

Fauna of Plant Parasitic Nematodes in Temperate Region of Japan

2. Survey in Chiba Prefecture

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Abstract

Fauna of nematodes damaging mainly vegetables and ornamental plants in some areas of Chiba Prefecture which is situated in the northern part of the temperate region of Japan was investigated. Root-knot nematodes (*Meloidogyne* spp.) were detected in 18 fields among 29 fields of vegetables and ornamental plants and *M. incognita* and *M. javanica* were observed on carnation planted in green houses at Tomiura. A spiral nematode (*Helicotylenchus dihystera*) was isolated from 50% of the cucumber fields while reniformis nematode (*Rotylenchulus reniformis*) was detected in only one field each of garden pea and amaryllis. Root-lesion nematodes (*Pratylenchus* spp.) were detected in flower, strawberry and potato fields in a limited area, at a high density, while pin nematodes (*Paratylenchus* spp.) were detected frequently on various crops at a low density. Fauna of nematodes damaging crops in some areas of Chiba Prefecture was different from that in Shizuoka and Kagawa Prefectures since ring nematodes (*Criconebella* spp.) and stylet nematodes (*Tylenchorhynchus* spp.) could not be detected while *R. reniformis* was infrequently observed though a large population of *Meloidogyne* spp. occurred commonly in both areas. The nematode fauna also differed from that on Ishigaki Isl. since in Chiba Prefecture *Meloidogyne* spp. were detected at a high frequency and *H. dihystera* and *R. reniformis* at a low frequency while *Tylenchorhynchus* spp., *Hoplolaimus* sp. and *Paratrophulus* sp. were not observed.

Additional key words : plant parasitic nematodes, Chiba Pref., temperate region, vegetables, flowers

Introduction

In the previous paper¹⁴⁾, the authors reported on the nematodes causing damage to vegetables and ornamental plants in some selected locations of Shizuoka and Kagawa Prefectures to analyze the difference in the distribution of the nematode fauna between Ishigaki Isl. in the subtropical zone and both prefectures in the temperate regions of Honshu, Japan. These investigations revealed that *Meloidogyne incognita*, *M.javanica*, *Helicotylenchus dihystra*, *Rotylenchulus reniformis*, *Tylenchorhynchus* spp., etc. occurred both in the temperate and the subtropical regions. However, *M. hapla* was detected only in Shizuoka Prefecture while *Hoplolaimus* sp. and *Paratrophulus* sp. reported on Ishigaki Isl. were not detected in Shizuoka and Kagawa Prefectures. *Pratylenchus penetrans* and *P. fallax* attacking chrysanthemum were found in Shizuoka Prefecture, whereas *P. zaeae* and *P. coffeae* were mainly observed on Ishigaki, indicating differences in the fauna of this genus between both areas.

On the basis of these results, the authors carried out further surveys on the nematode fauna in fields of vegetable and ornamental plants in Chiba Prefecture which is located in the northern part of the temperate region in Honshu.

Materials and methods

A total of 29 vegetable and flower fields were selected in Yachimata, Ohara, Ito, Sakaki, Tomiura, etc. in Chiba Prefecture (about 35° N Lat.; mean annual temperature, 15.5°C and mean annual RH, 75%). For the collection of soil and rootlet samples from the fields as well as separation and identification of the nematodes, the same methods as those described in the previous paper were applied.

Results

Results obtained are shown in Table 1. Root-knot nematodes, *Meloidogyne* spp. were detected at

