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Ability of *Pleurotus ostreatus in vitro* to kill different plant parasitic nematodes

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Abstract
Pleurotus Ostreatus has ability to act as a Nematophagous fungus, it paralyses and killed nematodes when it come in contact with the hyphae by means of some toxin secreted by the *Pleurotus* fungus at *in vitro* condition. In this experiment five different plant parasitic nematodes were assessed *in vitro* for understanding their killing behavior and mortality period. One species of nematode is resistant to *P. Ostreatus*, while the other four species are killed by the toxin droplet. Oyster mushrooms are Nematophagous toward some nematodes but are also consumed by others in three of the four families assayed. Species-specific interactions point to the need for studies of the host ranges of "Nematophagous" fungi, especially if they are to be used for biological control. Oyster mushroom shows antagonistic activity against nematodes within 24 hours. Nematodes were inoculated on water agar plates on which a single sparse fungal colony of one of the above mentioned fungi was grown. Different types of nematodes were quickly immobilised after inoculating the plates with *Pleurotus* species, and the mortality percentage (from 23.33 to 100% in 3h to 24h periods) of nematodes varied among nematode species.

Keywords: Oyster mushroom, nematodes, mortality percentage

Introduction
Root-knot nematodes are mainly involved in causing damage to vegetable crops causing estimated loss of up to 21.3% to agricultural products annually. *Meloidogyne incognita* and other plant parasitic nematodes are highly destructive to vegetable and agricultural crops, with rapid multiplication in seasonal vegetable crops such as tomato, brinjal, okra, spinach, and other crops (Gupta *et al*., 2021; Kumar *et al*. 2020) [1, 2]. Many farmers are looking for alternative methods to chemical approaches for the management of nematodes in the soil. Oka (2010) [3] reviewed the effects of a series of organic amendments, including green manures, compost, spent mushroom substrates and nematode-antagonistic plants, on suppressing the populations of plant-parasitic nematodes. The spent oyster mushroom compost containing *Pleurotus Ostreatus* secretes endotoxin compound i.e. against nematodes. *Pleurotus Ostreatus* is known to exude an endotoxin from the fungal hyphae known. as trans-2-decenedioic acid (Kwok *et al*., 1992) [4], a toxic compound that paralyses the nematodes on contact, colonize and digest the nematode Furthermore, use of mushroom compost with *Beta vulgaris* in the field by directly incorporating the mushroom compost into soil at 3% (w/w) suppressed more than 85% of sugar beet cyst nematode (*Heterodera schachtii*) cysts, Palizi *et al*. (2009) [5]. Although direct incorporation of the mushroom substrate into the soil could ensure direct contact of the mushroom mycelia with the root system, the amendment rate needed for nematode suppression using this approach could be found feasible in the small field or even at the garden-scale if ample supplies of the mushroom compost are not available (Manan *et al*., 2021) [6]. Overall, this finding has focused on *Pleurotus* species' ability to kill different plant parasitic nematodes, indicating a gap in knowledge regarding the action of the killing mechanism of plant parasitic nematodes. Therefore the present study was focus on potential of *Pleurotus Ostreatus in vitro* to kill several plant parasitic nematodes

Material and Methods
Isolate of *Pleurotus* fungus was collected from the fruiting body formed on the bark of mango trees from Vinadhya region of Mirzapur district of Eastern Uttar Pradesh and experimental sample were kept in sterilized plastic bag at 4 °C.

Small pieces of fruiting body was kept in the sterilized petri plates on Potato dextrose agar medium and fungal hypha tip method was used to purified fungus and incubated at 25 °C for 7days All the five plant parasitic nematodes *viz Xiphinema index*, *Pratylenchus brachyurus*, *Anguina tritici*, *Meloidogyne incognita* and *Tylenchulus semipenetrans* were collected from the agriculture fields and their interaction with the fungus was observed *in vitro* condition.

