The Libyan Journal of Agriculture: volume 9, 1980

# Some Preliminary Observations on Root-Knot Nematodes of Vegetable Crops in Tripoli Region of Libyan Jamahiriya

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## ABSTRACT

Preliminary observations were made during the survey of root-knot nematode problems on vegetable crops grown in the coastal belt from Al-Khoms to Janzoor. Many of the field plots, glasshouses and plastic tunnels of vegetables in the area were infested with root-knot nematodes. Vegetable crops of tomato, potato, cucumber, eggplant, pepper, broad-bean, bean, cauliflower, onion, and radish were infected to a varying extent. Severity of the disease was more in indoor cultivations. Infections on cucumber, tomato, pepper and eggplant were more widespread than potato, broad-bean, bean, cauliflower, onion and radish.

*Meloidogyne incognita* and *M. javanica* were identified as the species responsible for damage on these vegetable crops. *M. incognita* was found on cucumber, broad-bean, pepper, and tomato; while *M. javanica* on eggplant, bean, cauliflower, onion, potato, radish and broad-bean. These two species appear to be widely distributed on vegetables in the areas surveyed.

The occurrence of root-knot nematode on cucumber, cauliflower, onion and radish are new records for Jamahiriya.

## INTRODUCTION

Available information regarding root-knot nematodes in Libyan Jamahiriya is scanty and fragmentary. No survey for root-knot nematodes existing in association with the different crops has been done. Information available (up to 1968) indicates that 4 species of *Meloidogyne* exist in this country, viz. *M. incognita* (Kofoid and White, 1919) Chitwood, 1949; *M. javanica* (Trueb, 1885) Chitwood, 1949; *M. arenaria* (Neal, 1889) Chitwood, 1949; and *M. hapla* Chitwood, 1949. Kranz (2) reported the occurrence of *M. incognita* and *M. javanica* on certain vegetables in Cyrenaica region. Pucci (4,5) enlisted *M. incognita*, *M. javanica* and *M. hapla* on a number of hosts in the country. *M. incognita* was observed to infect potato, tomato and pepper; *M. javanica* to peach, apricot, pepper, beans, broad-beans, pea, potato and tomato and *M. hapla* to peanut and carrot. The root-knot nematodes from cucurbits, cabbage, eggplant, sugar-beet, cotton, tobacco, lettuce, water-melon, apple and pear were not identified up to specific levels. The list of "Plant Diseases Recorded in Libya" (1) included *M. arenaria* besides *M. incognita*, *M. hapla* and *M. javanica*. *M. incognita* was found on tomato, tobacco, pepper, peach and grape-vines. *M. javanica* was associated with potato, tomato, tobacco, sugar-beet, alfalfa, broad-bean, beans, pepper and peach. *M. hapla* was found on peanut, potato, tomato, tobacco, pepper, peas, bean, alfalfa and carrot. *M. arenaria* was observed on almond, peanut, potato, sugar-beet, tobacco and pepper.

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The identity of the species reported to exist on certain crops appear to be not well-ascertained and established, and needs reconfirmation.

This paper, based on the survey for root-knot problems of some vegetables, intends to provide preliminary information on the occurrence of root-knot nematode causing yield losses on a variety of vegetable crops in Jamahiriya, and to augment the research on these lines to check the ensuing danger.

## MATERIALS AND METHODS

Vegetables are grown in the coastal belt of Libyan Jamahiriya in glasshouses, plastic tunnels and outdoor field-plots. Most of the common vegetables that are grown in the country were included in the survey. These localities, where these vegetables were found grown in glasshouses, plastic tunnels and field plots, were surveyed. From each cultivation unit in the locality, samples of roots of the plants were collected at random. The cropping history or any chemical applied, wherever possible, was noted. Where crops exhibited a patchy appearance of decline or deterioration, samples were collected. Such areas provided a generally clear indication of nematode infestation.

