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*Insect Systematics & Evolution 42 (2011) 295–311*

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# Phylogenetic analysis of the genus *Orthaea* Dallas (Hemiptera: Heteroptera: Rhyparochromidae: Rhyparochrominae: Myodochini), and the description of a closely related new genus and species of Myodochini

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Published 5 August 2011

**Abstract**

A new genus and species from Brazil, *Thoraea brasiliensis,* is described and illustrated, and its phylogenetic affinities are discussed. The genus *Thoraea* is diagnosed by the V-shaped buccular juncture, the presence of jugal ridge, evaporative area extensive, mesepimeron barely emergent, male protibia and mesofemur spinose, posterior pronotal lobe with four rounded yellowish macula, unspined aedeagus with two vesical lobes and the gonoporal process enlarged distally. The male of *Orthaea meloae* Dellapé & Montemayor is described, and the male genitalia of *O. meloae* and *O. alveusincola* Harrington are also described and illustrated; *O. consuta* Dallas is recorded for the first time from Belize, *O. meloae* from Panama, and *O. montana* Dellapé & Montemayor from Bolivia. A cladistic analysis of the species of *Orthaea* Dallas is performed. One most parsimonious tree was obtained, with the following topology: (*Myodocha serripes* ((*Heraeus triguttatus*, *Paisana brachialis*) (*Thoraea brasiliensis* (*O. consuta* ((*O. procincta*, *O. montana*) (*O. alveusincola*, *O. meloae*)))))). *Orthaea* was recovered as monophyletic supported by seven synapomorphies.

**Keywords**

Insecta, South America, *Thoraea brasiliensis*, new species, phylogeny, male genitalia, *Orthaea meloae*, *Orthaea alveusincola*, geographic distribution.

## Introduction

Rhyparochromidae is one of the most diverse families within the infraorder Pentatomomorpha. Among the 14 tribes of the family, the Myodochini is one of the largest (Dellapé & Henry 2010) and includes 71 genera and more than 300 species worldwide. Even though the South American fauna is poorly known, this is the most diverse



DOI 10.1163/187631211X583356

group of rhyparochromids in the Neotropics with about 33 genera and 100 species described.

The genus *Orthaea* Dallas is distributed in southern Central America and northern South America (Harrington 1986). It was redefined by Dellapé & Montemayor (2008) to include five neotropical species, and the male genitalia of *O. consuta* Dallas, *O. procincta* (Breddin) and *O. montana* Dellapé & Montemayor were described.

In the present contribution a new Brazilian monotypic genus closely related to *Orthaea* is described and illustrated. The male of *Orthaea meloae* Dellapé & Montemayor is described, and the male genitalia of *O. meloae* and *O. alveusincola* Harrington are described and illustrated; new distributional data are provided: *O. consuta* is recorded for the first time from Belize, *O. meloae* from Panama, and *O. montana* from Bolivia. A cladistic analysis of the species of the genus *Orthaea* is performed.

## Materials and Methods

### *Species description*

The material examined belongs to the collections of the American Museum of Natural History, USA (AMNH), the National Museum of Natural History, USA (USNM), the California Academy of Sciences, USA (CAS), the Ohio State University Insect Collection, USA (OSUC) and the Museo de La Plata, Argentina (MLP). The measurements are given in millimeters.

### *Cladistic analysis*

The phylogenetic analysis was based on a matrix (Table 1) comprising 22 morphological characters and 9 taxa. Morphological characters were chosen from the head, thorax and abdomen, coloration patterns and male genitalia. Exact searches were performed by implicit enumeration in TNT (Goloboff et al. 2008). All characters were considered to be of equal weight, with multistate characters being treated as unordered. Bootstrap support was determined with 1000 replications, searching trees with implicit enumeration.

Following Harrington's cladistic analysis (Harrington 1980), the type species of the genera *Heraeus* Stål, *H. triguttatus* (Guerin) and *Myodocha* Latreille, *M. serripes* (Olivier), were selected as outgroups. *Catenes* Distant was not considered because the male genitalia suggest a different linage (Dellapé & Melo 2008). Also the type species of the genus *Paisana* Dellapé (Dellapé, 2008), *P. brachialis* (Stål) and *Thoraea* were used as outgroups.

## Systematics

### ***Thoraea* gen.n.**

*Type species*

*Thoraea brasiliensis* sp.n., by present designation.

**Table 1.** Data matrix including nine taxa and 22 morphological characters

| Taxon | Character | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| *Myodocha serripes* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Paisana brachialis* | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Thoraea brasiliensis* | 0 | 1 | 2 | 1 | 0 | 0 | 4 | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 0 |
| *Heraeus triguttatus* | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Orthaea meloae* | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| *Orthaea alveusincola* | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| *Orthaea consuta* | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| *Orthaea montana* | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 1 | 1 |
| *Orthaea procincta* | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 2 | 2 | 0 | 1 | 1 | 1 | 2 | 1 | 1 |

*Diagnosis*

Buccular juncture V-shaped; jugal ridge present. Posterior pronotal lobe with four rounded yellowish macula. Evaporative area extensive; mesepimeron barely emergent. Male protibia and mesofemur spinose. Aedeagus unspined; vesica with two lobes, gonoporal process enlarged distally.

*Etymology*

The generic name is an anagram of "*Orthaea*", which is the most closely related Myodochini genus.

