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Correlation between Attractions and Susceptibilities of Rice Varieties to *Aphelenchoides besseyi* Christie, 1942.*

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(접수. 11월12일)

Abstract

A laboratory observation and a greenhouse pot experiment were carried out to know the correlationship between the attraction and the susceptibility of rice varieties to *Aphelenchoides besseyi.*

Degrees of attraction of rice seedling extract to *A. besseyi* and the multiplication rates of the nematode varied greatly according to the rice varieties used.

And there was strong correlation between the two variables; i.e., the more the seedling extract of a variety attracted by the nematode in agar observation, the more the variety was susceptible in greenhouse pot experiment.

Introduction

For several decades, the rice white-tip nematode, *Aphelenchoides besseyi* Christie has been one of the most important pests in many countries where rice is grown since rice harvest has been suffered losses between 10 and 61% according to the susceptibilities of rice varieties (Yoshii & Yamamoto, 1950; Atkins & Todd, 1959; Hung, 1959; Tikhonova, 1966).

It has been also known as a pest of strawberry, onion, Italian millet, Chinese cabbage, maize, chrysanthemun, sweet potato, soybean, sugar cane, etc. Goto &. Fukatzu (1956) reported that there were great differences between rice varieties in attraction to *A. besseyi* and that the degrees of attraction in laboratory observation were correlated with the susceptibilities in field.

To confirm the work of Goto & Fukatsu (1956), studies were carried out, using modified or different material and methods.

Materials and Methods.

Attraction Test

A. besseyi were extracted from infested rice grain obtained from Korea and cultured on *Alternaria tenuis* and *Botrytis cinerea.*

Rice seeds of fifteen varieties were germinated axenically in petri dishes. 4 sprouts of each variety were removed from germinating seeds when they were 1 cm long to macerate in a cavity block with a round bottomed glass tube, adding a drop of water to make two 0.5 cm diameter filter paper discs moistened. These two seedling extract discs were placed on 2% agar surface prepared 60 hours before the nematode were introduced at 2 cm distances and opposite each other from the center. Two water discs made by moistening the same size of filter paper discs with sterile distiled water were placed at 2 cm distances from the center, orthogonally to

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the seedling extract discs.

Nematode suspension of larvae and adults of larvae and adults of *A. besseyi* cultured on *A. tenuis* were pipetted onto a 1 cm diameter fiter paper disc, removing excessive water with clean filter papers. This nematode disc was placed at the center of the above mentioned agar plate, nematode side being faced to agar surface. Prepared petri dishes were kept in 26°C constant temperature room for 24 hour. Agar quadrates were removed 24 hour later as shown in Fig. 1.

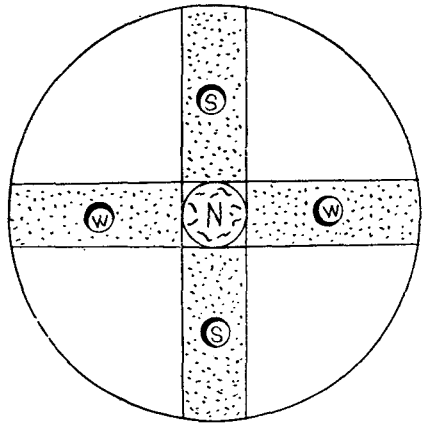

Fig. 1 Schematic view of an arrangement of 'seedling', 'water' and 'nematode discs' (dotted area: agar quadrates for nematode count)

Nematodes from each quatrate and the other parts were counted so that %-attraction of nematodes left the nematode disc for seedling discs could be figured out.

Susceptibility Test

Suspension of Nematodes cultured on *A. tenuis* and *B. cinerea* was pipeted onto the center of 9 cm clay pots in which 3 seedlings of 2-3 cm in height had been growing in steam sterilized soil so that each pot was inoculated with approximately 100 nematodes (100±6). Nematode inoculated rice plants were then grown in greenhouse. Eight week later, rice plants were removed from pots and the nematodes were extracted by modified Baemane's funnel technique for 48 hours. Extracted nematode were counted under a stereoscopic dissecting microscope. The experiment was a fully randomized design with 3 replications in each treatment or variety.