a high density, in 18 fields of tomato, cucumber, sweet potato, carnation, etc. among the 29 fields examined including sweet potato, Chinese yam, tomato, cucumber, garden pea, carnation, amaryllis fields, etc. Of these, *Meloidogyne incognita* and *M. javanica* on carnation cultivated in plastic houses in Tomiura and *M. javanica* on only Chinese yam in Yachimata were identified. Besides the genus *Meloidogyne*, root-lesion nematodes, *Pratylenchus* spp., were detected in chrysanthemum, campanula and strawberry gardens only in Sakaki and in one site in Shirahama at a very high density. On the other hand, pin nematodes, *Paratylenchus* spp., were detected in crop fields in various areas at a low density. A spiral nematode, *Helicotylenchus dihystra*, was detected in 50% of the cucumber fields surveyed. In contrast, reniformis nematode, *Rotylenchulus reniformis*, was detected in only a few fields of garden pea and ornamental plants. In gardens for ornamental plants including star thistle, common marigold, narcissus, Iceland poppy, campanula and Iceland poppy, few harmful nematodes were detected. However, among the nematodes found on flowers at a high density, *Pratylenchus* spp. on campanula and chrysanthemum, *Meloidogyne* spp. on carnation and *Rotylenchulus reniformis* on amaryllis were harmful. The presence or absence of nematodes on various vegetables and flowers was then compared to their presence in soil sampling sites, for instance, in tomato fields of Ohara, *Meloidogyne* spp. were found at a high density while there were few or no nematodes in the crop fields at Ichinomiya. Growth inhibition of the plants caused by *Meloidogyne* spp. was observed in tomato fields at Ohara and carnation gardens under plastic houses at Tomiura. In flower fields located in Menuma and Shirahama where *Pratylenchus* spp. were detected at a higher density than in other sites, damage to campanula and chrysanthemum, probably attributable to these nematodes was also observed, respectively. Furthermore, damage probably due to *Rotylenchulus reniformis* was observed on amaryllis at Maruyama while nematode damage to crops such as broad bean,

Table 1. Plant parasitic nematodes detected from flower and vegetable fields in Chiba prefecture.

Location	Crops	<i>Meloidogyne incognita</i>	<i>M.javanica</i>	<i>Meloidogyne</i> spp.	<i>Helicotylenchu dihystra</i>	<i>Rotylenchurus reniformis</i>	<i>Paratylenchus</i> spp.	<i>Pratylenchus</i> spp.
Yachimata	Sweet potato			++				
	Sweet potato			+				
	Chinese yam		+					
Ichinomiya	Tomato			+				
	Tomato						+	
Ohhara	Tomato			+++				+
	Cucumber			++	+			
	Cucumber			+	+			
Amatsukominato	Cucumber		++					
	Tomato			++				
	Tomato			++				
Chikura	Cucumber			+	+			
	Cucumber			+			+	
Susaki	Broad bean				+			
	Cucumber			+			+	
Ito	Star thistle			+				
	Common marigold				+			
	Garlic				+			+
Sakai	Garden pea					+	+	
	Garden pea				+			
	Narcissus						+	
Menuma	Iceland poppy							+
	Campanula							+++
	Strawberry							++
	Potato						+	++
Shirahama	Chrysanthemum					+	+++	
Tomiura	Carnation	++	++					
	Carnation	+++	++			+		
Maruyama	Amaryllis				+	++		
Detection rate(%)		-	-	-	50/cucumber	-	-	-

+: 1-10 nematodes/30g soil, ++ : 11-50 nemmatodes, +++ : 51 nematodes or more, separated by Baermann funnel method.

garlic, garden pea, star thistle, narcissus and common marigold was not observed.

Discussion

In all the sites surveyed in Chiba Prefecture, the detection frequency of nematodes was highest for *Meloidogyne* spp. followed by *Pratylenchus*, *Helicotylenchus* and *Paratylenchus* spp. on a few or various kinds of crops in that order. This tendency was almost the same as that observed in Shizuoka and Kagawa Prefectures. *M. javanica* from carnation at Tomiura was reported to be an exotic species differing from the native one in Japan based on the phenotype of esterase enzyme

determined by the electrophoretic method although the former could not be distinguished from the latter by morphological characteristics of the female perineal pattern¹³⁾.

The detection rate of *Helicotylenchus dihystra* in cucumber fields was 50% although the number of the fields surveyed was small and the nematode was rarely found in Shizuoka and Kagawa Prefectures. The frequency of *Rotylenchulus reniformis* observed in fields of various kinds of crops was considerably lower than in Shizuoka Pref. Taking into account the high rate of 44% reported in different kinds of host crops on Ishigaki Isl in the subtropical zone, it is assumed

that the higher the latitude, the less frequent the incidence of *Rotylenchulus reniformis*. In fact, it is known that the northern limit of the geographical distribution of this species lies along the isothermal line of 14°C for annual average which runs around the northern part of the Kanto Plain⁸⁾. The location of Chiba Prefecture, close to this northern limit may account for the low frequency and distribution of the species. Concerning the genus *Helicotylenchus*, with a higher detection rate in mulberry fields in the southern part of Japan than in the fields in the northern part¹²⁾, the detection rate in Chiba Prefecture was, though by far lower than in the subtropical region but higher than in Shizuoka Prefecture.