*Description*

Pruinose. Head with a short postocular region forming a short neck, postocular distance slightly longer than interocellar space (Figs 1, 25); eyes protruding, inserted high, surpassing the margin of head in lateral view (Fig. 21); buccular juncture V shaped; jugal ridge present. Anterior pronotal lobe with small punctures, lateral margins of both pronotal lobes rounded, collar well delimited. Clavus with three rows of punctures, filled in between with randomly placed punctures on distal half; corium with two rows of punctures on inner half, distal half evenly punctate. Evaporative area extensive, covering all of metapleural area, except shiny dorsal one quarter or less; mesepimeron barely emergent. Procoxa with one spine; protrochanter unarmed; profemur incrassate, with two rows of spines; protibia slightly curved, with minute tubercles on proximal half and one row of tubercles bearing spiniform setae (Fig. 30); mesofemur armed with a row of small spines (Fig. 36).

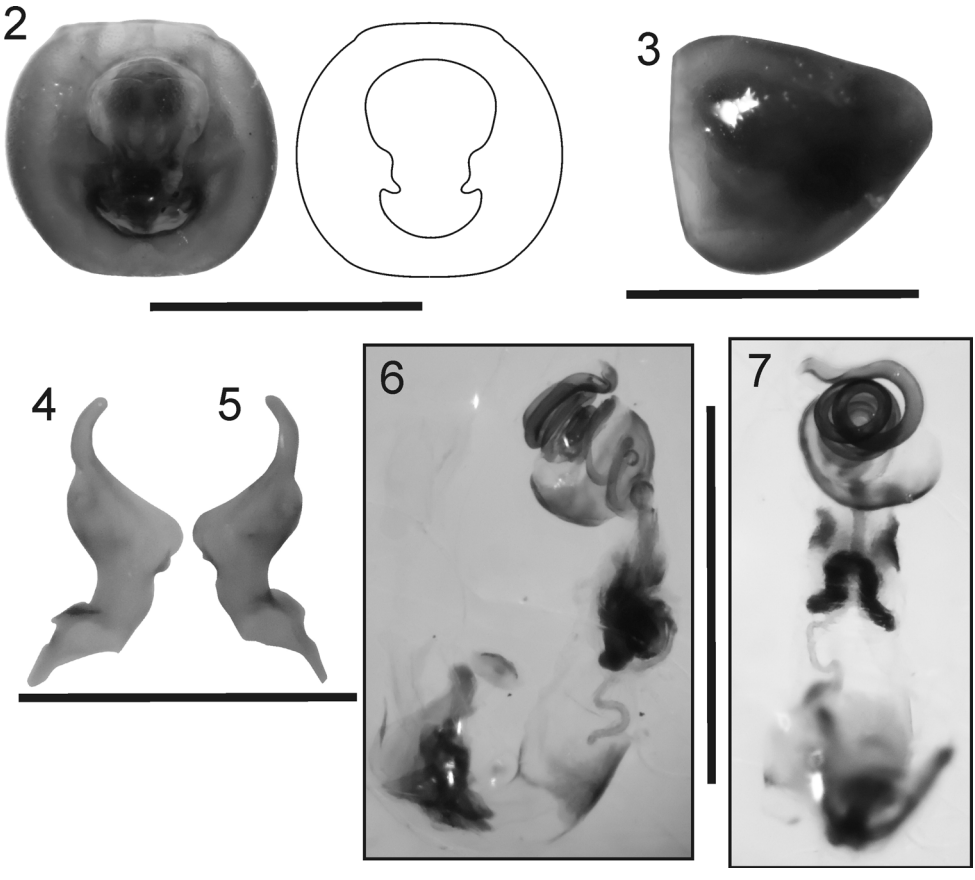
Male genitalia (Figs 2–7): posterior margin of pygophore distant from dorsal aperture. Without a median impression; aedeagus unspined; vesica with two lobes, gonoporal process enlarged distally.

*Discussion*

The species of *Thoraea* run to the couplet 35 in Harrington's Key to the Myodochini of the world (Harrington 1980), in which the genera *Orthaea* and *Neopamera* Harrington are identified. This new genus appears closely related to *Orthaea* based on the gonoporal process of the aedeagus enlarged distally, a character known only in these two genera; in addition, both genera share a pruinose dorsal body surface, a jugal ridge, a well-delimited collar, an emergent mesepimeron, an extensive evaporative area, a clavus with more than three rows of punctures, and spined protibia and mesofemur in males (except in *O. procincta*).

*Thoraea* can be distinguished from *Orthaea* by the protruding eyes, inserted high and surpassing the dorsal margin of head in lateral view, the larger ocelli, the shorter scape and profemora, the elongated inner projections of dorsal aperture of pygophore, and morphology of the parameres. In *Orthaea*, the eyes are not protruding and not surpassing the margins of head in lateral view, the ocelli are very small, the scape is at least as long as the head and the profemora are relatively elongate, the inner projections

**Fig 1.** Habitus of *Thoraea brasiliensis*. Scale bar = 1 mm.




**Figs 2–7.** *Thoraea brasiliensis*, male genitalia. (2, 3) Pygophore: (2) dorsal view; (3) lateral view. (4, 5) Paramere: (4) inner view; (5) outer view. (6, 7) Aedeagus: (6) lateral view; (7) frontal view. Scale bars = 1 mm.

of dorsal aperture of pygophore are digitiform, and the parameres have the outer projection developed in a digitiform or acute projection and the inner projection prolonged basally.

### *Thoraea brasiliensis* sp.n. (Figs 1–7, 21, 25, 30, 36)

*Type specimen*

Holotype ♂, Est. Minas, BRASIL, Barro Alto Dec '31, José Blaser collector, *Neopamera neotropicalis* Kirkaldy or near, det. Harrington 1981 (AMNH).

*Etymology*

The epithet "*brasiliensis*" refers to Brazil, the country where the specimen was collected.

