

area the better would be the protection of the vastly more important cotton sections within range of flight of the two insects here discussed. However, the direct results of migrations of weevils forced in the fall of 1919 have not yet been ascertained since the inspections in the field have covered only an insignificant fraction of the total number of cotton stalks. In Pima county alone there were approximately forty million stalks and the 188 man-days spent in field inspections could not have been equivalent to the thorough inspection of a hundred thousand of these. If the assumption is correct that no infestations exist in Arizona out-side of the fields where the weevil was actually found, the protective value of the outlaw cotton was greater even than I had supposed.

Necessary space limitations make it impossible to consider here the proper methods of dealing with the wild cotton problem in Arizona. The writer plans to discuss this in other papers on the subject. The more immediate need is for an understanding in political circles of how not to deal with the problem and this paper will doubtless serve a useful purpose in this connection.

OBSERVATIONS ON NATURAL ENEMIES OF THE FALL CANKER-WORM (*ALSOPHILA POMETARIA* PECK) IN FORESTS OF SOUTHERN ALLEGHANY MOUNTAINS, IN 1920

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THE CONDITION

In the years 1917, 1918, and 1919 there were repeated reports of injury by Fall Canker-worm to certain limited areas of wild mountain forests in western North Carolina. Approximately twenty such areas, in nine different counties, were reported,—the areas varying in extent from 10 to 200 acres or more. The injury occurs chiefly in June. Land owners were not familiar with this insect, and were apprehensive lest it should continue to increase and spread until the forests were damaged beyond recovery.

As most of the areas are without roads, with steep slopes and often with much miscellaneous undergrowth, such methods as banding and poisoning were out of the question. It was therefore decided to make a study of the natural enemies during June of 1920. The area selected was on the summit of Hump-back Mountain in Avery County, N. C., 4,170 feet elevation, giving conditions suggestive of the more northern states—Transition Life-Zone, bordering on the Canadian. The observation covered the period from May 27 to June 24, 1920.

BIRDS

A total of 53 species of birds were recorded in or near the infested area,—of these the following highly insectivorous Passerine birds were observed so commonly in the area that they could fairly be presumed to be of material help:—

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| 1. Mountain Vireo. | 9. Yellow-breasted Chat |
| 2. Red-eye Vireo. | 10. White-breasted Nuthatch. |
| 3. Black and White Warbler. | 11. Tufted Tit. |
| 4. Parula Warbler. | 12. Chickadee (prob. southern form). |
| 5. Black-throated Blue Warbler. | 13. Wood Thrush. |
| 6. Chestnut-sided Warbler. | 14. Veery. |
| 7. Black-throated Green Warbler. | 15. Robin. |
| 8. Ovenbird. | |

The variety and number of insectivorous birds appeared to increase in the worm area, but the concentration was not so pronounced as one might expect,—evidently there was much insect food outside the area. The above 15 are selected from the total of 53 species. Among the others were many which probably do feed on canker-worms. (The list included Pileated Woodpecker and Brown Creeper, among others).

PREDACEOUS INSECTS

Calosoma frigidum Kirby. (Coleop. Carab.). Despite much collecting in mountains we had not before taken this species in the state, yet it was found to be common in the worm area, was not found outside of the area, and did become increasingly conspicuous. They were often seen climbing among the twigs and foliage of infested trees, not only on cloudy days, but on clear days as well,—this was especially so when the worms became less numerous by reason of maturity. This species easily takes first rank among the insect predators observed, and in aggregate helpfulness was second only (if second) to the egg-parasite mentioned later. Its general distribution is northerly.

Calosoma scrutator Say. Found only the remains of one dead specimen.

Podisus modestus Dall. (Hemip. Pentatom.). This northerly bug takes second rank among the predators,—it was common, or rather, abundant,—and specimens were often seen with worms impaled on their beaks. It is widely distributed through our mountains.

