



Taxonomy of the Neotropical species of *Calythea* (Anthomyiidae: Diptera), with description of two new species from South America

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ABSTRACT

Calythea Schnabl & Dziedzicki has 15 known species distributed worldwide, including three species in the neotropics. The species of *Calythea* can be easily identified by having bright silvery grey-dusting on the thorax and abdomen, forming a contrasting pattern with the dark body. Herein, we describe two new species from the Neotropical region and present new records of the genus for Argentina, Brazil, Chile, Colombia, Ecuador and Peru. We also redescribe *Calythea comis* (Stein). In addition, we present an identification key for the Neotropical species and drawings of the terminalia and habitus images of the new species, *C. comis*, *C. crenata* (Bigot) and *C. micropteryx* (Thomson).

Introduction

Calythea Schnabl & Dziedzicki has 15 known species found in all biogeographical regions, including three species in the Neotropics (Griffiths, 1986; Evenhuis and Pape, 2021). Adults are floral visitors and larvae are known to eat mammalian faeces (Griffiths, 1986). The genus is composed of small flies with wing less than 5 mm long. They can be easily confused with small muscids and fanniids upon superficial inspection in having the lower calypter enlarged and a distally faint anal vein (Griffiths, 1986). The genus is very similar and closely-related to the more diverse genus *Pegoplata* Schnabl & Dziedzicki (Ackland, 1968; Griffiths, 1986; Michelsen, 1988; Gomes et al., 2021).

Calythea species can be recognized by a very characteristic bright silvery grey-dusting pattern on the thorax and abdomen, contrasting with the black body; the abdomen presents a transverse series of three basally connected black subtriangular marks at the anterior margin of each abdominal tergite (Malloch, 1934; Griffiths, 1986). The main characteristics of the genus are presence of interfrontal setae in females (also present in males of some species); female palpus enlarged; apex of scutellum ventrally setulose; scutellar apical setulae, when present, very fine, similar to the ventral setulae; a single long seta beyond middle

of posterodorsal surface of hind tibia, and large lower calypter, about 1.5 times larger than the upper one (Malloch, 1934; Griffiths, 1986).

The Neotropical species belong to the *Calythea micropteryx* group of species (Griffiths 1986) and the species of this group are very similar to each other, being properly identified only by examination of the male terminalia. The few studies on the Neotropical fauna consist of taxonomic lists of species (Malloch, 1934; Séguy, 1934; Albuquerque, 1953; Pont, 1974; Griffiths, 1986; Gomes et al., 2019).

Herein, we describe two new species of *Calythea*, one from Argentina and Brazil and the other from the Andean region of Colombia and Ecuador, including images and drawings. In addition, we present an identification key for Neotropical species.

Material and methods

We examined the type material of *Calythea micropteryx*; and non-type material from *C. comis*, *C. crenata*, and *C. micropteryx*. The material studied is deposited in the following institutions: Colección Entomológica de la Universidad de Antioquia, Medellín, Colombia (CEUA); Colección Nacional de Insectos, Ciudad de Mexico, Mexico (CNIN); Coleção Zoológica do Maranhão, Caxias, Brazil (CZMA);

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Padre Jesus Santiago Moure Entomological Collection, Curitiba, Brazil (DZUP); Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA); Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP); National Museum of Natural History, Washington, USA (USNM); Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRS); Maurice T. James Entomological Collection, Pullman, USA (WSU).

The morphological terminology followed Cumming and Wood (2017). The following abbreviations were used in the diagnoses, key, descriptions and redescrptions: *a* – anterior surface, *ad* – anterodorsal surface, *av* – anteroventral surface, *d* – dorsal surface, *p* – posterior surface, *pd* – posterodorsal surface, *pv* – posteroventral surface, *v* – ventral surface.

For examination of the male and female terminalia, the abdomen was removed from a dry specimen and was placed in cold potassium hydroxide (KOH) 10% for 24h to soften and lighten the parts. The abdomen was transferred to acetic acid, and then to glycerin. The postabdomen structures were separated from the rest of the abdomen. Examination and illustration of the structures were performed using a microscope and a stereomicroscope with a camera lucida attached to it. Dissected terminalia were placed in glycerin, inside microvials pinned beneath the respective specimens.

