

*Tetrastichus Minutus* (Howard) (Hymenoptera: Eulophidae)  
Reared from the Lady-Beetle, *Adalia Bipunctata* L.

W. W. JUDD

Department of Zoology, McMaster University  
Hamilton, Ontario

(Received for publication Oct. 13, 1948)

MATERIALS AND METHODS

On November 15, 1946, ninety pupae of the lady-beetle, *Adalia bipunctata* L. were removed from the lower trunks of a row of birches on the campus of McMaster University, Hamilton, Ontario. When the pupae were examined in the laboratory two small wasps were found moving about over them. These were captured and pinned. Each of 84 of the pupae was placed in a numbered vial (40 mm. x 10 mm.) and the vial was plugged with cotton, and the series of vials was kept at room temperature. Six of the pupae were dissected beneath a binocular microscope. Three pupae were found to contain 7 small larvae, two contained 10 and 12 larvae respectively and one contained 1 live larva and three empty pupal skins and had a small emergence hole in the thorax. The larvae wriggled sluggishly when removed from the coccinellid pupal skin. They were 2.0-2.5 mm. in length, had smooth skin and were light brown in colour. The body tapered to a blunt point anteriorly and posteriorly and showed a head and a series of thirteen segments, in this respect resembling the larva of *T. brevistigma* Gahan figured by Berry (1938).

On November 23, the pupae in vials were examined for holes made by the emerging parasites. Twenty pupae were found to have emergence holes. The pupae were left until August 6, 1948, and as adult parasites emerged they were pinned and numbered and their dates of emergence were recorded. On August 6, 1948, all pupae were dissected beneath a binocular microscope and all remaining larvae, pupae and adults were removed and preserved.

During the course of the observations one hundred and two adult parasites emerged from the pupae. These were examined by Dr. O. Peck, Division of Entomology, Department of Agriculture, Ottawa, who kindly determined the sex of the specimens. Mr. A. B. Gahan of the United States National Museum kindly identified the adults as dark northern specimens of *Tetrastichus minutus* (Howard) a species previously recorded by Burks (1943) as reared from the lady-beetle *Cycloneda sanguinea* (L.) and from several aphids and scales.

### RESULTS

Fifty-four of the ninety coccinellid pupae collected proved to be parasitized. Six of these were dissected and were found to contain larvae, as noted previously, ten showed emergence holes made previously to November 23, 1946, and thirty-eight produced parasites after November 23, 1946. Of the thirty-six non-parasitized pupae four produced adults of *Adalia bipunctata* (Nov. 16—2, Nov. 17—1, Nov. 20—1, 1947) and thirty-two were found to be empty and had no emergence holes.

### LOCATION OF EMERGENCE HOLES

Holes made in the walls of the coccinellid pupae by emerging adult parasites were measured with a stage micrometer under a binocular microscope and were found to be circular with diameter 0.3-0.4 mm. In most of the pupae a single emergence hole appeared but in some there were two holes. The location of these holes is summarized as follows:

head—center, upper right corner, upper left corner, top of head.

prothorax—mid-line of pronotum, left side of pronotum.

mesothorax—left corner of mesonotum.

metathorax—right side of metanotum, left side of metanotum.

abdomen—mid-line of terga of segments one and five, right and left corners of tergum of segment two,

mid-line of sternum of segments two and three, mid-line of venter of abdomen at suture between segments two and three and between segments three and four, left and right corners of segment two, end of abdomen.

#### EMERGENCE OF ADULT PARASITES

A total of one hundred and two adults emerged from the pupae between Nov. 15, 1946 and June 23, 1947, the peak of emergence being on April 18, 1947. Both males and females emerged from eleven pupae, males alone emerged from seven pupae and females alone emerged from twenty-five pupae.

#### PERCENTAGE PARASITISM

Of the fifty-four parasitized pupae forty-four produced no parasites previous to Nov. 23, 1946, while ten had produced parasites previous to Nov. 23, 1946. Of the non-parasitized pupae four produced adults of *Adalia bipunctata* and thirty-two were empty. The percentage parasitism was then  $(54:90) \times 100 = 60\%$ .

The number of parasites per pupa varied from one to twelve. In the six pupae dissected on November 15, 1946, all the parasites were living larvae and pupae from seven to twelve in number. The peak of emergence of adults (2 males and 9 females) occurred on April 18, 1947. It is thus evident that the parasites, under normal conditions, would have overwintered in the coccinellid pupae, an observation similar to that made by Berry (1938) in his study of *T. brevistigma* parasitizing the elm leaf beetle. The distribution of the number of pupae, with respect to the number of parasites produced, (including only those from which no adults emerged before November 23, 1946), is shown in Table I.

#### Distribution of Pupae With Respect to Number of Parasites Produced

Number of parasites.....	1	2	3	4	5	6	7	8	9	10	11	12
Number of Pupae.....	8	6	8	3	7	2	6	0	0	2	0	1

## SEX RATIOS

A total of one hundred and two adults emerged from the pupae between Nov. 15, 1946 and June 23, 1947. In addition sixteen dead adults were dissected from the pupae on August 4, 1948. Of the total number of adults (118) 32 were males and 86 females, giving a percentage of 27.1% males and 72.9% females. Twenty-eight pupae produced no adults before Nov. 23, 1948, and when dissected on August 4, 1948, were found to contain no larvae or pupae. They may therefore be used in estimating the ratio of sexes of adult wasps from individual pupae. These pupae produced 23 males and 80 females, giving a ratio of 28.8% males to 71.2% females approximating that of the sexes in the total population.

## DISPOSITION OF SPECIMENS

Of the one hundred and two adults which emerged from the pupae between Nov. 15, 1946, and June 23, 1947, three males and six females are retained in collections at McMaster University, while the remaining ninety-three are deposited in the Canadian National collection at Ottawa.

## LITERATURE CITED

- Berry, P. A. 1938. *Tetrastichus brevistigma* Gahan, a pupal parasite of the elm leaf beetle. U.S.D.A. Circular 485.  
Burks, B. D. 1943. The North American parasitic wasps of the genus *Tetrastichus*—a contribution to biological control of insect pests. Proc. U. S. Nat. Museum, no. 3170. (93:505-608).