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## Insects and Man

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great deal to bring science and its achievements to the common people. Edison has changed the night into day; Marconi has sent the spoken word around the world; and Henry Ford has sent many of us four-wheeling up and down the highways and byways.

Industrial science is making great achievement, but are we educators keeping pace in our schools of learning with the progress of industrial science? To the old curriculum of "readin', ritin', and 'rith-metic", we should add a study of science to round out the average individual. This course in science may only include fundamentals, but it will be a great aid to the young man or woman of today. As the alphabet is to reading and the multiplication table to mathematics, so are the fundamentals of science to the industries of today.

With these thoughts in mind, I ask you this question. Are we as educators, in this era of scientific achievement, going to continue to turn out the greatest percentage of our students from the schools of the country uneducated in the use of the fundamentals of chemical science, or for that matter, science?

Harold E. Murphy.

## INSECTS AND MAN

### Biology

(Continued from September)

Biologically speaking, insects may be called a highly successful group, and much of this success is due to their adaptability to the conditions of their environment. They are found everywhere, and eat almost everything. All of the large groups of insects are world-wide in their distribution, though the most widely distributed are the beetles.

Butterflies and beetles occur beyond the arctic circle, and several species of insects have been found living at an altitude of sixteen thousand feet. Only a few insects are found in the ocean, though certain fly larvae have been dredged from the ocean bottom, and one species of water-strider is normally found far out at sea. Some live on deserts; caves furnish many peculiar and interesting species, while a few have even been found in hot

springs. They are the most widely distributed of all animals, excepting perhaps, the Protozoa and the Mollusca.

Not less interesting than their distribution is the astounding variety of their food. I do not know of a single cultivated crop that is not attacked by them, and this is true of most plants and animals in the wild state. Even frogs are bitten by mosquitoes, and tadpoles are the common prey of certain aquatic 'bugs'. Insects eat nearly every kind of stored grain or seeds. They are the most common pests of fur or feathers when stored. They invade and destroy stuffed museum specimens, enter drugstores and feed on red-pepper, aconite, or other seemingly poisonous or indigestible substances. Many forms live on decaying animal or plant bodies; some live nearly exclusively upon animal excrement, others solely upon blood; some pass their lives between the dry pages of a book eating what it affords; while others actually eat holes in lead-pipe.

In spite of the fact that practically every kind of plant is eaten by insects, a few of them are restricted to one, or at most, two species of plants. The brilliant golden-green beetle, *Chrysochus auratus*, for example, eats only milkweed and Indian hemp. This is largely true also of the common monarch butterfly. It should be noted that these two plants are rather closely related botanically and are alike in having a milky juice. Some insects eat only plants of closely related species, the Colorado potato beetle feeding indifferently upon various plants of the nightshade family. The common cabbage butterfly feeds chiefly upon plants of the mustard family, such as cabbage, turnips, horseradish, etc. It is not restricted solely to this group, however, although all of its food plants have a pungent odor, which is probably its stimulus to egg-laying.

Most leaf eating insects eat many different kinds of plants. The larva of the cecropia moth feeds upon sixty different species of plants. The record, however, seems to be held by the gypsy moth, for its caterpillar will eat four hundred fifty

know species, refusing only a few poisonous ones such as larkspur. The migratory locust may also equal or even exceed this record.

On the other hand, many different insects feed upon the same kind of plant, the oaks, for example harboring seven or eight hundred different species, while corn is attacked by at least two hundred kinds, twenty of which may be called pests. Poison ivy is unique in being almost free from insect attack, though even this plant is eaten by two or three kinds of larvae.

While practically every kind of animal is attacked by one or more insect pests, these parasitic forms are limited to only a few orders, the most savage of these being the Diptera represented by such common forms as the stable-fly and the mosquito. The order Hemiptera, the "bug group", also contains some serious pests such as the bed-bug and the "cootie" or body louse. It is common knowledge that forms like butterflies and most ants and beetles never attack man. In fact, it may be said that most insects do not feed upon living animals.

Like many other great groups, the insects contain numerous species which prey upon their own kind or related species. The dragon flies, or as they are often called, snake-doctors, spend most of their lives catching mosquitoes and other small insects as prey. The robber-flies, large, powerful insects, are notorious as killers of their insects relatives, as also, are many kinds of ground beetles. The larvae of several species of lady-bird beetles are persistent killers of plant-lice. Certain ichneumon flies parasitize and destroy the eggs and larvae of many species of insects, and several kinds of wasps provision their nests entirely with caterpillars or grasshoppers. What would happen to civilized man if the insects would cease their internecine strife and concentrate their destructive efforts solely upon him?

Even if the insects ceased fighting among themselves, man would still have many powerful allies in his struggle for supremacy. First among these should be named the birds. It is difficult to conceive the

prodigious quantities of insects destroyed by birds. The birds of Nebraska alone, are credited with consuming more than a hundred thousand bushels of insects annually, and there is no reason why Iowa birds should not exceed this quantity. Such figures are not arrived at by mere guess. They are gained by patient watching of the food-habits of many kinds of nesting birds, and by examination of the crops of thousands of other specimens. Some birds are almost entirely insectivorous in food habit. Any one who has ever watched a turkey catching grasshoppers cannot fail to be impressed by the contribution of the birds to insect eradication.

The common garden toad is a great destroyer of insects; so also are most garter-snakes, and nearly half of the food of the common striped-ground squirrel or spermophile consists of common insect pests of farm crops. A casual examination of the dung around the burrow of the common skunk will quickly disclose the insectivorous habit of this creature; even foxes and raccoons feed upon them when other food is scarce.

Roy L. Abbott.

## THE SIMPLE MACHINES

### Physics

(Continued from October.)

With reference to a pulley system, the work equation is clearly discerned in its practical operation. In presenting the pulley, the writer uses a rectangular frame about two feet high and three feet wide. A number of hooks are screwed into the top cross piece of the frame. With such a device a number of different pulley combinations can be shown at one time.

Let us consider the problem in the case where we set up a pulley system containing two pulleys, one fixed and the other movable. Let us also assume that the fixed pulley fastened to the frame above has three sheaves while the movable one suspended below it has only two. In setting up the pulleys, a very smooth flexible cord should be used. The cord should be wound around the sheaves so that one of