The Parasites of the Japanese Beetle

Natural Balance in Nature

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Under primeval conditions in nature there is found to exist a natural balance of all living organisms among themselves. This may be illustrated by the role the small carnivors, such as the fox, skunk and weasel, play in checking the rapidly multiplying rabbits which are entirely plant feeders and which if not held in check would overrun a given region in a very short time. An illustration of this latter statement occurred in Australia shortly after the introduction of rabbits into that country. Australia is a region inhabited with peculiar primitive plant feeding animals of comparatively low reproductive ability; carnivors are almost lacking. Thus when rabbits were introduced the natural carnivor check was inefficient and rabbits soon dominated portions of the country in such overwhelming numbers as to become a serious pest and a menace to agriculture.

The same law of natural balance just mentioned as functioning with the higher animals also holds for the lower animal forms such as insects. Thus we find that the majority of our serious insect pests of agriculture are foreign in origin. They cause depredations because they multiply without check. Their natural enemies are not present to prey on them in the region into which they have been introduced.

THE OBJECT OF PARASITE INTRODUCTION

The object of introducing foreign insect parasites of insects is simply an attempt to restore the natural balance and hold the injurious insect in check. This work is commonly referred to as biological control. As a rule biological control methods are used chiefly on foreign insects which have been accidentally introduced into a country new to them, the introduced insects most frequently proving to be pests largely because they are free from all their natural enemies or parasites.

EARLY PARASITE INTRODUCTION WORK IN THE U. S.

The most outstanding example of effective parasite introduction work in this country occurred in California in 1889. Prior to that time the orange groves had been seriously threatened by the ravages of the Australian fluted scale bug which had been accidentally introduced into California on citrous stock from Australia. Dr. C. V. Riley, then Chief Entomologist of the U. S. Department of Agriculture, on learning that the fluted scale bug was not a serious pest in Australia had the natural conditions carefully studied in that country. It was learned by Mr. Koebele, who made these investigations, that in Australia there were several peculiar ladybird beetles which fed almost exclusively on the scale bug. These were collected in large numbers and shipped to California. The ladybird beetles arrived in good condition and were at once liberated in an infested grove. Results were almost immediate and the year following the introduction of this insect the scale bug was reduced in numbers to such an extent as to be of no further economic importance.

Since this foregoing work met with success similar attempts have been made with other insects. These have met with success in some instances and only partial results in others; however, negative results in several instances have not stood in the way of further trials. Even though only partial results are obtained, the effort is highly desirable, for after the initial expenditure, there is little expense, if any, thereafter.

Japanese Beetle Parasites

It was with the above ideas in mind that the parasite introduction work on the Japanese beetle was undertaken. At the time this insect became established in this country (1916) it was found to be practically free from natural parasites and predators.

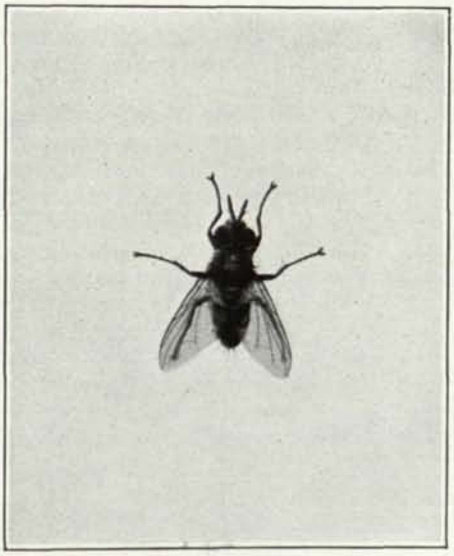

Fig. 1. Centeter parasite of the Japanese beetle.

In 1920 the foreign parasite work in Japan was instigated. Careful research soon revealed that the so-called Japanese beetle in its native land was not a pest of importance and that it had as many as five common parasites or special enemies which held it in check.

Later in 1922 an investigation was carried on in Korea. It was found there that the true Japanese beetle was wanting, but that a number of very closely allied forms were to be found. Further study revealed the fact that the natural enemies or parasites of these allied beetles could be easily transferred to the true Japanese beetle. This possibility increased the scope of the work and the ultimate possibilities of control in the United States.

Since the work in Korea was so successful the field of the work has expanded to China and India and we are now receiving shipments of parasites from all of these countries.

The parasites proper represent two groups of insects, namely parasitic flies of the family Tachinidae and parasitic wasps of the genus Tiphia.

Of the flies there are two species which have interesting life cycles and are worthy of mention.

First, the Centeter fly (Fig. 1). This fly is about as large as the common house fly and superficially resembles it. The fly is a parasite of the adult beetle. It deposits its eggs on the back of the beetle just behind the head (Fig. 2). The eggs hatch in about 24 hours and the young fly maggot drills down through the back of the beetle; it then migrates to the abdominal region of the beetle where it feeds on the internal organs. The death of the beetle occurs in an average of six days from the time the eggs hatch. The fly maggot then transforms into its winter resting stage and remains in this state until the following year.

