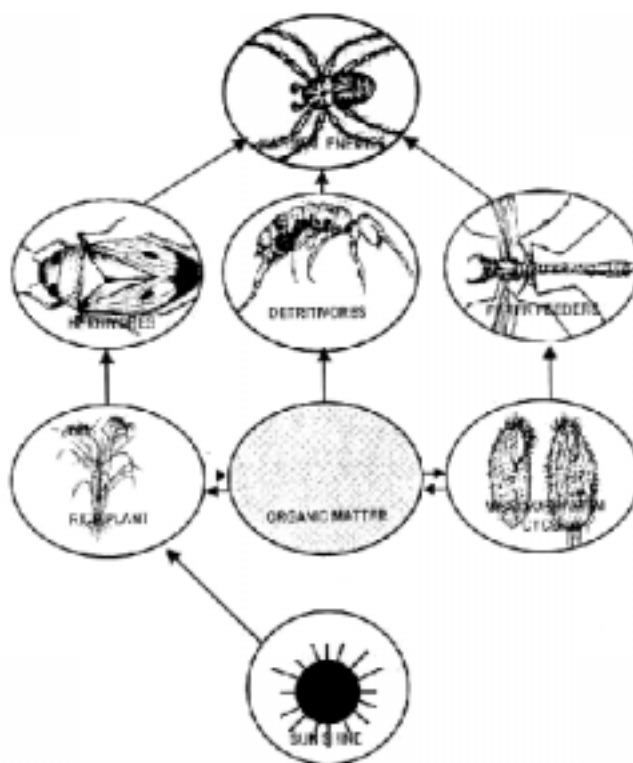




ENERGY FLOW IN THE RICE ECOSYSTEM

Background

In the rice ecosystem everything has a function. Considering the energy flow in the rice ecosystem, there are different levels of functions. The source of energy is the sun. The rice plant becomes the producer of organic materials. Plants “feed” themselves in the sense that they can derive energy directly from sun (through photosynthesis) and use that energy to build “energy rich” molecules that then can be stored and transported throughout the plant.



Other levels in the ecosystem get energy from the rice plant. They are called herbivores and are the first consumer's level. The next level would be the predators that feed on the herbivores (consumer's level 2), and then we might have a parasite that attacks the predator (consumer's level 3). Finally, we have the group of organisms that feed on dead and decaying organic matter, the detritivores.

Objective

We should be able to demonstrate the energy flow in the rice field and three sources of natural enemy feeding.

Times: 180 minutes.

Materials: Insects and spiders collection, large paper, drawing pen.

Procedures

□ Preparation

Start with an open discussion by asking:

- What is energy flow, where does the energy come from?
- Why can the rice plant get energy from only the sun?

□ Action

- Make a circle on the bottom part of a large paper and draw the sun in the circle,
- Draw another circle above and to the left of the first circle and draw a rice plant in it. Make an arrow from the sun to the plant that means the rice plant gets energy from the sun.
- Continue to make others circles containing the organisms we mentioned. Make arrows between the circles based on the direction that energy flow.

□ Discussion

- What is the food source of natural enemies?
- Why is organic matter in the soil important for natural enemies?
- What is the function of the detritivores in addition to decomposing organic matter?

□ Follow up

- Make an aquarium to get more information about water organisms. Set up a simple experiment about the effect of chemical and organic fertilizers on aquatic organisms.



BALANCED ECOSYSTEM COMPONENTS

Background

IPM is a pest management system that's based on interactions among the ecosystem. The goal of IPM is to maintain a balanced ecosystem (a healthy environment) which results in high economic, environmental, and social benefits. The objectives of ecosystem analysis are to make decisions about what to do to manage the rice field ecosystem to achieve the goals of IPM and the farmer.

Objective

We should be able to demonstrate the balance of the rice ecosystem components and to assess the probable impact of various management actions on the rice ecosystem.