*Description*

Male, total length: 8.5. Head (Figs 21–25) dark brown almost black, clypeus brown; with abundant short, decumbent, silvery setae, and long erect setae dorsally. Head length: 1.20; width: 1.15; anteocular length 0.55. Postocular length 0.18. Interocular space: 0.43. Ocelli located behind posterior margin of eyes, and to equal distance to the eyes and the posterior margin of head. Interocellar space: 0.20. Rostrum light brown, with semierect setae. Rostrum extending onto mesosternum, surpassing procoxae. Rostral segment lengths: I 0.73; II 0.83; III 1.00; IV 0.33. Antenna light brown, distiflagellomere brown with a broad sub-basal yellowish band. Scape 0.70; pedicel 1.60; basiflagellomere 1.50; distiflagellomere 1.55.

Anterior pronotal lobe dark brown almost black; posterior pronotal lobe brown, with the anterior half of lateral margins, four irregular maculae anteriorly on disc, and a small macula at humeral angles yellowish (Fig. 1); setae short and silvery. Collar length 0.15; anterior lobe length 0.85; posterior lobe length 0.65. Collar width 0.70; anterior lobe width 1.15; posterior lobe width 1.95. Scutellum dark brown paler at apex, with short decumbent and long erect setae. Hemelytra with short decumbent setae. Lateral corial margin serrated. Coloration pattern as in Fig. 1. Pleura dark brown, acetabular areas and metepimeron paler. Protibia with four or five spines, the proximal larger (Fig. 30). Mesofemur with two or three small spines (Fig. 36). Coxa, profemur except the basal fourth and apex, the distal third of meso- and metafemur and tibia at apex brown, rest of legs light brown. Abdomen brown with abundant short, decumbent, silvery setae.

Male genitalia: Pygophore (Figs 2 and 3) with anterior margin of dorsal aperture rounded, inner projection elongate, projecting distally, dorsal margin slightly declivent posteriorly. Parameres as in Figs 4 and 5. Aedeagus (Figs 6 and 7): vesica with two lobes, strongly sclerotized medially; body of ejaculatory reservoir large, with broad wings; gonoporal process with six turns.

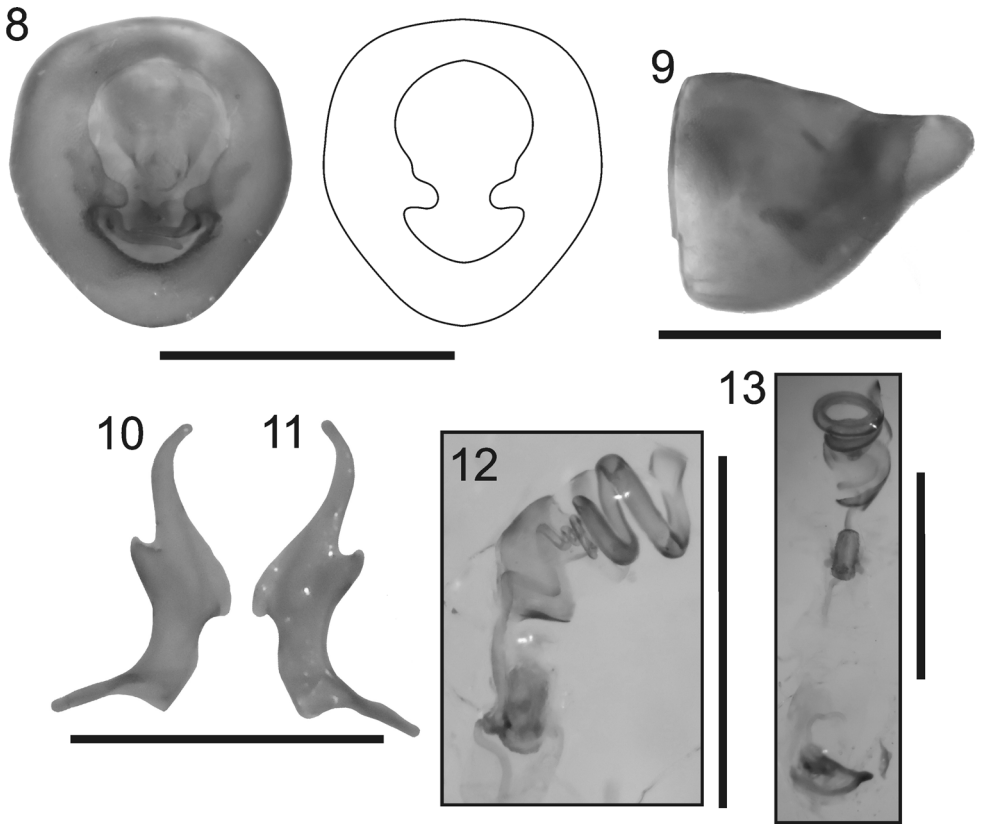
### *Orthaea meloae* Dellapé & Montemayor 2008

*Specimens examined*

1 ♂, PANAMA [new country record!], Canal Zn., Pipeline road, 9-VI-[19]74, D. Engleman col., collected on *Cylanthus bipartitus* by R. B. Johnson (USNM).

Male similar to female holotype except for the following characters: rostrum surpassing the mesocoxae almost reaching the metacoxae; antennae brown, distiflagellomere (lost in the holotype) with a subasal yellowish band occupying two thirds of the segment length; anterior pronotal lobe swollen and rounded; protrochanter with one or two small spines; profemur elongate, with two ventral rows of spines in all its length; protibia straight, with numerous minute tubercles over entire ventral surface and a row of 4–6 spines; mesofemur spinose, with a row of well developed spines. Total length: 9.80.

