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佐 賀 大 学

農 学 彙 報

第 30 号

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AGRICULTURAL BULLETIN

OF

SAGA UNIVERSITY

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Studies on the Nemic-Fauna of Soil of the Murberry Plant Field in Kyushu

II. On the Occurrence of Two Pin Nematodes, *Paratylenchus aciculus* BROWN, 1959 and *P. morius* n. sp.

Tamio YOKOO

(Laboratory of Nematology and Entomology)

Received June 12, 1970

Introduction

We have undertaken the studies on the nemic-fauna of soil of the murberry plant field in Kyushu since 1969, and reported on the occurrence of Dagger nematode, *Xiphinema bakeri* WILLIAMS, 1961 from soils of murberry plant field in Kumamoto Prefecture(*).

In this second report the author reports the occurrence of two pin nematodes, *Paratylenchus aciculus* BROWN, 1959 and *P. morius* n. sp. from soils of murberry plant field of the Sericultural Experiment Station, Kyushu-branch (Ueki, Kumamoto Prefecture) with some notes on the bionomics of pin nematodes.

Paratylenchus aciculus BROWN, 1959

Female (n=7): L=0.279 mm (0.24-0.31 mm); a=21.3(18.4-23.6); b=2.6(2.4-2.7); c=12.4 (10.0-15.9); V=70.0%(68.3-73.5%); Anterior gonad=35.2% (32.0-38.0%); spear length =67 μ (61-69 μ).

Male (n=5): L=0.293 mm (0.270-0.345 mm); a=25.5(21.6-28.5); b=3.7(3.6-4.1); c=12.0 (10.8-13.1); T=34.2%(31.2-38.2%); spicule=15.0 μ ; Gubernaculum=about 5 μ .

Female: Body very slender, small. Cuticle including lip region, rounded, transversely striated. Lateral fields marked by three incisures. Lip region continuous with body contour, with distinct rounded lips. Cephalic framework not sclerotized. When head observed from a face view, 4 small round lips appearing slightly more elevated than the two broader lateral lips. Labial papillae appearing as 4 minute dots. Spear flexible, very long and slender. Small muscles visible around basal spear knobs in live specimen. Spear 67 μ length. Spear knobs diameter about 3.5 μ . Dorsal oesophageal gland opening into oesophageal lumen about 4 μ behind spear knobs. Conspicuous excretory pore on ventral side in region of median oesophageal bulb. Hemizonid prominent. Oesophagus consisting of a long narrow precorpus which widens into the valvulated median bulb and a small posterior oesophageal bulb, distinctly separated from intestine. Vulva a transverse slit located about 70% of body length without vulval flap. Vagina extending directly inward less than half the diameter of the body. Post uterine sac seems to be absent. Spermatheca prominent, ellipsoid. Body tapering uniformly from above vulva to a finely rounded tail tip. Numerous small aperm in uterus. Ovary outstretched. Obscure anus visible in live specimens. Ante-

* YOKOO, T., (1969): Soil Nematological Notes II, Agric. Bull. of Saga University, 29: 15-28, esp. 26-28 pp.

rior gonad about 35% of the body length.

Male: Comparatively rare. Body size more or less smaller than that of female with similarly shaped lips. Lateral field marked with three incisures stylet and oesophagus are degenerated. Large vacuoles in body cavity. Body curved ventrally, C-shaped. Spicule tylenchoid, curved ventrally, surrounding by an anal sheath which protruded somewhat from surface of body. Gubernaculum present, almost straight, simple, about 1/5 length of spicule. Tail slightly curved, narrowing to a finely rounded tail tip.

