

The Effects of Inoculation Density of *Aphelenchoides besseyi*  
on the Growth of Rice Plant and the Body  
Length of the Female Nematode.\*

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Abstract

A greenhouse experiment was conducted to find out the influence of the inoculation density of *Aphelenchoides besseyi* on the growth of rice plant and the body length of female nematode.

The rice plants showed reduced height, number of tillers and dry weight of plant when the nematode was inoculated.

The body length of female nematode significantly decreased as the initial population density increased.

Introduction

For several decades, the rice white-tip nematode, *Aphelenchoides besseyi* Christie, 1942 has been one of the most important pests in many countries where rice is grown since Kakuda (1915) found the nematode in rice in Kyushu, Japan.

The common name of the disease, white-tip, is based on the characteristic symptoms which are seen on the leaf tips which become pale green and then turn to chlorotic white with tattered thread-like appearance. A typical symptom of the disease appears on the flag leaf or the upper-most leaf of a primary shoot. The nematode infected rice plants are stunted and produce small panicles, reducing the length of panicles and number of spikelets. Diseased panicles show excessive sterility and the fertile florets at maturity have twisted or distorted kernels (Yoshii & Yamamoto, 1950; Huu-Hai-Vuoung, 1969).

Yoshii & Yamamoto (1950) estimated 10—15% losses in yield from the disease in Japan. Attkins & Todd (1959) reported 40—50% reduction in grain yield when nematode was artificially inoculated onto susceptible varieties of rice in the U.S.A. Hung

(1959) found 29—46% losses of yield in 10 varieties investigated in Taiwan. In the U. S. S. R., the rice harvest has suffered losses between 29 and 61% (Tikhonova, 1966).

In Korea, the rice white-tip nematode was found in Bo-eun, Kim-je, Cheong-do, Sang-ju in 1968 (Lee et. al., 1972) and the disease caused by the nematode has since been spread out to other districts of the country to bring possible losses of grain yield.

Fukano (1962) has reported that if there are less than 30 live nematodes in a batch of 100 rice grains, there would be no significant loss in yield. If, however, there are more than 300, all the seeds from the field should be treated.

It may probably be important to know the influence of the nematode on the early stage of rice before the white-tip symptom appears since large population has been built up when the symptom is seen.

The purposes of this study are to know the effects of inoculation densities of *A. besseyi* on the growth of rice plant and the body length of the female nematode.

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## Materials and Methods

Rice seeds of Pal-Goeng variety were germinated axenically in a petri-dish to plant 3 seedlings in a 9 cm diameter clay pot in which steam sterilized soil was filled.

Suspension of the nematode cultured on *Alternaria tenuis* and *Botrytis cinerea* was pipetted onto the center of the pot when the rice seedlings were 2-3 cm high so that each treatment was inoculated with none for control, 100, 1,000 and 3,000 nematodes respectively, and the plants were grown in a greenhouse.

Plant heights were measured 2 weeks after nematode inoculation to see whether there was any difference between treatments.

9 week after nematode inoculation, rice plants were removed from the pots to extract and count the nematodes. Body length of 20 female nematodes were measured in T. A. F.

Before nematode extraction, the number of tillers were counted and the plant heights and fresh weights of plants were measured. The dry weights of plants were measured after nematode extraction.

The experiment was a fully randomized design with 3 replications.

## Result

Rice plant growth was significantly affected by the presence of the nematode (Table I).

**Table I.** The effect of *A. besseyi* on rice variety Pal-Goeng.

	inoculation number			
	0	100	1,000	3,000
Final number		276	2478.5	3,602.5
Body length (u)		744.18	724.78	718.69
Height (cm) 2wk	26.0	23.5	24.3	22.3
9 wk.	66.7	54.7	51.7	41.0
No. of tillers	15.7	10.7	11.0	9.0
Fresh wt.(g) top	27.7	12.8	9.0	9.6
root	8.4	6.3	5.3	3.5
Dry wt.(g) top	4.17	2.27	1.48	1.32
root	0.42	0.40	0.21	0.16

9 week old plant heights, number of tillers, fresh weights of tops and roots and dry weights of tops of nematode inoculated plants were significantly different from those of the control plants, but the dry weights of roots were not different statistically.

Correlation equations, correlation coefficients and significant levels of the correlation coefficients between the initial populations and final populations, body length of females and plant growth are shown in Table II and drawn in Figs. 1, 2, 3 and 4.

