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PLANT PARASITIC NEMATODES OF LEGUMES IN TURKEY

by

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Summary. Surveys undertaken in Turkey, during spring 1991 and summer 1992, revealed that root-lesion nematodes were the most common of the several plant parasitic nematodes associated with chickpea and lentil. *Pratylenchus thornei*, *P. penetrans* and *P. mediterraneus* occurred throughout the country and were suspected to reduce crop yields. *P. alleni* and *P. zaeae* were also present in a few fields. Among other root-lesion nematodes, *Pratylenchoides leiocauda* was widespread, while *P. alkani* and *P. erzurumensis*, and *Zygotylenchus guevarai* were present in a few samples only. *Heterodera ciceri* was detected in twelve fields of chickpea and two of lentil, although severe damage was observed only on chickpea. *Meloidogyne artiellia* was observed in one field only. *Ditylenchus dipsaci* was found in two samples of lentil. Other nematodes found in the soil were species of *Helicotylenchus*, *Tylenchorhynchus*, *Paratylenchus*, *Tylenchus*, *Longidorus*, *Trophurus*, *Trichodorus*, *Criconeimoides*, *Heterodera*, *Meloidogyne* and *Xiphinema index*, *X. pachtaicum* and *X. italiae*.

Nematodes cause severe damage to legumes in several Mediterranean countries (Greco, 1985; Greco and Di Vito, 1988; Sikora and Greco, 1990; Greco *et al.*, 1992; Di Vito *et al.*, 1994). For example, the pea cyst nematode, *Heterodera goettingiana* Liebscher, causes severe damage to pea (*Pisum sativum* L.) and faba bean (*Vicia faba* L.) (Di Vito and Greco, 1986). Surveys of nematodes in chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medik.) fields in Syria and North Africa (Algeria, Morocco and Tunisia) revealed that the most common nematodes were *Pratylenchus thornei* Sher *et* Allen, *P. penetrans* (Cobb) Filipjev *et* Shuurmans Stekhoven and *P. mediterraneus* Corbett (Greco *et al.*, 1984; 1992; Di Vito *et al.*, 1994). *Meloidogyne artiellia* Franklin, although observed in few fields, was present in all the countries surveyed, while *Heterodera ciceri* Vovlas, Greco *et* Di Vito was found only in Syria. All these nematodes are damaging to their host plants (Di Vito and Greco, 1988; Greco *et al.*, 1988).

Little is known about nematodes of legumes in Turkey, a country which ranks second in chickpea production and first in lentil production in the world. Therefore, surveys were conducted in Turkey during 1991 and 1992 to ascertain the nematodes associated with legume crops. The results of these surveys are reported in this paper.

Materials and methods

Two surveys, each of two weeks duration, were undertaken in the major chickpea and lentil growing areas of Turkey during May 1991 in the South and along the Medi-

terranean coast (locations 1-33, Fig. 1) and during July 1992 in the Anatolian Plateau (locations 34-56, Fig. 1) when these legumes were in an early podding stage. Soil (2 kg) and root (4-5) samples were collected from the rhizosphere of plants in each field sampled. Crops showing yellowing and stunting were preferentially sampled; otherwise, sampling was done at regular distances along the entire route taken for the survey.

Nematodes were extracted from 500 cm³ soil using the Cobb's wet sieving and Baermann's funnel method, fixed in 5% hot formalin and counted. Roots were incubated in jars (Young, 1954) to extract endoparasitic migratory nematodes, which were then preserved in 5% hot formalin. Endoparasitic sedentary and remaining migratory nematodes were extracted later using Coolen's method (1979). They were counted and about 20 specimens per sample and species were mounted in glycerine (Seinhorst, 1959). Perineal patterns of females of *Meloidogyne* spp. and cones of cysts of *Heterodera* spp. were also prepared. Measurements were also taken for root-lesion and cyst nematodes. Permanent slides were then examined microscopically for species identification. The key given by Handoo and Golden (1989) was used to identify *Pratylenchus* spp., and that of Sher (1970), along with the description of Yüksel (1977), for *Pratylenchoides* spp.

