

Fauna of Plant Parasitic Nematodes in Temperate Region of Japan

3. Survey in Wakayama Prefecture

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Abstract

Ten genera of plant parasitic nematodes were detected in 39 sites among 45 surveyed sites consisting of fields with vegetables and ornamental plants and of these, 5 species were identified, including *Aphelenchoides* spp., *Criconemella* spp., *Helicotylenchus dihystrera*, *Meloidogyne incognita*, *M. javanica*, *Paratrichodorus porosus*, *Paratylenchus*, spp., *Pratylenchus* spp., *Rotylenchulus reniformis*, *Tylenchorhynchus* spp. and *Tylenchus* spp. Although damage caused to the vegetables by the nematodes was not observed, heavy damage of carnation and sweet pea by *Meloidogyne* spp. and of chrysanthemum by *Pratylenchus* spp. was noted, respectively. The two genera of nematodes listed above were considered to be most harmful to crops. The nematode fauna in Wakayama Prefecture was similar to that in Shizuoka and Chiba Prefectures, since *Meloidogyne* and *Pratylenchus* were the major harmful nematodes to flowers and vegetables. However the nematode fauna was different from that in Shizuoka since no *M. hapla* were detected and from Chiba since a larger variety of nematodes was observed. The nematode fauna in Wakayama was different from that on Ishigaki Isl. in almost all the same characteristics as those described in the temperate region including Shizuoka, Kagawa and Chiba, namely a larger frequency of *Meloidogyne* spp., and a lower frequency of *Helicotylenchus* spp. were detected while *Hoplolaimus* and *Paratrophulus* spp. could not be observed.

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

Introduction

As reported in the previous two papers^{8,9)} the fauna of nematodes was investigated in several vegetable fields and flower gardens in the temperate region of Japan, including Shizuoka, Kagawa and Chiba Prefectures. The results showed considerable differences from those observed in the subtropical region (Ishigaki Isl.). In the present paper the nematodes detected in vegetable fields and flower gardens in 7 and 5 districts, respectively, in Wakayama Prefecture which is located on the southern coast of Honshu will be reported.

Materials and methods

The survey covered 26 vegetable fields and 13 flower gardens in Hirokawa, Mihama, Inami, Nubiki, Mikatsu, Kemi, Yugawa and Nada districts in Wakayama Prefecture facing the Kii Channel (about 33°30'N Lat.; mean annual temperature, 16.1° C and mean annual RH, 69%). Collection of soil and rootlet samples from the fields surveyed as well as separation and identification of the nematodes were performed by using the same methods as those outlined in the previous papers.

Results

Ten genera of plant parasitic nematodes were detected in the sites surveyed in Wakayama Prefecture and of these, four species were identified as indicated in Table 1. In spinach, eggplant, kidney bean and lettuce fields and in cockscomb and chrysanthemum gardens at Hirokawa as well as on lettuce at Nada, a spiral nematode, *Helicotylenchus dihystera*, was detected at a high population density. Java root-knot nematode, *Meloidogyne javanica*, was found in carnation at Yugawa and sweet pea at Yugawa at a very high density, respectively. Southern root nematode, *M. incognita*, was detected practically only on sweet pea at Yugawa at a very high density. In a cucumber field at Mihama and in a

chrysanthemum garden at Innami, bud and leaf nematodes, *Aphelenchoides* spp. were observed at a fairly high density but with a very low frequency of detection. Root-lesion nematodes, *Pratylenchus* spp., were detected in chrysanthemum at a high density. Reniformis nematode, *Rotylenchulus reniformis*, stylet nematode, *Tylenchorhynchus* spp. and pin nematodes, *Paratylenchus* spp. occurred at a low density in many flower and vegetable fields with a high detection frequency, respectively. *Paratrichodorus porosus* was found in carrot and garland fields at Kemi and in rocket larkspur gardens at Innami at a low density. Ring nematodes, *Criconemella* spp. were rarely found whereas, *Tylenchus* spp. were detected frequently but the damage by these nematodes to crops was not confirmed.

