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Guava Root Knot Nematode (*Meloidogyne enterolobii*) - A Menace in Guava Cultivation

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Abstract

M*eloidogyne enterolobii* is an emerging species of root-knot nematode, is currently considered to be one of the most damaging root-knot nematode species in many countries. Guava root-knot nematode is very similar to our common root-knot nematode in the type of damage it causes and its host range and morphology. The nematodes can cause severe damage to plants, reducing yields and causing early death. Stunting, yellowing of plant foliage and early wilting during drought are also characteristic symptoms of nematodes. Nematicides are routinely used to manage root-knot nematodes in guava. However, with the ban of effective nematicides from the market owing to concerns about risks to human health and the environment, safe and effective alternative control measures are highly sought. The concept of integrated nematode management is targeted at prevention and population reduction of plant parasitic nematodes with the development of resistant varieties of fruit plants.

Introduction

Guava is an important fruit of tropical and subtropical area of the world. It is commonly called poor man's fruit. Guava contains maximum 228.3 mg of vitamin C content per 100 g of pulp after amla. It contains antioxidant factors and can control systolic blood pressure. It is good source of roughage and help in removal of constipation. In many countries, the fruit is eaten raw and sold as a popular snack in many street corners and night markets. Because of its high level of pectin, guavas are extensively used to make candies, preserves, jellies, marmalade and juices. Guava is rich in dietary fiber and vitamin C with moderate levels of folic acid. It is a spreading tree, may grow up to height of 8 meters with same spread. The trunk is light brown in colour with shredding scaly bark. The leaves are oblong-elliptic in shape. The pubescent is present on the underside of leaves. Leaves are light green to dark green in color show crimson coloured strips during cold weather. Flowers appear on new growth singly or in three to four (Figure 1).

Guava is native to Central America and is widely cultivated in South Africa, Hawaii, India and Mexico. In India guava occupies an area of 2.03 lac hectares with annual production of 22.7 lac MT. Allahabad area in U.P is reputed for the production of high quality of guava in India and the world. In Punjab it occupies an area of 8022 hectares with annual production of 160463 MT. Major guava producing states include Uttar Pradesh, Bihar, West Bengal, Maharashtra, Chhattisgarh, Tamil Nadu, Karnataka, Madhya Pradesh, Gujarat and Andhra Pradesh. Guava tree is attacked by 80 different species of pest and diseases among them root knot nematode (*Meloidogyne enterolobii*) is the most severely damaging pest.

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Plant Parasitic Nematodes

Plant parasitic nematodes are obligate parasites feeding on roots of crop plants. Globally plant parasitic nematodes account for an annual yield loss of 173 billion dollars. Among the plant parasitic nematodes, *Meloidogyne* spp. is one of the most damaging nematode genera which is widely distributed and infecting important agricultural and horticultural crops. They are polyphagous and have the ability to infect a variety of important crops makes them one of the notorious crop pests. Globally they are responsible for billions of yield loss every year. Their problem is much more severe in crops like capsicum, tomato, gerbera, etc. which are grown under protected condition for commercial purpose leading to complete closure of cultivation (Ashokkumar and Poornima, 2019).

There are more than 100 reported species of *Meloidogyne* globally. Among them, *M. incognita*, *M. javanica*, *M. arenaria*, *M. Enterolobii* and *M. Hapla* are considered as major root knot nematode species infecting most of the cultivated crops. The other root knot nematode species like *M. graminicola*, *M. exigua*, *M. chitwoodi*, *M. fallax*, *M. naasi*, *M. minor*, *M. Enterolobii*, etc. are considered as minor root knot nematode species with restricted distribution.

