in great variety, especially since the spread of the Argentine Ant to so many parts of the state.

The great desideratum is the improvement and standardization of the great host of what may be called the minor insecticides. Those that are used in the spraying of orchard trees have been reduced to a good degree of uniformity, due to the work of the economic entomologists and the use of these preparations correspondingly enlarged as the users appreciated more fully their reliability.

The California insecticide law will go far to standardize the other insecticides by giving publicity to their composition, provided that we contribute our share in the study of their relative efficiency.

THE PETROLEUM FLY IN CALIFORNIA

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DIABROTICA VIRGIFERA LEC. AS A CORN ROOT-WORM

By C. P. GILLETTE

Diabrotica virgifera Le Conte; Trans. American Entomological Society, Volume II, page 59;

Diabrotica flicornis Horn: Trans. American Entomological Society, Volume XX, page 94.

The last week in July, 1909, a neighbor told me that his sweet corn was being killed by a little grub boring in the roots. A week later, I went to examine the corn and found the adult beetles of the above species abundant, resting on the leaves and stems of the corn and quickly taking wing when approached. The grubs had practically all left the roots but the injuries to the roots and crowns were everywhere present, very few plants escaping the attack. The owner said there were plenty of grubs in the roots during July. Figure 1 of the accompanying plate was drawn from a corn stalk taken by Mr. L. C. Bragg on July 12th of the following year and fairly represents the injury that the larvae do.

On July 2, 1910, I received a card from Mr. R. C. Aiken, of Loveland, Colorado, stating that fully one-third of his sweet corn was practically dead from the attacks of a small white worm in the roots. Mr.

Plate 9. *Diabrotica virgifera* Lec.; 1, Corn root attacked by the larvae, $\frac{1}{3}$ natural size; 2, larva; 3, dorsal view of last segment of larva; 4, dorsal view of elytra of male; 5, female; 6, egg; 7, reticulation of egg shell. Figures 2, 4, and 5 are enlarged 10 diameters; figure 3, 16; figure 6, 30; and figure 7, 80 diameters. Original, M. A. Palmer, Delineator.

Bragg was sent to investigate the trouble and *D. virgifera* was found to be doing the damage. Mr. Bragg spent considerable time hunting for the injuries of the beetle during 1910 about Fort Collins and was able to report it fairly common on ground where corn had been grown for two or more years in succession and, in a few instances, the injuries were very severe. During 1911, the injuries seemed to be less, though the insect has been taken frequently about Fort Collins upon corn during the late part of the summer.

This insect occurs in two forms, one striped and closely resembling *D. vittata* as shown in Figure 5; the other with the wing covers black except for the narrow yellow margins and yellow tips, as shown in Figure 4. Specimens were sent to Professor Wickham, of the Iowa State University, who determined the striped form as *D. virgifera* Lec. and the dark form as *flicornis* Horn, and stated that *virgifera* is known from New Mexico, Arizona, and Sonora, while *flicornis* is known from New Mexico. I have not been able to find any references to either of these insects from other localities and the species was not represented in our collection here until taken in the patch of sweet corn mentioned above.

It did not seem possible to me that these two forms, with some intergrading in the color markings, could represent two species, as they occur in practically equal numbers together in all cases where we have observed them. Furthermore, the striped form had every appearance of being the female beetle and the black form, the male, and the two forms have frequently been taken *in copula*. Late in the summer, the striped form was found to be full of eggs, whereas ova never developed in the dark form, so I think the conclusion is safely drawn that *D. flicornis* Horn is the female of *D. virgifera* Lec. The antennal differences as given in the original descriptions seem to be constant for the two sexes.

Mr. Bragg followed the habits of this insect quite carefully in the field but was unable to find the eggs out of doors. Beetles brought into the laboratory, however, deposited eggs quite freely in test tubes. The eggs are pale yellow in color and measure about .65 mm. in length, .45 mm. in width, and are finely reticulated on the surface. See Figures 6 and 7. The larva is pale yellowish in color, 11 mm. in length when fully grown, and has a conspicuous black anal plate. See Figures 2 and 3. The length of the beetles varies little from 5 mm.

It seems certain from the observations that we have already made that the insect is single-brooded, and has practically the same life history as *D. longicornis*. This being the case, the very simple remedy will be, not to grow corn after corn where this insect has been at all common the preceding year.