Results

A total of 151 soil and root samples were collected: 136 (90%) from chickpea, 11 (7%) from lentil and 4 (3%)

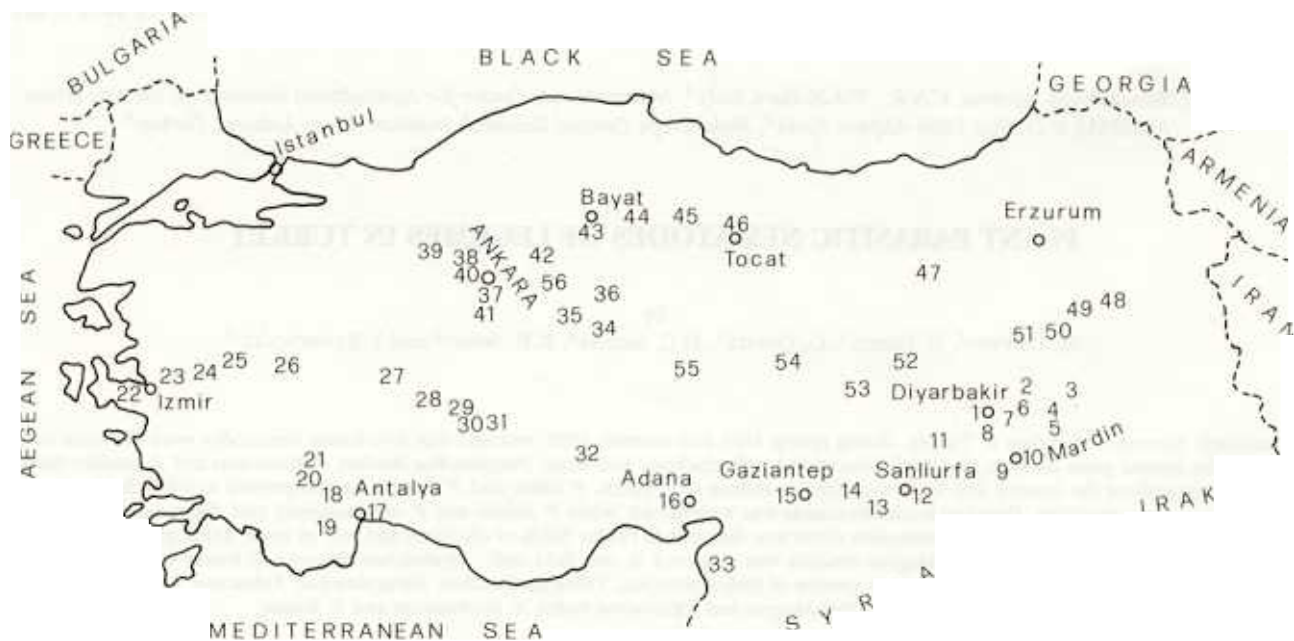


Fig. 1 - Map of Turkey showing location numbers, as in Table I, where chickpea, lentil and vetch were sampled for nematode infestation in 1991 and 1992.

from vetch (*Vicia sativa* L.) fields (Table I; Figs 1; 2; 3); the last named crop shares nematode species with the other two crops.

Cyst nematodes: *Heterodera ciceri* was the only cyst nematode found in Turkey. It occurred in 12 chickpea and 2 lentil samples collected at Kurtalan, Bismil, Pirinçlik, Kızıltepe, Siverek, Kirbasi, Suruc, Izmir, Gudul, Esagigab, Elazig and Kaiseri (Table I; Fig. 3). Morphometrics of second stage juveniles of the nematode population collected at Kurtalan, Bissell, Pirinçlik, Siverek, Kirbasi, Suruc, Izmir, Gudul, Esagigab, Elazig and Kaiseri were similar to those of the original description given by Vovlas *et al.* (1985), while the population from Kızıltepe has a shorter stylet. Heavily infested plants showed poor growth and extensive yellowing.

Root-knot nematodes: only *M. artiellia* was detected and was found in roots of chickpea in one sample collected at Usak (Table I; Fig. 3). Infested plants were yellowish and stunted.