Male genitalia: Pygophore (Figs 8 and 9) in dorsal view approximately as long as width, narrowing towards the end; with anterior margin of dorsal aperture rounded,




**Figs 8–13.** *Orthaea meloae* Dellapé & Montemayor, male genitalia. (8, 9) Pygophore: (8) dorsal view; (9) lateral view. (10, 11) Paramere: (10) inner view; (11) outer view. (12, 13) Aedeagus: (12) lateral view; (13) frontal view. Scale bars = 1 mm.

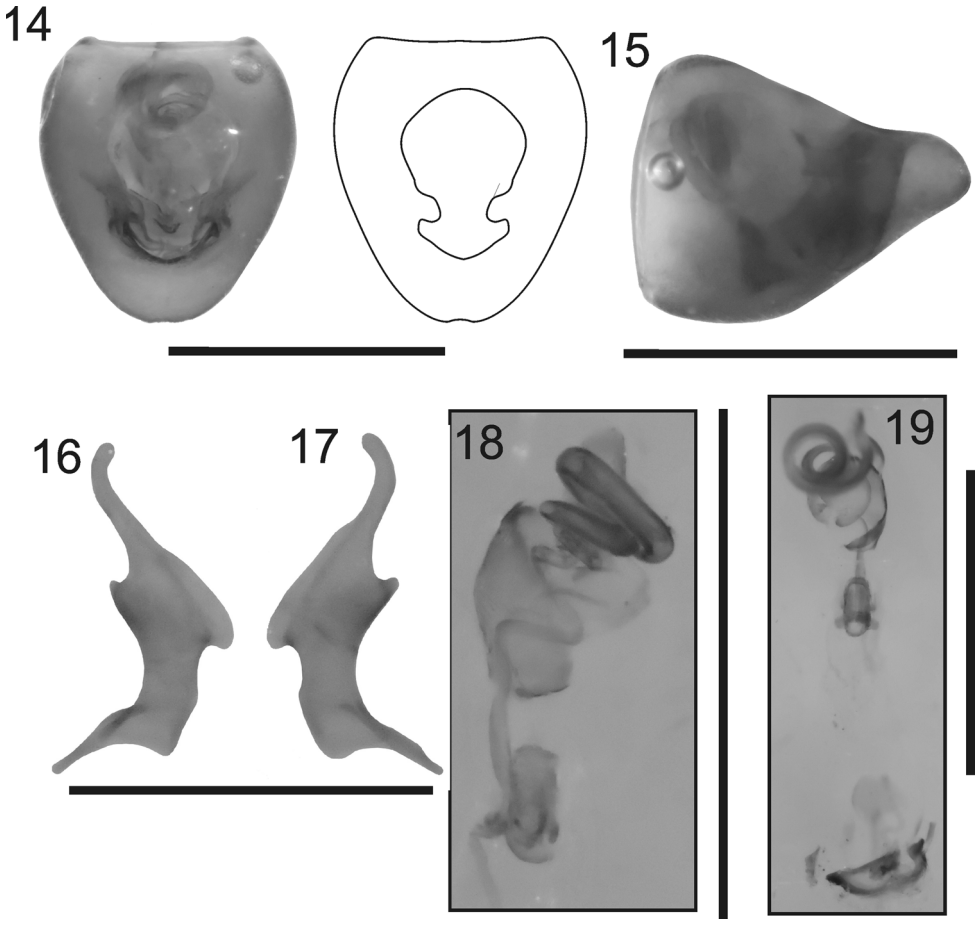
inner projection rounded, digitiform, dorsal margin slightly declivent posteriorly. Paramere (Figs 10 and 11): blade curved; inner projection of shank with setae continuing to base of blade; outer projection digitiform. Aedeagus (Figs 12 and 13): conjunctiva and vesica unspined; vesica with two membranous lobes; body of ejaculatory reservoir subrectangular, longer than wide; gonoporal process with three to four turns.

### *Orthaea alveusincola* Harrington 1986

*Specimens examined*

5♂ 2♀, PANAMA, Prov. Cocle, El Valle, 500m, 13 Jan 74, D. Engleman col. (USNM).

In the key to *Orthaea* species (Dellapé & Montemayor 2008), couplet 2b should be selected to identify *O. alveusincola*: "posterior pronotal lobe concolorous with the rest of pronotum". In the specimens studied here the posterior pronotal lobe shows the lateral margins from vaguely to clearly contrastingly paler. However, the most conspicuous character to identify this species is the lateral corial margin narrowly pale complete to the subpical maculae V-shaped.




**Figs 14–19.** *Orthaea alveusincola* Harrington, male genitalia. (14, 15) Pygophore: (14) dorsal view; (15) lateral view. (16, 17) Paramere: (16) inner view; (17) outer view. (18, 19) Aedeagus: (18) lateral view; (19) frontal view. Scale bars = 1 mm.

Male genitalia: Pygophore (Figs 14 and 15) in dorsal view longer than wide, narrowing towards the end; anterior margin of dorsal aperture rounded, inner projection digitiform, dorsal margin strongly declivent posteriorly. Paramere (Figs 16 and 17) blade curved; inner projection of shank with setae continuing to base of blade; outer projection digitiform. Aedeagus (Figs 18 and 19): conjunctiva and vesica unspined; vesica with two membranous lobes; body of ejaculatory reservoir subrectangular, longer than wide; gonoporal process with 3–4 turns.

## Phylogeny of *Orthaea*

*Additional specimens examined for cladistic analysis*

*Heraeus triguttatus*: CUBA: 1♂ ex coll. E.P. van Duzee, det. V.D. (CAS).

