

## Mealworms

### **Background:**

Most insects, such as butterflies, moths, flies and bees, are familiar to us in the adult stage of their life cycles. But the darkling beetle is best known as the larval stage, which we call the mealworm. Easily raised in large numbers, these golden-yellow grubs are used as fish bait, but they can also be very useful in the classroom animals, either as a source of food for insect-eating classroom animals (such as toads, frogs and salamanders) or as an interesting subject for classroom study.

Mealworms and darkling beetles, which are also called grain beetles or flour beetles, live where grain is grown, stored or processed. Thus, barns, grain elevators, feed and flour mills, and warehouses for grain derivatives are typical places to find them. Unfortunately, they can also live in kitchen cabinets, where they might infest stored flour, oatmeal, cornmeal or any other appropriate food source. Being secretive creatures, mealworms prefer relatively undisturbed places, such as the cracks, crevices and corners where food is allowed to accumulate. A small amount of food will support several mealworms, and populations of hundreds or thousands can develop if sufficient food is available.

### **From Egg to Beetle:**

Darkling beetles have complete metamorphosis, so there are four distinct stages in their life cycle. The eggs, which are small, whitish and difficult to find, hatch into larvae in one to two weeks. The larvae are very small when first hatched from the tiny eggs, except, similar in appearance to the larger mealworms. This is the longest stage of the life cycle, normally lasting four to six months, and is the only stage in which growth occurs. As they grow, the larvae molt several times and with the last molt the mealworms become pupae. Pupae are for the most part quiescent (inactive). But during this stage, which lasts from one to three weeks, major internal and external changes result in the development of the adult beetle. At first, the beetles are white and soft-bodied, but they harden quickly and change from white to reddish-brown and finally to black. Although the beetles typically live only about a month or more, the females begin laying eggs soon after transformation and may produce up to 500 eggs in this short time. The entire life cycle of the darkling beetle, then, lasts from five to seven months, with the temperature of the environment having a significant effect on the duration of each stage. Cooler temperatures will cause a longer period of development, while warmer temperatures will speed the process.

### **Mealworms in the Classroom:**

Mealworms are, for many reasons, ideal for classroom study. Their size and relatively slow movements make them easy for students to manipulate and they can be used in a variety of studies of insects, including studies of insect life cycles and external anatomy. Also, since they can be raised in large numbers in a relatively small space, they make ideal food for classroom animals that require live insect food, such as frogs, toads and anoles.

### **How to Obtain:**

You can usually obtain mealworms from a pet store or fish bait dealer (ask for white worms or golden grubs). Mealworms can also be ordered from practically any biological supply company that deals in live animals.

## Mealworms (cont)

### Caring for Mealworms

#### **Housing:**

Mealworms can be housed in almost any container that will confine them and their food. A 5- or 10-gallon aquarium will house hundreds of mealworms: plastic ice cream containers, margarine tubs or coffee cans are suitable for smaller colonies. Although the beetles have vestigial wings and cannot fly, a covered container will prevent any beetles from occasionally climbing out of the colony. The latter three containers come with snug fitting plastic lids, which will need small air holes punched in them for ventilation. Plastic shoe or sweater storage boxes are ideal because they have loose-fitting lids that provide adequate ventilation, are a convenient size and can be stacked to conserve space. The size of the container is also important since a colony's population seems to be more a function of how much surface area beetles have than of how much food they have. Thus, a given amount of food is divided among three or four plastic shoeboxes will produce many more mealworms than the same amount of food put into a single deeper container.

#### **Diet:**

As mentioned earlier, mealworms can live on practically any type of dry grain derivative. They have been raised successfully in cornmeal, flour, oatmeal, and cereal flakes of many kinds and mixtures of these. However, bran or chick starter mash (available from a grain dealer or pet store) is better and will result in higher populations, more rapid growth, and more vigorous mealworm colonies. Mealworms can complete the entire life cycle in a dry environment with no external water source of water. To accomplish this, both the beetles and the larvae extract moisture from their food and conserve most of it by eliminating waste products as dry pellets. Occasionally, adults desire more moisture and obtain it by cannibalizing pupae or newly transformed adults if no other source of moisture is available. Mealworms will grow faster, and the adults will live longer and produce more eggs, if some small amount of moisture is provided. This is most easily accomplished by occasionally placing sliced potato, carrot, or apple in the colony. A few drops of water can also be added, but the medium must not become wet. If it does (the smell of ammonia will be an obvious sign), the organisms should be transferred to fresh medium.

#### **A Breeding Colony:**

To establish a colony, put the mealworms in the desired container with 1 to 2 inches of food medium and cover the surface with a paper towel or two to provide a more secluded environment for the mealworms. At this point, the newly established culture should be relatively undisturbed for a few weeks so that the mealworms can develop, pass through the pupae stage, and become egg-laying adults. Once a culture containing all stages of the life cycle has been established, it will be self-perpetuating and will require little maintenance as long as additional food is occasionally added and moisture is provided as described above. About every three to six months, however transferring all adults, pupae and larvae to fresh medium should rejuvenate the culture. Doing so eliminates accumulated droppings, dead organisms and shed skins and it stimulates faster reproduction. During this transfer, it is easy to subdivide the colony to make additional cultures. And if a little fresh medium is added to the old, a number of larvae will probably appear from eggs that were left behind when the colony was cleaned. Further, if the colony is rejuvenated in this way at the end of the school year and put in a closet or dark place in the classroom, there should be an active colony at the beginning of the next year.

## Mealworms (cont)

### **Observations, activities and Questions:**

*Establish mini-cultures for each student to observe by placing three to five mealworms in pill vials partially filled with appropriate food.*

- Observe and describe a mealworm. Do all mealworms have the same number of legs? Body segments? Do they have eyes? Antennae? How do mealworms move?
- Carefully examine pupae and beetles. Do they have legs, wings, a head and eyes? Do they have body segments? How are pupae and beetles like (or different from) mealworms?
- Find out if mealworms and beetles prefer to be in light or dark places. With light shining from above, shade part of the mealworms' container. Where do the mealworms congregate? Do the same with some beetles.
- Try to find out the preferred food of mealworms by placing different foods in each corner of a plastic box. Place eight to ten mealworms in the box and record how many worms are in each food every day for three or more days.