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# Studies on the bio-efficacy of *Monacrosporium eudermatum* against root-knot nematode, *Meloidogyne incognita* on brinjal

**Pintoo Kumar and Ramesh Chand**

**Abstract**
*In vivo* efficacy of *Monacrosporium eudermatum* against root-knot nematode, *Meloidogyne incognita* on brinjal was studied. The observations on predacity test of *M eudermatum* against $J_2$ of *Meloidogyne incognita* showed that $J_2$ trapping increased with the increase of $J_2$ population in culture and the exposure time allowed for trapping being maximum at 96 hours of exposure period. The observations on plant height and root length while studying the effect of *M. eudermatum* in combination with various organic manures revealed that plant height and root length increased significantly in all the treatments in comparison to the inoculated, uninoculated and treated check with minimum in inoculated check. It was observed 18.12 and 6.12 in $T_1$, 18.00 and 5.50 in $T_2$, 17.75 and 5.37 in $T_3$, 17.10 and 6.12 in $T_4$, 17.07 and 5.25 in $T_5$ respectively in descending order. The reproduction parameters of *Meloidogyne incognita* on brinjal i.e. Nematode population in root and soil, eggs/ plant, total nematode population and multiplication factor significant decreased in all the treatments over the inoculated check where as significant increase was observed over the treated check. The nematode population in root and soil, egg / plant, total nematode population and nematode multiplication factor was highest (121.75, 1198.00, 8642.50, 9962.25, and 6.64) in inoculated check followed by 56.75, 226.75, 3668.00, 3951.50 and 2.63 in $T_5$, 54.25, 207.25, 2718.75, 2980.25 and 1.99 in T3, 49.50, 219.75, 2603.25, 2872.50 and 1.91 in $T_1$, 50.00, 218.75, 2593.25, 2862.25 and 1.91 in $T_4$, 50.50, 224.00, 2487.50, 2762.00 and 1.84 in $T_2$ with the minimum 26.50, 122.00, 1345.50, 1494.00 and 0.99 in treated check ($T_8$) respectively in descending order.

**Keywords:** Root- knot nematode, Nematode trapping fungi, Bio-efficacy, Biocontrol of nematode, Nematode management

## Introduction
Root-knot nematode, *Meloidogyne spp*. have been identified as one of the noxious nematode problem in India as well as in world over, causing enormous yield loss in brinjal crop along with more than 2000 plant species of vegetable, fruit, spices and causing average yield loss of 5 % globally. (Hussy and Janssen, 2002) [5]. The avoidable yield loss in vegetable crops due to *Meloidogyne spp.* ranges between 28.3 to 47.5 in tomato, 26.5 to 50.0 in brinjal, 19.7 to 33.3 in chilli and 60.0 to 90.0 per cent in bitter gourd under Indian condition. The approaches known so far for the management of root-knot nematode culture practices are not generally preferred due to several inherent problems (Jatala, 1985) [7]. The nematicidal applications although supress root-knot nematode population effectively but due to high cost, non availability, mammalian toxicity, environmental pollution and resurgence of new nematode pests, biological control of root-knot nematode through nematode trapping and antagonistic fungi is observed to be the one of the potential approach having ability to be the environmentally safe and effective as alone and in combination as an integral part of the integrated nematode management strategy. *Arthrobotrys oligospora* having proven its nematode controlling potential (Mankar, 1962; Kerry, 1987: Cooke, 1962) [13, 8, 3]. The sophisticated capturing mechanism and higher nematode predacity indicate the bio-control potential of *M eudermatum*. Accordingly, studies on bio-efficacy of *M. eudermatum* against root-knot nematode, *Meloidogyne incognita* on brinjal was studied.

## Materials and Methods
*In vitro* Studies on the nematode capturing ability of *Monacrosporium eudermatum* was carried out against $J_2$ of root-knot nematode *M. incognita* using the method as described by Belder and Jansen (1994) [2]. 2.00 mm fungal disc of *M. eudermatum* was taken from the periphery of 10-12 day old culture and inoculated into the Petri dishes containing 1:10 maize meal agar medium (0.2% agar) in 50 mm diameter petridishes.

