VARIETAL REACTION OF RICE AND OTHER FOOD CROPS TO THE RICE-ROOT NEMATODES, *HIRSCHMANNIELLA ORYZAE, H. IMAMURI* AND *H. SPINICAUDATA* [RESPUESTA DE VARIEDADES DE ARROZ Y DE OTRAS PLANTAS ALIMENTICIAS A LOS NEMATODOS RADICULARES DEL ARROZ, *HIRSCHMANNIELLA ORYZAE, H. IMAMURI YH. SPINICAUDATA*].

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Accepted:
5.IV.1979
Aceptado:

ABSTRACT

Thirty-four lowland rice varieties and 16 arable crops were assessed for susceptibility to 3 rice-root nematodes, *Hirchmanniella oryzae, H. imamuri* and *H. spinicaudata.* All rice varieties were susceptible to the 3 rice-root nematodes; however cowpea, pigeon pea, groundnut, sweet potato, tobacco, sorghum and finger millet were not.
Key words: Rice root nematodes, host lists, resistant varieties.

INTRODUCTION

Although, rice, *Oryza sativa* L. is a preferred host of many species of the genus *Hirschmanniella,* however, other crops and weeds of rice fields have been known to host the nematodes in the absence of the rice plant. Vecht and Bergman (10) observed specimens of *Hirschmanniella oryzae* (Breda de Haam 1902) Luc & Goodey, 1936, in 20 different plant species mainly of the Cyperaceae and Gramineae families which were common weeds of rice fields. Mathur and Presad (5) also reported large numbers of *H. oryzae* in four graminaceous weeds. Sher (8) reported *H. spinicaudata* (Sch.stek) Luc & Goodey, 1936 and *H. oryzae* as parasites of sugar-cane roots in Ghana and Nigeria. In Egypt, Tarjan (9) reported *Gossypium hirsutum* L. as a host of *H. oryzae* and in Nigeria Bridge (1) recovered *H. oryzae* from *Triticum aestivum* L. roots. Netscher (6) observed *Abelmoschus esculentum* L. as host of *H. spinicaudata* in Ivory-coast.

In most rice growing regions of the world, fields are fallowed to weeds for more than one-half year after the rice crop. There is need to check population increase of the rice-root nematodes and use the land effectively for food production other than rice where possible. Hence, the evaluation of rice varieties and other food crops may assist identifying levels of susceptibility of rice varieties and the role of crops in rotations for controlling nematodes. This paper discusses attempts to screen lowland rice varieties and arable crops for reaction to 3 species of *Hirschmanniella.*

MATERIALS AND METHODS

Thirty-four lowland rice varieties were germinated in seed trays filled with steam-sterilized sand and four seedlings were transplanted singly after 20 days into 250 cm^3 steam-sterilized clay loam soil in jiffy pots. Each seedling was inoculated with chopped rice roots containing approximately 200 nematodes. This procedure was carried out for *Hirschmanniella oryzae, H. imamuri* and *H. spinicaudata,* respectively. Pots were flooded as soon as seedlings began to tiller. Nematode populations were assessed six weeks after transplanting by recovering from soil and rice roots. For in-situ observa-

Table 1. Populations of three species of Hirschmanniella developing in different rice varieties after 42 da culture in a green-house.

Rice Variety	Country of Origin	Reaction of varieties after 42 da		
		H. imamuri	H. oryzae	H. spinicaudata
IR 5	Nigeria	VS[1]	VS	VS
IR 8	Nigeria	VS	VS	VS
IR 20	Nigeria	VS	VS	VS
IR 22	Nigeria	VS	VS	VS
IR 24	Nigeria	VS	VS	VS
BG 79	Nigeria	VS	VS	VS
Tjina	Nigeria	VS	VS	VS
D 114	Nigeria	VS	VS	VS
FARO 14	Nigeria	VS	VS	VS
FARO 15	Nigeria	VS	VS	VS
FARO 16	Nigeria	VS	S	VS
FARO 17	Nigeria	VS	S	VS
KAV 12	Nigeria	VS	VS	VS
MAKALIOKA 823	Nigeria	S	S	S
MAS 2401	Nigeria	S	S	S
MALIONG	Nigeria	S	VS	S
OS 6	Nigeria	S	VS	S
SML 140/10	Nigeria	S	VS	S
SIAM 29	Nigeria	S	S	S
SINDANO	Nigeria	VS	VS	S
TN 1	Nigeria	S	S	S
PANKAJ	India	S	VS	S
PALDAL	S. Korea	VS	VS	S
CICA -4	El Salvador	S	S	S
CICA -6	El Salvador	S	S	S

Table 1. Continued

Rice Variety	Country of Origin	Reaction of varieties after 42 da		
		H. imamuri	H. oryzae	H. spinicaudata
No. 1116	El Salvador	S	VS	S
No. 1160	El Salvador	S	S	S
X 10	El Salvador	S	S	S
CANILLA	Ecuador	VS	S	S
PERU 1	Ecuador	S	S	S
INIAD-2	Ecuador	S	S	S
AMBAR	Iraq	S	S	S
HWAZANY	Iraq	S	S	S
NAEMA 45	Iraq	S	S	S

[x] mean of 5 replicates

VS - Very susceptible

S - Susceptible

tions, one replicate was stained in 0.5% acid Fuchsin in lactophenol.

Sixteen arable crops: maize, sorghum, wheat, sugarcane, onion, bulrush millet, finger millet, okra, cotton, cowpea, pigeon pea, soybean, groundnut, tobacco, sweet potato, and tomato were sown directly in 250 cm^3 steam-sterilized clay loam soil mixed with chopped rice roots containing about 200 nematodes per pot. Nematode populations were assessed as described above on replicates stained for in-situ observations.

