

Incidence of Root-Knot Disease in Tomato and Potato and Identity of the Causal Species in the Western Region of the Libyan Jamahiriya*

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ABSTRACT

Root-knot nematodes are considered one of the most important group of plant parasites. They are distributed world-wide and infect a variety of food and fibre crops. Little information is available about root-knot nematodes in the Libyan Jamahiriya. An attempt has been made to study some aspects of root-knot nematodes infecting tomatoes and potatoes in western regions of the country. Surveying tomato and potato fields in ten localities from Zawia to El-Khoms revealed that tomatoes were more affected by root-knot nematode disease than potatoes.

Meloidogyne javanica and *M. incognita* were identified as the species of root-knot nematodes present on tomatoes and potatoes in this region. *M. javanica* was the dominant species, while *M. incognita* was found only in certain localities. Two races of *M. incognita* were identified; they were designated Race 1 and Race 2. Race 1 was found at El-Khoms while Race 2, in Ameriya, Airport Road and Zawia.

INTRODUCTION

Vegetables constitute one of the most important groups of cultivated plants in the Libyan Jamahiriya. Little information exists about the root-knot nematode problem of vegetable crops. Recently Khan (6) claimed that root-knot nematodes are a serious problem on a number of plants of economic importance. Khan (5) and Khan and Dabaj (7) reported that *Meloidogyne incognita* and *M. javanica* infect a variety of vegetable crops in Jamahiriya.

Tomato and potato are important vegetable crops in the Libyan Jamahiriya. Tomato is grown outdoors as well as under glass or in plastic tunnels. Potato is grown outdoors. They are well-known as hosts of root-knot nematodes and are known to be infected by *Meloidogyne* spp. in Libyan Jamahiriya (2,7). Therefore, it was considered desirable to investigate the incidence of root-knot on these two important vegetable crops in the western region of the Libyan Jamahiriya and to identify the species and races of root-knot nematodes infecting tomato and potato crops in this region.

MATERIALS AND METHODS

To assess the incidence of root-knot nematode disease on tomatoes and potatoes in the western region of the Libyan Jamahiriya, a survey was conducted from April to

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May, 1979 at ten localities, namely: El-Khoms; Gharabuli; Tajora; Hadba Khadra; Airport Road; Swani Ben-Adam; Ameriya; Ainzara; Sidi Misri and Zawia. In the survey, mostly outdoor field plots were included. However, in some localities indoor cultivation units were also surveyed. From each of the cultivation units, in each locality samples of roots of the plants were collected randomly. Root samples were thoroughly washed and were examined for the presence of galls. Number of galls per root-system were counted. Roots were immersed in an aqueous solution of Phloxine B (0.15 g/lit. tap water) for 15 minutes to stain the eggmasses. Eggmasses per root system were then counted. Root-knot index and eggmass rating were done according to the following scale: 0 = 0; 1 = 1 - 2; 2 = 3 - 10; 3 = 11 - 30; 4 = 31 - 100 and 5 = greater than 100 galls or eggmasses per root system (10).

The frequency of occurrence (percentage) of the disease in each locality was calculated by the following formula:

$$\text{Frequency of occurrence} = \frac{\text{No. of cultivation units with infection}}{\text{No. of cultivation units surveyed}} \times 100$$

In order to identify the species and races, the inoculum from different fields in each locality was maintained on tomato 'Rutgers' in a greenhouse. All the inocula were further cultured by single eggmass inoculation.

Identification of the species and races of *Meloidogyne* collected from different localities and maintained in pure form in the greenhouse was done by employing perineal pattern method and differential host test.

Mature females were dissected out from large galls on the roots of tomato plants on which pure cultures had been maintained. Ten to twenty perineal patterns were prepared from each sample maintained. The slides of perineal patterns were examined and the species were identified on the characteristics of the perineal pattern.

North Carolina Differential Test was carried out to determine the species and races of *Meloidogyne* collections maintained in the greenhouse (10).

Seedlings of tomato c.v. 'Rutgers', tobacco c.v. NC 95, pepper c.v. California Wonder, peanuts c.v. Charleston Grey and Cotton c. Deltapine 16, were grown in ten-centimeter clay pots with three replicates. Two additional replicates of tomato were included to determine the time of termination of the test.

