



Integrated Pest Management in Brinjal

Uma Shankar
Deepak Kumar
Saurav Gupta



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Jammu
Main Campus Chatha, Jammu-180 009 (J&K), India

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Compiled and Edited by

Dr. Uma Shankar
Assistant Professor
Division of Entomology
SKUAST-J, Chatha
Jammu-180 009
Mobile: +91 9419202151
E-mail:umashankar.ento@gmail.com
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Reviewed by:

Dr. Subrata Satpathy
Principal Scientist Entomology
Central Institute for Jute Allied Fibres (ICAR)
Barrockpore, Kolkata-700 120

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Installation of Traps in the brinjal field
Farmers' Training Programme at Narayana, Akhnoor

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Integrated Pest Management in Brinjal

SHANKAR, U. , KUMAR, D. AND GUPTA, S.

Introduction

Vegetables are considered as 'protective supplement food' as they contain large quantities of minerals, vitamins and essential amino acids required for normal functioning of human metabolic processes. Thus, vegetables constitute an essential component of a balanced diet and play a vital role in the maintenance of good health.

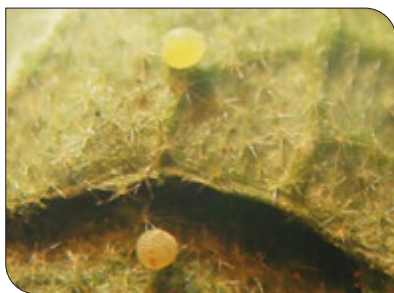
Brinjal, *Solanum melongena* L., is a common, popular and extensively grown vegetable crop in the subtropics and tropics. Insect pest infestation is one of the major bottlenecks in increasing the yield potential in brinjal crop. The crop is susceptible to the attack of various insect pests and diseases in different stages with varying degree of damage which causes considerable losses by reducing potential yield and quality of the produce. In view of the lucrative returns from brinjal, farmers with limited land holdings and resources are forced to follow monoculture and intensive cultivation, which also exacerbates the survival of various insect pests and pathogens from one season to another. In such conditions, the role of Integrated Pest Management in brinjal cannot be overlooked. The efficient management of these insect pests and diseases is possible only through adequate knowledge of different stages of insects, nature of damage and symptoms caused by pathogens, survival and dissemination of the pathogen as well as effect of environmental condition on insect pests and disease development.

During the recent years, important insect pests and diseases of brinjal from Jammu have been recorded and described in this bulletin for an easy identification, decision making and timely management by the farmers to avoid the losses caused by the pests.

INSECT PESTS OF BRINJAL

1. Shoot and Fruit Borers, *Leucinodes orbonalis* (Lepidoptera: Pyralidae)

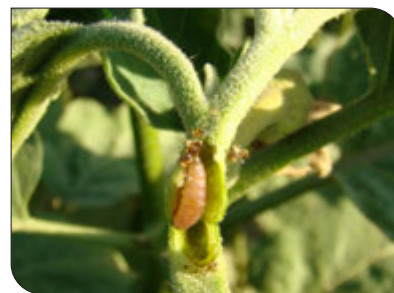
Brinjal shoot and fruit borer (BSFB) inflicts a serious damage to the fruit causing drastic reduction in the marketable quality fruit yield. The damage starts soon after transplanting the crop and continues till harvest of the fruits. The adults are small moths having brown to black spots on the wings. The adult female lays eggs on the ventral surface of the leaves, flower buds and on young fruits. After hatching within the week, small pinkish larva initially bores into the terminal shoots resulting in withering and drying of the shoot and at later stage, it damages the young fruits by making holes and feeds inside which makes the fruits unfit for consumption and marketing. One larva is responsible to damage at least 4-6 fruits. Often the entry hole encourages the secondary bacterial infection and rotting of fruits. As its larvae are concealed within the twigs as well as in fruits it is very difficult to control.