Results

Attraction of rice seedlings to *A. besseyi* varied greatly according to the varieties (Table I and Fig. 2)

Dividing the varieties into 3 groups according to the percentages of attraction in 24 hours, varieties

Table I. Varietal differences of Attraction to *A. besseyi*

Var.	Seedling disc side		Water disc side		Total	
	No. Nema.	%	No. Nema.	%	No. Nema.	%
Suweon 234	53	45.69	18	15.51	116	100
Matz-Mae	60	70.59	12	14.12	85	〃
Nong-Baek	28	38.89	18	25.00	72	〃
Shin-2	112	72.26	18	11.61	155	〃
Pal-Dal	88	69.29	10	7.89	127	〃
Poong-Gwang	71	44.33	17	11.33	150	〃
Jae-Geon	138	85.71	8	4.36	161	〃
Tokai-25	84	76.36	12	10.91	110	〃
Akibare	138	79.31	15	8.62	174	〃
Fuku-no-Hana	120	71.43	16	9.52	168	〃
Jin-Heung	170	70.83	42	17.92	240	〃
O-Ochal	73	61.86	18	15.25	118	〃
Suweon 213-1	34	53.97	11	17.46	63	〃
Shirogane	134	77.02	15	8.62	174	〃
Pal-Goeng	170	83.25	8	4.71	203	〃

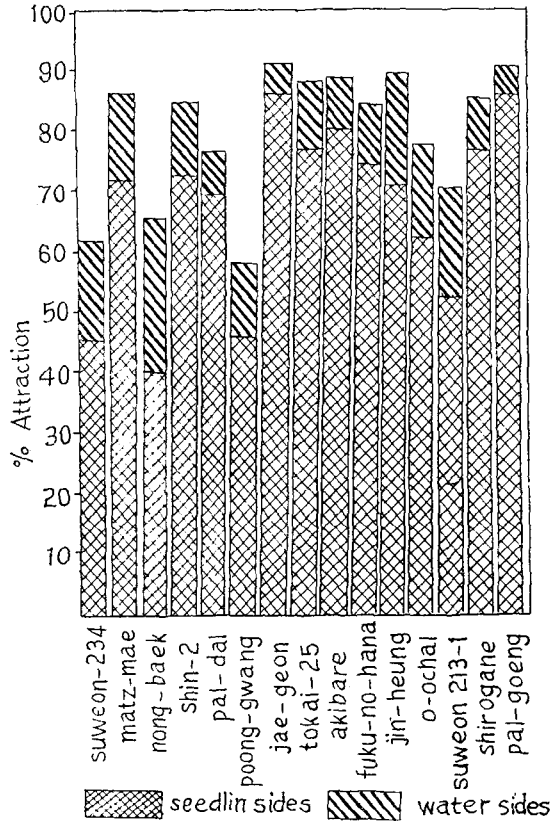

Fig. 2. Varietal differences of rice in attraction to *A. besseyi* within 24 hours

Suweon 234, Nong-Baek and Poong-Gwang were less than 50 %; varieties Matz-Mae, Shin-2, Pal-Dal, Fuku-no-Hana, Jin-Heung, 0-0chal and Suweon 213-1 were between 51 and 75%; varieties Jae-Geon, Tokai-25, Akibare, Shirogane, and Pal-Goeng were more than 75%.

Numbers of *A. besseyi* extracted from each variety varied considerably (Table Ⅱ).

In varieties Suweon 234 and Nong-Baek, the numbers of the nematode were fewer than those added at inoculation; varieties Poong-Gwang, 0-0chal and Suweon 213-1 maintained the numbers inoculated

Table Ⅱ. Numbers of *A. besseyi* extracted from different rice varieties 8 weeks after inoculation

Var.	Replications			
	Ⅰ	Ⅱ	Ⅲ	average
Suweon 234	—*	45	112	78.5
Matz-Mae	78	268	—	173.0
Nong-Baek	57	18	14	29.7
Shin-2	196	243	—	219.5
Pal-Dal	156	230	167	191.0
Poong-Gwang	47	—	147	97.0
Jae-Geon	441	563	—	502.0
Tokai-25	—	224	275	249.5
Akibare	338	355	—	346.5
Fuku-no-Hana	268	188	—	228.0
Jin-Heung	151	155	189	165.0
O-Ochal	79	98	127	101.3
Suweon 213-1	130	55	150	111.7
Shirogane	415	339	348	367.3
Pal-Goeng	378	330	273	327