For inoculation, the inoculum was prepared in the form of eggs by Chlorox method (4). After determining the number of eggs per ml, plants were inoculated with 10,000 eggs per pot. Inoculated plants were kept in a greenhouse for 50 days at a temperature from 24-30°C. Then the roots were harvested and thoroughly washed with water. Root systems with very light infection were stained with Phloxine B to determine the number of eggmasses. Galls and eggmasses were rated on 0-5 scale (10).

After rating the root systems, results were compared with the differential host test identification table (10) and the species and races were identified. The identification of species done on the basis of differential host test was compared with identifications earlier made by perineal pattern method for confirmation of their identity.

RESULTS AND DISCUSSION

The data obtained during the survey of tomato and potato crops in the western region for root-knot disease are summarized in Table 1. Results indicate that incidence of the disease on tomato was much higher than on potato in this region. Tomato was found to be infected in all localities surveyed and in each locality, the overall frequency of occurrence was high. The highest frequency was found in Hadba Khadra and Swani Ben-Adam followed Sidi Misri, El-Khoms, Gharabuli, Tajora and

Table 1. Incidence of root-knot on tomatoes and potatoes in the western region of the Libyan Jamahiriya.

Locality	Frequency of occurrence (%)		Root-knot index*		Eggmass index*	
	Tomato	Potato	Tomato	Potato	Tomato	Potato
El-Khoms	50	—	4	—	4	—
Gharabuli	50	—	3	—	3	—
Tajora	50	20	3	3	3	5
Hadba Khadra	90	—	2	—	2	—
Airport Road	40	—	3	—	3	—
Swani Ben-Adam	90	10	4	3	4	5
Ameriya	20	—	3	—	2	—
Ainzara	40	—	3	—	2	—
Sidi Misri	70	10	3	3	3	5
Zawia	50	40	3	3	2	5

*Data are the average of 10 root samples.

— = Not found.

Zawia, Airport Road and Ainzara, and Ameriya in descending order. The level of infection also varied as indicated by root-knot and eggmass indices (Table 1). All infected plants were stunted with poor foliage, yellow leaves, restricted root-growth and less fruit compared to healthy plants. Galls were well-formed, prominent and recognisable on roots (Fig. 1).

The incidence of disease on potato was found only in four localities out of ten surveyed. The infection was present at Tajora, Swani Ben-Adam, Sidi Misri and Zawia. The crops in fields surveyed in other areas were free from infection. The highest frequency (40%) was found in Zawia followed by that in Tajora (20%); and in Swani Ben-Adam and Sidi Misri (Table 1). Galls were not very large as found on tomato but were quite recognizable (Fig. 2). The average eggmass index was 5 but the root-knot index was 3 in all the localities where infection was found. Infected plants



Fig. 1. Tomato plants showing heavily galled roots due to infection of root-knot nematode.

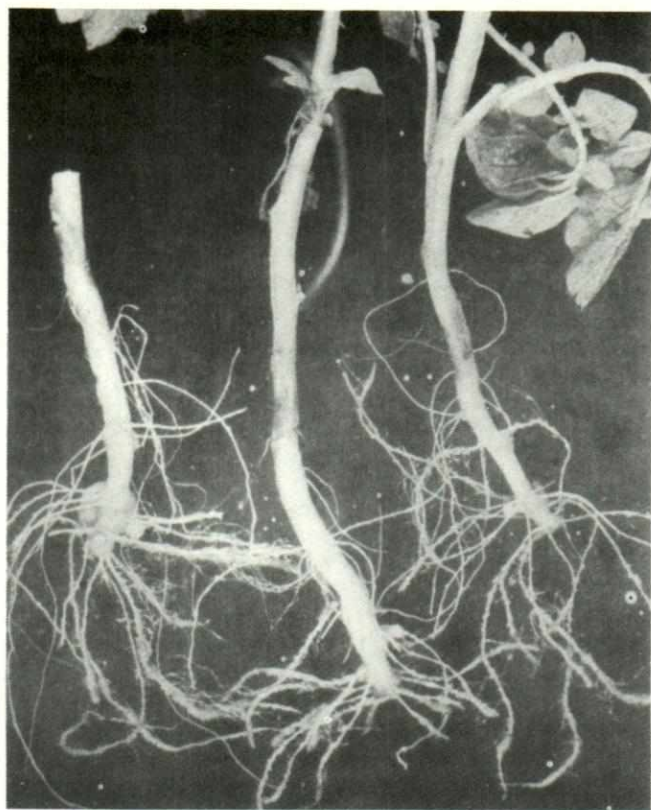


Fig. 2. Potato plants infected with root-knot nematode.

