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BIOLOGICAL NOTES ON SEVERAL SOUTH-WESTERN GROUND-NESTING WASPS (HYMENOPTERA, SPHECIDAE)

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In 1959 I had an opportunity to spend July 17 to 31 in residence at the Southwestern Research Station, American Museum of Natural History, near Portal, Arizona.[1] I spent the first week gathering a large number of nests constructed by solitary wasps and bees in borings in wooden traps and recording details of the biology and nest architecture; this study will be reported in another contribution. During the second week I made biological notes on some ground-nesting wasps, and collected wasps and bees, principally on flowers of *Euphorbia albomarginata*.

This paper presents the studies on ground-nesting wasps. All the observations were made on the desert floor, at about 4000 feet elevation, along the roadside about 3 miles east of Portal.[2]

Tachytes exornatus Fox

On July 26 I caught a worn female (72659 B) 19 mm. long at 3:15 p.m. She was flying with a paralyzed acridid nymph 12.5 mm. long of a species of *Conalcea* (?).

Cerceris bicornuta fidelis Viereck and Cockerell

At 3:10 p.m. on July 24 a female of this species (72459 A) flew to her burrow entrance several centimeters from the edge of the road. She dropped a bulky weevil at the entrance, went inside, and a few seconds later reached out and pulled in the weevil. She had not emerged when I left 5 minutes later. When I returned at 3:38, she flew out toward the southwest after hesitating a few seconds at the entrance. Seven minutes later she flew back with another bulky weevil, apparently of the same species. This time I netted the wasp with her prey, releasing the former after ascertaining her identity. The weevil was a species of *Eupagoderes* 12 mm. long. It occurred

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[2] Identifications of Curculionidae were made by R. E. Warner, of Miltogrammini by W. L. Downes, Jr., and of Orthoptera by A. B. Gurney.

rather commonly on foliage of snakeweed (*Gutierrezia* sp.). At 5:30 this weevil could make weak reflex movements of its tarsi, mouth parts and antennae, and had voided some excrement.

Four additional provisioning flights on July 26 and 27 required from 6 to 10 minutes from the time the wasp left the burrow until she returned with a weevil. She made two flights directly into the burrow with the weevil, but on the other flights she dropped the weevil at or near the entrance, entered the burrow, and reached out a few seconds later to pull in the weevil. On one of the return flights the wasp was trailed by two miltogrammine flies which perched on some vegetation near the burrow entrance. I captured one of these, a female of *Senotainia kansensis* Tns. (?).

The wasp constructed a closing plug of earth about 20 mm. below ground level during the afternoon of July 27. I tried unsuccessfully to dig up the cells on the 29th. About 25 mm. below the surface the burrow, which was about 15 mm. in diameter, turned at right angles toward the west and continued downward for 100 mm. at an angle of 45°. Then it turned toward the southwest at an angle of 75° for 50 mm., toward the south horizontally for 50 mm., downward for 125 mm. at an angle of 30°, and slightly eastward for 110 mm. at an angle of 30°. About half way down this last section a subsidiary burrow branched off toward the west at an angle of 75°; it ended at a depth of 56 cm. and there was no cell. The main burrow continued straight downward for 265 mm., then at an angle of 45° to the south for at least 150 mm.; and then toward the southeast at about 30° for 75 mm. The burrow apparently ended 75 cm. below the surface. I continued the excavation to a depth of 90 cm. and 45 cm. in diameter without finding any cells. At this point I had to abandon the digging because I had gotten under the road surface.

Typical *bicornuta* Guerin has been recorded as preying on several species of billbugs belonging to the genus *Calendra*. The biology of that subspecies has been discussed by Rau (1928), Cartwright (1929), Strandtmann (1945), and Krombein (1953).

Cerceris frontata frontata Say

A female *frontata* (72959 A) 21 mm. long entered her burrow at 3:42 p.m. on July 29. The burrow was located in the ditch along the road about 50 meters east of the burrow of *Cerceris bicornuta fidelis* described above. The entrance was in a small depression 75 mm. in diameter and 100 mm. in depth. There was a low pile of loose excavated soil around the entrance, which had been piled there since the heavy rain of the preceding evening.

The wasp left the burrow at 3:47 p.m. and flew back 5 minutes later carrying a weevil. I netted the wasp and prey and released the former. The weevil was a specimen of *Cleonus pulvereus* (Lec.) 11.5 mm. long. It was still thoroughly paralyzed by that evening and exhibited no reflex movements; however, it had voided some fecal pellets.

On July 31 at 9 a.m. the burrow was closed from within with a plug of loose soil, but the entrance was open by 9:28. I captured the wasp at 10:15 as she crawled out of the depression surrounding the burrow entrance. The burrow, which was about 15 mm. in diameter, was slightly sinuate and went nearly straight downward to a depth of 53 cm. Then it turned at right angles and ran very slightly upward or horizontally for about 25 cm. About 22 cm. along this horizontal section and 90 mm. to the right of it I cut into a cell destroying the contents except for one bulky weevil of a species of *Eupagoderes*. Another cell 25 mm. further along the horizontal section and 90 mm. to its right held a half-grown *Cerceris* larva and about 6 weevils or remains thereof. The boring then went downward at an angle of 45° for 14.5 cm. and ended about 64 cm. below the ground surface. There was a third cell about 11 cm. down this last section and 25 mm. to its left; it contained 6 specimens of *Cleonus pulvereus* from 10 to 13 mm. long, one of them with a wasp egg on the thoracic sternum. The cell was horizontal and about 13 mm. in diameter.

