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**Vipin Kumar Verma**
Department of Nematology, Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

**Ramesh Chand**
Department of Nematology, Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

**Shyam Babu Gautam**
Department of Nematology, Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

**Manish Kumar**
Department of Nematology, Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

**Richa Singh**
Department of Plant Pathology, V.B.S. Purvanchal University, Jaunpur, Uttar Pradesh, India

**Correspondence**
**Vipin Kumar Verma**
Department of Nematology, Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

# Effect of *Parthenium hysterophorus* plant parts products on hatching and larval penetration of root-knot nematode, *Meloidogyne incognita*

**Vipin Kumar Verma, Ramesh Chand, Shyam Babu Gautam, Manish Kumar and Richa Singh**

**Abstract**
An experiment was conducted on the effect of *Parthenium hysterophorus* on hatching of *Meloidogyne incognita* eggs under pot condition during 2017-18. The observations reveal that all the treatment were found significantly different from each other over control except to that of leaf compost @ 2.0 % with leaf powder @ 2.0 %; leaf compost @ 5.0 % with leaf powder @ 5.0 % and 7.5 %; ethanol leaf extract @ 2.0 % with 5.0 % with leaf extract 5.0 % were found at par to each other. The egg hatching recorded highest (609.75, 692.25, 702.00 and 725.50) was observed at 12, 24, 48 and 72 hours in control treatment where soil is not amended, however the minimum hatching was seen ethanol leaf extract treatment followed by leaf powder, leaf compost, leaf extract and ethanol leaf extract. The impact of *Parthenium hysterophorus* on larval penetration of *Meloidogyne incognita* shows that the penetration of second stage juvenile in the root system decreased in all the treatments as compared to untreated check. Maximum penetration was observed in untreated check i.e. 510.50, 565.25, 614.00, 692.75 and minimum penetration observed in the treatment in ethanol leaf extract @ 5% i.e. 204.00, 245.75, 325.25, 346.50 after incubation period 12, 24, 48 and 72 hours respectively.

**Keywords:** Tomato, *Parthenium hysterophorus*, *Meloidogyne incognita*, egg hatching and larval penetration

## Introduction
Tomato (*Lycopersicon esculentum* Mill.) is an important cash crop grown by both sustainable and commercial growers in India. It is grown in both rainy and dry season. It is perhaps the most profitable crop for small- scale farmers. Genus *Lycopersicon* has several species, but only two of them are edible i.e. L. *esculentum* Mill. and L. *pimpinenellifolium* Muller, are the only cultivated tomato. The tomato is an important vegetable crop which is cultivated throughout the year. In India, tomato is cultivated in 8.09 lack ha. With a total production of 19.69 corer tonnes with the productivity of 24.40 tonnes/ha. (NHB, 2016-17) [10]. The total area under tomato cultivation in Utter Pradesh is 2.08 lakh ha. With total production of 82.63 lakh tonnes and the productivity is 39.57 tonnes/ha. (NHB 2016-17) [10]. The ability of this crop to grow throughout the year, except in extreme climatic condition, makes it a very valuable to the growers and is an additional source of earning profit even during off season and tomatoes are being cultivated as food (Boswell, 1949) [3]. It can be used as a vegetable, soup, salad, pickles, ketchup, sauce and in many other ways. It is the most important "Protective food" because of it special nutritive value and also of its widespread production. Tomato is an important component in the diets of majority of Indians. The tomato fruit has been found to have considerable health benefits.

In spite of development of various plant protection measures, the crop unfortunately suffers severely from several diseases caused by bacteria, fungi, virus, nematode or by adverse environmental condition. Among nematodes, root-knot nematode, *Meliodogyne incognita* (Alam *et al*, 1975) [1], *M. javanica* (Rao and Prasad, 1969) [8], attack tomato crop but the root-knot nematode is the most common. Due to the wide distribution of root-knot nematode, it has gained countries. However, in Rajasthan, in was first noticed by Arya, 1957 [2] and found its infestation on tomato and later Yadav and Naik, 1966 [13], found *Meliodogyne spp*. Widely distributed in the soils of Udaipur, infecting vegetable and many other economically important crops.

