

Studies on the Important Nematodes in Korea

1. Some Nematodes Found in the Soil around the Root of Floral Plants in the Green-house*

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INTRODUCTION

Recently, damage of Phytophagous Nematodes have remarkably infested on the crops. In foreign country, there are many study results in this field but not in Korea except only Yokoo's(1945) study results on wheat *Anguillulina tritici*(Steinb). The author studied Phytophagous Nematodes damage the ornamental plants in the green-house of Agricultural College of Kyung-Pook National University in 1962~1963 and reporting it's results. The author wishes to express his hearty thanks to directed Professor EUI SOON LEE and students who study in the applied Entomology laboratory.

MATERIAL AND METHOD

The author collected 50 grs in each 3 pots soil around the root on the same species planted from 30 kinds of green-house plants in Agricultural College of Kyung-Pook National University, separated Nematodes from the soil according to Baerman's method and counted Nematodes number of each species through the microscope to know the Nemic fauna of the green-house plants. Parasite fauna to each species of Begonia was investigated according to Gall index method. Rearing in the various temperature of the Rhabditis sp. carry out according to Dougherty's method. The Sanceberia sap agar medium was made from the most

infested Sanceberia among them. After cut the root of Sanceberia to pieces, added 15 grs to 500cc water, heated for 2 hours and added water again to maintain 500cc. Sanceberia sap medium was made from added 10 grs agar, and autoclave for 30 minutes at 110°C. Being added 20cc to the sterilized petri dish(Diameter 9cm, Height 1cm), put into the various temperatures incubator(18°, 25°, 30°, 35°C), for 2 days and inoculated 50 Nematodes to each Petri dish that was collected from Sanceberia, according to Young's method. The author counted number of Nematodes 12 times from 1cm square to one tumbled petri dish among them through the analysis microscope on every 5 days for 40 days. Morphological taxonomy dimensions derived from De Man's formula.

RESULT AND DISCUSSION

A. Nemic Fauna

The author collected 4 species from the soil such *Meloidogyne arenaria* Chitwood, *Scutellonema coheni* Andrassy, *Paurodontus gracilis* Thorne, *Xiphinema americanum* Cobb, as parasitic Nematodes and 6 species such *Rhabditis* sp. *Diplogaster* sp. *Cephalobus* spp. *Monhystera* spp. *Mononcus* spp. *Dorylaimus* spp. to be expected as free living species. Parasite fauna of these species to

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various plants are as Table 1.

Meloidogyne arenaria Chitwood parasites only on Begonia, *Scutellonema coheni* Andrassy parasites on *Gardenia jasminoides* Euis(Cape jasmine), *Cycus revoluta* Thunb(Japanese Sago palm), *Hipp-
estrum hybridum* Hort(Amallylis), *Zebrina pend-*

ula Scinth(*Zebrina*). *Paurodontus gracilis* Thorne parasites on *Daphne odora* Thunb(Winter Daphne), *Auccuba japonica* Thunberg(Auccuba), *Dianthus caryophyllus* L.(Carnation), *Nephlonepis exaltata* L.(Sword-fern), *Hippestrum hybridum* Hort(Amallylis) while *Xiphinema americanum*

Table 1. Host plants of each Nematodes which are rather economically important observed in green house. Taegu, Southern part of Korea. (1936)

Host plants	Degree of damage by Nematodes per host									
	1	2	3	4	5	6	7	8	9	10
<i>Viburnum odoratisii</i> Mumk				*			*		*	**
<i>Gardenia jasminoides</i> Euis		***					*			*
<i>Hibiscus syriacus</i> L.							*	*		*
<i>Camellia japonica</i> L.			*							
<i>Daphne odora</i> Thunb			***	***		*				*
<i>Citrus tardiva</i> Hort						*	*	*		
<i>Auccuba japonica</i> Thunberg			***						*	
<i>Trachycarpus excelsa</i> Wendl		*					*		**	
<i>Trachycarpus fortunei</i> Wendl		*				*		*		
<i>Coffea arabica</i> L.				*		*				
<i>Osmanthus fratarmus</i> Lour							*	*		
<i>Rhododendron indicum</i> Sweet			*			*			*	
<i>Monstera deliciosa</i> Liebm		*						*		*
<i>Hippestrum hybridum</i> Hort		***	**			*	*	*		
<i>Pelargonium zonale</i> Ait		*						*	*	
<i>Crinum asiaticum japonicum</i>		*					*		*	*
<i>Cycus revoluta</i> Thunb		***				*		*		
<i>Cordyline terminalis</i> Kunth					*		*			*
<i>Nephlonepis exaltata</i>		*	***		*	*				*
<i>Begonia semperflorens</i> var.	***	*	*						*	
<i>Sancebria nilotica</i> Baker					***		*			
<i>Poinsettia pulcherima</i> Craham					**	*	*			
<i>Cyclamen pericicum</i> Mill		**		*					*	
<i>Kalanchoe globulifera</i> Perr.					*	*	*			
<i>Nerium indicum</i> Mill		*			*			*		
<i>Zantedesia aethiopica</i> Spr.					*	*	*			
<i>Zebrina pendula</i> Scinth		***			*			*		*
<i>Ficus erastica</i> Boxb		*			*	*	*			
<i>Dianthus caryophyllus</i> L.			***			*		*		
<i>Agave americana</i> L.				***			*			*
<i>Asparagas plumosus</i> Eaker					*	*			*	
<i>Codiaeum variegatum</i> Blume						**	*		*	

