

A remarkable new species of *Trirammatus* Chaudoir (Coleoptera: Carabidae: Pterostichini) from the Valdivian Forest of Chile

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ABSTRACT

A new species, *Trirammatus torqueotrochantus* is described from Caramávida, Chile. Males of this species are distinguished by unique femur-length, twisted and falcate trochanters, which are a form unlike that of any described pterostichine. Both sexes are recognizable from other species of *Trirammatus* by the combination of short metepisternum and bicolored legs. The species is included in *Trirammatus* based on the shared condition of having paired sub-tarsal claw setae. The status and characters of genera thought to be near relatives of *Trirammatus*, the evolution of elongate metatrochanters and their relationship to wedge-pushing are briefly discussed. The hind legs of *T. torqueotrochantus*, *Pterostichus (Cylindrocharis) acutipes acutipes*, *P. (Steropus) moestus* and *Acanthoferonia ferox* are illustrated to show relative trochanter lengths.

Key words: Coleoptera, Carabidae, *Trirammatus torqueotrochantus*, new species, Chile

INTRODUCTION

Currently the genus *Trirammatus* Chaudoir includes 22 species arrayed in four subgenera: *Trirammatus* s. str.; *Meraulax* Tschitschérine, *Plagioplatys* Tschitschérine and *Pachymorphus* Chaudoir. This assemblage of species and their division into these groups is entirely a historical vestige and inspection of type specimens and additional material has begun to reveal some clues as to a preferable and character-based system. As in many insect groups, this study of museum specimens suggests a significant undescribed diversity. It would be preferable to describe most of these species in monographs, providing a complete treatment of the systematics and taxonomy of the group. This is a prospect for the future. However, given the highly unusual sex-specific morphological characteristics of individuals of the species described herein and the unfortunate situation that none of the specimens are from natural areas currently managed or protected in Chile, there is a necessary urgency in

providing a morphological description of this species, discussion of its attributes and a preliminary treatment of the systematics of likely closely related taxa.

SYSTEMATIC TREATMENT

Presently the complex of supra-specific groups placed in or near *Trirammatus* in Straneo's 1979 classifications are certainly polyphyletic. *Trirammatus* s. str. is associated with genera attributed to and expanded *Euchroina* (*sensu* Will 2002) based on the form of the female reproductive tract. However *Pachymorphus* (= *Feronomorpha* Solier) species, generally placed as a subgenus of *Trirammatus*, lack characteristics found in *euchroine* taxa. The type species of the subgenus *Meraulax* appears to be congeneric with *Pachymorphus*. *Plagioplatys*, also a subgenus in recent classifications, is likely a member of *Euchroina*, but separate from *Trirammatus*, perhaps near *Blennidus* Motschulsky given its general form, or *Argutoridius* Chaudoir based on similarities such as the margined prosternal process.

Trirammatus s. str. is centered on its type species *T. unistriatus* (Dejean) and includes species similar to many *Blennidus* species. The absence of sulci or rows of punctures on the abdominal sterna distinguishes *Trirammatus* species from *Blennidus*, however, this character is variable and difficult to interpret in some taxa. The presence of two setae at the base of each tarsal claw in *Trirammatus* species is likely a synapomorphy for the genus and is lacking in *Plagioplatys* and other *euchroine* taxa so far examined. The state of having two setae at the base of the tarsal claw is rare in Carabidae but is known from the distantly related Cnemalobini and Zabrinini (Roig-Juñent 1993). The most common state in pterostichines and the family as a whole is a single sub-claw seta. A study of the types for all 22 species attributed to *Trirammatus* s. lat. may be necessary to confirm such characteristics and place the taxa. Many species remain to be studied and even more to be described in these taxa. Our overall knowledge of the group is still too preliminary to suggest a stable classification for all South American pterostichine genera. However, based on current understanding and using Lorenz's catalogue (1998) as a basis, the following generic interim classification is appropriate for these few taxa.

