STUDIES ON ROOT-KNOT NEMATODES IN KOREA

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Root-knot nematodes are one of the most important plant parasitic nematode group affecting economic food crop production, and having world-wide distribution and extensive host-ranges. A study on root-knot nematodes in Korea was not carried out till 1976. Thus the state of knowledge on root-knot nematodes is incomplete. I had an opportunity to take part in International Meloidogyne Project for study on root-knot nematodes.

Here, I report some results of studies on root-knot nematodes in Korea since 1976.

Collection and identification of root-knot nematodes: For study on the distribution of *Meloidogyne* species in Korea, 45 samples were collected from 37 different localities in 4 provinces (Table 1) Nineteen plant species were attacked by *Meloidogyne* spp. Four *Meloidogyne* species, *M. hapla, M. arenaria, M. incognita* and *M. javanica* were identified. *M. javanica* is newly reported for Korea.

Distribution of *Meloidogyne* spp. at various localities is shown in Table 2. *M. hapla* found most frequently, followed by *M. incognita, M. arenaria* and *M. javanica. M. incognita* was not found in Gyeong Gi and Gyeong Bug provinces. *M. arenaria* was not found in Gyeong Nam and Jae ju provinces. *M. Javanica* was not found only in Jae ju.

Table 1. Distribution of root-knot nematodes in various host plants in Korea.

Locality	Host plant	*Meloidogyne* sp.
Gyeong Bud Province		
Dongchon, Daegu	Chinese cabbage	*M. javanica*
Dongchon, Daegu	Edible burdock	*M. hapla*
Dongchon, Daegu	Tomato	*M. hapla*
Sangyeog, Daegu	Violet	*M. javanica*
Ohyeon, Punggi	Ginseng	*M. arenaria*
Haweonri, Uljin	*Perilla frutescens*	*M. hapla*
Pyeongri, Goryeong	Peanut	*M. hapla*
Seogpo, Ulneung	*Lactuca dentata*	*M.*
Dongbu, Yeongyang	Eggplant	*M. hapla*
Togu, Yeongyang	Tobacco	*M. hapla*
Togu, Yeongyang	*Perilla frutescens*	*M. hapla*
Weolmag, Cheongsong	*Perilla frutescens*	*M. hapla*
Ansim, Gyeongsam	Edible burdock	*M. hapla*
Namseong, Sangju	Peony	*M. hapla*
Daechon, Cheongdo	Carrot	*M. hapla*
Gyeong Nam Province		
Choeumri, Namhae	Lettuce	*M. hapla*
Choeumri, Namhae	Pumpkin	*M. javanica*
Singwanri, Hamyang	Eggplant	*M.*
Baegcheonri, Hamyang	*Perilla frutescens*	*M. hapla*
Nampori, Milyang	red pepper	*M. hapla*
Nampori, Milyang	*Perilla frutescens*	*M. hapla*
Haecheogri, Kimhae	Pumpkin	*M. incognita*

Table 1. Continued.

Locality	Host plant	*Meloidogyne* sp.
Nogsanri, Kimhae	Pumpkin	*M. incognita*
Bugogri, Changyeong	Soybean	*M. incognita*
Bugogri, Changyeong	Green bean	*M. incognita*
Gyeong Gi Province		
Gomagri, Gimpo	Ginseng	*M. hapla*
Masongri, Gimpo	Ginseng	*M. hapla*
Majoilri, Gimpo	Ginseng	*M. arenaria*
Naengjeongri, Ganghwa	Ginseng	*M. arenaria*
Yongpyeongri, Yongin	Ginseng	*M. hapla*
Jeondaeri, Yongin	Peony	*M. arenaria*
Nampungri, Anseong	Ginseng	*M. arenaria*
Ohagri, Yeoju	Peanut	*M. hapla*
Hupori, Yeoju	Tomato	*M. hapla*
Changdaeilri, Yangpeong	Tomato	*M. hapla*
Imog, Suweon	Potato	*M. javanica*
Haseongbugri, Pocheon	Eggplant	*M. sp.*
Jae ju Province		
Hanrimilri, Hanrim	Tomato	*M. sp.* unidentified
Gimnyeongri, Guja	Soybean	*M. incognita*
Weoljeongri, Guja	Melon	*M. incognita*
Seogiilri, Seogi	Chinese cabbage	*M. incognita*
Seogiilri, Seogi	Pumpkin	*M. incognita*
Seogiilri, Seogi	Carrot	*M. hapla*
Sangmori, Daejeong	Tomato	*M. incognita*

Table 2. Total number of plant species infested by *Meloidogyne* spp. in Korea.

