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Two new species of *Cephalastor* Giordani Soika (Hymenoptera: Vespidae: Eumeninae), with a review of the phylogeny of the genus

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Cephalastor Giordani Soika is a small Neotropical genus of eumenine wasps comprising 12 species, most of them described at the beginning of this century. The genus was revised by Garcete-Barrett, and a cladistic analysis carried out. *Cephalastor humeralis* n. sp. and *C. minarum* n. sp. are described herein, and the phylogenetic relationships among the species of the genus inferred from morphological data. A total of 34 characters were constructed (an increase of more than 209% from Garcete-Barrett's 2003 study) and new taxa added as outgroups. The monophyly of the genus was corroborated, and the relationships were stable under both equal and implied weighting schemes. New collecting records are added for *Cephalastor bossanova* Garcete-Barrett and *Cephalastor estela* Garcete-Barrett.

Keywords: *Cephalastor*; cladistic analysis; new species; eumenine; Neotropical

Introduction

Cephalastor is a small genus of eumenine wasps, with most species described at the beginning of this century (Garcete-Barrett 2001, 2003). The taxon was described by Giordani Soika (1982) as a subgenus of *Hypalastoroides* de Saussure, and raised to genus level by Carpenter (1986). The genus ranges from northern Mexico to Paraguay, with just two species being somewhat widely distributed, *C. relativus* (Fox) and *C. rufosuffusus* (Fox).

The genus was revised by Garcete-Barrett (2001, 2003) and a phylogenetic analysis among its species carried out. However, few characters were used to infer these relationships, and the monophyly of the genus is still to be tested. We describe two new species of *Cephalastor* herein. Also, characters used in the reconstruction of the phylogenetic relationships among species of *Cephalastor* by Garcete-Barrett (2003) are reanalyzed and others are included. Photographs and distributional maps are also provided.

Methods

The study of morphology and distributional information

The material studied belongs to the following institutions: Coleção de Entomologia Pe. Jesus Santiago Moure, Curitiba, Brazil (DZUP) and Museo Nacional de Historia Natural del Paraguay, San Lorenzo, Paraguay (IBNP). Photographs of relevant

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structures were obtained with a Leica DFC 500 digital camera attached to the stereoscopic microscope Leica MZ 16. Imaging was carried out with the softwares IM 50 (Image Manager) and Auto-Montage Pro 5.03.0040. Distributional maps were made using ESRI ArcView GIS 3.2 (ESRI, Redlands, CA). Longitude and latitude coordinates were obtained for the locality in which each specimen was collected by consulting online gazetteers (when GPS data were not available in the labels).

Abbreviations used are: MOW, mid-ocellar width; POL, post-ocellar line (minimal distance between posterior ocelli); OOL, ocello-ocular line (minimal distance between a posterior ocellus and a compound eye); MPOL, mid to posterior ocellar line (minimal distance between mid ocellus and a posterior ocellus). The terminology follows that of Garcete-Barrett (2001, 2003) and Carpenter and Cumming (1985).

Cladistic analyses

Terminals

Besides the species presently recognized in *Cephalastor*, seven terminals were also included in the present study as outgroups: *Ancistroceroides conjunctus* (Fox), *Ancistroceroides rufimaculus* (Fox), *Hypancistrocerus reflectorius* (Dalla Torre), *Parancistrocerus areatus* (Fox), *Stenodynerus convolutus* (Fox), *Stenodynerus scabriusculus* (Spinola) and *Stenodynerus suffusus* (Fox).

Character construction

Characters used in the present analysis are derived from the exoskeleton morphology of adult dry female specimens. Most of the 11 characters used in the cladistic analysis of Garcete-Barrett (2003) were reinterpreted and reanalyzed, and others were included making up a total of 34 characters. These inclusions (both characters and outgroup taxa) aimed to test the monophyly of the genus and to re-evaluate the evolutionary interpretation of the character states within *Cephalastor*.

The contingent character construction was applied in several situations herein. The contingent construction treats the presence/absence as a separate character from those that code the variation within it (Forey and Kitching 2000; see also Lee and Bryant 1999 and Strong and Lipscomb 1999). Although it is logically dependent on a character state derived from another character, the contingency is in various ways superior to the multistate construction, for it allows the recovering of more inclusive clades as well as a better recognition of reversals. However, in some cases the multistate construction was also applied. All characters were treated as nonadditive.

Analyses

The character matrix was constructed in Winclada (Nixon 1999–2002). A heuristic search for the most parsimonious cladograms was performed with NONA 2.0 (Goloboff 1993a), using equal weights of the characters and the commands hold10000, mult*1000, hold/20 and multiple TBR+TBR. The characters were also treated with an implied weighting scheme (Goloboff 1993b). In this analysis, the program PIWE 3.0 (Goloboff 1997) and the commands hold10000, hold/20 and mult*1000 were used. The default concavity value in PIWE was used. Branch support values were verified through Bremer support analysis (Bremer 1994), with the

program NONA 2.0 (Goloboff 1993a) and the commands nel, hold10000, and bsupport 5. The cladograms were produced in Winclada with only unambiguous changes shown.

Results and discussion

Taxonomy

The following is a key to the species of the genus *Cephalastor* (modified and adapted from Garcete-Barrett [2001] and Garcete-Barrett [2003]). (Based on females. Males are known for *C. relativus* and just putatively for *C. chasqui*.)

1. Propodeal submedial carina mostly effaced, just marked though not lamellar below the propodeal angles. Pronotum with a shiny partial indication of pretegular carina behind the pronotal lobe. Pronotal foveae oval, transverse, very closely set but clearly delimited from each other. Metanotum with a weakly indicated crest of blunt teeth and declivous posterior surface continuous with the propodeal concavity. Tergum II with a meso-apical tumescence delimited behind by a short transverse sulcus. Sternum II with a well-marked medial concavity. Vertex with a large transverse tumescence and large widely separated brushes behind the ocelli. (Mexican highlands) *sinusiticus* Garcete-Barrett
 Propodeal submedial carina well marked all around the posterior concavity of the propodeum and lamellar at least below the propodeal angles. Pronotum without a shiny indication of pretegular carina. Pronotal foveae oblique-oval to rounded and closely set and well delimited to completely fused together. Metanotum with a well-marked crest of sharp teeth and posterior surface rather steep, more or less discontinuous from the propodeal concavity by a thin propodeal shelf. Tergum II just occasionally with a meso-apical elevation, but never with a subapical transverse sulcus. Sternum II convex to flat medially. Vertex with smaller elevation and more closely set brushes behind the Ocelli 2
2. Mesoscutum with abundant close micropunctuation and pilosity confusedly mixed with the background microreticulation, just occasionally absent medially 3
 Mesoscutum regularly microgranulated and bare, at most with some sparse micropunctures posteriorly and laterally. 7
3. Pronotal carina blunt, almost imperceptible along most of its dorsal extension. Frons covered with close pilosity and micropunctuation. Sternum II abruptly elevated behind the basal groove. Body overall covered with a dense, thick whitish pilosity. Richly yellow-marked species. (Pacific desert of Peru) *lambayeque* Garcete-Barrett
 Pronotal carina sharp and complete in all its dorsal extension. Frons bare and free of dense micropunctuation. Sternum II just moderately elevated behind the basal groove. Body overall covered with a rather thin whitish fulvous pilosity. (Eastern Brazil and Paraguay) 4
4. Interocellar area sunken. Pronotal foveae very closely set, but still independent from each other. Mesoscutum completely covered with dense micropunctuation

