

* Plant Protection Laboratory, Deir-Alla Regional Agri. S. C. Ministry of Agriculture, Jordan

** Agriculture University, Nematology Department, Wageningen, The Netherlands

A NEMATODE SURVEY OF VEGETABLE CROPS AND SOME ORCHARDS IN THE GHOR OF JORDAN

by

D. M. YOUSEF * and J.J. S' JACOB **

Summary. A survey of plant-parasitic nematodes of vegetable and fruit crops was undertaken in the Ghor area in Jordan. From the 74 samples of soil and roots, 67 plant-parasitic nematode species, belonging to 32 genera, were recovered and identified. *Meloidogyne javanica* (Treub) Chitw. and *M. incognita* (Kofoid et White) Chitw. were the most damaging of the nematodes to vegetable crops. Nine species of *Helicotylenchus* were identified, with *H. multincinctus* (Cobb) Golden widely distributed in the bananas production area. Six *Tylenchorhynchus* species were identified, *T. goffarti* Sturhan being the dominant species in most vegetable crops. *Tylenchulus semipenetrans* was found in moderate densities in most citrus groves. Ten *Pratylenchus* species were identified, the most common being *P. thornei* Sher et Allen, *P. scribneri* Steiner, *P. zeae* Graham, in the Ghor area and *P. neglectus* (Rench) Filipjev et Schuurmans Stekhoven in the uplands. *Xiphinema* and *Longidorus* species occurred in low densities on vegetable crops and fruit trees in the Ghor area.

The climate of the Jordan Valley is characterized by a rainy winter followed by a dry summer with high temperatures raising up to 43 °C. The soil contain high proportion of calcium carbonate with high pH ranges between 7.7-8.3. Organic matter content is low. In the Jordan Valley production of vegetable and fruit crops has been increased by using irrigation. The average rainfall is 250 mm annually (between October and March). The soil texture varies from silty clay in the north to silty loam soil in the south. A wide variety of fruit and vegetable crops are grown in the Ghor area of Jordan. As many of them showed symptoms of attack by plant-parasitic nematodes, a survey was undertaken to identify the species responsible. Emphasis was placed on the detection of economically important plant-parasitic nematodes genera attacking vegetable crops and fruit trees from the Jordan Valley. Some samples were collected from the upland. Some plant-parasitic genera have also been recorded in previous surveys carried out in Jordan (Abu-Gharbieh, 1982 a, b; Hashim, 1979 a, b).

Materials and methods

A total of 74 samples were collected from 38 fruit orchards, 34 vegetable farms and two wheat fields during 1985-1988.

Generally soil and root samples were taken from a depth of approximately 20 cm; from fruit trees around the feeder roots. Nematodes were extracted from a subsample

of 100 ml thoroughly mixed soil by Fleggs sieving technique (Flegg and Hooper, 1970). Vermiform endoparasitic nematodes were recovered from 10 g roots by the maceration method described by Stemerding (1963). Cyst-forming nematodes were extracted from air-dried soil by a flash method (Shepherd, 1970). For identification, specimens were killed by hot F A 4-1 method, fixed in 4% formalin and for mounting processed to dehydrated glycerin (Seinhorst, 1962, 1966).

Results and discussion

The results of the survey are presented in Table I. The plant-parasitic nematodes are listed according to the plants with which they were associated.

Root-knot nematodes *Meloidogyne* spp. are widely distributed on vegetable farms throughout the Jordan Valley. Two species have been found, namely: *M. javanica* (Treub) Chitw. and *M. incognita* (Kofoid et White) Chitw. causing severe gall formation on the roots of many crops. Seedlings are often attacked soon after germination. *M. javanica* is widespread in the Jordan Valley. Of the 34 vegetable crops sampled, 57% were infested with at least one of the *Meloidogyne* species. Cucumber and eggplant appeared to be more susceptible than tomato to the two *Meloidogyne* species.