## Materials and Methods

The experiments were carried out in the laboratory and micro-plot experimental site of the Department of Nematology, College of Agriculture, N.D. University of Agriculture & Technology, Kumarganj, Ayodhya-224229. The effect of *Parthenium* plant products *viz*. leaf Compost, leaf powder, ethanol leaf extract and leaf extract on egg hatching and larval penetration of *Meloidogyne incognita* was studies by conducting an experiment with a total of thirteen treatments were prepared i.e. leaf compost @ 2.0 % ($T_1$), leaf compost @ 5.0 % ($T_2$), leaf compost @ 7.5 % ($T_3$), leaf powder @ 2.0 % ($T_4$), leaf powder @ 5.0 % ($T_5$), leaf powder @ 7.5 % ($T_6$), ethanol leaf extract @ 1.0 % ($T_7$), ethanol leaf extract @ 2.0 % ($T_8$), leaf extract @ 5.0 % ($T_9$), leaf extract @ 1.0 % ($T_{10}$), leaf extract @ 2.0 % ($T_{11}$), leaf extract @ 5.0 % ($T_{12}$) and untreated check($T_{13}$), were prepared using sterilized sandy loam soil in 9 inch earthen pots. Each pot Were inoculated with freshly hatched eggs of *M. inconita* @ 1000 eggs per pot. Two sets of such treatments were prepared. Mixing leaf compost and leaf powder in soil was done prior to conduct the experiment. Leaf extract ethanol and water based drench in pot when the plants were of one month old. Each treatment was replicated four times. The treatments thus prepared were left for a period of 12, 24, 36 and 72 hours. After expiry of the time, each replicate was harvested and processed for recording the number of eggs hatched out of the total eggs inoculated in the pot.

**Collection, Identification and maintenance of nematode culture:** The root-knot nematode, *Meloidogyne incognita* infected tomato plants were procured from the cage house of the department of Nematology, College of Agriculture, N.D. University of Agriculture & Technology, Kumarganj, Ayodhya. The collected root-knot nematode infected tomato plant roots were carefully washed with fresh water and surface sterilized with 0.25% NaOCl (sodium hypochlorate) solution for 4 minutes. The plant roots were again washed with fresh water. Single eggmass from the infected tomato plants was taken out carefully and kept in 5cm diameter petridis for 72 hour's at $25^0$C in order to obtain freshly hatched second stage juveniles of *Meloidegyne spp*. The female of which egg mass was kept in water for hatching was operated to get perennial pattern for species identification along with other morphological parameter such as stylet, head shape of male, larval length and their comparison with the description given by Eisenback, J. D., and H. Hirschmann. (1979) [4] the nematode was identified as *Meloidogyne incognita* and further verified differential host reactions as described by Hartman and Sasser (1985) [5], which was identified as race-1. The culture of *M. incognita* race-1 was raised by inoculating tomato seedling in sterilized soil with active second stage juveniles ($J_2$) hatched from single eggmass and subsequently multiplied in a similar manner and maintained on tomato.

**Raising of nursery for pure nematode culture:** For obtaining single egg mass nematode culture of *Meloidogyne incognita* race-1 on tomato, nursery was raised in the 12 inch diameter earthen pots containing sterilized sandy loam soil. The tomato seeds were placed carefully on the soil surface and covered with 1 cm layer of favorable soil. The earthen pots were then irrigated carefully and kept in the cage house for its germination. The tomato seedlings when reached to 3-5 leaf stage were used for transplanting.

**Preparation of nematode inoculum:** The required amount of freshly hatched second stage juveniles were procured from the infected plants, inoculated with the juveniles of single egg mass. The *M. incognita* infected tomato plants were up rooted carefully containing all fine roots and the roots were washed carefully in running tap water. The cleaned roots were then cut into small pieces and kept into 10 cm diameter petridis. The required amount of egg mass were then procured from the roots under of stereoscopic micro-scope and kept for hatching in a 10 cm diameter petriplate at $25^0$C for 72 hours.

**Preparation of Parthenium leaf compost:** The leaves of *Parthenium* plant species were used for preparing leaf compost. These plants were collected from the adjoining areas of Narendra Deva University of Agriculture and Technology. The foliage of such plants were procured, dried, grinded and composted to test their effect on hatching and penetration under pot condition were studied.

**Preparation of Parthenium leaf powder:** The leaves of *partheinum* plant species was used for preparing leaf powder. These plants were collected from the adjoining areas of Narendra Deva University of Agriculture & Technology. Fresh and succulent leaves of parthenium plants except collected and washed thoroughly with tap water to remove the dust and soil particles. These clean leaves were dried in shade to zero percent water content. Fully dried leaves were powdered in grinder. Fully were ground and used for amending in soil.

**Preparation of ethanolic leaf extract:** The leaves of *partheinum* plant species was used for preparing ethanolic leaf extract *i.e. Parthenium hysterophorus*. These plants were collected from the adjoining areas of Narendra Deva University of Agriculture & Technology. The leaves were thoroughly washed with sterilized water and then kept in oven at $38^0$C for 2 hours. The dried leaves were crushed in a pestle mortar. The ethanolic leaf extract was prepared using ethanol as a solvent. The leaf powder was mixed with ethanol in 1:3 ratio and kept for a period of 15-18 days. The extra ethanol was evaporated by keeping it at $35^0$C and leaf extract paste was obtained.