Results and Discussion

Based on microscopic as well as morphological characterization, this fungus was identified as *Pleurotus Ostreatus*. Isolated fungi from mango bark represent a well-defined group of Basidiomycota fungi of the order Agaricales and family Tricholomataceae. They are characterized by the production of fruit bodies with an eccentric stalk and a wide cap shaped like an oyster shell, with the widest portion of the cap being away from the stalk.

Five plant parasitic nematode species was tested with *P. Ostreatus*, among them *Meloidogyne incognita* were found more sensitive and become paralysed and killed in less time followed by the *Tylenchulus semipenetrans*, *Pratylenchus brachyurus*, *Anguina tritici* and *Xiphinema index* species respectively. These plant parasitic nematodes are killed by the toxin executed in the form of droplets (Figure 1and 2).

10 nematodes of *M. incognita*, *T. semipenetrans*, *P. brachyurus*, *A. tritici* and *X. index* were transferred on the fresh culture of *P. Ostreatus* and the mortality percentage of nematodes was observed during the period of 1hrs, 3hrs, 6hrs, 12hrs and 24hrs. In *M. incognita* 29% killing was observed within one hour while 100% mortality was observed within 3 hrs. (Figure 1&2). Within three to six hours period, the highest mortality rate of nematodes was seen in *M. incognita* (100%), followed by *T. semipenetrans* (45% & 61%), *P. brachyurus* (28% & 37%), *A. tritici* (12% & 19%), while no killing was observed during this interval of time in *X. index.* During 12 and 24 hours, maximum mortality was observed with *T. semipenetrans* (74% & 85%), followed by *P. brachyurus* (48% & 61%), *A. tritici* (27% & 34%). The minimum mortality was observed *in X. index* 13 to 17 percentage mortality even after the 24hrs period (Figure 1).

These finding support the earlier work and provide evidence that oyster mushroom are more specialized and robust killing for saprophytic and plant parasitic nematodes as a bio-control agent (Elkhateeb and Gaziea, 2021) [7]. Our research adds a new layer to this complexity; differential interactions were observed of plant parasitic nematodes with the *Pleurotus Ostreatus*. In this study, plant parasitic nematodes (*Meloidogyne incognita Tylenchulus semipenetrans*, *Pratylenchus brachyurus*, *Anguina tritici*n and *Xiphinema index*) were taken in account due to some recent reports that *Pleurotus* species were found able to kill some phyto pathogenic nematodes. Previously Marlin *et al*. (2019) [8] found that, plant parasitic nematodes were either resistant or susceptible to *Pleurotus* spp. This research had focused on mortality mechanism of nematodes. In fresh culture of *Pleurotus* spp small size nematode body mass i.e. *M. incognita* was observed more sensitive and take less time to kill than the big size nematodes like (dagger nematode) *Xiphinema index* which take more time to parlaysed and killed due to slow release of toxin effect in their body. In few research, it had been found that *Pleurotus* endo-toxin such as S-coriolic acid, linoleic acid, anisaldehyde, p-anisyl alcohol, 1-(4-methoxyphenyl)-1,2-propanediol, and trans-2-decenedioic acid have ability to paralyzed and killed saprophytic as well as few plant parasitic nematodes (Singh *et al*., 2017,) [12]. Moreover, our findings focused on some resistant species for mortality of phyto pathogenic nematodes. Age-related resistant could also be a factor for this results, we have used individuals of varying life stages in our assay or resistant plant parasitic nematodes may have evolved a mechanism to detoxify toxins before paralysis. The killing mechanism for susceptible plant parasitic nematodes to these toxins is also yet to be determined the toxins may simply be recognition or binding sites in cell receptor of susceptible (sensitive) nematodes while resistant plant parasitic nematodes may have evolved a mechanism to detoxify myco-toxins before paralysis and protect it (Jansson *et al*., 1984, Waller., 1993) [10, 11].

