

A GENERIC REVISION OF THE NORTH AMERICAN  
CREMASTOCHEILINI WITH DESCRIPTION OF  
A NEW SPECIES (Coleoptera-Scarabaeidae)

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The last comprehensive monographic paper dealing with the North American *Cremastocheilini* was that of Thomas L. Casey (1915) in which he discussed the probably origin of the tribe in North and South America, erected several new genera and constructed a key to all the known North American species. The present paper deals chiefly with this work and it is hoped that the evidence presented will aid in eventually obtaining, as nearly as possible, a correct conception of this tribe.

It is with a great deal of appreciation that I wish to express my thanks to Mr. C. W. Leng for his extensive *Cremastocheilus* collection which formed the basis for this study, to Dr. E. C. Van Dyke for loans of specimens from his collection, to Mr. E. P. Van Duzee for material loaned from the California Academy of Science and to Mr. G. J. Arrow of the British Museum of Natural History for supplying a cotype of the rare *Lissomelas flohri*. Also my thanks are due the following associates for exchanges and loans of material from their collections: L. W. Saylor, H. B. Leech, R. P. Allen, F. W. Parker, W. E. Simonds, P. C. Ting, O. H. Schwab, E. R. Leach, N. W. Frazier, E. S. Ross, J. L. Gressitt, A. P. Yearington and J. W. Johnson.

In his revision of the tribe Casey gives in the introductory paragraph (p. 340), the following hypothesis for the derivation of the American species: "Africa and North America are now, singularly enough, the principal abodes of these peculiar insects, the former doubtless being their place of origin, though some of the largest species of the tribe such as *Cyclidius elongatus*, inhabit South America, whence the North American archetypes were derived through migration in geologic time probably not so very long ago. The rupture of the south American-African land connection was much more remote in time, as shown by the complete lack of harmony prevailing between the members of the tribe now inhabiting these two continents." This conclusion is also in complete agreement with broken distribution as accounted for by Wegener's theory of continental drift, a detailed discussion of which is beyond the scope of the present paper. Herein is merely presented evidence which would tend to support the theory of the former existence of an Arctic Continent

or the derivation of the North American species from the north by way of Bering Strait.

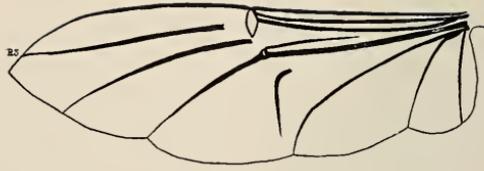
The tribe is represented in China by a number of genera, *Callinomes* being the one with which our North American and Mexican genera, *Genuchinus*, *Macropodina*, *Cremastocheilus*, *Trinodia*, *Lissomelas* and *Psilocnemis* will be compared. Inasmuch as no specimens of *Psilocnemis* were available the discussion and position given this genus will be based upon the work of others who wrote concerning it. The characters used in making this study covered most of the external morphology with special reference to the tarsi, second pair of wings, and the male genitalia. About three hundred specimens were dissected during the study and the following interesting observations made.

### MORPHOLOGY

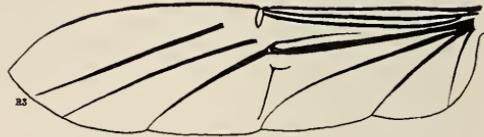
In the genus *Cremastocheilus* the following species were examined in detail: *harrisi*, *canaliculatus*, *castaneae*, *retractus*, *squamulosus*, *variolosus*, *nitens*, *pilosicollis*, *angularis*, *mexicanus*, *crinitus*, *knochii*, *tibialis*, *schaumi*, *westwoodi* and *quadratus*. Many of the Casey species omitted from this list were, I am sure, represented in the series but are not recognizable and will be dealt with in detail in a subsequent paper. The wing venation is not variable within the genus and is as shown in Plate 23, fig. 2. The male genitalis is as shown in Plate 24, figs. 1 and 2 and are monotonously the same throughout the genus. The tarsi are five-segmented in all species thus far described but the proportionate length, shape, etc. is one of the fairly specific characters. The shape, sculpturing and proportions of the prothorax are of great importance as specific characters as they undergo many modifications within the genus, *harrisi*, for instance, being entirely distinct from *quadratus* and *tibialis*.

In the genus *Trinodia* including the subgenus *Anatrinodia* the following species were examined: *saucia*, *hirsutus*, *opacula*, *whecleri*, *planipes* and *lengi*, the last of which is a new species to be described later in this paper. The wing venation and male genitalia are exactly as they are in *Cremastocheilus* (Plate 23, fig. 2 and Plate 24, figs. 1 and 2). The prothorax is trilobed in all species although much less so in *Anatrinodia*. The tarsi are five-segmented except in *lengi* which has only four segments.