- Genus *Trirammatus* Chaudoir 1835
- Genus *Plagioplatys* Tschitscherine 1900
- Genus *Pachymorphus* Chaudoir 1838
 - = *Meraulax* Tschitscherine 1900
 - = *Feronomorpha* Solier 1849
 - = *Feroniomorpha* Chaudoir 1876
 - = *Nortes* Motschulsky 1865

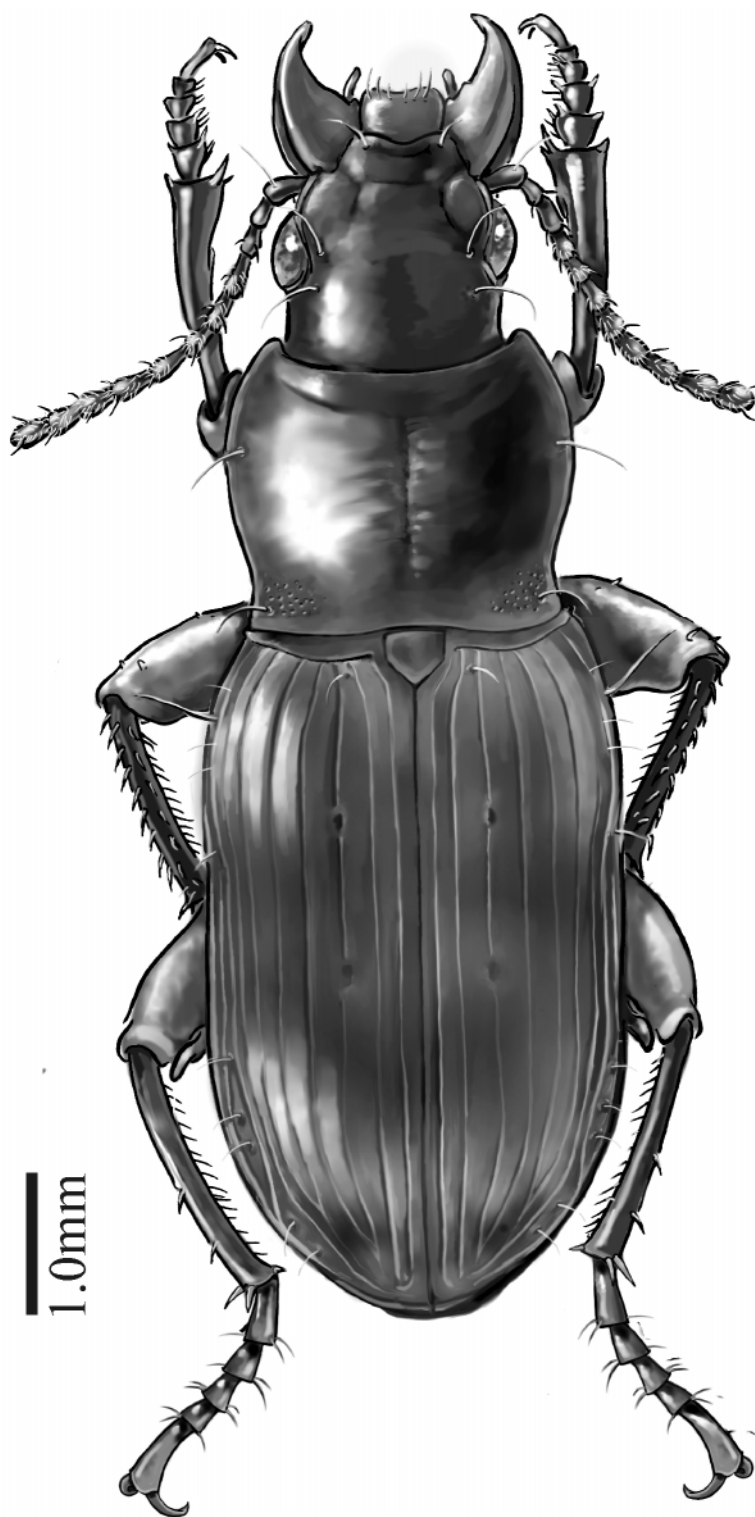


FIGURE 1. Dorsal habitus of *Trirammatus torqueotrochantus* new species. Male holotype.