*missing plot

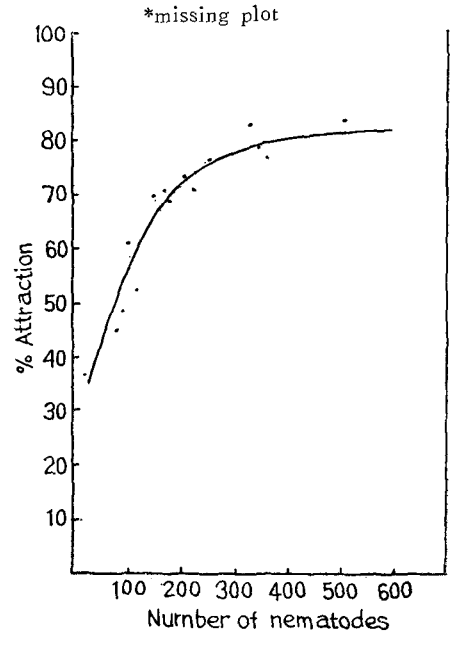

Fig. 3. Relationship between nematode numbers and % attraction

and the nematode populations in other varieties increased, multiplying between 1.65 times (in Jin-Heung variety) and 5.02 times (in Jae-Geon variety) as high as the inoculation level.

Correlation between the percentages of attraction

of seeding extracts of rice varieties to *A. besseyi* and the numbers of the nematode recovered from the plant of the varieties 8 weeks after inoculation were figured out.

As shown in Fig. 3, the numbers of *A. besseyi* were strongly correlated with the percentages of nematodes attracted to the same varieties; that is, the more the variety attracted the nematode in a laboratory agar plate test, the more susceptible it was in a greenhouse pot experiment. (The correlation coefficient r_s=0.96 by the Spaemann's rank test and this is significant at 1% level).

Discussion

Extensive work has been done on the attraction of plants to their nematode parasites (Webster, 1969; Green, 1972). Goto & Fukatsu (1956) reported that there was great difference between rice varieties in attraction to *A. besseyi*. Townshend (1964) found that *Aphelenchus avenae* and *Bursaphelenchus fungivorus* were attracted by their fungal hosts but not by nonhost fungi. Griffin (1969) showed that resistant strains of alfalfa attracted fewer *Ditylenchus dipsaci* than did the susceptible ones.

The present study shows that the nematode attraction toward the rice seedling extract varies according to the varieties which suggestes that there may be differences of content or contents either in quantity or quality which attract the nematode between varieties. (Table Ⅰ)

It also shows that the multiplication rates of *A. besseyi* markdely differ from one variety to another (Table Ⅱ).

Fukano & Yokoyama (1951) suggested that both the number of infected stems and the degree of white-tipped leaves should be considered in designation of susceptibility of rice variety because some varieties might be infected by the nematode without showing white-tip symptoms.

Such a high correlation between the attraction of rice varieties to *A. besseyi* and the numbers of the nematode recovered from the rice varieties in the present study suggests that the susceptibilities of rice varieties to the nematode may be due to the differences in attraction of seedlings to the nematode and in propagation rates of the nematode in different rice varieties as described by Goto & Fukatsu (1956) since the more nematodes can be detected in white-tipped plants even though the healthy looking plants in infected field may also contain the nematodes (Goto & Fukasu, 1956; Lee et al, 1972).

All the varieties used for this study are commonly grown ones in Korea. Special consideration is paid on varieties Suweon 234 and Suweon 213-1 since these varieties have been produced by a rice breeding team in the Office of Rural Development of Korea in colaboration with the International Rice Research Institute of the Philippines for a link in the chain of the Green Revolution Programme.

Hopefully, Suweon 234 was one of the least susceptible or resistant variety in terms of both the attraction and propagation rate of *A. besseyi* and Suweon 213-1 was moderate in susceptibility.

It is suggested that the varieties showed very low susceptibilities like Suweon 234, Nong-Baek and Poong-Gwang can be recommended and used for breeding of resistant rice variety to *A. besseyi* although it may need further investigations of three varieties continue even untill the harvest time of rice.

적 요

벼 이삭선충(心枯線虫), *Aphelenchoides besseyi* Christie에 대한 벼 品種의 誘引性과 感受性과의 相關關係를 알기 위하여 實驗室觀察과 溫室內의 포트 試驗을 수행하였다.

본 線虫에 대한 벼묘抽出液의 誘引性과 線虫의 增殖率은 벼의 品種에 따라서 크게 차이가 났으며 이들 두 要因간에는 큰 相關關係를 나타내었다. 즉, 벼묘의 抽出液이 線虫에 대하여 强한 誘引性을 나타낸 품종일수록圃場에서의 線虫增殖이 잘 되어 感受性이 높았다.

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