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Source: *The Coleopterists Bulletin*, Vol. 39, No. 2 (Jun., 1985), pp. 103-110

Published by: The Coleopterists Society

Stable URL: <http://www.jstor.org/stable/4008120>

Accessed: 07-12-2016 19:08 UTC

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A REVISION OF THE *CREMASTOCHEILUS*
(*MYRMECOTONUS*): THE ROBINSONI GROUP
(COLEOPTERA: SCARABAEIDAE)

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ABSTRACT

The *Cremastocheilus* subgenus *Myrmecotonus* Mann comprises four species groups. One of these, the Robinsoni Group, is diagnosed and both included species are figured for the first time. *Cremastocheilus robinsoni* Cazier is redescribed to include specific and species group characters previously overlooked. A new species, *Cremastocheilus* (*Myrmecotonus*) *tomentosus* Warner, is described from two localities in Arizona and one in northern Sonora, Mexico. Information on its mating habits is presented.

In mid-March 1978, I collected a series of an unusual *Cremastocheilus* near Gisela, Arizona. When I showed the specimens to Mont Cazier, he remarked that they were "... either very rare or new." Further investigation into *Cremastocheilus* taxonomy revealed that these specimens represent an undescribed species near *C. robinsoni* Cazier, and that the genus as a whole is badly in need of revision. Although a generic revision is now in progress, I am here making this species known so that it may be included in a histological survey of the genus to be presented elsewhere (G. Alpert, in preparation).

The Robinsoni Group

The Robinsoni Group as here defined contains two species, *C. robinsoni* Cazier and *C. tomentosus* new species, which may be separated from other *Cremastocheilus* by the following combination of characters: Head impressed above antennal insertions, frontoclypeal transition indicated by more or less abrupt declivity to strongly reflexed clypeal margin, declivity medially broadly carinate, with large tomentose area at each side of carina; mentum subpentagonal, with posterior margin angulate; pronotum widest behind middle, rather strongly narrowed to apex, disc elevated to basal third, abruptly declivous to posterior angles, bases of angles not constricted; each mesepimeron with large distinctly flattened or shallowly concave dorsal face, dorsal face tomentose along posterior margin; middle and hind tibiae with U-shaped carina near middle of dorsal face, apexes of middle tibiae each with anteroventral spine (next to anterior spur) narrow, about twice as long or more as anterodorsal spine.

Although both species are similar in general form to *C. (Cremastocheilus) nitens* LeConte, differences in pronotal angles and cephalic structures definitely place the Robinsoni Group in *Myrmecotonus* Mann (following the subgeneric classification of Alpert 1981). Within *Myrmecotonus* this group shows affinities to the Mexicanus Group (Crinitus Group of Alpert 1981), exhibiting several synapomorphies including dorsally enlarged and flattened mesepimera, distinct depressed areas above the antennal insertions, and similarly distributed to-

mentum. The Mexicanus Group, however, differs radically in head shape. The remaining two groups lack the above mesepimeral and cephalic characters.

Cremastocheilus (Myrmecotonus) robinsoni Cazier
(Figs. 1, 2)