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- and pilosity. Propodeal shelf very brief, medially thinner than the upper crenated band of the metanotum 5
- Interocellar area elevated. Pronotal foveae partially to completely fused together. Mesoscutum with a central area devoid of micropunctures and pilosity. Propodeal shelf better developed, at least as thick medially as the upper crenated band of the metanotum 6
5. Inner eye orbits thickened above. Cephalic foveae separated from each other by less than their own diameter. Pronotal macropunctuation dense, mostly coalescent. Pronotal carina perfectly sharp. Anterior pronotal face with just a few scattered micropunctures among the macropunctures. Clypeus with denser macropunctures and a wider apex. Cephalic brushes long and dense. Sub-basal elevation of sternum II without longitudinal mid depression or with just feeble traces of one. Overall body shape a little stouter: mesoscutum just 0.91 times narrower than long and tergum I behind the carina 0.93 times shorter than long. (Eastern Paraguay and south-eastern Brazil)
 *bossanova* Garcete-Barrett
- Inner orbits not thickened above. Cephalic foveae separated from each other by more than their own diameter. Pronotal macropunctuation dense but not coalescent. Pronotal carina rather blunt. Anterior pronotal face with abundant micropunctures among the macropunctures. Clypeus with sparser macropunctures and a narrower apex. Cephalic brushes rather short and sparse. Sub-basal elevation of sternum II with a short, shallow, but well-marked longitudinal depression. Overall body shape a little more elongate: mesoscutum 0.85 times narrower than long and upper tergum I behind the carina just as long as broad. (South-eastern highlands of Brazil)
 *estela* Garcete-Barrett
6. Ocular sinus narrower, being able to house two times an antennal socket. Pronotal foveae completely merged into a single small oval fovea. Mesoscutum with central bare area extended further forward. Propodeal submedial carina lamellar just up to the propodeal angle. Transverse hump of tergum I poorly elevated and without a central depression. Pronotal yellow band very thin, ending at the humeral angles (Brazil: eastern Minas Gerias)
 *minarum* n. sp.
- Ocular sinus wider, being able to house three times an antennal socket. Pronotal foveae partially merged in a larger, heart-shaped double-fovea. Mesoscutum with just a small bare area in the very middle. Propodeal submedial carina lamellar in all its extension. Transverse hump of tergum I well marked, elevated and with a central depression. Pronotal yellow band thicker, extending further behind the humeral angles. (Brazil: eastern Bahia)
 *humeralis* n. sp.
7. Gena narrow, less than half the breadth of the eye at its emargination. Clypeus dull, with markedly convex disk, a well defined apical spoon-shaped concavity and its apical margin truncate to slightly convex. Sternum II evenly convex behind a wide basal groove of coarse crenation. (Surinam, Brazilian Mato Grosso, Bolivian Santa Cruz and north of eastern Paraguay)
 *rufosuffusus* (Fox)
- Gena wider, more than half the breadth of the eyes at its emargination. Clypeus dull to shiny, with slightly convex to flat or even slightly concave

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- disk, without a spoon-shaped apical concavity and with its apical margin at least slightly concave. Sternum II either elevated behind a wide groove or evenly convex behind a narrow basal groove 8
8. Basal groove of sternum II closed in front by a well-developed basal area, very narrow at least in lateral view and with really or apparently thin crenation. Clypeal disk rather flat to slightly concave 9
- Basal groove of sternum II not closed by the basal area, wide under any view and with coarse crenation. Clypeal disk rather regularly convex 11
9. Mesoscutum with broad and deeply impressed notauli of coalescent macropunctation. Propodeum without lateral longitudinal carina and with submedial carina lamellar just up to the propodeal corner. Cephalic foveae very coarse and surrounded by a single large and circular brush of erect pilosity. Pronotal carina describing a regular curve in frontal view (Amazonia of Ecuador) *abraham* Garcete-Barrett
- Mesoscutum without well defined notauli. Propodeum with well developed lateral longitudinal carina and with submedial carina lamellar in all its extension. Cephalic foveae small and each one surrounded by a separate brush of semi-erect hair. Pronotal carina with a shallow central emargination as seen in frontal view 10
10. Tegula campanulate, subrectangular, with a widely transverse hind border. Occipital carina squared at gena. Propodeal angle blunt. Clypeus about as long as broad, centrally flattened and bare. Pronotal carina with a definite shallow emargination at middle. (Surinam, Colombian and Ecuadorian Amazonia, Bolivian Santa Cruz and Brazilian Mato Grosso)
- *relativus* (Fox)
- Tegula subcircular, with an oblique postero-lateral border. Occipital carina rounded at gena. Propodeal angle acute. Clypeus shorter than broad, completely covered with appressed silvery pubescence and rather concave centrally. Pronotal carina with just a weak indication of central emargination. (Peruvian Amazonia) *tupasy* Garcete-Barrett
11. Clypeal apex quite narrow, about four times narrower than the interocular clypeal width, and with a rather angular emargination. Tergum II shiner, with sparser punctures of two well differentiated sizes, with macropunctures of uniform size and density from the base to the apex. Tergum I with transverse tumescence effaced. Mesoscutum with some more or less visible clusters of micropunctation. Humeral angles poorly projected. (Mexican highlands) *mariachi* Garcete-Barrett
- Clypeal apex wider, about three times narrower than the interocular clypeal width, and with a shallowly curved emargination. Tergum II duller, with closer punctures of less differentiated sizes, with macropunctures very sparse and thin basally, which gradually become coarse and dense toward the apex of the tergum. Tergum I with a well-defined transverse tumescence behind the carina. Mesoscutum at most with a few scattered micropunctures. (South America) 12
12. Clypeus, mandibles, pronotum, propodeum and legs mostly yellow. Head richly yellow marked. Macro and micropunctures on tergum II sparser, with well-defined intervals. Sternum II with punctation very sparse in the

- middle and regularly dense at sides. (Venezuelan Llanos)
 *paezi* Garcete-Barrett
 Clypeus, mandibles and pronotum mostly black or red. Propodeum and legs
 mostly dark. Yellow markings on head reduced. Macro and micropunctures
 on tergum II denser, the latter with much reduced intervals. Sternum II with
 variable punctuation 13
13. Sternum II abruptly raised behind the basal groove and with micropunctures
 very sparse on its middle but suddenly dense at sides. Propodeal submedial
 carina lamellar just up to the propodeal angles. Clypeus, head and pronotum
 red. (Paraguayan Chaco) *rominae* Garcete-Barrett
 Sternum II gently raised behind the basal groove and covered with a rather
 uniformly dense micropunctuation over all its surface. Propodeal submedial
 carina lamellar in all its extension. Clypeus, head and pronotum black with
 yellow markings. (Bolivian Santa Cruz, putative male from subandean Peru-
 vian Amazonia) *chasqui* Garcete-Barrett

Cephalastor humeralis n. sp.

(Figures 1, 2, 7, 10, 14, 31, 33 and 38)

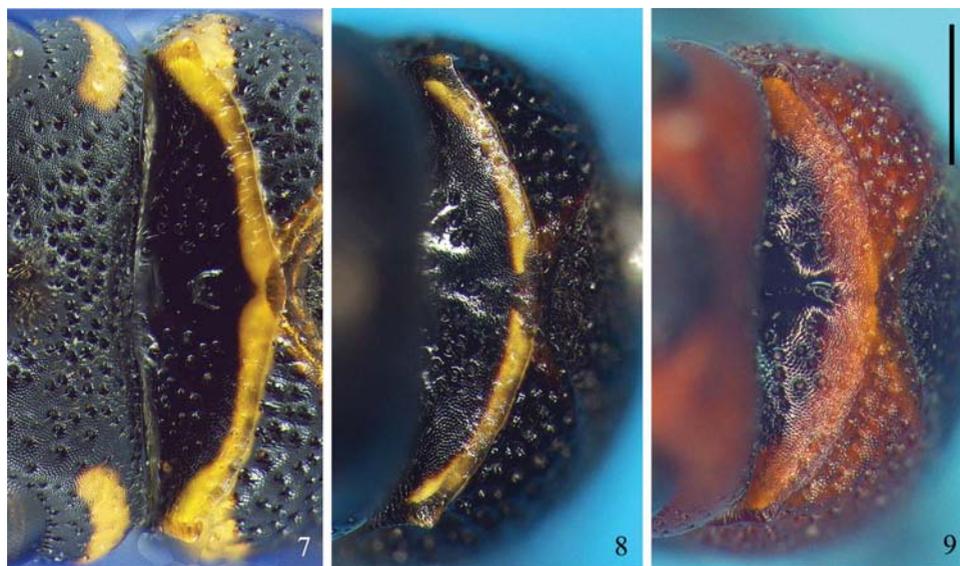
Diagnosis. This species and *C. minarum* have a general appearance, colour pattern and mesoscutum profusely micropunctate and pilose among the microgranulated background, similar to the conditions found in the eastern South American species *C. bossanova* and *C. estela* (Figure 13). But as in *C. minarum*, there is a central area devoid of micropunctures and pilosity, which is especially reduced in the present species (Figure 10), the interocellar tubercles are fused together (Figure 1), the cephalic foveae are closer to the lateral ocelli (Figure 2), the propodeal shelf is thicker and the sternum II is more elevated behind the basal crenated groove. The broader ocular sinus (Figure 1), just partially fused pronotal foveae (Figure 7), completely lamellar submedial propodeal carina (Figure 31), regularly curved transverse carina and well-marked transverse tumescence behind it on tergum I (Figure 33), and yellow-marked pronotal humeri separate this species from *Cephalastor minarum* (Figure 10).

