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Investigating an Insect's Life History

Anyone fascinated with insects should enjoy delving into their life histories. What is a life history? It is simply the complete cycle of life stages through which an insect progresses (a generation), and the time period in which this life cycle occurs under natural conditions. One complete life cycle or generation (from the egg on to the egg again) takes a full year for most insects, but there are many exceptions. Fast-growing aphids, for example, usually have 4 to 5 generations in one summer. The common fruit fly that we all see flitting around overripe bananas seems to be the record holder for the shortest life cycle--it may complete 25 generations in one year, though this occurs only in the tropics or in the laboratory. In contrast, one species of cicada requires 13 years in the South and 17 years in the North for its full life cycle. This is the well-known 17-year locust, which probably has the longest life cycle of any insect.

Scientists have named nearly a million insect species, yet the life histories are known for only a few thousand. And most of those species that scientists and naturalists have studied in detail are either harmful or beneficial to man. Life histories are absolutely necessary to properly manage most pestiferous species such as the ones that eat our food and those that harm us.

Which Insect to Study?

It's easy to begin your study of an insect's life history, but it pays to be careful so you don't select an insect with a very complicated or long life cycle. For best results, choose an insect that you can easily observe or sample such as a leaf feeder, a leaf miner, or one that makes a gall. Leaf miners and gall insects are especially interesting because most of their life cycles occur in a tiny space within the plant tissues. The serious student can study the gall development along with a gall insect's life history.

Start right in your own back yard where there are hundreds of kinds of insects. There is a good chance you'll find one that has not been studied, and in fact, it's quite easy to find a species that is still unknown to science. Look for insects or their evidence (tents, galls, nests, etc.) on leaves, stems or shoots of trees and shrubs, or on grasses, mushrooms, or other plants. Dig in logs, search under debris. In the winter you can find insects in your basement. You'll quickly find that insects are everywhere.

The Life Cycle

You can begin your study at any time because the life cycle is just that--a cycle! Sometimes it is convenient to start with the overwintering stage but the insect may be easier to locate when it is active. For example, many moths overwinter in a cocoon; others spend the winter in the egg stage.

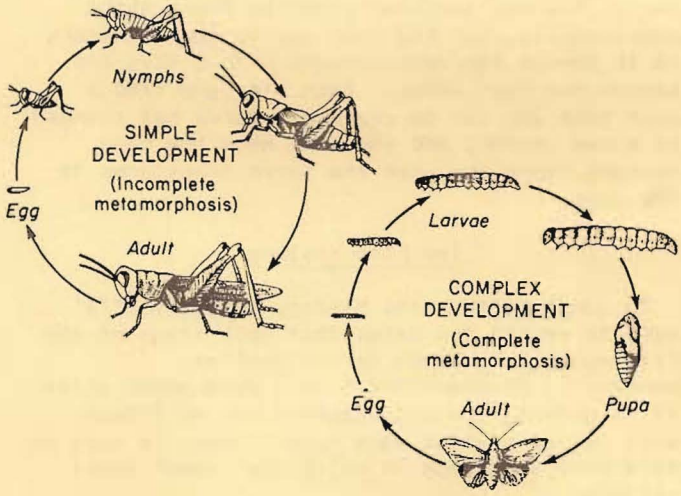

Figure 1. Life cycles of a grasshopper and a moth.

All but a few insects begin their lives as eggs (a few are born alive). Then from the egg, a small immature insect emerges. Depending upon the group to which it belongs, it will be either a larva or a nymph, but it may be called by various names. For instance, the larvae of the familiar butterflies and moths are often called caterpillars. And larvae of flies are called maggots, those of some beetles are grubs, and juvenile mosquitoes are known as wrigglers. "Baby" bugs, which closely resemble their parents in miniature, are just called nymphs.

Crawlers are the pinpoint-size nymphs of scale insects. The aquatic nymphs of dragonflies are known as naiads.

As the immature larva or nymph feeds and grows, it enlarges by shedding its rigid outer skin called an exoskeleton. Every time it does this it changes to a new stage called an instar. The first instar emerges from the egg and develops to the first molt. The last instar develops into the adult in simple development, or into the pupa in complex development (Fig. 1). Most common insects have 3 to 6 instars.

