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INSECT FRIENDS AND FOES OF AGRICULTURE.*

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Every farmer is forced to come in contact with his insect foes, and, therefore, knows something about them, but very few farmers know that there is a large number of insects that are not foes at all, but are friends. We shall, therefore, discuss these friends first.

Insect Friends.

The first class of friends we shall treat of is composed of those insects which aid agriculture by acting as pollenizers of plants. Almost everyone knows that before a plant can produce a fruit or seed some of the pollen must first be placed on the sticky tip of the pistil. This act fertilizes the plant and is called "pollination." In this work honey bees are the most important insect agents, but bumble bees and numerous other wild bees help greatly, as do also wasps, various kinds of flies, moths, butterflies and many other insects. Many of the lower kinds of plants, or plants with inconspicuous flowers, are pollinated in other ways, such as by the wind, but nearly all plants with conspicuous bloom require the aid of insects for proper and full fertilization. What would happen if we had none of this class of insect friends? We should not have more than one apple, or pear, or plum, or peach or any of our other much loved fruit to the one hundred or more we now enjoy. Moreover, there would be practically no fields of tomatoes, peas or beans, or of several other crops that are so necessary to us as foods.

The second class of insect friends consists of those insects that supply us with food, either directly or indirectly, through serving as food for the fish and birds that we use as food. Many tons of honey are produced in every country by the honey bee. A large part of the food of fresh-water fishes consists of the water insects

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that live about the shores of the lakes and rivers that these fish frequent. Even the larvæ of the troublesome mosquito serve in this way a useful purpose. Both domesticated and wild fowl feed to a great extent upon insects, the latter especially during the nesting season. So without taking time to go more into details we see that many insects may be friends in this important matter of providing food for us.

A third manner in which insects may act as our friends is as scavengers. If all the dead animals and plants, including trees, of course, were to lie undestroyed on the surface of the earth, they would soon make an intolerable condition of affairs. But in the summer no sooner does an animal or plant die than there gather to it various insects that quickly hasten the process of decay. Some of the insects that feed on dead animals are carrion beetles, rove beetles, blow-flies and flesh-flies. Any one who has watched how quickly a dead horse or smaller animal becomes a seething mass of insect life will readily understand why it has been said that a blow-fly can destroy a dead ox as quickly as a lion.

In the case of trees we have all seen beautiful pines that have been cut down or fallen and allowed to lie for a year or two in the forest, and then, when they are examined, are found to be perforated in numerous places by borers. These borers are the larvæ of certain kinds of beetles, chiefly long-horned beetles. We feel disappointed at the injury to the tree, but in nature the insects while feeding themselves on the wood are at the same time serving a useful purpose, because these holes allow the more rapid and deep entrance of diseases and so hasten greatly the rate of disintegration of the tree. We see, therefore, that insects help us greatly by removing dead animals and plants, and thereby giving back to the earth the substances of which they are composed and at the same time making room for other animals and plants to take their place.

The fourth way in which insects serve as friends is by many useful kinds helping to control injurious kinds. One class of insect that helps in this way is known as parasites, and another as predaceous insects. The latter merely capture their victims and feed on them as a lion would capture and devour a smaller animal, but the former kind pass all their larval stage either in or

attached to their victims, finally killing them. There are many kinds of parasitic insects, some, the Tachina Flies, resembling very closely house-flies; others, the Ichneumon-flies, Chalcis-flies, etc., resembling wasps. Some of the Ichneumon-flies are quite large and sometimes have a very long ovipositor or egg-laying apparatus, while the Chalcis-flies and Proctotrupids may be extremely small, so small in fact, that one can scarcely see them with the naked eye. Some of these very small parasites attack insect eggs, laying their own eggs in these. A single tiny egg is large enough to supply all the nourishment necessary to carry one of these little creatures through all its stages to maturity. Some parasites lay their eggs on the back of their hosts, but many lay them inside the body. A few species deposit not eggs, but living maggots upon or near the victims. The larvæ of a parasite does not, as a rule, kill the thing it feeds upon until it is itself full grown and ready to transform into an adult.