Rice varieties and arable crops were scored using multiplication rate index (m) and reproductivity in the crop as follows: very susceptible (VS) - $m \geq 1.5$; susceptible (S) - $m \geq 1$; fairly susceptible (FS) with eggs and juveniles in host root - $.75 \leq m \leq 1$; not susceptible (NS) - $m < .75$

RESULTS

All rice varieties were susceptible in varying degrees to each of the three nematode species (Table 1). Egg, juvenile and adult stages of both sexes of the three *Hirschmanniella* spp. were encountered in roots of all rice varieties screened.

Maize, sugarcane, wheat, okra and tomato were susceptible to all the three nematodes. Cowpea, pigeon pea, soybean, goundnut, tomato, sweet potato, bulrush millet, finger millet, sorghum and onion did not support a build-up or maintenance of the nematode population. However, a single adult and juveniles were occasionally

Table 2. Populations of three species of Hirschmanniella developing on different dicotylendonous crops after 42 da culture in a green-house.

CROP	Country of Origin	[x]Reaction of crops after 42 da		
		H. imamuri	H. oryzae	H. spinicaudata
Abelmoschus esculentum (L) Moench Okra	Nigeria	S	S	S
Gossypium hirsutum L. Cotton	Iraq	S	S	S
Vigna unguiculata Walp. Cowpea	Nigeria	NS	NS	NS
Cajanus cajan Mill Pigeon pea	Malawi	NS	NS	NS
Glycine max (L) Merr. Soya-bean	Ecuador	NS	NS	NS
Arachis hypogaea L. Groundnut	Nigeria	NS	NS	NS
Nicotiana tabacum L. Tobacco	Iraq	NS	NS	NS
Ipomea batatas Lam. Sweet potato	Nigeria	NS	NS	NS
Lycopersicum esculentum Mill. Tomato	England	S	S	S
Zea mays L. Maize	Nigeria	S	S	S
Sorghum vulgare var. Durra. Hubbard and Rehd. Sorghum	Iraq	NS	NS	NS
Triticum aestivum L. Wheat	Iraq	S	S	S
Saccharum officinarum L. Sugar-cane	Nigeria	S	S	VS

Table 2. Continued.

CROP	Country of Origin	[x]Reaction of crops after 42 da		
		H. imamuri	H. oryzae	H. spinicaudata
Allium cepa L. onion	Nigeria	NS	NS	NS
Eleusine carocona L. Gaertn. Finger millet	Malawi	NS	NS	NS
Pennisetun typhoides Stapf. & Hubbard. Bulrush millet	Malawi	FS	FS	FS
Oryza sativa L. Rice IR 8	Nigeria	VS	VS	VS

x VS - Very susceptible FS - Fair susceptible
S - Susceptible NS - Not susceptible

encountered in cowpea, pigeon pea, soybean, and finger millet, but no eggs were observed. Necrosis of the infected roots were observed around areas invaded by each nematode species. Groundnut, tobacco and onion were apparently non-hosts of the rice-root nematodes (Table 2).

DISCUSSION

The susceptibility of all the 34 rice varieties to the 3 species of *Hirschmanniella* may be due to the fact that all commonly grown rice varieties were developed in fields heavily infested by the rice-root nematodes. This view is shared by Ichinohe (3) on the basis of his observations in Japan on *H. oryzae*. Of the 270 varieties screened for reactions to *H. oryzae* in South Korea, only six were very poor hosts with less than 10 nematodes per 10 g of roots (7). The cultivation of susceptible crops such as okra, cotton, tomato, maize, sugarcane and wheat in rice fields after the rice crop enhances the survival and multiplication of the nematodes. Tarjan (9) found *H. oryzae* in association with cotton in Egypt. Netscher (6) also found *H. spinicaudata* in association with okra and tomato in Senegal. However, contrary to the observations of Mathur and Prasad (5), *H. oryzae* multiplied on maize, wheat, and cotton in the present studies although failure of *H. oryzae* and the other two species to multiply on finger millet, *Eleusine carocona* agrees with their observation. As observed in the present studies, Caveness (2) and Sher (8) found sugarcane to be a good host for *H. spinicaudata* and *H. oryzae*. The present study is apparently the first reported case of susceptible hosts for *H. imamuri* other than rice. Sugarcane, wheat, maize, cotton, okra, and tomato were good hosts of *H. imamuri*.

The inability of the 3 *Hirschmanniella* spp. to multiply on cowpea, pigeon pea,

soybean, groundnut, sweet potato, tobacco, sorghum, onion, and finger millet may imply their potential use in a crop rotation program for control of *Hirschmanniella* spp.

RESUMEN

Treinta y cuatro variedades de arroz y 16 plantas de cultivo fueron examinadas para determinar el grado de susceptibilidad a 3 nematodos radiculares del arroz, *Hirschmanniella oryzae, H. imamuri* y *H. spinicaudata.* Todas las variedades de arroz fueron susceptibles a las 3 especies de nematodos, lo que no fueron el frijol de costa, el gandul, maní, batata, tabaco, sorgo y el mijo.

Claves: nematodos radiculares del arroz, gama de hosperderos, variedades resistentes.

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ACKNOWLEDGEMENT

I wish to thank Dr. John Bridge for advice and guidance while carrying out this work.

Table 1: Populations of 3 species of *Hirschmanniella* developing in different rice varieties after 42 day culture in a greenhouse.

Table 2: Populations of 3 species of *Hirschmanniella* developing on different dicotyledonous crops after 42 day culture in a greenhouse.