In 1959 Brown reported three new species of the *Paratylenchus* from Canada. *Paratylenchus aciculatus* is one of these three new species. He found this species from soil around roots of fowl blue-grass (*Poa palustris* L.) at three miles south of Blackburn, Ontario, and also from meadow soil near Nesbitt, Manitoba. According to his descriptions, the females of *P. aciculatus* differ from all other species of *Paratylenchus* in having a longer spear (67 μ). And the presence of three lateral lines in the lateral field and the another position of valva distinguish *P. aciculatus* from all others of genus except *P. aciculatus* from which it differs in having conspicuous lips, and in having a more tapering tail. Male of *P. aciculatus* do not have a spear. The dimensions were given in the following Table 1.

And in 1963 BRJESKI and SZCZYGIEL reported *Paratylenchus aciculatus* from Poland. Making quotations from their descriptions, this specimen differs from those described by BROWN (1959) mainly in body length: 300 μ (290–310 μ) against 280 μ (240–310 μ) in Brown's specimens. However, as there is considerable overlap, but other characters agree with Brown's description, they consider their specimens as *P. aciculatus*. In 1962 RASKI noted it

Table 1: Dimensions reported by Brown & Brjeski.

Dimensions	Brown, 1959	Brjeski, 1963	Yokoo, 1970
Female: n	25	12	7
Body length mm	0.278 (0.24–0.31)	0.299 (0.29–0.31)	0.330 (0.26–0.39)
Spear length μ	67 (61–69)	66 (64–69)	62.3 (60.4–65.0)
V-Value (%)	70.0 (68.3–73.5)	74.0 (73.0–75.0)	70.0 (68.3–73.5)
G i (%)	—	—	35.2 (32.0–38.0)
Incisures (lateral)	3	3	3
a	21.3 (18.4–23.6)	21.5 (21.0–22.0)	21.3 (18.4–23.6)
b	2.6 (2.6–2.7)	2.6 (2.6–2.7)	2.6 (2.4–2.7)
c	12.4 (10.0–15.9)	14.0 (13.5–14.5)	12.0 (10.0–15.9)
Opening of Dor. oeso. gla. behind sp. knob (μ)	5.0	3.3	4.0
Male: n	3	1	5
Body length μ	0.284 (0.261–0.307)	0.342	0.293 (0.27–0.345)
Spicule length μ	15.5	—	15.0
Gubernaculum length (μ)	—	5.7	6.0
a	25.8 (23.7–30.7)	26.0	25.5 (27.0–34.5)
b	—	3.1	3.7 (3.6–4.1)
c	11.0 (10.9–11.3)	14.0	12.0 (10.8–13.1)
T %	—	33.0	34.2 (31.2–38.2)

from Maryland and California. They found it at Oleśnica (district: Strzelce Opolskie) in Poland around the roots of strawberry. Mrs. L. ROGUSKA WASILEWSKA sent them one female, collected around the roots of alfalfa in the vicinity of Warszawa, which they identified as *P. aciculus*. This is the first occurrence of *P. aciculus* in Europe. Dimensions given by them are shown in the following Table 1.

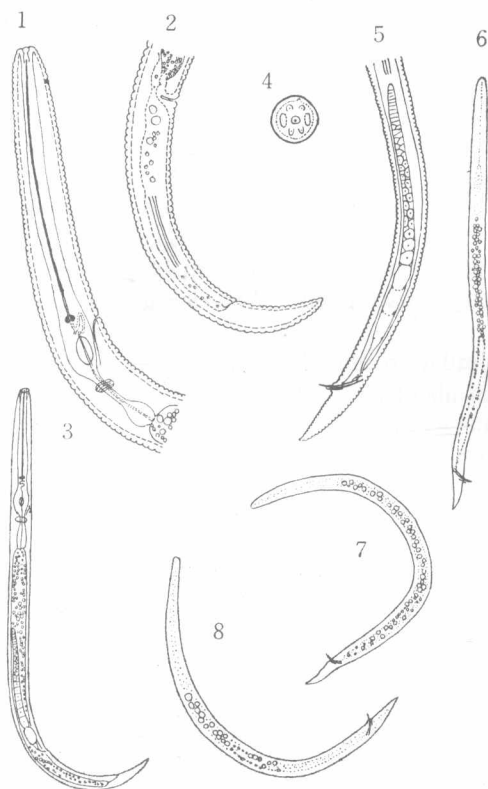


Fig. 1 *Paratylenchus aciculus* BROWN, 1959.