*Myodocha serripes*: USA: 1♂ Agricultural college, Miss, 21-VIII-1915, collection of H. M. Parshley (CAS); 1♂ IN. Monroe County, Bloomington, BLT, 4-V-1987, F. N. Young, *Myodocha serripes* (Olivier) det. F. N. Young (CAS); 1♀ Cold Spring Harb. 2-VIII-1919, L. Id, NY, J. R. T. B. Collr, *Spartina* (CAS); 1♀ Indiana, Posey Co, Murphy's Park, New Harmony, 2-VIII-1967, Hugh B. Leech (CAS); 1♀ Austing Texas, 20-I-[19]00, C. T. Brues, Parshley collection (CAS).

*Paisana brachialis*: ARGENTINA: 4♂ 2♀, Est. Pereyra, La Plata, 9-XI-2000, P. M. Dellapé (MLP); 1♂, Pereyra, X-1962, D. L. Carpintero (MLP); 1♀, Tandil, 22/24-XI-2002, D. L. Carpintero (MLP); 1♀, same locality, 19-IV-2003, pitfall trap, Carpintero-Dellapé (MLP).

*Orthaea consuta*: BELIZE [new country record!]: 1♂ British Honduras, San Antonio, VI-1931, J. J. White, J. C. Lutz collection 1961, *Orthaea consuta* Dallas det. P. Dellapé 2009 (USNM). COLOMBIA: 1♀ 3 mi w. Villa Vicencio. Meta. 920 m, 11-III-1955, E.I. Schlinger & E.S. Ross collectors, *Orthaea consuta* Dallas det. P.D. Ashlock 1962 (CAS); 1♀ 18 mi. SE. Mocoa. Narino 510 m. 2-III-1955, E.I. Schlinger & E.S. Ross collectors, *Orthaea consuta* Dallas det. P. Dellapé 2007 (CAS); 1♀ 5 mi. E. El Collegio. Cundinamarca 1370 m. 9-III-1975, E.I. Schlinger & E.S. Ross collectors, *Orthaea consuta* Dallas det. P. Dellapé 2007 (CAS). VENEZUELA: 1♂ Aragua, Rancho Grande, 1100 m., 26-IX-1972, *Orthaea consuta* Dallas det. P. Dellapé 2007 (AMNH); 1♂, same data, 9-VI-1966, *Orthaea consuta* Dallas det. P. Dellapé 2007 (AMNH); 1♀ Carabobo, San Esteban (Las Quiguas), 185 m., 5-8-XI-1974, J. Salcedo R. Diets and J.L. Garcia, *Orthaea consuta* Dallas det. P. Dellapé 2007 (AMNH); 1♀ Aragua, El Limon, Qda "El Piñal", Parque H. Pittier, 13-VIII-1976, J. A. Clavijo and Z. Hernandez, *Orthaea consuta* Dallas det. P. Dellapé 2007 (AMNH).

*Orthaea montana*: Holotype ♂, Sinchono, 4800 m (Perú) J. G. Sauders (OSUC). BOLIVIA [new country record!]: 1♂ Mapiri, N. La Paz, 10/16-VIII-1989, leg. L. E. Peña, Drake collection (USNM); 1♂ Chapare Riv. Región, 25-IX-1949, M. Zischka, C. J. Drake collection 1956 (USNM); 1♀ Yungas Chapare, 1900-2500 mts, Cochabamba, 9-XII-1984, col. L. E. Peña, Drake collection (USNM); 1♀ Pte. Mururata, Yungas La Paz, 1200-1600 mts, 24/26-XII-1984, col. L. E. Peña, Drake collection (USNM); 1♂ 4♀ Cristal Mayu, 1300 mts, Chapare, 9/10-XII-1984, col. L. E. Peña, Drake collection (USNM). PERU: 1♂ Cuzco Pilcopata, 600 mts, 8/10-XII-1979, J. B. Heppner, Premontane Moist Forest (USNM).

*Orthaea procincta*: ECUADOR: 1♂, Past. Prov., Tzapino, 22-V-1976, 400 mts, Jeffrey Cohen, black light trap, 1º 11`S- 77º 14`W 32 km NE Tigueno, Ecuador-Peace Corps, Smithsonian Institution Aquatic Insect Survey (USNM); 2♀, same data, 25-V-1976 (USNM); 3♀, Past. Limoncocha (70 mi.SE) 28-V-1976, Malaise trap, Jeffrey Cohen, on rio Cononaco at Anglo air-strip 1º 19`S 76º6`W; 2♂ 7♀, same data, 30-V-1976 (USNM); 1♂ 1♀, Prov. Napo, 00º 24`S 76º 36`W, Limoncocha, 280 mts, 10/16-VI-1975, Carl W. Rettenmeyer (AMNH); 1♂, same data, 12-VI-1975, taken at light, time 3-4 am (AMNH); 1♂ 2♀, same data, 15-VI-1975 (AMNH); 1♂, same data, 29-VI-1975 (AMNH).