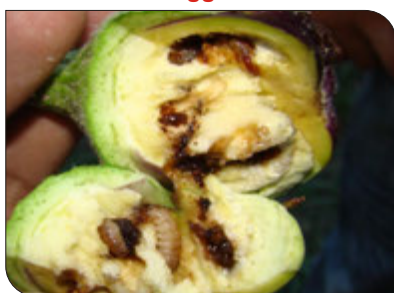
Eggs



Larva opened our from shoot



Larva inside the shoot



Larvae inside the fruit



Larva and pupae



Adult moth of BSFB



Clipping of affected shoot



Pheromone and water traps



Clipping of shoots and fruits

Management

- Monoculture or continuous cropping of brinjal on the same piece of land should be avoided.
- As soon as the insect is detected, the affected twigs should be clipped/removed along with the insect and destroyed. Fruits showing any boring symptoms should also be picked and destroyed.
- The moths can be mass trapped by installation of pheromone traps @ 100 per ha at 10 m spacing.
- Apply ash dust and avoid the excessive dose of nitrogenous fertilizers in brinjal crops to reduce the infestation of BSFB.
- Long and oblong varieties with bunchy fruiting/ flowering behavior are less susceptible to BSFB.
- Spraying the crops alternatively with profenophos 50 EC @ 2ml /litre of water at 15 days interval and cypermethrin (0.5 ml/litre of water) starting from 20 days after transplanting to control the pest.
- Before spraying, all the affected twigs and fruits should be clipped off or removed from the field.

2. Leaf Roller, *Eublemma olivacea* (Lepidoptera:Noctuidae)

The neonate larvae start folding the leaves from tip downwards. Caterpillars roll leaves and feed on chlorophyll while remaining inside the folds. The folded leaves wither and dry up. Full grown larvae are stout purple brown in colour and ornamented with yellow spots and hairs.



Leaf Roller larva



Adult

Management

- Collection and destruction of infested leaves along with insects in the initial stage help to minimize the infestation.
- Spraying of carbaryl (0.1%) or malathion (0.1%) just after clipping of damaged leaves.

3. Brinjal stem borer, *Euzophera perticella* (Lepidoptera: Phycitidae)

Pale white coloured larvae attack the stem and often kill the young plants. The growth is

stunted, plants wither and fruit yield is adversely affected in case of older plants. Moths have greyish brown forewings with transverse lines and white hind wings. The larvae are creamy white with few hairs.

Management

- Avoid rationing in endemic area.
- Removal and destruction of the affected plants help in reducing the infestation.
- Apply carbofuran 25 kg a.i/ha or neem cake @ 250 mg/ha as spot application around the root zone.



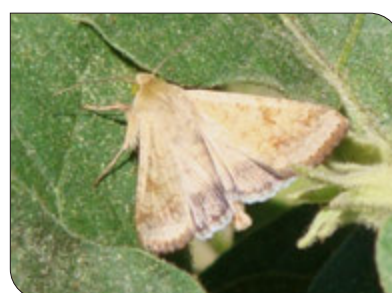
Stem borer larva inside stem

4. Brinjal Fruit borer, *Helicoverpa armigera* (Lepidoptera: Noctuidae)

Helicoverpa larvae damage the flowers, buds and fruits at several places in Jammu province. Their presence can be detected by using pheromone traps. It can also be used for mass destruction of male *Helicoverpa* moths. Their activity persists on brinjal from March to September months. They are responsible for causing serious damage in brinjal fruits, also.



Larva feeding on flower



Female moth laying eggs

Management

- Spray Ha NPV @ 250 LE per ha at evening hours mixed with adjuvant such as APSA 80 gave promising effect.
- Pheromone traps are beneficial to detect early infestation of the pest.
- Release of bioagents *Trichogramma brasiliense* and *T. chilonis* @ 2.5 lacs parasitized eggs per ha (in the form of Tricho-cards).
- Needs based application of cypermethrin @ 0.5 to 1 ml per lit of water with the appearance of insect pests in the field.

5. Brinjal leaf defoliators, *Spodoptera litura* (Lepidoptera: Noctuidae)

Spodoptera larvae are very common defoliators of leaves of brinjal plants. They are voracious feeders and completely defoliate the leaves of plants. Adult female lays eggs on leaves in batches. The egg masses are covered with scales. Initially young larvae with black spots on thoracic region feed gregariously.



Feeding on bud



Feeding on leaf



Adult *Spodoptera* moth

Management

- Mass trapping can be done by using pheromone traps. *Splt* NPV mixed with adjuvant can be sprayed in the afternoon @ 300 LE/ha.
- *Spodoptera* can be controlled by spraying endosulfan 35 EC @ 2ml per litre or cypermethrin 25 EC @ 0.5 to 1 ml per lit of water.
- Foliar spray of bioagent or chemicals should be done after removal of egg mass by clipping.