Description. Holotype female: colouration – black with yellow as follows: basal half of mandibles except small black triangle on the very base; small sub-apical spots, and large basal spots on clypeus; interantennal spot; frontal line; scrobal spots; line on gena; scape beneath; thin dorsal pronotal band projected backwards at humeri; very thin hind pronotal margin becoming suffuse medially; pronotal lobe suffusely; subalar spot; anterior and posterior subtriangular marks on tegula; posterior scutellar band; narrow basal line all along the submedian propodeal carina; tiny condylar maculae adjacent to the bases of mid and hind coxae; most of fore tibia anteriorly and innerly; diffuse apical macula on outer surface of fore femur; suffuse posterior line along mid tibia; tiny suffuse spots on apex of mid and hind femora; thin apical bands on terga and sterna I–V and tergum VI apically. Light reddish brown to chestnut are: sub-apical suffusion on mandible; clypeal apex; posterior surface of scape; pedicel and flagellum beneath (lighter at apical flagellomeres); suffusion on pronotal lobe and along thin hind pronotal margin; tegula; apical suffusion on femora and tibiae (much less visible on mid and hind legs); some suffusion along lateral submarginal



Figures 1–6. (1–2) *Cephalastor humeralis* (female holotype); (3–4) *Cephalastor minarum* (female holotype); (5–6) *Cephalastor rominae* (female holotype); (1, 3, 5) head in frontal view; (2, 4, 6) head in dorsal view. Note: Scale = 0.5 mm.

carina of propodeum; sternum I apically; lateral suffusion on tergum I; obscure thin lateral suffusion on tergum II. Foveal brushes fulvous. Body covered with short thin brownish appressed pubescence – mostly absent on frons, sides of vertex, gena, upper surface of pronotum and very small mid anterior area of mesoscutum – becoming

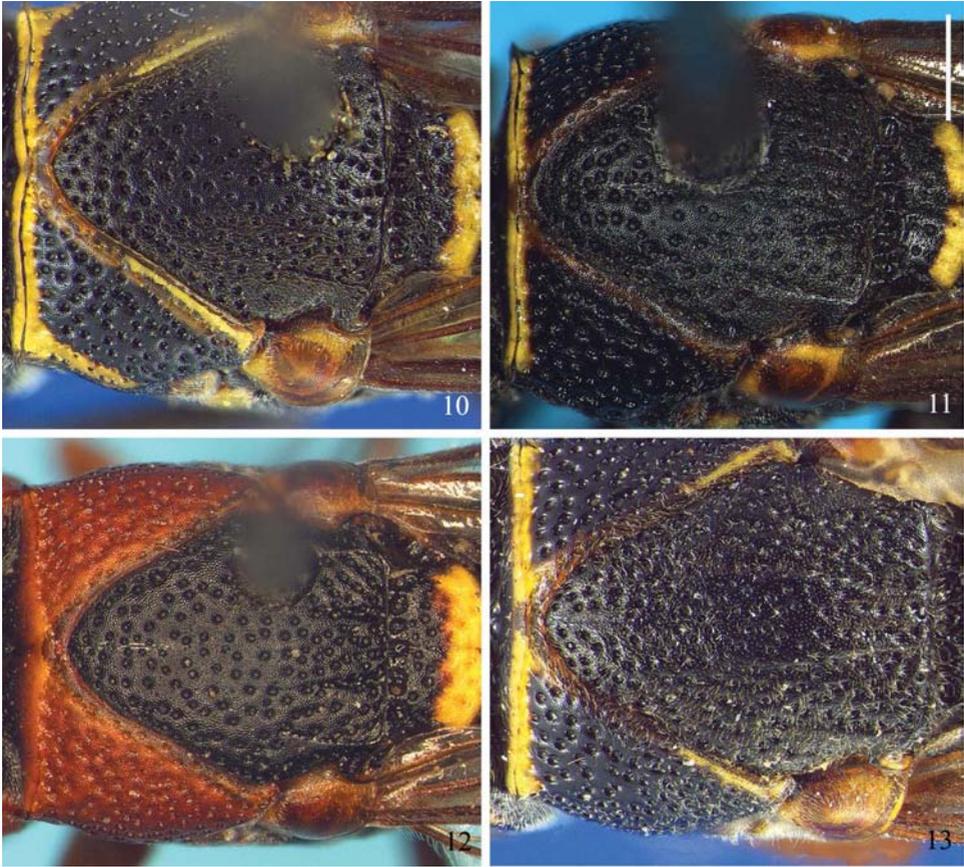


Figures 7–9. Female anterior surface of pronotum, frontal view. (7) *Cephalastor humeralis* (female holotype); (8) *Cephalastor minarum* (female holotype); (9) *Cephalastor rominae* (female holotype). Note: Scale = 0.5 mm.

paler on lower face, clypeus and mesosomal and metasomal sides and venter. Wings yellowish brown, just a bit darker at apex of basal cell and especially along dorsal half of marginal cell. Venation chestnut.

Dimensions: body from frons to apex of tergum II = 6.5 mm. Forewing length = 5.75 mm. Breadth of gena equivalent to 0.73 times the breadth of eye at emargination. Proportion MOW:POL:OOL:MPOL equivalent to 1:2.4:2.1:1.1. Upper surface of tergum I 1.7 times wider than long.

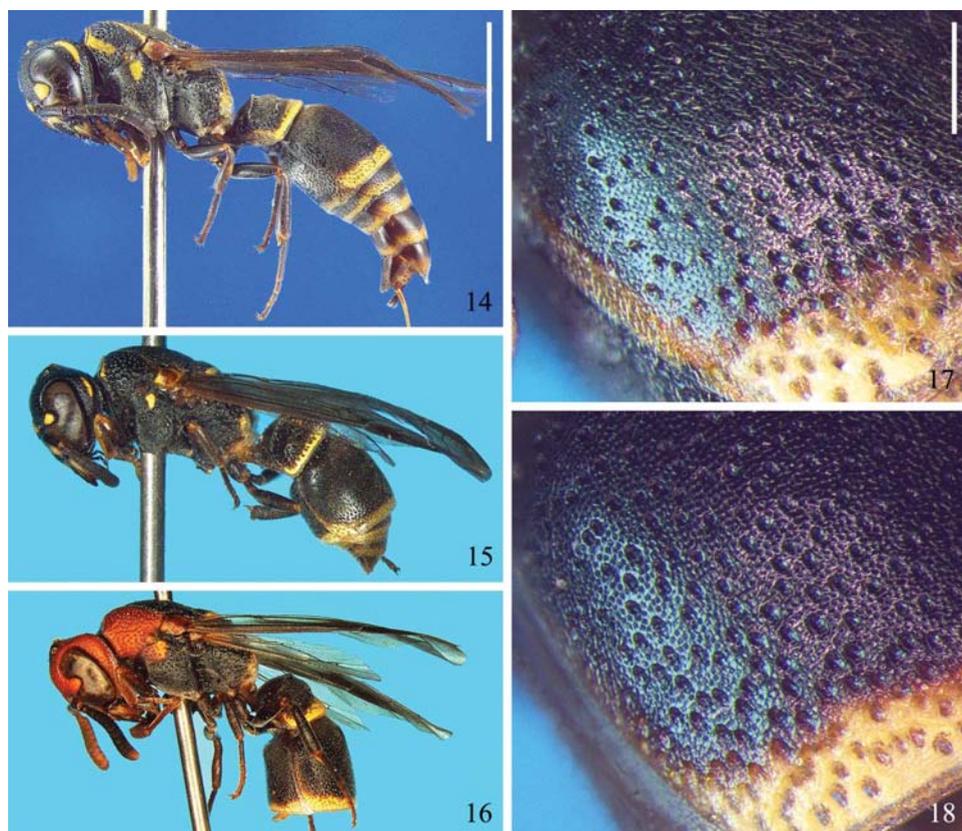
Structure: head, clypeus and mesosoma very finely microgranulated as in other species of the genus. Clypeus evenly convex, bearing some rather sparse macropunctures separated by one to three diameters, just a bit flattened on top and shallowly depressed on apical area. Clypeal apex with margin shallowly concave between teeth, which are separated by just a little more than the interantennal distance. Head with macropunctures separated by 0.5–1 diameter, mostly absent from yellow-marked areas becoming thinner and sparser on upper gena and coarser over the posterior declivity. Vertex tubercles rather square and with some coarse punctures at summit; foveal brushes rather small and narrowly separated from each other, but very dense, obscuring the foveae, which are separated by less than one diameter apart; posterior declivity slightly convex rather than plainly flat. Gena with a narrow precarinal depression widening down behind the lower ocular lobe. Occipital carina rounded at gena and almost straight medially. Anterior surface of pronotum with some few almost indiscernible micropunctures sublaterally adjacent to the carina and macropunctures mostly concentrated in two submedial clusters. Pronotal foveae heart-shaped. Pronotal carina well developed, with a slight projection backwards medially in dorsal view and forming a regular arc in frontal view. Humeral angle sharp and slightly pointing upwards. Posterior corner of pronotum without any pretergular