Carnation cultivated in plastic greenhouses at Yugawa and Kemi withered due to the damage caused by *Meloidogyne incognita* and the growth of only sweet pea in Yugawa was markedly inhibited by *M. javanica*, with root-knots, galls being attached to the plant roots. It is considered that carnation and sweet pea cultivated in greenhouses had been damaged by *Meloidogyne* spp. in Yugawa, due to continuous cropping of the flowers for more than 3 years though a nematicide (Telone, 1,3-dichloropropene) had been applied to soil in the gardens for the control of the nematodes. In the case of vegetables, on the other hand, only a small number of root-knot nematodes were observed on carrot and Japanese radish. However, *Helicotylenchus dihystera* occurred on various kinds of vegetables including spinach, eggplant, kidney bean, Japanese radish, Chinese cabbage, welsh onion, onion as well as flowers such as cockscomb, chrysanthemum only around Hirokawa and on one crop, lettuce in Nada. Although root-lesion nematodes, *Pratylenchus* spp. were detected in a spinach field at Mikatsu and in Japanese radish and chrysanthemum fields at Kemi, crop damage caused by these nematodes was not appreciable. Damage of vegetables and flowers caused by stylet nematodes, *Tylenchorhynchus* spp. and *Rotylenchulus reniformis* was not observed in this

Table 1. Plant parasitic nematodes detected in vegetable and flower fields in Wakayama Prefecture.

Location	Crops	<i>Meloidogyne incognita</i>	<i>M.javanica</i>	<i>Helicotylenchus dihystrera</i>	<i>Rotylenchulus reniformis</i>	<i>Aphelenchoides</i> spp.	<i>Criconebella</i> spp.	<i>Paratylenchus</i> spp.	<i>Pratylenchus</i> spp.	<i>Tylenchorhynchus</i> spp.	<i>Paratrichodorus porosus</i>	<i>Tylenchus</i> spp.
Nubiki	Ginger							+				
	Red pepper							+				
	Japanese radish							+				
Mikatsu	Lettuce									+		
	Spinach								+			
	Broccoli							+				+
Kemi	Garlic							+				
	Carrot	+										
	Garland							+			+	
	Japanese radish								+		+	
	Lettuce				+			+		+		
	Chrysanthemum	++										
	Dahlia				+		+					
	Carnation	++										
	Japanese radish	+		+								
Hirokawa	Chinese cabbage			+	+			+				
	Welsh onion			+								
	Spinach			++								
	Onion			+								
	Eggplant			++								
	Kidney bean			++								
	Cockscomb			++								
	Chrysanthemum			++								
	Kidney bean							+				+
Yugawa	Sweet pea		+++	+								
	Carnation	+++								+		
Mihama	Cucumber					++						
	Cucumber											+
Nada	Lettuce			++				+				
	Pea				+					+		
	Broccoli							+				
	Tomato											+
	Tomato		+							+		
	Gypsophila			+	+			+				
Inami	Star thistle							+				
	Gerbera	+										
	Chrysanthemum					++						
	Rocket larkspur									+	+	
	Orange											++

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

survey. In spite of the frequent detection of pin nematodes, *Paratylenchus* spp., crop damage by this nematode was not observed. Although conclusions on the nematode fauna should not be drawn hastily based on only a small number of sampling sites in limited areas, *Meloidogyne* spp. and *Helicotylenchus dihystrera* which were detected in a comparatively large number during the field surveys appeared to predominate in this area.

Pratylenchus spp. also predominated and were harmful particularly to root crops and some ornamental plants including chrysanthemum though these nematodes were detected in a low frequency and at a low density owing to the unsuitable separation technique for the nematodes currently used. Plants such as garland, chrysanthemum and Japanese radish at Kemi and rocket larkspur at Inami which were parasitized by

Paratrichodorus porosus did not show distinct damage.

Discussion

In Wakayama Prefecture, although there are fewer reports on major pest nematodes compared with other prefectures in the temperate region of Japan, *Aphelenchoides besseyi*^{1,2)} has been reported to damage rice, *Meloidogyne* spp. to infest vegetables²⁾, *M.incognita* to attack sweet potatoes³⁾, *Tylenchulus semipenetrans* to be harmful to citrus⁶⁾. Recently, it has been reported that such genera as *Psilenchus* on tulip, *Malenchus* on some vegetables, *Ecphyadophora* on sweet potato and other plants, *Coslenchus* on winter cereals and some fruit trees, etc. were distributed also in Wakayama Prefecture^{4,5)}. It was reported that in the temperate zone of Wakayama Prefecture, sweet potato had experienced damage from *Meloidogyne incognita*¹⁾.

Although the present investigation did not cover sweet potato fields, they revealed that damage due to this nematode could be observed on various crops. It was worth noting that both the incidence and extent of damage were more significant on ornamental plants than vegetables, presumably due to the effect of the application of nematicides to vegetable fields and crop rotation with paddy rice which may have resulted in the decrease of the density of nematode populations. According to Yamamoto⁷⁾ (1992), although taro in Mie Prefecture had experienced growth inhibition due to continuous cropping, the inhibition could be alleviated by the alternative use of land as upland or paddy fields and by the cultivation of seed potato. It seems however that, for ornamental plants in the areas investigated, appropriate measures of control have not yet been implemented due to the insufficient knowledge on nematodes. The results obtained at Hirokawa were interesting in that *Helicotylenchus* spp. were almost exclusively isolated from vegetables and flowers, compared with *Meloidogyne* spp. which were hardly detected. It is assumed that

Helicotylenchus spp. may be more tolerant to the chemical than *Meloidogyne* and that the type of soil and fertilizer application may be conducive to the occurrence of these nematodes.