The Inoculated Petri dishes were incubated at 28±1 ºC. After 5 days of incubation, fungal discs were removed for the use of experimentation. The population of second stage of *M. incognita* was obtained from Brinjal infected plants. Egg masses were collected from root in cavity blocks and incubated at 25 ºC for 48 hours to obtain freshly hatched juveniles. The Juveniles were washed with sterile water before transferring into Petri dishes containing Fungus culture. A drop of sterile water containing $J_2$ was poured with the help of micropipette into 5 day old Fungus cultures. All Petri dishes were incubated at 28±1 ºC for trapping. Four replications were maintained for each treatment. Observations on number of captured $J_2$ were recorded daily up to 4 days and percentage of captured $J_2$ was calculated.

*In vivo* studies on bio-control efficacy of *M. eudermatum* against *M. incognita* on brinjal was conducted in pots at departmental field. For experimentation, *M. incognita* infested sick soil having inoculum level of three larvae per gram of soil was used. Sick soil was hand mixed to make the nematode population uniform before adding amendments @ 15 gms/kg (Vermicompost, cow dung manure, goat dung and poultry manure) and mass culture of *M. eudermatum* @ 10 gms/kg soil. with ($3.50X10^5$) cfu on weight bases. Sick soil without fungus and without amendments served as control. Fungus and amendments were uniformly mixed in sick soil before filling the pots. Three days old seedlings of brinjal Var. Pusa Purple Round free from nematode infection were transplanted in pots, @ one seedling per pot. Each treatment were replicates 4 times. The pots were watered regularly and observations were recorded on plant height, root length, number of galls nematode population in root and soil population per plant after 45 days of planting.

**Results and Discussion**

The observations (Table-1) on predacity test of *Monacrosporium eudermatum* against $J_2$ of *Meloidogyne incognita* showed that $J_2$ trapping increased with the increase of $J_2$ population in culture and the exposure time allowed for trapping. The minimum $J_2$ trapping (1.75%) was deserved in 100 $J_2$ population level at 24 hours exposure period. It further increase as 2.75, 3.50, 4.25 and 5.90 at 24 hours, 11.25, 16.00, 18.08, 23.12 and 27.35 at 48 hours, 29.75, 39.25, 48.91, 73.00 and 77.85 at 72 hours and 64.50, 77.75, 91.50, 95.69 and 96.90 percent at 96 hours exposure period in 100, 200, 300, 400 and 500 nematode population level respectively in ascending order. The increase in percent predacity with the increase in time and population may be attributed to the time required for fungus to initiate trap formation on the mycelium. Various scientist have reported that in *Monacrosporium eudermatum* nematode trapping device is initiated within 24 hours of exposure period in presence of nematode (Cooke, 1962, Jaffee, *et al.*, 1992; Persmark and Nordbring-Hertz 1997; Mankau, 1962, Kerry, 1987, Bandyopadhyay *et al.*, 2001; Kumar and Singh 2006; and Simon and Anamika 2011) [3, 6, 15, 13, 8, 1, 9-10, 16].

**Table 1:** Predacity effect of *Monocroeudermatum* against root knot nematode, *Meloidogyne incognita in vitro* condition.

| J2 Inoculum levels | % $J_2$ captured/Exposure period(In hours) | | | |
|---|---|---|---|---|
| | 24 | 48 | 72 | 96 |
| 100 | 1.75 | 11.25 | 29.75 | 64.5 |
| 200 | 2.75 | 16.00 | 39.25 | 77.75 |
| 300 | 3.50 | 18.08 | 48.91 | 91.50 |
| 400 | 4.25 | 23.12 | 73.00 | 95.69 |
| 500 | 5.90 | 27.35 | 77.85 | 96.90 |
| CD. at 5% | 0.66 | 1.01 | 1.38 | 1.31 |

