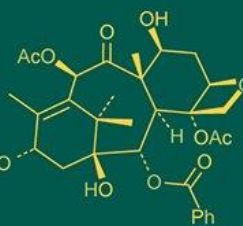
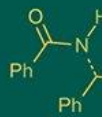


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 NAAS Rating (2026): 5.29
 IJABR 2026; SP-10(5): 199-202
www.biochemjournal.com
 Received: 29-04-2026
 Accepted: 20-05-2026

RK Thumar
 Department of Nematology,
 B.A. College of Agriculture
 Anand Agricultural
 University, Anand, Gujarat,
 India

Tulika Singh
 Department of Nematology,
 B.A. College of Agriculture
 Anand Agricultural
 University, Anand, Gujarat,
 India

Mayuri Y Patel
 Department of Nematology,
 B.A. College of Agriculture
 Anand Agricultural
 University, Anand, Gujarat,
 India

Corresponding Author:
RK Thumar
 Department of Nematology,
 B.A. College of Agriculture
 Anand Agricultural
 University, Anand, Gujarat,
 India

Nematicidal potential of botanicals against the root knot nematode, *Meloidogyne incognita*

RK Thumar, Tulika Singh and Mayuri Y Patel

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i5Sc.8350>

Abstract

A laboratory experiment was conducted to study the effect of Congress grass (*Parthenium hysterophorus*) and tobacco (*Nicotiana tabacum* L.) on juveniles mortality of root-knot nematode, *Meloidogyne incognita*. Observations revealed significant reduction in egg larval mortality in all the treatments in comparison to control. Maximum juveniles mortality was recorded in the aqueous extract of *P. hysterophorus* leaves, 20% as compared to tap water thus, exhibiting the toxic effect on root-knot nematode, *M. incognita*.

Keywords: *Parthenium hysterophorus*, *Nicotiana tabacum*, juveniles, toxic, *Meloidogyne incognita*

Introduction

One of the most successful multicellular creatures that parasitize practically all plants are plant parasitic nematodes (PPNs). They have an edge over other creatures in terms of their ability to live in a variety of environmental situations due to their diversification (Kern *et al.*, 2020; Lorenzen, 1994) ^[5, 6]. Among different plant parasitic nematodes, root-knot nematodes (*Meloidogyne* spp.) have a definite sexual dimorphism and a consistent life cycle. They are the most devastating biotic stressor for plants that have a negative impact on agricultural crop production (Postnikova *et al.*, 2015) ^[9]. These parasitic worms have developed unique feeding habits as a result of their parasitic adaptations (Mesa-Valle *et al.*, 2020) ^[7]. Nematodes that parasitize plants severely hinder plant growth, which eventually affects yield (Blaxter *et al.*, 1998) ^[2]. Usually, the secondary infection causes the plant to start wilting before worm attack occurs (Desmedt *et al.*, 2020) ^[3]. It has also been reported that nematode damage to the plant parts cause substantial crop yield losses by diverting nutrients, disrupting water transport and may also act as vector for viruses, which in turn mitigates the harm (Bird and Kaloshian, 2003) ^[1]. According to Indian estimates, crop losses would be 21.3% higher than expected, or \$1.58 billion yearly (Elling, 2013) ^[4].

Now-a-days scientists are growing more concern about unrestrained use of chemical-based nematicides which might lead to worm resistance. Therefore, it is need of the hour to establish eco-friendly management methods. Many plant components have been found to possess anti-nematode potential (Mwamula *et al.*, 2022) ^[8]. Plant extracts have been employed in certain studies to reduce PPNs damage both *in vivo* and *in vitro*. The discovery of secondary metabolites, which act as natural defence molecules in plants and, when scaled up, can prove to be a better source for nematode management, sparked the idea of controlling plant-parasitic nematodes using chemicals derived from plants. There have been numerous attempts to use plant-based remedies to manage different forms of root-knot nematodes (Shakya, 2022) ^[10]. Different plants have distinct effects on root-knot nematode isolates. It will therefore be necessary to search for additional plants that display anti-nematode characteristics.

Therefore, the aim of this study was to evaluate the anti-nematode potential of aqueous extract of leaves from two specific plants parthenium (*Parthenium hysterophorus* L.) and tobacco (*Nicotiana tabacum* L.) against the root-knot nematode, *M. incognita*.

Experimental details		
Location	:	Dept. of Nematology, BACA, AAU, Anand
Nematode	:	Root-knot nematode (<i>Meloidogyne incognita</i>)
Design	:	CRD
Repetitions	:	03
Treatments	:	10
Treatment details		T ₁ : <i>Parthenium</i> leaves, 10%
		T ₂ : <i>Parthenium</i> leaves, 15%
		T ₃ : <i>Parthenium</i> leaves, 20%
		T ₄ : Tobacco leaves, 10%
		T ₅ : Tobacco leaves, 15%
		T ₆ : Tobacco leaves, 20%
		T ₇ : <i>Parthenium</i> leaves, 10% + Tobacco leaves, 10%
		T ₈ : <i>Parthenium</i> leaves, 15% + Tobacco leaves, 15%
		T ₉ : <i>Parthenium</i> leaves, 20% + Tobacco leaves, 20%
		T ₁₀ : Tap water
Observations recorded	:	Juveniles mortality (%)

Methodology

The standard protocol described below were followed to collect root-knot nematodes, maintain nematode stocks, prepare leaf extracts, hatching of nematode eggs in occurrence of active compound, monitor hatching and inhibit hatching (if any) over a designated period of time.

