

Diptera 2, and Hymenoptera 2. Of these 33 new species and varieties, no less than 22 were described from material collected by members of this Society, divided as follows: E. H. Blackmore, 9; J. W. Cockle, 5; late Capt. Harvey, 3; E. M. Anderson, 2; G. O. Day, 1; A. W. Hanham, 1; and the late Tom Wilson, 1. This is a showing of which we should be proud, and should spur our individual members on to greater efforts, for much work remains to be done in each and every order.

It has given me much pleasure to place these facts before you, and perhaps I have put them in a rather unconventional manner, but if so I must beg your forgiveness, as I have only done what I have thought to be right and in the best interests of the Society.

**LIFE-HISTORY OF THE LEAF-EATING CRANE-FLY
CYLINDROTOMA SPLENDENS, DOANE (DIPTERA, TIPULIDAE)**

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INTRODUCTION

Previous to the discovery of the larvae of *Cylindrotoma splendens* by the author and Mr. E. W. White of Victoria, at Westholme, Vancouver Island, the species was known only from Alaska, and apparently the female had not been found. The original description of Doane (1900) was made from three male specimens, and Coquillett (1901) re-described the species under the name of *Cylindrotoma juneta* from a single male specimen.

In addition to the fact that the author, in the present work, obtained in the course of breeding all the pre-adult stages for the first time and described them in a paper recently read before the Annual Meeting of the American Entomological Society at Pittsburg, it may be remarked that never before had the immature stages of any species of the genus *Cylindrotoma* been found on the American continent.

The tribe Cylindrotomini occupies an isolated and intermediate position between the *Tipulidae brevipalpi* and *longipalpi*. The structure of the adult flies, especially as regards certain details of the venation of the wings, is quite unique, but it is in the immature stages of the different genera that the most interesting distinctions are found. The larvae, instead of living in the mud along the banks of streams or in rotten wood, as do the majority of the known crane-fly larvae, dwell upon the leaves of various terrestrial and aquatic plants; instead of being brown or grey in colour, they are bright green and usually resemble the leaves of their host-plants to a very remarkable degree.

LIFE-HISTORY

The larvae were first taken on April 28, 1917, on Vancouver Island, and were observed to be feeding on the leaves of the false bugbane, *Trautvetteria grandis* (Ranunculaceae). The food-plant generally affects damp and well-shaded habitats, and in this particular instance it was growing in great luxuriance in a rich woodland timbered by lofty cedars and spreading, large-leaved maples. At the time of first collection, the larvae appeared to be in the penultimate stage of their development. They were reared to maturity and the adults were obtained, both sexes, from the resulting pupae.

Egg Stage. Individual plants of *Trautvetteria grandis* were potted, and one each placed in special breeding cages. As the adults emerged from the pupal skins (May 15-30), they were transferred to the breeding cages. Copulation was undertaken soon after emergence, and the female deposited her elongate, glistening, white eggs along the margin of the leaves, generally on the under-surface. Under natural conditions the eggs were found to be invariably laid on the lower surface, but in the more confined area of the breeding cages, eggs were also deposited on the margin of the upper leaf-surface.

The female ovipositor is unique among Tipulidae, and consists of (1) a pair of double-bladed cutting valves; (2) an unpaired, upper, bifurcated valve; and (3) an unpaired, lower, plough-share valve. Each one of the cutting valves bears an inner, serrate-edged blade, and an outer, unserrated blade. It is their function to slit the epiderm of the leaf whilst the plough-share valve guides the egg into the resulting slit. The bifurcated valve apparently serves to keep the leaf in position during the operation of ovipositing, since the leaf-margin is held securely between this valve and the cutting valves.

The eggs are not wholly hidden. They are generally laid in close, parallel series, lending to the leaf-margin a characteristic, beaded appearance. The period of incubation occupies about two weeks.

Larval Stage. The first stage larvae are a semi-translucent greyish-white, and measure 1.19 mm. long and 0.37 mm. broad soon after they emerge from the egg. The segmental tubercles and pro-legs so characteristic of the mature larvae, are readily distinguishable although they are as yet not well developed. The black head-capsule stands out in decided contrast to the semi-transparent body.

The young larvae are very sluggish and are not readily disturbed when feeding. The mandibles are very firmly embedded in the leaf-tissue. Their movements are very characteristic and can be most aptly compared with those of the "measuring worms" or "looper-caterpillars" (Geometridae).

As the larva grows, it assumes a leaf-green colour, which renders it almost imperceptible to the casual observer. This general green colour is relieved by two brownish grey lines, one on each side of the median dorsal line.

After a period of about six weeks, end of July, during which time the larva has apparently only moulted but once and has attained a length of about 8.5 mm., it ceases feeding altogether and becomes quiescent. In this condition they spend the winter among the dead-leaves on the ground, and in the following spring they resume their activities when the food-plant once more sends up its shoots.

Growth then proceeds rather rapidly, the larva measuring 15 mm. in its penultimate stadium and 17 mm. when full-grown. The segmental tubercles on the dorsal surface and the paired "pseudopodia" on each of the last eight abdominal segments, are now well developed. The latter are the organs of locomotion and serve to retain the body of the larva on the leaf-surface by fluid-pressure, as well as by the secretion of a viscid liquid. When disturbed, the larvae relax their hold on the leaf-surface and readily fall to the ground. This response to a contact stimulus, together with their marked resemblance to their environment, would appear to be their only assets of defence against predaceous insects. In no single instance were the larvae found to be parasitized, although it is not improbable that there is quite a high percentage of mortality under natural conditions, caused by hunting spiders and ground-beetles.

