

RESEARCH ON INTEGRATED CROP PROTECTION SYSTEMS WITH EMPHASIS ON THE ROOT - KNOT NEMATODES (*MELOIDOGYNE* SPP.) AFFECTING ECONOMIC FOOD CROPS

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One group of plant-parasitic nematodes that is very important is the root-knot nematodes, *Meloidogyne* spp. This is because these nematodes are not only world-wide in distribution but also have a very wide host range and cause considerable damage to economic food crops. And, therefore, effective but practical and economical control measures against the root-knot nematodes must be developed. However, before an effective control program strategy can be developed the species and biotypes of root-knot nematodes present in the area must first be known, hence this study.

The objectives of this study were to determine the species and biotypes of root-knot nematodes present in the Philippines and to gather information on the relationships of ecological factors to the distribution and survival of *Meloidogyne* spp.

Materials and Methods

Survey/Collection trips.— Trips to different provinces in five regions of the Philippines were made to collect plants infected with root-knot nematodes. Soil samples around the roots of such infected plants were also collected.

Efforts were also made to collect or obtain root-knot nematodes from other Southeast Asian countries like Taiwan, Thailand, Malaysia, Indonesia and Japan.

Collection trips in the Philippines were made possible through the National Science Development Board (NSDB) research grant and in foreign countries, through SEATO research grant.

Identification of *Meloidogyne* spp.— Egg-laying females were extracted from the galled roots of each of the plants collected and root-knot nematode species involved identified. Tentative identification was based mainly on the characteristics of the perineal patterns prepared from the egg-laying females.

Inoculations.— Single egg-mass inoculations were made on the original hosts or tomato

seedlings planted in potted baked soil. At least five single egg-mass inoculations were made per source plant.

The soil samples collected around roots of root-knot infected plants were placed separately in clay pots and planted with the original host or tomato seedlings. All inoculated plants and plants planted in infested soil were kept in the University of the Philippines at Los Banos (UPLB) greenhouses.

Results and Discussion

Collection.— Samples of root-knot nematode infected plants were collected from 29 provinces in five regions of the Philippines (Table 1). Before the initiation of International Meloidogyne Project (IMP), a total of 88 root-knot nematode isolates had been collected through SEATO research grant. During IMP period, the total root-knot nematode isolates collected were 137. The present Philippine root-knot nematode isolates being maintained at the UPLB greenhouses are 225.

Most (111 or 44.4 %) of these isolates came from Southern Luzon which includes Laguna where UPLB is located. It was followed by Mindanao with 40 isolates or 17.7 percent.

Duplicates of 14 of these isolates were sent to the Central Unit at Raleigh, N.C.

The total root-knot nematode isolates collected or received from other Southeast Asian countries were 79 (Table 2). The pre-IMP collections were of 58 isolates and the IMP, 21 isolates. A bulk of these foreign isolates came from Thailand.

The root-knot nematode isolates from the Philippines and other Southeast Asian countries now being maintained at the UPLB greenhouses are 304 (Table 3). Of these, 146 isolates were collected before IMP was initiated and 158, during IMP period.

The total isolates from the Philippines were 225 or 74 %; Thailand, 26 (8.6 %); Taiwan,

18 (5.9 %); Malaysia, 16 (5.3 %); Indonesia, 14 (4.6 %); and Japan, 5 (1.6 %).

species of *Meloidogyne* were tentatively identified from the Philippines. These were *M. incognita*, *M. javanica*, and *M. arenaria*. Of the 225 Philippine isolates, 60 or 26.7 % were identified as *M. incognita*, 30 (13.3 %)

Meloidogyne spp. and distribution.— Three

Table 1. Geographical distribution of Philippine root-knot nematode isolates currently maintained at the UPLB greenhouse, February, 1978.

Region	Root-knot nematode collection		Total
	Pre-IMP*	IMP	
Northern Luzon (6 provinces)	27	15	42
Central Luzon (3 provinces)	2	6	8
Southern Luzon (7 provinces)	23	88	111
Visayas (6 provinces)	16	8	24
Mindanao (7 provinces)	20	20	40
Total	88	137	225

*Collections obtained through SEATO research grant.

Table 2. Collection of root-knot nematode isolates from other Southeast Asian countries maintained at the UPLB greenhouses, February, 1978.

Countries	Root-knot nematode collection		Total
	Pre-IMP*	IMP	
Thailand	18	8	26
Taiwan	18	-	18
Malaysia	16	-	16
Indonesia	6	8	14
Japan	-	5	5
Total	58	21	79

*Collections obtained through SEATO research grant.

Table 3. Collection of root-knot nematode isolates from Southeast Asian countries maintained at the UPLB greenhouses, February, 1978.