Lygus sp. (Hemip. Capsid.). One or more species of these were abundant, and several were seen with worms impaled on their beaks.

Ants, (2 sizes, black). Twice seen dragging worms.

Panorpa sp. (Neurop.). Several species were abundant, one was seen devouring a worm.

PARASITIC INSECTS

Telemonus sp. (Hymenop. det. A. B. Gahan). Early in this study a number of egg-masses of Fall Canker-worms were collected from which the larvae had hatched. It was observed that perhaps 25% to 40% of the eggs had not yielded larvae. From these this parasite was easily reared. This was apparently the most useful parasite. It is uncertain whether this or *C. frigidum*, should be given first rank among the natural enemies, in total good accomplished.

Euplectrus sp. (Hymenop. det. A. B. Gahan). Several Canker-worms were found with very small external parasitic larvae attached. From one of these this species was reared.

Sarcophaga cimbicis, or, *latisterna*, (Dip. Tachin.). One specimen was reared from Canker-worm. The specimen is female, and may be either of the above species. (det. J. M. Aldrich).

COLLECTED SPECIES

During the study six species of Tachina-flies were collected in the worm area,—of these *Masicera eufithiae* Twnd. was common. Also eight species of Ichneumonidae were taken among which were four species of *Amblyteles*, which may be parasitic to canker-worm, — the others were larger species which probably do not attack it.

FUNGOUS AND BACTERIAL DISEASE

It had been expected that these would be in much evidence by this, the fourth successive year of attack. This did not prove to be the case, although warm and damp weather was not lacking. Only an occasional worm was found which seemed to have perished from disease, and there was no hint of an epidemic among them. This condition may yet develop.

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While the canker-worms were present in countless numbers, yet residents testified (and evidences were observed) that the defoliation was not so complete in 1920 as it had been in 1917, 1918, and 1919.

It is believed that this was due largely to an increase in the efficiency of the natural enemies, especially *Calosoma frigidum*, *Telemonus* sp., and *Podisus modestus*,—(doubtless others helped), and the small birds. This gives basis for the hope that these may continue to increase, causing a further subsidence of the outbreaks, until the canker-worm may again become inconspicuous. An outbreak of disease among the worms would hasten this result.

The study was interesting and enlightening, and led to an increased appreciation of the unseen good which natural factors accomplish, especially in wild areas like the one under study, where artificial control seems hopeless. The area also proved to be a good one for insect collecting, especially in the family Cerambycidae.

THE EUROPEAN CORN BORER AND THE SUGAR CANE MOTH BORER: A COMPARISON¹

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Two prominent State Entomologists have recently requested data of the writer concerning the sugar cane moth borer and the similarity in its life history and damage to the European corn borer. After reading the papers and the discussions on the new pest in the *Journal of Economic Entomology*, the writer decided that possibly he should place the information on the two species in such form as to be readily available for comparison. While the climate of Louisiana is very different from the portions of New England and New York which have been infested by the European corn borer, yet information on the sugar cane moth borer may indicate in some degree what may be expected of the European insect.

SYSTEMATIC POSITIONS

Both insects are of course Lepidopterons of the family Pyralidae. The European corn borer, *Pyrausta nubilalis*, is in the subfamily Pyraustinae, while the sugar cane moth borer, *Diatraea saccharalis crambidoides*, is in the subfamily Crambinae.

DAMAGE TO CORN AND SUGAR CANE

The corn crop as planted in Louisiana is largely out of the way before the maximum development of the sugar cane moth borer is reached. Corn is usually planted about March, and is mature by mid-summer. While holes and tunnels may be found in the stalks, and while any injury to the stalk must have an effect on the ear, still the damage is usually so slight as never to have been estimated. Doubtless the weight of a number of ears from infested plants would be found to be somewhat less than an equal number from uninfested plants. As for the ears themselves, they are rarely damaged by the sugar cane moth borer. A larva is sometimes found to have entered an ear from the stalk, but this damage is negligible.

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