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Mutual grooming in cucujoid beetles (Coleoptera: Silvanidae)

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Abstract. Mutual grooming in two genera of silvanid beetles is described, and appears to be the first report of this behavior in the order Coleoptera. In *Uleiota debilis* (LeConte), allogrooming recipients were either stationary or moved away during the acts, without solicitation or facilitation. In *Nausibius major* Zimmermann, allogrooming was much more extensive and the individual being groomed appeared to facilitate the process by immobility or by changes in posture, there were no recognizable sexual overtones, no solicitations, and no avoidance movements. Gregarious behaviors of some other silvanid beetles are reviewed.

Introduction

Autogrooming, where an individual grooms its own body parts, is well documented in insects and has been summarized for Coleoptera by Valentine (1972). Allogrooming, where two or more conspecific individuals groom each other, is reported only in eusocial hymenopterans and termites (Wilson 1971). I now report two unique cases of allogrooming in non-social insects.

***Uleiota debilis* (LeConte).** Two female *U. debilis* were found together between sections of an apple stump, cut three years previously and stacked one above the other; and three females were found together between stacked pieces of scrap plywood set out two years previously, all in my backyard, Columbus, Ohio, 13 April 1993. The five individuals were placed in a 55 mm plastic Petri dish lined with damp filter paper and observed intermittently for two hours: 1800-1810, 2020-2120, and 2230-2330 hrs. All five were individually recognizable: one missing the left foreleg, one missing the left middle leg, three were complete but one was smaller and paler brown, one was dark with a faint pale postmedian spot on the left elytron, and one was uniformly dark. Individuals were seen to antennate each other when they met face to face, occasionally mouthparts contacted mouthparts, but no exchange of materials was observed. Before the first minute had elapsed, four individuals were motionless and in body or antennal contact with each other; they were joined by the fifth a minute later. After varying periods of immobility, individuals became active, running over others or around the container, usually becoming motionless after contacting another individual. On one occasion three individuals performed a perfect triangle each with the left antenna contacting the posterior body of the next. The patterns were very different from the thigmotaxis of dermapterans, since the sides of the container were rarely contacted, and the stimulus to aggregate was clearly the presence of another individual. Frequently, when one moved away, another would appear to search the vacated spot with its nearest antenna.

The five females exhibited no autogrooming (self-grooming), nor did two other females, also from my back yard, observed twenty years earlier. All grooming observed was allogrooming (mutual grooming) with mouthparts (cleaning). Individuals usually groomed one on one; occasionally an individual groomed another and was groomed by a third simultaneously. Grooming was unilateral; one individual groomed another with no reciprocity. Areas cleaned involved an antenna, dorsum of head including an eye, pronotum, serrate prothoracic margins, elytral carinae, femur, and tibia. The recipients either remained motionless or moved off while grooming was in progress; there were no attempts to facilitate the acts by changes in position.

***Nausibius major* Zimmerman.** One male and two females of the cosmopolitan silvanid beetle, *N. major* (determined by Dr. M. C. Thomas, 1993), were collected by P. W. Kovarik on Gibralter Island, Put-in-Bay, Lake Erie, Ohio, 16 August 1988, under bark of a rotten tree. They were placed in a vial with debris and examined with a binocular microscope by me on 19 August 1988, for 1.5 hours (1515-1645 hrs.). The autogrooming repertories observed were routine for cucujoids and consisted of the following:

Cleaning (grooming with mouthparts)

Antenna Clean. An antenna is pulled down into the mouth by an ipsilateral foreleg. The foreleg either assists in maintaining the antenna in the mouth or is returned to the substrate. The antenna can also be held in the mouth by lowering the head and using the substrate to support the antenna. In all three situations, the maxillae "chew" the antennal surface vigorously.

Foreleg Clean. A foreleg is raised to the mouthparts with the tarsus projecting anteriad, and is pulled rapidly posteriad without chewing movements. Only the tibia and tarsus were involved.