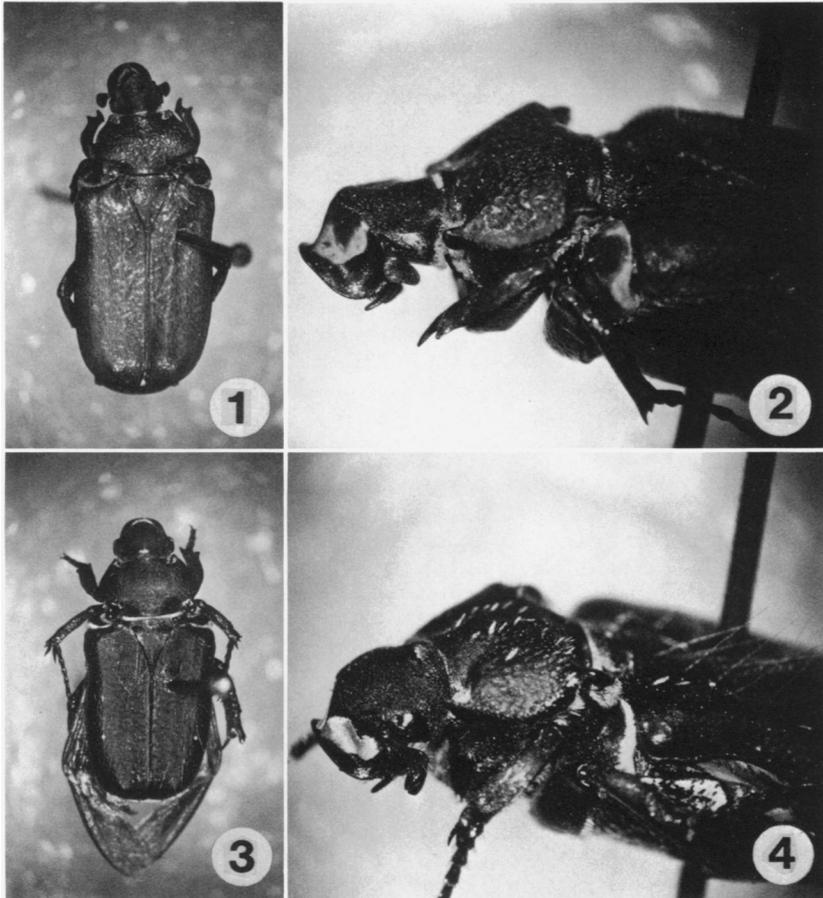
Cremastocheilus robinsoni Cazier 1940:128; Potts 1945:76.

HOLOTYPE. Collected at Lerdo, Durango, Mexico, by Wickham (USNM #65664).

DIAGNOSIS. Head with front angularly produced, very abruptly declivous to strongly reflexed clypeal margin, clypeus nearly half as long as pronotum, medially carinate, with large quadrate tomentose spot at each side of carina; dorsal faces of mesepimera large, shallowly concave; pronotum widest at posterior third, disc coarsely, densely punctate, posterior angles acutely triangular, pointed; elytral disc annularly punctate, punctures elongate.

DESCRIPTION. Holotype female, length 15.0 mm, width at elytral humeri 6.5 mm.

Body elongate, robust, uniform reddish brown. **HEAD** small, quickly narrowing behind eyes; frontoclypeal transition and supraocular areas shallowly punctate, punctures nearly contiguous, becoming obliterated on occiput and sides between eyes; eyes small, dorsal interocular width about four times maximum transverse diameter of eye, canthi not prominent; front shallowly depressed above antennal insertions, frontoclypeal transition in form of low triangular pyramid, front angularly produced at middle, very abruptly declivous to strongly reflexed clypeal margin; clypeus medially carinate, nearly half as long as pronotum (clypeal length taken parallel to carina), basomedially on each side of carina with large quadrate spot of tomentum, reflexed apical margin and deflexed lateral margins vaguely punctate, punctures dense, lunate. Antennal scape boot-shaped from dorsal view. Mentum cupuliform, subpentagonal, widest at about middle, anterior margin thickened, transverse; lateral angles slightly obtuse; posterior margins serrated; posterior angle obtuse, sharp; disc very vaguely lunately punctate. **PRONOTUM** nearly one and one-half times wider than long, nearly twice as wide as head, about three-fourths as wide as elytra, widest at posterior third, shallowly declivous in lateral and posterior fourths (abruptly so above posterior angles), coarsely punctate, punctures confluent to separated by slightly less than their own widths, impunctate near anterior margin and posteromedially from anterior trichome sinuses; lateral margins unevenly arcuate, shallowly sinuating before narrow anteriorly extending anterior angles; posterior angles small, sharp, acutely triangular, extending posterolaterally. **SCUTELLUM** extending to about basal fourth of elytra, rather densely punctate, punctures ovate, shallow, weakly annular, similar in size to largest pronotal punctures. **MESEPIMERA** each with large dorsal face, this subrectangular, shallowly concave, very vaguely punctate. **ELYTRA** rectangular, one and one-half times longer than wide, disc annularly punctate, punctures confluent to separated by about twice their own widths, mostly very elongate and about equal in length to scutellar punctures, smaller ones becoming ovate; punctures on lateral and apical declivities suddenly smaller, round, less annular. **PYGIDIUM** subpentagonal, rather densely punctate, punctures ovate to round, similar in size to pronotal punctures, very shallow, distinctly annular. **VENTER** with posterior apex of mesosternite (between middle coxae) tumid, prominent. Proepisternites, mesepimera (except dorsal face), metasternite, and hind coxae moderately semiannularly punctate; metepisternites contiguously, annularly punctate, most punctures open; abdominal sternites sparsely, annularly punctate, punctures smaller than those on metasternite. **LEGS** with front femora shallowly punctate-cariose; front tibiae each with anterior face sparsely vaguely punctate, dorsal margin arcuate, bidentate in apical fourth, teeth long, narrow, insertion of spur distinctly distal to proximal tooth. Middle and hind femora with anterior faces moderately, subannularly punctate, becoming cariose near apex; middle tibiae each rather narrow, dorsal face with U-shaped carina at apical half, tibiae from anterior view noticeably narrowed below carina, apex with anteroventral spine narrow, much longer than