The observations presented in table-2 on plant growth (i.e. plant height, root length), root galls and nematode reproduction parameters (i.e. Nematode population in root and soil, Eggs/Plant, Total Nematode Population and Multiplication factor) indicate that the use of *Monacrosporium eudermatum* @ 10 gm/kg soil in combination with the goat dung, poultry manure, vermi-compost and cow dung @ 15 gms/kg soil significantly increased the plant height and root length and reduced the galls/plant, nematode population in root and soil, eggs/plant, total nematode population and nematode multiplication factor significantly.

The plant height and root length was recorded minimum in inoculated check i.e.16.00, 3.62) followed by treated check i.e.18.50.7.50 and 18.12 and 6.12 in $T_1$, 18.00 and 5.50 in $T_2$, 17.75 and 5.37 in $T_3$, 17.10 and 6.12 in $T_4$, 17.07 and 5.25 in $T_5$ respectively in descending order. The decrease in plant height and root length in treatments may be due to nematode feeding on feeder roots and reduce the growth of the infected plants. The observation nematode on reproduction parameters of *Meloidogyne incognita* on brinjal (i.e. Nematode population in root and soil, eggs/ plant, total nematode population and multiplication factor) significant decrease in all the treatments over the inoculated check and increase over the treated check. The nematode population in root and soil, egg/plant, total nematode population and nematode multiplication factor was highest (121.75, 1198.00, 8642.50, 9962.25, and 6.64) in inoculated check followed by 56.75, 226.75, 3668.00, 3951.50 and 2.63 in $T_5$, 54.25, 207.25, 2718.75, 2980.25 and 1.99 in $T_3$, 49.50, 219.75, 2603.25, 2872.50 and 1.91 in $T_1$, 50.00, 218.75, 2593.25, 2862.25 and 1.91 in $T_4$, 50.50, 224.00, 2487.50, 2762.00 and 1.84 in $T_2$ with the minimum 26.50, 122.00, 1345.50, 1494.00 and 0.99 in treated check ($T_8$) respectively in descending order. The plant height and root length and nematode reproduction parameters where *M. eudermatum* was applied in combination with organic manures may be attributed to the fact that on decomposition the organic manures releases various organic acids which might have acted as the limiting factor for nematode activity and increase in nutrient supply to the plant and enhanced the tolerance level of plant against nematode feeding resulted in to increase over ($T_7$) and decrease in comparison to other checks ($T_6$ & $T_8$). Resulted is fully support by Taba *et al.*, (2001) [18] He reported that the effect of *M. eudermatum* and organic amendment reduction root knots multiplication and Linford and Yap (1938, 1939) [11-12] observed that out of five species of nematode trapping fungi incorporated in the soil, only a few gave a little control of nematodes. However, when nematode trapping fungi were incorporated with organic matter, they showed better effect. Bandyopadhyay, 2001 [1]; El-Nagdi *et al.* 2003 [4]; Mohamed *et al.* 2011 [14]; and Simon & Anamika 2011 [16]; also observed that *Monacrosporium eudermatum* reduced the population of *M. graminicola* in rice.

**Table 2:** Effect of *Monacrosporium eudermatum* in combination with organic manures on root- knot nematode, *Meloidogyne incognita* multiplication on brinjal.

