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# Studies on the effect of Allelopathic properties of some weed and medicinal plants leaf extract on galling, larval penetration and development of *Meloidogyne incognita* race-1 larvae on brinjal plant under pot condition

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## Abstract

*Pot experiment was conducted to analyse the allelopathic properties of some weed and medicinal plants leaf extract on galling, larval penetration and development of Meloidogyne incognita on brinjal plant. Studies show that larval penetration, root galling, soil nematode population, total root population and nematode multiplication factor decreased in comparison to control in all concentrations. All the treatments were found significantly deferent from each other. The highest percentage larval penetration, galling, soil population, root population and nematode multiplication reduced significantly at 10 per cent leaf extract level followed by 5.0, 2.0 and 1.0 per cent leaf extract in descending order. Among the treatments Parthenium hysteriophorus was found most effective in reducing the nematode population*.

## Introduction

Plant parasitic nematodes now a day a well known fact in reducing prop production specially vegetable horticultural crops. The root-knot nematode, *Meloidogyne* spp. Goeldi; 1892 has also shown it's importance in causing avoidable yield losses. The yield loss in vegetable crops ranges between 28.3 to 47.5 in tomato, 26.5 to 50.0 in brinjal, 19.7 to 33.3 in chilli, 60 to 90 percent in bitter gourd under Indian condition (AICRP, 1992). Among various approaches known so far the management of plant parasitic nematode below economic injury level, cultural practices are not generally advised to follow because of time limit economic pressure on land and other inherent difficulties (Jatala 1985). Likewise nematicides are also not being used primarily due to their unfavourable cost benefit ratio and their non-availability. The growing awareness regarding the use of various nematicides for the management of plant parasitic nematodes made the scientist to review the strategies of nematode management by incorporating other possible ecologically safe control measures. The exploitation of the Allelopathic properties of certain wild weeds and medicinal plants. Accordingly the present investigation was initiated on "Studies on the effect of Allelopathic properties of some weed and medicinal plants leaf extract on hatching and mortality of *Meloidogyne incognita* Race-1 larvae.

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# Materials and methods

## Larval penetration

The effect of various plant leaf extract on larval penetration was studied by preparing treatment of 1, 2, 5 and 10 percent leaf extract concentration. A control, without plant leaf extract was also kept. The 12 inch earthen pots containing well mixed sandy loam soil, transplanted with 3 to 5 leaf stage seedlings of brinjal cv. Pusa Purple Long. All the treatments were replicated four times. Each replicate was inoculated with 200 freshly hatched second stage juveniles of *M. incognita* exposed to the leaf extract of various concentrations for a period of 48 and 72 hours. The experiment was allowed to run for a period of 48 and 72 hours. After expiry of incubation period the observation on the number of second stage juveniles penetrated per plant were observed under stereoscopic binocular microscope.

## Gall formation and nematode development

The effect of various plant leaf extract on gall formation in 12 inch earthen pots containing well mixed sandy loam soil, transplanted with 3 to 5 leaf stage seedlings of brinjal cv. Pusa Purple Long. The gall formation and nematode development was studied by preparing treatment of 1, 2, 5 and 10 percent leaf extract and a control was also prepared in which no leaf extract was used. All the treatment were replicated four times. Each replicate was inoculated with freshly hatched second stage juveniles of *M. incognita* @ 5 larvae/g soil exposed to the leaf extract of various concentration for a period of 48 and 72 hours. The seedlings were allowed to grow for a period of 30 days. After one month the observations on number of galls/ plant, number of egg masses/ plant, number of $J_{2,}$ $J_{3,}$ $J_{4,}$ mature females and males per plant were recorded under binocular microscope.

# Results and discussion

The observations regarding the effect of various plant leaf extract on larval penetration of *Meloidogyne incognita* as presented in Table 1. Shows that the penetration of second stage juvenile in the brinjal root system decreased in all the treatments as compared to control. All the treatments were significantly different from each other and increase with the increase in the concentration of plant leaf extract irrespective of the plants under the test *i.e. Lantana camera , Xanthium strumarium , Achyranthus aspera , Ocimum bacilium*, and *Parthanium hysterophorus* . The total number of second stage juvenile penetrated at 10 percent concentration was 9.50 and 17.50 in *Lantana camera*, 8.00 and 14.00 in *Achyranthus aspera,* 12.00 and 17.00 in *Ocimum bacilium*, 12.00 and 16.50 in *Xanthuim strumarium* 6.50 and 12.50 in *Parthanium hysterophorus* for 48 and 72 hours time respectively whereas the