How useful parasites are can be seen when we remember the severe outbreak of the Army Worm last summer. Towards the end of this outbreak examination in the field showed that there was scarcely one of these caterpillars that was not parasitized. This year I have seen only one Army Worm. Now, the parasites may not be the only cause of the disappearance of this pest, but they are certainly one of the great causes and probably the chief one.

There are many useful predaceous insects, but I shall mention only two: namely, Ladybird beetles and Syrphus-fly larvæ. Everyone knows the pretty little Ladybird beetles with their hemispherical shape and often brilliant colours. The larvæ of these look like little alligators and are just as fond of destroying other insects as are the adults. Syrphus-fly adults usually resemble small bees or wasps, but they have only two wings. They may often be seen feeding upon flowers or hovering above them. Their larvæ are legless, taper towards one end and are stout and usually grayish or brown in colour. The Ladybird beetles and the Syrphus-fly larvæ are the two most helpful insects we have in the control of aphids or plant lice. Without their aid it would often be almost impossible to save our crops from these prolific and very destructive little pests. This is, however, only a single il-

lustration of many that could be used to show the good predaceous insects do.

The more one studies insects and thinks over what takes place, the more inclined he is to feel that were it not for our insect friends our insect foes would make this earth almost or quite uninhabitable for man. I do not mean, however, that insects are the only forces at work in controlling our foes, because disease also plays a great part, as do also extremes of heat and cold and several other things.

We must pass on now to consider briefly our insect foes.

Insect Foes.

There is no doubt that injurious insects every year take a large toll from farmers and especially from fruitgrowers. As there is not time to discuss many of these insects, we shall devote our attention first to our worst two orchard insects, and then to a few of the chief pests of the field crops.

There are many insects that attack fruit trees, but two of these stand out prominently for their powers of destruction. These are the San José Scale and the Codling Moth. The former is the most destructive insect pest ever introduced into the province, but fortunately, though it has been here for twenty years, it has not spread beyond the south-western counties. It is a very small insect, circular, and when full grown, has about the same diameter as the head of a pin. Its powers of reproduction are wonderful: from a single female there may be more than a million offspring by the end of the year. As all of these attach themselves to the trunk, branches, twigs, leaves or fruit and suck the juices, they soon do a great deal of harm. Any orchard that becomes infested with this pest in the warmer parts of the Province, and is not sprayed, is doomed to complete destruction in a few years, even the largest apple trees being killed. An exception to this statement should be made in the case of sour cherries and to some extent of Kieffer pears, the former being immune and the latter not often severely attacked. Up to the present time there have been only a few parasites attacking this scale in Ontario, but we are hopeful that these will become abundant in a few years. We have endeavoured to hasten the process by introducing parasites from Pennsylvania, where they are doing much good. In the meantime

there is a very satisfactory remedy against the insect, and no man who uses it intelligently need lose a single tree or have his fruit discoloured and rendered unsaleable by the scale. Even the worst infested orchards, provided the trees are not too nearly dead, can be taken in hand and brought back into perfect condition. Fortunately, the spraying necessary for this pest kills several others also, and is very valuable against certain diseases of fruit trees.

The Codling Moth does no injury to the trees themselves, but attacks the fruit of the apple and pear. It is the insect that causes the apple to be wormy. It is found all over the province and in unsprayed or poorly sprayed orchards does a great deal of harm. In the warm part of the province, where there is a larger percentage of a second brood, the amount of injury to the fruit varies from 40% to 90%. In the colder portions it is less and runs from about 5% to 50%.

We can easily see, therefore, that the growing of clean apples is by no means an easy job. The fact is that insects and fungus diseases make it impossible to grow apples successfully on a commercial scale without spraying. It is, however, most gratifying to know that thorough spraying at the right time and with the right mixtures (see the Spray Calendar) not only completely controls these two insects, but practically all other orchard insects and diseases; so that in an average year it is not uncommon to find orchards in any of the fruit districts where over 95% of the fruit is free from insect injuries or fungus diseases.

We shall not devote further attention to orchard insect pests, but pass on to a brief discussion of the common insects of field crops.