Ditylenchus dipsaci (Kuen) Filipjev was isolated from onions in the central part of the Jordan Valley. It has also

TABLE *Plant-parasitic nematodes and associated plants in the Jordan Valley.*

Nematodes species	Plants
Family: Tylenchidae <i>Basiria kashmirensis</i> Jairajpuri <i>Boleodorus</i> sp. <i>Coslenchus</i> sp.	<i>Citrus</i> sp. <i>Citrus</i> sp. <i>Musa</i> (AAA Group) dwarf cavendish <i>Annona cberimola</i> Mill.
<i>Ditylenchus dipsaci</i> (Kuehn) Filipjev <i>Filenchus</i> sp. (Andrassy) Meyl	<i>Allium cepa</i> L. <i>Olea europaea</i> L. <i>Malus sylvestris</i> Mill* <i>M. sylvestris</i> * <i>Solanum melongena</i> L.
<i>Malenchus</i> sp.	<i>A. cepa</i> <i>Cucurbita pepo</i> L. <i>Phaseolus vulgaris</i> L.
<i>Psilenchus</i> sp.	<i>Citrus</i> sp. <i>Lycopersicon esculentum</i> Mill. <i>S. melongena</i> <i>A. cepa</i>
<i>Tylenchus</i> sp.	<i>Capsicum frutescens</i> L. <i>Citrus</i> sp. <i>O. europaea</i> <i>A. cepa</i>
Family: Telotylenchidae <i>Amplimerlinius</i> sp. <i>Merlinius brevidens</i> (Allen) Siddiqi	<i>Brassica oleracea</i> L.* <i>Citrus</i> sp. <i>O. europaea</i>
<i>M. microdorus</i> (Geraert) Siddiqi	<i>C. pepo</i> <i>P. vulgaris</i> <i>Triticum aestivum</i> L. <i>S. melongena</i>
<i>Paratrophurus</i> sp.	<i>C. pepo</i>
<i>Scutylenchus</i> sp.	<i>Citrus</i> sp.
<i>Tylenchorhynchus clarus</i> Allen <i>T. delbiensis</i> Chawla, Bhamburkar, Khan <i>et</i> Prasad <i>T. goffarti</i> Sturhan	<i>Prunus persica</i> (L.) Batsch. <i>L. esculentum</i> <i>Citrus</i> sp. <i>Musa</i> (AAA Group) dwarf cavendish
<i>T. latus</i> Allen	<i>L. esculentum</i> <i>S. melongena</i> <i>C. pepo</i> <i>A. cepa</i>
<i>T. parvus</i> Allen	<i>P. vulgaris</i> <i>P. persica</i> <i>L. esculentum</i> <i>S. melongena</i>
<i>T. ventrosignatus</i> Tobar-Jimenez	<i>O. europaea</i> <i>C. pepo</i> <i>P. vulgaris</i> <i>Vicia faba</i> L.
Family: Hoplolaimidae <i>Helicotylenchus abunaamai</i> Siddiqi	<i>Citrus</i> sp. <i>Psidium guajava</i> L. <i>Citrus</i> sp.

