Integrated Pest Management in Bhendi Crop

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Bhendi (*Abelmoschus esculentus*), also known as okra or lady's finger, is a popular vegetable that is widely grown and consumed in India. 100 grams of bhindi contains 7.03-gram carbohydrates, 2-gram protein, 0.1-gram fat and 9% fiber. Okra is predominantly a crop of tropics and subtropics region. It occupies fifth position, next to tomato in area under vegetables in the country with a production of 33.24 lakh metric tonnes from an area of 3.47 lakh hectares. The crop is cultivated for its young tender fruits, used in curry and soups after cooking. It is a good source of vitamins A and B, protein and minerals. It is also an excellent source of iodine and is useful for the treatment of goiter. Fruit is useful against genitor-urinary disorders, spermetorrhoea and chronic dysentery. Fruits are also dried or frozen for use during off-season. Dried fruit contain 13-22% edible oil and 20-24% protein and is used for refined edible oil. Dry fruit skin and fibres are used in manufacture of paper, card board and fibres. Root and stem are used for clearing cane juice for preparation of jaggery. Okra originated in tropical and subtropical Africa. Existence of a large number of related species with wide variability and dominant characters suggest possible role of India as a secondary centre of origin. India is the largest producer of okra in the world. It is also used as a vegetable in Brazil, West Africa and many other countries. In India, major okra growing states are Uttar Pradesh, Bihar West Bengal and Rajasthan.

The crop is attacked by more than 72 insect pests which infest the crop from seedling to harvest. Amongst them, Melon Thrips (*Thrips palmi*), Leafhopper (*Amarasca biguttula*), Whitefly (*Bemisia tabaci*), Aphids (*Aphis gossypii*), Shoot and fruit borer (*Earias vittela* & *Earias insulana*), Okra fruit borer (*Helicoverpa armigera*) and Red spider mite (*Tetranychus spp.*) are most serious pests from quarantine point of view as these pests may find a place in the pathway of okra fruits export to European Union.

Identification of different Okra pests

Melon Thrips (*Thrips palmi*)

This is polyphagous but mostly found on Cucurbitaceae and Solanaceae crops. Eggs are colourless; bean shaped; turns yellow towards maturation; laid singly inside the plant tissues. Larvae resembles adult in general body form but lacked wings. They usually feed on older leaves. Full fed larvae descend to the soils of leaf litter where it pupates making an earthen chamber. Adult is pale yellow with numerous dark setae. A black line from the juncture of wings runs along the back of the body. Slender fringed wings are pale. Fringe is shorter on the anterior edge than posterior. Body length is 0.8 -1.0 mm. Thrips antenna is seven segmented, Ocelli red pigmented.

Leafhopper (*Amarasca biguttula*)

Adults are greenish yellow, small, wedge shaped 3 mm long having black spot on each forewing and vertex. Lays yellowish eggs in clusters on underside, embedded in the leaf veins. Nymphs and adults feed underside by sucking sap.

Whitefly (*Bemisia tabaci*)

Adults are yellowish dusted with white waxy powder, 1.0- 1.5 mm in length. Female lays stalked eggs singly on underside of leaves. Nymphs and adults suck the sap of leaves. Whitefly Aphids

Aphids (*Aphis gossypii*)

Adults are small soft bodied found in colonies in tender parts. Damage is caused by both nymphs and adults by sucking cell sap. Black shooty molds develop on honey dew secreted by aphids on leaves. Dry condition favours population flair up.

Shoot and fruit borer (*Earias vittela* and *E. insulana*)

Adult of *Earias vittela* is 2.5 cm across the wings and have narrow light green band in the middle of forewings. Whereas *E. insulana* does not have such conspicuous band on forewings. Full grown larvae are dull green, 2 cm long having tiny stout bristles and a

series of black spots on the body. Eggs are laid singly and are of sky blue. Both bores in to shoots resulting in to drooping down of growing points and later on bore in to fruits.

