THE ARGUS TORTOISE BEETLE

By F. H. CHITTENDEN

Entomologist, Truck-Crop Insect Investigations, Bureau of Entomology, United States Department of Agriculture

INTRODUCTORY

The foliage of sweet potato, wherever planted in the United States, is attacked every year by tortoise beetles of different species, the largest of which is known as the Argus tortoise beetle (*Chelymorpha cassidea* Fab.). This species breeds on convolvulaceous plants, and, until the year 1919, was rather generally believed to be more commonly found on bindweed (*Convolvulus* spp.) or wild morning-glory (*Ipomoea* spp.) and related wild plants than on sweet potato. That year the species was abundant and attracted more attention on sweet potato (*Ipomoea batatas*) than on wild plants, and recent studies tend to show that it prefers the cultivated plant, even when wild Convolvulaceae are available in the immediate vicinity. Thus far, however, it has not been a pest of importance.

DESCRIPTION

THE BEETLE

The beetle (fig. 1, a, and Pl. 1, A, a) is dark brick red when fully mature, and, before it is fully colored, of different shades of yellow. Its

---

1 Accepted for publication, Nov. 1, 1923.
2 Formerly known as *Chelymorpha argus* Licht.; order Coleoptera, family Chrysomelidae.
upper surface is ornamented with black dots of variable number and size, the variation being largely dependent on locality. Usually, in the eastern form, there are from 17 to 21 spots, which are more or less rounded. On the prothorax there are usually from 4 to 6 spots, and there is also one suttural spot behind the scutellum. The small marginal spot is sometimes lacking, especially in western forms. The lower surface is black, with the exception of the head, margins of the prothorax, and that portion of the elytra which can be seen from below. The antennae and legs are also black.

This form can readily be distinguished from all other genera of tortoise beetles by the characters given, and from other common species that attack sweet potato it can be known at once by its much larger size, since it is one of the largest of the leaf-beetle family occurring in the United States.

The full length is about one-third of an inch (8-11 millimeters) and the width about one-fourth of an inch (6-7 millimeters).

Several forms of this species occur in the United States which are considered to be merely varieties, races, and, in one instance, a subspecies. So far as known, these variants have practically the same habits, but some have a different distribution and all very closely resemble the form described above.

SYNONYMS AND VARIETIES

Chelymorpha cassidea Fabricius, Syst. Ent., 1775, p. 82.
Chelymorpha argus Lichtenstein, Cat. Mus. Hamb., 1795, p. 66.
Chelymorpha cribraria Olivier, In Enc. Meth., v. 5, 1790, p. 383; Ent., v. 6, 1808, p. 956.
Var. phytophagica Crotch, l. c., p. 77.
Subsp. geniculata Bohemann, Mon., v. 2, 1854, p. 39.

EGG

The egg mass (fig. 2) of Chelymorpha cassidea is most peculiar. The eggs are deposited normally on the lower surfaces of the leaves and probably elsewhere at times, since in confinement masses have been found on the stalks. In the field they are deposited in clusters varying from 16 to 28. Six masses contained 16, 17, 18, 24, 26, and 28 eggs, respectively. The eggs are attached to the leaf by long pedicels, the pedicels being fastened to the leaf surface by a considerable amount of glutinous substance. The eggs also adhere to each other at their bases and, in many cases, halfway or a little more toward the apices, but the ends are free and divergent. The eggs are deposited irregularly, without definite pattern. There is usually a central irregular row of 6 eggs, flanked at each side by a similar irregular row of 5 or 6, while the outer rows together form a mass, which is always irregular, but with a suggestion of a circular arrangement.

The individual egg measures about 1.6 millimeters in length and 0.8 millimeter in width, being approximately twice as long as wide. It is evenly rounded at the base and bears at the distal end a cap which opens at one side when the larva issues and which bears at the extreme apex a prominent dark reddish tubercle of irregular shape, somewhat resembling a bit of sealing wax. The general color of the egg is dull buff and the surface is granulated.
LARVA

The larva (fig. 1, b; Pl. 1, A, b; B) may be described as follows:

Head prominent, dark brown, outline of basal half semicircular; eyes small, black; mandibles prominent, darker brown, width of head about 1.6 millimeters; surface with numerous short bristles. Thoracic plate nearly twice as long as wide, each half irregularly pentagonal. Body dull light yellow, strongly marked with numerous dark brown, nearly tuberculate spots; its form, including thorax, robust, less than twice as long as wide, somewhat depressed, armed with long prominent lateral spines, 14 on each side as follows: 4 thoracic, first pair directed forward and upward above head, second pair at acute angles and semierect and two pairs at right angles; 8 abdominal spines, slightly curving upward at apex, 2 anal spines erect. Each spine wide at base and light colored in basal half with strong lateral spines, apical half acuminate, black. Dorsum of abdominal segments each with two rows of transversely rounded oblong tubercles, those of first three segments largest, size diminishing posteriorly. Anal segment with well-defined dark brown plate about twice as long as wide, terminating in a long proleg rounded at apex. The feci-fork is usually held slanting back from the body and rarely vertical or over it.