- * 1. *Meloidogyne arenaria* Chitwood.
- 2. *Scutellonema choeni* Andrassy.
- 3. *Paurodontus gracilis* Thorne.
- 4. *Xiphinema americanum* Cobb.
- 5. *Rhabditis* sp.

- 6. *Diplogaster* sp.
- 7. *Cephalobus* spp.
- 8. *Monhystera* spp.
- 9. *Mononchus* spp.
- 10. *Dorylaimus* spp.

Cobb parasites on *Agave americano*(Century plant), *Daphne odora* Thumb(Winter Daphne) etc.

Free living species are collected on the almost every plant. *Rhabditis* sp. are not parasite in woody plants but in herbaceous plants. Among them, many nematodes are collected on sanceberia.

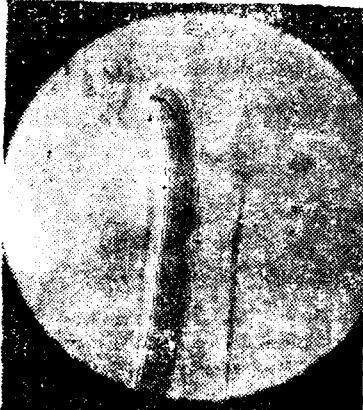
The parasite fauna of Begonia are as shown Table 2. *semperflorens* varieties(White flower, Red blot under the foliage) was heavily infested (Fig 1), *metalica* varieties was medium degree while *erytholophylla* varieties and *argentogutata* varieties are entirely none parasited. The author found 33.4% of contracting value by using 50 pots of Begonia against *Meloidogyne arenaria* Chitwood according to Gall index.

Contracting value =

$$\frac{(\text{Class value of Gall's -number} \times \text{Number of plant belonging to each class})}{(\text{Number of total investigated plants}) \times 4} \times 100$$



Fig. 1 Heavily infested *B. semperflorens* by *Meloidogyne arenaria* Chitwood.

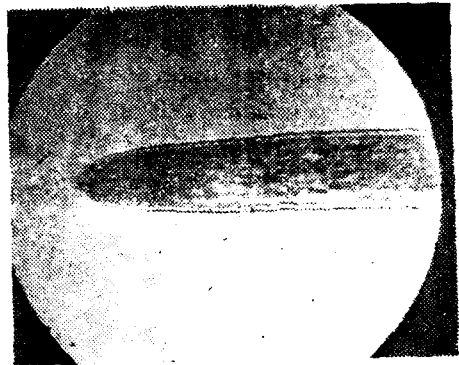


Spicule of *Meloidogyne arenaria* Chitwood.

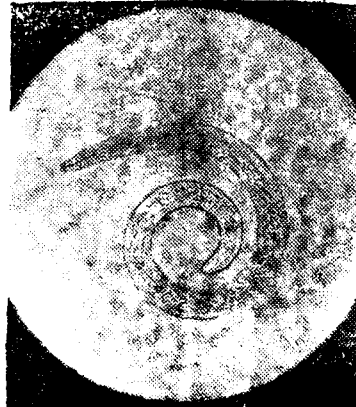
Table 2. The damage of the each varieties of Begonia by *Meloidogyne arenaria*, Chitwood in the green-house of Agricultural College in Taegu, Korea.

Host plant	<i>Meloidogyne arenaria</i> Chitwood
Begonia	
Semperflorens varieties	*****
Cocinea varieties	**
President carnot varieties	**
Hybrida varieyies	**
Rex varieties	**
Metalica varieties	****
Albo-picta varieties	**
Kewensis varieties	**
Hargenea varieties	*
Erytholophylla varieties	-
Argento-guttata varieties	-

***** Heavily. **** Medium. ** Light. -None.



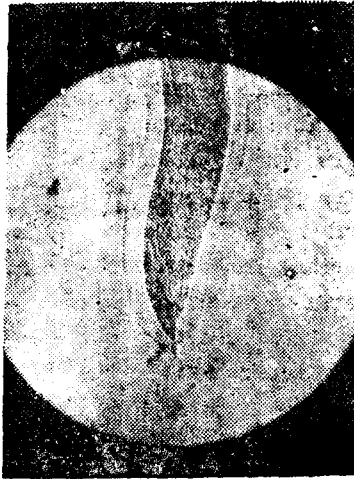
Outlet of Oesophageal glaand of *Meloidogyne arenaria* Chitwood.



