

THE FIRST RECORDS OF *BYCREA VILLOSA* PASCOE
(COLEOPTERA: TENEBRIONIDAE) IN THE UNITED STATES,
CENTRAL AMERICA AND COLOMBIA AND NOTES ON ITS ASSOCIATION
WITH LEAF-CUTTING ANTS

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Abstract

The first records of *Bycrea villosa* Pascoe (Coleoptera: Tenebrionidae; Opatrinae) outside Mexico are reported, including recent collections from Arizona, USA, and specimens from Colombia, Costa Rica, El Salvador and Guatemala. The beetle is of interest because of its association with the nests of leaf-cutter ants (Hymenoptera: Formicidae), specifically *Atta mexicana* (F. Smith) and probably other *Atta* species that have above-ground refuse dumps. A diagnosis and images of the beetle adult and larva are included.

Unlike most opatrine tenebrionid beetles, there is considerable published information on the life cycle and biology of *Bycrea villosa* Pascoe, but lists and catalogs do not indicate that the insect occurs anywhere outside of Mexico. Knowing this and the reported association of this unusual monotypic genus with *Atta* (leaf-cutting ant, Hymenoptera: Formicidae) nest debris, when shown such a nest on a visit to Organ Pipe National Monument, Arizona, less than 1 km from the border of Sonora, I had to have a look. Crawling under and through the thorny maze of mesquite branches was fortunately fruitful. Eureka! *Bycrea villosa* does occur in the United States. This discovery prompted a review of the collection records in several institutions and lead to three more Central American countries being added to the known distribution, a second Arizona record, and some new localities in Mexico, reported below. A disjunct record from Colombia is also discussed, along with possible ant hosts.

Material Examined. The specimens representing new U.S. records of *B. villosa* are labeled “ARIZONA: Pima Co., Organ Pipe Nat[ional]. Mon[ument]., 2 km W. Lukeville, 31°54’N, 112°50’W, 18 October 1999 / In debris mound of *Atta mexicana* at base of *Prosopis velutina* / W. E. Steiner, J. M. Swearingen & S. Rutman collectors” and include 10 point-mounted adults, one late-instar larva in alcohol, and several dry cast larval skins of various instars; one adult has an associated larval skin (in a gelatin capsule on the pin) and an additional label, “Reared from larva; adult emerged 14 January 2000.” Five examples of the host ant bear the same label data. There is also a sample of the associated substrate from the ant nest midden. The above material is deposited in USNM. A single pinned specimen labeled “Az. Cochise Co., Guadalupe Cyn., At UV light, 26 Sept 1982” (collector unknown) is in the collection of the University of Arizona. A few additional specimens and associated larvae have been reported by P. W. Kovarik (pers. comm. and *in litt.*) from several *Atta mexicana* colonies at OPNM in April 2003.

Central American records (USNM) include 2 specimens labeled “GUATE[MALA], Jalapa, Laguna del Hoyo, 16-VI-1982, J. Basterrechea, S. Maselli / Basurero zompompero.” Still going southward, 12 are labeled “EL SALVADOR, San Salvador, 2 June 1958, O. L. Cartwright / ex debris leafcutting ant nest.” Two additional specimens bear the same data except for the date, 1 June 1958; one of these was

collected by L. J. Bottimer and does not have the ant nest label. In the collection of INBIO, Costa Rica, are numerous (numbers in parentheses following the label data) recent specimens labeled "Est. Queb. Bonita, 50 m, Res. Biol. Carara, Prov. Puntarenas, Costa Rica, J. C. Saborio, May 1992, L-N 194500-469850" (25); same data except "Jun 1992" (50); same data except "Feb 1993" (5); same data except "Dic.1992, R. Guzmán, L-N-194500, 49850" (4); same data except "4 a 26 Ene 1993" (9); same data except "100 m, ENE 1995, L N 195250 496850 # 4433" (1); same data except "FEB 1995, # 4434" (1); same data except "MAR 1995, # 4435" (1); same data except "R.B. Carara (Aguirre), 50-100 m, ABR 1995, # 4725" (1); Finca Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 20 Jun a 11 Jul 1992, E. Araya, L-N 316200, 864400" (1); same data except "240 m, Ene 1994, L N 317150-363700 # 2621" (1); "Tierras Morenas, A. C. Arenal, Prov. Guana., Costa Rica, 700 m, Ene 1994, G. Rodriguez, L S 283950-424500, # 2573" (86); "Playa Naranjo, Sta. Rosa, P. N. Guanacaste, Prov. Guan., Costa Rica, E. Alcazar, Dic 1990, L-N-309300-353300" (1); "Est. Santa Rosa, Prov. Guana., COSTA RICA, 300 m, 23 FEB-7 MAR 1995, F. Alvarado, L_N_313300_359300 # 4574 (2); same data except "A.C.G. Liberia, P. N. Santa Rosa, ENE 1996, Hallwachs, de Luz, L N 313000 359800 # 52561" (1); "Santa Rosa National Park, Guanacaste Prov., COSTA RICA, Nov 1983, 300 m, D. H. Janzen & W. Hallwachs" (1).