Lower surface with a median row of 5 small, rounded, longitudinal brown spots on segments 2 to 6, 6 to last with transverse dark-brown marks, growing stronger to last segment, posterior third more or less marked with dark brown. Legs long and stout, dark brown, blackish when folded.

Length of full-grown larva without feci-fork 7 millimeters (about ½ inch), width 4.5 millimeters.

PUPA

The pupa (fig. 1, c, d; Pl. 1, A, c) is pale yellow, marked with dark brown, becoming nearly black toward the time of transformation to adult. The surface is nearly covered with a pale bluish bloom or waxy secretion resembling a mold, a peculiar covering not often seen in any other group of beetles. The ventral surface is somewhat flattened and the dorsal surface is convex. The thorax projects strongly at each side, being a little wider than the widest abdominal segment. It is armed apically with two short spinous processes in the proximal third. The antennal sheaths and legs are robust, the posterior pair being about as long as the elytral sheaths. The body is armed on each side with five long and strong black-tipped spines similar to those of the larva, the first pair situated about the middle of the body. The first two pairs are subequal in length and the remaining pairs decrease in length posteriorly. There are also two pairs of short unicolorous spines toward the apex. The cast skin of the larva with its spines is rolled up in a mass at the posterior extremity.

Length 8 millimeters, width 4.5 millimeters.

DISTRIBUTION

The Argus tortoise beetle is a native species inhabiting a large portion of the United States. It also occurs in Canada. The species does not appear to be recorded from Mexico, but several related species occur there. The known distribution, including what at present are considered varieties, is shown in Figure 3.
NOTES ON HABITS AND DEVELOPMENT

From larvae collected at Arlington, Va., June 20, 1919, and later, the first adults began to emerge June 29, continuing to emerge until July 3. In outdoor rearing cages emergence was from September 10 to the first week of October. Adults observed on sweet potato all developed within 7 to 10 days of each other. Individuals collected by Miss Marion T. Van Horn on wild bindweed (Convolvulus sp.) that grew in a shady location in the District of Columbia were, evidently as a result of not being exposed to direct sunlight, over two weeks late in development, while larvae one-third to two-thirds grown were observed after the Arlington material, which was almost constantly exposed to sunlight, had all transformed to pupae.

In 1919, 50 reared beetles were under observation during July. Of this number 20 were placed on growing sweet potato plants and covered with a large cloth-covered rearing cage, but they did not thrive, some individuals dying, and no eggs could be found up to the end of the month, although in a second lot kept in the insectary eggs were observed August 3. Finally the cage was removed and the beetles allowed to shift for themselves. September 2 an egg mass was found on the same plat where the beetles had been feeding.

The experience of two years shows definitely that the second generation is only a partial one, since only three egg masses of this generation were found and at intervals of a month, indicating that the majority of the beetles of the first new generation hibernate, in this respect agreeing with some other insects.

Of the second generation, the eggs of which hatched during August, several pupæ were formed a month later, showing a larval period of about three weeks in rather cool summer weather.

In its apparently irregular development, Chelymorpha cassidea resembles to some extent the Colorado potato beetle. The overwintered beetles first occur some time in May—in 1920, May 17, in an exception-
ally cool spring. The first egg masses were obtained May 23. The first new generation develops during the last week of June and throughout July, with the temperature 60° to 100° F., averaging 75°.

May 17, 1920, adults were collected on the western edge of the truck farm at Arlington, Va., and on the far side of a large sewer pipe which had undoubtedly attracted them, as it conserved considerable heat. Nearly all of these beetles were on the west side, morning-glory plants which were numerous on the east side harboring only one specimen. The beetles hibernated on the more protected side and mostly together, since all specimens were found in two small areas, representing colonies, quite close to each other. Additional evidence of the eminently gregarious habit of this species was afforded the following morning by examination of the jar in which these beetles were placed overnight. At first glance it was thought that some had escaped, but close examination showed that they were closely huddled together in the folds of the small leaves.

Larvae obtained in late August transformed to pupae September 1, and the adults emerged September 10, which gives 9 days for the pupal period during moderately cool weather, with the temperature ranging from 70° to 82° F., and averaging 74° F.