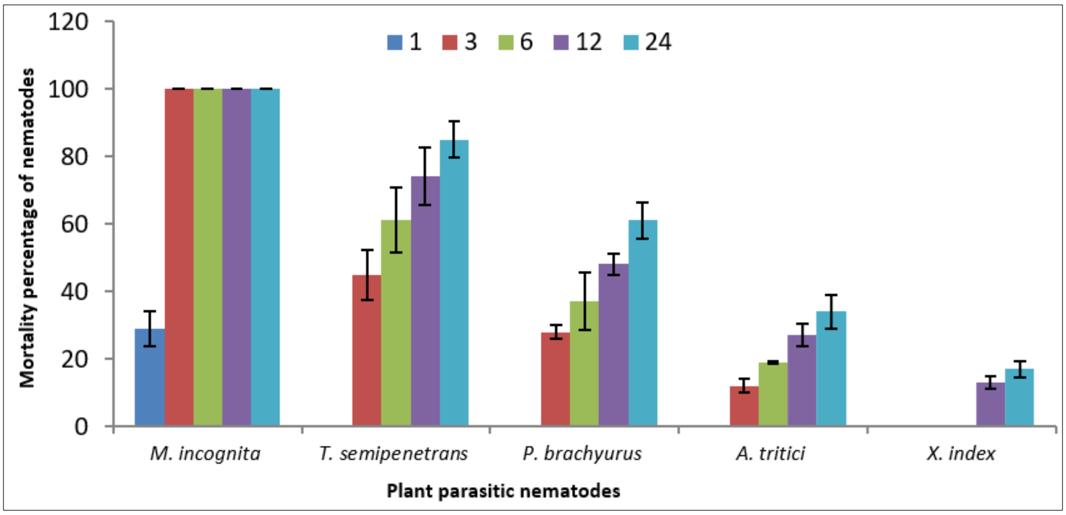

Fig 1: Mortality percentage of nematode with different time interval

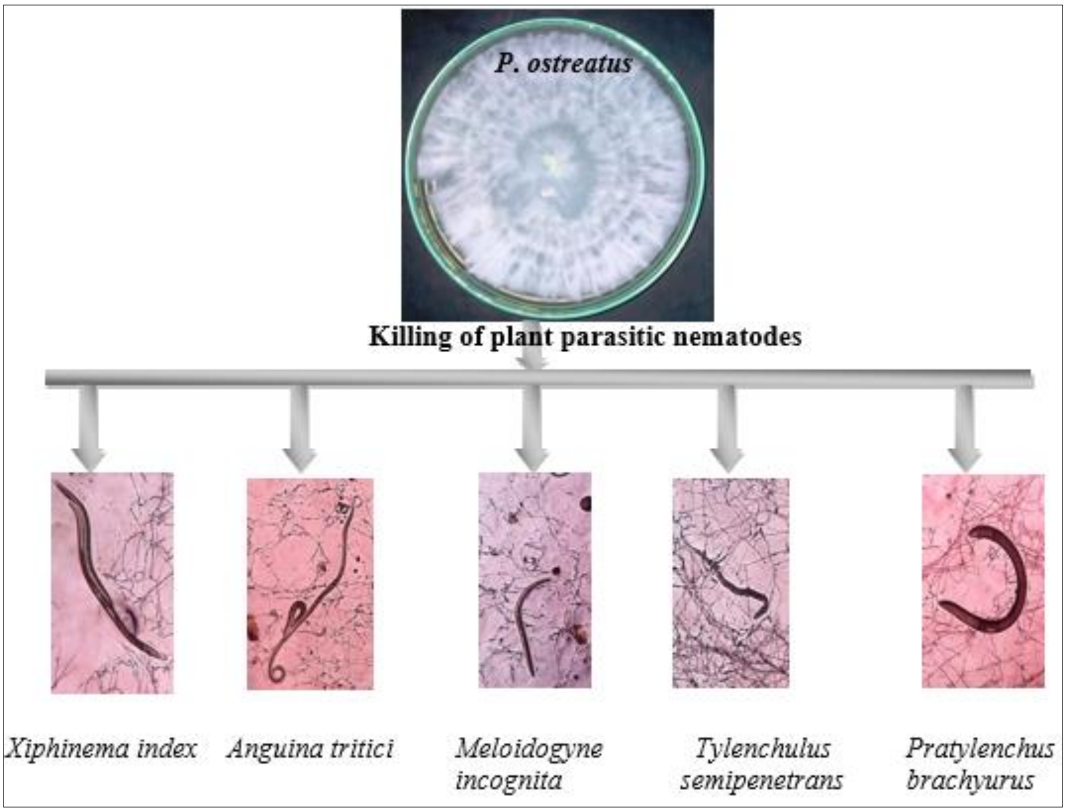

Fig 2: Plant parasitic nematode killing ability of *P. Ostreatus*

Conclusion

The edible fungus *Pleurotus Ostreatus* was isolated and cultured from the bark of mango tree. The hyphae of fungi emerging from the fruiting body, produces secretory cells with toxin droplets in culture media, which immobilize the nematode by contact with the mouth region mostly. Earlier screening revealed that these fungi killed only saprophytic nematodes through the mouth part, but similar observations in the plant parasitic nematode *Meloidogyne incognita* and other nematodes suggest that there is no obstacle from stylet in paralyzing and killing the plant parasitic nematodes and in future could be used as an alternative new approach to manage plant parasitic nematodes.

References

1. Gupta SK, Singh RK, Patel AK, Banjare U. Role of Growth-Promoting Bacteria as Bio control Agent against Root Knot Nematode of Tomato. Bio Sci Bio techno Res Com. 2021;14:4.
2. Kumar V, Khan MR, Walia RK. Crop loss estimations due to plant-parasitic nematodes in major crops in India. National Academy Science Letters. 2020 Oct;43(5):409-412.
3. Oka Y. Mechanisms of nematode suppression by organic soil amendments - A review, Applied Soil Ecology. 2010;44(2):101-115.
4. Kwok OCH, Plattner R, Weisleder D, Wicklow DT. A nematicidal Toxin from *Pleurotus Ostreatus* NRRL 3526. Journal of Chemical Ecology. 1992;18(2):127-136.
