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Root-knot nematode infestations of cultivated and non-cultivated soils of Nsukka, Nigeria

Verseuchung kultivierter und nicht kultivierter Böden mit Wurzelgallennematoden

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1. Introduction

The Meloidogyne, or root-knot nematode problem is without doubt the most important nematode problem in Nsukka which locates the University of Nigeria (06.52° N, 07.24° E). Home gardening is affected as good crops are hardly raised. Some people feel home gardening is not fruitful and have abandoned it entirely. Although many other pathogenic or suspected pathogenic genera of nematodes occur in Nsukka, none can approach the economic importance of species of Meloidogyne when the entire range of crops affected is considered. This work examines the extent of natural infestations of Nsukka soils by root-knot nematodes and identifies some human endeavours which help spread the pathogens. It is also intended to present a significant information relating to plant nematology problems in tropical Africa.

2. Materials and Methods

A survey was made in June 1977. Twelve composite soil samples were collected from selected areas within the University campus and the surrounding villages. Total land area covered was about 25 sq. km. Each composite sample was a random collection from different points in a designated sample area. Sampling sites had varying surface features and ranged from upper-, mid-, and bottom-slopes to flat depressions. Crop fields, fields of grasses, forbs and shrubs, a natural tropical forest, natural grasslands and a

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weed garden were sampled. Each composite soil was thoroughly mixed and placed in fifteen 20-cm plastic pots. One seed (or seedling) each of cotton (Gossypium hirsutum L. var. Coker 100), okra (Hibiscus esculentum L., var. Lady Finger, tomato (Lycopersicon esculentum Mill., var. Supersonic), sweet pepper (Capsicum frutescens L. var. California Wonder), and cucumber (Cucumis sativus L. var. Marketer), was planted to each pot and replicated three times. A total of 180 were used for the twelve samples. Plants were grown for six weeks (temperature averaged 25.8° C) before roots were washed and examined microscopically for egg mass production, this being the most important criterion for determining susceptibility or resistance to infection. Identity of species infecting crops was determined by the mounting and examination of perineal patterns under the microscope.

2.1. Samples and Sites

NS 1 Odim crop fields; multicropped with cassava, maize and melon; a flat depression.

NS 2 Odim grasslands of shrubs and forbs; a mid-slope.

NS 3 Odim natural tropical forests: a vegetation of hardwood, thick underbrush and climbers; a bottom slope.

NS 4 Owerre-Ezoba village hills: a vegetation of grasses, shrubs and forbs; mid-and upper-slopes; un-inhabited and uncultivated.

NS 5 Weed garden: a flat depression within the University farm area.

NS 6 Onuiyi village: sample area covered with grasses and forbs; a bottom slope.

NS 7 Obukpa village: crop-lands; multicropped with maize, cassava and melon; a flat depression.

NS 8 Obukpa village: grasslands and shrubs; a mid-slope.

NS 9 Commercial vegetable gardens: intensive monocropping with vegetables; a flat depression within the University Farm.

NS 10 Owerre-Ezoba village: natural grasslands: a bottom slope: land not inhabited.

NS 11 Ihie/Owerri village: small farm holdings; mixcroppings — cocoyam, maize, cassava; a bottom slope.

NS 12 Campus Staff Quarters gardens: mixcropped with vegetables; a flat depression.

3. Results

Plant infections by the root-knot nematodes were recorded from all twelve soil samples, irrespective of whether soil was from cultivated or noncultivated area (Table 1). Three root-knot nematode species were identified from the survey. These were Meloidogyne arenaria (NS 3), M. javanica (NS 7) and M. incognita, for the remaining ten soil samples.

Table 1: Susceptibility of plant species to attack by root-knot nematodes, Meloidogyne spp, from twelve different soil samples.

