How-to-do-it

A Cage for Studying Cockroaches and Other Insects

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The American Cockroach *(Periplaneta americana)* and its relatives (Yurkiewicz 1970) have proven an excellent animal for use in classroom experiments. The cockroach may be used in a wide variety of experiments (Verrett and Mills 1975). In some experiments, it becomes necessary to isolate individual animals and study them separately from the colony. A convenient method for caging individual animals has been developed and successfully implemented in our laboratories using a few inexpensive and accessible materials.

Cage Development

A disposable or glass Petri dish lid serves as the cage bottom. This cage bottom may be lined with a thin paper such as weighing paper or filter paper precut to the desired cage floor size. This paper may be tared after cutting and before placing it in the cage bottom and then removed and weighed regularly for studies involving waste production in comparison with food intake.

An inverted plastic drinking glass (fig. 1) with a mouth size slightly smaller than that of the Petri dish serves as a cage top. Aeration openings are constructed by melting small holes in the plastic glass with a hot soldering tool or heated probe. This cage top allows easy access to the animals.

Watering Methods

To facilitate watering the animals, a 5 mm diameter, J-shaped glass tube is mounted over the cage top and inserted through a hole made in the side of the cage top. These tubes may be calibrated by taping one end of the capillary tube and injecting, via a syringe, amounts of liquid into the tube. The water level at each of these intervals should be marked on the tube with tape or a pencil. These tubes have served well for studies involving cyclic water uptake demonstrated by the adult female insects (Verrett and Mills 1975). The use of the calibrated capillary tubes in place of water dishes also eliminates accidental drowing of the insects, decreases bacterial and fungal contamination, and reduces the rate of evaporation.

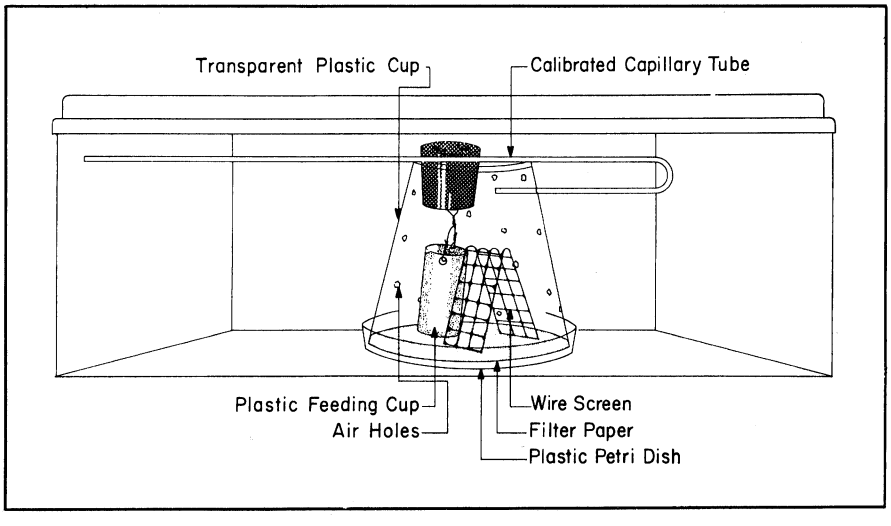

FIGURE 1. A front view of the chamber and cage suitable for use in insect studies.

Feeding

A feeding apparatus can be constructed from plastic prescription vials. To mount the apparatus to facilitate easy handling, a hole, approximately the same circumference as a number 3 double hole rubber stopper, is cut into the cage top. A thin piece of wire is looped through the stopper holes and attached to the vial. This feeder apparatus should be tared prior to placing it in the cage.

It may be weighed regularly to determine the amount of food intake. This type of feeder will prevent the cockroach from defecating in the food. The feeding system also allows for easy maintainence and cleanup of the cages for reuse after experimentation.

A stiff U-shaped piece of hardware cloth or wire screen may be placed in the cage to allow the animal better access to the feeder and capillary tube. The wire ladder may also be used to study climbing and behavioral patterns in the insect.

Discussion

A clear plastic shoe or storage box (30 × 16 × 8 cm) available at most department, drug, or hardware stores can serve as an outer chamber. These boxes are usually sold with overlapping tops allowing them to be stacked to conserve space, if needed. A hole, 5 cm^2 may be cut into the top to allow for further atmospheric exchange. A piece of fine mesh hardware cloth cut approximately 7.5 cm^2 and glued to the inside of the top over the hole serves to further keep the animals from escaping while providing air.

A 2.5 cm wide film of petroleum jelly around the top of the inside walls provides an added safeguard against escape when the chamber lid is removed. Tape or petroleum jelly can be employed for an absolute air seal between the chamber and the lid if this is desired.

Chambers without ventilation help to maintain a constant humidity and a vessel containing water may be placed in a corner of the chamber for this purpose. Also during cage changing, weighing, or other times the chamber may serve as a temporary holding area for the animals while these chores are completed. The chamber also serves to keep other smaller insects from mixing with the experimental animal or eating and drinking the food and water.

Because the cages and chambers are made of clear plastic it is easy to make observations, even while the cages are stacked. Also because the cages are fully transparent an external photoperiod can be applied (Llewellyn and Mills 1972). This is useful in sclerotization (Mills, *et al.* 1975), vitellogenesis (Mills, *et al.* 1966), and osmoregulation (Mills 1967) studies since physiological studies on *P. americana* have shown that the American Cockroach is in different physiological conditions during varying parts of the day. These cages also may be used to study toxins or insecticides fed to the animals in both the liquid or solid form (Llewellyn *et al.* 1976). Teachers may want to use this system in conjunction with their own experiments or ideas for using insects in the classroom and laboratory. They also may find valuable classroom material in the April, 1976 volume of this journal, which was devoted entirely to entomology.

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Teaching the Relationship of Mutation and Protein Structure: A Computer Demonstration

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A fundamental biological discovery of the last quarter of a century was that the linear sequence of the four bases of DNA or RNA grouped as triplet codons uniquely specify the amino acid sequence of cell proteins. The simplicity and universality of the genetic code, coupled with the fact that only 20 amino acids are required for the great diversity of proteins, permits the teaching of the basic facts of the genetic code at the first-year col-