Times: 120 minutes

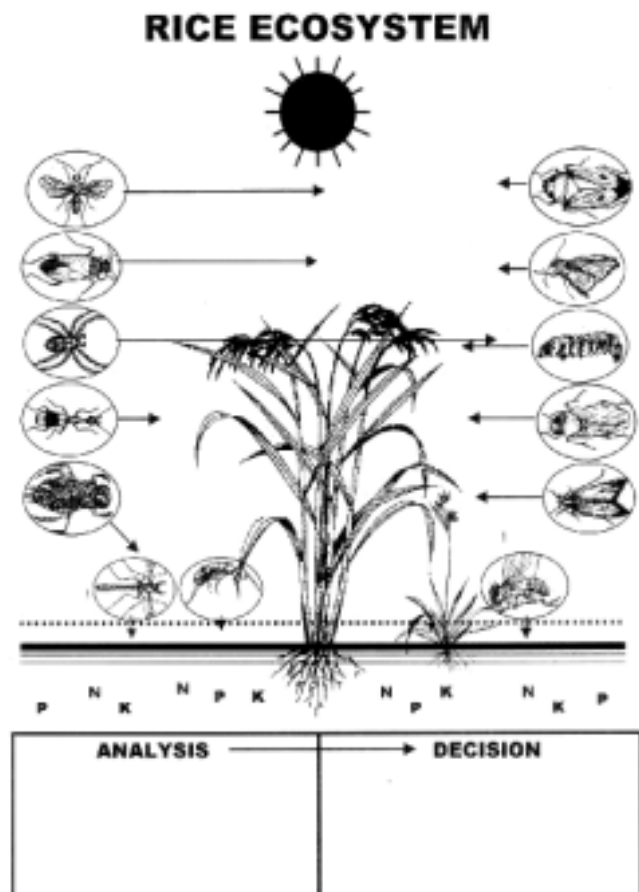
Materials: Small paper, large papers, pen, drawing crayon, glue, plastic bag

Procedures

□ Preparation

Open discussion by asking:

- What is an ecosystem? What is the meaning of "Eco" and what the meaning of "System"?
- What kind of components are in a rice ecosystem?
- What kind of inputs are put into the rice ecosystem?



□ Action

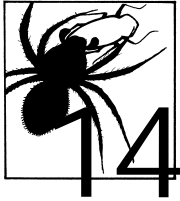
- Go to the rice field to observe and make notes on everything we find in the surrounding rice field. Try to catch some insects and spiders. Collect rice plants damaged by disease.
- Draw on small paper everything we have found, including the sun, rain, clouds and inputs that farmers provide to a rice field.
- Place the small pictures on a large paper and try to arrange the pictures into several related groups.
- Make a line between two components (groups) to explain interactions between the components.
- Discuss about some aspects within the each component (for example; in the soil there are three aspects i.e. soil structure, nutrients, and microorganism).

□ Discussion

- What is an ecosystem and what are the characteristics of ecosystems?
- What will happen if we give inputs into the rice ecosystem, such as:
 - chemical fertilizer?
 - organic manure when we prepare land?
 - more water over season?
 - Pesticides?
- What is a “balanced” ecosystem. Why is it important to grow a healthy crop, conserve natural enemies and observe the rice ecosystem weekly?

□ Follow up

- Continue to do AESA weekly.

