1-1-1965

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*Altica tombacina* (Mannerheim) (Coleoptera-Chrysomelidae)

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Habits and Life History of the Bronze Flea Beetle,

*Altica tombacina* (Mannerheim)

(Coleoptera: Chrysomelidae)

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In the summer of 1959 during an ecological study on Saddleback Mountain in the Oregon Coast Range in Northwestern Oregon, a bronze flea beetle, which proved to be *Altica tombacina* (Mannerheim), was found feeding extensively on the fireweed plant, *Epilobium angustifolium* L. Correspondence with Dr. Louis G. Gentner, a recognized authority on the genus *Altica*, concerning identification of the beetle disclosed that very little was known about the life history or habits of this species. Furthermore, Dr. Gentner stated that though he had examined many specimens he had never found a male and that the external characteristics by which males had been designated by Horn (1889) apparently were not valid for this species. He also mentioned the possibility of parthenogenetic reproduction.

As the lack of information about the bronze flea beetle presented a challenge, certain members of the Linfield research group began, as time permitted, observations and experiments which led ultimately to fairly complete knowledge concerning its life history.

**Materials and Methods**

Several groups of larvae were collected from fireweed plants in the fall of 1959 and taken to the Biology Department of Linfield College where they were placed in glass rearing cages with fine-mesh covers. There they were supplied from time to time with fresh fireweed leaves for food and were observed to pupate on the bottoms of the cages. From these larvae more than 30 adult bronze flea beetles were obtained, definitely establishing the identity of the larvae and giving preliminary data regarding length of stages in the life cycle.

On August 20, 1960, a series of fairly mature larvae was collected for further observation. These were placed in rearing cages in the laboratory and were found to have pupated on August 30. From 10 of them the data were obtained for Table 3 on the metamorphosis from pupa to adult during the last two days of pupation.
On May 13, 1961, one beetle was isolated from several collected on Saddleback Mountain that day. She was placed on a fresh fireweed leaf in a small cage in the laboratory. Throughout the summer and until September 20, this beetle, together with others reared from eggs produced by her, was checked at frequent intervals. All beetles under observation were supplied with fresh fireweed leaves as needed. It was possible to keep the leaves fresh and turgid for several days by removing them from the stem of the plant and placing the basal end of the leaf in loosely corked, small glass vials filled with water. This technique also kept the beetles from getting into the water and drowning. Excepting the technical description of the adult and the data in Table 3, nearly all of the following observations and records on the life history of \textit{Altica tombacina} are from this female and her laboratory-reared progeny.

\textbf{Life History}

\textit{Taxonomy of Adult.} \textit{Altica tombacina} was first described by Graf-Carl G. Mannerheim in August, 1853, from a single specimen taken from herbage along a small creek on the Tschunuktnu Peninsula, Kenai, Alaska. It belongs to the family Chrysomelidae, most members of which are called flower or leaf beetles, but the adults of the subfamily Alticinae jump like fleas and for this reason are termed flea beetles. In some books the genus is spelled \textit{Haltica}.

The external sex characteristics of the genus \textit{Altica} are described by Dr. Gentner (pers. comm.) as follows:

Normally males have the first joint of the anterior tarsi larger and broader than in the females, and the last ventral segment of the abdomen is sinuate on each side with a rather noticeable median lobe, more or less concave and smooth, with a longitudinal or triangular median impression extending three-fourths to two-thirds the length of the segment. In the female the last ventral segment is usually convex without a median impression.

Dr. Gentner, who has specimens in his collection from Oregon, Washington, British Columbia, Alberta, and Alaska, has never found the enlarged or broadened first joint of the anterior tarsi. He did find some specimens having the ventral median indentation, giving the impression that they might be males. But when dissected they proved to be females.

\textit{Description of Life Stages.} The cylindrical, finely punctate eggs, 0.6 mm long by 0.3 mm wide, are yellow and are deposited on undersurfaces of leaves (Figure 1).

