

## Controlling Eggplant Fruit and Shoot Borer

### *A Simple, Safe and Economical Approach*

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Eggplant fruit and shoot borer (EFSB), *Leucinodes orbonalis*, is the most damaging pest of eggplant in South and Southeast Asia. Its larvae feed inside eggplant fruit, making the fruit unmarketable and unfit for human consumption. At times, yield loss could be total.

Farmers are currently using too many toxic chemicals and applying them too frequently to control EFSB. This excessive pesticide usage threatens the health of farmers and consumers, besides making eggplant fruit more costly to consumers. In the meantime, the insect is becoming tolerant to the chemicals, making it more difficult to control.

This guide will teach you a simple, safe and economical method to control EFSB. This method has been successfully tested on farmers' fields in Bangladesh and India.

### How does EFSB look like and live?

EFSB goes through four different forms in one lifetime. Moths lay tiny white **eggs**, mainly on leaves (Fig. 1). After 4-5 days, eggs turn into translucent **larvae**. These larvae crawl a short distance and enter into a tender shoot or fruit. **This is the stage when EFSB causes damage.**

After 15-20 days of feeding, a larva is full-grown, measuring 10-15 mm. It makes a small hole in the fruit or shoot and escapes at night to the soil. It forms a sturdy cocoon around itself on or just below the soil surface, and rests as a **pupa**. The pupa looks like dried plant debris and cannot be easily recognized.

After a week, the pupa changes into an **adult** moth. The adult moth is small, white with a pink and bluish tinge, with a few brown spots on its wings. It lives for 6-10 days. Moths do not feed on eggplant, rather they survive on plant exudate or dew drops. They hide under eggplant leaves during the day and are not easily seen. During the night, the moths come out in the open and mate. Soon after mating, female moths lay eggs on eggplant plants. The eggs hatch and the life cycle continues.

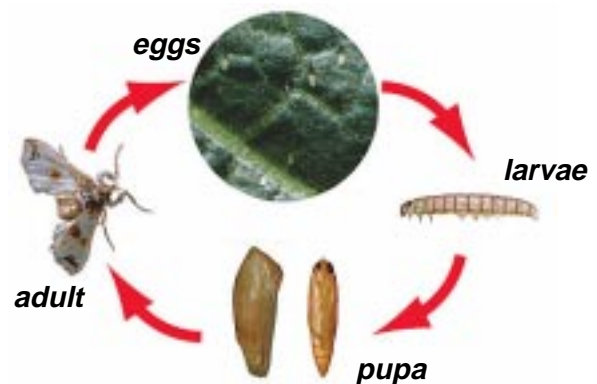


Fig. 1. Life cycle of eggplant fruit and shoot borer

## Where does EFSB come from?

EFSB survives on eggplant. It infests crops in one or more of four ways. First, in a newly-planted eggplant crop, EFSB moths can fly in from **neighboring eggplant fields** that have already been damaged (Fig. 2). This is the most important source of infestation. Because moths can fly from one field to another, it is important that all farmers in a community work together to keep EFSB under control.



Fig. 2. Moths can easily fly from field to field

Second, **eggplant seedlings used for transplanting** can sometimes be carrying eggs or tiny larvae. This is especially true if one uses slightly older seedlings raised in an open field in the vicinity of a pest-damaged older eggplant crop.

Third, if the previous crop grown in the field was also eggplant, the EFSB pupae from the **previous eggplant crop** resting within the soil will become adults and infest the new crop.

Fourth, if old uprooted eggplant plants are stored nearby, the pupae from underneath such **eggplant debris** can develop into adults and infest the eggplant crop.

## When and how does EFSB cause damage?

Infestations usually begin when the crop starts to flower. **The first symptoms are freshly-wilted shoots. No control is needed before this time.** Insecticides used before symptoms appear are wasteful and will kill natural enemies of EFSB.

