International Cooperator's

GUIDE

Published by Asian Vegetable Research and Development Center

MAILING ADDRESS:
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How to Control Sweetpotato Weevil: A practical IPM approach

AVRDC 88-292
March 1988

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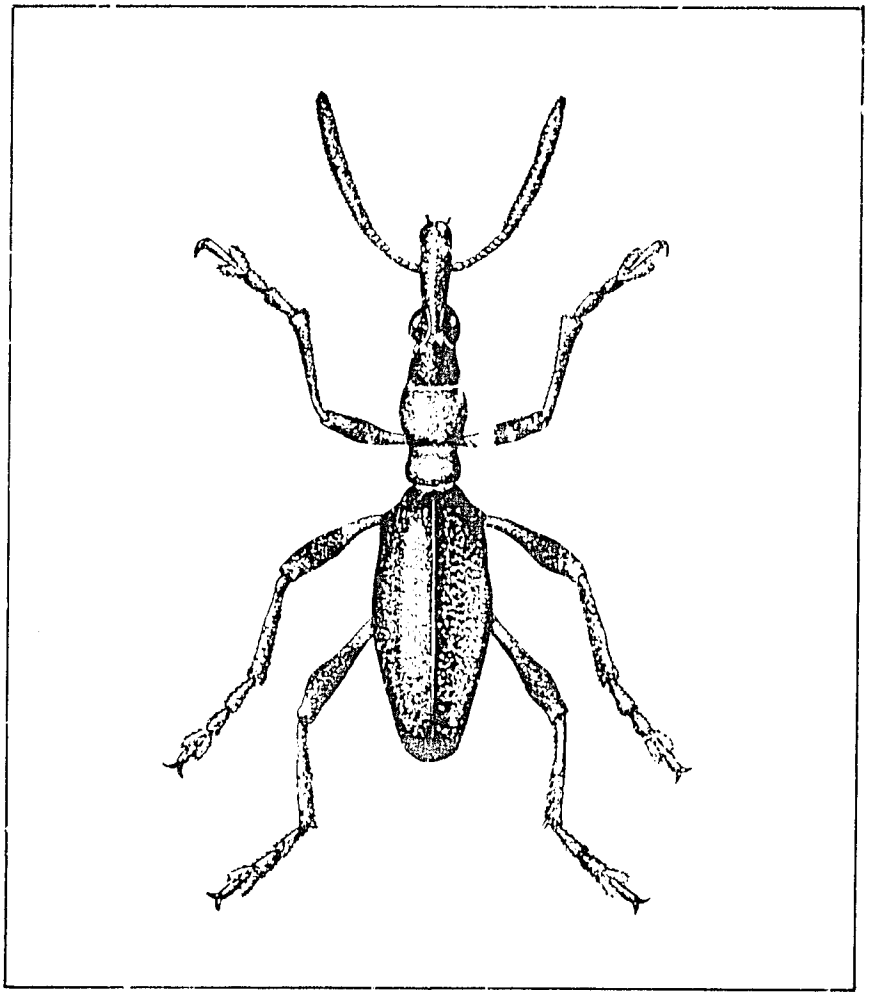

INTEGRATED CONTROL OF SWEETPOTATO WEEVIL

Sweetpotato weevil, *Cylas formicarius* F. is the most destructive pest of sweet potato wherever it is cultivated throughout the tropics and subtropics. The insect damages sweet potato roots in the field and in storage. The major damage occurs in the field. Even slightly infested sweet potato roots are usually unfit for human consumption. For successful cultivation of sweet potato; therefore, an effective control of the weevil in the field is necessary. Because of the concealed mode of life history and damage, this pest is difficult to control by ordinary methods. The Asian Vegetable Research and Development Center (AVRDC) has conducted intensive research on this pest, and has developed a simple and practical control method which is effective and inexpensive. The details of this method are described here.

How does weevil damage the sweet potato?

The shiny black weevil adults that you sometimes see on sweet potato plants or exposed roots (Figure 1) do not cause much damage. They feed only on the surface of exposed roots and this damage is insignificant. In some places they also feed on the foliage but such occasional damage is rarely serious. Weevil larvae, however, feed inside the roots (Figure 2) and stem (Figure 3). Their feeding, especially inside roots, sometimes destroy the roots completely. Even partially damaged roots are unsuitable for human consumption due to an off-flavor that weevil damage imparts to the roots.

How does the weevil enter the roots?