*Character list*

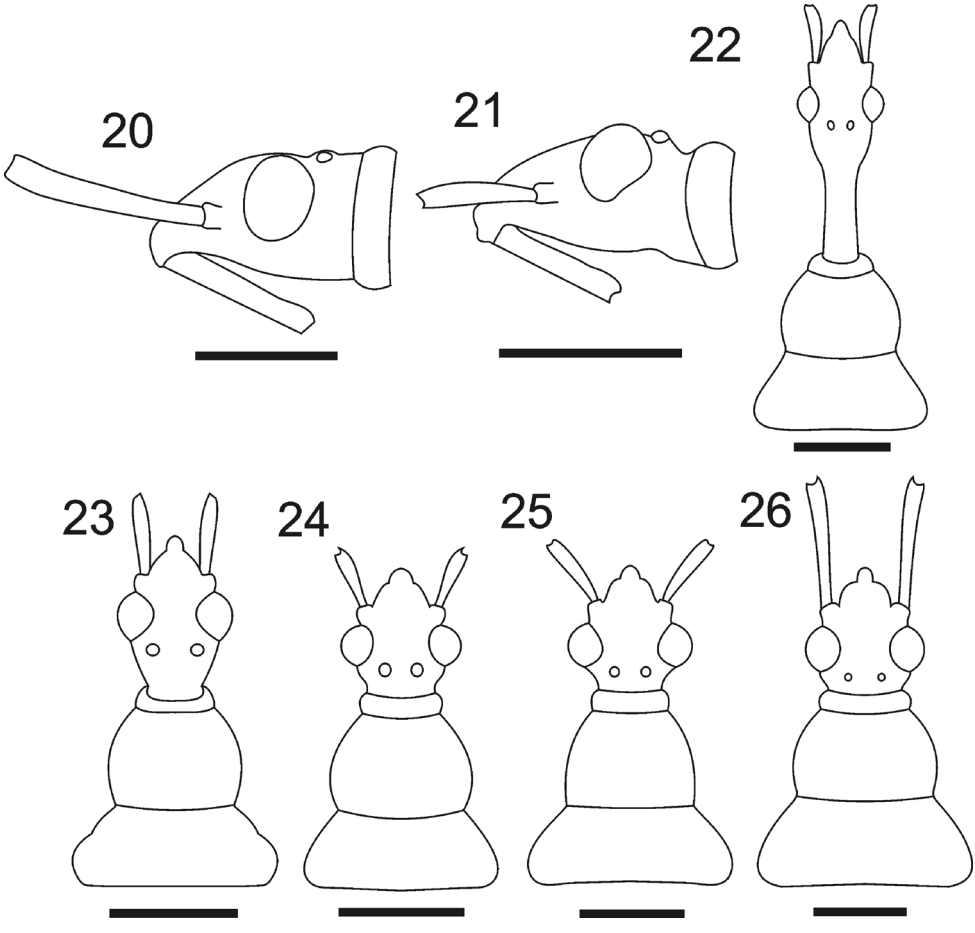
0. Total length: longer than 8 mm (0); less than 7 mm long (1).

   The *Orthaea* species are between 8.4-10.5 mm long. The smaller species are *H. triguttatus* and *P. brachialis*.

Head

1. Eyes: not protruding and not surpassing the dorsal margin of head in lateral view (0) (Fig. 20); protruding, inserted high surpassing the dorsal margin of head in lateral view (1) (Fig. 21).

   In *T. brasiliensis* n. sp. the eyes are protruding whereas in the other species the eyes are not.




**Figs 20–26.** (20, 21) Head, lateral view. (20) *Orthaea consuta*; (21) *Thoraea brasiliensis*. (22–26) Head and pronotum, dorsal view. (22) *Myodocha serripes*; (23) *Heraeus triguttatus*; (24) *Paisana brachialis*; (25) *Thoraea brasiliensis*; (26) *Orthaea consuta*. Scale bar=1 mm.

2. Ocelli position: nearer to the eyes than to the posterior margin of head (0) (Figs 22–24); nearer to the posterior margin of head than to the eyes (1) (Fig. 26); separated by the same distance from the eyes and from the posterior margin of head (2) (Fig. 25).

   *Myodocha serripes*, *H. trigutattus* and *P. brachialis* have the ocelli closer to the eyes than the posterior margin of the head, in all the species of *Orthaea* they are closer to the posterior margin of the head, and in *T. brasiliensis* they are separated by the same distance from both margins.

3. Ocellus: small (0) (Figs 22, 26); larger (1) (Figs 23–25).

   All *Orthaea* species and *M. serripes* have very small ocelli, the rest of the species analyzed have larger ocelli.

4. Interocellar space: more than one half of interocular space (0); less than one half of interocular space (1).

   Only *O. meloae* and *O. alveusincola* have the interocular space two or more times the interocellar space, in the rest of the species the ocelli are more distinctly separated.

5. Length of scape: clearly shorter than head (0) (Figs 22–25); approximately same length or longer than head (1) (Fig. 26).

   In the species of *Orthaea* the scape is long, at least as long as the head, in the rest of the species the scape is conspicuously shorter.

6. Development of the postocular region: forming a very long and slender neck (0) (Fig. 22); forming a long neck, postocular region longer than interocular space (1) (Fig. 23); short, as long as eye length (2) (Fig. 24); shorter than the eyes and slightly constricted (3) (Fig. 26); shorter than the eyes and strongly constricted (4) (Fig. 25).

   Among the species analyzed there are several morphologies of the postocular region, from long and slender as in *M. serripes* to short and slightly constricted as in *Orthaea*, or short and strongly constricted as in *T. brasiliensis*. In *P. brachialis*, the postocular region is developed in a short neck, and in *H. trigutattus* the neck is longer than the interocular space.

7. Jugum; rounded (0); forming a weak ridge (1); forming a conspicuous ridge (2).

   In *M. serripes*, *P. brachialis* and *H. trigutattus* the jugum is rounded, in all the species of *Orthaea* it is developed into a weak ridge, in *T. brasiliensis* it is more strongly developed.

Pronotum

8. Posterior pronotal lobe with coloration pattern of rounded yellowish maculae: absent (0); present with two maculae (1); with four maculae (2).

   All the species of *Orthaea* except for *O. consuta* have two maculae on the posterior pronotal lobe, *T. brasiliensis* has four, and the rest of the species analyzed do not have maculae.

9. Lateral margin of posterior pronotal lobe: concolorous with the rest (0); paler (1).

   All the species analyzed except for *O. meloae* have the lateral margin of the posterior pronotal lobe paler.

Hemelytra

10. Contrasting yellowish band on proximal half of clavus between median and external row of punctures: absent (0); present (1).

