

## SCIENTIFIC NOTES

### The Courtship and Copulation of *Pasimachus punctulatus* Haldemann (Coleoptera: Carabidae)<sup>1</sup>

RICHARD D. ALEXANDER  
University of Michigan, Ann Arbor

On July 9, 1957, while collecting at night with a headlamp in a ridge-top oak-hickory forest in Hocking County, Ohio, I observed the courtship and copulation of the large ground beetle, *Pasimachus punctulatus* Haldemann. Owing to the paucity of records concerning such observations and the increasing significance of behavior patterns associated with reproduction in insects—in species recognition as well as in evolutionary and comparative studies—the information seems worth recording.

My attention was initially attracted by a scuffling noise in the leaf litter, made by the male pursuing the female. Shortly after I turned my headlamp upon the insects, the male overtook the female and closed his mandibles around the constriction behind her pronotum. This constriction is particularly pronounced in members of this genus, and in this species the mandibles of the male are about twice as long as those of the female.

mandibles still fastened upon her thorax. When this happened the female stopped struggling and lay completely motionless. After a few seconds the male curled his abdomen up toward the tip of the female's abdomen and extruded his genitalia. Then for about 90 seconds he tapped lightly and rhythmically with both parameres upon the apical edge of her last abdominal sternite, his penis poised between the parameres just beyond the center of the tip of her abdomen. The parameres in this species are slender, blade-like, sclerotized structures bearing a comb-like row of long setae along their "tapping" (ventral) edges near the tips (fig. 1-2). The tapping rhythm was too rapid for accurate visual analysis, but it did not appear to be a simple steady sequence, and it may have been a series of pairs of taps, i.e., two closely spaced taps, a slightly longer interval, two closely spaced taps, a slightly longer interval, etc. The female's genital orifice was closed when this tapping began. Twice during the 90 seconds it opened slightly, but only momentarily, and both times the male darted the penis forward, but did not succeed in inserting it, and resumed the tapping of the parameres almost immediately. Finally, the female's genital orifice opened very obviously and the male inserted the penis and stopped tapping the parameres. The parameres remained outside and did not appear to function further. The insects remained attached for 2 or 3 minutes, with no movement visible other than a throbbing of the male's abdomen. At the end of this time the penis of the male slipped out and his genitalia were retracted and disappeared entirely. The insects lay motionless for about 2 minutes, then the female suddenly jumped up, and both ran off through the leaves.

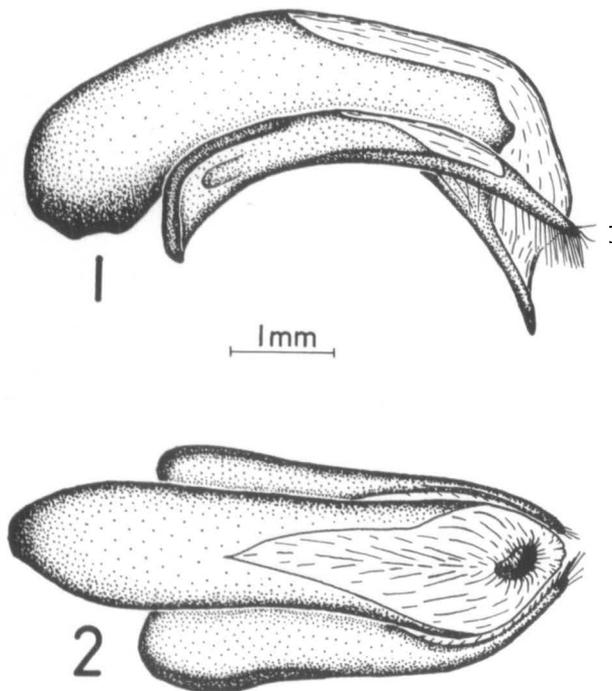
It is significant that the parameres were never used as pries during the above activities, and the genitalia were not forced together, successful intromission of the penis depending upon what appeared to be a positive response by the female. This response was apparently a result of the prolonged and peculiar tapping of the parameres which should therefore be interpreted as a courtship pattern. It would be interesting to compare this part of the precopulatory behavior of this species with that of other species in this genus which occur in the same areas.

The sensory function of the parameres (styli) in beetles has already been pointed out by Jeannel (1941) who notes that they remain outside during copulation and are brought into contact with the perigenital integument of the female. He suggests that their tactile sensory effects upon the female are much more important in species isolation than are structural differences which might cause interspecific copulation to be mechanically impossible. He substantiates this suggestion by pointing out unusually large differences in the structure of the parameres in closely related, otherwise very similar species which live together. The present observations corroborate Jeannel's conclusions and further suggest that the titillatory function of the parameres may involve the rate or rhythm with which they are brought into contact with the female's abdomen in addition to the effects of their peculiarities of structure.

The activities described here were observed with a bright light only a few inches away, and the beetles were apparently not disturbed. Both specimens were captured and are now located in the University of Michigan Museum of Zoology. I am indebted to Dr. William C. Stehr of the Department of Zoology, Ohio University, Athens, for confirmation of their identity.

#### REFERENCE CITED

Jeannel, R. 1941. L'isolement, facteur de l'évolution. Rev. Franc. Ent. 8(3): 101-110, 8 figs.



FIGURES 1 and 2.—Male genitalia of *Pasimachus punctulatus* Haldemann.

FIG. 1.—Lateral view of penis and left paramere.

FIG. 2.—Dorsal view of penis and both parameres.

For about 2 minutes the female struggled violently, dragging the male about through the leaves, but not succeeding in moving far from the spot where he had originally caught her. Eventually she slackened her struggle and the male, in some way which I could not perceive, instantly flipped her completely over on her back. He now lay beneath her, also on his back, his

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