Plant-Parasitic Nematodes of South Viet Nam[1]

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Abstract: Between 1974 and 1978, 2,842 identifications of plant-parasitic nematodes were made from more than 1,700 soil and plant samples collected in eight provinces of South Viet Nam. Species in nine genera—*Helicotylenchus, Criconemoides, Meloidogyne, Pratylenchus, Tylenchorhynchus, Hoplolaimus, Hirschmanniella, Xiphinema,* and *Rotylenchulus*—comprised 96.1% of the identifications; the remaining 3.9% were species of 11 genera. Fourteen genera were associated with rice which was grown on about 2,500,000 ha in 1970. Of these, *Ditylenchus, Hirschmanniella,* and *Meloidogyne* were most important. *Ditylenchus angustus* caused severe damage to about 50,000 ha of flooded rice in the Mekong Delta in 1976. *Hirschmanniella* spp. were found in all samples examined from flooded rice fields. *Meloidogyne* spp. were common in rice seedbeds, upland rice, and rice not kept flooded continuously. *Meloidogyne* and *Pratylenchus* spp. were found in roots of 22 of the 32 crop plants sampled. Little or no attempt was made in South Viet Nam to control nematodes. *Key words:* survey, *Helicotylenchus, Criconemoides, Meloidogyne, Tylenchorhynchus, Hoplolaimus, Hirschmanniella, Xiphinema, Rotylenchulus.*

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The only paper that has been published in an Indo-European language on plant-parasitic nematodes of Viet Nam is by Andràssy (1). It contains descriptions of 21 species found in samples sent to the author from North Viet Nam. Of these, only two—*Tylenchorhynchus elegans* Siddiqi, 1961 and *Hemicriconemoides mangiferae* Siddiqi, 1961—belong to recognized genera of plant-parasitic nematodes. One female and four juveniles of *T. elegans* and one female of *H. mangiferae* were found

In 1978, Khuong published three papers (4,5,6) in Vietnamese on plant parasitic nematodes of Viet Nam. Those papers are not generally available, and so this paper summarizes results of those papers and includes some additional surveys made while he was employed at the Department of Plant Protection, College of Agriculture, Saigon (now Ho Chi Minh City).

South Viet Nam is a long narrow country extending from about 8° to 17° north latitude along the South China Sea. The Delta of the Mekong River occupies a large area in the south. A range of mountains with a maximum height of about 2,500 meters extends along the length of the country. Rainfall may be heavy with a total of about 2,000 mm from April to November and little or none in other months. The principal farming areas are the Mekong Delta and numerous more or less isolated areas along the coast and on slopes of the mountains. Rice is the principal crop, with about 2,500,000 ha grown in 1970 (9). A very large percentage of the rice is produced in flooded fields, but upland rice is grown also. Rice fields which can be irrigated may be used for tobacco or other crops in the dry season. Other major crops in 1970 were sugarcane, 12,000 ha; maize, 28,500 ha; rubber, 39,000 ha; tea, 7,000 ha; and coconut, 22,000 ha (9). Farming soils are mostly alluvial, with basaltic soils in the mountains and soils derived from coral and rock in a few islands.

MATERIALS AND METHODS

More than 1,700 samples of soil and plants were collected from farm fields in the principal agricultural areas of South Viet Nam between 1974 and 1978. Nematodes were isolated by sieving and centrifugal flotation in sugar solution (2) or by use of Baerman funnels (11). Selected specimens were infiltrated with glycerine, using the slow method described by Thorne (12), then mounted in glycerine jelly. The principal aids to identification were Goodey and Goodey (3), Khuong and Smart (8), Sher (10), and Thorne (12).