- | | |
|-------------------------------------|---|
| 1. Anterior Part of Body (Female)* | 5. Posterior Part of Body (Male) |
| 2. Female. | 6. Male. |
| 3. Posterior Part of Body (Female)* | 7~8. Degenerated anterior Part of Male. |
| 4. Lip region.* | |

* After Brown (schematic)

Discussing from the Table 1 and details of morphology (Fig. 1), author identified this specimen detected from soil of murberry field in the Sericultural Experimental Station Kyushu-district, (Ueki, Kumamoto Prefecture) as *Paratylenchus aciculus* BROWN, 1959. And also in 1970 the author detected this species also from soils of murberry plant field at Yamato-Cho, Kamioho, Saga Prefecture.

Paratylenchus morius n. sp.

Female (n=10): L=0.239 mm (0.170-0.350 mm); a=17.8 (15.3-20.5); b=2.7 (2.2-3.5); c=14.6 (11.8-16.8); V=76.0% (72.0-78.8%); spear length=35 μ .

Larvae (n=10): L=0.185 mm (0.158-0.213 mm); a=16.3 (14.2-18.5); b=2.6 (2.3-2.8); c=11.9 (9.5-14.8); spear length=35 μ .

Male: unknown

Female: Body very small, about 0.25 mm. Cuticle transversely very finely striated. Lateral field marked by four incisures. Head protruded slightly from body, with distinct small constriction. Anterior margin of head is somewhat flat. Cephalic framework not sclerotized. Spear slender, $35\ \mu$ in length, with distinct basal knobs. Anterior margin of spear knobs obliquely inclined. Dorsal oesophageal gland opening into oesophageal lumen about $3\ \mu$ behind spear knobs. Conspicuous excretory pore on ventral side in region of anterior part of post oesophageal bulb. Hemizonid situated immediately behind excretory pore. Oesophagus consisting of a long narrow precorpus which widens into the valvular median bulb. Isthmus, narrow, short. Posterior oesophageal bulb slender, distinctly separated from intestine. Nerve ring crosses at the region of isthmus. Vulva a transverse slit located about 76% of body length without vulval flap. Vagina extending obliquely anteriorly inward less than half diameter of body. Postuterine sac absent. Spermatheca present, ellipsoid. Body tapering uniformly from above vulva to a finely pointed tail with terminal mucro-shaped tail tip. Ovary outstretched. Anterior gonad about 26% (21–32%) of body length.

Larva: Body shape is similar to adult female. Body length about 0.2 mm, smaller than female. Spear length about $35\ \mu$. Tail uniformly tapering to a finely pointed, with mucro-shaped tip, same as that of female.

Diagnosis and Relationships:

This specimen is characterized by having a small body length (0.24 mm), comparatively long spear (about $35\ \mu$), and comparatively anteriorly located vulva (V =about 76%) without vulval flap. Table 2 shows the dimensions of the closely related species of genus *Paratylenchus* to this specimen. As shown in Table 2, this specimen is closely related to *P. arcuatus* LUC & DE GUIRAN, 1962; *P. nainianus* EDWARD & MIRSA, 1963; *P. ivorensis* LUC & DE GUIRAN, 1962; *P. eschulatus* STEINER, 1949 and *P. vandenbrandei* DE GRISSE, 1962 in body length. And in a-value this specimen do to *P. arcuatus*, *P. ivorensis*, and *P. vandenbrandei*; and in b-value to *P. arcuatus* and *P. ivorensis*. And in c-value this specimen do to *P. arcuatus*; and in spear length to *P. vandenbrandei*.

