Nematol. medit. (1983), *11*: 21-25.

Nematology Division, National Cereals Research Institute, Ibadan, Nigeria

PATHOGENICITY OF *HETERODERA SACCHARI* ON RICE

by

J. O. BABATOLA

The sugarcane cyst nematode, *Heterodera sacchari* Luc and Merny 1963, has been found in some rice growing localities in the Kwara State of Nigeria (Babatola, unpublished). Merny (1970) has recorded the occurrence of *H. sacchari* on rice in Ivory Coast and this nematode was also observed on rice in Senegal (Fortuner and Merny, 1973). Pot tests were undertaken to assess the pathogenicity of the nematode to rice, *Oryza sativa* L.

Materials and Methods

Cysts were extracted by use of the Fenwick can from soil collected from sugarcane fields in Bacita, Kwara State of Nigeria. They were broken and the eggs were counted for estimation of egg population per cyst. Rice Faro 11 was grown in 20 cm diameter plastic buckets filled with 5 l of steam-sterilised soil. Mean egg number per cyst was estimated at 150 (N = 80). Ten of these buckets were inoculated with a water suspension of 7,500 eggs around the roots of the rice seedlings. Ten buckets were left as control. Another set of 5 buckets were inoculated with water suspension of the same number of eggs of *H. sacchari*. Five uninoculated buckets were used as control. The second set of 10 buckets were maintained until rice grains were harvested.

The growth of the rice plants was observed for up to 45 days

after inoculation in the first set of 20 buckets. Cysts were extracted from 200 ml of soil by use of the Fenwick can and juveniles were extracted by comminuting 50 g wet root for 30 sec. followed by filtration by a modified Baermann method (Whitehead and Hemming, 1965).

Another series of buckets was inoculated in groups of five replicates with eggs from 0, 9, 18, 36 and 72 cysts per litre of soil respectively. Tiller counts were taken at 30, 60, 90 and 120 days intervals. Plant height, date of 50% flowering grain yield and final nematode populations (cysts per 200 ml and juveniles per 50 g wet root) were also recorded.

Two rice cultivation patterns were also investigated. The lowland (flooded) cultivation pattern was simulated by planting seeds in unperforated 10 l buckets filled with 8 l of steam-sterilised soil. The buckets were filled with water to the brim when seedlings were 2 weeks old. Rice grown in perforated buckets and watered regularly were used for the upland cultivation pattern. Rice cv Faro 11 which is normally an upland cultivar but can be grown in shallow swamps was again used for the experiment. Buckets were inoculated with 100, 200 or 400 cysts by pouring a water suspension of the cysts around the roots of rice plants. Each inoculum level was replicated 5 times in both cultivation patterns. Five uninoculated buckets were used as controls in each cultivation pattern. Growth parameters, yield and final nematode populations were recorded as in the previous studies.

Results

At 30 days after inoculation, plants were chlorotic, especially the youngest leaves, and tillering was poor. Root growth terminated at the point of nematode attack but lateral roots proliferated in this area and most roots showed stubby tip symptoms. The root systems of infested plants became necrotic, blackened and twiggy. Both motile and sedentary juvenile were found in the roots.

Rice plant growth and tillering were adversely affected at 18, 36 and 72 cysts/l inoculum levels. Grain yields were also significantly depressed by the nematode (Table I).

Rice cv Faro 11 appears to grow and yield better under lowland than under upland conditions. At high inoculum levels, plants under upland conditions showed severe chlorosis and stunted growth; under

lowland conditions tillering decreased with increasing inoculum levels but chlorosis was not severe. Plant height and 50% flowering dates were not significantly different within and between the cultivation patterns. Dry straw weight, dry panicle weight and grain yield were significantly lower in the upland conditions than in the lowland conditions. There were also significant decreases in these weights with increasing inoculum levels (Table II) and tiller counts at 30 days

Table I - *Growth and yield of rice cv Faro 11 in soil infested by* H. sacchari.

Inoculum levels per litre of soil	50% flowering days	Panicle weight per bucket (g)	Plant height (cm)	Grain weight per bucket (g)	Juveniles/ 50 g wet root	Cyst/200 ml soil
0	96	14.7 a	137	12.9 a	0 a	0 a
9	95.6	11.9 ab	135	9.7 a	2,550 b	636 b
18	94.8	8.1 bc	131	5.3 b	2,710 b	722 bc
36	96.2	7.2 bc	136	4.6 b	7,110 c	992 bc
72	90.0	6.7 c	137	3.2 b	13,280 d	1,818 d
	NS		NS			

Figures with the same letters on columns are not significantly different at $p = 0.05$.