Figs. 1-4. *Cre mastocheilus* spp. 1-2, *C. robinsoni*, holotype female. 1, dorsal view. 2, lateral view of head and pronotum. 3-4, *C. tomentosus*, n.sp., holotype male. 3, dorsal view. 4, lateral view of head and pronotum.

anterodorsal spine, posterior spur linear, nearly as long as basal two tarsal segments; middle tarsi six-fifths as long as middle tibiae; hind tarsi much more robust than middle tarsi, three-fourths as long as hind tibiae.

VESTITURE. The holotype is very worn, possibly bleached, and very probably was already dead when collected. As there are no traces of setae anywhere on this specimen except for the prosternal process and pronotal trichomes, detailed description of setal vestiture must await collection of fresh material. Tomentum or evidence of tomentum, however, was apparent on the following areas: clypeus (mentioned above), occiput medially in small transverse patch, lateral pronotal margins, dorsal faces of mesepimera on posterior and lateral margins, elytra in scattered spots on disc and transverse spot before apical third on crest of lateral declivity, proepisternites below anterior pronotal angles, anterodorsal

margins of metepisternites, lateral margins of hind coxae, and posterior and lateral margins of basal four abdominal sternites.

RELATIONSHIPS. *Cremastocheilus robinsoni* is closely related to *C. tomentosus*, but it may be quickly differentiated from that species by its long clypeus with quadrate tomentose areas, more sharply angulate frontoclypeal transition, smaller acutely angulate (pointed) hind pronotal angles, and different surface sculpture. *Cremastocheilus tomentosus* has transverse tomentose "bands" on the clypeus, tumid (rounded) frontoclypeal transition, and larger, more lobi-form (blunted) hind pronotal angles.

DISCUSSION. This unusual species is known only from the holotype, a worn and damaged specimen. Possibly its mating flight is in early spring as is that of the closely related *C. tomentosus*. Future collectors might look for it on open sandy spots in riparian areas during the first warm days of spring.

Cremastocheilus (Myrmecotonus) tomentosus Warner, new species
(Figs. 3, 4)

TYPE MATERIAL. Holotype male (USNM #100711) labeled "Salt River Cyn. at Hwy. 60, AZ, VII-11-1965, S. A. Gorodenski; Prey of *Proctocanthus nearno* Martin, det. J. Wilcox, 1969." Allotype female labeled "Mex: Sonora, 9 km N El Coyote, VI-26-1981, roadside, S. McCleve." Types are deposited at the U.S. National Museum of Natural History, Washington, D.C.