Paratylenchus spp. showed the highest detection frequency in this survey but the effect of the nematodes on crops was not confirmed. These nematodes appear to be similar to those reported previously from Shizuoka and Kagawa Prefectures⁸⁾. *Meloidogyne* and *Pratylenchus* spp. were found in a lower frequency but they were the main pest nematodes. The detection frequency of *Rotylenchulus reniformis* was lower than that in Shizuoka Prefecture but slightly higher than that in Chiba Prefecture. In Wakayama Prefecture, *Tylenchorhynchus* spp. that were not detected in Shizuoka and Chiba Prefectures were found in a fairly high frequency also in Kagawa Prefecture and in the subtropical Ishigaki Isl. Low detection frequency of *Paratrichodorus porosus* was almost comparable in all the areas investigated. *Helicotylenchus Idihystera* was common to all the prefectures surveyed and showed the highest frequency of detection in Wakayama Pref., suggesting that the nematode incidence may increase when the latitude decreases and becomes closer to that in the subtropical region. To confirm this assumption, comparative studies on the geographical distribution of *Helicotylenchus* spp. including *H. erythrinae* commonly distributed throughout Japan should be carried out, based on the fact that *H. dihystra* occurs over a wide range of climatic zones encompassing the tropical, subtropical and temperate regions.

The differences in the detection rate and distribution of plant parasitic nematodes, particularly of the important ones in the temperate area of Japan (*Meloidogyne*, *Pratylenchus* and *Rotylenchulus* spp.) may be associated with the kinds of planted crops, cultivation methods and soil types. Therefore, further studies should be carried out using a larger number of samples collected from the same kind of crop for each nematode identified at the species level and employing sieving and centrifugal flotation techniques in addition to

Baermann method for nematode separation.

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本邦温暖地の畑地における植物寄生線虫相

3. 和歌山県における調査

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摘 要

和歌山県一部地域の45の野菜および花き圃場において線虫調査を行ない、このうち39圃場から10属の植物寄生線虫を検出し、5種を同定した。それらはハセンチュウ (*Aphelenchoides* spp.), ワセンチュウ (*Criconemella* spp.), ナミラセンセンチュウ (*Helicotylenchus dihystra*), サツマイモネコブセンチュウ (*Meloidogyne incognita*), ジャワネコブセンチュウ (*M. javanica*), ナガイモユミハリセンチュウ (*Paratrichodorus porosus*), ピンセンチュウ (*Paratylenchus* spp.), ネグサレセンチュウ (*Pratylenchus* spp.), ニセフクロセンチュウ (*Rotylenchulus reniformis*), イシユクセンチュウ (*Tylenchorhynchus* spp.) およびハリセンチュウ (*Tylenchus* spp.) であった。

野菜の顕著な線虫害はみられなかったが、ネコブセンチュウによるカーネーションやスイートピーの被害とネグサレセンチュウによるキクの重度の被害がそれぞれ認められた。この2属の線虫は主要有害線虫とみられた。和歌山県一部畑地の線虫相は、ビニールハウス栽培のカ

ーネーションなどでネコブセンチュウの発生が著しく、しかもネコブセンチュウ、ネグサレセンチュウの両種が花きや野菜にとって主要有害線虫であるという点で、静岡、千葉両県の事例とよく似ていた。しかし、多くの種類の線虫が検出されたという点で千葉県の場合と、またキタネコブセンチュウ (*M. hapla*) が検出されなかったという点で、静岡県の場合とはそれぞれ異なっていた。

本州で最も温暖な地域の一つである和歌山県一部畑地の線虫相は静岡、香川、千葉各県の場合とほぼ同じ理由で、亜熱帯に属する石垣島の線虫相とは異なっていた。すなわち、これらの県ではネコブセンチュウの発生が多くみられたが、石垣島では比較的少なく、逆に石垣ではヤリセンチュウ (*Hoplolaimus* spp.) とリュウキュウイシユクセンチュウ (*Paratrophulus* sp.) が検出されたが、これらの県ではみられず、またラセンセンチュウ (*Helicotylenchus* spp.) の検出頻度が石垣島ではより高かった。

キーワード：植物寄生線虫、和歌山県、温暖地、野菜、花き