SPECIES TREATMENT

Trirammatius torqueotrochantus NEW SPECIES

Holotype. Male- verbatim label data: "Caramavida Arauco Prov. XII-25/31-53 CHILE Pena" [approximate coordinates 37°41' 00" S/073° 21' 00" W]

Paratypes. 1 male, same data as holotype. 1 Male and 1 Female- verbatim label data "Alto Caicupil AraucoProvI-7-54 1200/1300 M., CHILE Pena" [approximate coordinates 37° 51' 00" S 073° 16' 00" W]. All specimens deposited Museum Comparative Zoology, Harvard (MCZ).

DESCRIPTION. Small sized, overall length of type 8.5 mm, range of series 7–8.5 mm. Dorsal surface deep brunneous with a distinct aeneous luster. Ventral body surface, base of legs up to middle of femora, and tibiae brunneous; mouthparts and antennae paler rufobrunneous; middle of femura pale nearly flavous.

Head.— Two supraorbital setae. Ocular ratio (width over eyes/ width between eyes at level of anterior supraorbital setae) of type 1.16, range of series 1.16–1.37. Mentum tooth broad and blunt at apex. Epilobes of mentum divergent; mentum transverse form. Suture between mentum and submentum distinct and entire. Submentum tumescent. Glossal sclerite with two apical setae. Paraglossae glabrous. Maxillary and labial palpi fusiform. Penultimate labial palpi with two prominent setae. Microsculpture of head effaced on disc, except for scattered micro-punctulae. Frontal impressions deeply impressed, well defined, divergent to anterior supraorbital setae. Clypeus with large setae at each apicolateral corner, slightly emarginate along anterior edge.

Thorax.— Pronotal form quadrate (Fig. 1); two pair lateral setae; lateral margin with narrow bead; margins slightly sinuate and nearly straight to the hind angles, which are slightly obtuse; basal margin medially emarginate; front angles slightly produced; basal margin not bordered; basal foveae broad shallow, distinctly punctulate. Microsculpture on disc nearly effaced and surface relatively shiny. Microsculpture of elytra with slightly more evident microlines forming mesh; surface shiny; basal section of stria 1 absent; parascutellar striae present; intervals nearly equal width on disc, intervals flat except laterally and apically on elytra where they are slightly convex; striae very shallow especially on elytral disc and laterally in middle third; elytral humeral tooth very large, positioned anterad interval 8. Elytra with notable depressed regions laterally in basal third of length. Metathoracic flight wings completely reduced. Legs (Fig. 2). Procoxae globose and glabrous. Protochanters with one setae. Profemora robust, ventral surface in male type with prominent posteroventral denticle (Fig. 2B); female paratype more slightly built, without denticle; one posteroventral and one posteroapical setae. Protibiae slightly expanded at apex, few small spinose setae laterally in male type and other males, setae notably larger and heavier built in female paratype. Three protarsi expanded and ventrally with pad of articulo-setae (Stork 1980) in male; female paratype with small compact protarsi. Mesocoxae globose with two setae, one lateral, one medial. Mesotrochanters with one seta.

Mesofemora robust nearly rectangular in form with two setae on anterior face, four-five setae on dorsal face. Mesotibiae in male type arcuate, with lateral row of heavy setae and denser brush of fine setae medially; female paratype with mesotibiae nearly straight and same setal pattern as male; mesotibial apex with prominent spine; apical ctenidium well developed. Mesotarsi small and compact. Metacoxae with two setae; margin pointed posteriorly; metacoxal sulcus straight and appressed to anterior margin. Metatrochanter in male exceptionally elongate, apex extending to apex of femora; apex slightly twisted, pointed falcate; in female paratype metatrochanter moderately elongate, extending to middle of femora, rounded at apex. Metafemora robust with two setae on anterior face. Metatibiae somewhat arcuate in male type, straight in female paratype; setal pattern as in mesotibiae. Metatarsi slightly more elongate than mesotarsi, dorsally smooth.