**Table II.** Correlation equations and correlation coefficients.

	equations	coefficient
Log Pi vs Pf	$Y=2342.69X-4440.53$	0.998**
" vs 'L'	$Y=780.84-18.44X$	-0.998**
" vs Ht(2wk)	$Y=25.94-0.91X$	-0.86n.s.
" vs Ht(9wk)	$Y=67.36-6.6X$	-0.95**
" vs No of tillers	$Y=15.38-1.8X$	-0.95**
" vs Fresh top wt	$Y=22.1-4.1X$	-0.98**
" vs fresh root wt	$Y=8.59-1.29X$	-0.96**
" vs dry top wt	$Y=4.13-0.89X$	-0.996**
" vs dry root wt.	$Y=0.46-0.08X$	-0.276n.s.

\*\*;significant at 1%, \*\*\*;at 0.1%, ns;none significant

The plant growth was affected not only by the nematode but also by spider mites contaminating the greenhouse. Assuming that the damages of the spider mites were even throughout the fully randomized experimental pots, however, the trends of the correlations might be similar to that when no spider mite damage was shown.

Plant height was seriously affected by the presence of the nematode after the second week of nematode inoculation since there was no difference in height between treatments in two week old plants but the differences in 9 week old plants were statistically significant.

## Discussion

As shown in Fig. 1, the body length of female nematode significantly decreased as the initial population density increased, due certainly to competition for space and nutrient.

In the present experiment, the rice plants showed

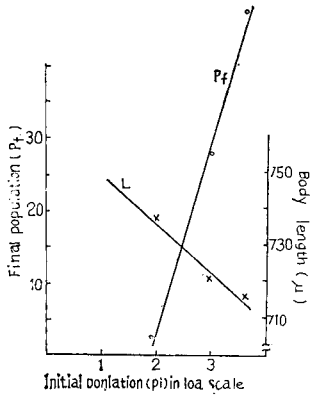


Fig. 1. Correlations between log. Pi and final population & body length

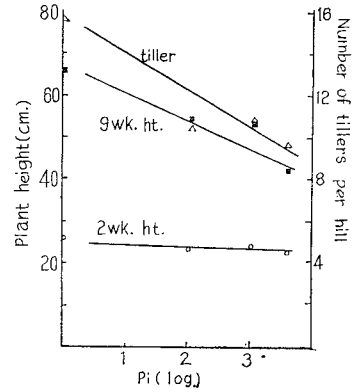


Fig. 2. Correlation between log. Pi and plant height & number of tillers

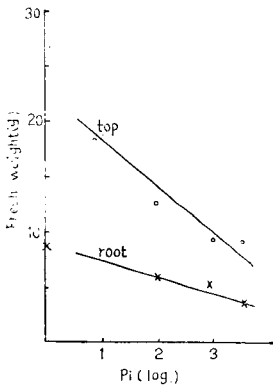


Fig. 3. Correlations between log Pi and fresh weights

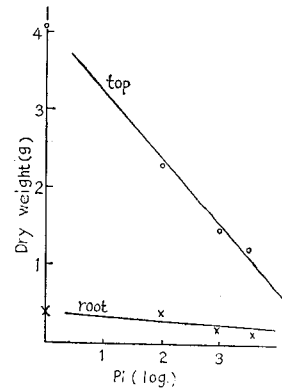


Fig. 4. Correlation between log. Pi and dry weights

reduced height, number of tillers and fresh and dry weights of plants when the nematode was inoculated. Since it is well known that healthy plant can produce better yield, the reduction of growth obtained from the present experiment would almost certainly affected the yield of plants.

It needs, however, further investigations to find out whether the damage to seedling is directly connected to the yield or whether there is any compensation of plant to the damage before harvest.

Since the rice white-tip nematode, *A. besseyi*, is a parasite of plant shoot, it is considered that the nematode affects the shoot primarily, decreasing the area and rate of photosynthetic activity resulting in reduced nutrient output, which eventually affects the growth of roots of the plant.

Considering the high multiplication rate even for 9 weeks of growth, the nematode must be eliminated before the nematode infested rice seeds are sown.

However, the economic level of the nematode population for control needs further investigations to be decided.

## 적 요

벼 이삭선충 (心枯線虫), *Aphelenchoides besseyi* Christie,의 接種密度가 벼의 生育 및 본선충의 雌成虫의 體長에 미치는 영향을 알기 위하여 溫室內에서 포트試驗을 수행하였다.

線虫을 接種하였을 경우에 벼의 草長, 分蘖數 및 地上部の 乾物重의 減少를 초래했으며 接種密度가 높아짐에 따라 雌成虫의 體長도 減少하였다.

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