Figures 10–13. Female pronotum, mesoscutum and scutellum, dorsal view. (10) *Cephalastor humeralis* (female holotype); (11) *Cephalastor minarum* (female holotype); (12) *Cephalastor rominae* (female holotype); (13) *Cephalastor estela* (female). Note: Scale = 0.5 mm.

ridge-like fold. Pronotal macropunctuation much coarser and denser than that of head. Tegulae smoothly reticulo-granulate, semicircular, with a few undiscernible punctures towards the anterior and posterior corners, and without developed outer rim. Macropunctuation of mesoscutum coarse and dense anteriorly (a little thinner and denser than that on the upper surface of pronotum), becoming sparser posteriorly.

Micropunctuation of mesoscutum rather dense and partially obscuring the microgranulation except for a central spot. Scutellum with broad anterior crenation (thinner than in *C. minarum*), slight medial longitudinal depressed line and with macropunctuation similar to that of mesoscutum anteriorly, though partly absent from yellow-marked areas. Metanotum with well-marked toothed carina separating the anterior horizontal surface from the posterior almost vertical surface; both surfaces very coarsely striatopunctate/crenate. Mesepisternum irregularly punctate with sparse, small macropunctures. Metapleura and propodeum with very fine and dense microsculpture. Metapleura with almost no macropunctures apart from those along the anterior crenation. Upper surface of propodeum with very coarse and close elongate alveoles separated by thin careniform intervals and as wide as the horizontal



Figures 14–18. (14–16) Habitus: (14) *Cephalastor humeralis* (female holotype); (15) *Cephalastor minarum* (female holotype); (16) *Cephalastor rominae* (female holotype); (17–18) detail of tergum II punctation: (17) *Cephalastor minarum* (female holotype); (18) *Cephalastor rominae* (female holotype). Notes: Scale (14–16) = 0.5 mm; scale (17–18) = 0.25 mm.

surface of metanotum at middle. Lateral surface of propodeum covered with coarse flat-bottomed alveoles separated by thin, flat to slightly convex intervals. Posterior surface of propodeum with some scattered thin macropunctures. Submedial carina complete and lamelliform along all of its extension.

Transverse carina of tergum I regularly circular in frontal view. Tergum I also with a slightly elevated transverse tumescence crossing the middle of its upper surface (steeper behind than in *C. minarum*), with a longitudinal small furrow formed by coarse punctation. Sternum I with rather sharp basal transverse carina, higher than the longitudinal carina. Sternum II abruptly elevated sub-basally, preceded by a wide and longitudinally coarse striate groove in ventral view, and followed by a slightly concave surface in lateral view. Micropunctation of metasoma very fine and dense, scale-like (as in Figure 17; compare with Figure 18), sparser on the middle of sternum II, and denser and coarser on terga and sterna III–VI. Anterior surface of tergum I with some scattered thin macropunctures; macropunctation coarsely alveolar on the upper surface of the same tergum, especially coarse and dense behind carina and tumescence; very coarsely alveolate with thin careniform intervals on sternum I, except for its mid-apical rim; very fine and sparse



Figures 19–21. Female head in dorsal view. (19) *Stenodynerus suffusus*; (20) *Ancistroceroides rufimaculus*; (21) *Cephalastor bossanova*. Note : Scale = 1 mm.



Figures 22–25. (22) *Stenodynerus suffusus* (female); (23) *Cephalastor rufosuffusus* (female), anterior surface of pronotum in profile; (24) *Ancistroceroides conjunctus* (female); (25) *Ancistroceroides rufimaculus* (female), detail of propodeal valvula. Note: Scale = 1mm.

on tergum II, becoming denser and coarser towards the apical margin; regularly coarse and sparse on sternum II, with some coarser points close to the hind margin; quite dense but rather fine on terga III and IV apically, and very fine, obscure to almost completely absent on terga and sterna V and VI.

Male unknown.



Figures 26–30. Female posterior surface of propodeum; (26) *Ancistroceroides conjunctus*; (27) *Ancistroceroides rufimaculus*; (28) *Hypancistrocerus reflectorius*; (29) *Stenodynerus suffusus*; (30) *Cephalastor rufosuffusus*. Note: Scale = 1 mm.

Type material. Holotype female: BRAZIL: BAHIA: Maracás, ix.1965, F.M. Oliveira (DZUP).

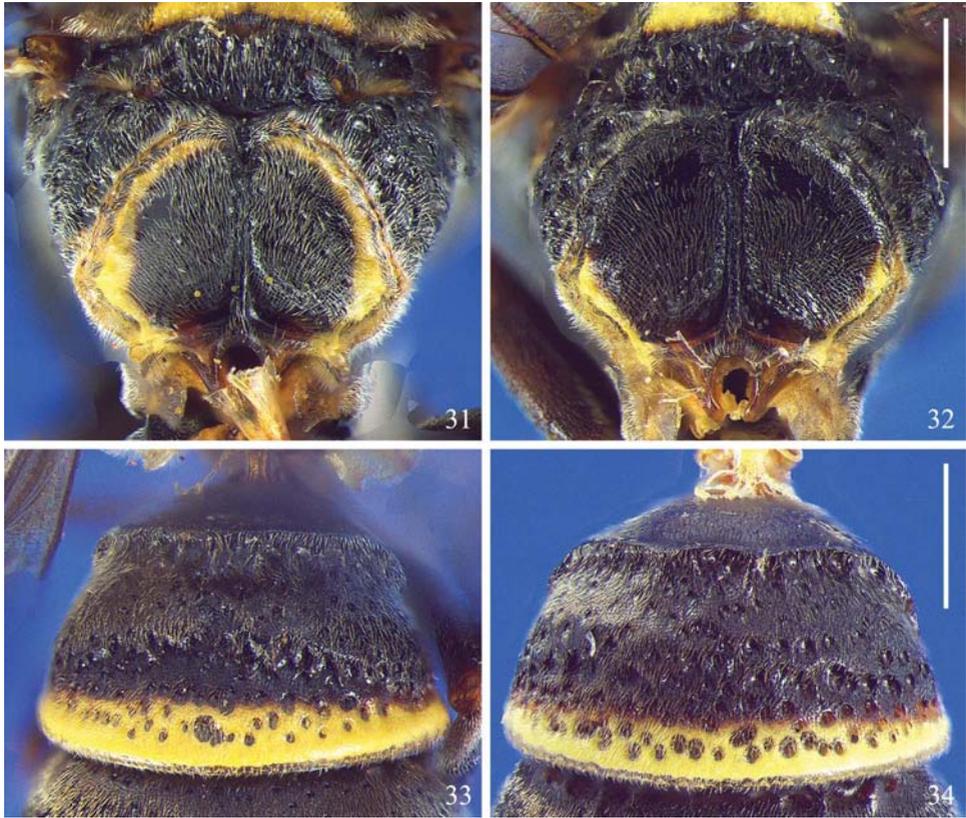
Etymology. The name refers to the backwards projecting yellow line along the pronotal humeri.

