**DATE- 18/03/2020 (LECTURE 3)**

# Insect Pests of Vegetables

## Pests of brinjal

### Shoot and fruit borer (Leuciniodes orbonalis Guenee, Lepidoptera: Pyralidae)

#### Key Identification-

The Major host plants of the pest is Brinjal This pest is reported from regions of brinjal cultivation in Africa, South of the Sahara, and South-East Asia including India, Bangladesh, Srilanka, China and Philippines.

Young caterpillars are creamy white, while full-grown are light pinkish and measure about 18-23 mm in length. The moth is medium sized with white wings having triangular brown and red markings on the forewings. The moth measures bout 20-22 mm across the wings.

#### Life cycle-

A female moth lays about 80-120 creamy white eggs, singly or in batches of 2-4 on the underside of leaves, on green stems, flowers buds or the calyces of fruits during its life span of 2-5 days. The incubation period is 3-6 days. The young caterpillars bore into the tender shoots near the growing points, flower buds or the fruits. There are five larval instars and mature in 14-20 days, depending on the prevailing temperature and humidity. A single caterpillar may destroy as many as 4-6 fruits. The larva comes out of the damaged shoot or fruit and pupates in a tough gray cocoon in soil or plant debris. The pupal period is 6-11 days. During the active season, the total life cycle is completed in 20-43 days. There are five overlapping generations in a year.

#### Damage-

The larvae bore into the petiole and midribs of large leaves and tender shoots and cause wilting. In the later stage, they also bore into the flower buds and fruits the flowers buds shed due to attack. The fruit is damaged considerably and the entry hole is plugged with excreta. Attacked fruits become unfit for consumption and marketing. Infestation up to 70 per cent has been recorded.

#### Management-

> Deep polughing during summer to expose resting stages of pests to sunlight. Removal and destruction of the infected shoots and fruits regularly. → intercropping brinjal with coriander/ fennel (2:1) or as crop.
> Periodical removal and destruction of early- infested shoots and fruits. Installation of sex pheromone traps @100/ha (10m x 10m) 15 days after transplanting and lure replacement after 25-30 days >> 4-5 releases of Trichogramma chilonis @ 2 to 2,50,000 parasitized eggs/ ha, first release coinciding with

initiation flowering, thereafter at 10 days interval along with weekly application of NSKE4 % or Bt formulation @ 500g/ ha Need based application of animal origin insecticide, cartap hydrochloride 50 SP or carbosulfan 25 EC @ 0.02% coinciding with reproduction phase of the crop. Trathala flavoorbitalis, Goryphus nursei, Eruborus argenteopilosus, and Bracon sp. are some of the promising larval parasitoids of this pest.

## Brinjal Stem borer (Euzophera perticella Rag. Lepidoptera: Pyralidae)

### Key Identification

Grown up caterpillars are creamy white with a few bristly hairs and measure about 20-22 mm in length. The moth is small having pale Occasionally this pest attains serious status; Infestation is noticed usually in the late stage of the crop.

### Life cycle-

The insect is active from March to October and hibernates as larva in the stem of old plant from November to the beginning of March. The moths emerge sometime in second half of March and soon after mating, Insect Pests of Vegetables the females start laying eggs. The eggs are creamy in colour and laid singly or in batches on tender leaves, petiole, and branches. The incubation period is 3-10 days. The young larvae feed for a few minutes on exposed parts of plants and then bore into the stem making longitudinal tunnels through a life span of 26-58 days. They pupate inside the feeding galleries after making silken cocoons in cracks and crevices in the soil, Moths emerge in 6-8 days. The insect completes its life cycle in 35 - 75 days,

### Damage-

The caterpillars cause the damage and feed exclusively in the main stem. It enters the main stem and makes tunnel, which result either in stunting of growth or wilting of whole plant, prior to yellowing of leaves.

### Management

Collection and destruction of egg, larvae and pupae from leaf surfaces of the plant Spraying of lambda cyhalothrin @ 0.02 % or dusing with 5% malathion @ 20-25 kg/ha. Pristomerus testaceus and P. euzopherae are parasitic on the larvae of this pest.