Root-lesion nematodes: a total of 150 root samples of chickpea, lentil and vetch were infested with these nematodes. Attack was often severe with roots becoming completely necrotic and black and aerial plant parts showing poor growth and yellowing. One hundred and four samples were infested with a single species of root-lesion nematode and 38 samples were infested with two or more species (Table I; Figs 2; 3). The most common species

were *Pratylenchus thornei* (61%), *P. penetrans* (23%) and *Pratylenchoides leiocauda* Sher (18%) (Table I; Figs 2; 3). *Pratylenchus mediterraneus* (7%), *P. alleni* Ferris (3%), *P. brachyurus* (Godfrey) Filipjev *et* Shuurmans Stekhoven and *P. zeae* Graham (2%) (Table I; Fig. 2), and *Pratylenchoides alkani* Yüksel (1%), *P. erzurumensis* Yüksel (1%), and *Zygotylenchus guevarai* (Tobar Jimenez) Brawn *et* Loof (3%) were less common (Table I; Figs. 2; 3). Nematodes were often numerous in the roots; 136,000 *P. penetrans*/5 g root were present in chickpea samples collected at Kaman and as many as 14,000 of *P. penetrans*, *P. thornei* or *P. mediterraneus*/5 g root in samples of chickpea collected at Kaman, Gudul, Malazgirt, Elazig and Kirikkale. Morphometrics of these nematodes were within the range reported by Handoo and Golden (1989).

Stem and bulb nematode: *Ditylenchus dipsaci* (Khuen) Filipjev was extracted from lentil at Pirinçlik and Bospinar. Symptoms of nematode attack (leaf and stem necrosis and stem and pod distortion) were not obvious in either field.

Other nematodes: analysis of soil samples revealed the presence of several other plant parasitic nematodes. Species of *Tylenchorhynchus* (55%), *Helicotylenchus* (68%), *Paratylenchus* (13%), *Trophurus* (4%), *Criconeimoides* (2%), *Tylenchus* (74%), *Zygotylenchus guevarai* 2%, *Ditylenchus dipsaci* 6%, *Xiphinema* [*X. index* Thorne *et* Allen 2%, *X. pachtaicum* (Tulaganov) Kirjanova 5% and *X. italicum* Mehl 2%], *Longidorus* (1%), *Trichodorus* (1%), *Meloido-*

TABLE I - *Nematodes in the root samples of chickpea, lentil and vetch collected in Turkey during spring 1991 and summer 1992.*

Location		Crop	N° samples collected	Samples infested with (1)											
N°	Name			Pa	Pb	Pm	Pp	Pt	Pz	Pra	Pre	Prl	Zg	H	Ma
1	Diyarbakir	Chickpea	5				4	4				1			
	"	Lentil	1				1	1							
2	Silvan	Chickpea	2			2	2					1			
3	Kurtalan	"	1			1	1					1			
	"	Lentil	2									1		1	
4	Besiri	"	1				1								
5	Batman	"	1				1								
	"	Chikpea	1				1								
6	Bismil	Lentil	1											1	
	"	Chickpea	1				1								
7	Közeli	"	1				1								
	Karabahce	"	3				3								
	Pirinclik	"	1			1	1							1	
8	Cinar	"	5			5									
9	Kiziltepe	"	1							1		1		1	
10	Mardin	"	1					1							
	"	Lentil	1					1							
	Karikly	Chickpea	1					1							
	Bespinar	Lentil	1					1							
	Asagi-Konak	"	1					1							
	"	Chickpea	1					1							
	Karakadaj	"	1					1				1			
11	Siverek	"	1									1		1	
	Kirbasi	"	1					1				1		1	
12	Sanliurfa	"	1				1					1			
13	Suruc	"	1				1							1	
14	Birecik	"	1				1								
15	Gaziantep	"	1				1						1		
	Nurdagi	"	1			1									
16	Adana	"	2					2							
17	Antalya	"	1					1							
18	Korkuteli	"	3					3				1			
19	Elmali	"	4					4				2			
	Beyler	"	1					1							
20	Tefenni	"	2					2				1			
21	Yesilova	"	1					1				1			
22	Izmir	"	2					2						1	
23	Kemalpasa	"	3					3							
24	Selihli	"	1					1							
25	Kula	"	1					1							
	Yurtarbasi	"	1					1				1			
26	Usak	"	1					1							1
	"	Vetch	1	1											
27	Cay	Chickpea	1	1								1			
28	Aksehir	"	1									1			
29	Ilgın	"	1	1											
30	Kadinhani	"	2	1								1	2		
31	Sarayonu	"	1									1	1		