RESULTS

Results of the survey are presented in Tables 1 and 2. Table 1 shows the genera

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Table 1: Distribution of nematodes on 32 crops in South Viet-Nam

Crop	Nematode genera																				Number of nematode genera associated with each crop
	Aphelenchoides	*Criconemoides*	*Ditylenchus*	*Dolichodorus*	*Helicotylenchus*	*Hemicriconemoides*	*Hemicycliophora*	*Hirschmanniella*	*Hoplolaimus*	*Longidorus*	*Meloidodera*	*Meloidogyne*	*Pratylenchus*	*Rotylenchulus*	*Scutellonema*	*Trichodorus*	*Trophonema*	*Tylenchorhynchus*	*Tylenchulus*	*Xiphinema*	
Black pepper (*Piper nigrum*)		+			+	+	+	+	+		+	+	+		+	+	+	+		+	14
Banana (*Musa sp*)		+		+	+	+	+		+	+		+	+	+	+			+		+	13
Corn (*Zea mays*)		+			+	+		+	+			+	+	+	+	+		+			11
Cucurbits (*Cucurbita sp*)		+			+		+	+	+			+						+			7
Cotton (*Gossypium sp*)		+			+				+			+	+	+				+			7
Coffee (*Coffea robusta*)					+																1
Cauliflower (*Brassica oleracea var. botrytis*)					+								+	+		+					4
Cucumber (*Cucumis sativus*)		+						+		+		+				+		+			6
Coconut (*Cocos nucifera*)		+			+			+	+	+			+					+		+	8
Common bean (*Phaseolus vulgaris*)		+			+			+				+	+	+				+		+	8
Grapefruit (*Citrus grandis*)		+			+	+	+		+	+		+	+	+				+	+	+	12
Greenbean (*Vigna radiata*)		+			+				+			+						+			5
Lettuce (*Lactuca sativa*)		+							+			+						+			4
Mustard (*Brassica rapa*)		+							+			+				+		+			5
Okra (*Hibiscus esculentus*)					+							+	+					+			4
Orange (*Citrus sinensis*)		+			+		+		+				+				+		+	+	8
Peanut (*Arachis hypogaea*)		+			+				+			+	+	+	+	+		+		+	10
Potato (*Solanum tuberosum*)					+							+	+	+							4
Pineapple (*Ananas sp*)		+			+			+				+	+	+		+		+		+	9
Pepper (*Capsicum frutescens*)		+																+			2
Rice (*Oryza sativa*)	+	+	+		+		+	+	+	+		+	+	+	+			+		+	14
Sugar cane (*Saccharum officinarum*)		+			+			+				+	+	+				+		+	8
Soybean (*Glycine soja*)		+			+							+	+	+				+			6
Sweet potato (*Ipomea batatas*)		+			+				+					+	+			+			6
Strawberry (*Fragaria sp*)					+																1
Sorghum (*Sorghum sp*)		+			+	+			+	+			+	+				+			8

Table 1 (Continued)

Crop	Nematode genera																				Number of nematode genera associated with each crop
	Aphelenchoides	*Criconemoides*	*Ditylenchus*	*Dolichodorus*	*Helicotylenchus*	*Hemicriconemoides*	*Hemicycliophora*	*Hirschmanniella*	*Hoplolaimus*	*Longidorus*	*Meloidodera*	*Meloidogyne*	*Pratylenchus*	*Rotylenchulus*	*Scutellonema*	*Trichodorus*	*Trophonema*	*Tylenchorhynchus*	*Tylenchulus*	*Xiphinema*	
Tea (*Thea sinensis*)		+			+								+					+			4
Tobacco (*Nicotiana tabacum*)		+			+		+		+	+		+	+	+		+		+		+	11
Tangarine (*Citrus reticulata*)		+			+				+			+	+	+							6
Tomato (*Lycopersicon esculentum*)		+							+			+	+			+		+			6
Watermelon (*Citrullus lanatus*)		+				+										+		+			4
Yard-long bean (*Vigna sesquipedalis*)		+			+		+	+				+	+	+		+		+			9
No. crops associated with each nematode genus	1	27	1	1	26	5	9	10	18	7	1	22	22	17	6	11	2	26	2	11	