Paratypes (87 males, 19 females) with data as follows: "AZ: Gila Co., 4.5 km NE Gisela, III-17-1978, sandy areas along Tonto Creek, W. B. Warner (17); same, III-24-1981 (1); same, III-24-1982 (3); same, III-10-1983 (85). Paratypes are deposited at the U.S. National Museum of Natural History, Washington, D.C.; Museum of Comparative Zoology, Harvard University, Cambridge; American Museum of Natural History, New York; Academy of Natural Sciences, Philadelphia; Florida State Collection of Arthropods, Gainesville; Field Museum of Natural History, Chicago; Arizona State University, Tempe; University of Arizona, Tucson; California Academy of Sciences, San Francisco; California Insect Survey, Berkeley; Los Angeles County Museum of Natural History, Los Angeles; Museo de Historia Natural, Mexico, D. F.; and the private collections of A. Evans, A. Hardy, H. Howden, S. McCleve, B. Ratcliffe, and W. Warner.

DIAGNOSIS. Frontoclypeal transition tumid, clypeus slightly less than one-third as long as pronotum, with tomentose "bar" at each side of carina; posterior pronotal angles blunted; dorsal faces of mesepimera flattened; elytra with discal punctures small, ovate, only vaguely annular; pygidium short-tomentose in basal half.

DESCRIPTION. Holotype male, length 13.0 mm, width at elytral humeri 6.0 mm.

Body elongate, piceus, legs reddish. HEAD weakly convex, shallowly depressed at each side above antennal insertions, nearly contiguously punctate everywhere except clypeus and medial impunctate area on occiput, punctures small; eyes rather small, dorsal interocular width slightly more than three times maximum transverse diameter of eye, ocular canthi not prominent, extending nearly to center of eye; frontoclypeal transition tumid (rounded), tumosity extending anteriorly at midline to form rounded medial carina; clypeus transverse, about one-third as long as pronotum, lateral margins acutely rounded, apical margin strongly reflexed, disc with large transverse bar of thick, cream-colored tomentum on each side of medial carina. Antennal scape boot-shaped from dorsal view. Mentum cupuliform, pentagonal, anterior margin transverse, tumid; lateral angles nearly right; posterior angle slightly obtuse; disc nearly impunctate. PRONOTUM one and two-thirds times wider than long, about three-fourths as wide as elytra, widest

slightly behind middle; lateral margins posteriorly arcuate, anteriorly straightening and rapidly converging to anterior angles; anterior angles small, not breaking line of lateral margins, free from anterior margin; posterior angles rather large, lobiform, extending posterolaterally free from disc; disc declivous in basal third and lateral fifths (steeply so above posterior angles), irregularly punctate, punctures shallow, small but varying widely in size, mostly separated by own width or less, very sparse near anterior and posterior margins. SCUTELLUM extending to about basal fourth of elytra, moderately punctate, punctures round, weakly annular, larger than pronotal punctures, with posterior margins effaced. MESEPIMERA each dorsally flattened, from dorsal view nearly as long as posterior pronotal angles, impunctate. ELYTRA one and one-third times longer than wide, lateral margins weakly converging to apical truncation; disc flattened, sparsely punctate, punctures ovate, weakly annular, smaller than larger pronotal punctures, separated by one to five or more times their own widths. PYGIDIUM subsemicircular, basal half short-tomentose; apical half polished; basal angles rounded; disc moderately punctate, punctures deep, round, more dense and larger in tomentose portion. VENTER with proepisternites and mesosternite sparsely vaguely punctate; metepisternites and lateral portions of metasternite densely lunately punctate, punctures becoming smaller and sparse near midline on metasternite; abdominal venter basomedially flattened; abdominal sternites sparsely lunately punctate, punctures smaller than metepisternal punctures. LEGS with front femora each with posterior face densely punctate, anterior face shallowly cariose-punctate; front tibiae bidentate in apical third, insertion of spur nearly even with distal margin of proximal tooth, anterior face scabriculous-punctate, proximal tooth with distinct carina running perpendicularly from near ventral margin to apex of tooth. Middle and hind femora each moderately lunately punctate, densely so near apex; dorsal margins of hind femora rather strongly arcuate; middle tibiae with strong U-shaped carina at distal two-fifths, from anterior view distinctly narrowing below carina, apex with anteroventral spine twice as long as anterodorsal spine; hind corbel dorsal of tarsal insertion deeply cupuliform, elliptical, inner margin of cup longer than outer margin; front and hind tarsi slightly shorter than their respective tibiae, middle tarsi equal in length to middle tibiae.