Table II - *Growth and yield of rice cv Faro 11 in upland and lowland condition.*

Inoculum levels cysts/bucket	Plant height (cm)	50% flowering days	Panicle weight per bucket (g)	Grain weight per bucket (g)	Dry straw weight (g)	Cyst count/ 200 ml soil	2nd stage juvenile population /50 g wet root
Upland							
0	114 c	94	13.9 abcd	10.8 cd	36.6 cd	0 d	0 d
100	128 bc	94	10.9 bcd	8.3 de	23.7 e	402 cd	2,530 c
200	120 c	95	9.0 cd	6.2 ef	21.6 e	658 b	3,340 b
400	115 c	97	8.8 d	4.6 f	16.2 e	1,032 a	11,220 a
Swamp							
0	137 ab	94	19.3 a	17.9 a	57.2 a	0 d	0 d
100	136 bc	95	17.3 ab	14.5 b	51.8 ab	500 bc	1,860 c
200	145 ab	95	16.2 abc	13.6 bc	45.2 bc	618 ab	3,760 b
400	150 a	96	13.5 abcd	8.4 de	37.0 cd	942 a	11,420 a

Figures with the same letters on columns are not significantly different at $p = 0.05$.

intervals under both upland and lowland cultivation patterns followed a similar trend (Table III). Although there were significant increases within each cultivation pattern in the juveniles and cysts population, relative to increasing inoculum levels, there were no significant differences between the same inoculum levels under both cultivation patterns.

Table III - *Number of tillers developed in rice cv Faro 11 at 30 days intervals.*

		DAYS AFTER SOWING			
No. of cysts		30	60	90	120
Upland	0	4.2	10.6 ab	10.0 bc	14.6 abc
	100	3.0	9.0 abc	9.2 bc	10.6 bcd
	200	4.0	9.0 abc	9.2 bc	10.0 cd
	400	2.8	7.8 bc	7.0 d	7.4 d
Swamp	0	4.2	12.8 a	15.2 a	20.2 a
	100	4.4	9.8 abc	11.0 ab	15.6 ab
	200	3.4	9.2 abc	9.8 bcd	13.6 abc
	400	2.2	6.8 c	8.2 bcd	12.6 abc
		NS			

Figures with the same letters on columns are not significantly different at $p = 0.05$.

Discussion

H. sacchari infects rice roots and multiplies under lowland and upland conditions but symptoms of infection are more severe and discernible under the latter type of cultivation. Unny and Hague (1980) also made similar observations on sugar-cane infested by *H. sacchari*. Proliferation of lateral roots at points of infection appear to be characteristic of *H. sacchari* infection. The high reproductive rates of *H. sacchari* and the numerous second stage juveniles found in the roots indicates the suitability of rice as a host for the nematode. *H. sacchari* populations were not adversely affected by flooding.

SUMMARY

In Nigeria the sugarcane cyst nematode occurred in lowland rice soils bordering sugarcane estates where the nematode was known to be present. Cysts collected from Bacita Sugar Estate near Jebba, Nigeria were used to inoculate potted rice plants in the glasshouse. Infested plants were very chlorotic and had retarded growth. Tiller numbers were reduced and grain yield was significantly lower. Rice roots were very necrotic and blackened. The nematode reproduced under both upland and simulated swamp conditions, although symptoms of infection were more discernible in upland rice plants.

LITERATURE CITED

FORTUNER R. and MERNY G., 1973 - Les nématodes parasites des racines associés au riz en Basse-Casamance (Sénégal) et en Gambie. *Cah. ORSTOM Biol., 21*: 3-20.

MERNY G., 1970 - Le nématodes phytoparasites des rizières inondées de Côte d'Ivoire. I. Les espèces observées. *Cah. ORSTOM Biol., 11*: 3-43.

SALAWU E. O., 1978 - The effect of an endomycorrhizal fungus and *Heterodera sacchari* on the growth of rice. *Niger. J. Pl. Prot., 4*: 74-77.

UNNY L. K. and HAGUE N. G. M., 1980 - Observations on the symptomology and survival of the sugarcane cyst nematode, *Heterodera sacchari*. XVth Int. Nem. Symp. European Society of Nematologists, Aug. 24-30, 1980 Bari, Italy. (Abst.). p. 60.

WHITEHEAD A. G. and HEMMING J. R., 1965 - A comparison of quantitative methods of extracting small vermiform nematodes from soil. *Ann. appl. Biol., 55*: 25-38.

Accepted for publication on 19 October 1982.