Root samples were brought to the laboratory; thoroughly washed and examined for the presence of galls. Root-knot index was determined according to the following scale:

$$\underline{0} = 0, \underline{1} = 1 - 2, \underline{2} = 3 - 10, \underline{3} = 11 - 30, \underline{4} = 31 - 100$$

and $\underline{5}$ = greater than 100 galls per root system (7).

Mature females were dissected out and perineal pattern was prepared from each sample to identify the species. The identity of the species, was established on the characteristics of the perineal pattern of the females.

## RESULTS AND DISCUSSION

Certain observations on root-knot problems of vegetable crops, i.e. cucumber, egg-plant, tomato, potato, pepper, broad-bean, bean, cauliflower, onion and radish in the Libyan Jamahiriya (Tripoli region), are made below. The identity of the root-knot nematode species from each vegetable crop, root-knot index, distribution and damage potentiality are being given cropwise.

### 1. Cucumber (*Cucumis sativus* L.)

During the survey, most of the glasshouses and plastic tunnels were found to be infested. Some of the outdoor fields were also infested. The root-knot index in indoor cultivations varied from 4 to 5 and in outdoor cultivations 3 to 4.

Severely infected plants exhibited poor and stunted growth, chlorotic leaves and tendency to wilt under moisture stress. In some indoor cultivations infestation was in patches while in others it was uniform. In one plastic tunnel at Swani, roots were severely galled (Fig. 1) and most of the plants eventually died and dried; some had survived with galled roots but had been rendered useless. This led to complete crop failure. An almost similar situation was observed at Ainzara. In some of the glasshouses or plastic tunnels where soil had been treated with certain nematicides like Methyl bromide or Nemacur, plants showed only a little or no galling with economic production. Cucumber cultivation in successive years was observed to be responsible for high infestation levels in certain locations.

Table 1 Association of root-knot nematodes to certain vegetable crops in Tripoli regions in the Libyan Jamahiriya.

| Vegetable crops | Root-knot Index | Percentage of* infestation | Root-knot nematode species |
|---|---|---|---|
| Cucumber | | | |
| Indoor | 4–5 | 90 | *Meloidogyne incognita* |
| Outdoor | 3–4 | 25 | *M. incognita* |
| Eggplant | 4–5 | 75 | *M. javanica* |
| Tomato | 4–5 | 70 | *M. incognita* |
| Potato | 2–3 | 15 | *M. javanica* |
| Pepper | 4–5 | 100 | *M. incognita* |
| Broad-bean | 3–5 | 15 | *M. incognita* *M. javanica* |
| Beans | 4–5 | 10 | *M. javanica* |
| Cauliflower | 4–5 | 15 | *M. javanica* |
| Onion | 3–4 | 10 | *M. javanica* |
| Radish | 3–4 | 10 | *M. javanica* |

*Calculated on the basis of number of cultivated units (i.e. field-plots, glasshouses or plastic tunnels) surveyed.

The species responsible for the disease on cucumber was identified as *M. incognita* (Table 1). Although *M. incognita* is reported to infect certain other plants in this country, but apparently there is no published record of its occurrence on cucumber in Jamahiriya.

### 2. Eggplant (*Solanum melongena* L.)

The survey of eggplant fields revealed that almost 75% of the fields were moderately to heavily infested with root-knot nematode. The root-knot index ranged from 4 to 5. Roots from two-year-old crops in infested fields were invariably heavily galled. Plants showed stunted growth, unthriftiness and poor yield.

The causal species was identified from most of the localities as *Meloidogyne javanica* (Table 1). Kranz (2) observed the occurrence of *M. incognita* and *M. javanica* on eggplant in Cyrenaica region. Pucci (5) although enlisted root-knot disease on eggplant in the country but did not specify the species.

### 3. Tomato (*Lycopersicon esculentum* Mill.)

The survey of different cultivation units of tomato in the Tripoli region demonstrated that 70% of the field-plots, glasshouses and plastic tunnels were infested with root-knot nematodes. The fields or glasshouses that had been continuously cropped with tomato or other suitable vegetable host crops were heavily infested. Infected roots demonstrated massive galling. Root-knot index was from 4 to 5.

