Effect of Disease complex of *Penicellium*and root knot nematode on thegrowth and development of chilli (*Capsicum annum* L.) crop

Abstract:

The behaviour of fungal pathogens in a dormant or active state under different changes by infection of the host plant parasitic nematode was related to the function of fungi. Due to RKNs on the chilli in *Meloidogyne*infected pot culture, *Penicillium* sp. demonstrated plant growth-promoting characteristics and nematocidal activities, according to the findings of the current study. This fungus can be used as a growth promoter in Treatments 2 and 3, where a mixture of *Meloidogyne* sp. and *Penicellium*sp. showed higher growth rates and yellowing leaves in some pots, but no knots were found in the roots however, the current research may offer a theoretical basis for a growth promoter agent for better growth in Penicillium inoculated pots and In Nematode inoculated pots, Meloidogynesp can reduce plant growth. In both *Meliodogyne*sp and *Penicillium* sp inoculated pots, it was demonstrated that decreasing nematode population increased the growth habits of chilies in terms of number of leaves Therefore, it has been demonstrated that *Penicellium* decreases nematocidal action while promoting growth parameters in chilli plants, and that using preventative measures can somewhat lessen insect infestation in control pots.

Keywords: *Meloidogyne incognita*, *Penicillium*sp, growth promoter, crop productivity, chilli, biocontrol.

Introduction:

The chilli (*Capsicum annuum* L) is a good source of vitamin C. Capsaicin, an alkaloid element in chilies that has positive health effects, gives chilies their intensely spicy, pungent flavour (Ahmed,*et al.*, 2014). Chilies are a wonderful source of vitamins and minerals like magnesium, potassium, manganese, and iron.So, crop productivity is negatively impacted by biotic and abiotic environmental stress. Among the biotic elements causing the decrease in yield may be to blame for the crop's loss (Mishra *et al.*, 2023).*Penicilliumitalicum* and *Penicilliumdigitatum*Sacc. The two most significant and frequently mentioned postharvest infections in citrus. Extremely prolific sporulation is visible on infected fruit; white mycelium totally covers the fruit before being followed by the green and bluish spores of *Penicilliumdigitatum and Penicilliumitalicum*, respectively (Yadav *et al.*, 2018). Where these fungi infect the fruit, the distinctive terpenous stench spreads throughout the neighbourhood. It's entirely likely that if these fungi release enough ethylene, it will cause nearby fruits to ripen quickly. The growth of *P. digitatum* is stimulated by citrus volatiles (Ehteshamul-Haque and Ghaffar, 1994) Blue mould, independent of injuries, is more dangerous since it spreads throughout the box and immediately attacks good fruits. Because blue mould is a pathogen that nests, it generates enzymes that weaken nearby fruit and let fungus in (Starr, 1977). Since green mould does not spread through nesting. The association of nematodes and fungi on plants may be synergistic, additive, or antagonistic with respect to disease development and yield suppression (Aghale*et al.*,2017). Because of the physiological changes that nematodes generate in the plant, synergistic relationships between fungi and

nematodes typically result in an increase in fungal infections.Numerous crops have been affected by nematode-fungal disease complexes containing *Meloidogyne*sp. (Sikandar*et. al.*, 2019) In order to investigate the many interactions between *Meloidogyne incognita* and *Penicillium*spon chilli, an experiment was carried out.

❖ **Material and Methods:**

The study was carried out at Village Perua,Medinipur, West Bengalin the year 2020, Under the Department of Plant Protection, SHUATS, Prayagraj.

- **Materials required:**

✓ 20 pots, Chilli seedlings, nematode infested okra plant,penicilliummold on citrus fruits,scale,water can, khurpi
✓ Plant selected for the experiment: - Chilli
✓ Nematode: root knot nematode taken from Okra plants.
✓ Fungus used-penicillium
✓ Date: 1st September to 28th of December.
✓ Seedlings collected from Local Market.

- **Collection of Chilli Seedling:**

Chilli seedlings were collected from local market and raise them in proper condition under pot cultivation during July to December 2020. Soil and some FYM also mixed for pot mixture and then ready for sowing.

- **Collection of *Meliodogyne incognita*and Fungus *Penicellium*sp:**

For one treatment freshly hatched second stage juveniles of *Meloidogyne incognita*collected (Fig.2)from *Meliodogyne* infestation roots of Okrathen cut into small pieces of roots by scissure and make suspension and 1g mycelial mat of *Penicellium*in the form of suspension was used (Nagnathan, 1994). 21 days oldCitrus fruitscovering with white fungus(fig.1)were used for inoculation. Just beforeinoculation, roots of chilli seedlings were exposed by carefully removing the top layer of soil and the required quantity of nematode suspension and fungus inoculum was poured uniformly all around the exposed roots. Exposed roots were immediately covered with soil properly. Un-inoculated plants served as control. Each treatment was replicated four times in earthen Pot culture. Plants were watered as and when required. Inoculations were made according to the following process. Treatments are

T1= Un-inoculated (control)
T2 = Inoculated with *M. incognita pot*
T3=Inoculated with *Penicillium*sp
T4= Inoculated with *Penicellium*sp and *Meliodogyneincognita*

Plate.2 Nematode collection from Root knot of okra.