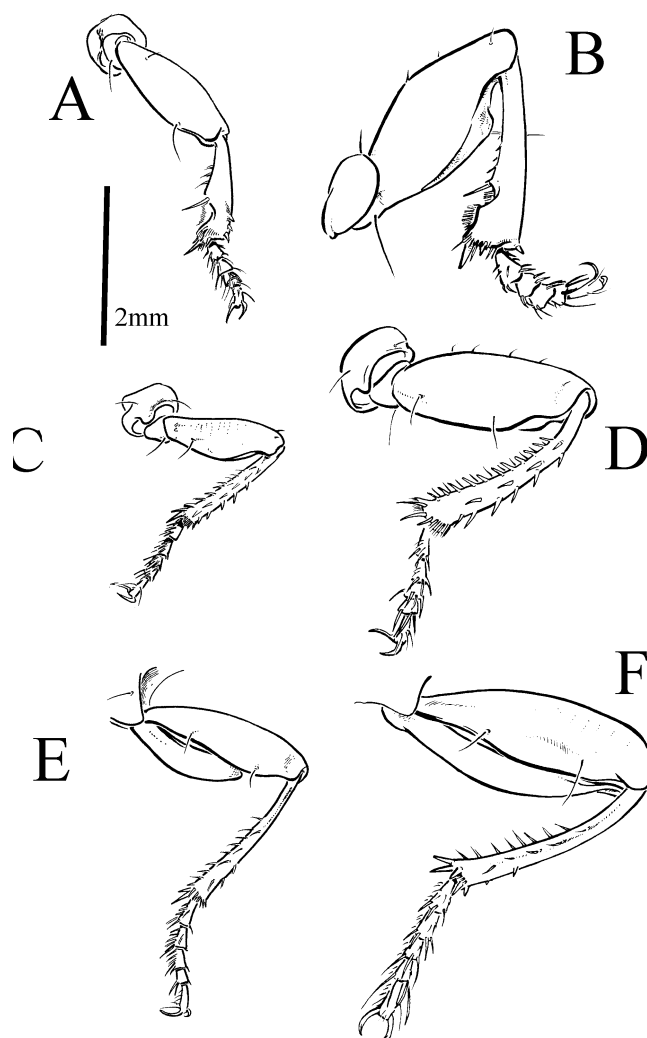


FIGURE 2. Anterior face of legs of *Trirammatus torqueotrochantus* new species. A, C and E = Female pro, meso and meta legs respectively. B, D and E = Male pro, meso and meta legs respectively.

Abdomen.— Shallowly and very irregularly depressed laterally on sterna V–VII; in some specimens nearly forming rudimentary sulci. Sterna V–VI with medial pair of setae, VII with two setae in male and four in female. Male median lobe of aedeagus simple, straight, evenly rounded at apex; ostium large, covering most of the dorsal surface; endophallus evenly covered with minute spinules, without large spines. Female reproductive tract typical for euhcroine taxa, bursa bent to left, spermatheca large with appended gland and gland duct diverticulum.

GENERIC PLACEMENT. Although the overall phylogeny of South American pterostichines is still not settled, *T. torqueotrochantus* does share the presumed synapomorphic female reproductive tract form with other euhcroines and shares the characteristic two setae at the base of each tarsal claw, known within pterostichines only in *Trirammatus* species. Outside of the obvious modifications of the trochanters and elytra, *T. torqueotrochantus* appears to be quite similar to other *Trirammatus* species and so is placed in this genus.

HABITAT. The specimen label data suggest that this species was likely collected in araucarian and deciduous forest, i.e., “bosque caducifolio” and within an altitude range of 100–500 m.

IDENTIFICATION. This species will trace through Straneo’s key to genera (Straneo 1979,350) to couplet 38. This couplet distinguishes between *Parhypates* s. lat. Motschulsky and *Trirammatus* s. lat. based on the relative length of the metepisternum. The shortening of the metepisternum is tied to flight-wing loss throughout carabids and *T. torqueotrochantus* is a flightless species, unlike the other taxa described in *Trirammatus*. Additional and adjusted couplets can be inserted to accommodate flightless *Trirammatus* species with short metepisterna and other genera considered herein. The second half of couplet 44 is missing in Straneo’s key and is altered here. Couplet 45 can be eliminated.

