Fundam. appl. Nematol., 1992, 15 (6), 575-577

Short notes

ROOT-PARASITIC NEMATODES OF DEEP-WATER RICE IN THE MEKONG DELTA OF VIETNAM

Nguyen Thi Thu CUC * and Jean-Claude PROT **

* *Plant Pathology Department, University of Can Thõ, Can Thõ, Hâu Giang, Vietnam, and ** Plant Pathology Division, International Rice Research Institute (IRRI), P.O. Box 933, 1099 Manila, Philippines.*

Accepted for publication 11 December 1991.

Key-words : Nematodes, rice, Vietnam.

Deep-water rice areas are those where rice is subjected to flooding with water depths of over 50 cm. It is usually called floating rice when water depths exceed 100 cm. About 11 million ha of deep-water rice are grown in South and Southeast Asia, mostly in Bangladesh, Burma, India, Thailand and Vietnam (Catling *et al.*, 1988). In deep-water rice, *Ditylenchus angustus* (Butler) Filipjev, the causal agent of ufra disease, may cause devastating damage and even total failure of the crop (Hashioka, 1963; Cox & Rahman, 1980; Cuc & Kinh, 1981; Catling & Puckridge, 1984). Although national losses caused by this nematode are relatively low (Catling *et al.*, 1979), it has received more attention than the root-parasitic nematodes. However, Page *et al.* (1979) reported that *Meloidogyne graminicola* Golden & Birchfield, *Hirschmanniella oryzae* (Van Breda de Haan) Luc & Goodey, *Tylenchorhynchus annulatus* (Cassidy) Golden (= *T. martini* Fielding), *Longidorus* spp. and *Xiphinema* spp. were associated with deep-water rice in Bangladesh.

In Vietnam, 400 000 ha of deep-water rice are grown in the Mekong delta. Because of the rapid development of supplemental irrigation facilities, there is a large-scale abandonment of deep-water rice in favor of one or two high yielding rice crops before and after the flood. Whereas *D. angustus* does not seem to affect the irrigated rice crop in Vietnam (Prot & Cuc, 1990), root-parasitic nematodes may damage both deep-water (Page *et al.*, 1979; Bridge & Page, 1982) and irrigated rice crops (Fortuner, 1974, 1977). Therefore, it is important to determine the root-nematodes associated with deep-water rice which may also damage irrigated rice when irrigation facilities allow the replacement of deep-water rice with high yielding rice crops. Hence, an extensive survey was carried out in the Mekong delta of Vietnam to identify the root-parasitic nematodes associated with deep-water rice and determine their frequency of occurrence and abundance.

Materials and methods

A total of 164 farmers' fields scattered all over the deep-water rice growing area were sampled between flowering and harvest (ten soil and root samples per field). These fields were distributed over five provinces : An Giang (7), Cuu Long (23), Dông Thap (8), Hâu Giang (47), and Minh Hai (79). Samples were collected during the 1989 and 1990 rainy seasons in fields where the water depth was ranging from 50 to 350 cm. IR66 and IR42 were the cultivars grown in shallow water areas whereas traditional varieties (Hay Ran, Do Lun, Do Mo Coi, and Nang Soi) were grown in deep flooding areas.

Each soil and root sample was processed separately. Nematodes were extracted from 100 cm^3 of soil and 3 g root subsamples. Soil samples were processed by using a combination of sieving and modified Baermann funnel methods. Root samples were shredded for 15 s in a blender and then macerated for 24 h in a modified Baermann funnel.

For each species, we calculated the absolute frequency or percentage of fields where the species was detected and the average absolute density or number of specimens of this species per dm^3 of soil and g of roots (fresh weight of roots) in fields where the species was observed.

Results

Only four species of root-parasitic nematodes were found associated with deep-water rice in the fields surveyed : *Hirschmanniella mucronata* (Das) Luc & Goodey, *H. oryzae*, *Meloidogyne graminicola*, and *Tylenchorhynchus annulatus* (Table 1).

H. oryzae was detected in all five provinces and all fields surveyed except one in Hâu Giang province. *H. mucronata* was present in all fields in An Giang, Hâu Giang and Cuu Long provinces and found in most of the fields in the other provinces. *M. graminicola* was observed only in Hâu Giang and Cuu Long provinces and *T. annulatus* in Hâu Giang, An Giang and Dong Thap provinces. In 53 samples, *T. annulatus* was recovered from roots as well as from soil. In most of these samples the number of *T. annulatus* recovered from roots was low (1 or 2 per g of root). However, a maximum number of 157 *T. annulatus* per g of root was observed and 20 root samples contained more than 50 *T. annulatus* per g. There was no significant correlation

ISSN 1164-5571/92/06575 03 $ 2,40 /

Table 1 : Average absolute densities (D) per dm³ of soil and g of root and absolute frequency (F) of occurrence (% of fields where the species has been detected) of root-parasitic nematodes associated with deep-water rice in the Mekong delta of Vietnam.

Nematodes species	Mekong delta provinces										Total Mekong	
	An Giang		Cuu Long		Dông Tap		Hâu Giang		Minh Hai			
	D	F	D	F	D	F	D	F	D	F	D	F
Hirschmanniella oryzae												
Soil	63	100	1402	100	526	100	1224	98	1353	100	1238	99
Root	32	100	76	100	12	100	82	98	26	100	49	99
Hirschmanniella mucronata												
Soil	61	75	274	100	53	73	123	96	232	85	191	96
Root	7	100	3	100	2	87	5	96	4	63	4	77
Meloidogyne graminicola												
Soil	0	0	115	44	0	0	547	42	0	0	408	20
Root	0	0	36	52	0	0	43	42	0	0	39	20
Tylenchorhynchus annulatus												
Soil	0	0	0	0	550	50	30	10	0	0	261	5
Root	9	25	0	0	26	87	0.1	20	0	0	12	11

between population densities of the different species observed.

With an absolute frequency of 99 % and average absolute densities of 1238 individuals per dm³ of soil and 49 per g of roots in the 164 fields, *H. oryzae* was the prevalent root-parasitic nematode of deep-water in the Mekong delta. *H. mucronata* was detected in 96 % of the fields with an average absolute density of 191 individuals per dm³ of soil. Average absolute densities of 408 *M. graminicola* per dm³ of soil and 216 *T. annulatus* per dm³ of soil were detected in 20 and 5 % of the fields, respectively. An average of 12 *T. annulatus* per g of root were detected in 11 % of the 164 fields.

Discussion

The two rice-root nematodes, *H. oryzae* and *H. mucronata*, were omnipresent in high population densities. Pathogenic to rice (Panda & Rao, 1971; Fortuner, 1974, 1977; Babatola & Bridge, 1979) and capable of causing yield losses in irrigated rice under field conditions (Prot *et al.*, 1992), they are potential important pests if irrigated rice replaces deep-water rice. Their effect on deep-water rice has not been assessed. *M. graminicola*, which was present in high populations in 20 % of the fields and pathogenic to deep-water rice (Bridge & Page, 1982), may locally cause yield losses in deep-water rice. *T. annulatus* was obtained not only from the soil but also from the roots.

Tylenchorhynchus spp. are usually ectoparasites. It is possible that the presence of *T. annulatus* in deep-water rice roots results from an adaptation to survive the absence of oxygen in the soil during the flood.

Acknowledgments

This work was supported by the International Rice Research Institute (IRRI) and the Institut Français de Recherche Scientifique pour le Développement en Coopération (ORSTOM).

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