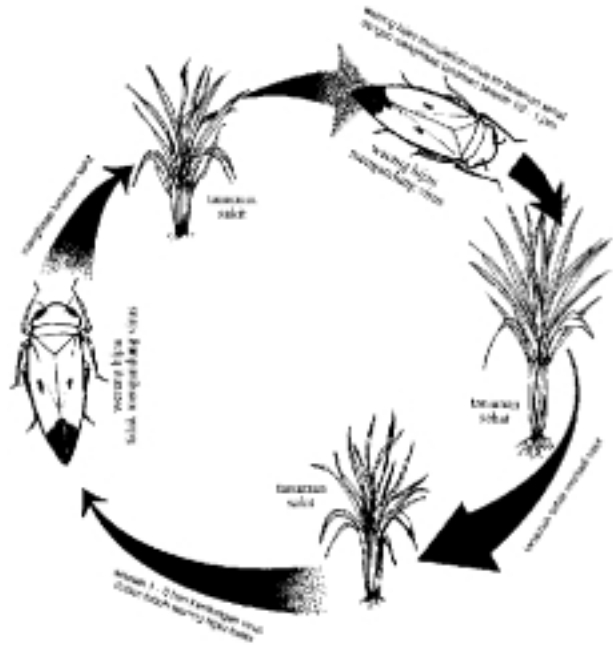


LIFE CYCLE AND FOOD WEB

Background

The *life cycles* of insects are well known. Some insects have complete life cycles (metamorphosis) and some insects have incomplete life cycles. A *food web* is the interaction among plants, plant feeders, and their natural enemies. A food web is simply an arrangement of names linked together by lines that indicate our understanding that one group feeds on or parasitizes another group.

Energy from one level of the ecosystem moves to other levels along a chain of interactions within the food web. As an insect goes through its life cycle, it can play a different role within a food web.



Objective

We should be able to explain life cycle and food web chains for several insect pests.

Times: 120 minutes

Materials: Large paper, drawing pen, and reference that have information about natural enemies of herbivores.

Procedures

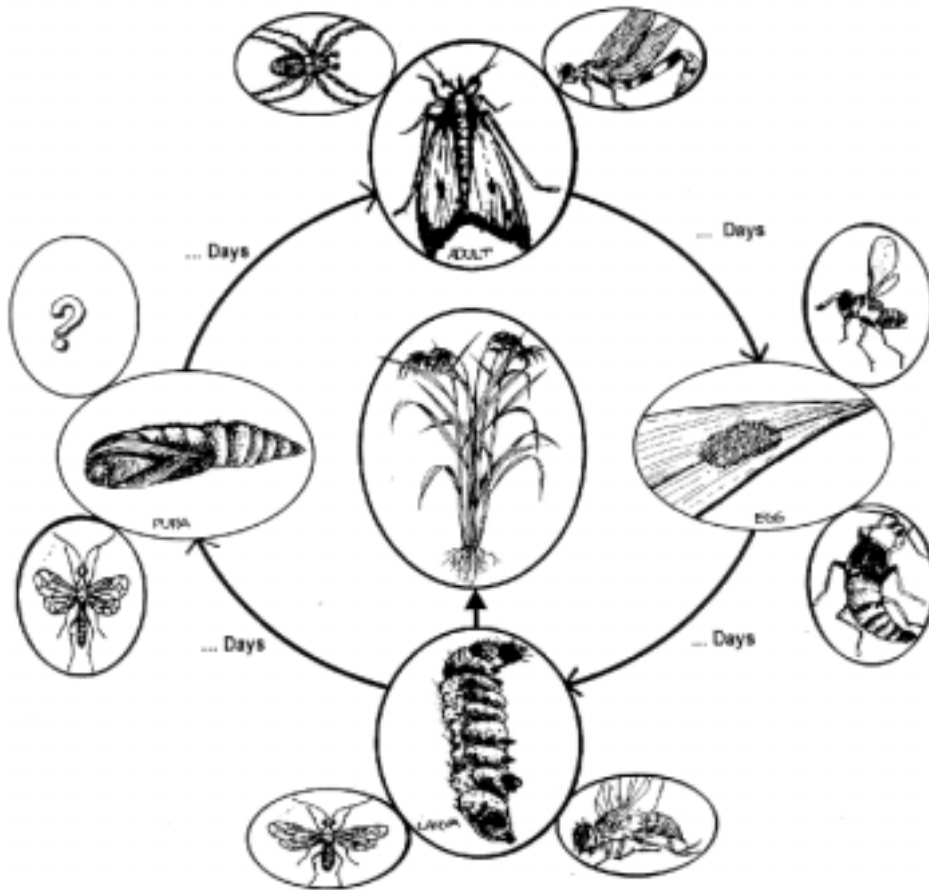
□ Preparation

Open discussion by asking:

- What is the meaning of life cycle?
- How many kinds of life cycles do insects have?
- What is the meaning of food web in the ecosystem?
- How do life cycles and food webs relate to each other?