    All the species of *Orthaea*, except for *O. consuta*, and *T. brasiliensis* present the clavus with a contrasting yellowish band.

11. Lateral corial margin: narrowly pale complete to the subapical macula (0); with narrow pale area along the lateral margin of corium stopping short of the pale, broad, transverse subapical corial maculae (1).

    The species that have the lateral corial margin narrowly pale complete up to the subapical margin are *O. alveusincola* and *T. brasiliensis.*

12. Lateral corial margin: serrated (1); smooth (0).

    The lateral corial margin serrated is only present in *T. brasiliensis*.

Legs

13. Male protibia: with a row of spines on distal half, the first one larger (0) (Figs 27, 29, 30); with a row of spines on distal half, all of similar size (1) (Figs 28, 31–34); without spines (2) (Fig. 35).

    *Orthaea procincta* is the only species of the genus whose males do not have spines in the protibia, whereas in the remaining *Orthaea* species and in *H. trigutattus* the males have a row of spines of similar size. In the rest of the species analyzed, the males have a row of spines in the protibia and the first spine is larger.

14. Male profemur: relatively short and stout (0) (Figs 27–30); elongate and slightly stout (1) (Figs 31–34); very slender, similar to meso- and metafemur (2) (Fig. 35).

    As in the previous character, *O. procincta* differs from the other members of the genus as it is the only one where the male profemur is similar to the meso- and metafemur. In the other *Orthaea* species, the male profemur is elongated and slightly stout, and in *M. serripes*, *P. brachialis*, *T. brasiliensis* and *H. trigutattus* they are relatively short and stout.

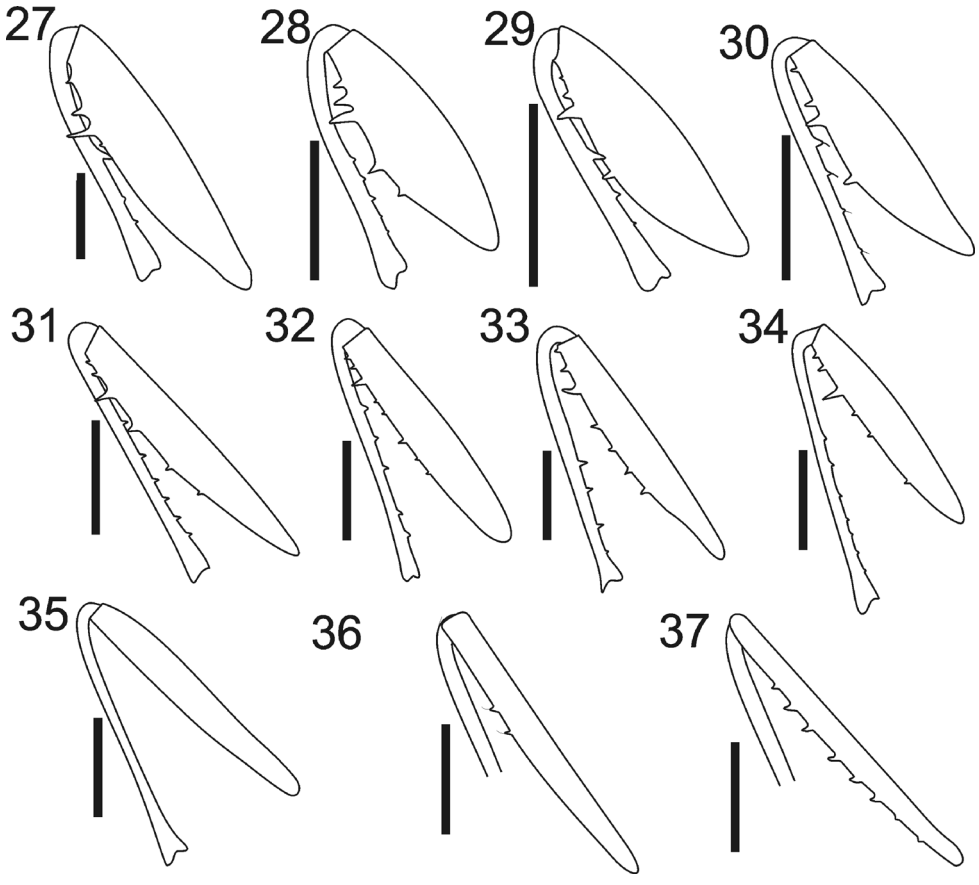
15. Male mesofemur: spined (1) (Figs 36 and 37); unspined (0).

    Three of the *Orthaea* species (*O.meloae*, *O. alveusincola* and *O. consuta*), and *T. brasiliensis* have the male mesofemur spined, whereas in the rest of species studied it is unspined.

Male genitalia

16. Gonoporal process: enlarged distally (1); not enlarged distally (0).

    All *Orthaea* species and *T. brasiliensis* exhibit the gonoporal process enlarged distally, whereas in the other species analyzed it is not enlarged.




**Figs 27–37.** (27–35) Male profemur and protibiae. (27) *Myodocha serripes*; (28) *Heraeus triguttatus*; (29) *Paisana brachialis*; (30) *Thoraea brasiliensis*; (31) *Orthaea alveusincola*; (32) *Orthaea consuta*; (33) *Orthaea meloae*; (34) *Orthaea montana*; (35) *Orthaea procincta* (only the external row of spines on profemora is illustrated). (36, 37) Male mesofemur. (36) *Thoraea brasiliensis*; (37) *Orthaea meloae*. Scale bar=1 mm.

17. Outer projection of paramere: strongly developed in a digitiform or acute projection (1); outer projection different (0).