Initially when eggplant fruits have not yet developed, all larvae go to the tender shoots and feed inside these

plant parts (Fig. 3a). Later when plants start bearing fruits, most larvae prefer to feed on the more tender fruits (Fig. 3b). Larvae also feed on flowers, reducing fruit set and yields.



Figs. 3a-b. Larva feeding inside shoot and inside fruit

When larvae become mature, they exit the fruit or shoot by making a hole and descending to the soil for pupation. Exit holes are clearly visible in fruits (Fig. 4a), but may not be obvious in shoots because of the hairiness of shoots (Fig. 4b). After an infestation begins, it can continue until the last harvest.



Fig. 4a-b. Exit holes on fruit and shoot

## How do farmers control EFSB now?

Most farmers spray their eggplant crop with chemical insecticides to protect their crop from the borer (Fig. 4). Some farmers use these pesticides indiscriminately, often using wrong chemicals and at wrong dosages. Many farmers spray their eggplant crop two or more times a week.

Such pesticide use is expensive, and damaging to human health and the environment. Such indiscriminate pesticide use allows the borer to become tolerant to these chemicals. As a result, it makes it impossible to control this insect pest again economically with the same chemicals.

## What's the best way to control EFSB?

### 1 Sanitation: remove infested shoots and fruits

Before plants start fruiting, EFSB larvae feed inside tender shoots. These damaged shoots are readily visible as dried tops of branches (Fig. 5).

**Cut and destroy these larvae-infested shoots immediately to prevent the larvae from developing and reproducing** (Fig. 6).

Do not drop the cut shoots in the field. They must be destroyed, preferably by burning. If burning is not possible, bury them at least 20 cm deep in soil or shred them into tiny pieces. Unless destroyed, the larvae in the shoots can pupate in the soil, become moths, and infest new plants.

These shoot-pruning activities are especially important in the early season. Once fruiting begins, most larvae will prefer to enter in fruits rather than shoots. Newly-infested fruits are difficult to detect. Continue cutting shoots at least once a week until final harvest. This cutting will not harm the plant. Any infested fruits found during harvest should also be culled and destroyed.

After the final harvest, the old plants should be uprooted and burned promptly because they may harbor EFSB larvae which could become a source of future infestation.



Fig. 5. Larvae-infested, freshly-wilted shoot



Fig. 6. Freshly-wilted shoots must be cut and destroyed immediately

### 2 Pheromones: trap male moths to prevent mating

**Sex pheromones can be used to trap male EFSB moths.** The pheromone of EFSB is now available from chemical suppliers. It consists of a mixture of (E)-11-hexadecenyl acetate and (E)-11-hexadecen-1-ol, in a mixture of 10:1 to 100:1. A 2-3 mg pheromone sample contained in porous plastic tube, when baited in a suitable trap and placed in the field, can attract male moths continuously for up to 6 weeks.

Various traps are available in the market or can be prepared locally. Winged (Fig. 7a) and delta (Fig. 7b) traps are commonly used for trapping other insects. The pheromone lure is attached underneath the top of the trap, one lure per trap, which protects the lure from sun and rain. The bottom surface is coated with sticky material in which the male moths attracted to the lure are trapped and killed. These traps can be used continuously in the field for 3-4 weeks depending upon weather. During rains or heavy winds they can be damaged and need to be replaced. Also during dry weather and strong winds, the sticky bottom surface, where the insects are trapped, get soiled which reduces stickiness and efficiency of insect catch.

A plastic funnel trap, developed for trapping tomato fruitworm or cotton bollworm (*Helicoverpa armigera*) also is effective in trapping EFSB adults (Fig. 7c). This trap is commercially available in some countries. It is made from sturdy and inexpensive plastic material and it does not have any sticky surface. The lure is attached underneath the top cover just above the mouth of the funnel. The adults attracted to the pheromone lure slip through the smooth surface of the funnel into a long plastic bag which is tied to the lower end of the funnel. This trap can last throughout the season and can even be used in subsequent seasons.

