

COPULATION *IN NATURA* OF PASSALID BEETLES
(COLEOPTERA: PASSALIDAE)¹

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Some 500 species of passalid beetles are known, showing mostly an inter-tropical distribution (Reyes-Castillo 1970). Despite this large number, copulation has only been observed in 14 New World species (Table 1). First recorded by Schuster and Schuster (1971) in some Peruvian species, copulation in Passalidae shows characteristic features described in detail by Schuster (1975) and by Valenzuela-González and Castillo (1983, 1984). The venter to venter position of male and female during copulation is the most striking feature, and is considered as an adaptation to the narrow galleries where copulation takes place. The total number of copulation bouts observed in the 14 species of Table 1 is 30 plus three cases in which the male exerted the aedeagus but did not copulate. In these 33 cases, the observations were made on couples in captivity, usually inside Petri dishes and during variable lapses of time. The above-mentioned authors, as well as those that have described different aspects of the subsocial behavior in these beetles (Ohaus 1900; Reyes-Castillo and Halfiter 1983, 1984), assumed that copulation took place in the galleries that the founding couple built within rotten logs where they nest.

Undoubtedly, copulation is difficult to observe even with couples under captivity and, to date, has not been recorded in nature. Perhaps this difficulty is related to the complex courtship process that involves a series of behavioral bouts that must not be interrupted. Apparently, these bouts occur only for a short period of time in which male and female must be synchronous, something difficult to obtain under laboratory conditions.

On July 29, 1985, at Los Tuxtlas, Veracruz (México), in a coffee plantation near the town of Dos Amates (elevation 395 m), we opened a rotten log and discovered a gallery with a couple of *Passalus (Pertinax) punctatostriatus* Percheron in copulation. The position (Fig. 1) was the typical one described for Passalidae (see Schuster 1975). The log, highly decomposed, was *Spondias rodlkoberii* Donn. Sm. (Anacardiaceae), which is known locally as "jobo." It was about 2 m long and 40 cm in diameter. Besides the copulating pair, two pairs of the same species were found in the same log plus one adult of *Verres cavicollis* Bates in a short colonization gallery. This finding confirms the opinion of several authors that copulation in Passalidae takes place within the galleries excavated by the founding couple.

Passalus punctatostriatus is the most abundant passalid of the 14 that have been recorded at Los Tuxtlas; it is found in several vegetation types, from sea level to 800 m, both in evergreen tropical forests and cloud forests, and in secondary forests and abandoned grasslands on different stages of secondary succession. The degree of decomposition and the size of the logs where this

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Fig. 1. *Passalus (Pertinax) punctatostriatus* Percheron, *in natura* copulation. Los Tuxtlas, Veracruz, México. Photo by M. L. Castillo.

Table 1. Copulation in Passalidae: species in captivity.

Species	Number of events observed	Country
PASSALINI		
1. <i>Passalus (Pertinax) affinis</i> Percheron	4 ^b	Dominican Republic
2. <i>Passalus (Pertinax) convexus</i> Dalman	1 ^b	Peru
3. <i>Passalus (Pertinax) inops</i> Truqui	e ^d	Mexico
4. <i>Passalus (Pertinax) punctatostriatus</i> Percheron	e, 1 ^b	Mexico
5. <i>Passalus (Passalus) confusus</i> Eschscholtz	1 ^a	Peru
6. <i>Passalus (Passalus) punctiger</i> Lep. et Serv.	6 ^b	Mexico
7. <i>Passalus (Passalus) sp. III</i>	3 ^a	Peru
8. <i>Ptychopus angulatus</i> (Percheron)	e ^d	Mexico
PROCULINI		
9. <i>Oileus heras</i> (Truqui)	1 ^a	Mexico
10. <i>Odontotaenius disjunctus</i> (Illiger)	4 ^b	U.S.A.
11. <i>Odontotaenius striatopunctatus</i> (Percheron)	1 ^b	Mexico
12. <i>Odontotaenius zodiacus</i> (Truqui)	2 ^{a,c}	Mexico
13. <i>Heliscus tropicus</i> (Percheron)	5 ^c	Mexico
14. <i>Verres corticicola</i> (Truqui)	1 ^a	Mexico

^a Schuster and Schuster (1971).