And in the fact that males are not still known this specimen is similar to *P. arcuatus*, *P. elachistus*, and *P. nainianus* respectively. But this specimen is different from *P. ivorensis* and *P. vandenbrandei* in the following characters (Table 2, Fig. 2):

From *P. ivorensis* (Table 2, Fig. 2)

- (1) Spear length ($52\text{--}59\ \mu$: $35\ \mu$ in this specimen)
- (2) Male is known (unknown in this specimen)

From *P. vandenbrandei* (Table 2, Fig. 2)

- (1) V-value (82% (81–86%): 76% (72–79%) in this specimen)
- (2) Male is known (unknown in this specimen)

Discussing from these characters and details of morphology, this specimen is most closely related to *P. arcuatus* LUC & DE GUIRAN, 1962, but differs from this specimen in the following points:

- (1) Spear length ($24\text{--}28\ \mu$: $35\ \mu$ in this specimen)
- (2) V-value (82%, (81–84%): 76% (72–79%) in this specimen)
- (3) Vulval Flaps (no in this specimen)
- (4) Head shape (rounded?; plain in this specimen)
- (5) Tail Tip (pointed: with small conical mucro-shaped tip in this specimen) (Fig. 3)

From these standpoints, author identified this specimen as *Paratylenchus morius* n. sp.

Type habitat: Soils around the root of Murberry plant

Type locality: Cultivated field of Murberry plant in the Sericultural Experimental Station Kyushu-branch, (Ueki, Kumamoto Prefecture,) Japan.

Table 2 (1): Dimensions of Paratylenchus spp.

Species	n	L (mm)	a	b	c
<i>P. arcuatus</i> LUC & DE GUIRAN, 1962	* n = 13	0.18-0.25	16.0-25.0	2.9-3.7	15.0-18.0
<i>P. iorensis</i> LUC & DE GUIRAN, 1962	n = 10	0.29-0.34	21.0-25.0	2.8-3.2	11.0-13.0
<i>P. elachistus</i> STEINER, 1949	n = 8	0.25-0.32	20.0-23.0	3.5-5.0	—
<i>P. nainianus</i> EDWARD & MIRSA, 1963	n = 10	0.25-0.29	21.5-22.5	4.0-5.0	19.4-20.4
<i>P. vandenbrandei</i> DE GRISSE, 1962	n = 3	0.25-0.29	14.0-24.0	3.2-3.7	15.0-21.0
<i>P. sp.</i>	n = 10	0.17-0.35	15.3-20.5	2.2-3.5	11.8-16.8

*n...Number of specimens investigated

Table 2 (2)

Species	Incisures of lateral field
<i>P. arcuatus</i> LUC & DE GUIRAN, 1962	4
<i>P. iorensis</i> LUC & DE GUIRAN, 1962	4
<i>P. elachistus</i> STEINER, 1949	?
<i>P. nainianus</i> EDWARD & MIRSA, 1963	4
<i>P. vandenbrandei</i> DE GRISSE, 1962	3
<i>P. sp.</i>	4

Table 2 (3)

Species	V %	Gi %	Spear μ	V-Flap	Sperm.	Male
<i>P. arcuatus</i> LUC & DE GUIRAN, 1962	81.0-84.0	31-51	24-28	present	present	?
<i>P. iorensis</i> LUC & DE GUIRAN, 1962	73.0-77.0	—	52-59	present	present	0
<i>P. elachistus</i> STEINER, 1949	80.0-82.0	—	22-23	present	present	?
<i>P. nainianus</i> EDWARD & MIRSA, 1963	80.0-84.0	—	22-27	?	?	?
<i>P. vandenbrandei</i> DE GRISSE, 1962	81.0-86.0	—	28-33	present	present	0
<i>P. sp.</i>	72.0-78.8	21-32	35	No	present	?