Cephalastor minarum n. sp.

(Figures 3, 4, 8, 11, 15, 17, 32, 34, 38)

Diagnosis. This species is very close to *C. humeralis* in general appearance and structure, differing by having a largest bare area devoid of micropunctures in the middle of the mesoscutum which extends further forward (Figure 11), the ocular sinus is narrower (Figure 3), the pronotal foveae are completely fused together (Figure 8), the submedial propodeal carina is lamellar just up to the propodeal angle (Figure 32), the transverse carina on tergum I is distorted, flattened dorsally and the tumescence behind it is very low, without a central depression (Figure 34), and the pronotal band does not project backwards (Figure 11).

Description. Holotype female: colouration – black with yellow as follows: basal half of mandibles except small black triangle on the very base; small subapical spots narrowly fused, and large basal spots on clypeus; interantennal spot; frontal line; scrobal spots; small line on gena; scape beneath; thin dorsal pronotal band narrowly



Figures 31–34. (31–32) posterior surface of propodeum: (31) *Cephalastor humeralis* (female holotype); (32) *Cephalastor minarum* (female holotype); (33–34) tergum I in dorsal view: (33) *Cephalastor humeralis* (female holotype); (34) *Cephalastor minarum* (female holotype). Note: Scale = 0.5 mm.

interrupted at middle; small sub-alar spot; ring-like mark on tegula; posterior scutellar band medially interrupted by a thin line; narrow basal line along lower half of the submedian propodeal carina; tiny condylar maculae adjacent to the bases of mid and hind coxae; most of fore tibia anteriorly and innerly; diffuse apical macula on outer surface of fore femur; tiny suffuse macula at very base of mid and hind tibia; thin apical bands on terga and sterna I–V. Light reddish brown to chestnut are: apex of mandible except the black points of teeth; clypeal apex; apex and posterior surface of scape; pedicel and flagellum beneath (lighter at basal flagellomeres); suffusion on pronotal lobe and along thin hind pronotal margin; tegula; apical suffusion on femora and tibiae (much less visible on mid and hind legs); inner face of mid and hind tibiae; some suffusion along lateral submarginal carina of propodeum; sternum I entirely; lateral suffusion on tergum I; obscure thin lateral suffusion on tergum II. Foveal brushes blackish-brown. Body covered with short, thin brownish appressed pubescence – mostly absent on frons, sides of vertex, gena, upper surface of pronotum and very small mid anterior area of mesoscutum – becoming paler on lower face, clypeus and mesosomal and metasomal sides and venter. Wings light grayish brown, just a bit darker at apex of basal cell and especially along dorsal half of marginal cell. Venation chestnut.

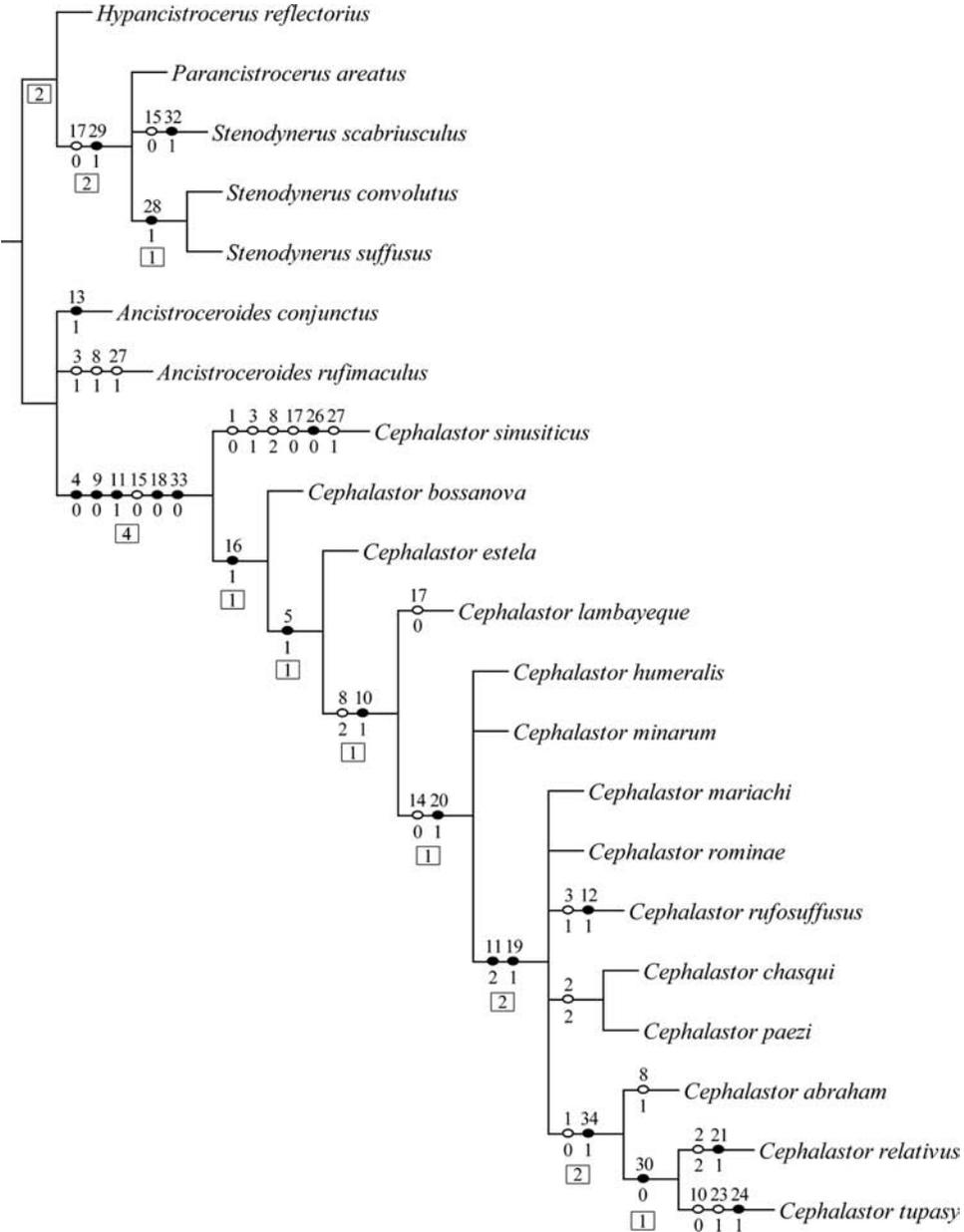


Figure 35. Strict consensus cladogram showing the relationships among species of *Cephalastor* with equal weighting of the characters (55 steps; consistency index = 0.67; retention index = 0.84). Notes: Black circles denote unique changes; white circles denote multiple changes; Bremer support values are presented inside rectangles below branches.

Dimensions: body from frons to apex of tergum II = 6.25 mm. Forewing length = 5.25 mm. Breadth of gena equivalent to 0.6 times the breadth of eye at emargination. Proportion of MOW:POL:OOL:MPOL equivalent to 1:2.5:2.5:1. Upper surface of tergum I 1.95 times wider than long.