Collection of parthenium and tobacco leaves

The leaves of parthenium and tobacco were collected from the nursery areas of tobacco at Bidi Tobacco Research Station (BTRS) and Nematology, BACA, AAU, Anand (Fig. 1).



Parthenium leaf

Tobacco leaf

Fig 1: Botanicals

Preparation of leaves extract

The early collected fresh leaves of *P. hystrophorus* and middle leaves of *Nicotiana tabacum* was kept in paper bags. The leaves were grounded into a fine paste using a mechanical grinder. The aqueous extract was prepared by dissolving 10 g, 15 g and 20 g in 100 ml water thus making 10%, 15% and 20% solution. After mixing the sample with water, the resultant suspension was filtered using filter paper. The same process was followed with both the leaves. The filtrate was centrifuged in a centrifuge at 1000 rpm for ten minutes. The extract was removed and the supernatants collected was then dissolved in 1 ml of tap water. Without employing any plant extracts, a control treatment was kept by using just tap water.

Nematode inoculum preparation

For juveniles inocula, freshly second stage juveniles (J₂) were extracted after 24 hours and nematode suspension was carefully collected and J₂ count/ml water suspension was determined by counting nematodes under stereoscopic binocular zoom microscope.

Concentrations of 10 percent, 15 percent and 20 percent were prepared from stock solution for each formulation in water. Ten, fifteen and twenty ml formulation of each concentration were poured in Petridishes. Besides, one control treatment were maintained (added tap water only). All the treatments were repeated three times. Fifty freshly hatched juveniles of *M. incognita* were added into each replicate. All Petridishes were kept at room temperature. Observations regarding percent juvenile mortality were recorded after 72 hrs of exposure. Dead juveniles exhibited no movement and attained the shape of straight line.

$$\text{Juveniles mortality (\%)} = \frac{\text{Number of dead J2 in treatment}}{\text{Total No. of J2 in treatment}} \times 100$$

The corrected percent mortality, used to adjust treatment mortality based on control mortality which is calculated using Abbot's formula (Finney, 1978).

$$m = (1 - nt/nc) \times 100$$

where

m = percent mortality

nt = number of viable nematodes after the treatment

nc = number of viable nematodes in the water control

Results and Discussion

The data in the Table 1 revealed that the leaves of the chosen plants exert nematode inhibition that prevents development of active *Meloidogyne incognita* juveniles. The anti-nematode action of the *P. hystrophorus* plant extract was notable, and it intensively showed highest juvenile mortality at different periodic intervals and also with the increase in the leaf extract concentrations. However, maximum juvenile mortality (92.00%) was recorded in the aqueous extract of *P. hystrophorus* leaves, 20% (Table 1, Fig. 2)].

The presence of various types of chemicals having lethal effect on root-knot nematode juveniles and the adverse effect of these chemicals might have further increased when the exposure period of egg hatching and larval penetration was increased. The reduction in larval penetration and hatching may also be due to the adverse effect of these chemicals which might have reduced the activity of juveniles or disrupted the host finding mechanism of the juveniles by blocking the receptor sites for receiving the

chemo attractants molecules emanating from the leaves or due to loss of orientation or co-ordinated movement towards

root effected by material interaction of Neuro sensory cholinesterase enzyme in nematode movement.

Table 1: Effect of leaves extracts of *P. hysterophorus* and *N. tabacum* on juveniles mortality of *M. incognita* after 72 hrs of exposure

Year: 2026					
Initial J2-50					
Tr. No.	Aqueous leaves extract (conc.)	No. of dead J2 after 72 hrs. of exposure		Juvenile mortality (%)	Corrected mortality (%)
		Active	Inactive		
T ₁	<i>Parthenium</i> leaves, 10%	18	32	63.33	62
T ₂	<i>Parthenium</i> leaves, 15%	12	38	76.00	74
T ₃	<i>Parthenium</i> leaves, 20%	4	46	92.00	90
T ₄	Tobacco leaves, 10%	27	23	46.67	44
T ₅	Tobacco leaves, 15%	26	24	47.33	46
T ₆	Tobacco leaves, 20%	25	25	49.33	48
T ₇	<i>Parthenium</i> leaves, 10% + Tobacco leaves, 10%	17	33	66.67	64
T ₈	<i>Parthenium</i> leaves, 15% + Tobacco leaves, 15%	11	39	77.33	76
T ₉	<i>Parthenium</i> leaves, 20% + Tobacco leaves, 20%	8	42	84.67	82
T ₁₀	Tap water	45	5	10.67	-