Species	Locality				Total
	Gyeong Gi	Gyeong Bug	Gyeong Nam	Jae ju	
M. hapla	6	11	4	1	22
M. arenaria	4	1	.	.	5
M. javanica	1	2	1	.	4
M. incognita	.	.	4	5	9
M. sp.	1	1	2	1	5
Total	12	15	11	7	45

Differential host test: Ten soil samples collected from different localities were used for differential host test. Two-week-old host seedlings were transplanted in 20 cm. clay pots in three replications. Plants were inoculated at the time of transplanting with 10,000 eggs per plant. These eggs were obtained using I.M.P. method. After 50 days from inoculation, egg masses were stained with phloxin B and counted. The responses of plant species to *Meloidogyne* spp. are recorded in Table 3. Taxonomical identifications of samples 001, 003, 004, 007, 008, 009 and 019 fit well with the host response. Sample 002 was identified taxonomically as *M. javanica* but it produced high egg-mass rate on pepper. Also, sample 005 was taxonomically identifiable as *M. javanica* but produced low egg-mass rate on peanut and high rate on pepper. Sample 006, identified as *M. incognita,* attacked peanut

with low rate. I think, the samples 002, 005 and 006 were either mixed populations or were misidentified. Cotton was not attacked by any of the samples.

Screening of resistance of tomato and tobacco cultivars to *Meloidogyne incognita:* For the screening of resistant of tomato and tobacco cultivars to *M. incognita,* ten local cultivars of the former and 15 local cultivars as well as 4 improved lines of the latter were tested. The results are shown in Tables 4 and 5. All tomato cultivars were susceptible. Among them, cvs. Naebyeonghongboseg, Bulambogsu and Taefung 2 supported much less egg-mass formation than cv. Rutgers.

Tobacco cv. Osibeubtchio-E and line 6601-8 with gall index of 1.6 and 1.9 respectively, appeared to be resistant; cvs. Gwangtchio, Hyangtchio and Itchio appeared to be susceptible, while cvs. Gajatchio and Byultchio were not significantly different from cv. Mc Nair-30 on comparison of their gall numbers. The other cultivars were moderately resistant.

Table 3. Response of differential plant species to attack by the *Meloidogyne* spp.

Sample No.	*Meloidogyne* spp.	Differential hosts					
		Tobacco	Peanut	Cotton	Pepper	Watermelon	Tomato
		Egg mass rating*					
001.	*M. hapla*	5	4	0	3	0	4
002.	*M. javanica*	5	4**	0	3**	3	5
003.	*M. hapla*	4	4	0	2	0	5
004.	*M. arenaria*	1	3	0	1	2	5
005.	*M. javanica*	5	2**	0	4**	4	5
006.	*M. incognita*	5	2**	0	2	4	5
007.	*M. hapla*	4	2	0	2	0	5
008.	*M. hapla*	2	4	0	3	0	4
009.	*M. incognita*	5	0	0	5	3	4
010.	*M. hapla*	5	4	0	4	0	4

* Rating 0:0, 1:1-2, 2:3-10, 3:11-30, 4:31-100, 5: greater than 100.