Images of specimens were obtained with sequential images mounting at different focal planes with a NIKON D610 digital camera coupled to a LEICA M165 C stereomicroscope. The images were stacked and edited using Adobe Photoshop CS6. The distribution map was produced using the software QGIS (available in: <http://www.qgis.org/en/site/>).

Results

Calythea Schnabl & Dziedzicki

Calythea micropteryx species group

Diagnosis. Male holoptic. Body black in general color, bright silvery grey-dusting pruinosity on thorax and abdomen (Figs. 1-3). Frontal vitta, antenna and palp black. Gena and parafacialia black with silvery pruinosity (Figs. 1a, 2a, d, 3a, d, g). Anepimeron, anepisternum,

and meron black, silvery pruinose (Figs. 2c, f). Prescutellar region, and postalar callus pruinose. Scutellum apically pruinose. Apical scutellar setae longer than basal and discal scutellar setae. Abdomen with 3 subtriangular dark spots basally connected on each abdominal tergite (Fig. 3c). Arista short pubescent. Presence of a keel on face, between antennae. Prosternum and katepimeron setulose. Meron bare or posteriorly setulose below spiracle. Katepisternum 1+2, covered by many long setae, including a differentiated seta discernible below the two posteriors one. Apex of scutellum ventrally setulose. Prealar short or absent. 1 supra-alars. 2 intra-alars. 2 postalars. Wing hyaline. Lower calypter 1.5 times larger than upper one. Fore tibia with one *a* seta. Hind tibia with 1 *av* (submedian), 2 *ad* (supramedian and submedian), 1 *d* (preapical), and a long *pd* (submedian) seta. Pulville small, similar to tarsomere width. Subcostal vein evenly bowed towards the Costal vein, without any sinuosity. Vein *dm-m* straight. Palpi claviform. Sternite 1 setulose. Sternite 5 with a serrated edge on its posterior incision (Figs. 4a, e, i, m, q). Cerci triangular on posterior view (Figs. 4b, f, j, n, r). Pregonite with two long setae, postgonite with a median long seta and distiphallus very large and rounded (Figs. 4d, h, l, p, t). Female: Dichoptic; body dark brown, palpi claviform, twice enlarged than male; interfrontal setae present. Thorax with 3-5 longitudinal stripes. Katepisternum 1+2, without several long covered setae. Pulville smaller, about half of tarsomere width. Epiproct as long as its wide, tergite 6 and 7 T-shaped dorsally (Figs. 5b, e, h, k). Hypoproct longer than wide, sternite 6 and 7 trapezoid (Figs. 5c, f, i, l). Three spermathecae, one smaller with about half diameter of the others.

Identification key to the males of *Calythea* Schnabl & Dziedzicki species from Neotropical Region

The Palearctic species *C. nigricans* Robineau-Desvoidy, 1830 was erroneously recorded from Neotropical Region (Pont, 1974), and *C. monticola* Bigot, 1885 occurs in the Nearctic Region of Mexico and United States (Griffiths, 1987). Both species were not included in the key. The species *C. costana* Séguy, 1934 is only known from its type-locality in Uruguay, this species probably is not an Anthomyiidae,