The chief insects attacking such crops are grasshoppers, cutworms (including the army worm), wireworms and white grubs. These are familiar insects to almost every one. Each kind is capable of doing an enormous amount of injury, the amount depending partly upon the weather conditions. For grasshoppers we have at last in the so-called "Kansas Remedy" found a most satisfactory and cheap remedy, so that no crop need be severely injured by these insects if the owner uses this treatment. The same remedy, sometimes, however, with slight modifications, will usually prove quite satisfactory against cutworms and army worms.

It is interesting to know that attacks from grasshoppers, wireworms, white grubs and often from cutworms, too, can be prevented by simply following the practices of good up-to-date farming in which a short rotation of crops with fall ploughing and thorough preparation of the soil before seeding play a very important part. This is a great source of encouragement to the man who is trying to do his best. A short rotation of crops means that there will be no old pasture fields on the farm. These are the favourite breeding places of grasshoppers, wireworms and white grubs. It is a rare thing to find serious outbreaks of these pests on farms where no old pasture fields exist. Again, a short rotation of crops means that the insects in any particular field are deprived of their special food and either have to starve or seek this food elsewhere, often failing to reach it; for instance, wireworms and white grubs attack grasses and such cereals as wheat, oats and barley, but seldom do any injury to peas or clover; hence a short rotation of crops in which clover or peas play a part will help to starve them out. Good farming, moreover, means careful preparation of the soil for the seed and the selection of good plump seed, with the natural result that the plants will be more vigorous and thus better able to withstand the attacks of insects than weaker plants on poorly farmed land. An illustration of this is seen in the case of the Hessian fly. This insect delights in attacking weak or unthrifty wheat plants. I have counted as many as 1000 of the pupæ in a single square yard in a poor field of wheat. It is not at all uncommon to see two fields close together, one scarcely at all injured by the Hessian fly and the other severely injured; the chief reason for the difference being the better seed and condition of the soil in the former. I am not speaking now of the value of late sowing to prevent Hessian fly attack, though this is often very helpful. My aim has been to show that the better a man farms, whether he knows anything about insects or not, the less injury will be done by these to his field crops.

It is impossible to go into this subject now in fuller detail, but, in conclusion, it may be well to say that we should never get into a panic about insects and fear that some day some new and terrible pest will come to our country that will do incredible damage. New pests are not arriving so frequently as most people think,

and even if some do come, there is very little fear that methods of controlling them will not be found. Many of the insects that are thought to be new have been here for years, but have seldom been noticed because of the controlling influences mentioned above.

A NEW FLY OF THE FAMILY PHORIDÆ FROM CALIFORNIA.

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When recently (August, 1915) at La Jolla, California, I captured on the grounds of the Scripps Institution for Biological Research a Phorid fly remarkable for its relatively large size, and interesting to me on account of the armature of its legs, which recalled one of the fossil species from Florissant. The species is new, and may be called:

***Dohrniphora gaudialis*, n. sp.**

♀—Length about 4 mm., wings over 3.5 mm.; dull black, the front and thorax above anteriorly somewhat polished; third antennal joint ferruginous, blackened above; palpi clear bright red, the spines strong and black; wings pale greenish, the heavy veins sepia; trochanters and immediately adjacent parts pale reddish; knees reddened; anterior tibiæ pale dull ochreous, and middle ones brownish in front; tarsi dusky brownish; extreme apex of abdomen light ferruginous. Head small; proboscis stout, longer than head; arista long, minutely plumose; front with the usual strong bristles, directed backward; ocellar region scarcely elevated; four scutellar bristles, the posterior ones longest; halteres black; wings with the two heavy veins running closely parallel, with a narrow interval between them, the second one (third vein of authors) minutely branched before the apex, which is about half way from base to apex of wing; costa bristly; first thin vein (fourth of authors) gently and evenly curved, not bent, failing at extreme base; third thin vein failing at end, but fourth reaching margin; hind femora high and flattened; anterior tibiæ with a bristle on inner anterior face at about end of first third, and a row of minute black setæ on apical half; middle tibiæ with two very long bristles on basal part,

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