Countries	Root-knot nematode collections		Total	Percent
	Pre-IMP*	IMP		
Philippines	88	137	225	74.0
Thailand	18	8	26	8.6
Taiwan	18	-	18	5.9
Malaysia	16	-	16	5.3
Indonesia	6	8	14	4.6
Japan	-	5	5	1.6
Total	146	158	304	100.0

*Collections obtained through SEATO research grant.

Table 4. Regional distribution of Philippine root-knot nematode species maintained at the UPLB greenhouse, February, 1978.

Region	<i>Meloidogyne</i> species				Total
	<i>incognita</i>	<i>javanica</i>	<i>arenaria</i>	unidentified	
Northern Luzon (5 provinces)	14	6	3	19	42
Central Luzon (3 provinces)	1	2	0	5	8
Southern Luzon (7 provinces)	16	8	1	86	111
Visayas (6 provinces)	10	7	0	7	24
Mindanao (7 provinces)	19	7	1	13	40
Total	60	30	5	130	225
%	26.7	13.3	2.2	57.8	100.0

Table 5. Species distribution of root-knot nematode isolates from Southeast Asian countries maintained at UPLB greenhouse, February, 1978.

Countries	<i>Meloidogyne</i> species					Total
	<i>incognita</i>	<i>arenaria</i>	<i>javanica</i>	<i>hapla</i>	unidentified	
Philippines	60	5	30	0	130	225
Thailand	11	0	8	0	7	26
Taiwan	13	2	2	0	1	18
Malaysia	5	0	4	0	7	16
Indonesia	3	0	3	0	8	14
Japan	2	0	1	2	0	5
Total	94	7	48	2	153	304
%	30.9	2.3	15.8	0.7	50.3	100.0

Table 6. Host distribution of species of Philippine root-knot nematode isolates.

Host	<i>Meloidogyne</i> species					Total
	<i>incognita</i>	<i>arenaria</i>	<i>javanica</i>	<i>hapla</i>	unidentified	
Vegetables (29 species)	28	2	19	0	70	117
Field crops (8 species)	12	2	7	0	17	38
Root crops (5 species)	4	1	0	0	5	10
Ornamentals (9 species)	3	0	0	0	6	9
Fruit crops (6 species)	3	1	1	0	12	17
Cereals (1 species)	2	0	0	0	0	2
Fiber crops (2 species)	1	0	0	0	1	2
Misc. (5 species)	5	0	4	0	19	27
Total	58	6	31	0	130	225
%	25.8	2.6	13.8	0	57.8	100.0

as *M. javanica* and 5 (2.2 %) as *M. arenaria* (Table 4). One hundred-thirty or 57.8 % were unidentified.

Nineteen out of 40 isolates from Mindanao consisted of *M. incognita*, 7 *M. javanica*, 1 *M. arenaria* and 13 unidentified. In South-

ern Luzon, 16 of the 111 isolates were *M. incognita*, 8 *M. javanica*, 1 *M. arenaria* and 86 unidentified.

The species distribution of root-knot nematode isolates from Southeast Asian countries maintained at the UPLB greenhouses is shown in table 5. Of the 304 total isolates, 94 or 30.9 % were *M. incognita*; 48 (15.8 %), *M. javanica*; 7 (2.3 %), *M. arenaria*, and 2 (0.7 %), *M. hapla*. One hundred fifty-three or 50.3 % were unidentified. *M. hapla* was identified only in isolates from Japan while *M. arenaria*, from the Philippines and Taiwan.

Host plants.— Root-knot nematode isolates from the Philippines were obtained from a wide variety of crops (Table 6). These include vegetables, field crops, root crops, ornamentals, fruit crops, cereals, fiber crops and others. Of the identified species attacking vegetables 28 were *M. incognita*, 19 *M. javanica* and 2 *M. arenaria*. On field crops consisting of 8 plant species the identified *Meloidogyne* spp. consisted of 12 *M. incognita*, 7 *M. javanica* and 2 *M. arenaria*.

Summary

Collection of root-knot nematode isolates

made in 29 provinces from five regions of the Philippines. In addition, collections were also made from other Southeast Asian countries such as Thailand, Taiwan, Malaysia, Indonesia, and Japan.

The total Philippine root-knot nematode isolates 225 and from other Southeast Asian countries, 79. The total root-knot nematode isolates now being maintained at the UPLB greenhouses are 304.

The species of root-knot nematodes tentatively identified in the Philippine isolates were *M. incognita*, *M. javanica*, and *M. arenaria*. Of these, *M. incognita* was the most common and widely distributed. It was followed by *M. javanica*.

Also in Southeast Asian countries *M. incognita* was most common and widely distributed, followed by *M. javanica*. *M. arenaria* was detected from Philippine and Taiwan isolates while *M. hapla*, only from Japan isolates.

Root-knot nematodes were found on a wide variety of crops in the Philippines. The most common species encountered was *M. incognita* followed by *M. javanica*.