Rearing eggplant fruit and shoot borer

A slide set and illustrated guide

Asian Vegetable Research and Development Center

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Preface

Eggplant fruit and shoot borer, *Leucinodes orbonalis* Guenée, is a destructive pest of eggplant in tropical and subtropical Asia and parts of Africa. Insect larvae bore into tender shoots and fruits; shoots wilt reducing plant vigor and fruits become unfit for human consumption. Farmers in Asia use large amounts of chemical insecticides to kill the pest in its larval stage. Without adequate pesticide residue on the plant, however, the newly hatched larvae survive their crawl to the nearest shoot or fruit, and once inside, are safe from pesticide spray. This leads farmers to spray chemicals frequently. This excessive use of pesticide has resulted in economic, environmental, and human health problems, but has not resulted in adequate control of the pest.

The use of pesticides to combat *Leucinodes* must be reduced. This will require development of alternative, safe, economical, and sustainable control measures. To accomplish this, more research is needed to better understand this insect and its relationship with its host and the environment. At present, the only way to obtain insects for study is to collect them from infested plants during the eggplant growing season. Not only is it difficult, if not impossible, to collect enough uniform quality insects to produce reliable results, but research can only be conducted at certain times of the year, so the search for a solution to this pest problem is prolonged.

To overcome this seasonal barrier and accelerate the progress of research, AVRDC has developed a procedure for rearing *Leucinodes* in the laboratory throughout the year. This booklet illustrates this procedure.

Successful rearing of any insect outside its host plant entails two basic steps: provision of an ideal diet on which the insect can develop normally, and provision of a site where male and female adults can mate and lay fertile eggs, and from where the eggs can be easily collected.

To feed the *Leucinodes*, we started with a commercially available diet

imported from the United States (designed for a polyphagous insect, *Spodoptera exigua*) to which we added a fine powder of dried eggplant fruits. When this commercial diet is not available, a locally prepared diet developed for *S. exigua*, *S. litura*, or another polyphagous Lepidoptera, such as *Helicoverpa armigera*, can be used. Such substitution, however, might require several trial-and-error experiments to find a formula acceptable to *Leucinodes*.

We have been rearing Leucinodes in our laboratory successfully for the past two years. We hope the procedure described in this slide set and booklet will work for you. Due to variations in diet ingredients and laboratory conditions, however, you might face some difficulties in rearing *Leucinodes*. If so, we suggest that you experiment to modify the procedure to suit your needs. We hope this information will at least give you a head start in your rearing efforts.

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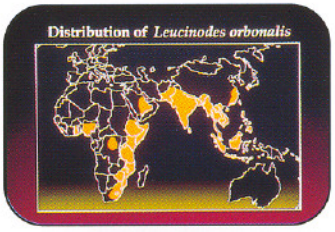
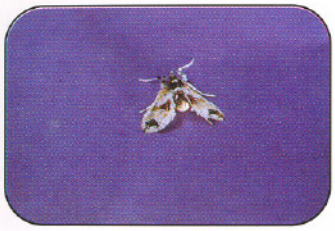
Introduction: the shoot borer problem



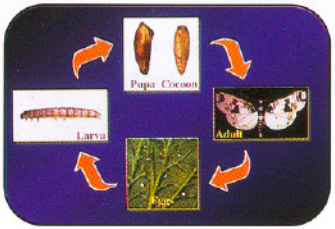
1 Eggplant fruit and shoot borer, *Leucinodes orbonalis* Guenee, is a destructive pest of eggplant mainly in South and Southeast Asia, and countries along the Indian Ocean in Africa.

2 *Leucinodes* larvae bore inside an eggplant fruit and feed until they fully pupate. Fruit feeding is the major cause of damage.

3 *Leucinodes* larvae also bore into tender shoots causing wilting and die-back of the branch terminals. This reduces the fruit-bearing capacity of the plant.



4 *Leucinodes* is a typical Lepidopteran moth belonging to family *Pyralidae*. The adults are weak fliers, active at night.



5 *Leucinodes* undergoes four distinct life stages: egg, larva, pupa, and adult.