	<i>Vitis vinifera</i> L.
	<i>O. europaea</i> *
	<i>Citrus</i> sp.
	<i>P. guajava</i>
<i>H. minzi</i> Sher	<i>O. europaea</i>
<i>H. multictinctus</i> (Cobb) Golden	<i>Musa</i> (AAA Group) dwarf cavendish
	<i>L. esculentum</i>
<i>H. pseudorobustus</i> (Steiner) Golden	<i>V. vinifera</i> *
	<i>Citrus</i> sp.
<i>H. pteracercus</i> Singh	<i>V. vinifera</i>
<i>H. truncatus</i> Roman	<i>O. europaea</i> *
<i>Hoplolaimus columbus</i> Sher	<i>Citrus</i> sp.
	<i>Musa</i> (AAA Group) dwarf cavendish
<i>H. seinborsti</i> Luc	<i>L. esculentum</i>
<i>Rotylenchulus macrosomus</i> Dasqupta, Raski <i>et</i> Sher	<i>O. europaea</i>
<i>R. parvus</i> (William) Sher	<i>Citrus</i> sp.
	<i>Phoenix dactylifera</i> L.
<i>R. variabilis</i> Dasqupta, Raski <i>et</i> Sher	<i>P. dactylifera</i>
	<i>Citrus</i> sp.
<i>Rotylenchus calvus</i> Sher. (presumably)	<i>C. frutescens</i>
Family: Pratylenchidae	
<i>Pratylenchus crenatus</i> Loof	<i>C. pepo</i>
<i>P. delattrei</i> Luc	<i>P. vulgaris</i>
	<i>Citrus</i> sp.
	<i>O. europaea</i>
<i>P. mediterraneus</i> Corbett	<i>L. esculentum</i>
	<i>Citrus</i> sp.
	<i>L. esculentum</i>
<i>P. neglectus</i> (Rench) Filipjev <i>et</i> Schuurmans Stekhoven	<i>C. frutescens</i>
<i>P. penetrans</i> (Cobb) Filipjev <i>et</i> Schuurmans Stekhoven	<i>V. faba</i>
	<i>B. oleracea</i> *
<i>P. scribneri</i> Steiner	<i>S. melongena</i>
	<i>C. pepo</i>
<i>P. sefaensis</i> Fortuner	<i>S. tuberosum</i> L.
	<i>Citrus</i> sp.
<i>P. sudanensis</i> Loof <i>et</i> Yassin	<i>S. melongena</i>
<i>P. thornei</i> Sher <i>et</i> Allen	<i>P. vulgaris</i>
	<i>O. europaea</i>
<i>P. zaeae</i> Graham	<i>L. esculentum</i>
	<i>Citrus</i> sp.
<i>Zygotylenchus</i> sp. Siddiqi	<i>Musa</i> (AAA Group) dwarf cavendish
Family: Heteroderidae	<i>M. sylvestris</i> *
<i>Bidera latipons</i> (Franklin) Krall <i>et</i> Krall	<i>S. melongena</i>
<i>Heterodera goettingiana</i> Liebscher	<i>P. persica</i>
<i>Meloidogyne incognita</i> (Kofoid <i>et</i> White) Chitw.	<i>C. frutescens</i>
<i>M. javanica</i> (Treub) Chitw.	<i>L. esculentum</i>
	<i>T. aestivum</i>
	<i>P. vulgaris</i>
	<i>C. pepo</i>
	<i>Musa</i> (AAA Group) dwarf cavendish
	<i>P. guajava</i> ,
	<i>C. pepo</i>

