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Different trapping and Infection mechanisms of Nematode-trapping fungi against Plant parasitic nematodes

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Abstract:-

Nematophagous fungi have more effect full control of plant parasitic nematode. They naturally occur in the rhizosphere of the tree and horticultural crops. They kill and parasitize nematodes by different mechanisms like Adhesive knobs, Adhesive branches, Adhesive networks, Adhesive spores, and Ring traps. Some fungi have different mechanisms like Zoospore to kill the nematodes.

Keywords: Nematode trapping fungi, Trapping mechanism, Nematode, Adhesion, Trap

Introduction:

More than 200 species of taxonomically varied fungi are classified as nematophagous (nematode-destroying) fungi because they all can assault and consume live nematodes, including juveniles, adults, and eggs. The saprophytic and parasitic properties of the fungi vary. Endoparasites primarily rely on nematodes for nutrition, although certain trap-forming and egg-parasitic fungi can thrive in soil saprophytically. The fungal mycelium's capacity to trap nematodes is linked to a particular stage of development. To catch nematodes by adhesion or mechanical means, the trapping fungi have evolved complex hyphal structures, such as hyphal nets, knobs, branches, or rings. Spores from endoparasite fungi either stick to the nematodes' surface or are ingested by them, attacking the nematodes with their spores. Irrespective of the infection method, the result is always the same: the death of the nematode. *Arthrobotrys* spp., including *A. oligospora*, *A. conoides*, *A. musiformis*, and *A. superba*, are examples of NTFs. On the other hand, *A. dactyloides* uses constricting rings to mechanically catch worms by causing the ring cells to enlarge. Adhesive knobs and adhesive branches (also known as adhesive columns) are produced by *Dactylella gephyropaga* and *Monacrosporium*,

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respectively. *M. haptotylum* generates both nonconstricting rings and sticky knobs. *Catenaria anguillulae* is an endoparasite that uses its zoospores to infect nematodes and lives inside of them in a vegetative state. Nordbring-Hertz, B., *et al* (2006).

Development of trap

Recognition: None of the nematode-trapping species have been observed to exhibit simple host specificity. Nematodes are drawn to the fungi's mycelia, where they may cause the construction of traps, and they are drawn even more to spores and completely formed traps. A lectin, a protein in the fungus that binds carbohydrates, and a nematode's carbohydrate receptor may interact in this stage. The ability to identify the host is likely crucial for the infection's later stages, such as the nematode cuticle's penetration.

Attraction: Compounds emitted from the mycelium, nematode-trapping fungus traps, and endoparasite spores all attract nematodes. The shape and, by extension, the saprophytic/parasitic abilities have a significant impact on the fungi's attractiveness.

Adhesion: Under an electron microscope, nematodes can be seen contacting and adhering to the spores and traps of nematophagous fungi. The adhesive phase is limited to a unique three-dimensional structure in *Arthrobotrys spp.* Adhesive bud is how *Drechmeria coniospora* conidia adheres to the worm cuticle, whereas *Catenaria anguillulae* zoospore development uses an adhesive phase. *Phymatopaga Dectylallina* forms an adhesive knob for nematode parasitization. *Dectylellina gephyropaga* attaches itself to the parasitic nematodes of the plant by means of sticky branches. The plant's parasitic nematodes are the attachment point for *Dectylellina gephyropaga*, which grows sticky branches. The two-dimensional structure that *Monecrosporium eudermata* creates is intended to hold the nematodes.

Penetration: It has been demonstrated that nematode-trapping fungus significantly affect the management of plant parasitic nematodes in crops by forming a specialized penetration tube to break through the nematode's cuticle.

Digestion of nematode: The nematode is digested by the infecting fungus. Once inside the nematode, the penetration tube of nematode-trapping fungi swells to form a large infection bulb The development of the bulb and trophic hyphae occurs in parallel with dramatic changes in the ultrastructure and physiology of the fungus. The dense bodies are degraded in the trap cells and the bulb.