The following members of the genus *Macropodina* were examined: *planata* and *ampla*. The wings and male genitalia are like those of the two preceding genera (Plate 23, fig. 2 and Plate 24, figs. 1 and 2). The prothorax is not trilobed as in *Trinodia* and closely resembles several species of *Cremastocheilus* namely *schaumi* and *knochii*. The tarsi are five-segmented with the fourth and fifth segments of the anterior tarsi dilated.



1



2

PLATE 23

Fig. 1. Hind wing of *Lissomelas flohri*.

Fig. 2. Hind wing of *Cremastocheilus angularis*.

*Genuchinus angustus* was examined and found to have different male genitalia (Plate 24, figs. 5 and 6) and a modification in the wing venation as shown in Plate 23, fig. 1. The tarsi are five-segmented and normal.

*Lissomelas flohri* has the wing venation as in *Genuchinus* but there is again a distinct modification in the male genitalia (Plate 24, figs. 3 and 4). The tarsi are five-segmented and normal.

*Callinomes davides* and an undetermined species in the same genus were examined and found to have the wing venation like that found in *Genuchinus* and *Lissomelas*. The male genitalia were like those of *Cremastocheilus*, *Macropodina* and *Trinodia*. The tarsi are four-segmented throughout the genus.

ANALYSIS

From the above brief descriptions of the various genera it is apparent that the North American genera fall into two distinct sections as based on the wing venation. One section composed of *Genuchinus* and *Lissomelas* and the other with *Macropodina*, *Cremastocheilus* and *Trinodia*. The former section having vein R3 ending on the costal margin and the latter with vein R3 terminating on the membranous posterior margin. The section composed of *Genuchinus* and *Lissomelas* also includes the Chinese *Callinomes* which, although undoubtedly distinct, is nevertheless closely allied to these North American genera. *Lissomelas* can be separated from *Callinomes* and *Genuchinus* by the genitalia as well as other external differences. *Genuchinus* can be sepa-

rated from *Callinomes* by the genitalia and by the five-segmented tarsi, thus we have in this section three distinct genera each of which is separated from the others by at least one basic morphological character plus marked external differences.

The second section of the tribe consisting of *Cremastocheilus*, *Macropodina*, *Trinodia* and its subgenus *Anatrinodia* presents quite a different picture and one which has apparently been greatly confused. The evaluation of generic characters seems to have been greatly misunderstood, due probably to the lack of long series and knowledge concerning wings, genitalia and the variability of the characters in use. The tarsi in this section are variable as can be seen from the modifications existing in the enlargement as in *Macropodina* and the reduction in number of segments to four as in *Cremastocheilus lengi*. The enlarged front tarsi in *M. planata* and *M. ampla* were used by Casey as one of the main characters upon which he established the genus *Macropodina*. In Casey's *Trinodia* group we now have *lengi* which has only four tarsal segments, and in the genus *Cremastocheilus* a number of species can be distinguished on the relative length and shape of the tarsal segments, such as *schaumi*, *tibialis* and *angularis*. During the course of these studies teratological specimens were found to be very much in evidence, a number having one tarsus four-segmented and the rest five, while one specimen had the tibia reduced and the tarsus two-segmented on one leg. It is therefore relatively safe to say that the tarsi do not constitute a reliable generic character in this section.

The divergence of *M. planata* and *M. ampla* from all other members of the tribe in the dilation of the fourth and fifth segments of the front tarsus, clypeus, general shape, mentum, the lateral carinae and the transverse basal fossa of the head, and the long legs prompted Casey to erect the genus *Macropodina* for these species. As has been shown the tarsi in this section are variable, the clypeus is variable as can be seen by comparing *harrisi* with *crinitus* and *wheeleri*, the value of the general shape is questionable when *quadratus* is compared with *harrisi* and is of little use generically except in associating related species within the genera. The variability in the mentum can be observed in *schaumi* and compared with that in *harrisi* which was apparently unknown to Casey who also reached an erroneous conclusion when he stated (p. 340) that these variations in *schaumi* were probably sexual. Dissected specimens in a series show all variations in both sexes. The lateral carinae and transverse basal fossa of the head, the long legs and the dilated front tarsi are therefore the only seemingly stable characters remaining. After viewing the generic characters existing elsewhere in the tribe I think that it is needless to say that *Macropodina* is not of generic value, however it will serve as an excellent subgenus of *Cremastocheilus* based on the above-mentioned characters.