Suppose you choose to study a moth that feeds on a tree or shrub. Because it is a moth, the insect has a type of complex development called complete metamorphosis. This simply means that during each generation the insect develops through four major stages--the egg, larva (caterpillar), pupa, and adult moth as in fig. 1. A complete life cycle, then, should account for all these stages, and it will also include the several larval stages or instars.

Let's assume you locate a cluster of moth eggs on a study tree and plan to start the cycle with them. If possible, leave the eggs on the tree until the larvae begin hatching. This way the food will be in the correct stage to support the young larvae. Then transfer the insects and their food (leaves) to a wide-mouth jar, cover the opening with a cloth, and seal with a rubber band. You can study the general life cycle in the jar, but to learn the number of instars, you'll need to isolate several insects and their food into baby food-type jars (one larva per jar). You may see them shedding their skins occasionally, but the best way to count instars is to remove the debris every 4 to 5 days and search for cast skins. Each time you find a cast skin you can be certain a larva has changed to a new instar, and you will know how many instars there are when the larva transforms to the pupa.

The Life History

To complete the life history study, you'll need to record the dates that each stage of the life cycle is present in its habitat. Generally, observations 3 to 5 days apart while it is growing are satisfactory for an insect with one generation each year. Also, be sure to determine the stage in which the insect overwinters.

For the moth we've chosen to study, check the eggs every few days. Soon you'll notice how the periods of the stages overlap each other and two or more stages can be found at the same time. Write down the stages and dates for each. First you'll see eggs and small larvae. Later all the eggs will be hatched and you will notice several sizes of larvae. Near the end of the cycle you'll observe larvae and pupae at the same time, and then pupae, adults, and new eggs will be present together.

Because the period in which each larval instar occurs is difficult to observe directly in the field, you'll need to collect 20 or more larvae each 3 or 4 days and preserve them in 70% alcohol. The insect, of course, must be fairly common to do this. Then to determine the number of instars in each collection you'll need to measure the larvae. Scientists measure the larval head capsule (at the widest area) under a microscope, using an eyepiece micrometer. You can do this too if your school has one of these. Ask your teacher for instructions for its use. If you plot all the measurements on a chart as a

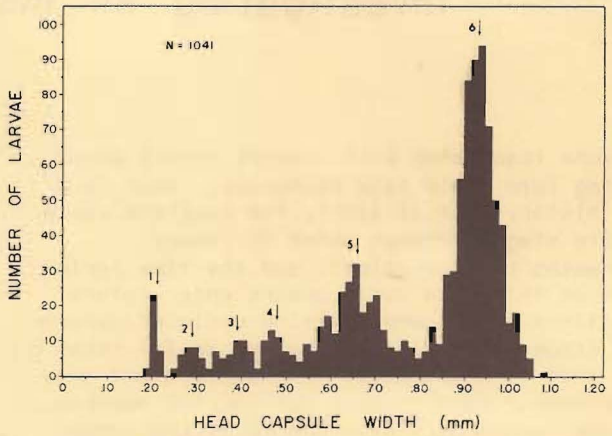

Figure 2. Graph of head-capsule measurements of moth larvae having six instars.

frequency histogram (as in Fig. 2) you'll see the head-capsule measurements fall into several groups. In this case the insect has six groups, indicating six instars. Now by simply comparing the measurements in the chart with the larvae taken at each collecting date, you can tell when each instar was present in the field.

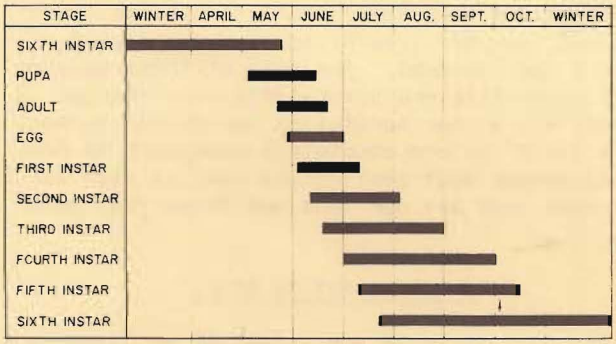

Figure 3. Life history of an insect.

When you have all the observations for all the stages of the life cycle for the whole year you can depict your insect's life history as in fig. 3. This figure is an example of an insect that has six larval instars, and the last instar is the overwintering stage. Your life history, of course, will look different, but it should be equally as interesting, and it could be the life history of an insect that has never been studied before.

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