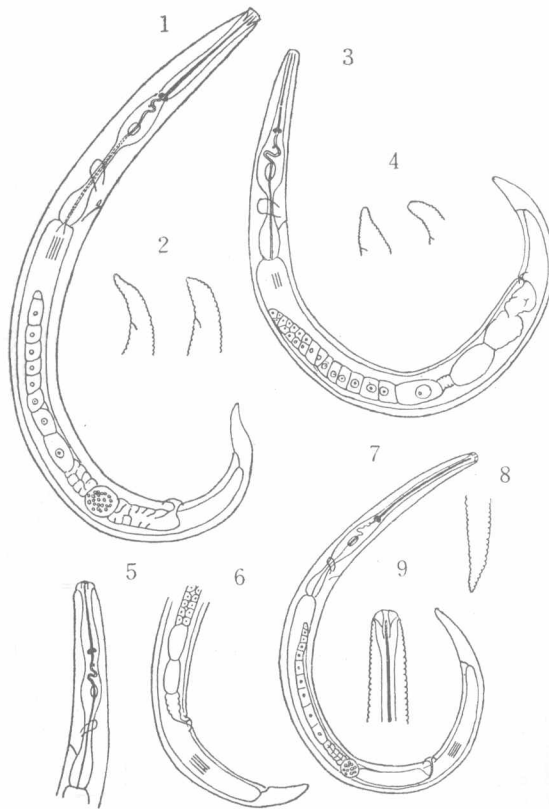


Fig. 2 closely resemble *Paratylenchus* spp. (Schematic figures from originales)

- | | |
|--|--|
| 1. <i>P. arcuatus</i> LUC & DE GUIRAN, 1962. | 6. <i>P. nairianus</i> EDWARD & MIRSA, Tail-Tip. |
| 2. " , Tail-Tip. | 7. <i>P. ivorensis</i> LUC & DE GUIRAN, 1962. |
| 3. <i>P. vandenbrandei</i> DE GRISSE, 1962. | 8. " , Tail-Tip. |
| 4. " , Tail-Tip. | 9. " , Anterior Part of Body. |
| 5. <i>P. nainianus</i> EDWARD & MIRSA, 1963. | |

Bionomics

In 1968 Yutaka Ikeda, a staff of the Sericultural experimental Station, Kyushu-branch, (Ueki, Kumamoto Prefecture,) investigated on the seasonal and vertical distributions of pin nematodes in the soil of murberry plant fields in station, and informed to author as follows (Table 3 & Fig. 4~5.):