Scientific plant name (horticultural variety)	SOIL SAMPLES/SUSCEPTIBILITY RATINGS											
	NS1	NS2	NS3	NS4	NS5	NS6	NS7	NS8	NS9	NS10	NS11	NS12
Gossypium hirsutum L. (Coker 100)	*2	2	0	4	3	2	0	3	4	3	3	2
Hibiscus esculentus L. (Lady Finger)	3	4	2	4	4	4	2	3	4	3	4	3
Lycopersicon esculentum Mill. (Supersonic)	3	3	3	2	4	2	3	3	4	3	3	4
Capsicum frutescens L. (California Wonder)	3	3	3	3	2	3	0	3	3	3	3	3
Cucumis sativus L. (Marketer)	3	2	4	2	3	2	4	3	4	2	3	3

0: no infection 1: very light infection; mature females and egg masses rare.

2: light infection; mature females and egg masses seen occasionally.

3: moderate infection; mature females and egg masses common.

4: severe infection; mature females and egg masses abundant. All soil samples contained M. incognita, except NS3 (M. arenaria) and NS7 (M. javanica).

*Ratings are to the nearest whole number.

4. Discussion

Differences in responses of different plants grown in one soil sample relate to factors of host-parasite relationships. But if a plant was susceptible to a Meloidogyne species, occurrence of differences in the degree of infection of the host by that species was determined by the level of its infestation in the soil sample, as well as the intrinsic character of the population in the soil sample. Root knot problem in Nsukka can be related to several factors:

1. Limited space and the continous cultivation of vegetables on the same land, often two to three crops per year.
2. Untreated compost from yam peel, cocoyams, potatoes and carrots, are likely to be sources of nematode infestation.
3. The transplanting of infected seedlings from untreated, nematode infested seed beds (Caveness, 1967).
4. Natural infestations from weed hosts (Edwards, 1953; Odihirin & Adesida, 1975; Taylor, 1976).

An interesting aspect of the Meloidogyne problem in Nsukka as in the other parts of tropical Africa is the rapidity with which the problem becomes severe (Taylor 1976). Jackson (1962) reported root-knot nematode damage to vegetables in the first crop planted on land not previously cultivated. Edwards (1953) observed complete failure of tomato in Ghana in the first season of freshly cleared land due to Meloidogyne. Whitehead (1969 a) reported the occurrence of Meloidogyne in 37 of 51 samples from indigenous forests in East Africa. Although crop infections occurred in all of the twelve soil samples, infection was higher in soil collected from the University farms and would indicate that the intensive monocropping there intensified the problems, a situation observed earlier by Leiper (1939).

Unlike most other plant diseases in which minute inocula can initiate epidemics under conditions favourable for the parasite, damage caused by nematodes depends on the initial population density present at the time of planting (Netscher 1978). Therefore nematode control in Nsukka or some other areas would consist of reducing soil populations to such levels that susceptible crops can be grown without suffering great losses from the remaining nematodes. An effective method of control is the application of nematicides that kill a large proportion of nematodes present in the soil. Nematicides are, however, expensive; sometimes toxic and usually difficult to use for persons lacking experience in pesticide application. Crop rotation offers a possible way to control Meloidogyne. Like all plant-parasitic nematodes, species of Meloidogyne are obligate parasites that must feed on a suitable host to complete their life cycle and to reproduce. Thus, crop sequences which include non-hosts and resistant varieties of otherwise suitable host plants should decrease soil populations of root-knot nematodes and improve conditions for production of susceptible crops.

5. Summary

In Nsukka, Nigeria, plants grown in twelve soil samples collected from cultivated and non-cultivated fields were attacked by root-knot nematodes. Three species of the root-knot nematodes were identified, with Meloidogyne incognita as the dominant species. A measure to reduce crop damage by root-knot nematodes is suggested.

Zusammenfassung

In Nsukka, Nigeria, wurde der Befall durch Wurzelgallennematoden von Pflanzen untersucht, die in 12 verschiedenen Böden von bebauten und unbebauten Feldern kultiviert worden waren. Drei Gattungen von Wurzelgallennematoden konnten identifiziert werden; davon war Meloidogyne incognita die dominate Gattung. Eine Maßnahme zur Verringerung des Befalls durch Wurzelgallennematoden wird vorgeschlagen.

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