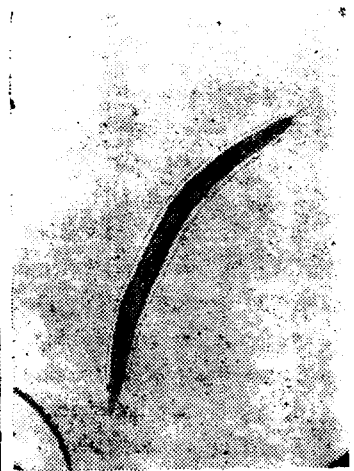
Stylet of *Scutellonema coheni* Andrassy.



Ovary of *Rhabditis* sp.



Tail of male *Rhabditis* sp.



Spicule and Gubernaculum of *Diplogaster* sp.

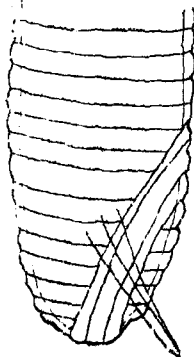
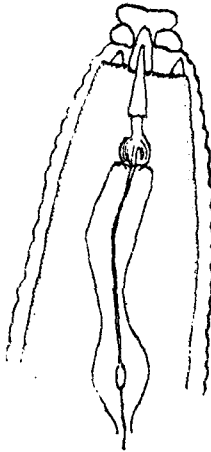
B. Morphological Taxonomy of Nematodes

Though the author collected 10 species of Nematodes from the soil around the green house plants, writer reports most strikingly infested species and top parasitic degree of the free living species as follows.

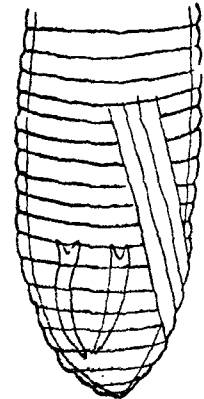
1. *Meloidogyne arenaria* (Neat, 1889) Chitwood, 1949 (Fig.

II, 1~4)

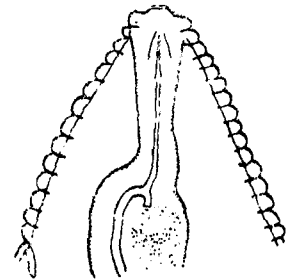
Adult Male; Body slender cylindrical, covered with cuticular sheath attached to extremities and in the region of vulva. The annule of lip region is wide. Lateral cheeks about 5 microns. The stylet strong varied in length from 22.0 to 24.0 microns with a mean of 23.0 microns. The basal knobs strong, varied from 3.8 to 5.0 microns with a mean of 4.4 microns in length by from 3.0 to 4.2 microns with a mean of 3.6 microns in width. The dorsal oesophageal gland opening about 5.7 microns posterior to the stylet base. The lateral fields marked by weakly four longitudinal glands.



3



2



4

Fig. II 1~4

Meloidogyne arenaria Chitwood, 1949

1. Head of male 2, 3. Tail of male 4. Head of female

The testis outstretched in single. The spicules arcuate about 32 microns.

Adult Female; Body pear shaped. The stylet varied in length from 14 microns to 16 microns with a mean of 15 microns. The dorsal oesophageal gland opening about 5 microns posterior to the stylet base. Anus of posterior transverse striation is nearly straight line. Lateral line is no clear. Many short irregular transverse striations are lightly arched at lateral part.

Dimension:(On Begonia)

♂: L-1.57mm(0.94mm-2.08mm), a-61u(41-85u), b-13u(11-18u), (n-20)

♀: L-0.53-1.2mm, Wide-0.4-0.8mm, Spicule-23u(22-24u)

2. Scutellonema coheni:(J. B. Goody, 1952) Andrassy 1958, (Fig. III 1~5)

Adult Female; Body cylindrical tapering evenly at both ends, covered with cuticular sheath att-

ched to extremities and in the region of vulva, and spirally curved ventrally when killed by gentle heat. The annules clear, rounded, about 1.2 microns in width, interrupted by the lateral fields. The lateral fields, one fifth as wide as the body width, marked weakly by four longitudinal glands and near the stylets that is united a strip. The head region bearing 3 annules. The stylet and basal knobs are strong, with anterior margin smooth. Outlet of dorsal oesophageal gland about 6.2 microns behind stylet base. Median oesophageal bulb one half to body width with central vulve apparatus. Isthmus short, crossed by nerve ring. Terminal oesophageal bulb covered at anterior of intestine. The excretory pore located on the junction of basal oesophageal bulb and intestine. Hemizonid visible on the situated beneath the 2-3th annule anterior to the excretory pore. The vulva, about a half body width in length at it region, opening transversely on the