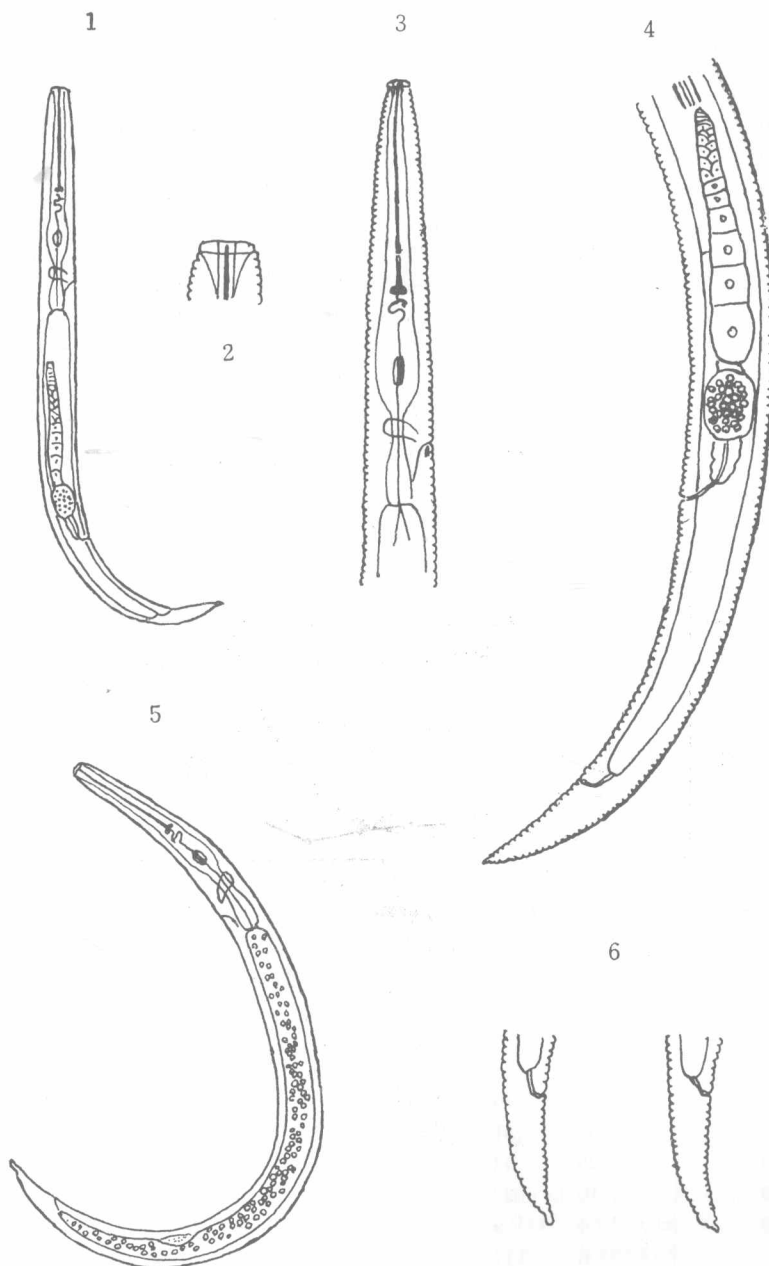


Fig. 3 *Paratylenchus morius* YOKOO n. sp.

1. Female ($\times 800$)
2. Head of Female.
3. Anterior Part of Body (Female)
4. Posterior Part of Body (Female)
5. Larva.
6. Variations of Tail Tip.

(Yokoo, 1970)

Table 3: Seasonal and vertical distributions of pin nematodes (1968).
(Number of nemas in 50 gr. soil,* by Baermann's method)

Month Depth cm	5	6	7	8	9	10	Total	%
5- 10	98	550	165	69	350	92	1294	22.6
15- 20	60	50	340	123	290	54	917	16.0
25- 30	110	130	169	58	243	390	1100	19.2
35- 40	46	89	214	43	135	72	599	10.5
45- 50	12	26	90	27	160	82	397	6.9
55- 60	25	26	56	23	114	154	398	6.9
65- 70	11	8	25	31	90	172	337	5.9
75- 80	0	11	32	14	36	96	189	3.2
85- 90	0	16	5	44	316	37	418	7.3
95-100	1	5	8	31	19	10	74	1.5
Total	363	911	1104	463	1753	1129	5723	100.0
Index Nr.	100	251	350	128	483	311	—	—

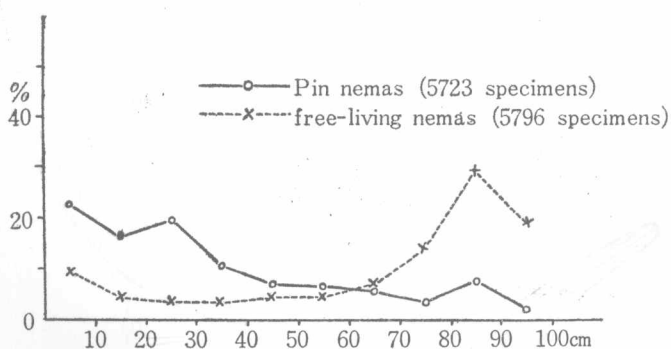


Fig. 4 Vertical distributions of free-living nematodes and Pin nematodes. (0-100 cm) (1968)

Table 4: Seasonal and vertical distributions of free-living nematodes.
(number of nemas in 50 gr. soil*, by Baermann's method)