**Preparation of leaf extract:** The leaves of *partheinum* plant species was used for preparing leaf extract *i.e. Parthenium hysterophorus*. These plants were collected from the adjoining areas of Narendra Deva University of Agriculture & Technology. The leaves were thoroughly washed with sterilized water and then kept in oven at $38^0$C for 2 hours. The dried leaves were crushed in a pestle mortar. The water based leaf extract was prepared using ethanol as a solvent. The leaf powder was mixed with ethanol in 1:3 ratio and kept for a period of 15-18 days. The extra ethanol was evaporated by keeping it at $35^0$C and leaf extract paste was obtained.

**Statistical analysis of data**: The experiments were carried out in completed randomized block design with four replications of each treatment. The variance of each mean value was analyzed at five percent confidence limit.

## Result and Discussion

The observation on egg hatching of *Meloidogyne incognita* decreased significantly in all the treatments in comparison to untreated check i.e. 609.75, 692.25, 702.00 and 725.50 and

the minimum in the treatment where ethanol leaf extract was used i.e. 215.25, 265.00, 325.50 and 385.75, 228.00, 289.75, 344.25 and 392.50, 245.50, 298.00, 375.75 and 409.25 after 12, 24, 48 and 72 hours incubation at 5.0 %, 3.0 % and 1.0 % doses respectively. The minimum hatching observed in ethanol leaf extract was followed by leaf extract, leaf compost and leaf powder respectively at all the time interval in ascending order.

The effect of ethanol leaf extract, leaf extract, leaf compost and leaf powder on hatching indicated significant reduction. The less number of $J_2$ hatched out eggs after 12, 24, 48, and 72 hours of incubation and also increased with the exposure time may be due to the allelopathic effect of respective plant originated allelochemicals present in *Calotropis gigantea* and *Parthenium hysterophorus* having medicinal value like parthenin, botulin, dihydroisoparthenin, Isoguaiene, Parthenicin these chemicals are effective to reduce nematode eggs hatching (Singh et al, 2012) [12]. The mean of four replicates for egg hatching are presented in Table-1

The observation on $J_2$ penetration shown significant decreased in all the treatments in comparison to the untreated check. Maximum hatching was observed in untreated check i.e. 510.50, 565.25, 614.00 and 692.75 at 12, 24, 48,and 72 hours after larvae incubation respectively with the minimum in the ethanol leaf extract treatment i.e. 204.00, 219.50 and 237.25 after 12 hours incubation, 245.75, 270.25 and 276.00 after 24 hours, 325.25, 338.00 and 354.75 after 48 hours and 346.50, 372.7 and 397.50 after 72 hours of *Meloidogyne incognita* second stage larvae inoculation at 5.0 %, 3.0 %, and 1.0 % concentration treatment respectively. The minimum penetration was observed in ethanol leaf extract followed by leaf extract, leaf compost and leaf powder respectively in all the time interval in increasing order. The adverse effect of these chemicals might have further increased when the exposure period period of larvae was increased. These result are in conformity of the published records. The aqueous extract of various plants such as Aloe *barbadens, Annona squamosa, Azadirachta indica, Chenopodium anthelminticum, Tobacco catotrop sprocera, Cuscuta reflexa, Colocasia antiquorum, Croton sparsiflorus, Datura stramonium, Parthenium hysterophorus, Tagetes erecta,* etc. had adverse impact on juvenile mortality of root-knot nematode (Krishnamurthy and Murthy, 1993) [7]. Mojumder and Gosawami, 1987; Prasad *et al.*, 2002; Husain and Masood, 1975 [7]; Siddiqi and Alam, 1987b [11]. The mean of four replicates for larval penetration are presented in Table-2.

**Table 1:** Effect of Congress grass, *Parthenium hysterophorus* on root-knot nematode, *Meloidogyne incognita* egg hatching. Observations are the mean of four replicates