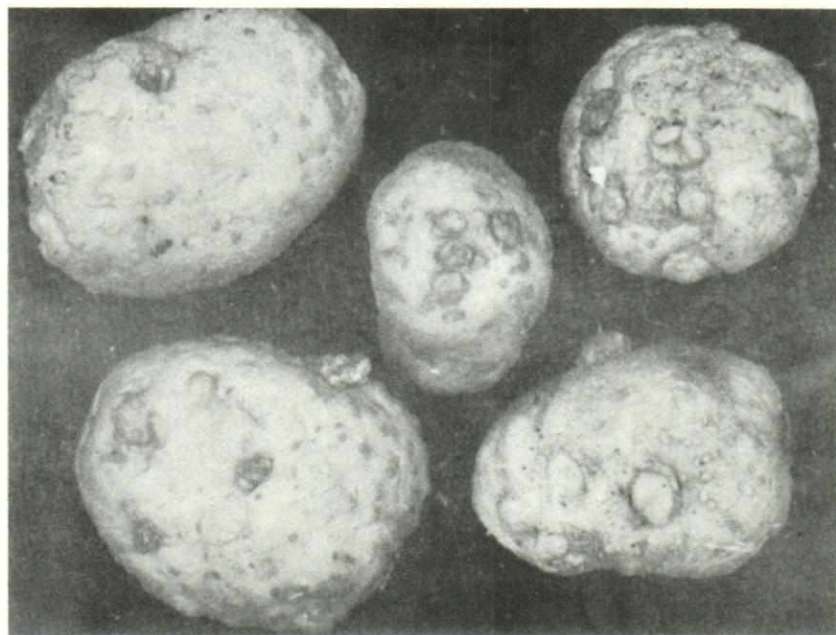


Fig. 3. Potato tubers severely infected with root-knot nematode.

showed poor growth, less foliage and few tubers. Potato tubers were also found infected at Tajora and Swani Ben-Adam. All over the surface of the tubers, galls of various size were present. The surface was ruptured, rough, crinkled (Fig. 3). Diseased tubers contained females, third-stage juveniles and eggmasses.

It could be implied, based on this information, that crops of tomatoes are suffering comparatively more than potatoes in this region. This situation is comparable to similar conditions in many parts of the world (9). Estimates of losses due to root-knot, in different parts of the world, recognise tomatoes as the most severely affected plants. Tomatoes are considered one of the chief hosts of all the major species of root-knot nematodes (9).

The perineal pattern studies indicated that *M. javanica* and *M. incognita* are the species of *Meloidogyne* distributed in the areas surveyed. *M. javanica* was present in all the localities surveyed whereas *M. incognita* was found only in El-Khoms, Ameriya, Airport Road and Zawia (Table 2).

The identity of the species recognised in the differential host test was identical to those determined by the perineal pattern method (Tables 2, 3). Race 1 and Race 2 of *M. incognita* were differentiated in this test. Race 1 was found in El-Khoms whereas Race 2 was found in Airport Road, Ameriya and Zawia.

Table 2. Identification of *Meloidogyne* species in different localities using the perineal pattern method.

Locality	<i>Meloidogyne</i> species
El-Khoms	<i>M. incognita</i> , <i>M. javanica</i>
Gharabuli	<i>M. javanica</i>
Tajora	<i>M. javanica</i>
Hadba Khadra	<i>M. javanica</i>
Airport Road	<i>M. incognita</i> , <i>M. javanica</i>
Swani Ben-Adam	<i>M. javanica</i>
Ameriya	<i>M. incognita</i> , <i>M. javanica</i>
Ainzara	<i>M. javanica</i>
Sidi Misri	<i>M. javanica</i>
Zawia	<i>M. incognita</i> , <i>M. javanica</i>

Table 3. Identification of the species and races of *Meloidogyne* using the differential host method.