Location		Crop	N° samples collected	Samples infested with (1)											
N°	Name			Pa	Pb	Pm	Pp	Pt	Pz	Pra	Pre	Prl	Zg	H	Ma
	Dortler	"	2					2							
33	Irikhan	"	2					2				1			
34	Kirshir	"	3						3						
35	Kaman	"	6		1		6								
36	Cicekdagi	"	3				1	3							
37	Ankara	"	3					3							
38	Gudul	"	8					7				1		2	
39	Bey pazazi	"	4					4							
40	Yenikent	"	2					2							
41	Haymana	"	2				2								
	"	Lentil	1				1								
42	Kalecik	Chickpea	2					2							
	"	Vetch	1									1			
43	Bayat	"	1					1							
	"	Chickpea	2					2							
44	Corum	"	3					3							
45	Amashia	"	1					1							
46	Tocat	"	1					1							
	Yarkisar	Vetch	1					1		1					
47	Erzincan	Chickpea	1					1							
48	Malazgirt	"	2				2								
49	Bulanik	"	3				3								
	Herentebe	"	1					1							
	Hastoy	"	2					2							
50	Mus	"	1					1				1			
51	Solhan	"	1					1							
	Kancilar	"	1									1			
	Kaybagi	"	2					2							
	Esagigab	"	1			1								1	
52	Elazig	"	3					3						2	
53	Malatya	"	2					2				1			
	Kozluca	"	1					1				1			
54	Gurum	Lentil	1												
55	Kaiseri	Chickpea	3					3				1		1	
	Kolis	"	1					1							
	Kalizegic	"	1					1							
56	Alpinar	"	2					1				1			
	Kirikkale	"	2					2							
Total			151	4	1	11	35	93	3	1	1	28	4	14	1
Percentage				3	1	7	23	61	2	1	1	18	3	9	1

(1) Pa = *Pratylenchus allenii*; Pb = *Pratylenchus brachyurus*; Pm = *Pratylenchus mediterraneus*; Pp = *Pratylenchus penetrans*; Pt = *Pratylenchus thornei*; Pz = *Pratylenchus zeae*; Pra = *Pratylenchoides alkani*; Pre = *Pratylenchoides erzurumensis*; Prl = *Pratylenchoides leiocauda*; Zg = *Zygotylenchus guevarai*; H = *Heterodera ciceri*; Ma = *Meloidogyne artiellia*.

gyne (second stage juveniles) (6%) and *Heterodera* (second stage juveniles) (5%) were encountered in 151 samples collected. No plant damage was observed associated with these nematodes.

Discussion

The two surveys cannot be considered exhaustive; however, they demonstrate that several nematodes are commonly associated with chickpea and lentil in Turkey. Many of them are known to be highly damaging to these pulses. Root-lesion nematodes were present in all sampled fields and could cause considerable yield losses. The large number of *P. thornei*, *P. penetrans* and *P. mediterraneus* specimens extracted from roots of chickpea and their association with extensive root necrosis, suggest that they are highly pathogenic to this food legume in Turkey. Di Vito *et al.* (1992) demonstrated that up to 50% of chickpea yield can be lost in fields infested with *P. thornei* in Syria. However, the extent of damage caused by root-lesion nematodes at farm level is less than that caused by cyst and root-knot nematodes. Nevertheless, root-lesion nematodes are widely distributed and, therefore, must be considered of economic importance at the country level. The

effect of other root-lesion nematodes on the yield of sampled crops is, however, not known.

Although different species of root-lesion nematodes were present in different parts of the country, *P. mediterraneus* was dominant in south-eastern Turkey (Silvan, Kurtalan, Pirinçlik and Cinar) in an area bordering North-east Syria, where this was the only root-lesion nematode attacking chickpea and lentil. *Pratylenchus thornei* was found throughout Turkey but was dominant in the Anatolian Plateau and was the only *Pratylenchus* species occurring on the Mediterranean coast.