❖ **METHODS:**

- All the pots were filled with Soil mixed of dry cow dung and kitchen waste
- In pots T3 and T4 pots citrus infested wi covered.
- After 24 hrs of Chilli seedlings were planted in the soil and light irrigation were given
- When plants attain 3-4 cm height the root knot nematodes (Starr *et al.*,1987)taken from okra plant were put in the rhizosphere region of Chilli plant.
- Watering was done regularly at an interval of 2-3 days.
- Various observations were done timely to check each and every change in the plant growth and development.

❖ **OBSERVATIONS:**

Various parameters were taken for the observation with nematode and *Penicillium* inoculated pots at different time intervals. They were following:

- ✓ Number of leaves emerged
- ✓ Plant height
- ✓ Nodes and internodes developed
- ✓ Nematodes galls present in root region

➢ **Estimation of various Plant growth Parameters**:

Plant growth Parameters were determined on the basis of nodes,internodes. Heights, No of Leaves at 15, 30, 45, 60, 75, 90, days after sowing intervals were taken. Plants were uprooted after days of inoculation and roots were washed thoroughly in slow running tap water. Most care was taken to avoid loss and injury of root system during the entire operation. Height of plant was recorded in centimetres from the cut end to the tip of first leaf.For measuring Nematode infestation,no of galls per roots were observed (Jain, 1992).For interpretation of results, the reduction in plant growth was calculated in terms of percentage reduction for all plant growth parameters.

Root-knot and root-rot estimation: The galls produced by root-knot nematode (*Meloidogyne incognita*) wereestimated by counting the number of galls per root system 15, 30, 45, 60, 75, 90, days after sowing (James, 1996).

Plate:3. Recording data

Plate: 4. Measurement of plant height

Plate.5 Number of leaves counted per plant.

Plate 6: Growth of plant

❖ RESULTS AND DISCUSSION:

- **Influence of *Meloidogynesp* and *Penicilliumsp* on vegetative growth of chilli:**

It wasproved that, from the Table 1 that the mean number of nodes of chilli plant with *Meloidogyne incognita* (Mi) *Penicilliumsp*, no treatment (control) individually, in this treatment mean number of Nodes minimum in Nematodes inoculated pots 90 Days after sowing (DAS) is16.5 Nodes had seen& In penicillium infested pot mean number of nodes are maximum at 90DAS 26.5,as compare to control 19 nodes and in T4 20 nodes had seen at 90DAS.

It was evident from the Table 1 that the mean number of internodes of chilli plants which is inoculated with*Meloidogyne incognita* (Mi) *Penicilliumsp*, no treatment pot (control) individually, in this treatment mean number of internodes in Nematodes inoculated pots at 90 Days after sowing (DAS) minimum have seen 10.5 and In penicillium infested pot mean number of nodes maximum at 90DAS 17.5 as compare to control 13internodes had seen.

From Fig 1 result shown that, maximum mean height had seen in penicillium inoculated pot was 67.5cm and minimum mean height of *Meloidogyne*treatment infested pot was 41 cm at 90DAS.Mean number of leavesmaximum at 90DAS are 67.5 in number in T3 *Penicellium* inoculated pots(plate 8) and in T4 condition 42,5 leaves, and mean height at 90DAS is 33cm andminimum number of leaves had seen in control pot is 38.5 at 90DAS.

Table 2 shown that, in nematode infested pot, first root knot had seen at 75 DAS and at 90 DAS had seen at 90DAS in root portion of chili plant (Plate 10&11) but in both T3 treatment shown that there is no nematode infestation occurred by nematode means no galls/knots seen (Golden, and Gundy, 1975).and in control pot various insect attack like chili mites, thrips, bug, *Zygogramma* beetle seen and leaf hole symptoms also seen (plate.7)

Table: 1 Effect of *Penicillium*Fungus and *Meloidogynesp*on growth parameters (Nodes, Internodes) of chilli plant:

S.No	Treatment	Mean number of Nodes						Mean number of Internode					
		Days after sowing						Days after sowing					
		15DAS	30	45	60	75	90DAS	15	30	45	60	75	90
1.	Uninoculated (Control)	4	7.5	11.5	13.5	16	19	1	2	3	6	8	13
2.	Inoculated with *Melidogyne*	4.5	7.5	10	13	15	16.5	1	2	2.5	4	6	10.5
3.	*Penicillium*Inoculated	5.2	8.5	13	17	22	26.5	2.5	4	6.2	9	12	17.5
4.	Both *Penicillium* and *Meliodogyne*	5	8	11	14	16.5	20	2	4	5	7	10	13.5

Fig.1. Effect of *Penicillium* Fungus and *Meloidogynesp*ongrowth parameters of chilli plant:

