UNIT 5
MULBERRY ROOT DISEASE

Root rot

Root rot, due to its epidemic nature and potential to kill the plants, is a dangerous disease of mulberry. It is widely distributed in almost all the sericultural areas and mainly caused by the fungus Rhizoctonia bataticola (= Macrophomina phaseolina)and other microbes such as Fusarium solani, F. oxysporum, Botryodiplodia theobromae etc. The disease is very serious in mulberry growing areas of southern India. The disease occurs throughout the year in all types of soils especially when the soil moisture and organic matter are low. About 15 % loss is estimated due to the disease.

Symptoms: The disease appears in patches of the mulberry garden. Sudden withering of plants and leaves are the initial symptoms. The leaves then start falling off from the bottom of the branches.

Management

- Application of farm yard manure @20tonnes as basal
- At root surface pour copper oxy chloride(2gm/lit of water)
- Prevent the spread of disease to other healthy plant by basin irrigation
- Uproot the died plants
- Application of Trichoderma viride @ 25gm/plant
- Application of Bacillus substilis @ 25gm/plant at the time of planting or pruning

Root knot (*Meloidogyne incognita*)

Introduction

The root knot disease is a very severe disease of mulberry in China, Japan, Korea, and India. Since the disease causing pathogen has many number of host plants, the disease is wide spread and cause huge loss. Since the affected part is root system, diagnosis of the disease is very difficult in the initial stage and the aerial symptoms will start very late after infection. The soil factors such as type and texture of soil and nearby crops plays a major role on severity of the disease.

Symptoms

The affected plants appear to lack water and nutrients. Their leaves gradually become yellow and the growth becomes stunted . Later the leaf margin curls and turns brown and eventually will fall. In severe cases, the affected plants wilt and die. Many root knots can be seen on the roots . The root knots are spherical or nearly spherical. They may be small as a bean or large with irregular surface. The young knots are yellowish white in colour and are smooth and compact. If these knots are dissected, some white and translucent mature female worms can be seen by the naked eye. Later the knot gradually turns brown and finally will become black and rotten. In sandy soil, the affected plants will generally die within 2-3 years in severe cases.

Causal organism

Meloidogyne incognita (Kofoid and White) Chitwood

Systematic position

Class: Secernentea

Subclass: Diplogasteria

Order: Tylenchida

Suborder: Tylenchina

Superfamily: Tylenchoidea

Family: Heteroderidae

Genus: *Meloidogyne*

Species: *incognita*

Description of the pathogen

*M. incognita*is sexually dimorphic. The female is 0.4-1.3 mm long, and usually embedded in root tissues which are often swollen. Its body is soft, pearl white in colour and does not form a cyst. The neck protrudes anteriorly and the excretory pore is anterior to the median bulb and often near the stylet base. Vulva and anus is terminal, flush with or slightly raised from the body contour, the cuticle of the terminal region forms a characteristic pattern, which is made up of the stunted tail terminus, phasmids, lateral lines, vulva and anus surrounded by cuticular striae; the pattern is often characteristic for individual species. The female stylet is shorter, 10-24 µm usually 14-15µm, and more delicate with small basal knobs. The paired gonads have extensive convoluted ovaries that fill most of the swollen body cavity. There are six large unicellular rectal glands in the posterior body which produce a gelatinous matrix, which is excreted via the rectum to form an egg sac in which many eggs are deposited.

The male has long, thin, cylindrical shape of a worm but the lip region has a distinct head cap, which includes a labial disc surrounded by lateral and medial lips . The head skeleton is usually weaker and the stylet less robust and shorter, 18-24 µm long for many species. Infective second stage juveniles, often free in the soil, are usually 0.3-0.5 mm long; they are less robust, the stylet is delicate with small basal knobs. The median oesophageal bulb is well developed and the oesophageal glands are extensive, overlapping the intestine for several body widths, mainly ventrally; the tail is conoid, often ending in a narrow rounded terminus, but tail length is variable, 1.5-7 anal body widths between species, it often ends in a clear hyaline region, the extent of which can help to distinguish species.

Predisposing factors

The pathogenic nematode overwinters in the affected roots. During the following spring, the second stage larva infests the mulberry roots and cause formation of root knots. The root knot nematode move slowly in the soil, thus by their active movement the spread of disease is limited. However, the disease is spread to new localities by means of cultivation, irrigation, contaminated fertilizers and by planting of infected saplings.

There must be an adequate temperature and humidity for the normal activity of nematode. The required temperature ranges from 12- 34°C while the optimum temperature is 20-25°C. When the soil is extremely moist or water is in short supply, the nematode activity is curtailed. The requirement of water content is 20-90% and the optimum is 70%.

The disease will easily occur if the land is hilly, plain sandy loam soil, clay loam soil, fertile land or infertile land. The disease occurs quite seriously in sandy soil.

The disease is also serious if the preceding crops are hemp, jute, tobacco, cucumber, soybean etc.

Disease cycle

The mature nematode is heterogametic. Males are cylindrical, worm like, colourless, transperant, elastic with stripes across the body. Its caudal part is short and blunt and posterior is finger shaped. The female nematodes has a white saccate spherical and an elongated pyriform body with an elongated neck. The eggs are ellipsoidal and are always laid in egg sacs.

The young nematode undergoes four stages. The first stage larva develops and moult within the egg, it break the shell then goes in to second stage. The second stage larvae are small, worm like, very active and moves freely in the soil until it invades the root. The time of invasion is referred to as the infection period and the young nematode worm is known as infection stage larva. During the parasitic period, when the nematode attacks the new roots, the worm is referred to as the second stage parasitic larva. Following the second moulting, the worm becomes the third stage larva and resembles a pea pod. The fourth stage larva moults again and becomes a mature worm.

Control

(a) Physical method

- Deep ploughing to a depth of 30-40 cm during summer helps to kill the nematode eggs and larvae.
- Always use disease free saplings for new plantation. If the saplings are having root knot symptoms, treat them with hot water (48°C for 20 minutes) before planting.

(b) Cultural method:

- Plant marigold (*Tagetus patula*) as intercrop at distance of 30 cm in between mulberry rows.
- Apply neem oil cake @ 2 mt/ha/yr in 4 split doses during fertilizer application/ cultural operation.

(c) Chemical method:

- Apply Furadan (Carbofuran 3G) @ 40 kg / ha/ yr in 4 split doses during fertilizer application / cultural operations (safety period: 40-45 days).

(d) Integrated management:

This involves the soil application of 'Bionema' (*Verticillium chlamydosporium*) after mixing with FYM and neem oil cake in the ratio of 1:200:24.

Method of application

- Mix one kg Bionema with 200 kg FYM (for 1000 plants) and 24 kg neem oil cake, and store the mixture under the shade and keep moistened by sprinkling 30-32 liters of water for about one week.
- Expose the roots of infected plants by digging to a depth of 15 cm. Cut and remove the bunches of knots on the roots and burn.
- Apply the prepared mixture @ 200 g/ plant around the exposed roots (3 times/year at an interval of 4 months) during cultural operations/ fertilizer application followed by irrigation.
- Bionema is a bio-nematicide with no toxic effect on both mulberry and silkworm.