*M. incognita* was found to be mainly responsible for the disease in the area (Table 1), although possibility of *M. javanica*, another widely distributed species infecting tomato, is not excluded. *M. incognita* and *M. javanica* are on record as infecting tomato in Jamahiriya (1).

### 4. Potato (*Solanum tuberosum* L.)

In the present survey, only a few plots were found to be infested with root-knot nematode. Some of the infested plots did not show much suppressing effect of root-

Fig. 1. Severe galling on cucumber roots infected with *Meloidogyne incognita* from a plastic tunnel.

knot nematodes on potato. However, in others its effect was devastating e.g. in one field at Tajora, the infestation led to almost total crop failure. The reduction in the yield was estimated up to 85–90%. Roots exhibited poorly developed galls. Root-knot index was rated as 2 to 3 but eggmass index (7) was 5. The species was identified as *M. javanica* (Table 1).

*M. javanica*, *M. incognita*, *M. arenaria*, *M. hapla* are reported to infect potato in the country (1).

*Meloidogyne*, damage to potatoes is usually related to light soil because nematodes, as well as potato crops, prefer light soil. This factor is important in a Libyan context as the soil is mostly sandy or sandy loam in the areas of cultivation.

### 5. Pepper (*Capsicum annuum* L.)

In the survey almost 100% of the plots were infested with root-knot nematode. Infested plants showed heavy galling, mostly of small size. Root-knot index was 4 to 5. Plants appeared stunted with poor foliage and declining twigs. The species from most of the collection identified was found to be *M. incognita* (Table 1).

Kranz (2) and Pucci (5) enumerated *M. javanica*, *M. incognita* as causal organism of root-knot on pepper. This does not seem to be well ascertained. Pepper is known not to be infected by *M. javanica* (7). *M. incognita*, *M. arenaria*, *M. hapla* are usually encountered on pepper (7).

### 6. Broad-bean (*Vicia faba* L.)

Broad-bean was usually found to be free from root-knot nematodes. The crop in three field-plots was found to be badly affected by root-knot nematodes. In one field at Gharabuli, the crop was heavily damaged and most of the plants eventually died.

Fig. 2. Numerous galls on broad-bean roots caused by *Meloidogyne incognita*.

Surviving plants were too unhealthy to produce any pods (Fig. 2). Roots showed numerous coalescing galls. Root-knot rating was up to 5 on a majority of plants. The species from this field was identified as *M. incognita*. A similar situation was found at Swani. In another field, at Khalat-Farjan, plants showed moderate galling on roots and crop stand was poor. Root-knot index was 3. *M. javanica* was identified as the causal agent (Table 1). Broad-bean is reported to be infected by *M. javanica* in Jamahiriya (1).

### 7. Beans (*Phaseolus vulgaris* L.)

Only a few fields were observed to be infested with root-knot nematode. In a plot at the University of Al-Fateh, Agriculture Farm, the bean crop was severely damaged and excessive galling on the roots was observed. Root-knot index was 4 to 5 on most of the roots (Fig. 3). *M. javanica* was identified as the causal organism (Table 1). *M. javanica* (5) and *M. hapla* (1) are reported to infect beans in Jamahiriya. Occurrence of *M. hapla* on beans seems to be not well ascertained and needs reconfirmation.

Fig. 3. Cauliflower root with galls and reduced root system caused by *Meloidogyne javanica*.

**8. Cauliflower (*Brassica oleracea* var. *botrytis* L.)**

Cauliflower is one of the common cruciferous vegetables grown in field plots in the country. Although it is not considered a very good host for root-knot nematodes, it was found infested in few plots. In one field at Tajora, there was almost uniform infection of cauliflower plants. Young plants with severe infection became unthrifty, stunted and unproductive. Infected plants showed reduced root system with small conglomerated roots (Fig. 4). Root-knot index varied from 3 to 5. The species was identified as *M. javanica* (Table 1).

There is no published record of occurrence of root-knot on cauliflower in Jamahiriya, this is the first report.