Month Depth cm	5	6	7	8	9	10	Total	%
5- 10	32	76	255	111	120	125	719	9.8
15- 20	30	51	85	99	70	30	365	4.8
25- 30	25	42	46	25	64	74	276	3.6
35- 40	16	20	123	54	19	18	250	3.3
45- 50	4	9	189	132	19	18	371	4.9
55- 60	6	17	233	92	6	14	368	4.8
65- 70	3	3	380	77	18	8	489	6.4
75- 80	0	2	900	135	12	5	1054	13.9
85- 90	1	4	2000	219	9	4	2237	29.5
95-100	1	2	1200	261	3	0	1467	19.3
Total	118	226	5411	1205	340	296	7596	100.0
Index Nr.	100	192	4590	1020	288	251	—	—

* Blackish volcanic ashes-Soil.

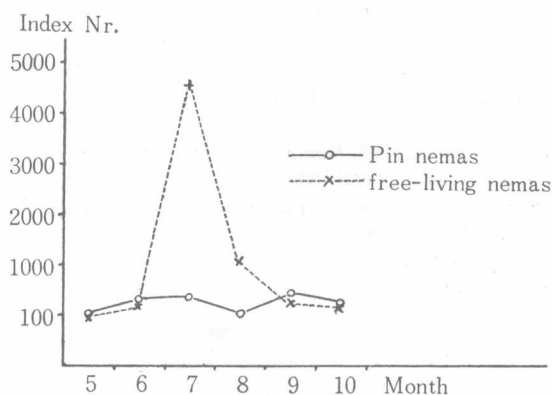


Fig. 5 Seasonal distributions of free-living nematodes and Pin nematodes from May to October (1968).

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Summary

In Japan the investigations on the soil nemic fauna of the murberry field are not still undertaken except the root knot nematodes (*Meloidogyne spp.*). We have undertaken the studies on the nemic fauna of the murberry field soil in Kyushu, Japan since 1969.

In this second report the descriptions on the two pin nematodes (*Paratylenchus aciculus* and *P. morius n. sp.*) found from soils of murberry fields in Kumamoto prefecture, with some notes on the bionomics of these nematodes. This is the first occurrence of *P. aciculus* in Japan. The new species of *Paratylenchus*, *P. morius*, is characterized by having a small body length (0.24 mm), comparatively long spear (about 35 μ in length), and anteriorly located vulva (V=76%) without vulval flap. Male unknown.

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佐賀県神埼地区における水収支の調査について

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昭和45年7月10日 受理

An Investigation on Water Balance in Kanzaki District, Saga Prefecture

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Summary

Recently, the more rapidly increases water demand, the more important it becomes to use water as repeatedly as possible. In order to understand the present status of the repeated use of irrigation water, investigation of the water balance in a large area becomes an essential problem.

In the present paper, the water balance was investigated at Kanzaki district which is located on the upper land than the creek-paddy field in the eastern part of Saga Prefecture. This district includes two areas along a stream; upstream area without creek and downstream area having some creeks partly.

The water balance equation in a large area is expressed as follows:

$$P + (D_1 - D_2) = E + (G_2 - G_1) + \Delta S$$

where P : precipitation D_1 : inflow discharge
 D_2 : outflow discharge E : evapotranspiration
 G_1 : inflow discharge of ground water
 G_2 : outflow discharge of ground water
 ΔS : variation of storage

P , D_1 and D_2 were determined by actual measurements. E was estimated by the evaporation (E_p) that was observed at Saga Weather Station, and the ratio of E/E_p was assumed to be 1.1. $(G_2 - G_1)$ and ΔS were not observed actually. Therefore, $(G_2 - G_1) + \Delta S$ was calculated by using P , D_1 , D_2 and E .

As a result, $(G_2 - G_1) + \Delta S$ showed the considerable variation during the irrigation period. The value of $(G_2 - G_1) + \Delta S$ is remarkably influenced by the variation of $(G_2 - G_1)$ in the upstream area, while in the downstream area it is effected by that of ΔS . This difference between both areas seems to be due to the fact that some creeks are distributed in a part of the downstream area and are capable of storing inflow water, but not in the upstream area.