Female weevils which are ready to lay eggs, search for exposed roots. They find these roots through the cracks in the soil. These cracks could be caused by very low soil moisture or by sweet potato roots that are enlarging. Once the weevil finds roots it makes a small hole in the root just underneath the epidermis and lays eggs. From these eggs cream-colored larvae develop and feed inside the roots. Weevils also can lay eggs in the stems and these larvae feed inside the stem. Such feeding, however, only rarely causes any yield loss but the adults that develop from the larvae in the stem increase weevil population and chances of damage to the sweet potato roots. Both routes of weevil entry into the sweet potato plants must, therefore, be controlled to reduce the weevil problem.

Where does the weevil come from?

Sweetpotato weevils feed mainly on sweet potato and morning glory (*Ipomoea* sp) weeds. These are the only two sources of weevil infestation.

1. If the preceding crop in the field was sweet potato, and it was infested by the weevil, the small roots or stem pieces that are left in the field will harbor the sweetpotato weevil. These weevils will leave the old host and attack freshly planted sweet potato.

2. If your neighbor's field is already planted to sweet potato and is infested with weevil, then those weevils will migrate to your newly planted field and cause damage. Weevil can walk and hop long distances; if there is a weevil infested field within a radius of 200 m, your crop is liable to be damaged by the insect.

3. If a grower uses stem cuttings from a planting where the crop is infested with weevil, the cuttings will carry the weevil eggs into the new planting and larvae from these eggs will feed inside stems and the adults will infest roots. Cuttings taken from an infested sweet potato planting may hide adult weevils underneath the leaves. In large batches of cuttings many weevils may go unnoticed. This is an important route by which the weevil moves into a new planting and starts an infestation.

4. Perhaps the most important source of weevil infestation is the species of morning glory plants which harbor the weevil. Most of these innocent looking plants (Figure 4) are perennial and are present on the borders along the fields, along highways, and empty areas. Weevils lay eggs in their stems and larvae feed and pupate in the stems. At least 27 species of *Ipomoea* are known

Figure 1. Sweetpotato weevil adult.

Figure 2. Sweetpotato weevil larvae feeding inside the roots. Infestation usually begins from the top of the root.

Figure 3. Sweetpotato weevil larvae also feed inside the sweet potato stem.

Figure 4. Most species of *Ipomoea* plants like the ones shown above harbor sweetpotato weevils in their stems. The weevil larvae found in the stems are shown below each plant.

Figure 5. Dip the cuttings in a suitable insecticide solution to free the cuttings of weevil infestation. Cuttings should be kept submerged for at least 30 minutes. Observe safety precautions while using insecticides.

to be the alternate hosts of the weevil worldwide. When there is no sweet potato grown in the field, the weevil feeds and survives on these plants and soon after planting they move to sweet potato.

How to control the sweetpotato weevil?

Based on the characteristics of the damage and movement of the weevil from one source to the next, AVRDC entomologists investigated various pest management strategies in the control of this pest. Based on repeated tests on the AVRDC experimental farm and in farmers' fields, we have developed the following integrated control method which should be useful in any area wherever sweetpotato weevil, *Cylas formicarius*, and even the African sweetpotato weevil, *Cylas puncticollis*, is a problem.

1. Follow rotation. Do not plant sweet potato after sweet potato. From an agronomic and disease prevention point of view, it is a good practice to avoid a sweet potato after sweet potato cropping pattern. In places where sweet potato is a staple food and one must plant the crop continuously, then make sure that after the harvest of the first sweet potato crop the field is clean. Remove all debris such as small roots and pieces of root and stem. Flooding the field for one to two weeks, soon after the harvest, causes rotting of the leftover plant materials and makes the field free of weevil. If water is not in short supply, flooding the field is the surest method of destroying the weevil.

2. Do not plant sweet potato in the vicinity of another sweet potato field where effective control measures are not being practiced. This will be a rather difficult task, hence it will be most useful if all farmers in the community follow these control measures which will be beneficial to the entire community. If you must plant sweet potato in the vicinity of a neighbor's crop where suitable control measures are not undertaken, rigorous use of all the measures suggested here will still reduce weevil problem in your field.

3. Before planting and throughout the season, control the morning glory (*Ipomoea* sp) from the vicinity of your field. Since these weeds are perennial and have long vines which produce roots at practically every node, it will be most useful if these plants are uprooted along with their vines and roots and burned. Thereafter, it will be easier to control these plants. Once the entire area becomes free of weevil for a few years, these beautifully flowering plants will not pose a serious threat. But until that time, these plants should be thoroughly removed if weevil is to be controlled successfully.

