematodes per 1000 cm^3 of soil, respectively (Fig. 3). Stylo (*S. hamata*), groundnut and sesame (local) were the least preferred hosts with 43, 47 and 30 nematodes per 1000 cm^3 of soil, respectively. The nematode density in plots planted to other crop species were reduced in all the treated plots for all plant species.

Xiphinema parasetariae. The nematode densities in plots planted to local variety of sesame and pigeonpea were 2 to 10 times greater than that in plots planted to other plant species. The nematode density was lowest in plots planted to *Stylosanthes* spp. Maize and bambara grounnut were moderate hosts (Fig. 4). Sharma (1990) reported sesame and pigeonpea to be good hosts of this species.

Paralongidorus bullatus. The population of this nematode at planting time was below detectable levels in most plots. However, at harvest the nematode, generally in low number, was present in plots planted to pearl millet, groundnut, cowpea, sunflower, bambara groundnut, pigeonpea, maize and sesame (data not shown).

Total plant parasitic nematodes. The number of plant parasitic nematodes at harvest was greatly influenced (P=0.01) by the plant species grown. Nematode density was greatest in plots planted to pigeonpea (Fig. 5). Maize was also conducive for increase in the populations of plant parasitic nematodes. Nematode population build-up was similar on pearl millet, cowpea and bambara groundnut. *S. hamata* was the least suitable crop for reproduction and population increase of the plant parasitic nematode community associated with variability in crop growth of pearl millet and groundnut.

Plant parasitic nematodes are important constraints to crop production in Sahelian region of West Africa (Sharma *et al.*, 1991). Species of *Scutellonema*, *Paralongidorus*, *Hoplolaimus*, *Xiphinema* and *Helicotylenchus* are among the most important nematode parasites of cereals and legumes in the region. Few options are available to

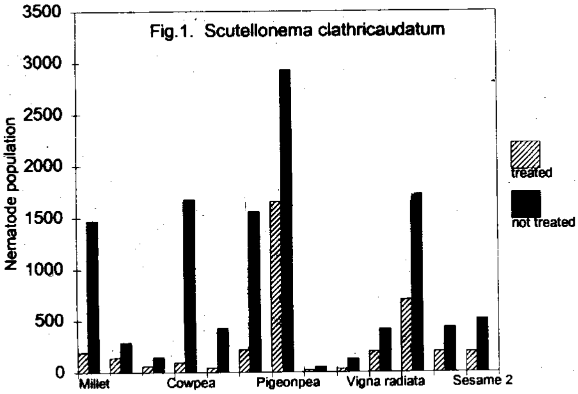

Fig. 1. Population densities of *Scutellonema clathricaudatum* in 1000 cm^3 soil collected from rhizosphere of 13 plant species.

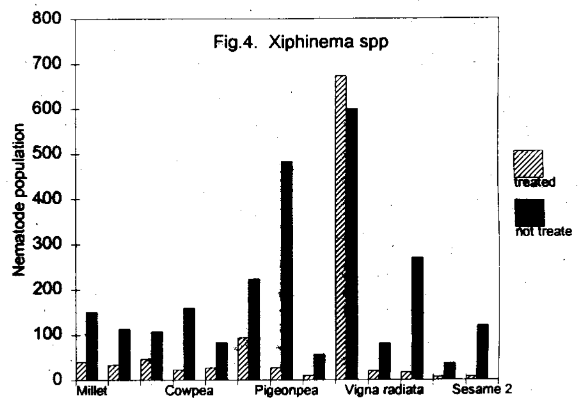

Fig. 4. Population densities of *Xiphinema parasitariae* in 1000 cm^3 soil collected from rhizosphere of plant species.

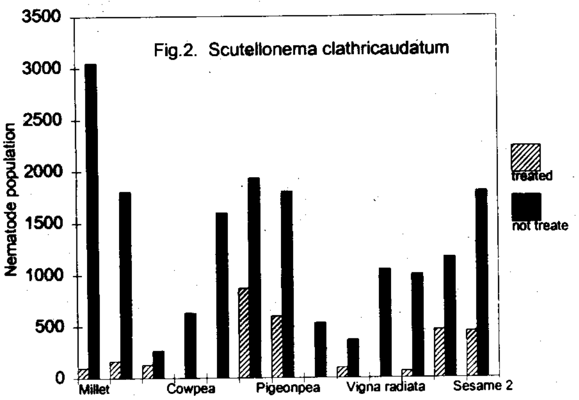

Fig. 2. Population densities of *Scutellonema clathricaudatum* in 100 g roots of plant species.

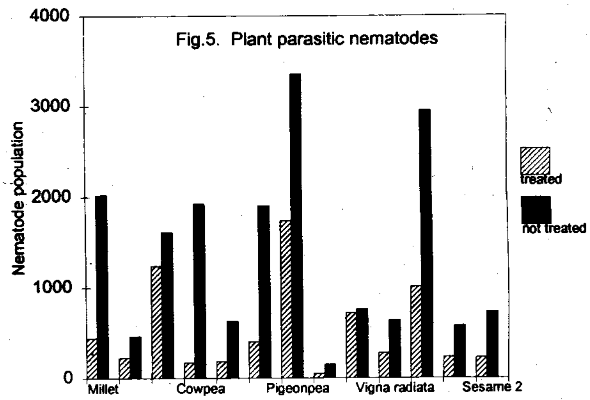

Fig. 5. Population densities of total plant parasitic nematode species in 1000 cm^3 soil collected from rhizosphere of plant species.