The chickpea cyst nematode (*H. ciceri*) is very damaging to chickpea, pea, grasspea (*Lathyrus sativus* L.) and lentil. Severe yield losses in chickpea and lentil can be expected when population densities of the nematode exceeds 1 egg/g soil in chickpea fields and 2.1 eggs/g soil in lentil fields (Greco *et al.*, 1988). *H. ciceri* was found in different areas of Turkey (Fig. 3). It was most frequent in south-east, but was present also in the Anatolian Plateau (Gudul and Kaiseri) and the Mediterranean coast (Izmir). *H. ciceri* is common in the provinces of Aleppo and Idleb in northern Syria (Greco *et al.*, 1992). Despite extensive cultivation of chickpea and lentil, both hosts of the nematode, in the provinces of Dara'a and Sweda in southern Syria, the cyst nematode was not found there. Most prob-

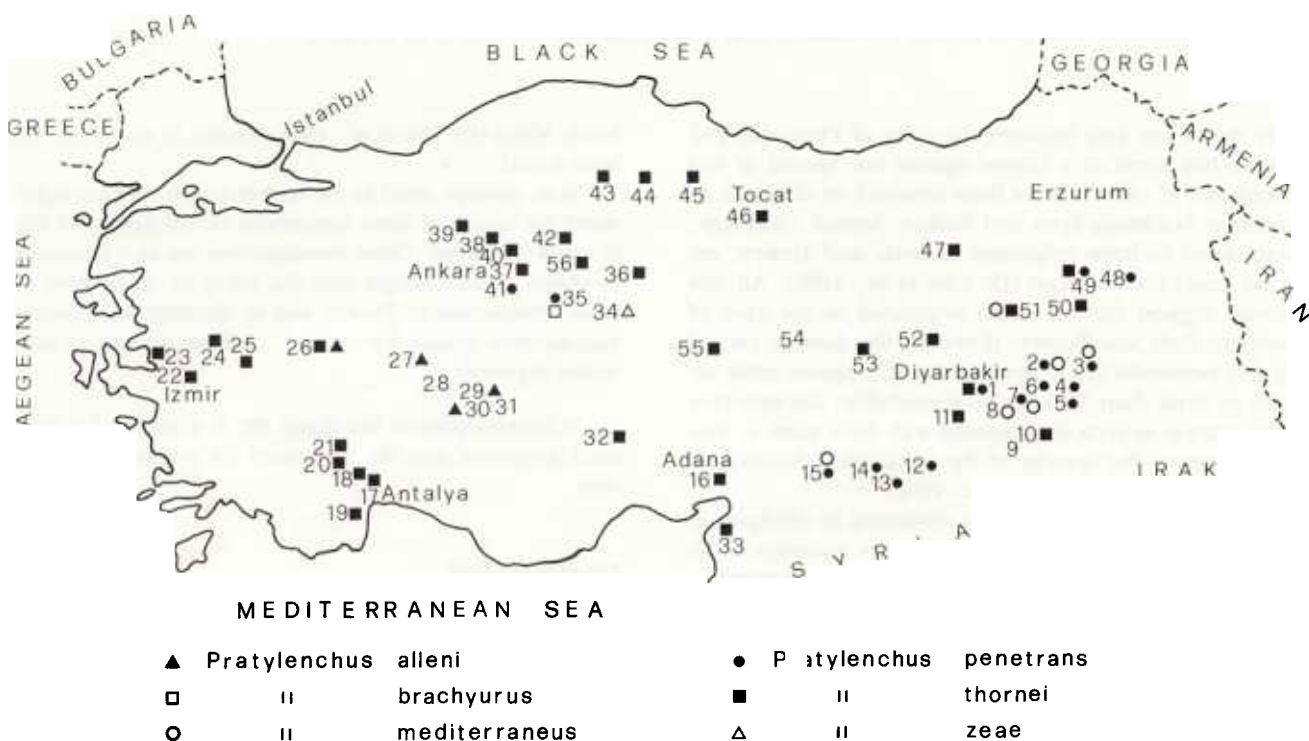


Fig. 2 - Distribution *Pratylenchus* species found in roots of chickpea, lentil and vetch crops in Turkey