	<i>P. vulgaris</i>
	<i>P. persica</i>
	<i>S. melongena</i>
	<i>Cucumis sativus</i> L.
	<i>L. esculentum</i>
Family: Tylenchulidae	
<i>Tylenchulus semipenetrans</i> Cobb	<i>Citrus</i> sp.
Family: Paratylenchidae	
<i>Gracilacus micoletzky</i> (Edward, Misra <i>et</i> Singh) Raski	<i>Citrus</i> sp.
<i>Gracilacus</i> sp.	<i>Musa</i> (AAA Group) dwarf cavendish
<i>Paratylenchoides sheri</i> Raski	<i>P. dactylifera</i>
<i>Paratylenchus variabilis</i> Raski	<i>Musa</i> (AAA Group) dwarf cavendish
Hemicycliophoridae	
<i>Hemicycliophora typica</i> De Man	<i>V. vinifera</i>
	<i>Citrus</i> sp.
Family: Criconematidae	
<i>Criconema mutabile</i> (Taylor) Raski <i>et</i> Luc	<i>Musa</i> (AAA Group) dwarf cavendish
<i>Hemicriconemoides intermedius</i>	<i>Musa</i> (AAA Group) dwarf cavendish
<i>H. cocophillus</i> (Loos) Chitw. <i>et</i> Birchfield	<i>Musa</i> (AAA Group) dwarf cavendish
	<i>Citrus</i> sp.
	<i>A. cherimola</i>
Family: Aphelenchoididae	
<i>Aphelenchoides subtenuis</i> Cobb	<i>Citrus</i> sp.
<i>Aphelenchoides</i> sp.	<i>Citrus</i> sp.
Aphelenchidae	
<i>Aphelenchus avenae</i> Bastian	<i>T. eastivum</i>
	<i>L. esculentum</i>
<i>Aphelenchus</i> sp. Bastian	<i>A. cepa</i>
Trichodoridae	
<i>Paratrichodorus minor</i> (Colbran) Siddiqi	<i>V. vinifera</i>
Longidoridae	
<i>Longidorus africanus</i> Merny	<i>Musa</i> (AAA Group) dwarf cavendish
	<i>S. melongena</i>
<i>L. siddiqi</i> Aboul-Eid	<i>S. melongena</i>
<i>L. leavicapitatus</i> Williams	<i>Musa</i> (AAA Group) dwarf cavendish
<i>L. vineacola</i> Sturhan <i>et</i> Weischer	<i>L. esculentum</i>
	<i>S. melongena</i>
<i>Xiphinema diversicaudatum</i>	<i>Citrus</i> sp.
(Micoletzky) Thorne	<i>P. persica</i>
<i>X. ingens</i> Luc <i>et</i> Dalmasso	<i>T. aestivum</i>
<i>X. pachtaicum</i> (Tulaganov) Kirjanova	<i>O. europaea</i> *
<i>X. simillimum</i> Loof <i>et</i> Yassin	<i>Citrus reticulata</i> L.
	<i>V. vinifera</i> *

* From Uplands.

been recorded from faba bean by Hashim (1979b). *Tylenchorhynchus goffarti* Sturhan is widespread in the Jordan Valley, mainly occurring on tomato, cucumber and squash; population densities may reach 1140/100 ml soil. Many other nematodes were found in association with vegetables (Table I), but their impact on the growth of crops is not known.

Banana plantations in Jordan Valley are often infested with *M. javanica* and *M. incognita*. The spiral nematode *Helicotylenchus multincinctus* (Cobb) Golden, a parasite of roots and suckers (rhizomes) is widespread throughout the Ghor area; populations may reach 3500/100 g soil or ca. 2000/10 g roots. This might suggest that *H. multincinctus* is adversely affected by the climatic conditions prevailing during the long dry season. Other nematodes found on bananas in the Jordan Valley include *Criconema mutabile* (Taylor) Raski et Luc, *Paratylenchus variabilis* Raski and *Hemicriconemoides cocophyllus* (Loos) Chitw. et Birchfield. In the southern Ghor a *Gracilacus* sp. was found; these nematodes were relatively scarce and are not likely to be of pathogenic importance.

Tylenchulus semipenetrans Cobb, was found in moderate densities in most citrus groves in Jordan Valley, the highest population density on the roots being 28,000/10 g, and in soil ca. 27,000 juveniles and males / 100 ml. The population level considered to be critical for citrus is 40,000 juveniles and males / 100 g roots (Cohn, 1972). This nematode is spread through infested root-stocks or other planting material, and therefore the production of nematode-free nursery stock for growers is of vital importance to minimize its spread. *Xiphinema smillimum* Loof et Yassin was found on *Citrus reticulata* L. in the Jordan Valley and on *Vitis vinifera* L. in the upland, but it appears to be of limited distribution and in low densities, ca 120/100 ml soil. Other nematodes associated with citrus were *Merlinius brevidens* (Allen) Siddiqi, *Tylenchorhynchus clarus* Allen, *Hoplolaimus columbus* Sher, *Pratylenchus delattrei* Luc, *P. mediterraneus* Corbett, *P. scribneri* Steiner, *Xiphinema diversicaudatum* (Micoletzky) Thorne and *Paratricodorus minor* (Colbran) Siddiqi.

The Mediterranean cyst nematode *Biddera latipons* (Franklin) Krall et Krall, occurred in two wheat field at low densities.

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