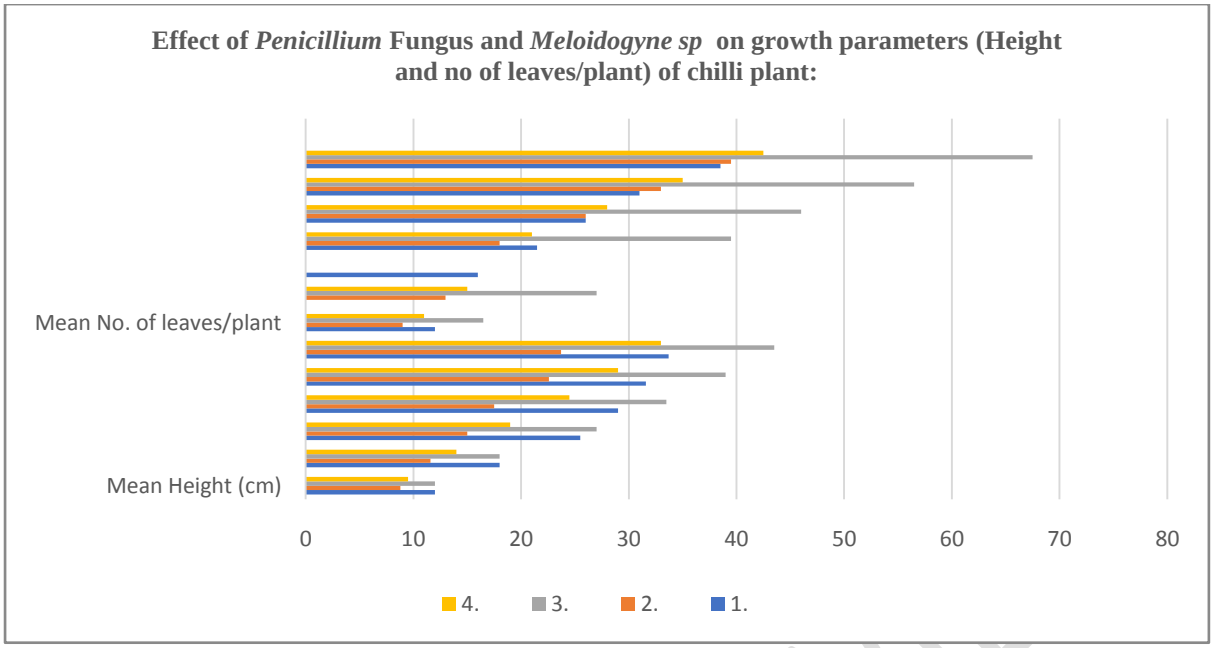

Table: 2. Number of root knot in *Meloidogyne* inoculated and mixture of *Meliodogyne*and *Penicillium*inoculated pots

S.No	Treatment	No. of Root knot/Plant root					
		Days after sowing					
		15DAS	30	45	60	75	90DAS
1)	Uninoculated (Control)	00	00	00	00	00	00
2)	Inoculated with *Melidogyne*	00	00	00	00	1	3
3)	*Penicillium*Inoculated	00	00	00	00	00	00
4)	Both *Penicillium* and *Meliodogyne*	00	00	00	00	00	00

- **Insect infestation:**Thrips, Mites, *ZygogrammaBettles*, bugs were seen mostly in Control pots then treated pots

➢ **Preventive Measures taken to prevent**	A mixture of neem leaves and clove in water were sprayed on each plants in the early morning to avoid infestation Marigold plants were also planted in between the okra plants to see whether they act as trap crops(Kumar*et al.*, 2017).

Plate.7 various Insect infestation seen in control plot.

Plate.8 Growth pattern of chilli is vigorous in only penicillium inoculated pots.

Plate.9 Nematode Inoculated pots

Plate10 three small root knot seen in root of chilli root.

Plate.11 Both *Penicillium*and *Meloidogyne*mixture pots.

❖ **Conclusion:**

The role of fungi was related to the behaviour of fungal pathogens in a dormant or active state under changed conditions created through infection of the host plant parasitic nematode. Based on the finding of the present study, it was concluded that *Penicillium*sp showed plant

growth-promoting characters and nematocidal activities because RKNs on chilli in *Meloidogyne* inoculated pot culture. This fungus can be considered as a use for growth promoting agent, and in both Treatment 2 and 3where mixture of*Meloidogyne*spand*Penicellium*sp showing growth rate is increasing and in some pot yellowing of leaves are there but there is no knot present in roots. However, present findings may provide a theoretical foundation as a growth promoter agent for better growth in *Penicellium* inoculated pots and In Nematode inoculated pots, *Meloidogynesp*can decrease plant growth and in both *Meliodogyne*sp and *Penicellium*sp inoculated pot proved that decreasing nematode population and increase growth habits of chilies in term of number of leaves and height. So, it has proved that, *Penicellium* reduce the nematocidal activity and promote growth parameters in chili plants and preventive measure helps to reduce of insect infestation at some extent at control pots.

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