Table 1: Studies on the effect of Allelopathic properties of some weed and medicinal plants leaf extract on larval penetration of *Meloidogyne incognita* Race-1 larvae on brinjal plant under pot condition

| Concentration (In %) | No. of larvae penetrated after 48 hours of Inoculation | | | | | No. of larvae penetrated After 48 hours of Inoculation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *L.c.* | *A.a.* | *O.b.* | *X.s.* | *P.h.* | *L.c.* | *A.a.* | *O.b.* | *X.s.* | *P.h.* |
| 1 | 23.50 | 12.00 | 28.00 | 28.00 | 22.50 | 45.50 | 39.50 | 36.50 | 38.50 | 37.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 20.50 | 20.00 | 21.50 | 22.50 | 12.50 | 32.50 | 29.00 | 25.50 | 31.00 | 32.50 |
| 5 | 14.00 | 13.00 | 16.50 | 16.50 | 9.50 | 30.00 | 21.00 | 21.00 | 22.00 | 17.50 |
| 10 | 9.50 | 8.00 | 12.00 | 12.00 | 6.50 | 17.50 | 14.00 | 17.00 | 16.50 | 12.50 |
| Control | 35.50 | 35.50 | 35.50 | 35.50 | 35.50 | 61.50 | 61.50 | 61.50 | 61.50 | 61.50 |
| C.D. at 5% | 3.73 | 2.97 | 4.39 | 3.52 | 3.86 | 2.98 | 3.11 | 4.37 | 5.60 | 4.09 |

(Observations are the mean value of four replicates)

Table 2: Studies on the effect of Allelopathic properties of some weed and medicinal plants leaf extract on galling of *Meloidogyne incognita* Race-1 larvae on brinjal plant under pot condition.

| Plants | No. of Galls/Plant at various Concentrations (%) | | | |
|---|---|---|---|---|
| | 1 | 2 | 5 | 10 |
| *L.c.* | 33.25 | 27.00 | 22.25 | 15.50 |
| *A.a.* | 27.25 | 20.00 | 14.50 | 9.25 |
| *O.b.* | 21.25 | 17.50 | 13.00 | 11.50 |
| *X.s.* | 23.25 | 18.25 | *16.50* | *13.00* |
| *P.h.* | 23.25 | 19.75 | 14.75 | 10.75 |
| Control | 34.5 | 34.5 | 34.5 | 34.5 |
| C.D. at 5% | 2.57 | 2.19 | 3.10 | 3.75 |

(Observations are the mean value of four replicates)

*L.C. = Lantana camera, A.o. = Achyranthus aspera O.b. = ocimum bacilium X.s. = Xanthium strumarium P.h. = Pathenium hysterophorus*

highest number of juveniles penetrated in 1.0 % treatment among the all treatments except to that of control. While comparing the effect of higher concentration of leaf extract among the tested plants *Parthanium hysteroporus* greatly reduced the juvenile penetration followed by *Achyranthus aspera, Lantana camera*, *Xanthium strumarium*, *Ocimum bacilium* respectively in descending order at both 48 and 72 hours time. The highest percentage penetration reduction in larval penetration was observed at highest plant leaf extract concentration (10 %), it was 73.25 and 71.50 *Lantana camera*, 77.46 and 77.35 in *Achyranthus aspra* ,66.19 and 72.35 in *Ocimum bacilium*, 66.19 and 73.17 in *Xanthium strumarum* 81.69 and 79.67 in *Parthinium hysterophorus* for 48 and 72 hours time respectively. When the comparison is made between the exposures time period of second stage juveniles for penetration, it is observed that the penetration increased after 72 hours in comparison of 48 hours. The highest increase in juvenile penetration (229.17%) in *Achyranthus aspera* followed by *Lantana camera* (93.66%) *Parthanium hysterophorus* (64.44%), *Xanthium strumarium* (37.50%) and *Ocimum bacilium* (30.36%) at one percent concentration where as at 10% it was highest in *Parthanium*

*hysterophorus* followed by *Lantana camera* (84.21) *Achyranthus aspera* (75.00), *Ocimum bacilium* (46.67) and *Xanthium strumarium* (37.50) respectively in descending order.

Table 3 Studies on the effect of Allelopathic properties of some weed and medicinal plants leaf extract larval development of *Meloidogyne incognita* Race-1 larvae on brinjal plant under pot condition