| Treatments | Plant Height (In cm) | Root Length ( In cm) | Galls/ Plant | Nematode Population | | Eggs/ Plant | Total Nematode Population | M/F |
|---|---|---|---|---|---|---|---|---|
| | | | | Root | Soil | | | |
| $T_1$ | 18.12 | 6.25 | 27.75 | 49.50 | 219.75 | 2603.25 (51.02) | 2872.50 (53.59) | 1.91 |
| $T_2$ | 18.00 | 5.50 | 29.00 | 50.50 | 224.00 | 2487.50 (49.87) | 2762.00 (52.55) | 1.84 |
| $T_3$ | 17.75 | 5.37 | 27.00 | 54.25 | 207.25 | 2718.75 (52.14) | 2980.25 (54.59) | 1.99 |
| $T_4$ | 17.10 | 6.12 | 28.50 | 50.00 | 218.75 | 2593.75 (50.83) | 2862.25 (53.50) | 1.91 |
| $T_5$ | 17.07 | 5.25 | 29.75 | 56.75 | 226.75 | 3668.00 (60.56) | 3951.50 (62.86) | 2.63 |
| $T_6$ | 16.00 | 3.62 | 52.25 | 121.75 | 1198.00 | 8642.50 (92.96) | 9962.25 (99.81) | 6.64 |
| $T_7$ | 19.75 | 8.12 | - | - | - | - | - | - |
| $T_8$ | 18.50 | 7.50 | 1200 | 26.50 | 122.00 | 1345.50 (36.68) | 1494.00 (38.65) | 0.99 |
| C.D Value at 5% | 0.90 | 1.61 | 3.56 | 2.31 | 3.39 | 4.77 | - | - |

Observations are the mean of four replicates
*The figures parenthesis are squire root transformation values
**$T_1$ =** *M. eudermatum*@10g/kg soil + Goat Dung@15g/kg soil
**$T_2$ =** *M. eudermatum*@10g/kg soil + Poultry manure@15g/kg soil
**$T_3$ =** *M. eudermatum*@10g/kg soil + Vermicompost@15g/kg soil
**$T_4$ =** *M. eudermatum*@10g/kg soil + Cow Dung@15g/kg soil
**$T_5$ =** *M. eudermatum* alone@10g/kg soil
**$T_6$** = Inoculated check
**$T_7$** = Uninoculated check
**$T_8$** =Treated check
M/F=Multiplication factor

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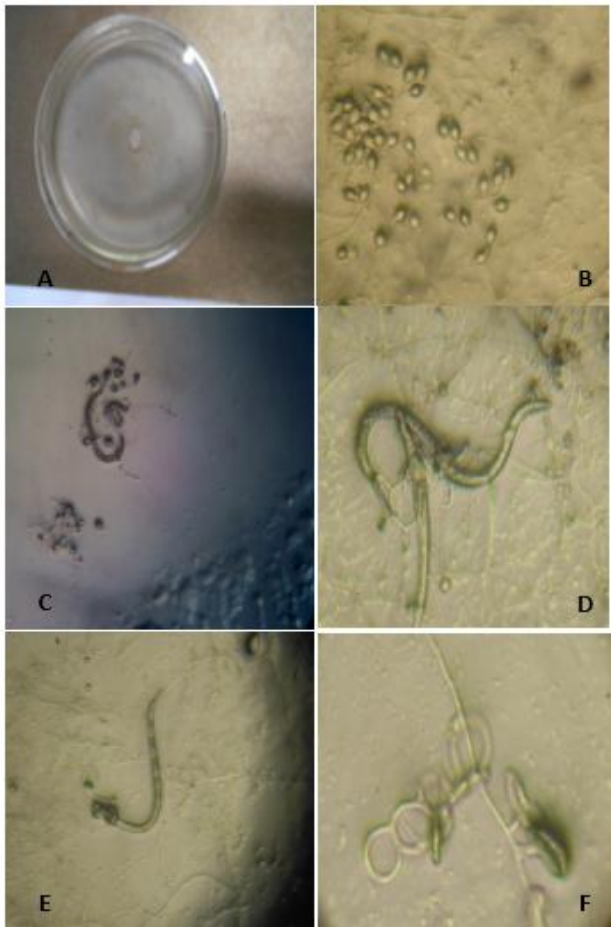


**Fig 1:** Nematode trapping fungus, *Monacrosporium eudermatum* (a) Pure culture (b) Conidia (c), (d), (e) Trap nematode (f) 3 Dimensional trap

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