Pupal Stage. Previous to pupating, the larva firmly attaches itself to the surface of the leaf or to the leaf-petiole by means of its anal pseudopodia. The skin splits transversely posterior to the head, but is only partially sloughed off. The head, thorax and first four abdominal segments of the pupa are exposed, but the remainder of the abdomen remains enclosed in the larval skin, the terminal portion of which attached to the leaf-surface, is collapsed and wrinkled. The black head-capsule of the larva, which is moulted with the rest of the exuvium, lies ventrad of the fifth abdominal segment of the pupa. The pupae may be found on both the upper and lower leaf-surface as well as attached to the petioles.

The pupal period persists for 6 to 10 days, at the end of which time the adult appears.

Proportion of Sexes. Of 108 adults reared, 91 were females and the remaining 17 males. Thus the percentage of females and males reared were respectively 84.2 and 15.8.

On June 1, 1917, 96 individuals were captured by sweeping the food-plant at Westholme, when the males were found to be in the

ascendant in the ratio of 60.2% to 38.9%. On this date many specimens were taken in copula.

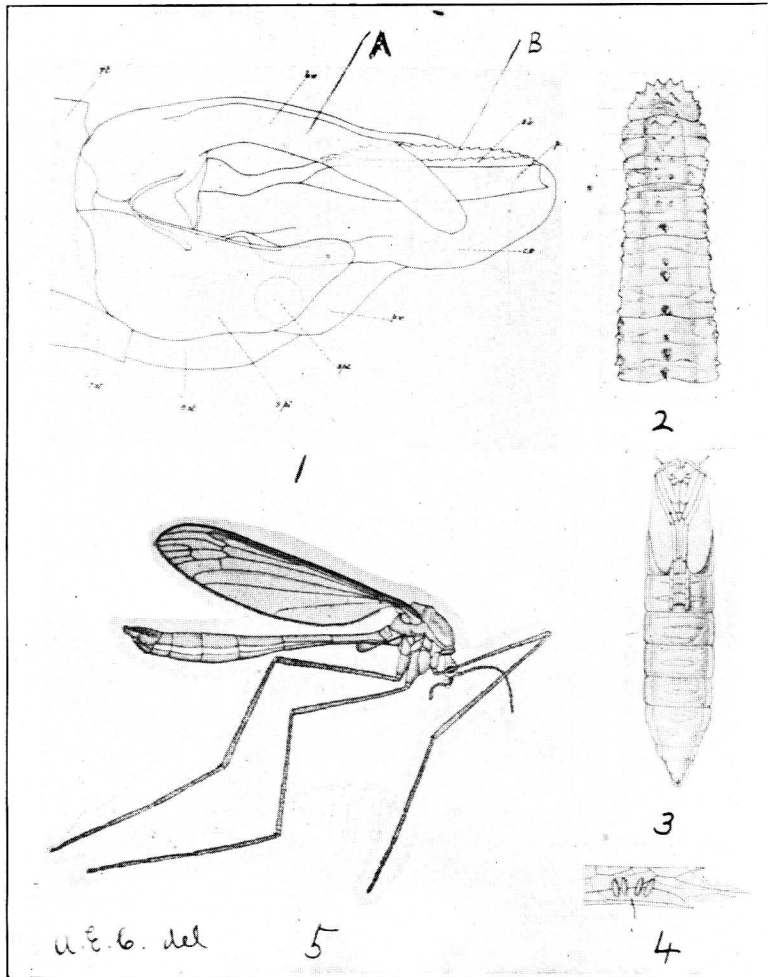
The marked discrepancy between these two sets of figures appears at first glance to be inexplicable. It is just probable, however, that the figures resulting from rearing the adults, represent approximately the actual superiority in total numbers of the females over the males. On the date that the collection was made at Westholme, there were comparatively few adults to be seen. When one adds to this the fact that the females emerge in larger numbers before the males appear and that they die off soon after laying their eggs, the greater proportion of the later-emerging males towards the end of the adult season on June 1, is readily accounted for.

The same male may copulate with several different females.

Explanatory Note. In the original paper, to be published in the Annals of the Entomological Society of America, full and detailed descriptions have been given of the egg, larva, head-capsule and mouth-parts of the larva, the pupa and adults, together with illustrations in each case. As the presentation of these descriptions from a read manuscript would be rather tedious, I have thought it best not to attempt to exhaust the patience of the members by including them in this paper, which your President has kindly asked me to send. I have, however, had photographs made of my drawings, and these, I think, will explain the salient features of the different stages of the species.

I should like to say here that Mr. W. Downes, one of the Society's members, has the hibernating larvae under his able care, and from his last letter, I understand that they are hibernating in good condition. With his continued assistance, I hope to be able to determine the exact number of larval moults when these larvae commence feeding again in the spring. The larvae of the closely allied genus and species **Liogma glabrata** have been stated by Dr. Mueggenberg in an admirable paper published in 1901, to have probably eight moults, and this is the number determined for **Phalacrocera replicata**, also belonging to the *Cylindrotomini*, by Bergtsson. Both of these species are European.

CYLINDROTOMA SPLENDENS DOANE



- Fig. 1. Ovipositor of adult female. Note bifurcated valve (A) and saw-toothed blades (B).
 Fig. 2. Larva (dorsal anterior).
 Fig. 3. Pupa.
 Fig. 4. Eggs in leaf.
 Fig. 5. Adult female.

