

Major Nematode Pest of Vegetable Crops and Their Managements

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Introduction

Vegetables are an essential component in the nutritional diet of human beings which usually consists of various vitamins, dietary fibers, minerals, antioxidants, low fat, and calories. India is the second-largest vegetable producer in the world after China, it contributes about 15% of total world's vegetable production. India is the largest producer of okra and ginger amongst vegetables and ranks second in production of potato, onions, gourds, brinjal, cabbage, lettuce, pumpkin, squash, etc. As per National Horticulture Database published by NHB, during 2018-19 (3rd Advance Estimates), India's vegetable production was 185.88 million metric tonnes and the area under cultivated was 10.10 million hectares. Vegetable crops are affected by a number of biotic and abiotic factors.

Among various biotic factors, plant-parasitic nematodes (PPNs) are very serious and economic pests because vegetables are excellent hosts for a wide range of plant-parasitic nematodes. Overall, PPNs cause a huge loss to vegetable crops. most prominent number of genera of PPNs associated to vegetables are *Meloidogyne* spp., *Rotylenchulus reniformis*, *Pratylenchus* spp., *Tylenchorhynchus* spp. and *Globodera* spp. So, to reduce the losses caused by these PPNs, their management becomes an important aspect.

1. Root-knot nematode (*Meloidogyne* spp.):

Meloidogyne spp. is the most damaging and wide host range nematode genera. In this genera *Meloidogyne incognita*, *M. arenaria*, *M. javanica*, *M. hapla* are the major species with their cosmopolitan distribution and widest host range are of particular economic importance to vegetable production. However, this is the serious problem in tomato, brinjal, okra, peppers, cabbage, cucumber, cucurbits etc. The second-stage juvenile (J2) is the only infective stage. This stage survives in soil for several days in normal condition and in adverse condition; it converts into an anhydrobiotic phase. The nematode takes 21-

30 days to complete its life cycle at 25-30°C. Galls on roots and stunted growth of plants are most peculiar symptom of this nematode.

Management:

- ❖ Use of nematode free sites for nursery preparation as a prophylactic measure.
- ❖ Soil solarization and deep summer ploughing is very effective in nursery area as well as in main field.
- ❖ Use of resistant/ tolerant varieties is most economical method.
- ❖ Application of bio-agents like *Pseudomonas fluorescens* @10g/m² in nursery.
- ❖ Application of carbofuran 3G @ 10g/m or aldicarp 10 g a.i./m for nursery bed treatment.
- ❖ Dip the root with carbofuran/ phorate/ aldicarp @ 500 ppm for one hour.
- ❖ Apply carbofuran 3G (Furadan) @ 1kg a.i./ha.

2. Reniform Nematodes (*Rotylenchulus reniformis*):

This nematode is sedentary semi-endoparasite in nature and produce permanent feeding site on the secondary or tertiary roots. This nematode is an important pest of tomato, cauliflower, brinjal, okra, cowpea, cucumber, beans, carrot etc. Immature females are the Infective stage. This nematode completes its life-cycle in 17-30 days. Severely infected plant severe necrosis shows necrosis and destruction of feeder roots, and yellowing and wilting of above-ground plant parts.

Management:

- ❖ **Cultural:** Crop-rotations with maize, sugarcane finger millet, groundnut, capsicum, chillies, sugarcane and other grasses. Soil amendments such as organic manure and cotton seed cakes play a supportive role in control of reniform nematode.
- ❖ **Physical:** Flooding for short periods also reduce nematode population in the field. The nematode can also be eradicated from infested soil following treatment with 50° C hot water for 5 min. Soil solarization may provide season-long control of *R. reniformis* on tomato.
- ❖ **Chemicals:** A wide range of fumigant and non-fumigant nematicides is effective in controlling *R. reniformis*. All granular nematicides reduce *R. reniformis* densities in tomato crop.

- ❖ **Integrated:** Soil solarization or soil mulching with plastic sheet for 5 weeks combined with carbofuran @ 3kg a.i. /ha significant increase in tomato or cucumber yields and reduction in nematode densities.