The tiny, newly hatched larvae, 1.5-2.0 mm in length, have pale-yellow bodies with four dark dots on the dorsal side, their heads varying from yellow
from eggs deposited by the observational female (presumably overwintered), produced eggs from June 29 through August 18. No account was kept of the total number laid or hatched. As shown in Table 2 adults emerged throughout the summer approximately 30 days after the eggs hatched. Since the experiment terminated September 20, beetles from the last eggs oviposited were still in the pupal stage.

TABLE 2. OVIPOSITION BY ONE OVERWINTERED* FEMALE
(Spring and Summer 1961)

<table>
<thead>
<tr>
<th>Date Deposited</th>
<th>No. of Eggs</th>
<th>Dates Larvae Were Observed and No. of Larvae (in parentheses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15-16</td>
<td>35</td>
<td>May 23 (8)</td>
</tr>
<tr>
<td>May 17</td>
<td>15+</td>
<td>May 23 (3)</td>
</tr>
<tr>
<td>May 18</td>
<td>15</td>
<td>May 25 (20+)</td>
</tr>
<tr>
<td>May 20</td>
<td>15</td>
<td>May 25 (20+)</td>
</tr>
<tr>
<td>May 22</td>
<td>15+</td>
<td>May 27 (some)</td>
</tr>
<tr>
<td>May 23</td>
<td>16</td>
<td>May 27 (8)-May 31 (4)</td>
</tr>
<tr>
<td>May 25-27</td>
<td>18</td>
<td>May 29-June 2 (13)</td>
</tr>
<tr>
<td>May 29</td>
<td>32</td>
<td>June 2 (27)</td>
</tr>
<tr>
<td>May 31</td>
<td>31</td>
<td>June 2-4 (some)</td>
</tr>
<tr>
<td>June 1</td>
<td>12</td>
<td>June 9 (9)-12 (1)</td>
</tr>
<tr>
<td>June 2-4</td>
<td>46</td>
<td>June 8-9 (some)</td>
</tr>
<tr>
<td>June 6</td>
<td>30</td>
<td>June 12 (5)</td>
</tr>
<tr>
<td>June 8-9</td>
<td>36</td>
<td>before June 20 (some)</td>
</tr>
<tr>
<td>June 10</td>
<td>10</td>
<td>June 20 (5)</td>
</tr>
<tr>
<td>June 12</td>
<td>31</td>
<td>June 20 (8—1-2 days old)</td>
</tr>
<tr>
<td>June 14</td>
<td>22</td>
<td>June 20—or before (16)</td>
</tr>
<tr>
<td>June 15</td>
<td>15</td>
<td>to June 26 (3)</td>
</tr>
<tr>
<td>June 16-19</td>
<td>49</td>
<td>June 20 (first 1)</td>
</tr>
<tr>
<td>June 20</td>
<td>8</td>
<td>June 26 (some)</td>
</tr>
<tr>
<td>June 22</td>
<td>2</td>
<td>June 27 (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>discarded because too dry</td>
</tr>
<tr>
<td>Total Eggs</td>
<td>453+</td>
<td></td>
</tr>
</tbody>
</table>

* Presumed on basis of life-cycle observations.

No eggs were laid by second-generation beetles, leading to the assumption that second-generation beetles are the ones which hibernate and emerge in the spring to produce the next year's eggs.

_Hatching._ The eggs hatch in a minimum of two days, but more generally require four to eight days. Within a cluster some eggs may hatch before others begin. In one instance eight of 16 eggs laid before 9:30 a.m. on May 23 had hatched by 10:00 a.m. on May 29. On May 31, four of the
remaining eggs had hatched, and the others were discarded since they were moldy.

Though the newly hatched larvae have pale-yellowish bodies (Figure 2), within 24 hours they darken, ranging in color from light gray-green to dark gray or black.

Larvae feed within a few hours after hatching. They respond readily to tactile stimuli but do not move rapidly away while feeding. There are no unusual quick movements.