ALLOTYPE FEMALE. Length 14.0 mm, width at elytral humeri 6.0 mm. As in holotype except middle and hind tibiae with anterior and ventral faces sparsely finely punctate; pronotum less densely punctate, posterior angles longer; pygidium longer, subpentagonal; disc of mentum with inverted T-shaped tumosity (deformity); venter of abdomen basomedially weakly convex. Besides slight differences in shape of the abdomen and pygidium, the sexes are practically indistinguishable without dissection.

VESTITURE. Besides the nondeciduous clypeal and pygidial tomentum mentioned above, a complex array of vestitural characters was noted on the holotype and allotype as follows: White or cream-colored tomentum present on occiput medially in small transverse patch, anterior pronotal angles dorsally in triangular patches, each mesepimeron on posterior margin of dorsal face, elytra in small dot (twice width of adjacent punctures) at apical third on crest of lateral declivity, anterior third of proepisternites below anterior pronotal angle (lacking on holotype, but present on allotype and many paratypes), dorsal and posterior portions of metepisternites, all of metepimera, dorsomedial margins of middle coxae, hind coxae above trochanter and on lateral margins, lateral and apical margins of basal four abdominal sternites, and within middle and hind corbels on posterior side of tarsal insertion.

Setae hyaline, flat, present in several more or less distinct forms as follows: 1) erect, lanceolate (subsquamiform), about two to four times as long as larger pronotal punctures, with margins long-ciliate, present rather densely on pronotum and posterior face of front tibiae, very sparsely so on elytra; 2) erect, very fine, apparently capillary and very short plumose (actually flat, ciliate, twisted), about half to three-fourths as long as pronotum, present very sparsely on pronotum, moderately densely on elytra; 3) narrow, blade-like, about two to

four times as long as larger pronotal punctures, fringing posterior margin of pronotum, apical and posterior margins of antennal scapes, posterior margin of mentum, anterior margin of prosternite, anterior faces of front and middle coxae, ventral margins of femora, basoventral margins of middle tibiae; 4) similar to above but strongly recumbent and little longer than the punctures from which they arise, present moderately densely on propygidium and pygidium in tomentose area; 5) mostly subrecumbent, lanceolate (subsquamiform), about one to three times as long as larger pronotal punctures, with margins entire or very short-ciliate, present moderately densely on all thoracic sternites (except prosternite) and episternites, mesepimera (except dorsal face), hind coxae, abdominal sternites (mostly rubbed in specimens seen), scattered on femora and middle and hind tibiae, fringing apical margins of proximal four tarsal segments.

VARIATION. The paratypes vary in length from 11.5 to 14.5 mm and in width from 5.0 to 6.0 mm. Thirty two paratypes have piceus bodies and red legs; the others are entirely black. About half of the paratypes have medially carinate mentum (apparently a common deformity). There are minor variations in sculpture and in proportions of the sclerites. All paratypes are rubbed and possess only traces of the complex "deciduous" vestiture present on the holotype and allotype.

RELATIONSHIPS. See under *C. robinsoni*.

ETYMOLOGY. This species is named for its diagnostic tomentose vestiture.

ECOLOGY. Both the holotype and allotype were collected in early summer and have relatively intact vestiture, which indicates that they had recently emerged from their pupal chambers. All paratypes are worn and were collected in March during mating flights. These data suggest a two to three month larval-pupal period with newly eclosed adults entering their host ant's nests in early summer and remaining there until the following March. This life cycle is consistent with those reported for other *Cremastocheilus* (Alpert and Ritcher 1975; Alpert 1981).

I first encountered this species on March 17, 1978, in mating aggregations on sand dunes along Tonto Creek about 4.5 km NE of Gisela, Arizona. I subsequently made eight additional trips to that site, but found *C. tomentosus* active on only three of those occasions. The behavioral observations mentioned below were made primarily on March 10, 1983.