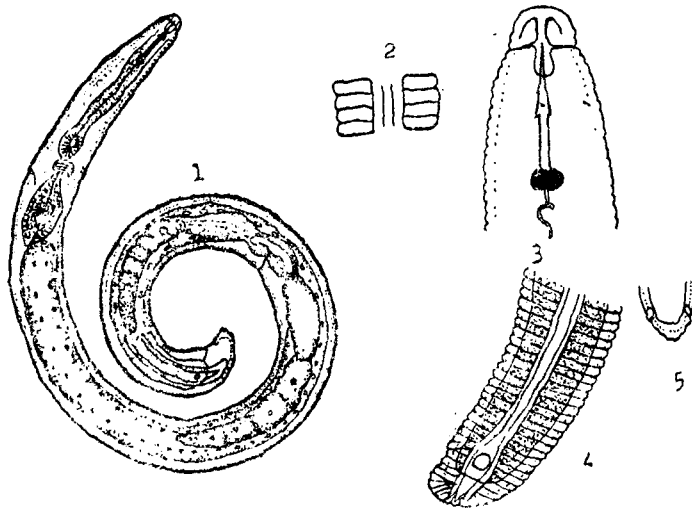


Fig. III, 1~5
Scutellonema coheni Andrassy, 1958.
1. Female 2. Lateral field 3. Stylet 4. Phasmid
(lateral view) 5. Phasmid(dorsal view)

ventral surface, located at a distance from the mouth equivalent to 60% of the body length. Ovary is double and not curved. The tail round and short. Terminal transverse striation was distributed like radiation. Phasmid large as semicircle makes scutella.

Adult male was not observed.

Dimensions(On Cap jasmine)

: L-764u, a-26, b-5, c-60, v-61%

Anterior Reproductive organ 26%, Posterior Reproductive organ 24% Spicule: 30u(n-20)

3. *Paurodontus gracilis* Thorne, 1941

(Fig. IV, 1~5)

Adult Female; Body covered with cuticular sheath attached to it at anterior terminus and in

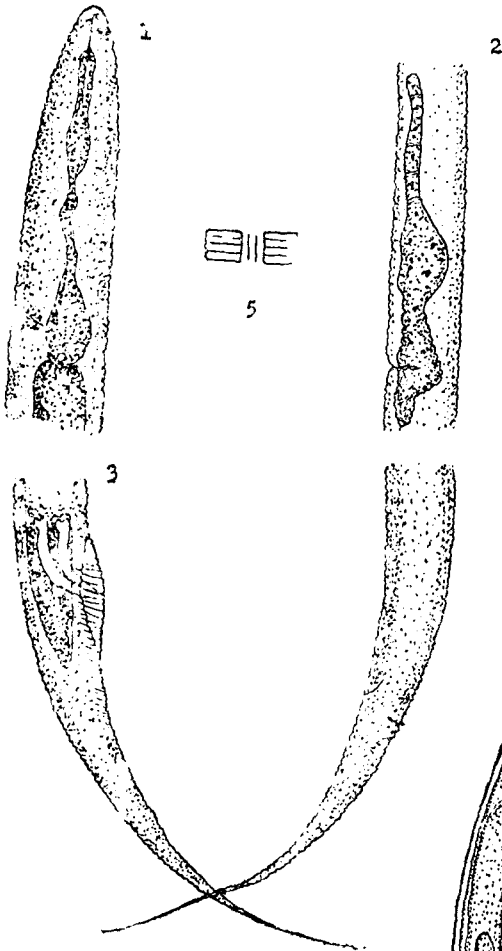


Fig. IV 1~5

Paurodontus gracilis Thorne, 1941
1. Head 2. Ovary 3. Tail of male
4. Tail of female 5. Lateral field

the region of the vulva. The lateral field one third as wide as the body width, marked weakly by four longitudinal glands. Stylet longer than head width, with knob at base. Corpus cylindrical, Isthmus short, crossed by nerve ring. terminal oesophageal bulb ship shape. Oesophago-intestinal valve located at intestine covered terminal oesoph-

geal bulb. Excretory pore is located at anterior part of intestine. Ovary is single anterior, not curved and posterior is degenerated.

Adult Male; Body is nearly likely to adult female. The bursa copulatrix is not extending to the end part of tail but up to down at the anus. Spicules being arcuate, about 20 micron in length, pointed sharply at the distal end. The gubernaculum not observed. The testis single, long extending to the anterior part of intestine and not curved at tip. Tail part is longer, narrower and tip is likely to thread.

Dimensions; (On auccuba)

♂; L-0.74mm, a-30, b-6.2, c-6.5, v-65%, n-20

♀; L-0.65mm, a-33, b-5.3, c-6.0 spicule-20u

4. *Xiphinema Americanum* Cobb, 1913

(Fig. V, 1~4)