In some notes on the biology of *frontata raui* Rohwer, Rau (1928) recorded that subspecies as preying on two weevils, *Thecesternus humeralis* (Say) and *Lixus concavus* Say.

Eucerceris triciliata Scullen

I discovered a burrow of this species on July 26 about 15 meters east of the nest of *Cerceris bicornuta fidelis* discussed above. The burrow was in the ditch along the roadside on a slight slope.

On July 27 at 4:10 p.m. I caught the wasp (72659 A) returning to her burrow with a small weevil. I kept the weevil and released the wasp. She returned 9 minutes later with another weevil, which I took from her also. She flew back again at 4:33, hovered near the entrance for several seconds, and then flew in. I did not see her leave, but 15 minutes later she flew back with another weevil. At this time the wind was so strong that she could not fly into the burrow, but landed a short distance from the entrance and crawled in. Both weevils which I took from the wasp were specimens of *Minyomerus languidus* Horn, 3.0 and 3.5 mm. long; the smaller one could move only its tarsi that evening, and the larger one could

move its legs and antennae but was unable to walk.

I began to dig up the burrow at 9:30 a.m. on July 28. The ground to a depth of 50 mm. consisted of loose soil with some intermixed gravel; below this was a layer of hardened mud. Several minutes after starting to dig I caught a newly eclosed female *triciliata* when she tried to leave the burrow. The burrow was 4.5 mm. in diameter, began on a 15° slope toward the north, went downward toward the east at an angle of 75° for 50 mm., and then became almost perpendicular (85°). Another burrow branched off toward the south at a depth of about 18 cm.; the mother *triciliata* 11.5 mm. long with greatly eroded mandibles and frayed wings was recovered from this burrow. At 36 cm. the original burrow turned to the south at an angle of 60°. I caught a newly eclosed male *triciliata* when he tried to leave the burrow at this depth. I was unable to trace the two burrows beyond a depth of 43 cm. However, I continued the excavation to a depth of 75 cm. and recovered the following: two old cocoons with attached weevil fragments at the 46 cm. level (the two newly eclosed wasps mentioned earlier may have emerged from these cocoons); some paralyzed weevils in a cell and two newly spun cocoons with attached weevil remains at a depth of 49 cm., all separated from each other by short distances; and three more newly spun cocoons with attached weevil fragments at depths of 52, 54, and 57 cm. Three of the newly spun cocoons contained prepupae and two contained pale pupae.

The cocoons were 12–13 mm. long, 6 mm. in diameter across the middle, and tapered slightly toward the rounded ends. They were completely encrusted with the dismembered exoskeletons of the weevil prey. All weevils were specimens of *Minyomerus languidus,* 3.0–3.5 mm. long. One cocoon had 39 pairs of weevil elytra adhering to the surface, a second cocoon had 41 pairs of adherent elytra.

Additional observations on this species would be very desirable. The limited data recorded above suggest that a female may have a prolonged period of nesting activity. Offspring from the first cells stored by the mother apparently emerge as adults before the eggs that will produce some of their siblings have been laid.

It would be of great interest to learn something about the subsequent nesting activities of the eldest daughters. Would each one establish herself at a new nesting site, or would they possibly continue to use the old burrow entrance and merely dig subsidiary burrows of their own off the main burrow?

The few published observations on other species of *Eucerceris,* namely those on *flavocincta* Cresson by Scullen (1939) and by Bohart and Powell (1956), and those on *ruficeps* Scullen by Lins-

ley and MacSwain (1954), indicate some diversity in nesting habits. Both species also prey on weevils, but larger species are usually used, so that fewer weevils are required per cell.

E. flavocincta constructs several cells 7.5–12.5 cm. below the surface; Scullen records it as having a silken cocoon with adherent beetle remains, but Bohart and Powell state that there is no cocoon.

E. ruficeps is more closely related to *triciliata,* and some details of the biology are similar. Linsley and MacSwain found that it utilizes abandoned vertical burrows of the halictine bee *Sphecodogastra aberrans* Cwfd. for the vertical section of its burrow and then constructs a lateral oblique burrow of its own 20 to 23 cm. below the surface. Four or 5 cells were found from 28 to 42 cm. below the surface; some of these contained larvae in cocoons with adherent beetle remains, and some contained moldy weevils or puparia of parasitic flies. They found two females in one burrow, but were unable to determine which of these could be associated with the cells and weevils found in that burrow. They commented that "the burrow evidence might be interpreted to indicate that the species is double-brooded," an inference which is supported by my findings in the nest of *triciliata.*

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