4. Use weevil-free cuttings to plant new sweet potato. This step is as important as the control of alternate *Ipomoea* hosts. For this, take cuttings from a sweet potato field where there is no weevil infestation. If it is impossible to do this, then dip sweet potato cuttings in a suitable insecticide solution diluted in water to give a concentration of 0.01 to 0.05% active ingredient. Insecticide should have adequate (about 100 ppm) solubility in water. Most organophosphorus and carbamate insecticides are suitable for this purpose. Please consult your local extension agent for this purpose. Do not use any organochlorine, synthetic pyrethroid, or insect growth regulators. Since cuttings float in water make sure that all cuttings are submerged (Figure 5). Put a heavy object on the top of the cuttings so that they will remain submerged. Keep the cuttings submerged for as long before planting - even overnight - as is convenient to you. Longer contact with insecticide will facilitate the penetration of chemical and kill the eggs and larvae inside the stem. A minimum of at least 30 minutes dipping is necessary. Please do a simple preliminary test with few cuttings to make sure that the long exposure of the insecticide is not phytotoxic to the sweet potato cultivar you are planting. Remove the cuttings and allow the insecticide solution to drip inside the container. You may use the same solution for several dippings as long as enough quantity remains to keep cuttings submerged. Use hand gloves and protective clothing while handling the insecticide and the treated cuttings even during transplanting. Follow other safety precautions related to pesticide handling. The purpose of insecticide treatment, if you cannot obtain weevil-free cuttings, is to free the cuttings of weevil. This treatment will kill the weevil inside the stem but it will not prevent weevil reinfestation after one week. In order to prevent reinfestation, you must observe the control measures suggested above.

If you strictly follow the above control measures, the weevil population will be re-

duced considerably and in some cases there is no need for other control measures. However, there are locations where weevil population is already too high and certain post-planting control measures will be necessary. We suggest the following.

5. Banking: Due to drought stress or enlarging of the roots, the soil may crack around the main stem. These cracks facilitate entry of weevils to lay eggs in roots. Survey the field for land cracks during the period from one month after transplanting until a week before harvest. Filling cracks with soil will deny the weevil access to roots and prevent weevil damage.

6. Sex pheromone: Recently scientists in the United States Department of Agriculture (USDA) have discovered a sex pheromone chemical that attracts male weevils. At AVRDC we have tested this chemical in large scale trials and developed a simple relatively inexpensive trap (Figure 6) to capture the male weevils. After initial use of this trap, you may be able to modify the trap design on your own and construct one from locally available inexpensive material. In that case, please compare the trapping efficiency of the new trap with ours and use yours, if it is as good or better than our trap. The sex pheromone is coated on a rubber septum and is placed in the trap. The trap should be placed in sweet potato field in such a manner that the pheromone coated septum is always 10 to 20 cm above the plant canopy. The traps are placed 10 to 15 m apart in the field. Keep the water container always filled with water to trap the weevils continuously. Start placing the traps in the field as soon after planting as possible. This will help reduce the weevil population from the field and the surroundings before sweet potato starts producing roots. One septum coated with 50 micrograms of pheromone is enough for a 100 to 200 square meter area for one cropping season. To get better control, move the traps from place to place but try to maintain 10 to 15 m distance between any two traps. If you do not have enough traps, initially place the traps near the border against the usual wind direction. The wind passing over the traps will attract males from some distance. Move the traps every two days along the border, always against the wind direction. Sex pheromone is very effective, but it alone will not control weevil completely. Other control measures, especially the use of weevil-free cuttings and removal of *Ipomoea* weeds, are essential to control the weevil successfully.

Please note that this sex pheromone is specific to *Cylas formicarius* and it may not work on *Cylas puncticollis* and *Cylas brunneus* which are prevalent in Africa.

Where to get the pheromone?

At AVRDC we have been able to get the sex pheromone synthesized and we will supply five pheromone-coated septa to any researcher or extension worker who is interested in trying this method of weevil control. Eventually when USDA patents this chemical, you will be able to purchase or obtain it on your own. We will keep you informed on this matter. If all sweet potato growers in an area follow all of the above control measures rigorously, weevil population could be reduced significantly in 3 or 4 years. At that time if the sex pheromone is not available, the remaining control measures should be adequate to protect sweet potato from serious weevil infestation.