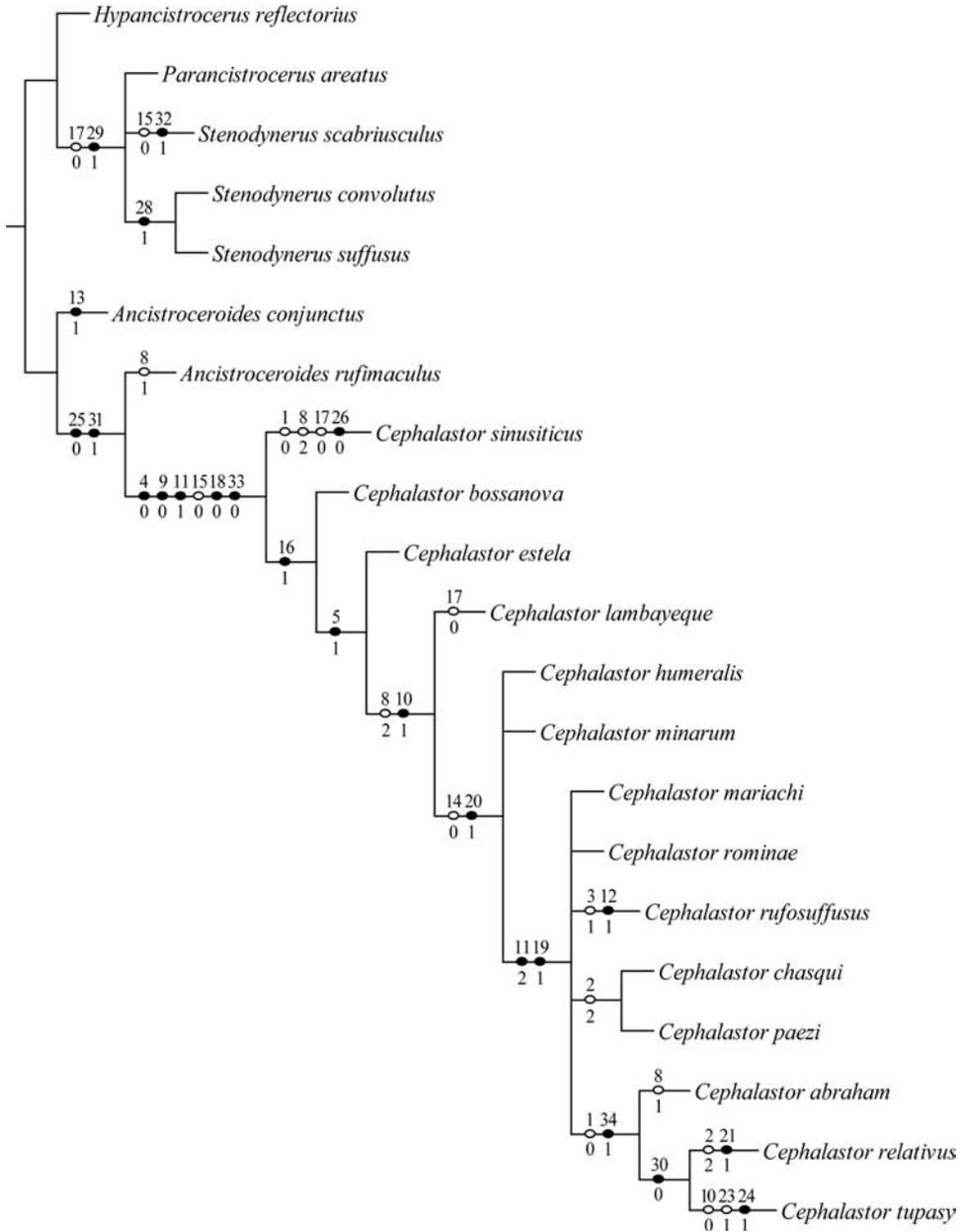


Figure 36. Cladogram showing relationships among species of *Cephalastor* with implied weighting of the characters (total fit of 245; 53 steps; consistency index = 0.69; retention index = 0.85). Notes: Black circles denote unique changes; white circles denote multiple changes.

Structure: head, clypeus and mesosoma very finely microgranulated as in other species of the genus. Clypeus evenly convex, bearing some rather sparse macropunctures separated by one to two diameters, just a bit flattened on top and shallowly depressed on apical area. Clypeal apex rather translucent and with margin shallowly

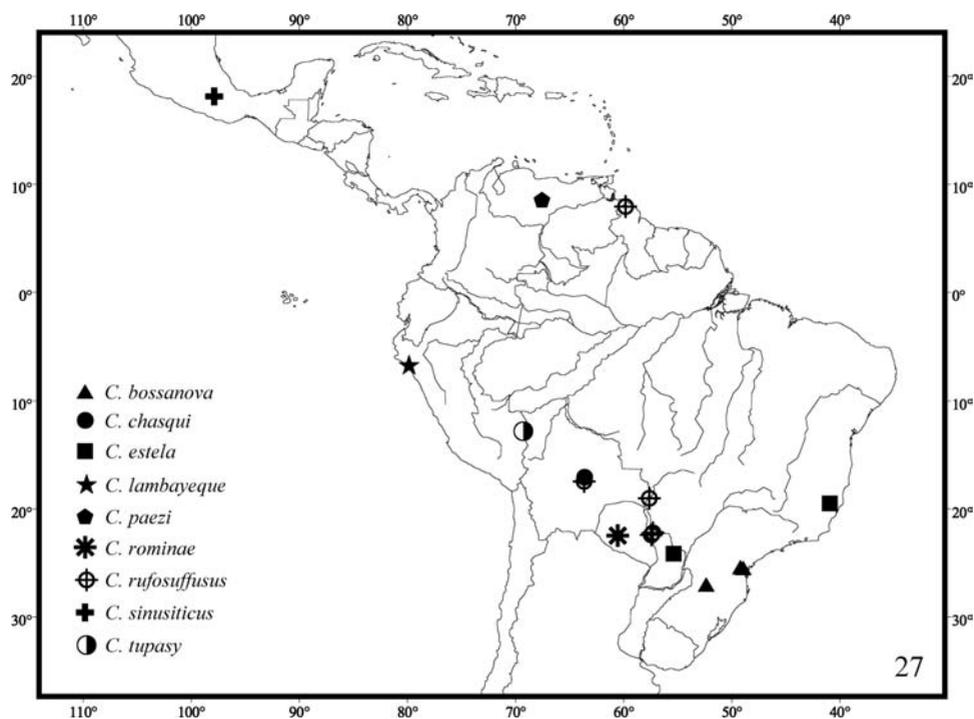


Figure 37. Collecting record map for species of *Cephalastor*.

concave between teeth, which are separated by just a little more than the interantennal distance. Head with macropunctures separated by 0.5–2 diameters, absent from yellow-marked areas, becoming thinner and sparser on upper gena and coarser over the posterior declivity. Vertex tubercles rather square and with a well-marked middle longitudinal depression; foveal brushes rather small and narrowly separated from each other, but very dense, obscuring the foveae, which are separated by about one diameter apart; posterior declivity slightly convex rather than plainly flat. Gena with a narrow precarinal depression widening down behind the lower ocular lobe. Occipital carina rounded at gena and almost straight medially.

Anterior surface of pronotum with some few almost indiscernible micropunctures sublaterally adjacent to the carina and macropunctures mostly concentrated in two submedial clusters. Pronotal fovea oval. Pronotal carina well developed, almost straight in dorsal view and forming a regular arc in frontal view. Humeral angle sharp and slightly pointing upwards. Posterior corner of pronotum with a slight but well-marked pretegular ridge-like fold, which nevertheless does not form a carina. Pronotal macropunctuation much coarser and denser than that of head; becoming denser at sides, with some confluent punctures. Tegulae smoothly reticulo-granulate, semicircular, with a few indiscernible punctures towards the anterior and posterior corners, and without developed outer rim. Macropunctuation of mesoscutum coarse and dense anteriorly (similar to that on the upper surface of pronotum), becoming markedly thinner and sparser posteriorly. Micropunctuation of mesoscutum rather dense and partially obscuring the microgranulation at lateral and posterior thirds.