Table 2. Distribution of nematode genera in South Viet-Nam by province*

Nematode genera	Provinces and no. samples containing each genus								Total no. of identifications	Percent of total identifications	Highest population in 100 cm³ of soil
	Lam-Dong (33)	Thuan-Hai (26)	Dong-Nai (887)	Tay-Ninh (63)	Long-An (93)	Tien-Giang (190)	Con-Dao (205)	Sai-Gon (212)			
Criconemoides	10	12	142	38	23	47	106	159	587	18.9	1800
Dolichodorus	0	0	0	0	0	0	8	0	8	0.3	1
Helicotylenchus	19	3	381	11	43	8	20	38	563	19.8	495
Hemicriconemoides	0	0	10	1	0	0	0	0	11	0.4	60
Hemicycliophora	0	0	18	0	0	0	4	6	28	1.0	35
Hirschmanniella	0	1	0	2	2	55	11	64	135	4.8	940
Hoplolaimus	1	15	89	5	0	14	91	64	279	9.8	330
Longidorus	1	0	4	1	0	0	6	2	14	0.5	15
Meloidodera	0	0	0	0	0	0	5	0	5	0.2	8
Meloidogyne	8	2	186	7	28	55	35	47	368	12.9	2000
Pratylenchus	12	7	142	24	34	42	27	64	352	12.4	405
Rotylenchulus	1	4	53	2	11	9	2	6	88	3.0	550
Scutellonema	0	0	9	0	0	0	0	3	12	0.4	30
Trichodorus	1	0	0	1	0	0	1	15	18	0.6	30
Trophonema	0	0	0	0	0	1	0	3	4	0.1	136
Tylenchorhynchus	1	3	44	18	17	68	16	165	332	11.7	290
Tylenchulus	0	0	9	0	0	0	0	0	9	0.3	40
Xiphinema	2	0	9	13	3	1	36	15	79	2.8	75
Aphelenchoides	+†	0	+	+	+	0	0	0	—	—	—
Ditylenchulus	0	0	0	0	0	+	0	0	—	—	—
Totals	11	8	14	13	9	11	14	13	2842		

*Principal soil types: Lam-Dong, red latosol and red-yellow podzolic; Thuan-Hai, regosol and grey podzolic; Dong-Nai, basaltic, alluvial, grey podzolic and low-humic gley; Tay-Ninh, grey podzolic; Long-An, alluvial and acid sulfate; Tien-Giang, alluvial; Con-Dao, coral and rock; Sai-Gon, grey podzolic, alluvial, low-humic gley and acid sulfate.

†No exact figures available, very numerous in rice.

associated with 32 crop plants. Table 2 shows distribution by province. On rice, the most severe and conspicuous damage was caused by *Ditylenchus angustus* in flooded fields of the Mekong Delta. The Provincial Agency of Agriculture of Dong-Thap Province estimated in 1976 that about 50,000 ha are severely damaged each year, with 50% losses of yield being common.

Throughout the country, several species of *Hirschmanniella* were found in rice roots during the survey. Specimens were present and associated with extensive root discoloration and rotting in every sample examined (7). Crop loss is difficult to assess because there were no nematode-free plants for comparison.

Meloidogyne graminicola and other species of *Meloidogyne* often were found in rice seedbeds that were not flooded or not kept flooded continuously and in fields of flooded and upland rice (5).

Meloidogyne species comprised 12.9% of the total number of identifications and were found on 21 other crop plants. The species on these were almost invariably *M. javanica* or *M. incognita*.

Pratylenchus spp. were found in 22 crop plants and constituted 12.4% of the total.

Helicotylenchus comprised 19.8% of all species identified; banana roots often had heavy infections as internal parasites.

Rotylenchulus was found in 17 crop plants, but was only 3.0% of the total identifications.

Among the ectoparasites, *Criconemoides* and related genera were most prevalent, being associated with 27 crop plants and comprising 18.9% of the nematodes identified. *Hoplolaimus* was associated with 18

crop plants, *Trichodorus* with 11, *Xiphinema* with 11, *Hemicycliophora* with 9, *Longidorus* with 7, *Scutellonema* with 6, and *Hemicriconemoides* with 5.

Radopholus was not found in any of approximately 400 samples of banana, 150 samples of black pepper, and 200 samples of citrus.

Low populations of *Tylenchulus semipenetrans* were found only nine times in about 200 samples of citrus roots.

DISCUSSION

Climate and irrigation make it possible to grow several crops a year in some parts of South Viet Nam. It is customary to grow rice every year on all land that can be flooded. Both of these practices, dictated by economic necessity, contribute to increase and maintenance of high populations of plant-parasitic nematodes. Yield loss, although difficult to assess, is probably high; it is increased by a shortage of fertilizers, an almost complete lack of nematicides, and the absence of cultural control practices or resistant crops. Education of farmers in recognition and control of nematodes is in a very early stage.

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