A farmer is watching the trap catches

6. Hadda Beetle, *Epilachana vigintioctopunctata* and *E. Dodecastigma* (Coleoptera: Coccinelidae)

The yellowish coloured grubs and adults feed voraciously by scrapping the leaves and tender parts of the plant. As a result, the leaves are completely skeletonized leaving only a network of veins. It often causes serious damage when they appear in large numbers.



Eggs



Grubs



Adult

Management

- Collection and destruction of infested leaves along with the grubs, adult and eggs reduces the pest incidence.
- Spraying the crop with malathion 50 EC (2ml/litre of water) or carbaryl 50 WP (2 g/litre of water) effectively controls the hadda beetle incidence.

7. Jassids, *Amrasca biguttula biguttula* (Hemiptera:Cicadellidae)

Both nymphs and adults suck the sap from the lower surface of the leaves. The infested leaf curl upward along the margins, which may turn yellowish and show, burnt up patches. They also transmit mycoplasma disease like little leaf and virus disease like mosaic. Fruit setting is adversely affected by the infestation.



Jassids



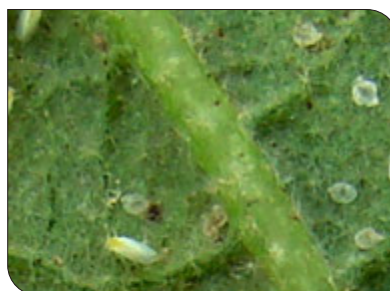
Cup like curling symptoms

Management

- Seed treatment with thiamethoxam 70 WS @ 3g/kg seed at the time of sowing.
- Foliar spray of imidacloprid (0.006 %) during the vegetative stage of the crop.

8. Whiteflies, *Bemesia tabaci* (Hemiptera:Aleyrodidae)

Whiteflies directly suck the saps from the leaves and lower the vigour of crops, more importantly it causes damage by transmitting the leaf curl diseases in plants. Infested plants show the symptoms like vein and leaf yellowing, mosaic of leaves, leaf curling and plant stunting.



Whitefly eggs and nymphs



Adults

Management

- Use the tolerant varieties like Hisar anmol and Kashi vishesh.
- Seed treatment with imidacloprid 70 WS @ 3 g per kg to protect the crop from whiteflies attack.
- Use of nylon agro-net in nursery.
- Removal of weed hosts to reduce the damage.
- Spraying of imidacloprid 17.8 SL @ 0.3 ml per lit of water after transplantation.

9. Red Spidermite, *Tetranychus cinnabarinus* and *Paratetranychus indicus* (Acari: Tetranychidae)

The red spider mite infests brinjal particularly in low humid dry condition. Different

stages of mites are found in colonies covered by white-silky webs on lower surface of leaves. Nymphs and adults suck cell sap and white patches appear on leaves. Affected leaves become mottled, turn brown and fall down.



Red spider mites



Mites webbing on buds & leaves

Management

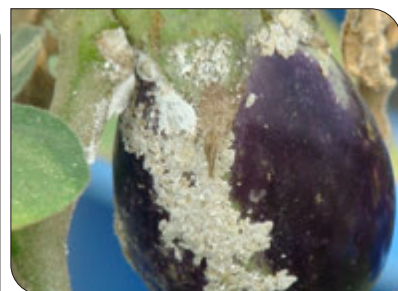
- During egg stage and the resting stages, most acaricides are ineffective. At high temperatures, it may be necessary to apply these at an interval of two days.
- Acaricides like dicofol (0.05%) and wettable sulphur (0.3%) gives effective control of mites. Avoid use of synthetic pyrethroids for borer control.
- Collection and burning of severely infested plant parts reduces further multiplication of mites.
- Proper irrigation and clean cultivation are essential to reduce the damage caused by mites.