More than 18 genera of nematodes in numerous soil samples collected from fields with various kinds of crops such as vegetables, cereals, pulses, fruit trees and others in Chiba Prefecture, were reported by Yoshida¹⁵⁾ (1965), including *Meloidogyne*, *Pratylenchus*, *Rotylenchulus*, *Heterodera*, *Helicotylenchus*, *Nothotylenchus* (*N. acris*), *Aphelenchoides* (*A. fragariae*, *A. rittermabosi*), *Criconebella*, *Paratylenchus*, *Ditylenchus*, *Paratrichodorus*, *Tylenchorhynchus*, *Xiphinema*, etc. The authors concluded that among these nematodes *Meloidogyne* spp. (*M. incognita*, *M. hapla*, and *M. arenaria*) and *Pratylenchus* spp. (*P. penetrans*, *P. coffeae*, *P. vulnus* and *P. loosi*) were most harmful to vegetables, ornamental plants and nursery fruit trees. Actually, these nematodes damaged crops such as carrot^{2,5)}, burdock^{1,2,4)}, cucumber⁶⁾, watermelon⁷⁾, spinach³⁾, Japanese radish¹⁰⁾, Chinese yam¹¹⁾, etc. Our survey, also revealed that the predominant occurrence of *Meloidogyne* spp., distributed throughout the Kanto district⁹⁾, and *Pratylenchus* spp. remained unchanged. Nematode fauna in crop fields in Chiba Prefecture is very similar to the fauna of Shizuoka Prefecture where *Aphelenchoides* spp. and *Pratylenchus* spp. attack ornamental plants but is different from the fauna on Ishigaki Isl. since in Chiba Prefecture *Hoplolaimus* spp. and *Paratrophulus* could not be detected. On mulberry in Hachijo-jima Isl. which is located in a

warm area, two species belonging to the genus *Xiphinema*, *X. bakeri* and *X. insigne*, were reported¹⁶⁾, suggesting that they belonged to the warm area-type of nematodes.

Although it is considered that the incidence of cyst nematodes, which we could not be identified in this survey, has decreased with the decrease or discontinuation of cultivation of their host plants such as soybean and barley or wheat, damage by *Heterodera glycines* is still a serious problem for green soybean-producing centers in Chiba. Moreover, although two species of the genus *Meloidogyne*, *M. javanica* and *M. incognita*, were detected in our survey, both *M. arenaria* from pulses and *H. hapla* from peach and fig¹⁵⁾, which attack peanut, a major product of this prefecture, could not be detected.

Therefore, further investigations on the distribution of these nematodes including *Meloidogyne* spp., *Pratylenchus* spp. and *Heterodera* spp. should be carried out on various crops in a larger number of sites.

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本邦温暖地の畑地における植物寄生線虫相

2. 千葉県における調査

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摘 要

ネコブセンチュウは29調査圃場のうちキュウリ、トマト、サツマイモ、カーネーションなど18圃場から検出されたが、2期幼虫のみのものが多く、種名が同定できたのは富浦のハウス栽培のカーネーションからのサツマイモネコブセンチュウ (*Meloidogyne incognita*) とジャワネコブセンチュウ (*M. javanica*) および八街のヤマトイモからのジャワネコブセンチュウのみであった。ネコブセンチュウ以外では、ナミラセンチュウ (*Helicotylenchus dihystra*) がキュウリ圃場の50%から検出されたが、ニセフクロセンチュウ (*Rotylenchulus reniformis*) は以外に少なく、エンドウとアマリリスから見い出されたのみであった。ネグサレセンチュウ (*Pratylenchus* spp.) は、布沼と白浜の花き、イチゴ、ジャガイモなどから高密度に検出されたが、その分布は局地的で、わずかではあるが各

地から検出されたピンセンチュウとは対照的であった。千葉県の一部地域で検出された線虫の種類を静岡・香川両県のそれと比べると、ネコブセンチュウとネグサレセンチュウが高密度に検出されたという共通点はあるが、静岡・香川では検出されたワセンチュウがみられなかったこと、静岡では比較的多くみられたニセフクロセンチュウがまれであったこと、香川ではみられたイシユクセンチュウが検出されなかったなどの点で異なる。また、石垣島の線虫調査結果とは、静岡と同様、ネコブセンチュウの検出頻度は高いが、イシユクセンチュウ (*Tylenchorhynchus* spp., *Paratrophurus* spp.) が検出されなかったこと、ラセンセンチュウとニセフクロセンチュウの検出頻度がより低いことなどの点で異なる。

キーワード：植物寄生線虫、千葉県、温暖地、花き、野菜