## Date -19-03-2020 (LECTURE 4)

# Pests of Tomato

## Tomato Fruit borer (Helicoverpa armigera (Hub.), Lepidoptera: Noctuidae)

### Key Identification

The caterpillars are greenish to variable colours with dark broken gray lines along the sides of the body. Mature larvae messure about 3545mm in length and the moth is brown with a V- shaped marking and dull black border on the hind wings. The Major host plants of the pest are Okra, onion, brinjal, potato, chillies, tomato cowpea beans, gram, maize, cotton, pea, pigeon pea etc.

### Life-cycle

Female moth lays eggs on the leaves, flowers and developing fruits. Eggs are yellowish and spherical. A female lays an average of 700 eggs over a week's time. The younger larvae feed initially on the foliage for a while and later bore into the green fruits. The larva while feeding, Manual on Insect Pest of Crops and their Management thrusts its head into the fruit leaving the rest of its body outside. The fully matured larva pupates in an earthen cell. H. armigera has a facultative pupal diapause which is induced by short day lengths (11-14 hours/ days) and low temperatures (15-23°C) experienced as a larva. The total developmental period varies from 2540 days depending upon the temperature and the host.

### Damage

Early instars feed on leaves and fruiting bodies. Latter they bore into fruits. The bored fruits invite secondary infection by other organisms, lead to rotting.

### Management

ETL 8-10 moths/ day/trap > Deep ploughing during summer season to expose the larvae and pupae to sunlight and predation by birds → Planting one row of 40 days seedlings of marigold as trap crop after every 16 rows of 25 days old seedlings of tomato for attraction of adults to trap crop for egg laying and colonization. > Collection and destruction of larvae from marigold flowers, Installation of pheromone traps (5/ha) 25 days after transplanting for early pest detection Two releases of Trichogramma brasiliense @ 2, 50,000 parasitised eggs/ ha (Tricho- cards) during peak flowering stages at interval of 10 day. Foliar spray of HaNPV @ 250 LE with jaggery (10g/ lit), soap powder (5g/ lit) and tinopal (1ml/ lit) during evening hours or need based application of quinalphos 30 EC@ 0.02 % or Indoxacarb 14.5 SC @ 0.01 % coinciding with appearance of infestation. Compoleties chlorideae, Bracon brevicornis, Tichogramma chilonis, and Trichogrammatoidea are some of the important parasitoits recorded from

# Tobacco caterpillar

**(Spodoptera litura (F.), Lepidoptera: Noctuidae)**

## Key Identification

Major host plants of this pest are Brinjal ,Cabbage, cauliflower, Capsicum, cucurbits, okra, Phaseolus, potato, sweet potato and species of Vigna and other wild hosts. Commonly known as the tobacco caterpillar, S. litura, is one of the most important insect pests of agricultural crops in the Asian tropics. the fully-grown larva is stout, cylindrical, pale - greenish brown with dark markings, which measures about 35-40mm in length . The moth is stout, dark with wavy white markings on the forewings and white on hind- wings.

## Life-cycle

The pest is active throughout the year. Fecundity varies from 2000-2600 eggs and oviposition period varies from 6 to 8 days. The female moth after mating at night, lays about 300 eggs in clusters. These clusters are covered with brown hairs. The incubation period is about 45 days. After hatching, the larvae feed gregariously together and later they spread out and feed individually. The larvae pass through six instars and the longevity of larvae and pupae are 20-30 days and 7-15 days, respectively, the life cycle completes in 32-60 days. There are 8 generations in a year.