    All the members of *Orthaea* have the outer projection of the paramere strongly developed in a digitiform or acute projection, whereas in the rest of the species the outer projection is different.

18. Inner projection: not prolonged (0); prolonged basally (1).

    The basally prolonged inner projection is only present in all *Orthaea* species.

19. Anterior region of dorsal aperture of pygophore: subquadrangular (0); broadly rounded (1); laterally expanded (2).

In all the species analyzed the anterior region of the dorsal aperture is broadly rounded, except for *O. montana* and *O. procincta* where the anterior region is laterally expanded, and in *M. serripes* where the anterior region is subquadrangular.

20. Posterior margin of pygophore in dorsal view: rounded (0); pointed (1); truncate (2).

    *Thoraea brasiliensis* has the posterior margin of the pygophore truncate, in all *Orthaea* species, except for *O. consuta,* it is pointed, and in this last species as well as in *M. serripes*, *P. brachialis*, and *H. trigutattus* it is rounded.

21. Inner projections: long projected distally (0); digitiform (1).

    The inner projections digitiform are only present in *Orthaea* species.

*Results of the cladistic analysis*

From the parsimony analysis of the data matrix (Table 1) one most parsimonious tree (Fig. 38) was obtained with a score of 38, a consistency index of 0.84 and a retention index of 0.86. Characters 2, 3, 6, 7, 10, 11 and 19 have an ambiguous optimization. The analysis recovered *Orthaea* as a monophyletic taxon supported by seven synapomorphies: scapus long, at least as long as the head (5: 1), posterior pronotal lobe with the lateral margins pale (9: 1), profemora elongate (14: 1), male protibiae spined (13: 1), outer projection of paramere developed in a digitiform or acute projection (17: 1), inner projection of paramere prolonged basally (18: 1), and the inner projections of dorsal aperture of pygophore digitiform (21: 1). *Orthaea consuta* is the basal species of the genus; *O. procincta* is the sister group of *O. montana* and they are related by the shape of the anterior region of dorsal aperture of pygophore (19: 2) and by the unspined male mesofemora (15: 0); *O. alveusincola* is the sister group of *O. meloae,* and they are related by the short interocellar distance (4: 1). These four species constitute a clade supported by two synapomorphies: the posterior pronotal lobe with two rounded yellowish macula (8: 1) and the posterior margin of pygophore pointed in dorsal view (20: 1). *Thoraea brasiliensis* n. sp. shares with the *Orthaea* species the spined male mesofemora (15: 1) and the apically enlarged gonoporal process of the aedeagus (16: 1).

**Distributional comments**

According to Harrington (1986), species of *Orthaea* are associated with rapid streams at high elevations, 750 m for *O. alveusincola*, and 500 and 1600 m for *O. procincta*. Some of the species of the genus have been collected not only at high altitudes but also in lowlands, suggesting that high altitude is not a requirement for these species. This also suggests that the habitats where they live may be different from the ones mentioned by Harrington.

*Orthaea consuta* is the most widely distributed species of the genus, known from Belize, Venezuela, Colombia, and Guyana. *Orthaea procincta* and *O. montana* are only known from high altitudes, presenting the most austral distribution (Fig. 39).

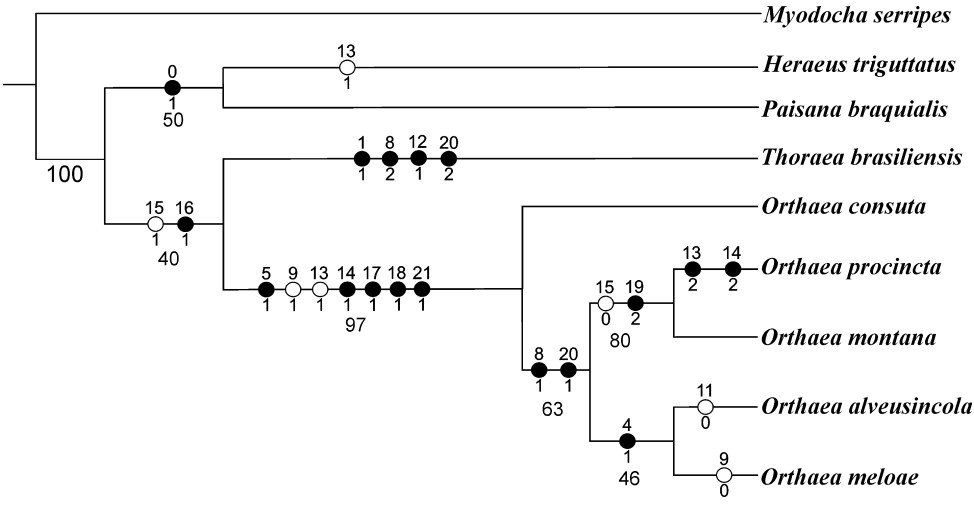



**Fig. 38.** Single most parsimonious tree (score of 38, a consistency index of 0.84 and a retention index of 0.86). Black circles indicate unique changes and white circles homoplasies. Bootstrap support values over 39 % are indicated under the nodes.


**Fig. 39.** Geographic distribution of *Orthaea* species (data from studied material and bibliography).

## Acknowledgements

We express our gratitude to Thomas Henry (Department of Entomology, National Museum of Natural History (USNM), Smithsonian Institution, Washington, DC, USA) and Randall Schuh (American Museum of Natural History, New York, NY,

USA) for the loan of the *Orthaea* specimens. We also thank María Cecilia Melo (Instituto de Limnología Dr. Raúl A. Ringuelt) for a critical reading of the manuscript, and to the División Zoología Invertebrados (Museo de La Plata, La Plata, Argentina) for providing the photographic equipment. This work was supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET).

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