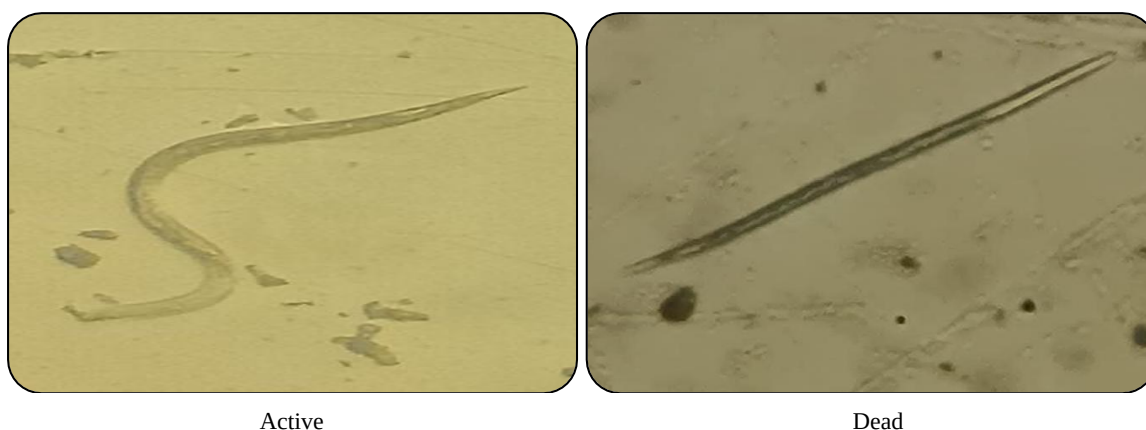


Fig 2: Characteristics of root-knot juveniles at varying degrees

Conclusion

The anti-nematode potential of botanicals (*Parthenium* and tobacco) screening showed that the anti-hatching active compounds may be present in the chosen leaves at varying levels. With varied dosages of leaf extract, *Meloidogyne incognita* egg hatching and juveniles mortality was significantly hindered and the percent juvenile mortality in the presence of different leaf extract increased gradually. According to the aforementioned results, *P. hysterophorus* leaf extract demonstrated most potent anti-nematode properties. It is obvious that all of the selected plants' leaf extracts exerted anti-nematode effects. *Parthenium* leaf extract prevented nematode eggs from hatching to a high level in comparison to the untreated control. The inhibitory effect of extracts of the *P. hysterophorus* might be due to the chemicals present in the extracts that possess ovicidal or larvicidal properties. The major secondary metabolite in *Parthenium*, parthenin shows strong inhibitory effects on nematode movement and viability. This weed also contains bioactive compounds like sesquiterpene lactones, flavonoids and phenolics which affect nematode mobility, reproduction and survival. Probably these chemicals affected the embryonic development of the nematode or killed the eggs (Wondimeneh *et al.*, 2013) [11]. Using 20% concentration of aqueous extracts of the weeds for more than 80% control of root-knot nematode seems effective botanical.

In vitro evaluation of leaf extracts was carried out at various concentrations for determination of least effective dose for environment friendly management of root knot nematode.

Hence, the leaves extracts of *P. hysterophorus* can be used to control the plant parasitic nematode *M. incognita*. The use of this invasive weed for developing nematicide has explored the possibility of control of the weeds.

References

1. Bird DMK, Kaloshian I. Are roots special? Nematodes have their say. *Physiol Mol Plant Pathol.* 2003;62:115-123.
2. Blaxter ML, De Ley P, Garey JR, Liu LX, Scheldeman P, Vierstraete A, *et al.* A molecular evolutionary framework for the phylum Nematoda. *Nature.* 1998;392:71-75.
3. Desmedt W, Mangelinckx S, Kyndt T, Vanholme B. A phytochemical perspective on plant defense against nematodes. *Front Plant Sci.* 2020;11:602079.
4. Elling AA. Major emerging problems with minor *Meloidogyne* species. *Phytopathology.* 2013;103:1092-1102.
5. Kern EMA, Kim T, Park JK. The mitochondrial genome in nematode phylogenetics. *Front Ecol Evol.* 2020;8:250.
6. Lorenzen S. The phylogenetic systematics of freeliving nematodes. In: Platt HM, editor. London: Ray Society; 1994.
7. Mesa-Valle CM, Garrido-Cardenas JA, Cebrian-Carmona J, Talavera M, Manzano-Agugliaro F. Global research on plant nematodes. *Agronomy.* 2020;10:1148.

8. Mwamula AO, Kabir MF, Lee D. A review of the potency of plant extracts and compounds from key families as an alternative to synthetic nematicides: history, efficacy, and current developments. *Plant Pathol J.* 2022;38(2):53-77.
9. Postnikova O, Hult M, Shao J, Skantar A, Nemchinov L. Transcriptome analysis of resistant and susceptible alfalfa cultivars infected with root-knot nematode *Meloidogyne incognita*. *PLoS One.* 2015;10:e0118269.
10. Shakya S. Nematicidal activity of natural products against root-knot nematode: a review. *J Plant Sci Res.* 2022;38(2):663-674.
11. Wondimeneh T, Sakhuja PK, Tefera T. Root-knot nematode (*Meloidogyne incognita*) management using botanicals in tomato. *Acad J Agric Res.* 2013;1(1):9-16.