Adult Female; Body cylindrical tapering evenly

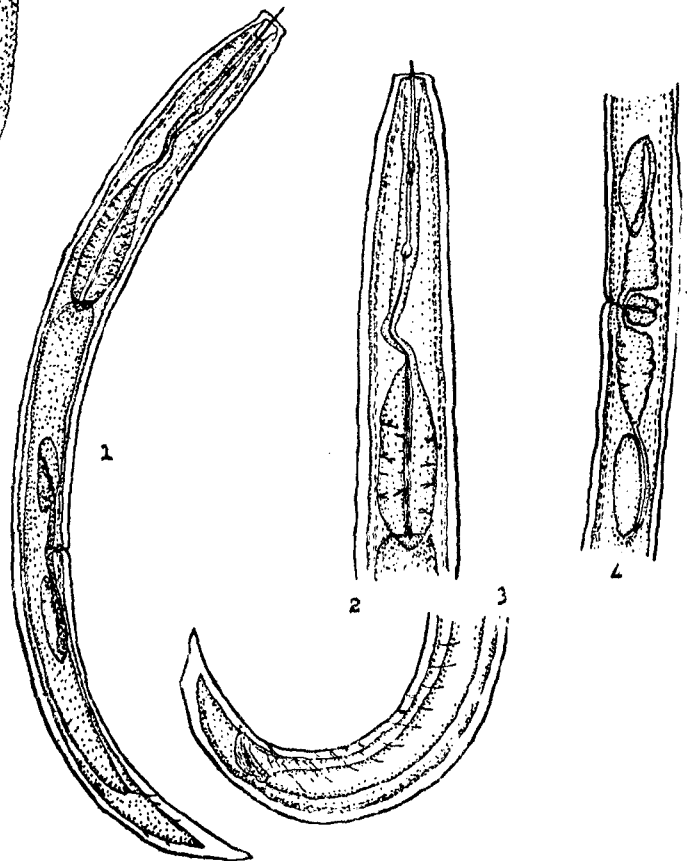


Fig. V, 1~4

Xiphinema americana Cobb, 1913

1. Female 2. Head 3. Tail of Female 4. Ovary

at each terminus, covered with cuticular sheath and slightly curved ventrally when killed by gentle heat. Lip region with 6 papillae and lightly projected. Guiding ring is double, about 10 microns. Anterior part of oesophagus with small tube-like shaped, gradually corpulence and forms terminal oesophageal bulb. Cardia between intestine and oesophagus.

Reproductive organ is a paired, relatively one another, and curved at tip. Anterior ovary is 150 microns while posterior ovary is 135 microns. Tail is curved to the dorsal part and cylindrical tapering with 2 paired Caudal papillae.

Adult Male; Body is likely to Female. Spicule is situated near the Tail, membranous shaped and 31.4 microns in length. There many transformation at papillae array of dorsal part. Near the up anus with 1 papillae and 8 papillae at far distance than up anus.

The Gubernaculum and bursa copulatrix is absent.

Dimensions: (On century plant)

♂: L-1.3-1.6mm, a-36.5-45.2u, b-5.1-5.3u, c-35-45

♀: L-1.2-1.8mm, a-34.5-43.6, b-4.7-7.2u, c-35.7-52.7 v-48-54%

5. *Rhabditis* sp.

(Fig. VI, 1~4)

Adult Female; Body short cylindrical thick evenly at terminus, body cuticular sheath flatten, 13 microns. Body length varied from 0.769 microns to 1.026 microns with a mean of 0.851 microns. Lateral field not observed. Lips are 6 with a little papillae. Oral opening is tube-like shaped. Cheilostom, prostom and telestom are divided by Rhabdions. cheilostom is covered with lips, prostom is commonly tube-like shaped, telestom is short and attached to the Oesophagus. Pericorpus cylindrical, beneath of the stoma was swollen. The ithmus being narrowly crossed by nerve ring. Ter-

minal oesophageal bulb is swollen, with valve apparatus. The excretory pore located on ithmus. Tail is round with a Caudal papillae. Vulva is located on the half body, with swollen especially lips-like shaped. Reproductive organ relatively, with a pair and not curved at tip. Intestine containing numerous granules. Anus located on the lateral part of posterior. Egg is 37 microns length by 25 microns wide in the body.

Adult male; Body is similar to the Female. Testis is single and tip is half curved, spermatid and sperms are observed in it. The spicules about 34 microns in length and it's half is separated while half united and forms Rhabditis shaped, with a Gubernaculum. Tail with feather like bursa copulatrix and 8 bursal ribs that are support in bursa.