The first pupa was observed on June 23. The larval period is about three weeks in cool summer weather, and the pupal period for the same temperature is about nine days. The fact that the species has only an exceptional second generation in the District of Columbia tends to show that it is single-brooded in the North and fully double-brooded in the Southern States.

The adults issue at any time during the day, and the coloring begins at the head and legs, the dots on the prothorax appearing some time before those on the elytra. When first emerged the beetles are bright yellow, afterwards changing to a darker yellow and finally to yellowish red or dark brick red. For full coloring the insect requires at least two, and probably three days.

The beetles cling most tenaciously to foliage or to objects in rearing cages, unless they drop down to "play 'possum," and evidently for that reason do not very often find their way into the collecting net, most individuals having been collected on their food plants and elsewhere, where attention was attracted to them because of their conspicuous coloring.

The first eggs obtained during 1920 were laid during the last week of May, beginning May 22, and the first larvae were noticed June 10. Eggs that were laid June 4 and were isolated, hatched June 14, 10 days later. From this lot the larvae began to transform to pupae July 3 and the adults began issuing July 10. The pupae began to transform to beetles at the same date in different jars kept under different atmospheric conditions.

The foregoing data furnish the following as an approximate average life cycle from egg to adult for the District of Columbia and vicinity:

<table>
<thead>
<tr>
<th>PERIODS OF THE STAGES OF CHELYMORPHA CASSIDEA FAB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg period:</td>
</tr>
<tr>
<td>June 1 to June 11.....................................</td>
</tr>
<tr>
<td>June 4 to June 14.....................................</td>
</tr>
<tr>
<td>Larval period: June 14 to July 3........................</td>
</tr>
<tr>
<td>Pupal period: July 3 to July 10, September 1 to 10.</td>
</tr>
<tr>
<td>Total from egg to adult.................................</td>
</tr>
</tbody>
</table>
The Argus tortoise beetle was described, under the name *Coccinella cassidea*, by Fabricius in 1775 (3, p. 82).

In 1869, A. S. Packard (10, p. 504) figured the pupa and adult, with the statement that he had found all stages on the leaves of “silkweed” in July and early in August, and that in one instance in Salem, Mass., it occurred in abundance on raspberry.

In 1870, Riley (11, p. 58; 12, p. 4) published a short note on the larva and adult, stating that it was found on Asclepias.

In 1870, Harrington (2, p. 120) published a short note in which the species was reported as a new foe by market gardeners in Canada, where it occurred in immense numbers and destroyed plants and flowers. It was said to be first noticed on wild Convolvulus.

In the early eighties the writer received from Ovid, N. Y., specimens of the larva of the Argus tortoise beetle on raspberry.

The first record of the Bureau of Entomology is dated March 11, 1884, when specimens were received which were taken on the foliage of sweet potato at Touch Key, Fla.

June 28, 1886, Dr. J. M. Shaffer, Keokuk, Iowa, reported numbers of larvae on sweet potato vines.

In 1887, Lintner (8, p. 673) wrote of this insect under the title “Milkweed beetle with bad habits.” A correspondent in Chenango County, N. Y., stated that it was found on morning-glory, corn, cabbage, and plantain. In Doctor Lintner’s reply he mentions other alleged food plants, including milkweed, mustard, and plants of the rose family.

In 1889, J. B. Wielandy reported the species on Convolvulus at Springer, N. Mex., on July 13, and on June 30 attack on sweet potato was reported at Slatonville, Ark., by D. D. Forman.

In 1893, Webster (14, p. 204) treated this insect as occurring on raspberry and blackberry.

In 1897, the writer published what appears to be the first account of attack by this species on sweet potato (2, p. 23). In 1898, Webster and Mally (15, p. 99) mentioned its occurrence at Willard, Ohio, on strawberry vines. In 1899 Lugger (9, p. 254) mentioned this insect as frequently being found on raspberry. In 1899, also, Sanderson (13, p. 140-142) gave a biological account of this species, with breeding records showing variability in the adults from the same mass of eggs. He also described the eggs, larva, and pupae.

July 31, 1901, specimens were received from J. P. Reynolds, North Haven, Me., taken on rose leaves.

In 1905, Forbes (5, p. 192) included this species in a list of insects found on corn.

July 8, 1906, specimens were received from Silver Creek, N. Y., found on timothy, evidently an accidental occurrence. The same comment applies to specimens found next year in a cornfield at Arlington, Va. July 19, 1907, larvae were reported by I. J. Condit attacking sweet potato at Benning, D. C., and in that year Fall and Cockerell (4, p. 200) mentioned its occurrence on Solanum in New Mexico.