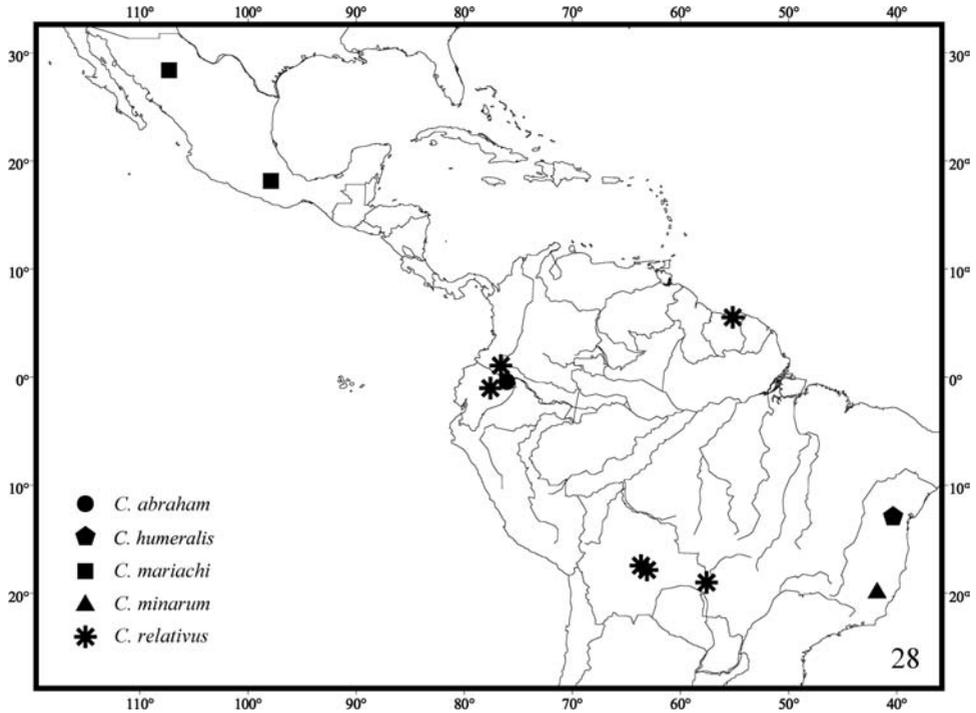


Figure 38. Collecting record map for species of *Cephalastor*.

Scutellum with broad anterior crenation, slight medial longitudinal depressed line and with macropunctuation similar to that of mesoscutum, though mostly absent from yellow-marked areas. Metanotum with well-marked toothed carina separating the anterior horizontal surface from the posterior almost vertical surface; both surfaces very coarsely striatopunctate/crenate. Mesepisternum irregularly punctate with sparse, small macropunctures. Metapleura and propodeum with very fine and dense microsculpture. Metapleura with almost no macropunctures apart from those along the anterior crenation. Upper surface of propodeum with very coarse and close elongate alveoles separated by thin careniform intervals and as wide as the horizontal surface of metanotum at middle. Lateral surface of propodeum covered with coarse flat-bottomed alveoles separated by thin, flat to slightly convex intervals. Posterior surface of propodeum with just some scarce thin macropunctures mostly present adjacent to the submedial carina. Submedial carina complete and lamelliform from propodeal angle down to the submarginal carina.

Transverse carina of tergum I sub-trapezoidal and shallowly emarginated on top in frontal view. Tergum I also with a low but regularly developed transverse tumescence crossing the middle of its upper surface. Sternum I with rather sharp basal transverse carina, higher than the longitudinal carina. Sternum II abruptly but roundly elevated sub-basally, preceded by a wide and longitudinally coarse striate groove in ventral view, and followed by a rather flat surface in lateral view. Micropunctuation of metasoma very fine and dense, scale-like (Figure 17), sparser on the middle of sternum II, and denser and coarser on terga and sterna III–VI.

Macropunctuation almost entirely absent from anterior surface of tergum I; coarsely alveolar on the upper surface of the same tergum, especially coarse and dense behind carina and tumescence; very coarsely alveolate with thin careniform intervals on sternum I, except for its mid-apical rim; very fine and sparse on tergum II, becoming denser and coarser towards the apical margin; regularly coarse and sparse on sternum II, with some coarser points close to the hind margin; quite dense but rather fine on terga III and IV apically, and very fine, obscure to almost completely absent on terga and sterna V and VI.

Male unknown.

Type material. Holotype female: BRAZIL: MINAS GERAIS: Ipanema, Fazenda Montes Claros, 19°45'S 41°50'W, 30.iv.1998, G. & C. Melo (DZUP).

Etymology. The specific epithet refers to the State of Minas Gerais in Brazil, where the specimen was collected.

New collecting records

Two new collecting records were found while examining the *Cephalastor* material deposited in the DZUP: *Cephalastor bossanova*: one female: BRAZIL: PARANÁ: Piraquara, Mananciais da Serra, 25°30'S 48°59'W, 28.iv.2001, G.A.R. Melo. *Cephalastor estela*: one female: BRAZIL: ESPIRITO SANTO: Baixo Guandu, 29.iv-6.v.1970, C. & C.T. Elias (Figures 37 and 38).

Phylogeny

List of characters used in the cladistic analyses of *Cephalastor*

- (1) Clypeal disc: (0) flat; (1) convex (Figures 1, 3 and 5)
- (2) Clypeus: (0) broader than long (Figures 1, 3 and 5); (1) longer than broad; (2) as broad as long
- (3) Apical margin of clypeus: (0) concave (Figures 1 and 3); (1) not concave (figure 5a in Garcete-Barrett [2001])
- (4) Cephalic foveae 1: (0) between compound eyes (Figures 20 and 21); (1) behind level of compound eyes (Figure 19)
- (5) Cephalic foveae between compound eyes (applicable only to terminals that received state 0 for Character 4): (0) one ocellar diameter behind level of lateral ocelli; (1) about half ocellar diameter behind level of lateral ocelli
- (6) Cephalic foveae 2: (0) with arc-like carina posteriorly (Figure 19); (1) without arc-like carina posteriorly (Figures 20 and 21)
- (7) Modified cuticle around cephalic foveae 1: (0) undefined (Figure 19); (1) well defined (Figures 2, 4, 6, 20 and 21)
- (8) Modified cuticle around cephalic foveae 2 (applicable only to terminals that received state 1 for Character 7): (0) single transverse elyptical (Figure 21); (1) single subcircular (Figures 4 and 20; figure 3c in Garcete-Barrett [2001]); (2) two small closely set (Figure 6)
- (9) Vertex: (0) with interocellar tubercles (Figures 1–6, 20 and 21); (1) without interocellar tubercles (Figures 19 and 22)

- (10) Interocellar tubercles (applicable only to terminals that received state 0 for Character 9): (0) separated by wide depression (Figures 1–6 and 21; figures 1c, 4b, 6c and 8c in Garcete-Barrett [2001]); (1) fused (Figure 20; figure 5b in Garcete-Barrett [2001]; figures 3c and 4c in Garcete-Barrett 2003)
- (11) Head posterior declivity: (0) convex; (1) slightly flattened; (2) concave
- (12) Gena: (0) broad (Figures 14–16 and 22); (1) narrow (Figure 23)
- (13) Anterior pronotal surface 1: (0) with foveae (Figures 2, 6–9, 19–21); (1) without foveae
- (14) Foveae of anterior pronotal surface (applicable only to terminals that received state 0 for Character 13): (0) contiguous to completely fused (Figures 6–9 and 20; figures 11, 2e, 4e and 5g in Garcete-Barrett [2001]); (1) not contiguous (Figures 19 and 21; figures 1e, 2e, 3h and 4f in Garcete-Barrett [2003])
- (15) Anterior pronotal surface 2: (0) punctate (Figures 2, 6–9, 21 and 23); (1) not punctate (Figures 19, 20 and 22)
- (16) Anterior pronotal surface 3: (0) concave (Figure 22); (1) convex (Figure 23)
- (17) Pronotal carina: (0) low obtuse dorsally; (1) sharp dorsally
- (18) Background microsculpture of head and dorsal mesosoma: (0) reticulo-granulate (Figures 1–6, 10–13, 21 and 23; figures 3e and 5e in Garcete-Barrett [2003]); (1) smooth (Figures 19, 20 and 22)
- (19) Mesoscutal micropunctuation 1: (0) abundant (Figure 11; figure 3e in Garcete-Barrett [2003]); (1) scattered (Figure 12; figure 5e in Garcete-Barrett [2003])
- (20) Mesoscutal micropunctuation 2 (applicable only to terminals that received state 0 for Character 19): (0) present throughout; (1) absent meso-anteriorly (Figure 11)
- (21) Tegula: (0) rounded (Figures 10–13; figures 2f, 3g, 4f, 5h, 6e, 7g and 8j in Garcete-Barrett [2001]); (1) campanulate (figure 1j in Garcete-Barrett [2001])
- (22) Outer margin of tegula: (0) expanded, hiding basalar sclerites (Figures 10–13); (1) not expanded, not hiding basalar sclerites
- (23) Basal angle of second submarginal cell: (0) acute (figures 5a, 5b and 5c in Garcete-Barrett [2003]); (1) straight (figure 5d in Garcete-Barrett [2003])
- (24) Second submarginal cell: (0) not petiolate (figures 5a, 5b and 5c in Garcete-Barrett [2003]); (1) petiolate (figure 5d in Garcete-Barrett [2003])
- (25) Metanotum: (0) cristate (Figures 27 and 30); (1) not cristate (Figures 26, 28 and 29)
- (26) Crests of metanotum (applicable only to terminals that received state 0 for Character 25): (0) slight (figure 1g in Garcete-Barrett [2003]); (1) strong (Figures 27 and 30; figures 2f, 3j, 4h, 5h and 5g in Garcete-Barrett [2003])
- (27) Propodeum dorsum: (0) with median shelf (Figures 26, 28–32); (1) without median shelf (Figure 27)
- (28) Concavity of posterior surface of propodeum: (0) enlarged, covering the entire face (Figures 26–28, 30–32); (1) reduced to median lower area (Figure 29)
- (29) Propodeum 1: (0) with submedian propodeal carina (Figures 26–28 and 30); (1) without submedian propodeal carina (Figure 29)
- (30) Propodeum 2: (0) with lateral propodeal carina (figures 1k and 2h in Garcete-Barrett [2001]); (1) without lateral propodeal carina (figure 3i in Garcete-Barrett [2001])