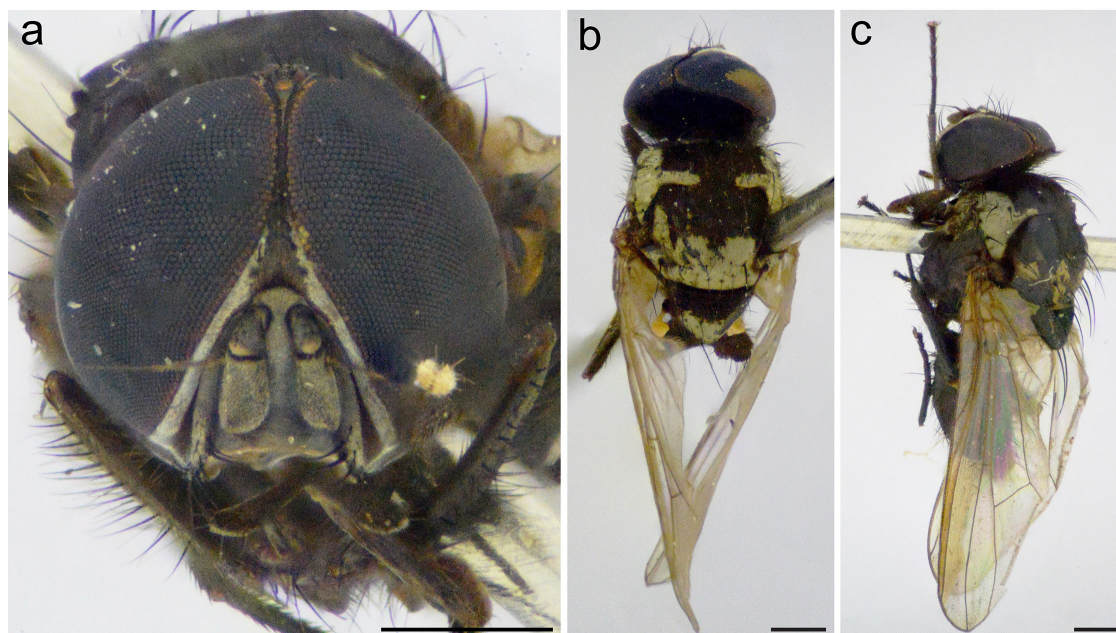


Figure 1 *Calythea andina* new species Male: head, frontal view (A); habitus, dorsal view (B); habitus, lateral view (C). Bar= 0.5 mm.