Different trapping structures form by the nematode-trapping fungi

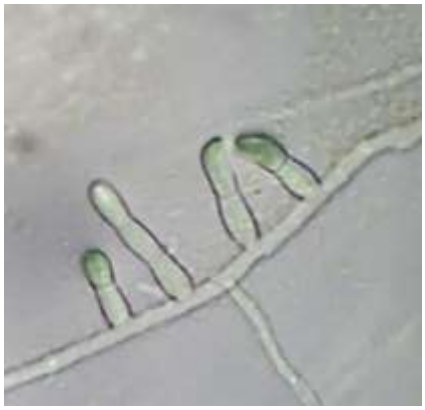
1. **Adhesive network:** One of the most common trapping mechanisms of nematode-trapping fungi. In order to attract

and capture plant parasitic nematodes, the fungi's mycelium outgrowth initiates the formation of two and three-dimensional networks, which resemble a net. These networks secrete certain sticky chemicals. Ex. *Arthrobotrys conoids, A. oligospora, A. thaumasia* fungi form a three-dimensional network, and *Monecrosporium eudermata* is a two-dimensional network-forming fungus. KUMAR, D. (2017)

Three-dimensional (3D) network of ***Arthrobotrys conoids***

Two-dimensional (2D) network of ***Monecrosporium eudermata***

2. **Adhesive hyphal branches (column):** Adhesive hyphal columns consist of one to more than one or several elongated cells produced densely side-by-side. When the inclusion of adhesive branches they are a form of scalariform network. Ex. *Dectylellina gephyrophaga* with inclusion branch. (two-dimensional network) KUMAR, D. (2017)



Adhesive branches of ***Dectylellina gephyrophaga***

Nematode trap by branches of the ***Dectylellina gephyrophaga***

3. **Adhesive sessile and stalked knobs:** Adhesive knobs are morphologically unique inflated cells that are typically closed along the hypha and can be either short (sessile) or long (stalked). Ex. *Dectylellina phymatopaga* is a producing

sessile knob and *Dectylellina heptotylum* appears with stalked knob. Kumar, D. (2024)

Stalked knob of ***Dectylellina heptotylum***

Sessile knob of ***Dectylellina phymatopaga***

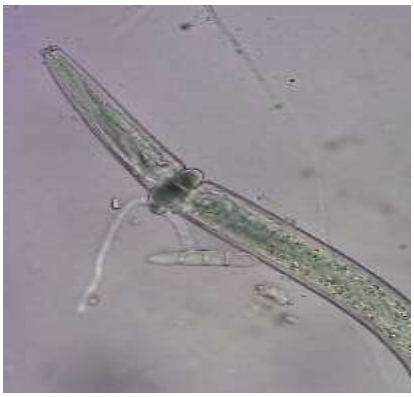
4. **Non-constricting ring:** Constricting rings and these kinds of traps are comparable, but when a nematode enters the ring, the cells do not expand. formed by the prostrate septate hyphae's erect lateral branches. Ex. *Dectylellina heptotylum* produced both stalked knob and non-constricting ring. KUMAR, D. (2017).

Non-constricting ring
Dectylellina heptotylum

Non constricting ring
Dectylellina heptotylum

5. **Constricting ring:** The constricting ring is three-celled and the most sophisticated trapping device that captures nematodes. When a nematode moves into the ring, it triggers a response such that the three cells composing the ring rapidly swell inward and close around the nematode. Ex. *Arthrobotrys dactyloides* and *Drechslerella brochopaga*. KUMAR, D. (2017).

Constricting ring of
Drechslerella brochopaga



Swelling of constricting ring cell after Nematode traps and kills them

6. **Adhesive spore:** Fishhooks A distinct strategy is used by species of *Harposporium,* which releases hook-shaped spores into the soil. Although the spores are small enough to be ingested by a grazing worm, their form causes them to frequently become lodged in the nematode's "throat". As the spores sprout, they fill the nematode's body and begin to consume its contents. The nematodes shell is broken by the fungus then forms structures on which a new spore will grow and be released into the soil to capture other nematodes. Ex. *Harposporium anguillulae.* Esser, R. P., & El-Gholl, N. E. (1992).

Fishhook-like adhesive spore of
Harposporium anguillulae

Nematode parasitized by
Harposporium anguillulae

7. **Infected by Zoospore:** One example is a member of a small family of zoosporic fungi that was formerly classified as chytrids. With just one whiplash flagellum, its zoospores differentiate within zoosporangia within the host body, then break free from the tip of a single exit tube and swim in the direction of their nematode prey. On reaching a host, the spores encyst and germ tubes enter the body through orifices or penetrate directly

through the cuticle to initiate a new infection**.** Ex. *Catenaria anguillulae.* Singh, K. P. *et al* (2012).

Zoo-sporangium filled with zoospore

Nematodes infected by ***Catenaria anguillulae***

Conclusion:

All the nematode-trapping fungi are found in Indian soils naturally. They are more capable and affect full control of the nematode naturally. Nematophgous fungi have different parasitic mechanisms to kill and digest plant parasitic nematodes. They are alternative options for nematicide and other chemicals.

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