6 *Leucinodes* adults lay eggs on leaves and tender shoots of eggplants.

7 Shortly after hatching, the neonate larvae migrate to the nearest shoot or fruit and bore inside. In fruit, the larvae typically enter just below the calyx.

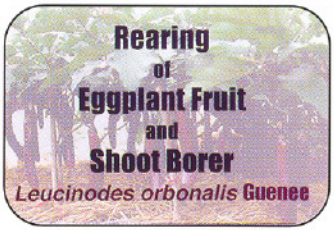
8 A *Leucinodes* larva feeding inside a fruit or shoot completes its larval stage in 15 to 20 days, during which time it passes through four larval instars. This slide shows an eggplant fruit broken open to reveal a larva.

9 Fully grown *Leucinodes* larvae bore back to the surface and emerge from the fruit or shoot leaving obvious exit holes. Larvae migrate to the soil surface to pupate in plant debris.

10 *Leucinodes* pupal cocoons are covered with a layer of thick material. The pupal period lasts 7 to 10 days.

11 Young *Leucinodes* adults are generally found on the lower leaf surface following emergence from the pupal cocoons. *Leucinodes* females are slightly bigger than males. The abdomen of the male moth tends to be pointed, whereas the abdomen of the female moth is blunt.

12 Farmers in Asia spray their eggplant crops frequently with a plethora of chemicals. (Surveys indicate that in some countries farmers spray every 2 to 3 days.) This insecticide use increases the cost of production, exposes farmers and consumers to toxic residues, pollutes the environment, and leads to insecticide resistance in the insect.



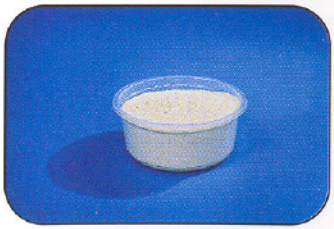
13 In order to develop alternative, safer, and sustainable control measures, it is essential to accelerate the pace of research. In any such research it is essential to have a continuous supply of insects. In many areas of Asia, the fruit and shoot borer is seasonal, present in large numbers only during the hot, dry season. AVRDC has developed a rearing procedure that allows easy multiplication of the pest in the laboratory, on an artificial diet, throughout the year.

14 When fortified with eggplant fruit powder, diets commonly used for rearing polyphagous insects (such as *Helicoverpa armigera*, *Spodoptera exigua*, or *Spodoptera litura*) can also be used for rearing *Leucinodes*. To rear *Leucinodes* at AVRDC we use the *S. exigua* diet sold by BioServe Inc., USA, to which 1 part dried eggplant powder is added for every 10 parts of commercial preparation. Locally developed diets for *H. armigera*, *S. litura*, or *S. exigua*, fortified with eggplant fruit powder, can also be used.

Preparation of eggplant fruit powder

15 Collect young, tender eggplant fruits, wash them thoroughly with tap water, and slice them into thin (2–3 mm) pieces.

16 Dry the slices in direct sunlight, or at 60°C in an oven for 48–72 hours.



17 Grind the dried slices into a very fine powder. Refrigerate the powder in a tightly sealed container until you are ready to use it.

18 Pour 1 liter of distilled water into a stainless steel container.

19 Add 20 g of agar to the water and mix thoroughly.

20 Slowly bring the suspension to a boil, stirring intermittently. Boil until the solution becomes clear.

21 Shut off the heat and allow the solution to cool to 55°C.

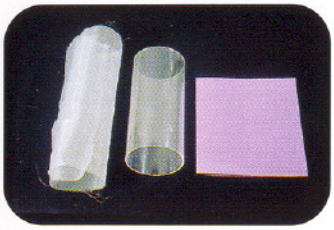
22 In the meantime, take 190 g of diet designed for *S. exigua*, *S. litura*, or *H. armigera* and combine it with 19 g of eggplant fruit powder.