3. Root lesion nematode (*Pratylenchus* spp.):

This nematode is migratory endoparasitic in nature, ten species of which have been found from the rhizosphere of vegetable crops. But under Indian conditions only *P. indicus* has been found to be most prevalent. This is the important pest of vegetables like tomato and brinjal etc. All life stages of this nematode are capable of infection by penetrating the root tissue. This nematode completes its egg to egg life cycle in 30 to 90 days depending upon the species, host plant and environmental conditions. Above ground symptoms; stunted, chlorotic plants lacking vigour, poor fruiting and die back can be seen in infested plants. Root symptoms are in the form of necrotic lesions which may coalesce with one another as the infection spreads and may girdle the root system. These lesions are the ideal sites for secondary infection by other microorganisms such as fungi, bacteria etc. which leading to disease complex.

Management

- ❖ Nursery should be raised in nematode free soil.
- ❖ This can be controlled with fumigant and non-fumigant nematicides.
- ❖ Integrated management practices as for other nematodes such as root-knot and reniform nematodes would also effective control this nematode.

4. Stunt/stylet nematode (*Tylenchorhynchus brassicae*)

Among the 22 species of *Tylenchorhynchus* found from the rhizosphere of vegetables, only *Tylenchorhynchus brassicae* which infects cabbage, cauliflower, knob-khol, lettuce, radish and tomato etc, holds economic importance in India. Though most of the *Tylenchorhynchus* species are migratory ecto-parasitic in nature. These nematodes feed on epidermal cells of the plant roots, *T. brassicae* has been observed to penetrate throughout the cortex. The infected plants show poor germination and stubby root condition which leading to stunting growth of cabbage and cauliflower crop.

Management

- ❖ Crop rotation with non-host crops

- ❖ Inter-cropping with margosa found effective to improve the growth of susceptible vegetable crops.

5. **Potato cyst nematodes:** (*Globodera rostochiensis* and *G. pallid*)

This nematode is sedentary endoparasite in nature. Basically, this found in temperate climate. In India, it is mainly confined to about 4000 ha of Nilgiris, Palani and Kodai kanal hills of the southern states due to effective implementation of domestic quarantine as per which the movement of seed potato from infested areas is banned but, it has recently been reported from Himachal Pradesh also. As this nematode have a limited host range, potato is the main host but is can multiply on other solanaceous plants like eggplant, tomatoes and certain weed plants. Second stage juveniles (J2) cause infection by invades the host behind the root tip. The life cycle is completed in about 35-50 days under Nilgiri conditions where a second generation may also occur. After female's death, they become cysts, and contain as many as 500 eggs. Inside the cyst the eggs remain viable in soil for a long period of time (up to 8 years). In India, only two pathotypes i.e., Ro 1 and Ro 2 of *G. rostochienesis* and all the three pathotypes of *G. pallida* i.e., Pa 1, Pa 2 and Pa 3 are found as mixed populations. Infected plant shows yellowing of leaves and stunting of plants with patchy appearance. Early senescence and proliferation of lateral roots. Initially, small immature females of white and yellow stages on the roots at flowering time. Females can also be observed on the tuber surface but with less frequency.

Management

- ❖ Adopt 3-7 years long crop-rotations. Generally, Graminaceae and Leguminaceae crops are used in these rotations.
- ❖ Use of resistant cultivars like Kufri Swarna, Kufri *Thenmalai* etc.
- ❖ Adjusting crop sowing time to escape from the damage. Application of carbofuran 3G @ 1-2 kg a.i/ha.

Recommendation by CCSHAU, Hisar

For *Meloidogyne* sp.

Tomato, Brinjal and Okra:

- ❖ deep summer ploughing
- ❖ Carbofuran @ 33kg/ha at nursery sowing
- ❖ Tomato- Hisar Lalit

- ❖ *Trichoderma viride* @ 2.5 kg/ ha at TOS (In case of okra)
- ❖ Neem cake @ 750g/ m² in nurse beds

Bottle gourd:

- ❖ Neem cake @ 30 g/spot + S. T. with *Gluconacetobacter diazotrophica* strain 35-47 @50 ml/ 2 kg seed

Protected cultivation:

- ❖ Soil solarization
- ❖ *Trichoderma viride* @ 20g/m² + neem cake/ Vermicompost @ 100g/m² in tomato beds