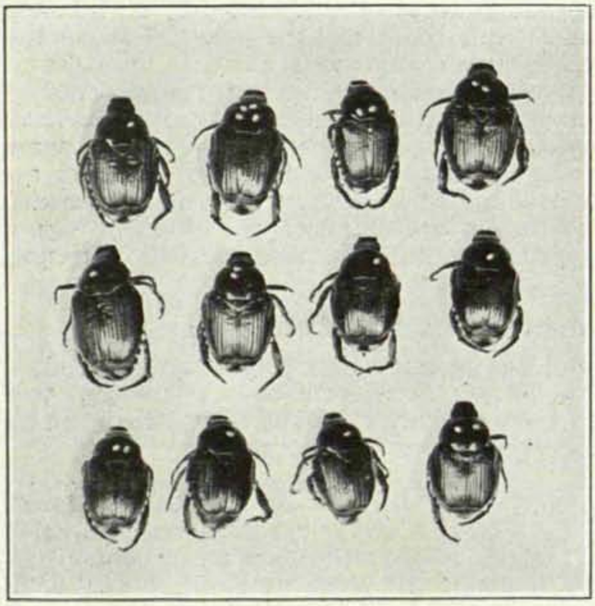

Fig. 2. Eggs of Centeter parasite on Japanese Beetles.

This parasite was found in North Japan and in certain localities it was responsible for the destruction of over 50 percent of the Japanese beetles. This fly is now established in New Jersey where it has spread thinly over an area of approximately 60 square miles.

The second fly of importance is the Prosena fly. This fly is somewhat like a long legged horse fly. It is formidable looking but is perfectly harmless. It feeds on flowers as do many parasitic flies. It deposits living maggots on soil infested with Japanese beetle grubs. The maggots search for the beetle grubs and on finding them, bore their way into the bodies of the grubs and become internal parasites. In the spring of the year, rapid growth starts and they soon destroy the beetle grub by completely devouring it.

Fig. 3. Tiphia wasp parasite of Japanese beetle grub.

It is not definitely known whether this parasite is yet established in this country, hence, work will continue on it until it is either proved that it is established or can not be. It would be a valuable addition to our fauna as it commonly effects 15 to 20 percent parasitism of the host beetle.

The second group or parasitic wasps, all have similar habits so it will be necessary to give only one life history as an example.

The Tiphia wasps (Fig. 3) all deposit their eggs on the grubs of beetles. The wasp proper looks much like a winged black ant of rather large size being about three-quarters of an inch in length.

The female wasp spends much of its time in the soil in search of Japanese beetle grubs. Upon contact with a grub the wasp stings it causing a temporary paralysis during which time the wasp deposits her egg, attaching it firmly to the beetle grub. After the recovery of the host grub, feeding takes place only for a short period, for when the parasite egg hatches the wasp grub (Fig. 4) starts to sap the vitality from it at such a rate that the host is soon devoured completely. The parasite grub then spins a silken cocoon in the soil and remains in it until the following season when it transforms into a wasp and the cycle is again started. In nature these wasps effect about 20 percent parasitism of the beetle grub. Of this group two species are now established; one a Japanese species and the other a Korean species.

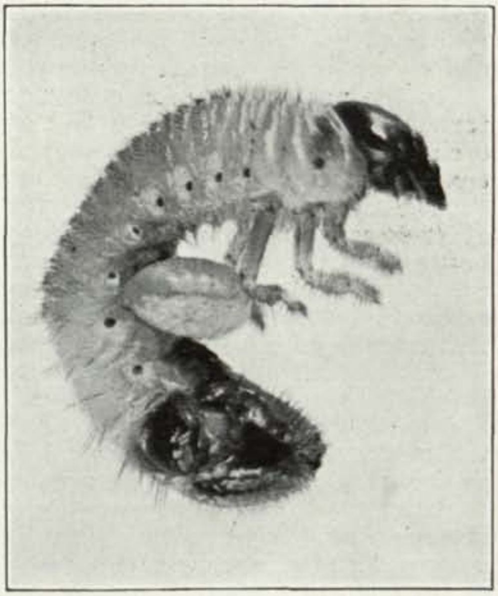
Fig. 4. Tiphia larva feeding on Japanese beetle grub.

Out of a possible nine or ten natural enemies of the Japanese beetle so far only three give evidence of actual establishment, however, in the six years in which the work has progressed this number is not discouraging. The long distance which some of the parasites have to travel before reaching the laboratory at Riverton, N. J., causes a high death rate with some of the parasites, but gradually methods have been improving and we are now more encouraged and determined than ever before.

It is by this method of biological control that some of the insects which are found on the golf course are being controlled by the U. S. Department of Agriculture.

What seems most needed in golf architecture today is a greater use of variety by undulating the fairgreen, the construction of natural-appearing strategic mounds and ridges, and some character given to the rough.

To attempt to penalize all badly played strokes is just as futile as to imagine that a police force can be made large enough to catch all those who err.