

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

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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), Đông 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 cm³ 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 dm³ 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

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		
<i>Hirschmanniella oryzae</i>												
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
<i>Hirschmanniella mucronata</i>												
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
<i>Meloidogyne graminicola</i>												
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
<i>Tylenchorhynchus annulatus</i>												
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.

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ON THE ALLOTYPE CONCEPT

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Many nematologists, and probably other zoologists too, when describing a new species, designate beside the holotype, one specimen of the other sex as allotype (Greek *allos* = other). I did it myself until 1965, then I abandoned this practice, realizing that it is illogical and even absurd.

It has been pointed out by many authors (e.g. Simpson, 1961) that the word "type" is misleading. It suggests "typical example" but it is really something quite different, viz. a specimen (we are dealing here with species only) to which a name is, or by designation can be, tied (Int. Code Zool. Nomencl., 1985, Art. 61). It is a nomenclatural concept, not a morphological or systematical one. The attempt of Simpson to have it replaced by the more correct term "onomatophore" (in the Code) has not been successful: "the dead hand of the past weighs too heavily upon us all" (Simpson, 1961, p. 48). There can be only one type specimen of a nominal species, not two, for the simple reason that males and females of any species are indicated by the same name. From this point of view it is incorrect to give a special nomenclatural status to a specimen of the sex to which the holotype (lectotype, neotype) does not belong. Stys (1973) has also pointed out that an allotype does not have any nomenclatural function; designation of allotypes is "a typological relict".

Since, thus, an allotype cannot be used to give an objective basis for a specific name, and it can neither (as all types) be regarded a "typical example" of morphological characters, the allotype concept should be discarded. Allotypes are not recognized formally in the Code, only Recommendation 72A states: "The term 'allotype' may be used to designate among paratypes a specimen of opposite sex to the holotype", but not a single argument is given *why* this "may" be done, and in my opinion it conflicts with the philosophy underlying Art. 61, that a type provides an objective standard of reference by which the application of a name is determined.

The Secretary of the International Commission of Zoological Nomenclature has informed me that the Commission is considering publication of a new edition of the Code. Recommendation 72A will be discussed.

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