Mexican material includes some large series and more references to ant associations: "Mex. / bought 1920 from Gebien by Schwarz / *Bycrea villosa* Pasc., Gebien '20" (2); "MEXICO, Dgo., Durango, VI-27 & 28-64, P. J. Spangler" (1); "MEXICO: Guerrero, Chilpancingo, March 1963, G. Halffter / In ant nest *Atta* sp." (22); "Ajijic, JAL., MEX., 24 June 1964, UV lt. 5,140 ft, W. L. Nutting" (1) and with same data except "11 August 1964" (1) and "13 August 1964" (1); "Apodaca, 10 mi NE Monterrey, N. L., MEXICO, VII-12-[19]60, light, R. B. Selander & J. M. Mathieu (1); "5 mi S Monterrey, N. L. Mex., VII 13, 1963, H. Howden (2); "Oaxaca, Mex, 6 May 1938, R. Greenfield" (106); "MEX., 10 mi N. Pinotepa Nacional, Oax., V-13-1971 / J. M. Campbell, D. E. Bright Collectors" (150+); MEX., Pue., 9 mi S. Izucar Matmoros, 8.VI.1971, S. Peck, 4,500' / Ber. 211 and debris pile" (8); "5 mi N. Mazatlan, Sin. Mex., VII.24.[19]64, H. F. Howden" (1); "Venodio, Sin Mex, Kusche '18, VI-17 / B P Clark, donor" (1); "Alamos, Sonora, Mexico / Stephan, X.1972" (15); "5 mi W. Alamos, SON., MEX., VIII-14-1959, Black light trap, W. L. Nutting & F. G. Werner" (1); "Hermosillo, SON., MEX., VIII-12-1959, Black light trap, W. L. Nutting & F. G. Werner" (1); "MEXICO: Sonora, 60 km W Moctezuma, 24-IX-1980, Robert Gordon" (2); "MEXICO: Moctezuma, 20 M. West, 27-IX-1980, Robert Gordon" (3); "MEX: Sonora, 8 mi S Tesopaco, 21-VII-84, E. Larsen" (1); "MEXICO, Yuc., Merida, VII-29-30 1964, Paul J. Spangler" (1).

Rojas (1988) recorded *B. villosa* from seven states, Guanajuato, Guerrero, Jalisco, Michoacan, Morelos, Puebla, and Tamaulipas. The material above adds new state records for Durango, Oaxaca, Sonora, and Yucatan. In addition, records from Nuevo Leon and Sinaloa are in the collection of the Ohio State University (C. A. Triplehorn pers. comm.).

Two female specimens labeled "COLOM. Magd. Parque / Tayrona, 21 mi E. Sta. / Marta, V-13-1973 / Howden & Campbell" were recently discovered among unsorted Tenebrionidae in the Canadian National Collection.

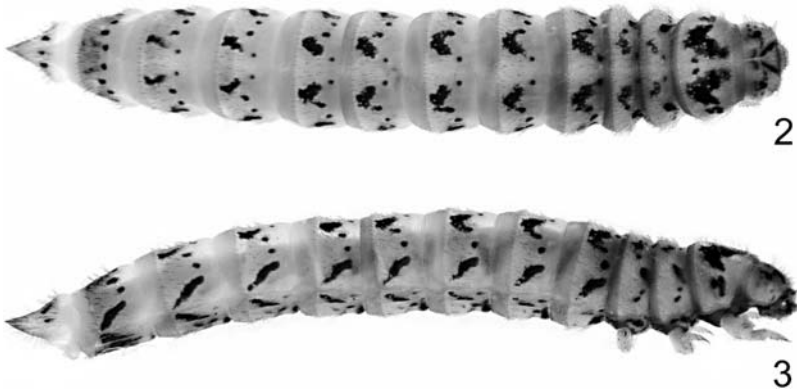
Diagnosis. The larva, pupa and adult beetle were described in detail by Duges (1885) who made the first association of the beetle with an *Atta*; the work includes illustrations, though a bit simple and stylized, of all stages. Champion (1884) added some descriptive diagnosis and a better illustration of the adult. The setose vestiture of the beetle (Fig. 1), is distinctive, with a combination of erect golden setae and patches of flat whitish setae on the elytra. Ventral surfaces and legs have dense, flattened,



Fig. 1. *Bycrea villosa*, male, dorsal view. Body length, 6 mm. Specimen from Pima County, Arizona.

golden to whitish setae similar to those on the pronotum. Very few known tenebrionid larvae have such a distinct color pattern (Figs. 2, 3). *Bycrea* is included in a key to North American opatrinines (Aalbu and Triplehorn 1985). The unique “key” character is the single, stout, curved spur of the front tibia (but these are conspicuous only in males). Similar spurs are also on the middle and hind tibia in males; the second (posterior) spurs are greatly reduced in each case. In females, both spurs are present and not unusually modified except that the anterior spur of the front tibia is curved. Male *B. villosa* also have the first tarsomere greatly expanded. In the key to U.S. genera (Aalbu *et al.* 2002), *Bycrea* will run to section Q, couplet 6, as *Trichoton*, members of which have similar vestiture but differ greatly in the form of the tibiae.