** Taxonomical identification did not correspon with the host response.

Table 4. Comparison of numbers of egg masses by local tomato cultivars inoculated with *M. incognita.*

Cultivars	Days after inoculation	Mean no. egg masses/root
Daehyeongbogsu (Heungnong)	45	253.75
Bulambogsu 2	45	176.00
Weolgyaegwan	45	206.33
Doweonhong	45	303.66
Naebyeonghongboseog	45	155.28
Naebyeongjangsu	45	220.50
Daehyeongbogsu (Jangang)	45	233.12
Mansudaehyeong	45	224.00
Mansujosaeng	45	266.11
Taepung 2	45	188.55
Rutgers	45	264.14

Table 5. Reactions of tobacco cultivars to the root-knot nematode, *Meloidogyne incognita.*

Varieties	No. of galls	Gall index	Mean (%)
Gajatchio	21.6b	3.4	68
Moggitchio	14.5ab	2.8	56
Byultchio	23.1b	3.2	64
Suantchio	16.7ab	2.8	56
Sinjangtchio	14.9ab	3.1	62
Osibeubtchio-E	5.4a	1.6	32
Osibeubtchio-D	17.2ab	2.5	50
Useultchio	14.1ab	2.4	48
Ubangtchio	17.5ab	2.5	50
Itchio	27.5b	3.5	70
Gwangtchio	29.0b	3.8	76
Hyangtchio	28.3b	3.5	70
Daegu-1	18.5ab	2.5	50
Sosa-1	13.1ab	2.1	42
Sosa-3	14.7ab	2.4	48
6601-3	12.7ab	2.3	38
6601-8	8.0ab	1.9	46
6602-2	14.0ab	2.9	58
6602-3	14.2ab	2.9	58
NC-95	5.3a	1.6	32
McNair-30	28.5b	3.8	76
Hicks	24.ob	3.3	66

Different letters show significant difference, LSD (p = 005) = 7.2

Chemical control of *Meloidogyne incognita:* In order to get an idea about effects of chemical soil treatment on *M. incognita* in tomato, three nematicides, Mocap 10G, Temik 15G and Ac64, 475 5G (2-(Diethoxyphosphinylimino)-1, 3-dithietane) and two insecticides were used. Twenty-day-old tomato seedlings cv. (Doweonhong) were transplanted in 20 cm. clay pots in three replications. Plants were inoculated at the time of transplanting with 10,000 eggs per plant. After one week from inoculation, chemical treatment of the soil was carried out, repeated 15 days later. Egg masses were stained with phloxine B and counted 45 days after inoculation. The results are included in Table 6. AC 64, 475 and Mocap were the most effective and Temik the least. Insecticides, Furadan and Curaterr were more effective than the check, but not as good as AC 64, 475 and Mocap.

Table 6. Controlling effects of chemical soil treatment on *Meloidogyne incognita.*

Treatment	Rate Kg/10a	Mean no. egg masses /root	Root gall idex (%)
Furadan 3 % G	5.0	227b	84.0
Temik 15 % G	5.0	49a	54.6
Mocap 10 % G	5.0	7a	24.0
Curaterr 3 % G	5.0	279b	85.3
Ac 64,475 5 % G	5.0	7a	17.3
Untreated		464c	95.7

Different letters show significant difference at 5 % level by Duncan's multiple range test

Summary

A study on root-knot nematodes in Korea has been under taken in order to get some knowledge about the distribution of the *Meloidogyne* species, differential host test screening of resistance and control. Altogether 45 samples were collected from 37 different localities in 4 provinces. Nineteen plant species were attacked by *Meloidogyne* species. Four *Meloidogyne* species, i.e., *M. hapla, M. arenaria, M. incognita* and *M. javanica* are identified. *M. javanica* is newly reported from Korea. *M. hapla* is the commonest species in Korea.

Ten soil samples were used for the differential host test. Except two samples, 002 and 005, taxonomical identification of the samples fit, well with the host response.

In the screening of resistant tomato and tobacco cultivars all tomato cultivars appeared as susceptible. Tobacco cultivar Osibeubtchio and line 6601-8 appeared to be resistant.

In a trial on chemical control of *Meloidogyne incognita,* Ac 64, 475 and Mocap were the most effective and Temik the least. Furadan and Curaterr were more effective than the check, but not as good as AC 64, 475 and Mocap.

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DISCUSSION

Madamba: Do you find difficulty in maintaining differential host plants obtained at Central Unit? Is it possible to develop substitute host plants from native varieties to solve such difficulties?

Choi: I got some difficulties with watermelon, but not with other plants.

Inagaki: Don't you have root-knot nematode on apple trees in Korea?

Choi: No, we have not found them until now. We do have same symptoms on apple root but it is infected by wooly apple aphid.