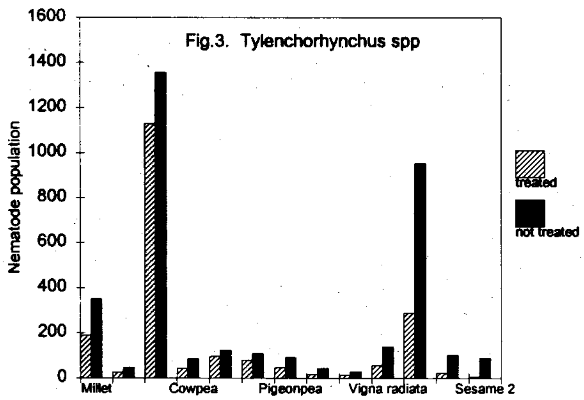

Fig. 3. Population densities of *Tylenchorhynchus* spp. in 1000 cm^3 soil collected from rhizosphere of plant species.

manage the damage caused by these nematodes (Waliyar *et al.*, 1992). Liquid fumigant nematicides such as DBCP, which act by releasing toxic gases when injected into the soil, have been highly effective (Germani *et al.*, 1984).

Our results indicate that there is a scope to control the nematode-caused damage by inclusion of poor host crops in the cropping cycles. Crop rotation could be an important environment-friendly option for managing the nematode populations in cereals and legumes based cropping systems in the Sahelian zone of West Africa. For instance, Baujard and Bernard (1995a) observed that *Helicotylenchus dihystera* was never found in the rhizosphere of *Euphorbia balsamifera*, a plant commonly used as green fence in Senegal. Therefore, it is essential to test a large number of plant species for their effect on the major nematode fauna to identify and develop widely acceptable rotational crops for nematode management.

LITERATURE CITED

Baujard, P. 1994. Nematicides, nematodes phytoparasites et rendements des cultures pluviales dans la zone sahelienne de l'Afrique de l'Ouest. *Afro-Asian Journal of Nematology* **4,** 129-146.

Baujard, P. 1995. Laboratory methods used for the study of the ecology and pathogenicity of Tylenchida, Longidoridae and Trichodoridae from rainy and semi-arid tripics of West Africa. *Fundamental and Applied Nematology* **18,** 63-66.

Baujard, P. and M. Bernard 1993. Ecology and pathogenicity of the nematode *Paralongidorus duncani* (Nematoda: Longidoridae) in Senegal. *Afro-Asian Journal of Nematology* **3,** 177-181.

Baujard, P. and M. Bernard 1995. Ecology and pathogenicity of the nematode *Hoplolaimus seinhorsti* Luc, 1958. *Fundamental and Applied Nematology* **18,** 435-444.

Baujard, P. and M. Bernard 1995a. Ecology and pathogenicity of the Hoplolaimidae (Nemata) from the Sahelian zone of West Africa. 7. *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961 and comparison with *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956. *Fundamental and Applied Nematology* **18,** 503-511.

Germani, G., P. Baujard and M. Luc 1984. Control of phytoparasitic nematodes in the bassin arachidier of Senegal. *ORSTOM*, 16 pp.

Schindler, A. F. 1961. A simple substitute for a Baermann funnel. *Plant Disease Reporter* **45,** 747-748.

Sharma, S. B. 1990. Further investigations on the role of plant parasitic nematodes in crop growth variability of groundnut in Niger. *Legumes Pathology Progress Report, ICRISAT* **8,** 61 pp.

Sharma, S. B., P. Subramanyam and E. Sarr 1990. Plant parasitic nematodes associated with groundnut in Niger. *Tropical Pest Management* **36,** 71-72.

Sharma, S. B., P. Subramanyam, E. Sarr and H. Van Riel 1990a. Plant parasitic nematodes associated with groundnut at Sadore in Niger. *International Arachis Newsletter* **4,** 10-11.

Sharma, S. B., Waliyar, F. and B. J. Ndunguru 1991. Plant parasitic nematodes associated with groundnut in Benin, Burkina Faso and Nigeria. *Oleagineux* **46,** 119-120.

Sharma, S. B., Waliyar, F., Subramanyam, P. and B. J. Ndunguru 1992. Role of *Scutellonema clathricaudatum* in etiology of groundnut growth variability in Niger. *Plant and Soil* **143,** 133-139.

Subramaniyam, P., B. J. Ndunguru, S. B. Sharma and K. L. Saharawat 1993. Etiology of crop growth variability in groundnuts in Niger. *Plant and Soil* **143,** 139-146.

Waliyar, F., B. J. Ndunguru, S. B. Sharma and A. Bationo 1992. Effect of liming and carbofuran on groundnut yield in sandy soils in Niger. *Fertilizer Research* **33,** 203-208.