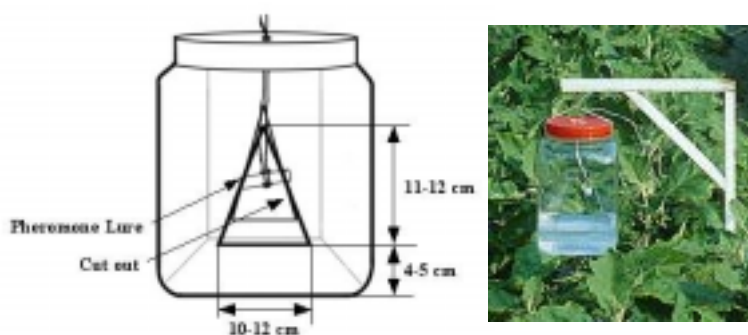


Figs. 7a-c. Winged, delta and plastic funnel pheromone traps

A simple water trough pheromone trap has been developed by Bangladeshi scientists (Figs. 8a-b). It consists of a 3-liter capacity, 22-cm tall rectangular or round, clear plastic container. A triangular hole is cut in any two opposite sides. Soapy water of 3-4 cm height is maintained inside the trap throughout the season. The pheromone lure, usually in a closed plastic tube, is hung through the center of the lid inside the trap in such a way that the lure is 2-3 cm above the water level.

It is the smell of the pheromone seeping from the lure tube that attracts male EFSB moths. They enter the trap, fly around the lure, and fall into the soapy water and die. It is important that the soapy water inside the trap is replenished often to make sure the trap is never dry, or else the moths will not be killed. This trap can last at least one season.

No matter what type of pheromone trap is used, the lure tube should always be kept closed. Pheromone chemicals seep slowly and uniformly from this tube. Traps should be erected in the field starting 3-4 weeks after transplanting until the last harvest. A distance of 10-15 m should be maintained between traps in the field. The traps are hung in such a way that the lure is just above the plant canopy. This will require that the traps be moved higher as plants grow taller.



Figs. 8a-b. Drawing and photo of water trough pheromone trap

**COMMUNITY APPROACH:**

The steps described in this guide are simple and can be put into practice easily. However, it is important that all farmers in the community observe these steps. This is because EFSB adults fly readily from one field to the next. Therefore, if some eggplant growers in the middle of a large area do not follow these steps, their eggplant crop will be infested by EFSB and these fields will spread the pest epidemic to neighboring fields.

**3 Reduce pesticide use: protect natural enemies of EFSB**

The indiscriminate use of toxic, broad-spectrum insecticides is not giving satisfactory control of EFSB. At the same time, these pesticides are killing the natural enemies of EFSB. These natural enemies were giving satisfactory control of the pest before the use of insecticides became widespread.

Several parasitoids and predators of EFSB are prevalent in the eggplant fields in South and Southeast Asian countries. The most notable parasitoid is *Trathala flavo-orbitalis* (Fig. 9), a tiny wasp that is harmless to humans. This wasp lays its eggs in EFSB larvae. The eggs hatch into wasp larvae that eat the EFSB larva they were laid into.

Broad-spectrum chemicals sprayed to kill EFSB will also kill these beneficial insects. If selective, preferably biological insecticides are used instead, this and many other parasitoids will survive and be able to attack EFSB larvae. Reducing the use of pesticides will allow common predators, such as spiders, ants, earwigs and mantids, to survive and kill EFSB and other pests. These natural enemies are important assets of vegetable farmers and should be protected by reducing or, if feasible, eliminating broad-spectrum chemical pesticide use.

If one must apply insecticides to combat EFSB or other pests, it is important that only the locally recommended and still effective insecticides, and preferably, pest-specific biological products, be used.

Fig. 9. *Trathala flavo-orbitalis*, a wasp that attacks EFSB (3X actual size)



The sex pheromone chemicals are readily available from specialty chemical companies. They are being registered in some countries of South Asia and will soon be available in the market. Until that time, AVRDC will provide a few samples for testing purposes only.

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