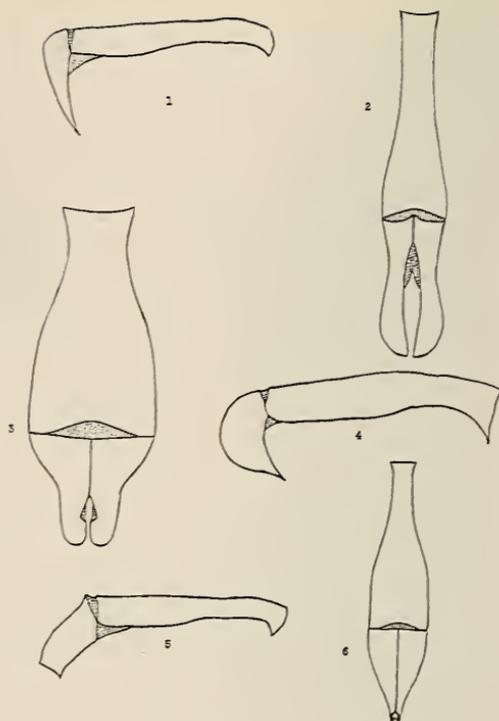


PLATE 24

- Fig. 1. Male genitalia of *Cremastocheilus angularis* (side view).  
 Fig. 2. Male genitalia of *Cremastocheilus angularis* (dorsal and front views).  
 Fig. 3. Male genitalia of *Lissomelas flohri* (dorsal and front views).  
 Fig. 4. Male genitalia of *Lissomelas flohri* (side view).  
 Fig. 5. Male genitalia of *Genuchinus ineptus* (side view).  
 Fig. 6. Male genitalia of *Genuchinus ineptus* (dorsal and front views).

Several species of *Cremastocheilus* attracted Casey's attention with their longitudinally trilobed pronotum for which he erected the genus *Trinodia* including *saucia*, *spinifer*, *opacula*, *setosifrons*, *quadricollis*, *planipes* and *wheeleri*. Within this genus he discovered that *wheeleri* had the pronotal impressions from base to scarcely beyond the middle and the clypeus strongly dilated laterally as compared to the remainder of the species having the pronotal impressions continuing from base to apex, clypeus not dilated laterally but having a median carina. He, therefore, established the subgenus *Anatrinodia* for *wheeleri*.

The following is Casey's discussion of *Anatrinodia*: "Although apparently intermediate between the preceding species (referring to *planipes*, *quadricollis*, *setosifrons*, etc.) and *Cre-*

*mastocheilus* in many respects, and with curtailed pronotal sulci, there are so many peculiar characters pertaining to the unique type of this group, such as the remarkable abdominal structure, that it evidently should be considered as at least subgeneric in value." In a comparative discussion of the two groups the following was given: "The mentum in the first group or *Trinodia* proper is deeply concave to flat, in the latter case with reflexed hind margins; this is a conspicuous difference and is almost undoubtedly of a sexual nature; the plate is more or less sinuate at each side and at the hind margin it is entire, sometimes slightly produced medially. In the second group now represented by *wheeleri* alone, the mentum is very different; it is more transverse, deeply concave, having each side prolonged and lobiform and the hind margin is broadly bisinuate and transverse, a form of mentum which, like that of clypeus, differs from anything else known in the tribe."

It seems incredible to me that Casey could key *C. crinitus* Lec. out on page 359 by use of the clypeus etc. and then make the statements given above on page 369. The clypeus and mentum of *crinitus* are almost exactly like *wheeleri* and intermediate between *wheeleri* and other members of *Cremastochilus* proper. This is also true to some extent in *mexicanus*. As far as the difference in concavity and flatness of the mentum in *Trinodia* being sexual, I can only say that this again breaks down in *saucia* and undoubtedly would in the other species if series were available.

The remarkable abdominal structure that was considered to be of so much importance by Casey was as follows: "Abdomen very opaque, not coarsely, rather closely punctured and with short yellowish plumose hairs, closely placed throughout, the apices of all the segments bearing a dense even spongiöse fringe." This character is regarded as being of great significance by Casey and yet specimens of *C. pilosicollis* from British Columbia have almost the same structure including the spongiöse fringe which may extend along entire edge or for only a short distance from the lateral margins of each segment.

