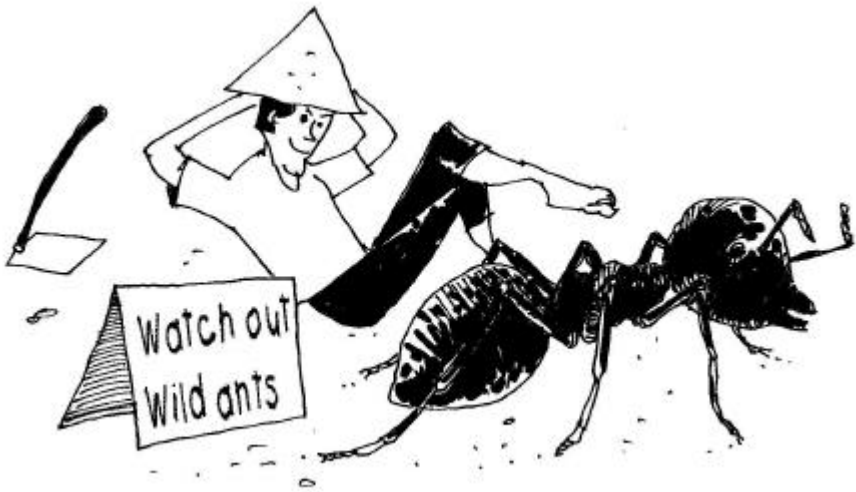


8 Natural enemies: the farmers' friends

Background

The agroecosystem provides the living place for crops cultivated by farmers. The existence of crop plants in a field provides a living place for a range of animals. Many farmers believe that all animals occurring in their fields will damage the plants and, therefore, have to be destroyed. There are kinds of animals that, indeed, eat parts of plants, and these animals are called pests when their eating results in visible damage to the crop. However, in a healthy ecosystem, there are normally more animals that do not eat the crop plants, but live on other kinds of food available in the ecosystem. Many of them even eat other animals, including pests, and these are called natural enemies. These natural enemies help farmers to control pests and should therefore be protected.



Objectives

The objective of this activity is to enhance the participants' awareness and knowledge about the existence and role of natural enemies in the sweetpotato agroecosystem.

Materials

- Newsprint paper.
- Felt-tip markers.
- Small plastic bags.
- Plastic or glass containers, one per small group. The containers should be coated inside with paper, and the lids perforated with small holes or provided with a screen-covered window.
- Sweetpotato roots with and without weevil infestation.
- A knife.

Activity steps

A *Why don't we get drowned under insects?*

A.1 Make a calculation together with the participants of the total number of sweetpotato stemborers that would develop from one pair during six months with the following assumptions:

- One pair of adults produce 100 surviving caterpillars within one month.
- The adults die after having produced the next generation.
- At the age of one month, the next generation also produces 100 caterpillars per pair, and dies afterwards.
- This cycle is repeated during a total of six months.

The total number of caterpillars produced after six months is given in Section 4.1 (Part III).

A.2 Discussion:

- Do we normally experience an insect population growth like this within one season in our field?
- Why does a population growth like this never happen in nature?

→ Have you ever noticed animals (insects) in your field that eat or attack the sweetpotato pests? If yes, what are these?

B *Field sample of natural enemies*

- B.1 The participants are divided into small groups. Each group collects insects and other animals from fields around the FFS meeting place that they believe are natural enemies. The samples are kept in small plastic bags. They should try to observe what and how the natural enemies are eating, whether they prey or parasitize. Predation can usually be observed near ant hills. The ants walking in and out of the hill should be observed and can be fed with some small caterpillars.
- B.2 After the field observation, the groups take turns in presenting their results.
- B.3 Lead a discussion about the three different categories of natural enemies: predators, parasitoids and pathogens. Probe from the participants' existing knowledge and add explanations about how each category lives and functions in the ecosystem. Show samples of each category that were collected from the field.

C *Observation of the behavior of natural enemies*

- C.1 Each small group receives a container with a perforated or screen-windowed lid. They can use this container as a life cage to experiment with and observe the behavior of natural enemies. Every FFS session, the group participants should collect a certain type of natural enemy and different kinds of food. During the week, one of the



group members can take the container home and observe whether, what and how much the natural enemy eats. The group members take turns in observing natural enemies at home.

- C.2 The results of interesting observations should be reported during the next FFS session, for instance included in their agroecosystem analysis presentation. The following questions could be used to let the participants discover the behavior and function in the agroecosystem:
- How did the natural enemy behave during the period of observation?
 - What is the function of the natural enemy in the field?
 - Is this natural enemy common in the sweetpotato field or not?
 - How can we utilize this natural enemy in crop management?
- C.3 Although it would be better if the participants determine themselves what they want to observe, some suggestions for easily observable pest-natural enemy relationships are given below:
- *Predation by a rove beetle*
A few rove beetles (Staphilinids) are put in the container which was given a little bit of soil on the bottom. Weevil infested sweetpotato roots are cut into pieces and the weevil larvae are taken out and put in the containers with the rove beetles. Observe what happens with the beetles and with the weevil larvae. How many weevil larvae are eaten a day per beetle? Try also other foods.
 - *Weevils can mould*
Some (pieces of) weevil infested sweetpotato roots are put in the container. Observe the roots for a few weeks. If the weevil begin to emerge, add some fresh, uninfested roots in the container. Observe the weevils every day, and look for the weevils with their skin covered with a whitish powder. The powder is fungus. Observe the behavior of the fungus infected weevils. After how many days do they die?

→ *The existence of parasitoids*

Several different species of insect pests that are likely to be infested with parasitoids (leafeating and stemborer caterpillars, aphids, etc.) are collected from the field and put in a container. Observe the development of the pest insects every day and see whether the pest passes its own life cycle, or whether parasitoids emerge. The following categories of parasitoids can be observed:

- Egg parasitoids: collect sweetpotato leaves with eggs of insect pests from the field. Eggs can normally be found on the back side of the leaves. Eggs of hornworms are usually easy to find since they are quite big, round and green colored. Leaves with eggs are put in a container that is coated with filter paper. Too many leaves in one container may cause high humidity, hence rotting of the eggs. Observe the eggs every day to see whether caterpillars (= pest) or small wasps (= parasitoid) hatch.
- Larval parasitoids: Collect various kinds of leafeating caterpillars from the field and put them in the container with some fresh sweetpotato leaves. Provide fresh leaves to the caterpillars every day. Try to maintain the humidity in the container low. If the conditions are favorable, the caterpillars will become pupae, but some caterpillars may die before they reach the pupal stage. What is the cause of death? Did a parasitoid (a wasp or a fly) appear? Observe all species of parasitoids that emerge.
- Other parasitoids: Collect sweetpotato leaves with aphid, whiteflies, mealybugs, etc., and put them in a container—preferably one container for each species. The containers should be coated with filter paper. Observe the insects every day to see whether parasitoids (small wasps) emerge.

- Leafminer fly parasitoids: Collect sweetpotato leaves leafminer tunnels, and put them in a container coated with filter paper. Larvae of leafminer flies are often infested with parasitoids. After a few days, the larvae will emerge and pupate on the leaf surface. Observe the pupae continuously to see whether flies (=pest) or small wasps (=parasitoid) emerge. The wasps are smaller than the flies. We can calculate the percentage of parasitism as follows:

$$\% \text{ parasitism} = \frac{\text{no. of parasites}}{\text{no. of parasites} + \text{no. of pests}} * 100\%$$

For more information see:

- Natural enemies (Part III, Chapter 4).

Notes

