

NOTES ON THE PREY AND INQUILINES OF *PODALONIA VIOLACEIPENNIS* FORM *LUCTUOSA* (F. SMITH)

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The digger wasp, *Podalonia violaceipennis* form *luctuosa* (F. Smith)¹, captures cutworm larvæ and stores them as food for her young. The prey is usually dug from the soil and paralyzed by stinging. Later, after a cell has been constructed, it is placed in the earth, an egg is attached to its side and it soon becomes food for the waspling.

The prey, large, mature or nearly mature cutworms, are found and overcome by the wasp but usually, not without some difficulty. The hunt and capture has been described by Newcomer², who also has given an account of the wasp's habits, and later by Hicks³. The larvae hide by day, concealed beneath the soil or some suitable object, and it is a task for the wasp to find them.

A study of the cutworms, taken by the wasp, shows that several species are involved. The wide geographical distribution of *P. luctuosa*, (found according to Fernald², "practically everywhere in the Northern United States and Southern Canadian territory"), would suggest this probability and the facts thus far bear it out. A consideration of certain data follows.

¹ Kindly determined by Professor H. T. Fernald.

² Newcomer, E. J. Notes on the Habits of a Digger Wasp and Its Inquiline Flies. *Ann. Ent. Soc. Amer.*, 23: 552-563, 1930.

³ Hicks, Charles H. The Hunt and Capture of the Prey of a Digger Wasp. *Bull. So. Calif. Acad. Sci.*, 30: 75-83, 1931.

—On the Digger Wasp, *Podalonia luctuosa* (F. Smith). *Pan-Pacif. Ent.* 8:49-51, 1931.

⁴ Fernald, H. T. The Digger Wasps of North America of the Genus *Podalonia* (Psammophila). *Proc. U. S. Natl. Mus.*, Vol. 71, pp. 1-42, 1927.

In Colorado, although no specific determinations were made, it was nevertheless evident from the diversity of structure and markings of the prey, that a number of species of moth larvae had been taken by the wasp. In California, a few species were reared to maturity or otherwise identified.

It appears almost impossible, under the present imperfect conditions, to rear to the imago the inert and stung prey, in order to learn the species of moth used. The cutworm, if the wasp egg be removed and if it contains no serious internal parasites, usually lives for a time, wastes away and finally dies. It seems possible that a suitable antidote might be prepared and injected into the prey to counteract the poison of the sting but as yet, to my knowledge at least, this has not been advanced nor perfected.

The prey has been taken away from nesting females, from time to time, preserved and studied. In this manner, many larvæ have been secured. To supplement this phase of the work, live, normal cutworms have been collected from the field, taken to the laboratory and reared to adults. These larvae have been found hiding beneath old boards, under rocks in the soil, or in the earth around the roots of plants. One reared specimen was *Lycophotia saucia* Hubn.¹ It was taken from a wild tobacco plant, *Nicotiana glauca* Graham, upon the leaves of which there was evidence of it having been feeding. This individual pupated February 1st and emerged mature February 23rd. Another species, determined from a larva sent to Carl Heinrich at Washington, is *Chorizagrotis agrestis* Grt., a prey of *P. luctuosa*. A moth, concerning which there remains some doubt as to whether or not its young is often used as prey, is *Lycophotia margaritosa* Haw.²

One group of wasp cells, dug and provisioned by a single mother over a period of time, numbered seven. They had been stored with moth larvæ, representing three undetermined species. These had been used in as nearly equal numbers as possible. The ratio here, as also

¹ Determined by Dr. John A. Comstock.

² Determined by Dr. H. G. Dyar.

found elsewhere, would seem to follow the law of chance and not be due to a definite selective action on the part of the huntress.

The observed females of *P. luctuosa* have appeared to use, nevertheless, some selection in the individual cutworms chosen for their young. Whether this is a wise and consistent discrimination, or a chance and sporadic habit, it would be difficult to say.

The wasp rather frequently malaxates her prey after it has been stung to quietness. She pinches its neck and laps up the juices issuing from its mouth. This appears usually to be tasteful to her and may play a part in her life's economy. A rejected prey may or may not have been one previously malaxated. In one instance, at least, she stored a prey, which from malaxation was found to be highly distasteful to her, and that with no ill effects to her young.