## Damage

The caterpillars feed on leaves in the nursery and in the main field and cause serious damage. In crops like tomato and chillies, they bore into fruits and spoil them. Larvae are very active at night. Heavy infestation in the form of out breaks can severely defoliate the crop

## Management

Deep ploughing during summer season/ land preparation to expose the pupae to natural enemies and clean cultivation  Installation of pheromone traps 25-30 traps/ ha to predict egg laying and also for mass trapping of adults Hand picking and mechanical destruction of caterpillars and application of neem kernel extract (4%) during early stage of attack Manual on Insect Pest of Crops and their Management Spraying with SINPV@250LE with jaggery (10g/ lit), soap powder (5g/lit) and tinopal (1ml/lit) during evening hous coinciding with early stage larvae. Spraying of triazophos 40 EC @ 0.02 % or indoxacarb 14.5 SC @0.01 % and repetition of the same at 10 days

interval if necessary Bracon brevicornis, Campoletis chlorideae, Eriborus argenteopilosus, Microplitis prodiniae Peribaea orbata are the important larval parasitoids, Trichogramma chilonis an egg parasitod,

Bacillus thuringiensis (bacteria), Beauveria bassiana, Metarhizium anisopliae, Nomuraea rileyi (Fungi) and Nucleopolyhedrosis virus are some of the entomopathogens recorded.

## Date -20-03-2020 (LECTURE 5)

### Serpentine leaf miner: (Liriomyza trifolii (Burgess), Diptera: Agromyzidae)

### Key Identification

Major host plants of the pest are Okra, onion, cucurbits, beans, potato, brinjal, crucifers and other crops. Liriomyza trifolii is one of the polyphagous agromyzids causing serious damages on several crops including ornamentals.

### Life-cycle

Eggs are inserted just below the leaf surface. Eggs hatch in 2-5 days. Many eggs ma be laid on a single leaf. Neonate larva is transparent turn to yellow- orange in later instars. After hatching, the larva starts mining into the leaves. The typical mine resembles a serpent shape, hence the name. Pupation occurs in the soil beneath the plant. Adult emergence takes place 7-15 days after pupation. Life cycle completes in 12-15 days.

### Damage

Damage is due to mining into leaves and petiole by the larva. The photosynthetic ability of the plans is often greatly reduced as the chlorophyll - containing cells are destroyed. Severely infested leaves dry up and

### Management

Avoidance of hybrids and judicious application of nitrogen fertilizers in pest endemic area Removal and destruction of infested leaves followed by an application of NSKE 4% with a sticker (0.5ml/lit of water). Spraying with imidacloprid 17.8 SL @ 0.3ml/ lit of water during early stages of crop growth before flowering → Application of dichlorovos @ 0.03% in severe infestation during reproductive phase of the crop.

## Whiteflies: (Bemisia tabaci Gene., Hemiptera: Aleyrodidae)

The major host plants, the pest are Okra, crucifers, cucurbits and solanaceous crops.

### Life-cycle

Eggs are laid in groups in a circular fashion on the undersides of leaves with a pediciel inserted into a fine slit made by the female. Eggs are whitish in colour when laid, later turn brown. A single female lays up to 120 eggs. Hatching occurs in 3-5 days. On hatching, the first instars larva (only mobile stage) or crawler moves to a suitable feeding site on the lower leaf surface where it moults and becomes stationary throughout the remaining sates. The first three larval stages last 2-4 days each (depending on temperature). The fourth larval stage is called as puparium. Pupation lasts for about 2-8 days. The adult emerges through a 'T' – shaped rupture made in the puparium. A female may live up to 60 days while the male lives shorter (9 to 17 days). There are 11 to 15 generations in a year.

### Damage

Apart from the direct damage to the crops by way of sucking the sap. B. tabaci is an important vector of a wide array of plant virus diseases. Eg. Tomato yellow leaf curl virus (TYLCV), Bean Golden Mosaic (BGMV), African cassava mosaic virus (ACMV), etc. Infected plants exhibit any one or a combination of the symptoms like vein yellowing, inter- vein yellowing, leaf yellowing, yellow blotching of leaves, yellow mosaic of leaves, leaf curling, vein thickening, leaf enations, leaf cupping and plant studding.

### Management

ETL 15-20% affected plants Avoid late sowing and excessive use of “N” fertilizers.

 Destory infected shoots during early stages.