Vegetation at the site is Arizona Upland Desert intergrading with Great Basin Conifer Woodland (Brown 1982). The south facing slope is predominantly *Cercidium-Opuntia-Carnegie* Association, and the north facing slope is Juniper Woodland. The dominant riparian perennials are mesquite (*Prosopis velutina* Wooton), desert willow (*Chilopsis linearis* (Cav.) Sweet), catclaw (*Aca-cia greggii* Gray), and seep-willow (*Baccharis glutinosa* Pers.).

The sandy areas are small (about 100 m² or less), mostly within 30 m of the creek, and their size and location are variable from year to year because of periodic flooding. The relative rarity and abruptly different color and reflectivity of sandy areas make them well suited for aggregation sites. Indeed, *Cremastocheilus mexicanus* Schaum and a species of *Spilodiscus* (Histeridae) use these same sandy areas as mating sites concurrent with *C. tomentosus*.

Apparently *C. tomentosus* becomes active above ground during the first warm days in March, and activity ceases by the end of the month. Adults collected on March 10, however, survived through the end of April in the laboratory. Beetles began arriving at the sandy areas about 1100 h MST, and were still active on some dunes at 1530 h. Cruising flight was swift and delib-

erate about 1 m from the ground with beetles flying slower, lower, and zig-zagging (indicative of osmoclinotaxic orientation) when over the sand. Beetles landed clumsily and often toppled onto their backs as they hit the sand. Once on the ground beetles righted themselves, and then either sat quietly, dug into the sand, or more commonly made several short (ca. 20 to 80 cm) hopping flights before coming to rest or burying themselves. Beetles were wary, but could be caught by hand. Once frightened into flight, however, they flew swiftly out of sight.

Locations where beetles had buried themselves were marked by barely perceptible swirls in the sand. I excavated 17 of these locations and recovered one female with one or two males in each excavation. Nearly all specimens collected on the surface of the sand or in flight were males (69 of 73), whereas nearly half (17 of 37) of the excavated specimens were females. Apparently females dig under the sand soon after landing, while males more commonly make hopping flights before digging in or coming to rest.

Once under the sand, females dig to where the sand abruptly changes from dry and friable to wet and compact (2 to 8 cm deep) and apparently wait to be found by a male. Sand dunes serve as mating sites only and are undoubtedly not oviposition sites for this species because they are frequently inundated. Of the pairs excavated only two were actually coupled; however, many were in a copulatory position with the males having their genitalia retracted.

I observed one pair *in copulo* on the surface of the sand. The male was at a 45° angle to the dorsal plane of the female and had its front tarsal claws hooked around the enlarged dorsal faces of the female's mesepimera. The pair was on a section of a sand bar where the friable sand was only a few millimeters deep and was underlain with compacted decomposed granite. The female was frantically trying to bury itself (but was unable to because of the granite) and through its efforts had left a tortuous furrow several centimeters long in the sand.

When beetles were handled they often exuded a drop of chalky tan liquid (feces?) from the anus and/or occasionally produced small amounts of a clear fluid (allomone?) from near the basal pygidial angles. The clear fluid had a very weak odor somewhat akin to that of rotting apples. *Cremastocheilus mexicanus* at the Gisela site similarly produced a clear fluid when disturbed, but in this case the fluid had a rather strong odor very similar to some carabid allomones, especially those of certain *Chlaenius* species.

I dissected one female *C. tomentosus* which contained 10 mature eggs. The eggs were ovate, cream-colored, and about 1.6 by 1.1 mm in size.

The mating habits described above are remarkably similar to those reported for *C. (Cremastocheilus) harrisii* Kirby (Alpert 1981).

ACKNOWLEDGMENTS

Thanks are due to T. L. Erwin, U.S. National Museum of Natural History, for loaning me the *C. robinsoni* holotype, and to F. F. Hasbrouck, Arizona State University, and S. McCleve for allowing me to name the holotype and allotype (respectively) of *C. tomentosus* from their material. I thank R. Carey, Barrow's Neurological Institute (St. Joseph's Hospital, Phoenix, Arizona) for allowing me use of their surgical photomicroscope to make the figures. N. K. and L. R. Warner, S. Turza, and M. Lamb assisted me on field trips. S. Rissing and F. F. Hasbrouck reviewed an early draft of the manuscript.

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(Received 6 December 1983; accepted 13 September 1984)

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