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Effects of Some Indigenous Plant Extracts on Mortality of the Root Lesion Nematode, *Pratylenchus thornei* Sher & Allen

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ABSTRACT

The genus of root lesion nematodes (RLN), *Pratylenchus*, feeds and reproduces in the root cortex of many plant species. RLN was reproduced on carrot culture by using a pure culture. *In vitro* tests were carried out to determine the effects of plant extracts from three indigenous plants: henbane, *Hyoscyamus niger*; bead-tree, *Melia azedarah* and common cocklebur, *Xanthium strumarium* on *P. thornei* (the major wheat root-lesion nematode). The nematodes were exposed for 12, 24, 48, 72 and 96 hrs in three concentrations of plant extracts. The effect of plant extracts was performed using the suspensions of *P. thornei* (100 nematodes ml⁻¹) in distilled water. Distilled water was used as a control. All dishes were kept at 28±2°C. The plant extracts of *H. niger*, *M. azedarah* and *X. strumarium* exhibited highly promising mortality rate (100%) after 72 hours of exposure time. The result of this study suggests the studied plant extracts to be used for reducing the *P. thornei* population.

Key words: Root lesion nematode, *Pratylenchus thornei*, plant extracts, mortality.

INTRODUCTION

Plant parasitic nematodes are a major problem in agricultural crop production. *Pratylenchus* species (RLNs) occupied the third rank, followed by the root-knot and cyst nematode that causing highest impact on crops worldwide (Castillo and Volvas, 2007). RLNs cause root damage such as lesions and necrotic zones. *Pratylenchus* is an economically important pest of many crops such as cereals, sugarcane, coffee, maize, legumes, potatoes, vegetables and fruit trees (Castillo and Volvas, 2007). The genus of root lesion nematodes, *Pratylenchus* feeds and reproduces in the root cortex of many plant species. It migrates through root tissue causing extensive root damage, and results in severe reductions of plant growth and yield losses. Specifically, the root-lesion nematode *Pratylenchus thornei* Sher & Allen, a polyphagous, migratory endoparasitic nematode, is an important pathogen of cereals, vegetable and ornamental plants in Europe, Africa, North America, Asia, the Middle East and Australia (Nicol, 2002). Because of a wide range of host plants, it is difficult to control. Many nematicides are synthetic. Due to the environmental concerns and the side effect on human health and non-target organisms, researches have focused to develop alternative methods for managing plant parasitic nematodes. Many studies reported that the identified natural products such as plant extracts have nematicidal effect (Shaukat and Siddiqui, 2001; and Ntalli *et al.*, 2011). Numerous plant species belong to 57 of families; contain nematicidal compounds (Sukul, 1992).

The objective of this study was to determine the effectiveness of some indigenous plant extracts

against the major wheat root-lesion nematode *P. thornei* under *in vitro* conditions.

MATERIALS AND METHODS

Nematode culture

Pratylenchus thornei was reproduced on carrot culture using pure culture from Biological Control Research Institute (Adana, Turkey). *P. thornei* individuals were obtained from infected field and cultured in the sterile carrot discs according to Moody *et al.* (1973). The nematodes were extracted by placing the chopped carrot discs into a misting chamber for 2-4 days. Inoculation suspensions were prepared by sterile water and freshly extracted nematodes. *P. thornei* individuals were counted under a binocular microscope.

Plant material and preparation of aqueous extracts

Three selected indigenous plants were collected from various ecological zones of Anatolia, Turkey. Plant leaves were plucked from their branches and spread on polythene sheets in the laboratory for ten days to air dry. The extracts of *Hyoscyamus niger* L. (Solanaceae), *Melia azedarah* L. (Meliaceae) and *Xanthium strumarium* L. (Asteraceae) were performed. Plant extraction method of Brauer and Davkota (1990) was used.

Effect of plant extracts on the mortality of *Pratylenchus thornei*

One ml of *P. thornei* suspension, containing 110-158 juveniles and adults, was added into the doses of 0.5, 1.0 or 1.5 ml of the 3% plant extract with distilled water (each Petri dish contained totally 5 ml). They

were poured into sterilized Petri dishes with four replicates. Distilled water was used as a control. Following incubation at $28\pm 2^{\circ}\text{C}$, mortality of nematodes was estimated after 12, 24, 48, 72 and 96 hrs. Nematodes were considered dead if they lost mobility when probed with a fine needle (Abbasi *et al.*, 2008).

Statistical analysis

Data were analysed by using the analysis of variance and means were compared using Duncan's multiple range test (SPSS, 1999).