Observations and Discussion. Specimens of *B. villosa* from the site in Arizona were found concentrated at the base of the mesquite tree (*Prosopis velutina* Woot.) where there was a small mass of slightly moist substrate in an otherwise dry, loose bed of sawdust-like material which was about 3 m in diameter and to a depth of 10–15 cm. The variable speckled coloration and setose surface of adults (Fig. 1) and larvae (Figs.



Figs. 2–3. *Bycrea villosa*, larva, dorsal and lateral view. Body length, 13 mm. Specimen associated with adult beetles from Pima County, Arizona.

2, 3) along with their “play dead” behavior when first exposed, make them very difficult to detect in the ant refuse, made up of leaf bits of creosotebush (*Larrea tridentata* (D.C.) Coville) which have a similar color and texture. In fact, I did not know that larvae were present until close examination of a small sample (ca. 80 cc) of the debris under a microscope several days later. About 5 larvae representing several instars were seen; one of the two largest was preserved and the others were kept in the vial of substrate for rearing, which eventually produced the one adult mentioned above. The pupal stage was not observed; the other larvae apparently did not survive.

The cryptic coloration of the adult beetle and the speckled pattern of the larva are remarkably similar to that of the adult and larva of *Amydria anceps* Walsingham (Lepidoptera: Acrolophidae), also associated with the refuse piles of *Atta mexicana* (Sanchez-Pena *et al.* 2003, figs. 2–3, 10–11). I suspect that the beetle and the moth are subject to predation by lizards and ground-foraging birds and that the camouflage among the ants’ spent fungus garden material offers some protection.

The range extensions reported above substantiate the hypothesis of Rojas (1989): The distribution of the beetle would coincide with that of the ant, which is known from the southern edge of Arizona (Byars 1949) southward to Honduras, Guatemala and El Salvador. The beetle would also be expected to occur in Nicaragua, but a recent and thorough catalog (Maes 1998) listed no records. The nest refuse mounds of *Atta mexicana* (F. Smith) have been shown to harbor a diverse assemblage of arthropods (Navarrete-Heredia 2001; Rojas 1989; Sanchez-Pena *et al.* 2003) and *B. villosa* is considered to be uniquely associated with this ant, since all stages of the beetle are found in numbers in the mound material (Rojas 1988, 1989). The large surface mounds of *A. mexicana* are apparently unusual among its congeners; most *Atta* species deposit their spent fungus-garden debris in subterranean chambers (Weber 1972). The diverse habitats occupied by this ant (Smith 1963; Mintzer 1979) include desert scrub and sites of extreme temperature changes. The organic surface mounds may be an adaptation to aridity, providing some insulation and moisture for the ant colony, but also providing a haven for numerous other specialized scavenging insects such as these tenebrionids.

The occurrence of *B. villosa* in Costa Rica, outside the range of *A. mexicana*, and the apparently disjunct occurrence in Colombia suggests that nests of other species of *Atta* may be utilized. The two Colombian specimens are from a dry forest habitat with sandy soil, and this region of Colombia is known to hold disjunctions from Central American

areas of a similar biome (H. F. Howden pers. comm.). Additional records of the beetle and any ant associations in Costa Rica and this region of Colombia would be of interest. *Atta colombica* Guérin and *A. cephalotes* L. are the species reported from these regions and the former typically has surface refuse dumps (Hart *et al.* 2002; Hart and Ratnieks 2002; Navarrete-Heredia 2001; T. Schultz, J. Longino, U. Mueller, W. MacKay pers. comm.) and may provide habitat for the beetle.

Not all encounters with *B. villosa*, however, involve *Atta* nests. Label data on several specimens indicate that beetles come to artificial lights; the single specimens from Durango and Merida were taken a black lights (P. J. Spangler pers. comm.) and the Moctezuma specimens were likely found under cow dung or possibly at black light (R. D. Gordon pers. comm.). The flight wings of *B. villosa* are fully developed and it is not surprising that the beetle would have retained the ability to fly (contrary to many opatrine and other tenebrionids in arid regions) in order to disperse to new ant nests, and take shelter under other forms of consolidated plant material in the interim.

Bycra villosa and other scavenging invertebrates of the ant nest debris mounds may be indirectly beneficial to the health of the ant colony by helping to break down and consume the waste material, which has been shown to harbor ant pathogens (Hart and Ratnieks 2002). As many as five potential trophic levels have been recognized in these waste dump systems (Sanchez-Pena *et al.* 2003) and the assemblage of all ant nest associates and their interactions offers a wealth of research topics to be investigated. Additional studies on the inquiline fauna of *Atta mexicana* nests in Organ Pipe National Monument will surely lead to the discoveries of more first-time U.S. records. Also, we should look for *A. mexicana* in Guadalupe Canyon, Arizona, as the occurrence of the beetle indicates the ant's proximity as well.

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