 Release predators, viz., Coccinellids or Chrysoperla carnea, Release pathogen Entomophathora aphidis as recommended, Seed treatment with imidacloprid 70 ws @ 3 g per kg to protect the crop from pest infestation up to 25-30 days

 Removal of weed hosts to reduced the incidence of white flies and associated viral diseases

 Protection of seedlings in nursery covered with nylon net (200 mesh) for 25-30 days. Need based application of systemic insecticides such as demeton -0- methyl (0.03%) or dimethoate (0.03%) after transplanting or thiamethoxam 25 WDG (0.01 %). → Application of neem oil (0.03 %) coinciding with appearance of the pest. Encarsia brevivena, Eretmocerus corni, Eretmocerus mundus are some of the parasitoids; Chrysoperla carnea, Mallada boninensis, Cocinella septempunctata are the predators and Beauveria bassiana and Paecilomyces farinosus are the pathogens recorded from B. tabaci.

## Date -21-03-2020 (LECTURE 6)

# Pest of chilli

## Thrips (Scirtothrips dorsalis Hood, Thysansoptera: Thripidae)

### Key Identification

This is a polyphagous pest. Besides chillies, it feeds on tomato, cotton, castor, sunflower, mango and citrus. The nymphs are like adults in shape and colour but are wingless and smaller in size. The adults are slender, yellowish brown, having apically pointed wings and measure about 1 m in length. The female has long narrow wings with the fore margin fringed with long hairs. The pest is active throughout the year except the monsoon season,

### Life cycle

A female lay about 45 to 50 eggs over a period of 20-30 days inside the tissues of the leaves and shoots. Entire life cycle completes in 15-20 days. The pest has several overlapping generation in year.

### Damage

The nymphs and adults lacerate and suck the cell sap from leaves and tender parts of the plants and causes the leaves to shrivel and curl upward. In case of severe infestation, there is a malformation of leaves, buds and fruits. The attacked shoots hardly develop and the leaves fall off. They are also responsible for transmitting the leaf curl disease in chillies.

### Management

»Seed treatment with imidacloprid 70WS @ 2.5g per kg to protect the crop from infestation up to 25-30 days. → Production of seedling from thrips and whiteflies infestation in the nursery using nylon nets (200 mesh) to reduce the leaf curl incidence. Foliar spray of thiamethoxam @ 0.01 % during the prefloweing stage and endosulfan @ 0.07 % during fruiting stage Franklinothrips megalops, Mymarothrips garuda, Scolothrips indicus (Predatory thrips). Orius maxidentex, Geocoris ochropterus (Predatory bugs) are some of the effective predators.

## Broad mite: (Polyphagotarsonemus latus Banks Acari: Tarsonemidae)

## Key Identification

This mite is a polyphagous pest with a wide array of host plants belonging to solancaeae and cucurbitaceae. Tiny yellow coloured mites and found in large numbers in the ventral side of leaves. They suck the cell sap and cause deformity of leaves creating confusion with leaf curl.

## Life cycle

On chilli, the developmental period from egg to adult averages 3-4 days. Adults' longevity is 10-15 days. Each female lays about 25 eggs. Eggs are laid on the underside of leaves, tender stems, flowers and fruit. Attack occurs during a short period of time.

## Damage

Edges of damaged young leave usually curl. The foliage often becomes rigid and appears bronzed scorched. Discoloration of tissues due to mite feeding, fruits become deformed or fail to develop. Severely infected fruits fall. When leaves are attacked, the leaf tissues disintegrato and the epidermal layer of the infested leaves thickens. Downward curling of leaves like inverted boat and petiole elongation in older leaves are characteristic symptom of mite damage. Yield is significantly reduced.

## Management

→ Conservation of native predatory mites → Spraying of dicofol @ 0.03 %, wettable sulphur @ 0.04 % or propargite 57 EC @ 0.03 % alternatively at an interval of 15 days. Amblyseius sp. is an efficient predatory mite, which regulates the pest under field conditions.