23 Pour the combined ingredients in a large blender.

24 Pour in the molten agar solution which has been allowed to cool to 55°C.

25 Blend the mixture thoroughly for about one minute.

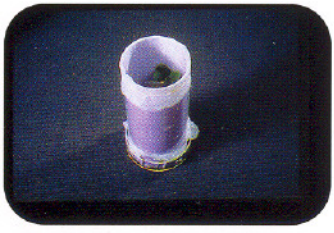
26 Pour the diet into containers and refrigerate it until needed.



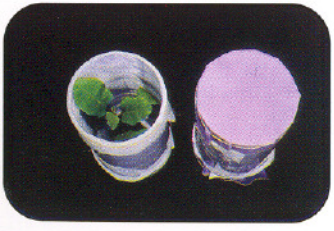
Construction of oviposition chambers

27 Supplies required: open-ended cylinders (plastic or glass), 15 cm in diameter, 30 cm long; nylon net (16 mesh); and purple paper with a rough surface.

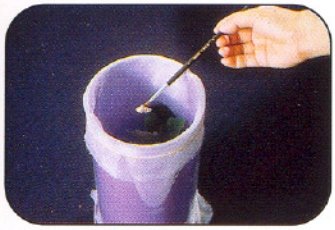
28 Line the inner surface of the cylinder first with purple paper and then with a single layer of the nylon netting.



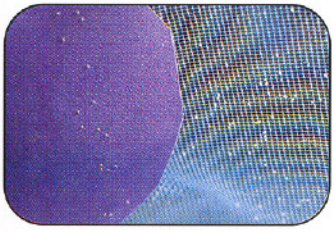
29 To close the lower end of the cylinder, stand it vertically in a petri dish or other suitable container which has been lined with purple paper and nylon netting.



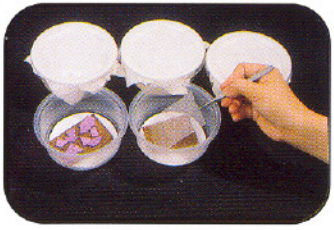
30 Place a four-week-old potted eggplant seedling inside the oviposition cylinder. Cover the soil in the pot with aluminum foil. Next to the plant stem, place a shallow dish containing a cotton swab that has been dipped in dilute honey. Cover the cylinder top with nylon net and purple paper secured with an elastic band.



31 For oviposition, release inside the chamber 2–3 pairs of freshly emerged *Leucinodes* adults. Cover the top. (Adults can be obtained by scouting an eggplant field or storing several *Leucinodes*-damaged fruits in a laboratory cage with a layer of soil at the bottom. Collect the adults as they emerge from pupae in the soil.)



32 Place the oviposition chamber in a room or incubator maintained at 26–30°C. Check the nylon netting and purple paper after 4–6 days for the presence of eggs. *Leucinodes* will lay eggs on the paper and the netting.

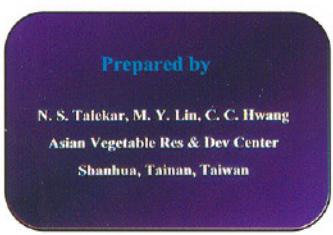


33 Place slices of rearing diet on tissue paper in 9-cm diameter plastic cups. Cut out small pieces of the nylon netting and purple paper onto which eggs have been laid. Place pieces of the cut nylon and paper (bearing a total of about 50 eggs) on the rearing diet. Cover the cups with snap-on lids lined with rough tissue paper.

34 When larvae reach the third instar, remove them and place two larvae each on fresh diets in 30-ml cups. Cover the cups with tissue-paper-lined snap-on lids. After one week, transfer the larvae to containers with fresh diet.

35 *Leucinodes* larvae will crawl onto the tissue paper lining the lid, and will pupate there. Pupae can be collected from the lid.

36 Adults usually emerge from 8- to 10-day-old pupae. The adults can be used to initiate another cycle of mass rearing.



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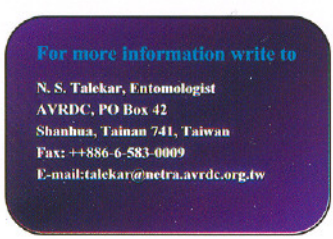

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