From the above discussion of *Anatrinodia* it is quite obvious that *wheeleri* is an intermediate between *Cremastochilus* proper and what Casey would consider as *Trinodia*. The only character of any importance which might be used to separate the two is the presence of the pronotal impressions. This is variable as has been shown in *wheeleri* where they only extend from base to scarcely beyond the middle and also there is a great deal of modification of the prothorax in various other members of this section namely *C. harrisi*, *nitens*, *quadratus*, *schaumi* and *tibialis*. In view of this lack of stability and positive generic characters such as exist in other genera of the tribe, I think that both *Trinodia* and *Anatrinodia* should be suppressed as synonyms of *Cremastochilus*.

Although no specimens of *Psilocnemis leucosticta* were available for study I am of the opinion that it properly belongs in *Genuchinus*. This opinion is based entirely upon the original description, the remarks of Casey (1915) and the discussion and illustration given by Horn (1879, 1885). The characters given by Casey for its separation are those that have already been shown to be specific and not generic and since it is undoubtedly very close I prefer to relegate it to this position.

KEY TO THE NORTH AMERICAN GENERA AND SUBGENERA  
OF CREMASTOCHEILINI

1. Anterior angles of prothorax each with a sinus at apex; vein R3 of hind wings terminating on membranous posterior portion of wing (Plate 23, fig. 2) ..... 2  
     Anterior angles of prothorax entire; vein R3 of hind wing terminating on costal margin (Plate 23, fig. 1) ..... 3
2. Anterior tarsi without dilated fourth and fifth segments; head without lateral carinae ..... *Cremastocheilus*  
     Anterior tarsi with fourth and fifth segments dilated; head with lateral carinae ..... subgenus, *Macropodina*
3. Surface of prothorax and elytra coarsely, closely punctured; tarsi without longitudinal carinae; genitalia with apex of lateral lobes truncate (Plate 24, fig. 5) ..... *Genuchinus*  
     Surface of prothorax and elytra smooth or with sparse, very minute punctures; tarsi sculptured with longitudinally arranged carinae; genitalia with apex of lateral lobes pointed (Plate 24, fig. 4) ..... *Lissomelas*

CREMASTOCHEILUS LENGI Cazier, new species.

Medium sized; head, pronotum, elytra and body beneath opaque, black, clypeus, antennal scape and legs rufous; tarsi four-segmented. Head with vertex rather densely, shallowly punctate, punctures separated by their own widths, front smooth, canthus prominent, with a dense patch of short stout hair on its free end; clypeus semi-circular, margin widely reflexed and clothed with short stout hair, strongly carinate at middle; antennae ten-segmented, scape large and flat; mentum evenly, somewhat deeply excavated, reflexed margins even throughout. Pronotum divide longitudinally into three well defined regions, anterior angles auriculate, posterior angles spiniform, widest at apical fourth, sides straight to basal angles, apical angles obtusely rounded, median region on disk irregularly, shallowly, somewhat

densely punctate, lateral regions more densely and deeply punctured, lateral regions slightly more shining than median. Elytra flat, edges sharply reflexed, side margins subparallel, rather abruptly angulate at apices, disk with punctures in the form of elongate scratches which are arranged in more or less definite striae, some of the punctures being longitudinally connected, side margins with sparse, small punctures. Body beneath shining, sparsely clothed with short erect hair, coarse and fine punctures irregularly scattered over entire surface; legs slender, rufous, tarsi four-segmented, not greatly flattened. Male genitalia the same as in the rest of the species in the genus.

Length 10 mm., width 4 mm.

Holotype male in the author's collection. Type locality Palmerlee, Arizona, July, 1912, collected by Mr. H. A. Wenzel and given to the author by Mr. C. W. Leng after whom the species is gratefully named. Allotype female in the collection of Mr. F. H. Parker, collected at Globe, Arizona, July 13, 1937 by Mr. Parker and loaned to the author for study. Four designated male paratypes as follows: one from Nogales, Arizona, April, 1897 from the Koebele collection and one from Nogales, Arizona, April 4, 1921, collected by Mr. E. P. Van Duzee, deposited in the collection of the California Academy of Sciences; one specimen from the White Mountains, Arizona, deposited in the collection of Mr. L. W. Saylor; one from Prescott, Arizona, June 21, 1902, collected by Mr. Oslar and obtained from C. W. Leng, deposited in the collection of Mr. E. R. Leach.

There is little variation in the specimens before me. The allotype female is less opaque than the holotype and has the venter of the abdomen flat or convex rather than concave as in the males. This species has been confused in many collections with *C. opaculus* Horn from which it can be easily separated as follows: by its four-segmented tarsi which are known in no other species from North America, by the side margins of the pronotum which are straight rather than arcuate, by the shorter legs and the rufous color of the clypeus, antennal scape and legs which remain rufous throughout the six specimens of *lengi* whereas they are black in the type and one additional specimen of *opaculus* from Lower California.

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