□ Action

- Each group should choose a guild to analyze (Brown plant hoppers, Stem borers, leaf folders, rice bugs, grass hoppers)
- Draw a large circle and draw in the general stages for the insect around the circle (see example below).
- On the drawing, draw the natural enemies that attack a particular stage of the insect.
- For the natural enemies, write the stages of the natural enemy life cycles.

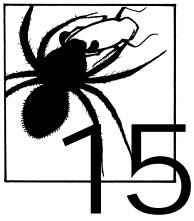


□ Discussion

- What would happen to natural enemies if there were no insect pests? Do we think insect pests can become beneficial at low populations? Why are they important?
- What will happen if we spray broad-spectrum pesticides?

□ Follow up

Analyze for other guilds.



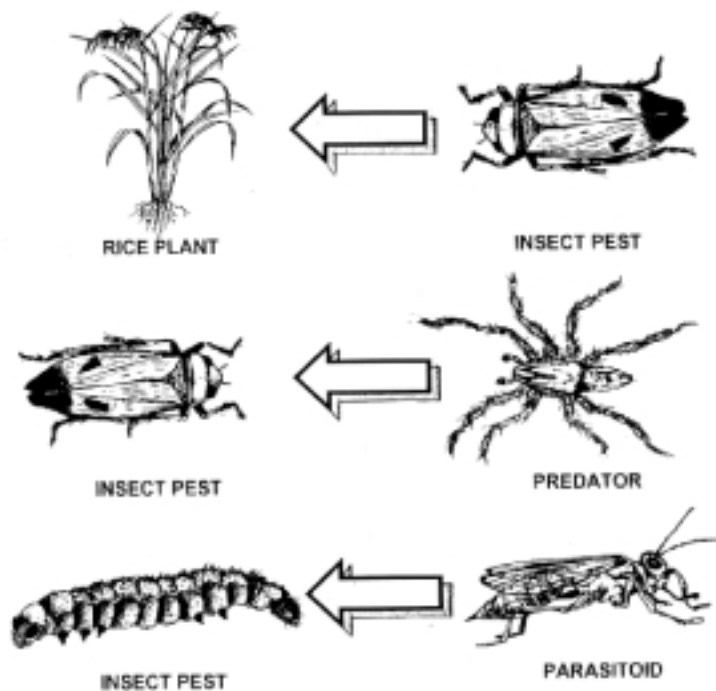
PREDATOR, PLANT FEEDER AND PARASITE BEHAVIOR

Background

All insects and spiders have different characteristics, activities and behaviors. One way to group them, however, is according to their food characteristics: plant feeders, predators and parasites.

All *predators* have some adaptations which help them to be better predators. Mouthpart, legs, eyes, and other parts of the body are well designed for the process

of hunting, killing and eating prey. The predator body structure is adapted to their ecological function. Adult wasp *parasites* are usually small, dark and winged. There are some flies, which are parasites also. Female parasites are very active in looking for hosts. After they find their host they put their eggs inside or near the host by using their ovipositor. *Plant feeders* have specially designed mouth parts to chew plant parts or to suck plant juices. Often they can migrate to areas in search of food.



Objective

We should be able to explain the different characteristics, activities and behaviors of plant feeders, predators, and parasites.

Times: 180 minutes

Materials: Plastic bag, large paper, drawing pen

Procedures

□ Preparation

Open discussion about the different characteristics of plant feeders, predators and parasites including their body structure and parts, activities and behaviors.

□ Action

- Each small group should divide into 3 smaller groups. Each group is given a different task: (first group will observe plant feeders, second group will observe predators and the third group will observe parasites)
- Go to a near by rice field to observe the activities and behaviors of plant feeders, predators and parasites. Try to catch the insect with your hand or small sweep net.
- Kill the insects with alcohol (put into a glass for 15 minutes and then dry in an open place).
- Observe some parts of body with a microscope.
- Make notes that mention characteristics the body that is linked with their function.

□ Discussion

- What parts of predator body are important for their function as killer or hunter?
- What are the specific characteristics of parasites which allow them to find their host and lay eggs?
- What characteristics allow plant feeders to feed on specific parts of the plant?

□ Follow up

- Make an insect zoo to observe the characteristics of various insects, particularly parasites and predators. Rear some eggs or larva that are attacked by parasites.