Locality	Differential hosts						<i>Meloidogyne</i> species	Race
	Tobacco	Cotton	Pepper	Watermelon	Peanut	Tomato		
El-Khoms	—	—	+	+	—	+	<i>M. incognita</i>	1
	+	—	—	+	—	+	<i>M. javanica</i>	
Gharabuli	+	—	—	—	—	+	<i>M. javanica</i>	
Tajora	+	—	—	+	—	+	<i>M. javanica</i>	
Hadba Khadra	+	—	—	+	—	+	<i>M. javanica</i>	
Airport Road	+	—	+	+	—	+	<i>M. incognita</i>	2
	+	—	—	+	—	+	<i>M. javanica</i>	
Swani Ben-Adam	+	—	—	+	—	+	<i>M. javanica</i>	
Ameriya	+	—	+	+	—	+	<i>M. incognita</i>	2
	+	—	—	+	—	+	<i>M. javanica</i>	
Ainzara	+	—	—	+	—	+	<i>M. javanica</i>	
Sidi Misri	+	—	—	+	—	+	<i>M. javanica</i>	
Zawia	+	—	+	+	—	+	<i>M. incognita</i>	2
	+	—	—	+	—	+	<i>M. javanica</i>	

+ = Plants infected.

— = Plants without infection.

The observations that *M. javanica* was common in all the localities whereas *M. incognita* was present only in some provide an indication that the former species is predominant in this region of the Libyan Jamahiriya. Out of the seven species of *Meloidogyne* recorded in association with crops of agricultural importance in sub-tropical and Mediterranean regions, *M. javanica* and *M. incognita* are considered to be the most common and widespread species (8). The present findings support this contention. *M. javanica* and *M. incognita* are also the most frequently encountered species on world-wide basis (9).

M. hapla and *M. arenaria* listed to occur in the Libyan Jamahiriya on potato (2) were not found. *M. javanica* is enlisted on several plants in twelve localities in different parts of the country, whereas *M. incognita* was reported from three localities (2). The present study supports this pattern of distribution and recognises *M. javanica* as the most prevalent and predominant species of root-knot nematodes in this part of the Libyan Jamahiriya. This species also predominates in other countries with sub-tropical and Mediterranean climates such as Sudan, Cyprus, Greece and Egypt (8). *M. javanica* and *M. incognita* are known to be dominant species in Egypt (3) and *M. javanica* in Sudan (11) and Morocco (1).

M. incognita, found in certain localities in the present study is an important species with economic importance under sub-tropical and Mediterranean climates (8). It is the most dominant species in the tropics (9). Four races of *M. incognita* have been differentiated (9,10). Even though *M. incognita* was reported to exist in Libya a long time ago, its races have never been differentiated. This study establishes the occurrence of Race 1 and Race 2 in the Libyan Jamahiriya. The possibility of the existence of the other two races in the country cannot be excluded.

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مدى تأثير مرض تعقد الجذور على
الطماطم والبطاطس وتعريف النوع المسبب
في المنطقة الغربية من الجماهيرية
العربية الليبية الشعبية الاشتراكية

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المستخلص

لقد تم حصر نيماتودا تعقد الجذور *Meloidogyne* spp. على محصولي الطماطم والبطاطس في المنطقة الغربية من الجماهيرية وهي المناطق الواقعة بين الزاوية والخمس وذلك لمعرفة مدى شدة الإصابة على هذين المحصولين وتعريف النوع المسبب .

وقد تبين من الحصر ان محصول الطماطم يصاب بهذا المرض في جميع المناطق المحصورة وان شدة الإصابة عالية جدا خصوصا في منطقتي الهضبة الخضراء والسواني . واما محصول البطاطس فكانت الإصابة اقل حيث وجدت في اربع مناطق فقط وهي تاجوراء ، الزاوية ، سيدى المصرى والسواني .

بالإضافة الى ذلك فقد تم التعرف على نوعين للجنس *Meloidogyne* وهما *M. javanica* و *M. incognita* وان النوع الاول اكثر انتشارا من النوع الثانى حيث وجد في جميع المناطق المحصورة .

وقد تم أيضا ولأول مرة التعرف على سلالتين النوع *M. incognita* وهى السلالة (١) ووجدت في الخمس والسلالة (٢) ووجدت في طريق المطار الزاوية والعنبرية . ومن المعروف انه يوجد أربع سلالات لهذا النوع في العالم وان امكانية وجودها في الجماهيرية غير مستبعد .