- 38(37) Metepisternum short, anterior and lateral margins subequal..... 38a
 38' Metepisternum elongate, lateral margin longer than width at anterior margin
 *Trirammatus* Chaudoir (sensu latiore, in part) ...43
 38a (38) One setae at the base of the tarsal claws
 *Parhypates* (sensu latiore) Motschulsky
 38a' Two setae at the base of the tarsal claws
 *Trirammatus* (sensu stricto, in part) Chaudoir
 43 (38') Elytron with parascutellar stria joined to stria one and angular base of stria one
 absent; two setae at the base of tarsal claw *Trirammatus* (in part)
 43' Elytron with both parascutellar stria and angular base of stria one impressed;
 stria one continuous with angular base of stria and/or parascutellar stria; one
 setae at the base of tarsal claw..... 44
 44 (43') Stria one continuous with angular base of stria one and separate from parascutel-
 lar stria..... *Pachymorphus*
 44' Prosternal process with apex margined..... *Plagioplatys*

The evolutionary and functional importance of the relatively large metatrochanters in Adephagan beetles is well known (Evans 1977, 1986). In good wedge-pushing carabid beetles the metatrochanter contains the large femoral reductor muscle that rotates the femur causing a downward push of the tibia and tarsi (Evans 1977). Based on measurements of over 150 species of carabid beetle species from across the family Evans (1977,217) showed that femur/trochanter length was not related to overall body size, but was related to wedge-pushing capabilities. Evans shows a range of femur/trochanter length from 1.4 to 7.3 (1977,217, fig. 17). Species that fell in the lower part of the range (~2.5–1.4) were classified as “particularly good wedge-pushers”, while those above that were “less good” and generally better runners. In regard to trochanter length Evans does note that sexually dimorphic species exist (Jeannel 1941), but apparently did not incorporate any of these in his study.

In Pterostichini elongation of the trochanters has evolved several time in very disparate taxa. There seems to be no suggestion that there is any significant phylogenetic grouping information in this change as the different genera where this occurs are mostly monotypic or have few species. Likely near relatives of these genera do not share modification of the trochanters. Some notable instances of elongate trochanters include the Australian *Acanthoferonia* Moore (Fig. 3B), South American *Oribazus* Chaudoir and some of the North American *Pterostichus* (*Cylindrocharius*) Casey (Fig. 3C) and *T. torqueotrochantus* (Fig. 2B; 3A).

A typical Pterostichine has a femur/trochanter ratio (f/t) of about 2.3, e.g. *Pterostichus* (*Steropus*) *moestus* (Say) (Fig. 3D). In some species the ratio is lower and equally-elongated trochanters are found in both sexes. This is the case for all three species of the subgenus *Cylindrocharis*, including relatively short trochanters in *P. rostratus* (Newman) ($f/t = 1.9$), long in *P. acutipes acutipes* Barr ($f/t = 1.8$) and very long in *P. hypogenus* Barr ($f/t = 1.4$). However, a number of other pterostichine taxa have exceptionally long metatrochanters in males only. Females of these species have long trochanters, but within the “normal” range for Harpalinae taxa (Evans 1977). *Acanthoferonia* and *T. torqueotrochantus* are examples of sexual dimorphism and in both cases the f/t in males is notably lower than typical pterostichines and their female conspecifics (*Acanthoferonia* male $f/t = 1.25$ (Fig. 3B), female = 1.8; *T. torqueotrochantus* male = 1.0, female = 1.59 (Fig. 2E, F)).

Assuming that males have an increased vertical, downward push relative to trochanter size still does not explain exactly why exceptional trochanter elongation would evolve multiple times. It is possible that males are subject to female choice based on some aspect of vertical pushing strength or that there is intersexual competition involving the ability to push or block competing males’ access to females. The incredible trochanters of the male *T. torqueotrochantus* with a femur/trochanter ratio of 1.0 may not entirely translate to vertical pushing power as the apex is flattened, narrow and falcate, suggesting only a limited increase in muscle attachment, unlike *Acanthoferonia*, which has a more uniformly shaped

trochanter. The apex of the trochanters in *T. torqueotrochantus* is long enough, and their form suggests an interaction with the tibiae, perhaps a locking mechanism. It will be necessary to have live specimens to observe how they actually use their trochanters.