^b Schuster (1975).

^c Valenzuela-González and Castillo (1984).

^d Authors' observation.

^e Non-copulating male with exerted aedeagus.

species is found vary widely; it can be found in logs of 1 to 26 m in length and 10 to 120 cm in diameter, under the bark, in the duramen or even under the trunk. During a period of field work of 41 days distributed in 16 months, 20 lone specimens, 16 founding couples and 66 familial groups have been found, these last formed by the founding couple, immature stages (eggs, larvae and pupae) and/or teneral adults of the first generation. The passalid beetles that are most frequently found in the same logs as *P. punctatostratus* are: *P. (Passalus) punctiger* Lep. and Serv., *P. (Pertinax) caelatus* Erich., *Paxillus leachi* MacLeay, *Odontotaenius striatopunctatus* (Percheron), *Verres corticicola* (Truqui), *V. cavicollis* Bates, *Heliscus tropicus* (Percheron) and *Veturius* sp.

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LITERATURE CITED

- OHAUS, F. 1900. Bericht über eine entomologische Reise nach Centralbrasilien. Stett. Ent. Zeitg. 61:164-173.
- REYES-CASTILLO, P. 1970. Coleoptera, Passalidae: morfología y división en grandes grupos; géneros americanos. Folia Entomol. Mex. 20-22:1-240.
- , AND G. HALFFTER. 1983. La structure sociale chez les Passalides (Col.). Bull. Soc. Ent. France 88:619-635.
- , AND ———. 1984. La estructura social de los Passalidae (Coleoptera: Lamellicornia). Folia Entomol. Mex. 61:49-72.
- SCHUSTER, J. C. 1975. A comparative study of copulation in Passalidae (Coleoptera): new position for beetles. Coleopt. Bull. 29:75-81.
- , AND L. SCHUSTER. 1971. Un esbozo de señales auditivas y comportamiento de Passalidae (Coleoptera) del Nuevo Mundo. Rev. Peruana Entomol. 14:249-252.
- VALENZUELA-GONZÁLEZ, J., AND M. L. CASTILLO. 1983. Contribution à l'étude du comportement chez les Passalides (Col.). Bull. Soc. Ent. France 88:607-618.
- , AND ———. 1984. El comportamiento de cortejo y cópula en *Heliscus tropicus* (Coleoptera, Passalidae). Folia Entomol. Méx. 61:73-92.

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LITERATURE NOTICES

- EDWARDS, P. B. 1988. Contribution of the female parent to survival of laboratory-reared offspring in the dung beetle *Kheper nigroaeneus* (Boheman) (Coleoptera: Scarabaeidae). Jl. Austr. Ent. Soc. 27:233-237.
- HOUSTON, K. J. 1988. Larvae of *Coelophora inaequalis* (Fab.), *Phrynocaria gratiosa* (Mulsant) and *P. astrolabiana* (Weise) (Coleoptera: Coccinellidae) with notes on their relationships and prey records. Jl. Austr. Ent. Soc. 27:199-211.
- BALLANTYNE, L. A. 1988. The identities of *Luciola australis* (Fab.) and *L. guerini* Laporte (Coleoptera: Lampyridae). Jl. Austr. Ent. Soc. 27:161-165.
- GUTOWSKI, J. M. 1988. Studies on morphology, biology, ecology, and distribution of *Leioderus kollari* Redt. (Coleoptera, Cerambycidae). Pols. Pis. Entom. 58:309-357.
- BOROWIEC, L. 1988. Review of the genus *Parachirida* Hincks, 1952 (Coleoptera, Chrysomelidae, Cassidinae). Pol. Pis. Entom. 58:301-308.
- MAZUR, S. 1988. New neotropical histerid beetles with additional notes on the genus *Plagiogramma* Tarsia in Curia (Coleoptera, Histeridae). Pols. Pis. Entom. 58:287-299.