Meloidogyne enterolobii

The guava root-knot nematode (*Meloidogyne enterolobii*) is considered to be the most damaging root-knot nematode in the world because of its wide host range, aggressiveness, and ability to overcome the resistance that has been developed against root-knot nematodes in many crops. Although this nematode was originally described from the Pacara earpod tree in China, it has been particularly damaging to guava orchards. More recently it was reported from India on guava orchards of Tamil Nadu where trees were declining showing yellowing and stunted growth (Poornima et al., 2016). This nematode causes severe root galling there by reducing the nutrient uptake ability of the plant. Among these minor root knot nematodes, *M. enterolobii* is now spreading quickly to different cultivated crops and new areas where it was not existing earlier. Like most of the other root knot nematodes, *M. enterolobii* is also polyphagous and can infect vegetable crops like tomato, okra, capsicum, sweet potato, ornamentals and fruit crops like guava, melon, fig etc.

Distribution, Biology and Movement

The maximum number of nematodes is present at a distance of 25 to 50 cm from the base of the plant and at a depth of 20 to 40 cm. This nematode is similar to other root-knot nematode species in which young juveniles of the nematode hatch from eggs in the soil and migrates toward

root tips of susceptible plants. The nematode enters the roots, sets up a permanent feeding site and begins developing into a mature female. During this process, large galls, or swellings, of the root tissue may form in association with the developing female. A single female will produce as many as 400 to 600 eggs, and the life cycle can be completed in just four weeks during warm weather. Large numbers of egg masses may be visible on small roots or found within storage roots of sweet potatoes. Although the nematode itself cannot move very far in the soil, it can easily spread by any outside force that moves soil, such as farm equipment, irrigation or heavy rainfall. The nematode can easily be disseminated on plant materials such as the storage roots of sweet potatoes or ornamental plants (Dawabah et al., 2019).

Symptoms and Damage

These nematodes are responsible for 30 to 50 percent yield losses in guava. The incidence of fungal pathogen would be double the yield loss. These nematodes cause breakdown of resistance to fungal diseases in certain varieties of fruit crops.



Figure 1: Healthy plant

Guava Plant Show above Ground Decline Symptoms

- Drastic reduction in plant growth, before death of tree.
- Leaves show bronzing (Figure 2, Figure 3).
- Plant exhibits stunting growth.
- Number, size of Flowers and fruit will get reduced.
- Declined yield quality and quantity.

Guava Plant Show below Ground Symptoms

- Roots with large sized galls (Figure 4).
- Absence of fine white roots, a poorly developed root system.
- Severely infested roots will be distorted by small and large multiple galls.
- Brown colored degraded roots are visible at severely infected roots.



Figure 2: Initial browning of leaf margin



Figure 3: Severe browning of leaf margin



Figure 4: Root system with severe root galls

Mode of Spread

Nematodes spread from one area to another mainly through infested planting materials. This nematode is mainly disseminated by the soil that comes along with the planting material. It also spreads though when water that drains from infested areas, soil adheres to implements, tyres of motor vehicles and shoes of plantation workers may also spread nematodes from one area to other area.

Methods of Management of Nematodes

Nematode management is therefore important for high yields and quality that are required by the high cost of modern crop production. Management of this

nematode is a challenge because of its polyphagous nature and ability to survive on weed hosts. This nematode is spreading to new areas through infected guava saplings. Hence prevention is better than cure. Once infected the following management measures can be followed as well.

Management of Nematode Entry into New Orchards

- Use of clean and nematode free planting material. The saplings should be tested for nematode infection before they are used for planting. This can avoid the entry of nematode to new areas.
- Removal of infected trees from the orchards.
- Avoiding movement of infected soil to uninfected areas.
- Applying a mixture of farm yard manure – 5 kg, neem cake – 250 g, nematode egg parasitic fungus *Purpureocillium lilacinum* – 25 g and carbofuran 60 g/tree at an early stage of nematode infestation can keep the nematode in check which prevents further crop loss.

Conclusion

The present investigations indicate that the association of root knot nematode, *Meloidogyne enterolobii* is highly pathogenic to guava plants. This poses a serious threat to guava cultivation, if the management practices are not governed to keep the population under check. Therefore, it needs immediate attention of the growers to manage the nematode by following suitable management measures.

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