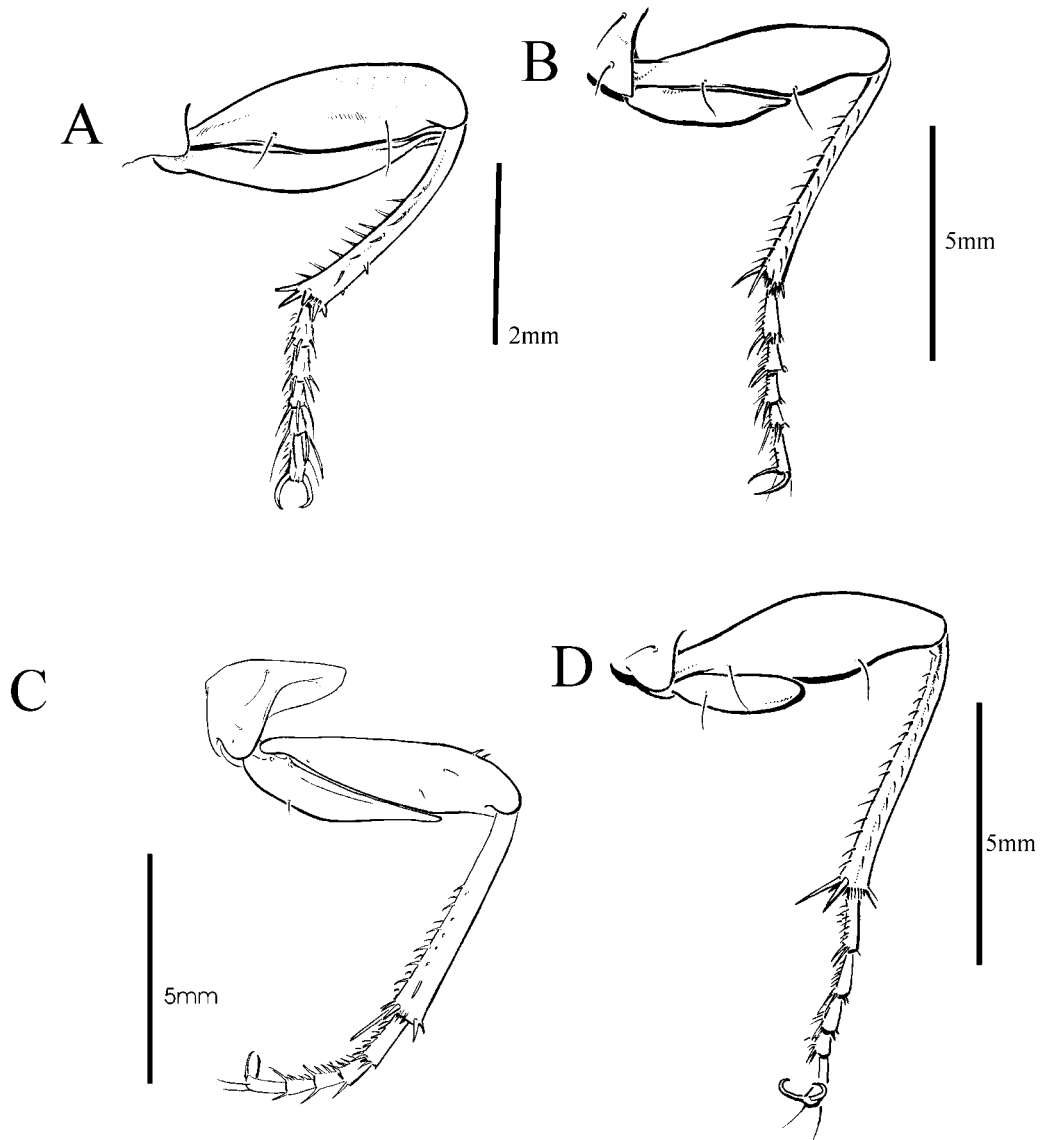


FIGURE 3. Anterior face of meta legs. A= *Trirammatius torqueotrochantus* New Species. B= *Pterostichus (Cylindrocharis) acutipes acutipes* Barr. C. *Acanthoferonia ferox* Moore. D= *Pterostichus (Steropus) moestus* (Say).

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