| Treatment | 1% | | | 2% | | | 5% | | | 10% | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **S.P** | **T.R.P** | **M.P** | **S.P** | **T.R.P** | **M.P** | **S.P** | **T.R.P** | **M.P** | **S.P** | **T.R.P** | **M.P** |
| P.h. | 46.75 (8.84) | 222.00 (14.90) | 8.00 | 33.25 (5.77) | 202.75 (14.24) | 8.25 | 18.75 (4.33) | 179.25 (13.40) | 9.00 | 12.75 | 121.25 (11.01) | 10.50 |
| O.b. | 51.75 (7.18) | 223.50 (14.95) | 8.50 | 38.00 (6.16) | 210.25 (14.5) | 9.00 | 21.00 (4.58) | 185.75 (13.63) | 9.75 | 15.50 | 135.00 (11.62) | 12.00 |
| X.s. | 56.75 (7.53) | 227.25 (15.07) | 9.00 | 40.75 (6.38) | 215.00 (14.66) | 10.50 | 23.75 (4.87) | 186.50 (13.66) | 12.50 | 17.75 | 141.75 (11.90) | 14.25 |
| A.a. | 63.50 (7.97) | 236.50 (15.38) | 9.25 | 46.50 (6.82) | 222.50 (14.92) | 11.50 | 26.25 (5.12) | 188.75 (13.74) | 14.25 | 19.00 | 144.25 (12.01) | 16.00 |
| L.c. | 69.25 (8.32) | 245.75 (15.68) | 10.50 | 51.75 (7.19) | 232.50 (15.25) | 12.75 | 29.75 (5.45) | 192.25 (13.86) | 14.75 | 23.50 | 147.75 (12.15) | 17.75 |
| Control | 75.50 (8.69) | 272.50 (16.51) | 7.25 | 75.75 (8.70) | 272.50 (16.51) | 7.25 | 75.50 (8.69) | 272.50 (16.51) | 7.75 | 75.50 | 272.50 (16.51) | 7.25 |
| C.D at 5% | o.59 | 0.29 | 1.63 | 0.38 | 0.15 | 2.09 | 0.031 | 0.71 | 1.63 | 3.09 | 0.69 | 1.19 |

(Observations are the mean value of four replicates)

S.P = Soil population, T.R.P. = Total root population, M.P = Male population

*L.C. = Lantana camera A.o. = Achyranthus aspera O.b. = ocimum bacilium X.s. = Xanthium strumarium P.h. = Pathenium hysterophorus*

The observations on the effect of plant leaf extract on gall formation as present in (Table 2) indicate that the galls were formed in all the treatments where the second stage juveniles were inoculated. The number of gall formed were significantly more in all the treatment in comparison to control. It was highest in *Lantana camara i.e.* 33.25, 27.00, 27.25 and 15.50 followed by *Acyranthus aspera* i.e. 27.00, 20.00, 14.50 and 9.25, *Parthamuim hysterphorus* i.e. 23.25, 19.75, 14.75, and 10.75 *Xanthium strumarum* i.e. 23.25, 18.25, 16.50, and 13.00 and *Ocimum bacilium i.e.* 21.25,17.50,13.00and 11.50 respectively at 1.0, 2.0,5.0, and 10 percent concentration of leaf extract. The highest percent decrease in gall formation was observed at 10 percent concentration i.e. 55.07, 73.19, 66.67, 62.32, and 68.84, followed by at 5.0 percent i.e. 35.51, 57.97, 62.32, 52.17, and 57.25, 2 percent i.e. 21.73, 42.03, 49.27, 47.10 and 42.75 with minimum percent decrease at 1.0 percent concentration i.e. 3.62, 21.01, 36.96, 32.62and 32.61 *in Lantana camara, Achyranthus aspera, Ocimum bacilium, Xanthium strumarium and Parthenium hysterophorus* respectively.

The observations on penetration of second stage juveniles $J_2$ of *Meloidogyne incognita* in the roots of brinjal cv. Pusa Purple Long indicated that significantly less number of juveniles penetrated the root system when they were expose to the leaf extract of the test plants, which might be due to the adverse effect of various chemicals emanating from the leaves. These chemicals 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 affected by material interaction of neurosensory cholinesterase enzyme in nematode. Marigold root exudates containing alpha terthienyl, a nematicidal compound was ascribed to aerobic inactivation of neurosensory cholinesterare and glucose-6-

phosphate dehydogenase enzymes in nematodes (Bakker *et al.*, 1979). Aqueous extracts of various plant *i.e. Sushas calotropis gigantean, Cuscuta reflexa, Tagetes erecta, Chloris gagans* etc. have been reported to adversely affect root penetration by root knot nematodes. Majumdar and Goswami, 1987; Caswell *et al.,* 1991, have shown that Urine and Vermiwash also possess antinemic compounds (Anonymous; Lee, 1985).

The leaf extract of *Parthenium hysterophorus, Lantana camera, Xantheium stumerium, Ocimum bacilius* and *Achyranthus aspera* reduce gall formation, soil population and root population significantly where as male population and larval mortality increase significantly which might be because of the growth inhibitory effects of chemicals emanating from the leaves. Chand et.al. (2011) also reported inhibitory impact of some decomposed weed plant leaves on galling and development of Meloidogyne incognita Race-1 on brinjal plant under pot condition. These observations are inconformity with the observations of Zarina *et al*. (2003) where the soil was amended with leaf extract of calotropis, dhatura and neem, significantly reduced root knot infection caused by *Meloidogyne javanica* and improved growth of brinjal plant as compared to un-amended control. The neem leaf extract showed better results followed by Calotropis and Dhatura leaf extract at higher concentration. Maximum heights, number of leaves, fresh and dry weight of shoot were significantly suppressed. The growth of plant was in direct proportion to the concentration of leaf extract while root – knot development was in case of root-knot development negative proportion to these extracts.

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