10. Mealy Bug, *Planococcus solenopsis* (Homoptera: Pseudococcidae)

P. solenopsis has been recorded for the first time in Jammu causing damage in different parts. Nymphs and adults of mealy bugs suck sap from the leaves, tender shoots, and the fruits. Leaves show characteristic curling symptoms similar to that of a virus. A heavy black sooty mould may develop on the honeydew like droplets secreted by mealy bugs. Flower development and fruit set are adversely affected. Infested fruits are entirely covered with the mealy bug. The infestation may lead to fruit drop or the fruits remain on the shoots in a dried and shriveled condition.



Mealybugs on leaves



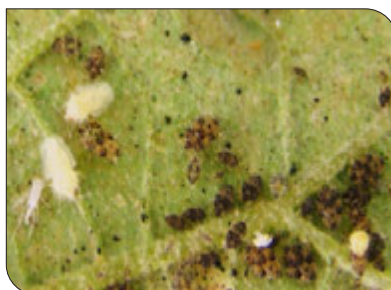
On fruit

Management

- Unlike the adults, the crawlers are free from waxy coating and therefore the crawler stage is the most effective for spraying pesticides. Crops should be monitored to spot the early infestation.

11. Lace wing Bug, *Urentius hystricellus* (Hemiptera: Tingidae)

This pest has been reported first time from Jammu and is a specific pest of brinjal mostly attacking in the summer and rainy season. Both the nymphs and dark brown bugs with lace like wings suck the sap from leaves, which turn whitish and are found covered with insect excreta. The affected leaves eventually dry up.



Lace wing eggs and nymphs



Adult Bug

Management

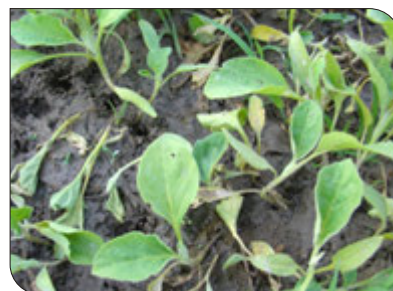
- Proper crop rotation and spraying with imidacloprid 17.8 SL @ 0.3 ml per lit of water help in the reduction of the pest population.

Diseases of brinjal A. Fungal diseases

1. Damping off

Causal organism (Species of *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia solani*)

It is an important disease of brinjal and also other vegetable crops like bell pepper, chilli, cabbage, cauliflower, broccoli, onion etc. for which nursery is raised for transplanting. In case of pre-emergence damping off failure of seedling emergence from the soil results in patchy appearance of seedling stand in the nursery in early stages of growth whereas in case of post-emergence damping off topping over of infected seedlings at any time after their emergence from the soil resulting in mortality of the seedlings.



Damping off

Management

- Change the nursery site every year
- Either treat the soil with transparent polyethylene (25µm) sheet for 45 days during summer months or treat the soil with formalin (5%) at least 21 days before sowing or apply bio-agents like *Trichoderma harzianum* / *T. viride* (40g/m²).
- Treat the seed with Captan or Thiram (0.3%).
- After seedling emergence from the soil, drench the bed with the mixture of mancozeb

(0.25%) and carbendazim (0.1%) and repeated at 10 days interval. Give light but frequent irrigation.

2. Phomopsis blight and fruit rot

Causal organism: *Phomopsis vexans*

In nursery bed it causes damping off. After transplanting circular grey spots with light coloured centers appear on leaves. Affected leaves turn yellow and fall down prematurely. The disease also appears on the stem in the form of elongated blackish brown lesions. Pale sunken spots with black picnidia develop on the fruits and may progress to cover the entire fruit surface. The pathogen is seed born and it also survives in the infected plant debris. Warm (25° C) and wet weather conditions favour infection and subsequent disease development.



Phomopsis blight and fruit rot

Management

- Collection & burning of the old plants as soon as the crop is over.
- Use disease free seeds and treat the seeds with carbendazim (0.2 %)
- Spray the crop with mancozeb ((0.25 %) or carbendazim (0.1 %) or combination of mancozeb ((0.2 % & carbendazim (0.05 %) or copper oxychloride 0.3 % and repeat at 10-14 days interval.

B. Wilt Complex

This disease is becoming a limiting factor in successful cultivation of brinjal. There are many pathogens associated with this disease include *Verticillium* sp., *Fusarium solani*, *Sclerotium rolfsii* and *Macrophomina phaseolina*. In Jammu province wilt disease causes severe problems in commercial brinjal cultivation. The characteristic symptoms of the disease are wilting and yellowing of the foliage followed by collapse of entire plants.