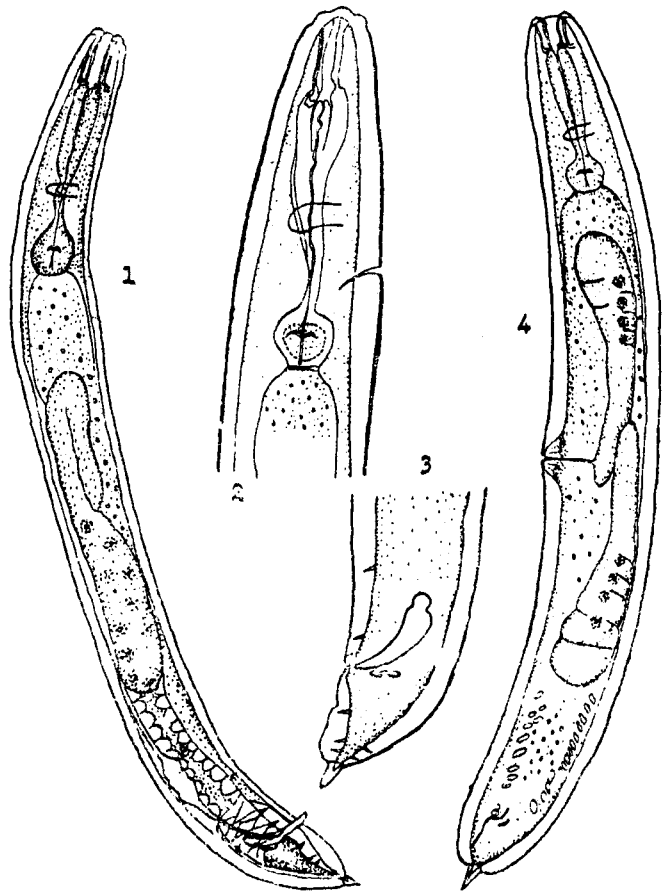


Fig. VI. 1~4
Rhabditis sp.

1. Male 2. Head 3. Tail of male 4. Female

Dimensions: (On *Sanceberia*)

♂: L-0.769mm-1.026mm, a-13.4-13.8, b-3.8-4.5, c-67.4-72.2

♀: L-0.757mm-0.912mm, a-13.2-11.8, b-3.7-4.0, c-64.2-66.4

V-53.0%-57.8%, (n-20)

6. *Diplogaster* sp.

(Fig. VII. 1~3)

Adult Female; Body covered with cuticular sheath, tail long, thread-like at end. Lips are 6, each lip with a little papillae. Stoma is tube-like shaped transversely wide, with some onchia. Precorpus cylindrical with muscles. Terminal part is swollen and formed Median Oesophageal bulb in

which with a bulb apparatus. Terminal part of isthmus is swollen gradually and formed terminal oesophageal bulb. Terminal Oesophageal bulb with no valve apparatus. 1 pair of reproductive organs are confront at front and back. Tip of it are not curved.

Adult Male: Body is similar to the Female. Testis is single, curved at tip. Spicule is single, 37 microns in length and boot-like shaped. It's head is curved to the dorsal part. The Gubernaculum is large and 14 microns in length. 6 pair of Caudal papillae at tail part.

Dimension;(On asparagus)

♀: L-0.92mm, a-16.6, b-7.0, c-6.2,

v-46%

♂: L-0.74mm, a-20, b-5.8, c-4.4, (n-20)

7. *Cephalobus* sp.

(Fig. VIII, 1~2)

Adult Female; Body with transverse striation. Lateral field extending over the tail as projected Alae-like shaped. Junction of head and mouth part is not clear.

Anterior part of Stoma forms wide trench shape. Posterior part to it is slender, long and tube-like shaped. Isthus is long. Nerve ring crosses the isthmus. Central valve at terminal oesophageal bulb. Junction of terminal oesophageal bulb and intestine is clear. Ovary of anterior reproductive organ is extended over the vulva and curved.

Adult Male; Body is similar to female. Tail papillae at up and down anus. Tail is sharply elongated conoid shaped. Testis is single, long, extending over anterior intestine and curved at tip. Spicule is 20 microns in length and curved to the dorsal

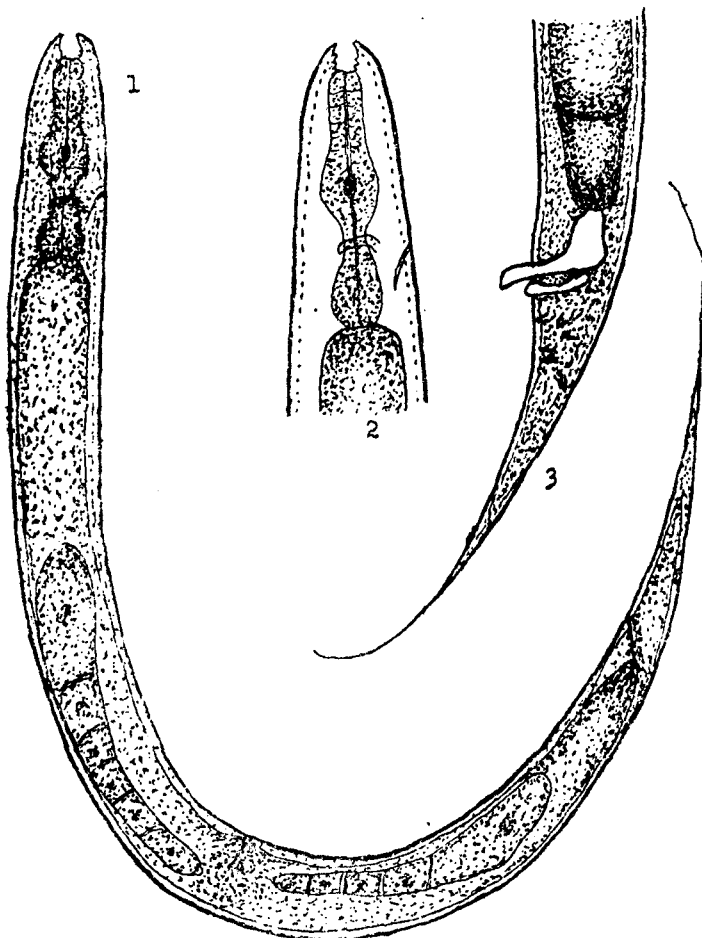


Fig. VII. 1~3

Diplogaster sp.

