sarily mean that it will be effective when eaten by an insect in the natural way. The pure poison when injected directly into the stomach may remain powerful enough to do its work, but the same formula when taken through the mouth of the bug may be absorbed in such minute quantities that its effectiveness may be nullified. To test the solution under practical conditions it must be "tasty" enough to tempt the insect.

A very important method of eliminating unwanted bugs is the insecticide in powder form. Huge areas can easily be dusted with a powder insecticide, and airplanes are being used by farmers to dust many acres in a day. The powder poison is usually an "eaten" poison that operates through the stomach of the bug. When it passes from the stomach into the bloodstream it must be powerful enough to kill the pest. The entomologist must develop a powder that will cling to the fuzzy legs of the insect and thus be absorbed when the bug cleans its legs. The "cockroach racetrack" is a device developed by the New Jersey Experiment Station Department of Entomology to test the value of such powders. It consists of a narrow channel just wide enough to accommodate the insect being experimented upon. The floor of the groove, or racetrack, is dusted with the powder to be tested. The amount of the powder used is no greater than could be applied to plants or in houses by ordinary dusting methods. In the "racetrack" the insect can walk only straight ahead, picking up the powder that has been spread there. The time it takes the poison to work is carefully observed. Many such tests are made using greater and smaller amounts of the poison. Sometimes the entire formula is rejected if the test discloses that the stomach liquids neutralize the insecticide. Sometimes a good poison may not have enough clinging power to stay on the insect's legs long enough for him to lick it off.

When the formula is perfected through the use of these three tests it is tried under actual conditions. Bugs are sprayed with a liquid solution; they are fed a "tasty" food composed of the poison; and they are turned loose on dusted plants. If the poison is found effective in these tests, at least half the job is done. It remains to be seen that the poison does not harm the plant or animal on which the pest thrives. More tests are made to determine this. Sometimes a chemical, like arsenic, may kill insects effectively, but also injures plants. Only after the entomological department is completely sure of its formula does it release it. Then when farmers or housewives apply to the department for aid in ridding their homes or farms of insect pests, they can obtain the formula of insecticides and mix their own solutions, or they can buy solutions already prepared.

It was found that the best kind of insect for experiments is the cockroach. It breeds rapidly enough so that a constant supply is guaranteed; some varieties are very large and are therefore easy to observe; and any insecticide that is effective with cockroaches is likely to kill many other insects. Three varieties of cockroaches are commonly used in the vivarium. The American cockroach, which reaches a length of two inches, is used for injection tests because of its size. The German cockroach, about one inch long, is used for contact or spray tests. The Oriental cockroach, about one-half inch in length is used as a check after a solution has been found effective on the two other varieties.

In addition to the cockroaches, the entomological staff keeps a supply of the milkweed bug, the webbing clothes moth and the black carpet beetle. The milkweed bug is too small an insect to be used in the injection tests, but after a solution has been developed successfully, this bug and the Oriental and German cockroaches are used in practical application tests--tests in which the insecticide is applied by ordinary methods such as spraying, feeding or dusting. The webbing clothes moth and the carpet beetle are used in experiments developing moth repellents.