- (31) Propodeal valvula: (0) rounded (Figure 24); (1) square (Figure 25)
- (32) Tergum I: (0) with transverse carina (Figures 14–16, 25, 33 and 34); (1) without transverse carina
- (33) Disc of tergum I: (0) with transverse hump (Figures 14 and 16; figure 5e in Garcete-Barrett [2001]); (1) without transverse hump
- (34) Sternum II transverse furrow: (0) wide (figures 7e and 7f in Garcete-Barrett [2001]); (1) narrow (figures 3e and 3f in Garcete-Barrett [2001])

Table 1 presents a character matrix for the cladistic analyses of *Cephalastor*. The two most parsimonious cladograms were obtained under equal weights (strict consensus shown) and one under an implied weighting scheme (Figures 35 and 36). The trees were rooted between the clade *Hypancistrocerus reflectorius* (*Parancistrocerus areatus*, *Stenodynerus scabriusculus* (*Stenodynerus convolutus*, *Stenodynerus suffusus*)) and the remainder of the terminals in order to investigate a possible paraphyletic condition of *Ancistroceroides* and its relation with *Cephalastor*.

Despite the main goal of the analyses being to evaluate the character evolution and relationships among species of *Cephalastor*, some considerations about the outgroup are quite important as well. A clade composed by *Hypancistrocerus*, *Parancistrocerus* and *Stenodynerus* was recovered. A closer relation between *Parancistrocerus* and *Stenodynerus* was already observed by Carpenter and Cumming (1985) by the presence of foveae on the anterior pronotal surface, while *Hypancistrocerus* was not included in their analysis.

Ancistroceroides was not supported as monophyletic based on the species included in this study. The consensus tree under equal weights recovered a polytomy among *Ancistroceroides conjunctus*, *A. rufimaculus* and *Cephalastor*. Under the implied weighting scheme, *A. rufimaculus* was sister to the clade *Cephalastor*. Despite this small difference, we believe the cladogram in which the homoplasies were down-weighted (implied weighting scheme; Figure 36) is more stable and better supported (Goloboff et al. 2008), since a better indication to understanding the relationship within *Ancistroceroides sensu lato* and with related genera is expressed therein. In fact, the morphological heterogeneity of this genus is evident and might prove the parphyly of the taxon, although further investigation is needed.

The relationships within *Cephalastor* and the character state distribution were stable under both weighting schemes, except for some autapomorphies of *C. sinusiticus*. The monophyly of *Cephalastor* is supported in this study by five synapomorphies and one homoplasy as follows: the cephalic foveae located between the compound eyes (Char. 4 [0]), the presence of interocellar tubercles (Char. 9 [0]), the modified posterior declivity of the head (Char. 11[1]), the punctate anterior pronotal surface (Char. 15 [0]), the reticulo-granulate background microsculpture of the head and dorsal mesosoma (Char. 18 [0]), and the transverse hump on disc of tergum I behind the transverse carina (Char. 33 [0]). The presence of punctures on the anterior surface of the pronotum is a character state shared with several species of *Stenodynerus* and which was considered by Carpenter and Cumming (1985) as a synapomorphy for their *Stenodynerus-Microdynerus* component.

The topology obtained in the present analysis differs little from that of Garcete-Barrett (2003), with *C. sinusiticus* being sister to the remaining *Cephalastor* species. *C. bossanova* and *C. estela* were not recovered as sister species as previously done. The new species *C. humeralis* and *C. minarum* were placed in an intermediary position in

Table 1. Character matrix for the cladistic analyses of *Cephalastor*.

Terminals	Characters																																												
	1												2												3																				
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4											
<i>Ancistrocoeloides conjunctus</i>	1	0	0	1	-	1	1	0	1	-	0	0	1	-	1	0	1	1	0	0	1	0	0	0	1	1	0	0	1	1	0	0	1	0	0	1	0	0	1	0					
<i>Ancistrocerotoides rufimaculus</i>	1	0	1	-	1	1	1	1	-	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	0	0					
<i>Hypancistrocerus reflectorius</i>	1	1	0	1	-	0	0	-	1	-	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	1	-	0	0	0	1	0	0	1	0			
<i>Parancistrocerus areatus</i>	1	1	0	1	-	0	0	-	1	-	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	-	0	0	1	-	0	0	1	1	0	0	1	0	0			
<i>Stenodynerus convolutus</i>	1	1	0	1	-	0	0	-	1	-	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	-	0	1	1	0	0	1	1	0	1	0	1	0	0			
<i>Stenodynerus scabriusculus</i>	1	1	0	1	-	0	0	-	1	-	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	-	0	0	1	1	0	1	1	0	1	1	0	1	0	0			
<i>Stenodynerus suffusus</i>	1	1	0	1	-	0	0	-	1	-	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	-	0	1	1	0	0	1	1	0	0	1	0	0	1	0	0		
<i>Cephalastor abraham</i>	0	0	0	1	1	1	0	1	1	0	1	2	0	0	0	1	1	0	1	-	0	0	0	0	0	0	0	0	1	-	0	0	0	0	1	0	0	1	1	0	0	1	0	0	
<i>Cephalastor bossanova</i>	1	0	0	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Cephalastor chasqui</i>	1	2	0	0	1	1	2	0	1	2	0	0	0	0	1	1	0	1	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor estela</i>	1	0	0	1	1	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor humeralis</i>	1	0	0	1	1	1	2	0	1	2	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor lambayeque</i>	1	0	0	1	1	1	2	0	1	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor mar-tachi</i>	1	0	0	1	1	1	2	0	1	2	0	0	0	0	0	1	0	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor minarum</i>	1	0	0	1	1	1	2	0	1	2	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor paezi</i>	1	2	0	0	1	1	1	2	0	1	2	0	0	0	0	1	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor relativus</i>	0	2	0	0	1	1	1	2	0	1	2	0	0	0	0	1	1	0	1	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor rominae</i>	1	0	0	1	1	1	2	0	1	2	0	0	0	0	1	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor rufosuffusus</i>	1	0	1	0	1	1	2	0	1	2	0	1	0	0	0	1	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor sinustiticus</i>	0	0	1	0	0	1	1	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cephalastor tupasy</i>	0	0	0	1	1	1	2	0	0	2	0	0	0	0	0	1	1	0	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: -, inapplicable data.

the cladogram in an unresolved polytomy with a larger clade comprised by eight species (*C. mariachi*, *C. rominae*, *C. rufosuffusus*, *C. chasqui*, *C. paezi*, *C. abraham*, *C. relativus* and *C. tupasy*). This large clade is supported by two synapomorphies and has a Bremer support value of 2, and the same was also recovered in the analysis of Garcete-Barrett (2003). Most of this clade remains unresolved, despite for *C. chasqui* and *C. paezi* which were recovered as sister species and *C. abraham* that came out as sister to *C. relativus* + *C. tupasy*.

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