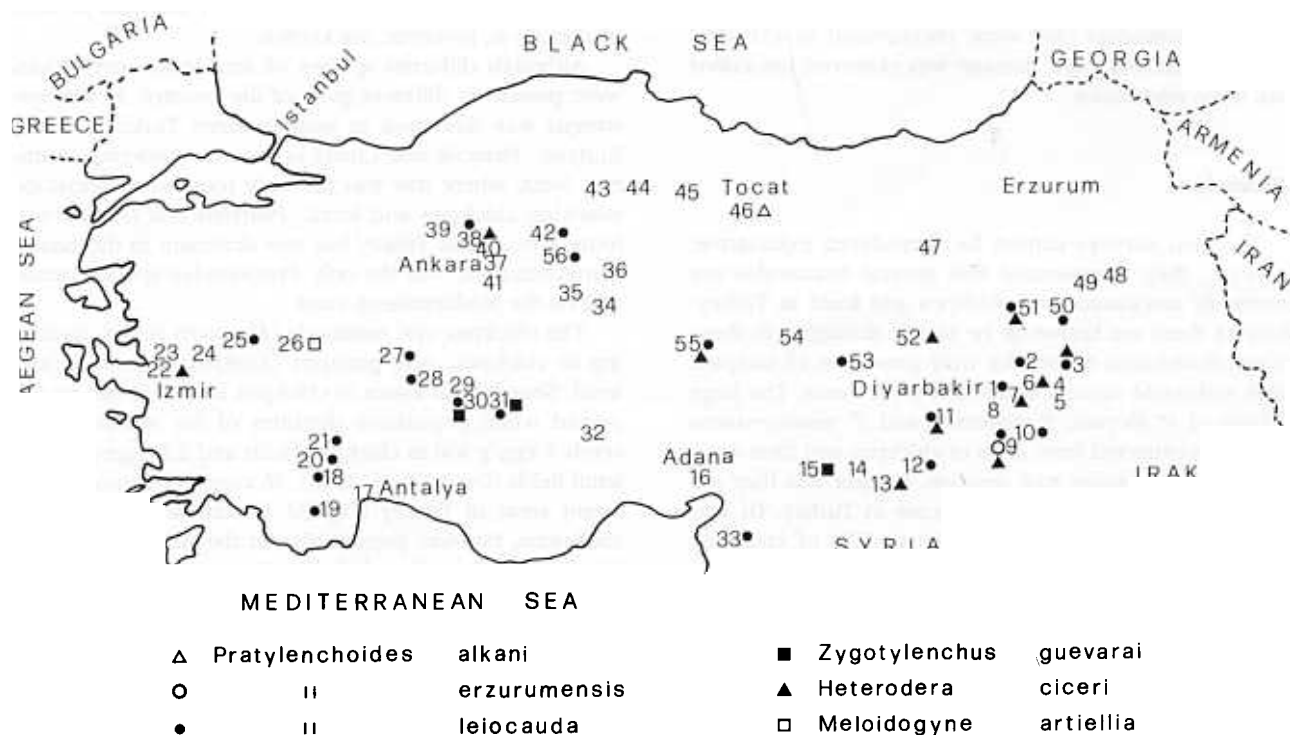


Fig. 3 - Distribution of some plant parasitic nematodes in roots of chickpea, lentil and vetch crops in Turkey.

ably the desert area between the cities of Damascus and Nabak has acted as a barrier against the spread of this nematode. *H. ciceri* has not been reported on chickpea, in countries bordering Syria and Turkey. Several *Cicer* spp., considered to have originated in Syria and Turkey, are good hosts for *H. ciceri* (Di Vito *et al.*, 1988). All this would suggest that *H. ciceri* originated in the area of northern Syria and Turkey. However, the damage caused by this nematode in chickpea and lentil appears more severe in Syria than Turkey. Most probably, the two-year crop rotation in Syria as compared with three years in Turkey, increases the severity of the nematode infestation in the former country (Saxena *et al.*, 1992).

Meloidogyne artiellia is very damaging to chickpea in northern Syria and occurs in several other countries in the Mediterranean basin (Sikora and Greco, 1990). Surprisingly, it was detected in only one root sample of chickpea at Usak, despite the fact that in Turkey chickpea is grown in rotation with cereals, which are good hosts for the nematode.

Heterodera ciceri, *P. thornei* and *P. mediterraneus* are widely distributed in both Syria and Turkey. The two *Pratylenchus* species and *P. penetrans* were also common in

North Africa (Di Vito *et al.*, 1994) where, *H. ciceri* has not been found.

More surveys need to be undertaken to better understand the impact of these nematodes on chickpea and lentil crops in Turkey. Other investigations are also necessary to obtain greater insight into the effect of nematodes on pulse production in Turkey and to develop an effective management system for controlling those species of economic importance.

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