1. Female 2. Oesophagus 3. Tail of male

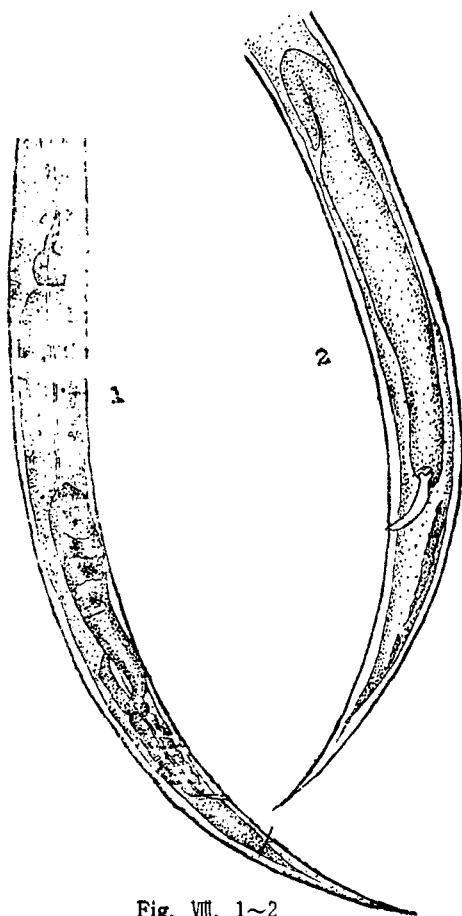


Fig. VIII, 1~2
1. Adult Female 2. Adult Male

part.

Dimensions:(On Calla)

♂: L—0.513mm, a—22.76, b—3.60, c—12.20

♀: L—0.458mm, a—22.9, b—3.20, c—8.40,
(n—20)

C. Rearing

The author reared *Rhabditis* sp. in each 18°, 25°, 30°, 35°C incubators by above mentioned method. As the results, after incubating to the 35°C incubator. *Rhabditis* sp. reproduced a little, while after 30 days, all of individuals were killed. But in 18°C incubator, individuals are gradually increased. Suddenly increased after 25 days and appeared 50.02% of Reproductive Value(Each reproductive value derived from 498.2 individuals to 100 percentage in 30°C incubator after 40 days). In 25°C incubator, cumulative 50% of treated days was shorten strikingly and reproductive value was 67.98%. In 30°C incubator, cumulative 50% of treated days appeared the most shorten condition and reproductive value was 100%. (Table 3.)

From these points, the author knew that the most proper temperature in reproduction of *Rhabditis* sp. is about 30°C. All of above mentioned incubators formed logistic curve; The author believe density effects influenced much to it. (Fig VIII.)

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Table 3.—Accumulated daily numbers of *Rhabditis* sp.
Reared in various temperatures (1962)

Days after incubating	Temp. (C)		18°		25°		30°		35°	
	Total	cumulative	Total	cumulative	Total	cumulative	Total	cumulative	Total	cumulative
5	0.4	0.05	3.6	0.23	6.8	0.31	3.2	16.67		
10	3.8	0.62	22.2	1.63	53.4	2.78	6.2	48.95		
15	9.0	1.93	84.2	7.24	161.4	12.78	3.8	68.75		
20	18.0	4.56	176.4	18.83	209.4	15.35	3.8	88.54		
25	81.8	16.58	262.8	36.11	353.0	36.36	1.6	96.78		
30	136.6	36.63	311.5	56.69	381.6	54.06	0.6	100.00		
35	182.6	63.43	321.5	77.73	492.2	76.88	0	—		
40	249.2	100.00	338.7	100.00	498.2	100.00	0	—		
Total	681.4		1520.9		2156.0		19.2			
※ Reproductive Value	50.02		67.98		100.00		0			

※ Reproductive Value—Each Reproductive Value derived from 498.2 individuals to 100 percentage in 30°C incubator after 40 days.