Rubbing (progressive contact of non-oral surfaces)

Antenna + leg 1 Rub. An antenna is rubbed by an ipsilateral foreleg either in mid-air or with the antenna supported by the substrate.

Head + leg 1 Rub. The head capsule is rubbed by a foreleg on lateral or ventral surfaces.

Body + leg 1 Rub. A foreleg rubs the prosternum.

Body + leg 2 Rub. A middle leg rubs the metasternal areas.

Body + leg 3 Rub. A hind leg rubs the abdominal sternites.

Leg 1 + 2 Rub. Ipsilateral fore and middle legs rub surfaces either resting on the substrate or aerial.

Leg 2 + 3 Rub. Ipsilateral middle and hind legs rub together while contacting the substrate.

Leg 3 + 3 Rub. The two hind legs rub together while contacting the substrate.

This normal autogrooming repertory was intermixed with mutual allogrooming by all three individuals. One or two beetles groomed the third with chewing motions of the maxillae. There were no attempts to copulate, no attempts to resist or avoid being groomed, and there was no visible solicitation. However, once allogrooming was in progress, the recipient frequently tilted or raised body parts in an apparent effort to facilitate the process. The parts groomed include some of the most delicate or sensitive sites on the insects: parts or all of the antennae, venter of head and mouthparts, head capsule including the eyes and the notch between eye and prothoracic margin, femur, tibia, femoral-tibial articulating membrane, pronotal disc and lateral marginal teeth, prosternum and procoxae, scutellum, entire elytral surface including elytral apex and abdominal tip. There was no visible pattern; grooming proceeded anterior to posterior, or reverse, or side to side; no site received extra attention and sites appeared to be random.

External sexual differences are slight in this species so sex was not verifiable during observations; however it was noted that each beetle groomed, and was groomed by every other.

Discussion

This type of cooperative behavior in the absence of other life history stages and without overt sexual overtones, is not recorded in Coleoptera; however, other species in the family Silvanidae have been reported in communal situations. Wasmann (1904) and Salt (1929) (cited by Wilson 1971) mention that *Nausibius* Redtenbacher is an ectosymbiont of eusocial meliponine stingless bees of the genus *Trigona* Jurine. Lea (1910) records the silvanid genera *Nepharis* Laporte and *Nepharinus* Grouvelle in ant colonies. Wheeler (1921) states that the silvanids *Coccidotrophus socialis* Schwarz and Barber (1921) and *Eunausibius wheeleri* Schwarz and Barber (1921) of British Guiana "... live with their larvae in the leaf petioles of the legume *Tachigalia paniculata* Aubl., where they first eat out protein rich pith and exist thereafter by 'milking' honeydew from mealybugs (*Pseudococcus breviceps*) who follow them into the cavities... A third silvanid species, *Coccidotrophus cordiae* Barber, 1928, was discovered in Bolivia, living with the same species of mealybug in *Cordia alliodora* (Ruiz and Pav.) Oken (Wheeler, 1928), but it is not known whether its social habits differ in any significant way from those of its congener." (Wilson 1971: 123).

It is clear from these references and present data the silvanids belong to an unusually interesting family. Thomas (1993) mentions that the world (and United States) fauna contains about 47(14) genera and 470(32) species. Despite the low taxon counts, silvanids have remarkable behavioral diversity. Most silvanids live under bark in tight crawl spaces, and a few are ectosymbionts. For the subcortical species, allogrooming provides a means to maintaining body surfaces even if they cannot be reached by the owner. For those living ectosymbiotically, allogrooming (which probably evolved in subcortical habitats) provides a powerful

preadaptation for acceptance by a host species, culminating in guests and hosts grooming each other.

Although I have now examined grooming behavior in 90 families of Coleoptera, the observations presented here are the only instances of allogrooming. This low incident may be real, but I suspect some sampling error. In most non-social insects, stimulation and/or contact with conspecific or nonspecific individuals inhibits grooming, so most of my observations were with isolated specimens. Future observations should include conspecifics; obvious taxa to check are termitophiles, myrmecophiles, and any congregating species.

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