1. 緒 言

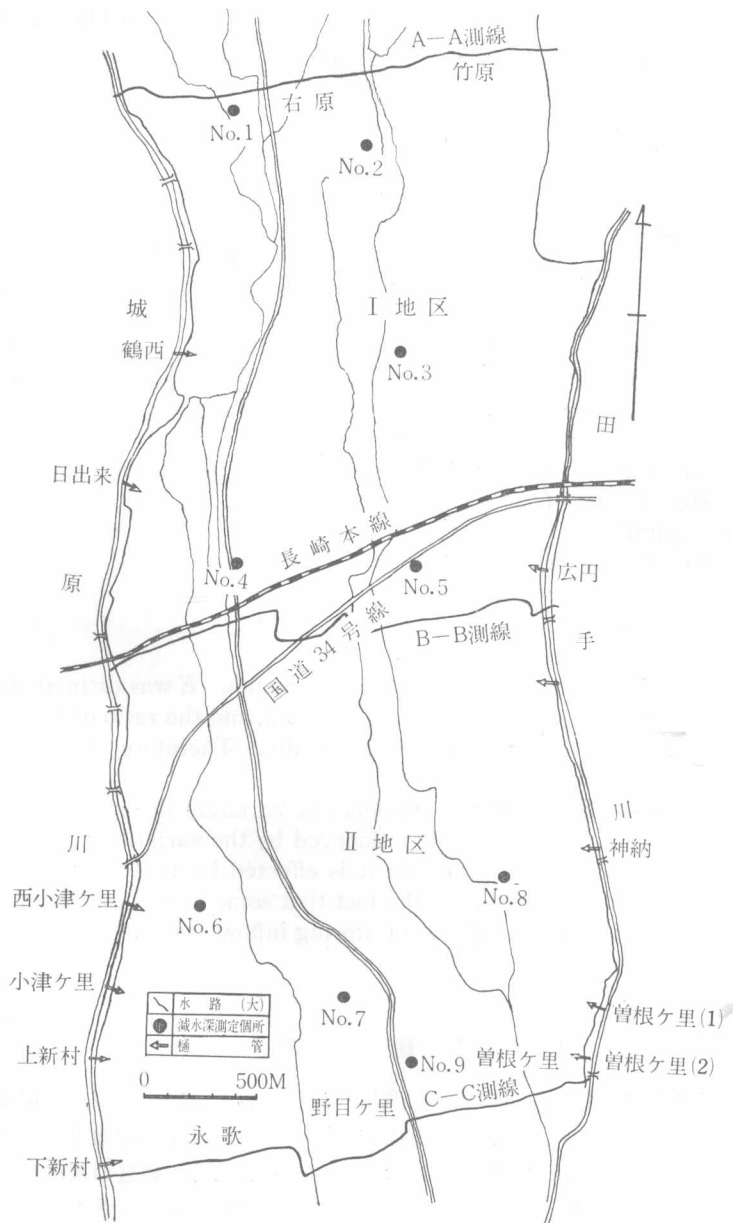
最近、水需要の増大にともない水の経済的利用が要求されてきているが、水需要のなかでも農業用水の占める比率は極めて大きく、特に水田用水に対する適正化が問題となってきた。これまで水田におけるカンガイ用水量は局部的なホ場の減水深にその地区の水田面積を乗じた値をもって決定されるのがふつうであった。しかし水田における水の消費は蒸発散が大部分を占め、地下に浸透した水は再利用される可能性が残されており、用水量の決定に対してはその地区の減

水深と用水の反復利用量を考慮しなくてはならない。このためには広域の水収支調査を必要とする。

佐賀県神埼郡神埼町において、昭和 43, 44 年のカンガイ期に地区内水田の水利用の現況を把握するために水収支調査を行なった。

2. 調査地区概要

調査地区は佐賀市の北東約 10 km の佐賀県神埼郡神埼町右原および竹原から永歌、野目ケ里、



図一 地区概要および測定位置図