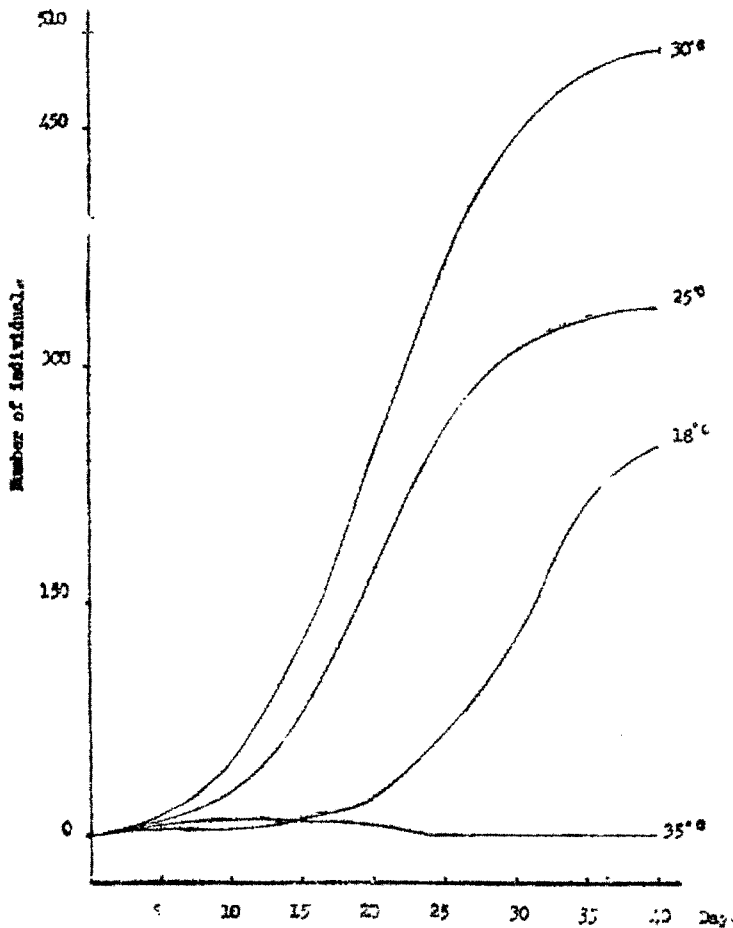


Fig. K Accumulated daily numbers of *Rhabditis* sp. reared in various temperature(1962)

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摘 要

우리나라 農業上 重要한 線蟲類에 關한 研究 (I)

溫室花卉類의 根部에서 發生되는 數種의 線蟲에 關하여 崔 永 然

摘 要

最近 農作物에 대한 各種 線蟲類의 被害가 注目되어 있는 實性에 비추어 筆者는 線蟲類 研究의 基礎的 課題로서 溫室內의 花卉類 根部에서 發見되는 線蟲類 中 農業上 比較的 重要하다고 認定되는 種類와 그밖에 몇 種類에 대하여 形態의인 特徵을 記述하였다. 즉 取扱된 種類들은 다음과 같다.

1. *Meloidogyne arenaria* Chitwood
2. *Scutellonema coheni* Andrassy
3. *Paurodontus gracilis* Thorne
4. *xiphinema americaum* Cobb
5. *Rhabditis* sp
6. *Cephalobus* sp
7. *Diplogaster* sp

그리고 以上 7種類의 寄主植物 및 寄生程度를 보면 *Meloidogyne arenaria* Chitwood는 *Begonia*에만 寄生하였고 그밖에 花卉類에는 寄生을 볼 수 없었다. *Scutellonema choeni* Andrassy는 꽃치자, 소철, 아마리리스, 제브리나에 가장 많이 發見되었고, *Paurodontus gracilis* Thorne는 동백나무, 淸木, 지내고사리, 카네이션, 등에서 가장 많이 發見되었다. 그리고 *Xiphinema americanum* Coob는 산호수, 서향, 코피

나무, 시크라멘, 용설란, 동백 등에서만 發見되었으나 그중에 용설란, 동백에서 가장 많이 볼 수 있었다. *Rhabditis* sp.는 草本類 花卉類의 大部分에서 發見되었으나 그중에도 산세베리아에서 가장 많았다. *Diplogaster* sp는 大部分의 花卉類에서 發見되었으며 그중에 크로톤에 比較的 많았다. *Cephalobus* sp.는 全般的으로 發見되었으며 發見程度는 모두 비슷하였다. *Monhystera* spp., *Mononchus* spp., *Dorylaimus* spp. 등도 調査한 過半數의 花卉類들에서 發見되었으나 특히 많이 發見되는 花卉類는 없었다.

以上 綿蟲類中 根瘤를 形成하여 被害가 가장 注目되는 *Meloidogyne arenaria* Chitwood에 대해서 溫室內에서 그의 唯一한 寄主植物인 *Begonia*의 品種別 寄生程度를 比較調査한 結果 *sempiflorens* 品種에 가장 寄生率이 높았고 *metarica* 品種은 中程度였으며 *erytholopylla*와 *argento-guttata* 品種들에는 寄生이 없었다. 이點은 매우 意義있는 事實로서 앞으로 더욱 研究한 課題로 삼았다.

끝으로 *sanceberia*에서 많이 發見되는 *Rhabditis* sp를 18°C, 25°C, 30°C, 35°C 의 冬溫度別의 incubator에서 飼育한 結果 本種의 生育適溫이 30°C라는 事實을 알았다.