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Short Communication

Survey of plant parasitic nematodes associated with rice (*Oryza sativa* L.) in South Eastern Nigeria

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The presence and population of plant parasitic nematodes associated with rice cultivation was determined at the rice cultivation zone of Ini Local Government Area of Akwa Ibom State, through a survey. Samples of plant roots and soil were randomly collected for the presence of nematodes while extraction was conducted using Pie Pan Modification of the Baerman funnel method. The results showed the presence of three genera of nematodes: *Heterodera*, *Hirschmaniella* and *Meloidogyne*. There was a significant (P<0.05) difference in the preponderance of the different nematode population with *Heterodera* recording a mean distribution of 60 and 65% in soil and roots samples, respectively. The significant presence of *Heterodera* in the studied area could pose a potential problem to rice cultivation.

Key words: Rice, nematodes, *Heterodera*, Baermann, Nigeria.

INTRODUCTION

Plant parasitic nematodes (PPN) have been found to successfully colonize a greater variety of habitats than any other group of multicellular organisms (Babatola, 1984) and the extent of nematode distribution is economically important because of wide host ranges with some species transmitting viruses from one plant to another (Siddiqi, 1983).

PPN are widely distributed and their association with other soil borne pathogens results in disease complexes (Slough, 1985). Unfortunately, the majority of farmers are unaware of the nature and harmfulness of nematode infestation in the field. There are however, no reliable estimates in crop losses arising from nematode attack but their spread and damage caused to crops are enormous. PPN are capable of inflicting direct severe damage to growing plants by making injury while the degree of such injury depends on the level of soil infestation, new races and prevailing environmental conditions such as drought, water-logging, salinity and inadequate plant nutrition (Siddiqi and Booth, 1991).

Root inhabiting species of nematodes inflict virtually the same type of root damage on rice leading to reduced nutrient uptake, stunted/poor shoot growth, leaf chlorosis, delayed flowering and sometimes in critical cases, non-flowering (Babatola, 1984). Two species of nematodes, *Hirschmanniella spinicaudata* and *Hirschmanniella oryzae* are involved in below ground infection in lowland rice soils across West Africa. Other species such as *Heterodera oryzae* is suspected to be associated with rice in Nigeria where it is implicated with root hair reduction. *Meloidogyne* spp. has been reported to attack both upland and lowland rice producing symptoms like root knots/galls on infected roots as well as twisted and fewer root hairs (Babatola, 1984).

Information on economic losses arising from nematodes attack on rice and other crops in Nigeria is estimated at 18 to 25%, but under experimental conditions, 2000 juveniles of *Meloidogyne* spp. per kilogram of soil reduced the growth and yield of maize by 65% (Veech, 1987). Economic losses in yield of rice due to *Meloidogyne* spp. alone in West African sub-region have been estimated at about 39% while in Nigeria the same species is responsible for about 10 to 25% loss in yield (Akinsola, 1979). *H. oryzae* has been reported as a parasite of rice and in Nigeria accounts for a yield loss of 35 to 67% (Adesiyan, 1990).

Data on nematode presence, prevalence and economic

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Table 1. Genera of nematode and mean population (%) in soil sample (0 to 15 cm depth).

Rice producing community	Mean population (%)		
	***Heterodera* spp**	***Hirschmanniela* spp**	***Meloidogyne* spp**
Ikpe	29.0^{b}	32.0^{a}	21.0^{ab}
Nkari	18.5^{c}	12.5^{b}	26.0^{a}
Iwerre	10.0^{c}	14.0^{b}	7.5^{bc}
Itu Mbonuso	53.0^{a}	21.0^{b}	15.5^{bc}
LSD	10.16	9.80	10.00

Means in the same column followed by different letters are significantly different (P<0.05).

Rice being a major staple food is grown extensively in Ini Local Government Area of Akwa Ibom State, Nigeria, and yield losses arising from nematodes attack in the area are lacking. A study was therefore carried out to determine and identify the different types of nematodes attacking rice in the studied area as well as determining the population of PPN in Ini Local Government Area of Akwa Ibom State.

MATRIALS AND METHODS

Study location

The experiment was conducted in Ini Local Government Area of Akwa Ibom State, Nigeria, located between latitude 5°7′ and 5°31′N and longitude 7°37′ and 7°31′E (SLUS-AK, (1989)). The area has an annual rainfall of about 2250.60 mm, mean monthly sunshine of about 3.14 h and mean annual temperature of 29°C. Four rice cultivating communities comprising Ikpe, Nkari, Iwerre and Itu Mbonuso, were selected for the study with six farms randomly chosen and in each farm ten locations were selected for both roots and soil samples.