*Molting.* The different states or instars in the development of the larva are separated from one another by a molting or shedding of the larval skin as shown in Table 1. The first molt occurs within two to four days after hatching. When the larva first emerges from the old skin it is an even gray all over. Within two hours it has turned black and begun to feed again. The second molt occurs within three to five days after the first. A third molt follows in from six to eight days and initiates the beginning of pupation (see Table 1).

*Pupation.* The larva stops feeding and becomes less active for one to two days as it migrates from its feeding position on the plant into the soil. As pupation begins, the larval skin splits at the head and is shed from the anterior to the posterior end through longitudinal contractions and expansions of the emerging pupa, requiring about 20 hours. The only obvious movements are in the region of the abdominal segments. The pupa is slightly curled after this metamorphosis has been completed (Figure 4). Pupation lasts from nine to eleven days; the interesting changes noted during the last two days of pupation are presented in the following table.
The specimens we have in our collection (23) were taken 6 miles east of Estacada feeding on Siletz strawberries. I collected the specimens on April 20, 1962, but their presence was reported to me at least two weeks earlier. The field was recently cleared of stumps and ferns typical of cutover forest land. Fireweed occurs in abundance in the bordering areas of the field. The beetles were congregated on individual berry clumps rather than as a general infestation of the entire field. Feeding damage is illustrated by the enclosed leaf (Fig. 9). I did not observe larvae at the time, although eggs, presumably flea beetle, were present. The beetles disappeared from the fields shortly after the collection date and have never been observed since.

The genus *Altica* is also listed as a minor pest of strawberries by Rosenstiel and Vaughan (1952) who state: “Both the adults and larvae skeletonize the leaves, sometimes defoliating younger plants.” Mr. Goeden believes the species referred to is *A. tombacina*.

The larvae feed on the underside of fireweed leaves, removing most of

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Figure 7. Detail of aedeagus, the male genital organ of the bronze flea beetle. A. Apical one half of ventral side. B. Lateral view. C. Apical one half of dorsal side. Drawings by Kenneth M. Fender.
surface of leaves. The tiny larvae, initially yellowish, through three instars grow to 7 mm in length and turn shiny black. Larvae feed on the lower epidermis and mesophyll of the leaves while adults chew entirely through the leaves. In the soil pupae undergo a series of visible changes during the last 48 hours of pupation. No pupal skin is shed in the course of this metamorphosis.

Apparently two complete generations occur each year: one in May and early June and the second during the last of June through July. The second-generation adults lay no eggs during their first summer; therefore, it is concluded that the beetles which emerge in the spring are the second-generation adults from the preceding summer.

There are no reliable external sex characteristics to distinguish males from females. Although the male is small, usually under 4.0 mm in length and the female is 4.0-4.5 mm, small females occur occasionally. The sex ratio seems to be one male to two females, but more dissections are necessary to establish a definite ratio.

More research is needed to determine how soon the beetles start eating after emergence from pupation and, also, from hibernation.

**Acknowledgements**

For the painstaking observations entailed in this life history study and tabulation of data, I owe an especial debt of gratitude to three people. Nancy Myron Collins initiated the study in the fall of 1959 by rearing the first adults in the laboratory from larvae; in the fall of 1960 she noted the habits of larvae and described the metamorphosis of pupae. The details of egg-laying, larval development, and length of developmental stages were recorded by Frances W. Daniels by means of observations on laboratory-reared specimens during the summer of 1961. Dissection of adult beetles to determine presence of males and the sex ratio and summarization and analysis of data were accomplished by Rose M. Gillette.

Kenneth M. Fender kindly made the initial dissection of genitalia on one of the beetles, demonstrating the dissection technique. He also read the manuscript, making useful suggestions concerning it.

I am grateful also that Dr. Louis G. Gentner proposed the study in addition to identifying the bronze flea beetles for us. Kenneth Goeden supplied valuable information concerning feeding habits of the beetle on strawberry plants.

Thanks are due also to Howard C. Daniels and William Good for the photography used in this life history study.

National Science Foundation Grant G-8779 supported the research.
Literature Cited


