

# The Canadian Entomologist

VOL. LI.

LONDON, FEBRUARY, 1919.

No. 2

## POPULAR AND PRACTICAL ENTOMOLOGY.

### NOTES ON THE HABITS OF HETERO CERUS BEETLES.

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In the hot, dry days of summer, when the creeks run low and the mud bars become numerous along the margins of the streams, a common sight on this recently deposited mud is the network of lines which mark and ramify the surface. Investigation shows clearly that some small animal has pushed its way through the soft alluvium and formed little tunnels in the freshly exposed sediment left by the receding water. These little subterranean passages were a source of great perplexity to the writer until the summer of 1916, when the entire mystery was revealed as if by magic.

Along a small creek in western Illinois on a day late in July, the entire life-history of the little builder of the burrow was found in all completeness. Near the water (pl. I, fig. 1), just beneath the surface of the soft squashy mud, were the tunnels, freshly made. Farther back on the dryer portion of the bar, the tunnels were more numerous and the elevation of the soil which marked the passages was more distinct, due to the drying of the earth. Still farther back the lines formed, in places, an almost unbroken mat, so extensive had the network become (pl. I, fig. 2). On the higher, firmer portions of the deposit, among the older less distinct galleries, were little cases with chimney-like extensions projecting from the mud (fig. 3).

Here then was the life-history of these interesting beetles in all its completeness within this very limited area. The adult beetle (fig. 4) was found to be the maker of the tunnels in the fresh mud near the water. Several were captured within the burrows, and others, when disturbed, forced their way out through the mud and flew away. In these newly constructed passages are laid the eggs in small masses (fig. 5). The eggs hatch into active running larvæ (fig. 6) which greatly extend the home already started for them by the adult. growing to a length of 7 or 8 millimetres, the larvæ construct for themselves the mud chambers with the peculiar little chimneys extending upward from them (fig. 3). The openings of these chimneys are usually closed near the top by a very thin layer of dry mud. These structures become firm and strong after they are dry. In the chamber the larva changes to a pupa (fig. 8). Beside the larvæ and pupæ, several adults were found within the cells (fig. 3).

The beetles were identified for me by Mr. A. B. Walcott, of The Field Museum of Natural History, Chicago, who says: "The sending represents two species, the larger and paler ones are *Heterocerus pallidus* Say; while the smaller and darker ones are *Heterocerus tristis* Mann." The adults of these two distinct species were found together in the same limited area and in the same kind of pupal cases. Their habits apparently are identical.

The smaller beetles measured on an average 4.3 mm. in length, the larger ones were slightly longer. At the time of pupation the larvæ measured from 7 to 8 mm. in length (fig. 7). The cases averaged 10 mm. in their longest dimension.

When the place was visited again a few days later, a rise of the stream had obliterated the entire colony, and nothing remained but a plain mud bar.