The rejection of certain prey does not always seem to have been prompted by the small size of the victim, for often it is large and plump and in the matter of size the wasp is not exceedingly exact. She apparently never stores more than one cutworm to a nest but the particular cutworm may vary somewhat in actual dimensions. Although she exercises great freedom of choice, it is yet possible she does sometimes unearth one too small for her needs.

The wasp appears wholly unable to recognize a parasitized prey. This is shown by the fact that she not infrequently stores such a one for her young to eat. It then presents grave danger or dire disaster to her progeny. Two such prey were used in quick succession one afternoon by the same digger, the wasp larvae of which escaped seemingly only by a miracle. These nests were taken in my own backyard at Pasadena, California on April 30, 1928. The two nests were both provisioned in a total time of but little more than one hour.

Each larva, with an attached wasp egg, was obtained at once after the wasp had stored it in her nest. They were kept in a warm room where development was hastened and recorded. During the first day nothing unusual was noted but on the second a number of small larvae were

found issuing from one. We will trace the subsequent history of each prey separately.

The small larvae were coming to the outside of the cutworm through holes made in its body wall. These punctures were formed rather generally over the body surface and consisted of seventeen in all. Fortunately, they were all some distance from the point where the wasp's egg had been attached. The larvae soon began spinning cocoons in the fine cotton on which the cutworm was resting. Two days later the last of these cocoons had been finished. These remained until May 11th when the adults began emerging. The insects were small ichneumonids, *Meteorus vulgaris* Cress.¹ which cut circular caps off the anterior ends of the cocoons in order to get out. The cocoons empty, their size and structure could more readily be noted. They were somewhat oblong in form, measured about 4.5 mm. in length and 2 mm. in width, through the center, and were light in color. Coarser strands of silk held the cocoon proper attached to the cotton threads. The anterior end possessed a distinct broad, blunt and thicker cap; the posterior end somewhat larger and more pointed, contained within the meconium or splotch of excrement, expelled from the larva after the cocoon had been formed.

The egg of the wasp, attached to the cutworm from which the larval ichneumonids emerged, hatched in due season, the larva began feeding and continued to eat the prey so long as any remained. The food exhausted, it soon spun a cocoon in which to pupate. On May 25th, an active female, *P. luctuosa*, cut away the end of the cocoon and crawled out. She was apparently normal in every respect, with the exception that she was smaller than the average. Thus the cutworm from the first nest had provided food for seventeen internal parasites and later furnished enough for the growth and development of the wasp in addition.

The cutworm from the second nest met a somewhat similar fate. Three days after capture by the wasp, eight fly maggots squeezed their fat bodies through small holes in the cutworm's body. The wasp larva (the egg of which had

¹ Kindly determined by Mr. A. B. Gahan.

already hatched in this instance) was not injured, although one fly larva came through the wall very near to it. Puparia were soon formed and the flies emerged on May 12th. Specimens were sent to Washington and have been determined as *Wagneria carbonaria* Panz.¹

Again, the larva of *P. luctuosa* developed and formed a cocoon, emerging on the same day as the insect from the first nest. It, too, was a female of about the same size as the one from the other cell. Although each of these females were undersized, they were no smaller than some others found in the field capturing prey and provisioning nests and there is no reason to believe that these could not have done likewise had they developed in the soil or been released from the laboratory.

Newcomer, in the paper previously mentioned, gives the noctuid, *Euxoa testula* Sm., as a possible prey of the wasp, the adults having been captured about his laboratory at a time when the cutworm should have reached maturity had similar ones been used earlier by the wasp. He lists three flies associated with the wasp. There are: *Hilarella hilarella* (Zett.), a species which deposits living young in the nest; *Taxigramma (Heteropterina) heteroneura* (Meig.), a species superficially resembling *Hilarella*; and *Metopia leucocephala* (Rossi).

Hilarella hilarella is a fly frequently met with at or near Los Angeles, depositing its larvae in the nest of this wasp and that of other nesting wasps. It was found quite common at Boulder, Colorado, in association with the wasp, *Sphex aberti* (Hald).²

¹ Determined by Dr. J. M. Aldrich.

² Determined by Dr. H. T. Fernald.



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