Okra fruit borer (*Helicoverpa armigera*)

Polyphagous, lays spherical yellow eggs singly on tender parts. Eggs are flat at the bottom. Larvae are of varying colour with darker broken lines along side of the body. Body covered with radiating hairs. Pupates inside the soil. Adult is medium sized brownish forewings with dark cross band near outer margin and dark spots near coastal margins. Bore fruits with circular irregular holes comparatively bigger in size. Half portions of larva remain inside the fruit while feeding.

Red spider mite (*Tetranychus spp.*)

Mites are minute in size and vary in colour with two dark spots on the body. Infestation usually observed during warm and dry periods. Damage is done by sucking cell sap, giving grey patches on leaves and leaves become brown and fall. In severe infestation webbing is observed in plants.

Pest Surveillance

Weekly monitoring through pest scouting and with the help of monitoring device like pheromone traps, colored sticky traps should be practiced from germination to harvesting stage. For field scouting 100 plants per acre in a cross-diagonal pattern through zig zag manner is required to be observed for counting of each and every type of insects which may fall in the pathway of okra fruit export. If 95% plants found free from insect pests then the field should be considered fit for export of okra fruits.

Management Practices:

The following Good Agricultural Practices should be adopted for the management of various okra pests:

- Destruction of debris, crop residues, weeds & other alternate hosts
- Deep summer ploughing.
- Adoption of proper crop rotation and avoid growing of malvaceae crops in sequence.
- Use of resistant and tolerant varieties recommended by the State Agricultural Universities of the region.
- Use well decomposed FYM @ 8-10 tonnes per acre or wormi-compost @ 5 tons per acre treated with *Trichoderma sp.* and *Pseudomonas sp.* @ 2 kg per acre as seed / nursery treatment and soil application.
- Apply neem cake @ 100 kg per acre for reducing nematode population.
- Weeding and earthing up in rows should be done 25-30 days after sowing.
- Field should be kept free from weeds.
- Plant tall crops like maize, sorghum and pearl millet on border of the field to reduce white fly population.
- Erection of bird perches @ 10/acre in the field for facilitating bird predation.
- Pheromone traps for two insects' viz. *Helicoverpa armigera* and *Earias sp.* should be installed @ 4-5 traps per acre. Install the traps for each spp. separated by distance of more than 75 feet in the vicinity of selected field. Fix the traps to the supporting poles at a height of one foot above the plant canopy. Change the lures after 2-3 weeks interval.
- Set up yellow/blue traps/ sticky traps 15 cm. above the crop canopy for monitoring and mass trapping of thrips, white fly, aphids, jassids @ 10-20 traps per acre.
- Set up light traps @ one trap per ha.15 cm. above the crop canopy for monitoring and mass trapping of insects between 6 pm to 11 pm.
- Collect and destroy the infested fruits with fruit and shoot borer infestation and larvae of *Heliothis, Spodoptera* and adults of blister beetle.
- Conserve the existing bio-control agents like Spiders, Coccinalids, Syrphid flies etc. in the field by avoiding, delaying and reducing the use of chemical pesticides and promoting the use of bio-pesticides including botanicals and microbial.
- Augment the bio-control agents like egg parasitoids, *Trichogramma chilonis*, *Trichogramma*

achaea, *Trichogrammatoidea sp.*, *Telenomus sp.*, *Encarsia spp.*; larval parasitoid *Bracon sp.*, *Campoletis chlorideae*, *Chelonus blackburni*; predators like *Chrysopa sp.*, *Coccinella sp*. 16. Install bird percher to conserve predatory birds.

- Spray NPV @ 250LE per hectare to control *H. armigera* and *Spodoptera litura*. Spray *Beauveria bassiana* 1% @1500-2000 g in 160-200 l of water/acre.
- Spray *Azadirachtin* 0.03% (300 ppm) neem oil based WSP @1000-2000 ml in 200-400 l of water/ acre or *Azadirachtin* 5% W/W neem extract concentrate @ 80 ml in 160 l of water/acre.
- Apply Need based application of chemical pesticides *viz.,* imidacloprid 17.8 SL @ 150 ml/ha, cypermethrin 25 EC @ 200 g a.i/ha (0.005%), quinalphos 25 EC @ 0.05% or Propargite etc. 57 EC @ 0.1 % for control of leaf hoppers, aphids, white flies, borers and mites.

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