Soil and roots samples

Soil samples were collected at the depth of 0 to 15 cm and 15 to 30 cm around rice plants using soil auger from ten different locations in a particular farm. The soil samples were pooled and sealed in polyethylene bags where they were protected from sun (Akinsola, 1979). Roots samples were obtained by uprooting ten rice plants from the different locations selected. Matchet was used to separate the root from the rice plant. The roots were washed gently in water to remove soil and plant debris. Thereafter, the roots samples were sealed in polyethylene bags and labeled.

Extraction of nematodes from soil and roots samples

Nematode extraction was carried out in the Crop Pathology laboratory, University of Uyo, Nigeria, using the modified Baermann technique (Siddiqi, 1983). Actively migrating nematodes were recorded from soil and roots samples (20 g each) placed in plastic tray filled with water. The samples were kept for 48 h after which the water was decanted into plastic cups and labeled. Using a measuring cylinder, 50 ml was measured and stirred using a magnetic stirrer. Thereafter, 2 ml aliquots each of soil and roots samples were pipetted unto a Duncaster counting dish. Counting was done four times under a microscope and the mean was determined.

RESULTS AND DISCUSSION

The mean population of the three genera of nematodes present in the different soil depth is presented in Tables 1 and 2. The highest mean of 53% was recorded for *Heterodera* within 0 to 15 cm soil depth, in Itu Mbonuso clan. The mean population for the same genus was found to be decreasing by about 35% thus recording a mean population of 19% within 15 to 30 cm soil depth. This trend was also observed for the other two genera of nematodes at varying soil depth. This decrease in nematode population as the soil depth increases could be explained to the absence of adequate soil moisture as nematodes could not survive without restriction of water. Nematode population in the different rice growing communities showed Iwerre recording the lowest population of *Meloidogyne* and this suggest having good potential for rice cultivation and production as less damage arising from nematode attack would be encountered.

Similarly, the population of the three genera of nematodes in the roots of rice is presented in Table 3. There was a significant difference in the mean population of PPN with *Heterodera* recording the highest population of 98% in Nkari community. The lowest PPN population was observed amongst *Meloidogyne* in Ikpe and Itu Mbonuso communities with zero nematodes of this genus. The possible absence of *Meloidogyne* in the roots of rice in Ikpe and Itu Mbonuso communities suggest none infection of the roots by this nematode although it was observed in the soil. This could encourage more rice cultivation and production as less damage would be sustained.

The results of this study clearly show that surface and sub-surface treatments for nematode control could enhance effective rice cultivation. The study has also revealed the presence of PPN in rice fields of Southeastern of Nigeria and the impact on rice production could result in reduced output. This calls for concerted efforts from relevant stake holders in order to

Table 2. Genera of nematodes and mean population (%) in soil sample (15 to 30 cm depth).

Rice producing community	Mean population (%)		
	***Heterodera* spp**	***Hirschmanniela* spp**	***Meloidogyne* spp**
Ikpe	10.5^{ab}	20.5^{a}	12.0^{ab}
Nkari	9.0^{b}	8.5^{b}	20.5^{a}
Iwerre	4.0^{b}	5.5^{b}	4.0^{bc}
Itu Mbonuso	18.5^{a}	9.5^{b}	7.5^{bc}
LSD	9.30	8.72	7.50

Means in the same column followed by different letters are significantly different (P<0.05).

Table 3. Distribution of genera of nematodes in roots samples.

Rice producing community	Mean population (%)		
	***Heterodera* spp**	***Hirschmanniela* spp**	***Meloidogyne* spp**
Ikpe	86.3^{b}	93.0^{a}	0.0^{c}
Nkari	98.7^{a}	58.5^{c}	17.0^{a}
Iwerre	63.3^{c}	66.5^{bc}	9.0^{b}
Itu Mbonuso	78.3^{b}	74.0^{b}	0.0^{c}
LSD	10.17	15.30	7.50

Means in the same column followed by different letters are significantly different (P<0.05).

increase rice production in the studied area. It has been established that cultivated rice in field are vulnerable to PPN damage thereby resulting in extremely unfavorable crop growing conditions with probable retardation of growth. The PPN attack may also result in delayed tillering, toppling of plants and often discoloration of older leaves (Babatola, 1984). It is imperative for farmers to be informed of the presence of PPN and the associated dangers as regarding rice cultivation and output.

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