Can the weevil be eradicated?

Yes, if all farmers rigorously follow the above control measures it is possible to eradicate the weevil in 5 to 6 years. Denying weevil access of *Ipomoea* plant is the key to the success of eradication. In this connection removal of all *Ipomoea* weeds from the cultivated and surrounding areas; use of weevil free cuttings; and not allowing any sweet potato roots or cuttings from other areas into your area during the experimental and subsequent period are absolutely necessary.

For additional information or queries regarding any aspect of the sweetpotato weevil control, please write to: N. S. Talekar, Entomologist, AVRDC, P.O. Box 42, Shanhua, Tainan 74199, Taiwan, R. O. C. Telephone: (06) 583-7801; Telex: 72560 AVRDC ; Fax: 06-5830009

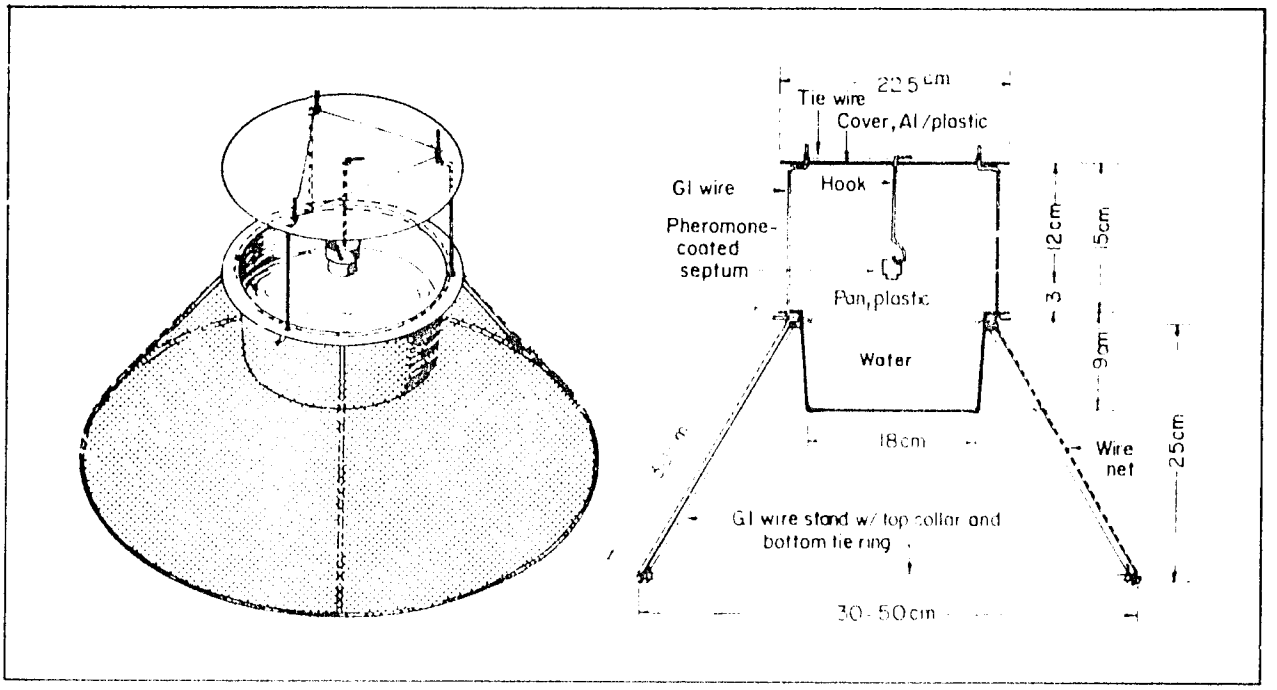

Figure 6. A detailed diagram of a sex pheromone trap. When placed in the field the pheromone-coated septum should always be 10 to 20 cm above the crop canopy. Keep the container filled with water all the time.

Important steps in sweetpotato weevil control

Pre-planting	Planting	Post-planting
•Follow rotation or clean the field of sweet potato debris left over from the preceding sweet potato crop. •Avoid planting near weevil-infested sweet potato. •Uproot all *Ipomoea* weeds in the surroundings.	•Use weevil free cuttings or •Dip cuttings in a suitable insecticide solution for as long as is convenient but at least 30 minutes.	•Use sex pheromone traps. •Fill the soil cracks. •Control *Ipomoea* weeds in the field and the surroundings.