1. Fungal wilt, *Verticillium* sp.

The pathogen is soil-borne and the primary inoculum usually comes from the soil. Its characteristic symptoms are found on stem and roots of young as well as on mature plants. The infected plants become stunted in growth and do not flower and set fruit. If the infection takes place after the flowering or fruit setting, the flowers and fruits are deformed and finally drop off.



Fungal wilt

Management

- Soil solarization and crop rotation are recommended as control measures.
- Use of resistant varieties like Pusa purple long (PPL), Black beauty and K 2282.

2. Bacterial wilt, *Ralstonia solanacearum*

The symptoms of bacterial wilt on susceptible plants are yellowing, curling and wilting of leaf; and dying of the plant. The bacterium has a wide host range and can also survive in moist soil for longer periods in the absence of plant debris. The disease usually develops when the average temperature is above 20 °C and more severe wilting is seen at higher temperature of 30 °C or more along with high soil moisture. Disease is further aggravated if soil is infested with root knot nematodes.



Bacterial wilt



Ooze test

Management

- Follow at least three year crop rotation with non- solanaceous crops.
- Solarize the field soil before planting for at least 45 days.
- Apply bleaching powder (15 kg/ha) before transplanting.
- Use resistant varieties/hybrids if available.
- Apply carbofuron @ 1.25 kg per canal at the time of field preparation and immediately irrigate the field.

C. Little leaf of brinjal

Causal organism: *Phytoplasma* spp.

The disease is characterized by smalling of leaves and shortening of node and internodes, which gives the plant a bushy appearance. The fruiting is very rare. In nature, the phytoplasma perenate on the weed host like *Datura* spp. and *Vinica rosea* and several others. The disease is transmitted through leaf hopper vector, *Hishimonas phycitis*.



Little leaf of brinjal

Management

- Destruction of weeds like *Datura* and *Vinica rosea* from in and around the field.
- Dipping of seedling in tetracycline (0.05 %) before transplanting followed by soil

application of carbofuron @ 1.25 kg per canal also keeps the disease under check.

D. Cucumber Mosaic virus

There are several viruses which infest the brinjal plants under natural conditions and produce the cucumber mosaic symptoms on leaves. Perhaps the whiteflies and jassids are the important source of virus vector for mosaic disease in brinjal plants. The leaves of infected plants are deformed, small and leathery. Plants infected by the virus in early stages show the stunted growth. Another important viral disease is caused by potato Virus Y and transmitted by aphids.



Cucumber mosaic symptoms

Management

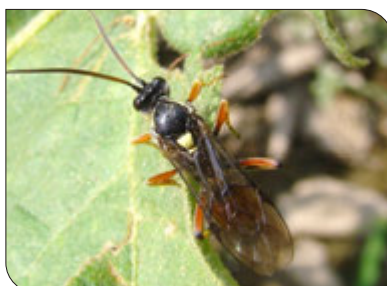
- Proper management of vectors like whiteflies, jassids and aphids.
- Rouging and destruction of infected plants and eradication of weed hosts around the fields.
- Use of resistant varieties.
- Spraying imidacloprid 0.5 ml per lit of water twice after 15 days interval on 20 days transplanted plants.

Natural enemies of Brinjal pests

Natural enemy fauna or farmers friend insects also play a vital role in regulating the insect pests of brinjal. They can be preserved and encouraged by planting some border row of flowering plants and reducing the pesticide pressure. It would be beneficial to use eco-friendly pesticides in less quantity at evening hours. Various types of coccinellid beetles, big-eyed bug, green lace wing larva, rove beetles, minute pirate bug (nymphs and adults) and spiders are the general predators abundantly found in brinjal eco-system to control small and sucking pests. Besides this, several parasitoids are also recorded in brinjal crop ecosystem which suppresses the immature stages of insect pests on crops.



Xanthopimpla sp.



Ichneumonid wasp



Brachymeria wasp



Ichneumonid wasp



Minute pirate bug



Nymph feeding on aphids



Eocanthecona bug



Green lace wing larva



Green lace wing adult



Spider feeding on BFSB larvae



Long legged fly



Big eyed bug



Rove beetle & coccinella



Coccinella tarnsversalis



Coccinella spp.



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