RESULTS AND DISCUSSION

Nematicidal activity of the plant extracts from 3 plant species against *P. thornei* are shown in table (1). The results revealed that the nematode mortality was recorded after exposure of 3% of plant extracts. Number of dead nematodes increased with increasing the dose of plant extracts and the time. They were highly toxic to *P. thornei* and mortality was observed after 12 hrs of exposure. All nematodes were found dead after 72 hours. Plant extracts of *H. niger*, *X. strumarium* and *M. azedarach* exhibited up to 85% mortality after 24 hrs at all doses. *H. niger* showed greatest nematicidal activity against *P. thornei* and all nematodes were found dead after 48 hours at the dose of 1.5 ml of *H. niger* (Tables 1 and 2).

Table (1): Effect of plant extracts on *Pratylenchus thornei* mortality under laboratory conditions

Plant Extract	Dose (ml)	Time (hour) Live nematode (Mean \pm SE)				
		12 h	24h	48h	72h	96h
<i>Hyoscyamus niger</i>	0.5	75.86 \pm 1.70	14.99 \pm 0.24	9.16 \pm 1.59	0.00	0.00
	1.0	78.90 \pm 1.51	15.64 \pm 1.78	5.47 \pm 0.88	0.00	0.00
	1.5	91.32 \pm 0.70	8.68 \pm 0.70	0.00 \pm 0.00	0.00	0.00
<i>Xanthium strumarium</i>	0.5	64.89 \pm 5.86	24.31 \pm 2.89	10.80 \pm 3.00	0.00	0.00
	1.0	64.51 \pm 4.37	26.17 \pm 4.75	9.32 \pm 0.41	0.00	0.00
	1.5	81.48 \pm 5.52	15.03 \pm 5.27	3.49 \pm 0.97	0.00	0.00
<i>Melia azedarach</i>	0.5	72.25 \pm 2.32	19.36 \pm 2.37	8.39 \pm 0.38	0.00	0.00
	1.0	91.15 \pm 2.58	6.52 \pm 1.86	2.33 \pm 0.93	0.00	0.00
	1.5	84.53 \pm 4.59	9.55 \pm 2.50	5.92 \pm 2.26	0.00	0.00
Control (Water)	-	100.0 \pm 0.0	100.0 \pm 0.0	100.00 \pm 0.00	100	100.0

Table (2): Interactions among plant extracts on *Pratylenchus thornei* mortality (%)

Source	Sum of squares	df	F	P
<i>Hyoscyamus niger</i>	4878,80100	9	11,058	<0.0001
<i>Xanthium strumarium</i>	27132,89666	9	97,060	<0.0001
<i>Melia azedarach</i>	32167,08004	9	458,060	<0.0001

Potential uses of plant extracts to control the plant parasitic nematodes have been reported by several researches (Shaukat and Siddiqui, 2001; Ntalli *et al.*, 2011, and Kepenekci and Saglam, 2015). Many compounds such as dithioacetylenes, glycosides, glucosinolates showed nematicidal activities against

Pratylenchus spp. They were found in different plant species (Ferraz and De Freitas, 2004). *Tagetes* spp. and *M. azedarach* are well known plants that act against nematodes (Hasabo and Noweer, 2005 and Rehman *et al.*, 2012). In this study, *M. azedarach* proved effective nematicidal compound at all doses. Romabati *et al.* (1999) reported that *Acorus calamus* L. showed nematicidal activity against *P. thornei* and mortality of the nematode increased with increase of exposure period from 6-48 hours. Aqueous extracts from the tree, *Quillaja saponaria* Molina, containing triterpenoid, saponins, polyphenols, salts and sugars have been tested against *P. neglectus* and *P. thornei* in Chile (San Martin and Magunacelaya, 2005). Some studies showed that the extract of *X. strumarium* affected egg hatching of *Meloidogyne* spp. (Mennan *et al.*, 2000). Another study cited that, plant extracts from *Capsicum frutescens*, *H. niger*, *M. azedarach*, *X. strumarium* and *Achillea wilhelmsii* had a nematicidal effect on *M. javanica* which is similar to the results of the present study. Although *A. wilhelmsii* and *C. frutescens* achieved the lowest level of mortality rates, *H. niger*, *M. azedarach* and *X. strumarium* had showed highest level of mortality rates after 3 days. The juvenile mortality was associated with increase level of dose of plant extract (Kepenekci and Saglam, 2015). These findings agree with the present results. Use of *H. niger*, *M. azedarach* and *X. strumarium* extracts is suggested to be a potential substitute of synthetic nematicides used for RLNs management in crop production.

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