August 15, 1908, Otis Andrews, El Paso, Tex., reported injury to morning-glory and moonflower. July 22, 1909, a canning company at Cherry Creek, N. Y., sent specimens of pea vines on which were found

*Reference is made by number (italic) to "Literature cited," p. 50-51.*
many larvae and adults of this tortoise beetle. The vines were also well covered with pupae from which the adults were beginning to issue. July 28, Miss Julia D. Whiting, Deerfield, Mass., sent specimens found on morning-glory, including larvae with the nymphs of the pentatomid predacious enemy *Apateticus bracteatus* Fitch. The same year Frederick Knab (7, p. 152) wrote a short note on the nuptial colors of this species.

July 15, 1910, report was received from F. H. Horsford that the pupa was found on the lower side of the leaves of *Lilium henryi* at Charlotte, Vt.

July 13, 1911, Fabian Garcia, Agricultural College, N. Mex., reported attack on sweet potato. July 2, 1913, F. B. Milliken collected this species at Garden City, Kans., on bush morning-glory (*Ipomoea leptophylla*).

In 1916, H. S. Barber (1, p. 119) included this species in a review of North American tortoise beetles, summing up briefly the habits of the species as published and furnishing a map showing its distribution.

May 16, 1917, J. A. Hanchey, Allen Parish, La., reported attack on sweet potato, the plants looking as though fire had gone through them. This, however, was only in spots and did not extend through entire fields.

During 1919 this insect, as previously stated, attracted much attention. It was first noticed attacking sweet potato at Arlington, Va., when full grown larvae were observed. June 28, 1920, a farm hand at Arlington, Va., noticed it on sweet potato and expressed the usual apprehension of injury.

July 21, 1922, Prof. H. F. Wilson, Madison, Wis., reported this species as being very common in Wisconsin and as creating considerable apprehension. Later he wrote that reports of damage were obviously erroneous and that the insect was not in reality a pest in that State.

**NATURAL ENEMIES**

The United States Bureau of Entomology has records of three natural enemies of this tortoise beetle; an egg parasite, a larval parasite, and a predacious bug:

*Emersonella niveipes* Girault.4—From egg masses collected by Miss Van Horn in the District of Columbia June 28, 1919, *Emersonella niveipes* Gir., a minute chalcidoid, began emerging July 12, 1919. From eggs collected by the writer September 5, 13 of these parasites emerged from one egg mass consisting of 19 eggs, in each case issuing from a round hole on one side near the top of the egg.

*Masicera exilis* Coquillett.—During July of 1907 several mature larvae were observed in the District of Columbia on sweet potato leaves, from which the tachinid fly *Masicera exilis* issued July 19 to 29. July 2, 1919, the same species was reared from a larva from Arlington, Va.

*Apateticus bracteatus* Fitch.—July 26, 1909, Miss Julia D. Whiting, Deerfield, Mass., sent specimens of a large pentatomid bug, *Apateticus bracteatus* (fig. 4), which were observed attacking the larva of the Argus tortoise beetle in that vicinity. The nymphs transformed to adults August 4 to 7.

4 Determined by A. B. Gahan.
The Biological Survey has found the Argus tortoise beetle in the stomachs of 14 species of birds, most often in those of the starling (*Sturnus vulgaris*) and kingbird (*Tyrannus tyrannus*).

**GENERAL SUMMARY**

The foliage of sweet potato, bindweed, and morning-glory is attacked by the adults and larvæ of the Argus tortoise beetle (*Chelymorpha cassidea*). Reports of attack to plants other than Convolvulaceae are in the main, if not entirely, erroneous.

The species has been studied in the District of Columbia. The eggs are deposited in clusters, varying from 16 to 28, on the lower surface of the leaves. They hatch in about 10 days into light yellow larvæ, which are gregarious and feed on the lower side of the foliage. In about three weeks they become mature and develop into similarly colored pupæ, which in from 7 to 9 days give forth the beetle. The species is evidently single-brooded in the North, double-brooded southward, and in the District of Columbia there is an exceptionally small second generation.

The Argus tortoise beetle is seldom so abundant as to be very destructive, plants readily recovering from its attack. The insect may be hand-picked in all stages and larvæ and adults can be killed with arsenicals.

**LITERATURE CITED**


The Argus Tortoise Beetle


(6) Harrington, W. Hague. 1879. [Note on Chelymorpha cribaria.] In Canad. Ent., v. 11, no. 6, p. 120.


(11) Riley, Charles V. 1870. Second annual report on the noxious, beneficial, and other insects, of the state of Missouri. 135 p., illus.


PLATE I

Chelymorpha cassidea

A.—Sweet-potato leaf showing (a) adult, (b) larva, and (c) pupa.
B.—Half-grown larvae preparing to molt at tip of stem on which they have devoured the foliage.

(52)