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An Exploration on the Nematodes for human and domestic animal illnesses

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Abstract

Background: It is estimated that the more than 4100 species of phytoparasitic nematodes cause an annual economic loss in the agricultural sector of close to $125 billion. It is crucial to understand the key areas of study and issues with nematodes that impact plants. Methods: Because of this, an analysis based on bibliometric data was conducted to trace the current state of global research in this area and identify the main lines of inquiry, their priorities, and their evolution. Results: This will enable us to define strategic trajectories for the advancement of this study. Conclusions: The analysis has allowed us to determine that interest in nematodes that influence plants has continued to develop over the past few decades, and that tomato, soybean, and potato crops, as well as nematodes of the genera Meloidogyne and Globodera, are the ones that attract the most attention. Additionally, we have noted that biological control and host-parasite interaction are the primary areas of this field's research.

Keywords: nematodes; phytoparasite; bibliometric; Meloidogyne; tomato;

Introduction

Nematodes that parasitize plants and have dense populations reduce yields in most agricultural crops by amounts that are economically significant. Nematodes that parasitize plants cause about 12% of the world's food production to be lost. Plant-parasitic nematodes may cause a US$121 billion global economic loss. In India, the annual loss in 24 crops from economically significant nematodes is estimated to be around Rs. 21068 million. The preventable yield loss caused by Meloidogyne incognita in vegetable crops is as high as 40.5%. Because chemical nematicides are linked to environmental and health risks, the development of novel techniques to control these nematodes is crucial. Utilizing their natural adversaries is an alternative strategy for managing plant-parasitic nematodes. The nematode-destroying fungi, which are a class of soil-dwelling fungus that are natural enemies of plant-parasitic nematodes, are among them and significant. A approach that is environmentally sustainable uses nematode-destroying fungus as a biocontrol agent, either on their own or in conjunction with other worm management techniques. In soils harboring nematode-eating fungus, Linford made the first attempt to lower the number of plant-

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parasitic nematodes. A vast variety of fungus makes up nematophagous fungi, also known as nematodextrin-producing fungi. They are predatory, pathogenic, or parasitic, and some of them infect and consume nematodes. The majority of nematode-eating fungi are saprophytic in soil, but when a host is present, they transition into a parasitic phase that is primarily seen in soil with high organic matter concentration. There are already about 700 species of nematode-eating fungus known based on the nematicidal action mode.

Nematode- trapping or predacious fungi

Approximately 75% of the 200 nematode parasites, predators, and diseases that are now recognized are nematode-destroying fungi. Each group uses a distinct kind of trapping tool to attach to or attack nematodes. From the tropics to Antarctica, they can be found anywhere in the world. The majority of them have the ability to develop as parasites using nematodes as food and as saprophytes using decomposing organic waste as substrate. Nematicidal fungi are most abundant in the top 20 cm of the soil horizon, and very few are found below the depth of 40 cm. The Cretaceous era mentions nematode-trapping fungi, which have been discovered petrified in amber that is 100 million years old. Fresenius originally provided a description of A. oligospora in 1852. In 1870, A. oligospora reportedly formed networks of hyphal slings or loops, according to Woronin. According to Zopf, a fungus can ensnare a living thing. Drechsler, an American mycologist, released a significant paper that recognized 11 new species. Numerous fungi have predatory action against eelworms, according to Duddington. Nematode-trapping fungi were more prevalent in the rhizosphere, according to Peterson and Katznelson, Garspard and Mankau , and Persmark and Jansson The colonization of A. oligospora in epidermal cells may be used to trap newly hatched juvenile plant-parasitic nematodes.

Structures of nematode -trapping fungi

- The hyphal structure, which has an adhesive layer covering some or all of its surface, serves as the trapping mechanism for these fungi . When these fungi's scant mycelia come into touch with nematodes, they naturally differentiate into useful traps. The mycelial traps then break through the nematode cuticle, kill the nematodes, and consume their insides branch

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or adhesive hyphae One or more cells make up the adhesive hyphae or branch that infects nematodes. A few swelling cells make up the short, upright hyphae that makes up the sticky column.

Adhesive knobs

The hypha that forms adhesive knobs has globose or subglobose cells that are either sessile or have an erect stalk. The knob has the ability to separate from the mycelia, move with the nematode, pierce the worm cuticle, and ultimately infect the nematode. Typically, an infection consists of one knob and multiple related hyphal components. The cuticles of nematodes are infected at many sites. An infection peg and infection bulb are produced by adhesive knobs. Within the nematode body, the infection bulb multiplies before breaking down and absorbing the nematode body's contents. They produce an exterior hyphal structure that resembles vegetative mycelium after breaking through the worm cuticle. The nematode- and stage-specific Monacrosporium ellipsosporum traps have a passive effect.

- **Adhesive network**

A straight lateral branch is first formed by the vegetative hypha before it curves to join the parent hypha. The hypae give rise to appressorias, which pierce the entangled worms and cause the creation of an infection bulb and infection hyphae that digest the nematode body's contents.

- **Mechanical structures**

Constricting ring: As soon as a nematode enters the ring and securely loops the prey, the three ring cells are activated to rapidly inflate inwards. One of the three ring cells produces an infection peg, and once the infection peg has entered the worms' body cavity, an infection bulb forms. The internal nematode contents are digested and absorbed by the infection bulb. Increased vacuolation, osmotic mechanisms, and the presence of membrane-bound inclusions in traps cause rings to inflate, which may act as a matrix for plasma membrane expansion on a trap's inner face. Cells of the ring are capable of forming a loop when exposed to low temperatures, pressure, or Ca2+.

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Nonconstricting rings are created when the lateral branches from the vegetative hyphae thicken, curve, and finally fuse to the supporting stalk. Nematodes get stuck while trying to push their way through the rings if they thrust their heads inside them during movement. This holds them hostage. The ring frequently comes off during the nematode's fight at a weak spot close to the stalk's apex. Up to the point where the host is surrounded by numerous rings, the procedure can be repeated. When the prey is pierced and the detached rings are viable, the contents are subsequently devoured. The nematode is only maintained in place by friction and is not adhered to anything.

Conclusion

In order to formulate agricultural policies and identify strategic axes, it is essential to understand the basic nematode research areas and issues that influence the world's major agricultural plantations. Up to 15% of productivity can be lost as a result of phytoparasitic nematodes. To comprehend the most important issues facing the industry, it is crucial to describe the context in which global research in this subject is being conducted. However, this was restricted to works published in the Journal of Nematology between 1969 and 2009, as was the case with R. McSorley's 2011 bibliometric analysis. However, several of the inferences made from that study's findings went in a direction that is supported by the findings of this study, such as the significance of the USDA Agricultural Research Service or the emerging trends in studies of biological control or resistance. The history of Scientific Output demonstrates the continuing growth in interest in nematodes that damage plants, notably over the past thirty years. The most intriguing crops are tomato, soybean, and potato, and the nematodes Meloidogyne javanica, Heterodera glycines, or Globodera rostochiensis that impact them are the main topic of most study papers. Due to its significant economic and food significance at the worldwide level, where it provides human food, oils, animal feed, and inputs for aquaculture, agricultural production has recently become a crucial strategic line of development. Because of this, the nations with the highest scientific output of nematodes + plants serve as both the primary producers and the top economic powers in the world..

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