5. Palizi P, Goltapeh EM, Pourjam E, Safaie N. Potential of oyster mushrooms for the bio control of sugar beet nematode (*Heterodera schachtii*). Journal of Plant Protection Research. 2009;49:1.
6. Manan S, Ullah MW, Islam M, Atta OM, Yang G. Synthesis and applications of fungal mycelium-based advanced functional materials, Journal of Bioresources and Bio products. 2021;6(1);1-10.
7. Elkhateeb WA, Daba GM, Soliman GM. The anti-nemic potential of mushroom against plant-parasitic nematodes. Open Access Journal of Microbiology & Biotechnology. 2021;6(1):1-6.
8. Marlin M, Wolf A, Alomran M, Carta L, Newcombe G. Nematophagous *Pleurotus* Species Consume Some Nematode Species but Are Themselves Consumed by Others. Forests. 2019;10(5):404.
9. Singh RK, Pandey SK, Singh D, Masurkar P. First report of edible mushroom *Pleurotus Ostreatus* from India with potential to kill plant parasitic nematodes. Indian Phytopathology; c2018, 72(8).
10. Jansson HB, Nordbring Hertz-B. Involvement of sialic acid in nematode chemotaxis and infection by an Endoparasitic Nematophagous fungi. J Gen Microbiol. 1984;130(1):39-43.
11. Waller PJ, Faedo M. The potential of Nematophagous fungi to control the free-living stages of nematode parasites of sheep: screening studies. Veterinary Parasitology. 1993 Sep 1;49(2-4):285-97.
12. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. Int J Res Med Sci. 2017 Jul;5(7):3264-7.
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