| Treatments | | Incubation Period | | | |
|---|---|---|---|---|---|
| | | 12 hours | 24 hours | 48 hours | 72 hours |
| $T_1$ | Leaf Compost @2.0% | 434.00 (-28.82) | 355.25 (-48.68) | 296.50 (-57.76) | 278.00 (-61.68) |
| $T_2$ | Leaf Compost @5.0% | 422.50 (-30.70) | 362.75 (-47.58) | 282.00 (-59.82) | 272.50 (-62.43) |
| $T_3$ | Leaf Compost @7.5% | 416.25 (-31.73) | 347.00 (-49.87) | 262.75 (-62.57) | 264.25 (-63.75) |
| $T_4$ | Leaf powder @2.0 % | 448.50 (-26.44) | 393.75 (-43.12) | 329.00 (-53.13) | 297.25 (-59.02) |
| $T_5$ | Leaf powder @5.0 % | 436.25 (-28.45) | 374.00 (-45.97) | 318.75 (-54.59) | 283.00 (-60.99) |
| $T_6$ | Leaf powder @7.5 % | 426.75 (-30.01) | 369.50 (-46.62) | 297.25 (-57.65) | 281.75 (-61.16) |
| $T_7$ | Ethanol Leaf Extract @1.0 % | 245.50 (-59.73) | 298.00 (-56.95) | 375.75 (-47.81) | 409.25 (-43.59) |
| $T_8$ | Ethanol Leaf Extract @2.0 % | 228.00 (-62.60) | 289.75 (-58.14) | 344.25 (-50.96) | 392.50 (-45.89) |
| $T_9$ | Ethanol Leaf Extract @5.0 % | 215.25 (-64.69) | 265.00 (-61.71) | 325.50 (-53.63) | 385.75 (-46.82) |
| $T_{10}$ | Leaf Extract @1.0% | 278.00 (-54.40) | 316.50 (-54.27) | 387.25 (-44.83) | 426.00 (-41.28) |
| $T_{11}$ | Leaf Extract @2.0% | 263.75 (-56.74) | 292.25 (-57.78) | 366.00 (-47.86) | 414.50 (-42.86) |
| $T_{12}$ | Leaf Extract @5.0% | 231.25 (-62.07) | 275.75 (-60.16) | 346.50 (-50.64) | 401.00 (-44.72) |
| $T_{13}$ | Untreated check | 609.75 | 692.25 | 702.00 | 725.50 |
| C.D. at 5 % | | 8.74 | 12.26 | 9.36 | 10.37 |

**Table 2:** Effect of Congress grass, *Parthenium hysterophorus* on root-knot nematode, *Meloidogyne incognita* larval penetration in tomato root Observations are the mean of four replicates

| Treatment | | Incubation Period | | | |
|---|---|---|---|---|---|
| | | 12 hours | 24 hours | 48 hours | 72 hours |
| $T_1$ | Leaf Compost @2.0% | 436.00 (-14.59) | 398.75 (-29.45) | 356.50 (-41.93) | 281.25 (-59.63) |
| $T_2$ | Leaf Compost @5.0% | 429.75 (-15.81) | 383.00 (-32.24) | 338.25 (-44.91) | 279.50 (-59.65) |
| $T_3$ | Leaf Compost @7.5% | 418.25 (-18.07) | 375.50 (-33.56) | 312.75 (-49.06) | 272.00 (-60.38) |
| $T_4$ | Leaf powder @2.0 % | 455.75 (-10.72) | 408.00 (-27.81) | 378.25 (-38.39) | 322.50 (-53.44) |
| $T_5$ | Leaf powder @5.0 % | 443.25 (-13.22) | 393.50 (-30.38) | 359.75 (-41.40) | 302.00 (-56.54) |
| $T_6$ | Leaf powder @7.5 % | 432.50 (-15.27) | 381.25 (-32.55) | 343.00 (-44.13) | 287.75 (-58.46) |
| $T_7$ | Ethanol Leaf Extract @1.0 % | 237.25 (-53.42) | 296.00 (-47.33) | 354.75 (-42.22) | 397.50 (-42.61) |
| $T_8$ | Ethanol Leaf Extract @2.0 % | 219.50 (-57.00) | 270.25 (-52.18) | 338.00 (-44.95) | 372.75 (-46.19) |
| $T_9$ | Ethanol Leaf Extract @5.0 % | 204.00 (-60.03) | 245.75 (-56.52) | 325.25 (-47.02) | 346.50 (-49.98) |
| $T_{10}$ | Leaf Extract @1.0% | 281.50 (-44.85) | 344.25 (-39.09) | 389.00 (-36.64) | 419.75 (-39.40) |
| $T_{11}$ | Leaf Extract @2.0% | 269.00 (-47.30) | 324.75 (-42.54) | 377.50 (-38.51) | 412.25 (-40.49) |
| $T_{12}$ | Leaf Extract @5.0% | 222.75 (-56.36) | 274.50 (-51.48) | 342.25 (-44.25) | 381.00 (-45.00) |
| $T_{13}$ | Untreated check | 510.50 | 565.25 | 614.00 | 692.75 |
| C.D. at 5 % | | 7.36 | 9.03 | 7.83 | 10.09 |

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