**9. Onion (*Allium cepa* L.)**

In the present studies, onion plots were usually free from infestation. However, in one field at Tajora, roots showed slight to moderate galling. Root-knot index was 3 to

Fig. 4. Severely galled roots of bean infected with *Meloidogyne javanica.*

4. Galls were not very prominent but contained well developed females (Fig. 5). *M. javanica* was identified as the causal organism (Table 1). This is the first record of root-knot nematode on onion in Jamahiriya.

**10. Radish (*Raphanus sativus* L.)**

Most of the plots were free from infestation. At one location in Tajora, fusiform roots were found to be infected. Galls were present on main roots as well as on fine roots. The infected modified roots showed a cracked and distorted surface (Fig. 6). Root-knot index was rated as 3 to 4. The species was identified as *M. javanica* (Table 1).

It is clear from the foregoing that most of the vegetable crops were affected by root-knot nematodes to a varying extent in the areas surveyed. Cucumbers, eggplant, pepper, and tomatoes were suffering in a widespread area. The damage to other included vegetables was, to some extent, less.

*M. javanica* and *M. incognita* seem to be the predominant species on vegetables in Jamahiriya.

Thirteen species of root-knot nematodes are reported on vegetables of which *M. incognita, M. javanica, M. hapla, M. arenaria* are most widely distributed. Sasser (6) identified 97% of the species, from a population of 400 collected all over the world, belonging to only these four species. In the tropics *M. incognita* was found to be more dominant, accounting for 64%, while *M. javanica* accounted for 28%. The occurrence of *M. incognita* and *M. javanica* on a large number of vegetables in a relatively wide area is a matter of economic significance for Libya.

*M. incognita* is known to be a serious pathogen of many other industrial, ornamental and fruit crops (3). *M. javanica* is the second most widely distributed species in

Fig. 5. A young onion bulb with roots showing small developing galls due to *Meloidogyne incognita* infection.

Fig. 6. Galled and cracked surface of fusiform root of radish due to *Meloidogyne incognita*.

areas with subtropical and Mediterranean climates (3). General estimated loss of vegetables in different regions of the world due to root-knot nematodes varies from 11–25% (6). This loss in the tropics is estimated at 29% for tomato, 23% for eggplant, 22% for okra, 28% for beans, 15% for pepper and 26% for cabbage (6).

The climatic conditions in Jamahiriya, particularly in areas of cultivation, is of Mediterranean type. The soil is sandy or sandy loam and poor in organic matter. Rainfall is not very high. All these factors combined are important for the pathogenicity, disease development, severity, population build-up, and survival of the nematodes.

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# بعض الملاحظات الأولية على نيماتودا تعقد الجذور على محاصيل الخضر فى الجماهيرية

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## مستخلص

أثناء عملية حصر لمشكلة نيماتودا تعقد الجذور على محاصيل الخضر بمنطقة الشريط الساحلى والتى تمتد من الخمس الى جنزور وجد أن كثير من المساحات المزروعة بالخضر سواء فى الحقل أو تحت الأعطية مصابه بنيماتودا تعقد الجذور خصوصا الطماطم والبطاطس والخيار والباذنجان والفلفل والفول والفاصوليا وكرنب زهره والبصل والفجل وكانت الاصابه شديده على الطماطم والبطاطس والخيار والباذنجان وشدة الاصابة تحت الاغطية أكثر منها فى الحقل .

وقد لوحظ أن الاصابة على الخيار والطماطم والفلفل والباذنجان منتشرة جدا أكثر منها على البطاطس والفول والفاصوليا وكرنب زهرى والبصل والفجل فى المناطق التى تم حصرها .

وقد وجد أن M. incognita تصيب الخيار والفول والفلفل والطماطم وأما M. javanica تصيب الفاصوليا وكرنب زهره والبصل والبطاطس والفجل وهذين النوعين هما الأكثر انتشارا فى المناطق المحصورة .

مع ملاحظة أنه لأول مرة فى الجماهيرية يتم تعريف نيماتودا تعقد الجذور على الخيار وكرنب زهره والبصل والفجل .