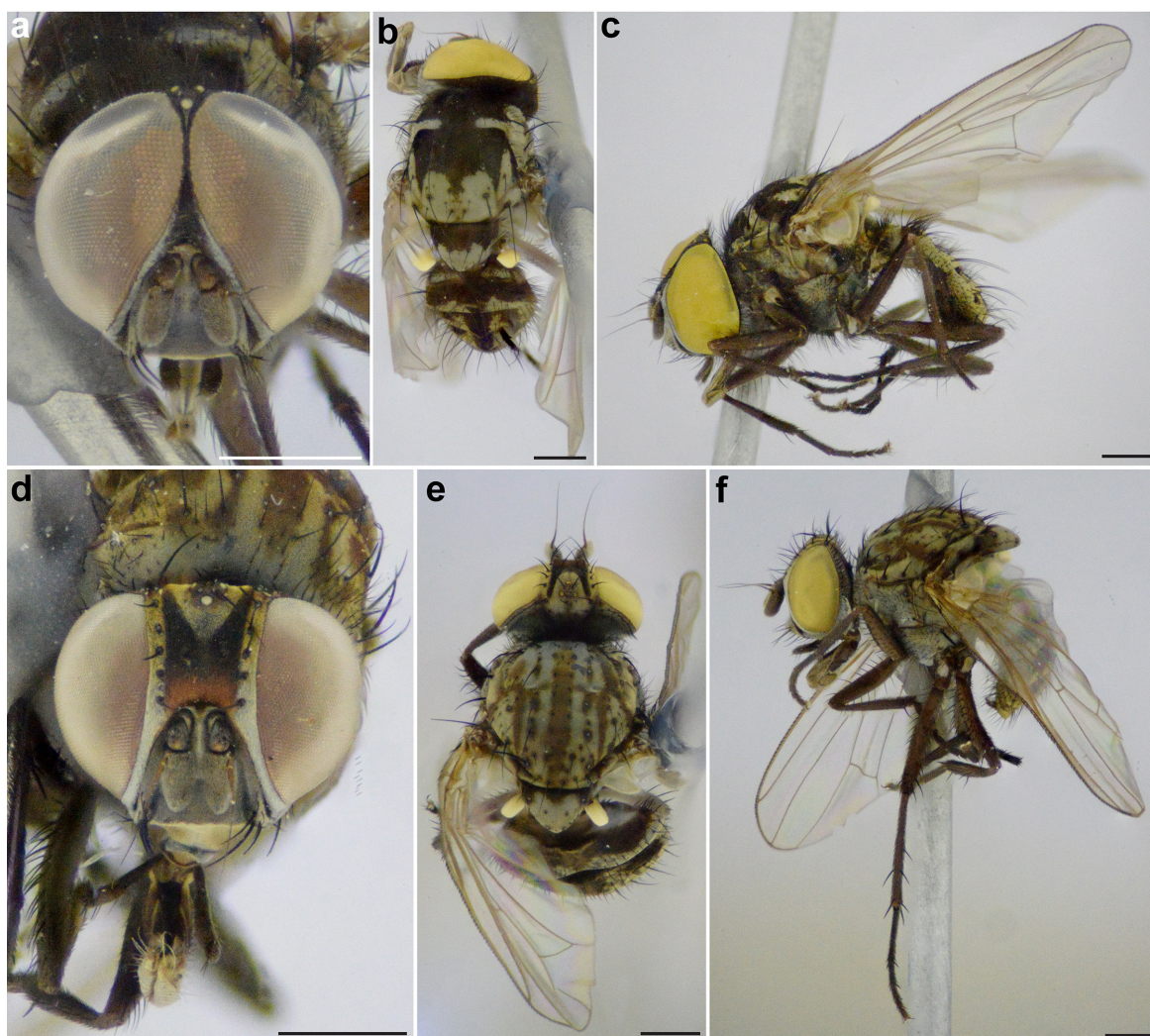


Figure 2 *Calythea cochlearis* new species Male: head, frontal view (A); habitus, dorsal view (B); habitus, lateral view (C); Female: head, frontal view (D); habitus, dorsal view (E); habitus, lateral view (F). Bar= 0.5 mm.

due to male terminalia and dorsocentrals setae 2+4, and also was not included in the key.

1. Eyes setulose; thorax without pruinose near transversal suture (Fig. 3e); hind tibia with a *pd* seta 4 times longer than tibia width *C. crenata* Bigot, 1885
 - Eyes bare; thorax with pruinose near transversal suture (Fig. 1b, 2b, 3b, 3h); hind tibia with a *pd* seta 2-3 times longer than tibia width 2
- 2 (1). Face not projecting beyond frontal angle 3
 - Face projecting beyond frontal angle 4
- 3 (2). Palpi enlarged; frons with fronto-orbital plates separated by frontal vitta (Fig. 3a); anterior anepisternal seta twice longer than covered cilia; thorax pruinose from transversal suture, with a forward projection, reaching the anterior dorsocentral presutural seta (Fig. 3b) *C. comis* Stein, 1911
 - Palpi slightly enlarged; frons at narrowest point with contiguous fronto-orbital plates (Fig. 3g); anterior anepisternal seta slightly longer than covered cilia; thorax pruinose from transversal suture, without forward projection, reaching anterior dorsocentral presutural seta (Fig. 3h) *C. micropteryx* (Thomson, 1869)
- 4 (2). Margin of calypters brownish; setulae on sternite 1 twice longer than length of sternite; postgonite distally not bilobate (Fig. 4d) *C. andina* new species
 - Margin of calypters whitish; setulae on sternite 1 slightly longer than length of sternite; postgonite distally bilobate (Fig. 4h) *C. cochlearis* new species

Calythea andina new species

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Diagnosis. *Calythea andina* new species can be separated from the other species of the genus in having the distance between the presutural acrostichal rows, at least the two first pairs of setae, similar to the distance to dorsocentral rows; calypters white, with apical half of upper calypter brownish, calypter margin basally brownish.

Description. Male holotype. Body length: 4.5 mm. Wing length: 4.5 mm.



Figure 3 *Calythea comis*. Male: head, frontal view (A); habitus, dorsal view (B); Female: habitus, dorsal view (C). *Calythea crenata*. Male: head, frontal view (D); habitus, dorsal view (E); Female: habitus, dorsal view (F). *Calythea micropteryx*. Male: head, frontal view (G); habitus, dorsal view (H); Female: habitus, dorsal view (I). Bar = 0.5 mm.

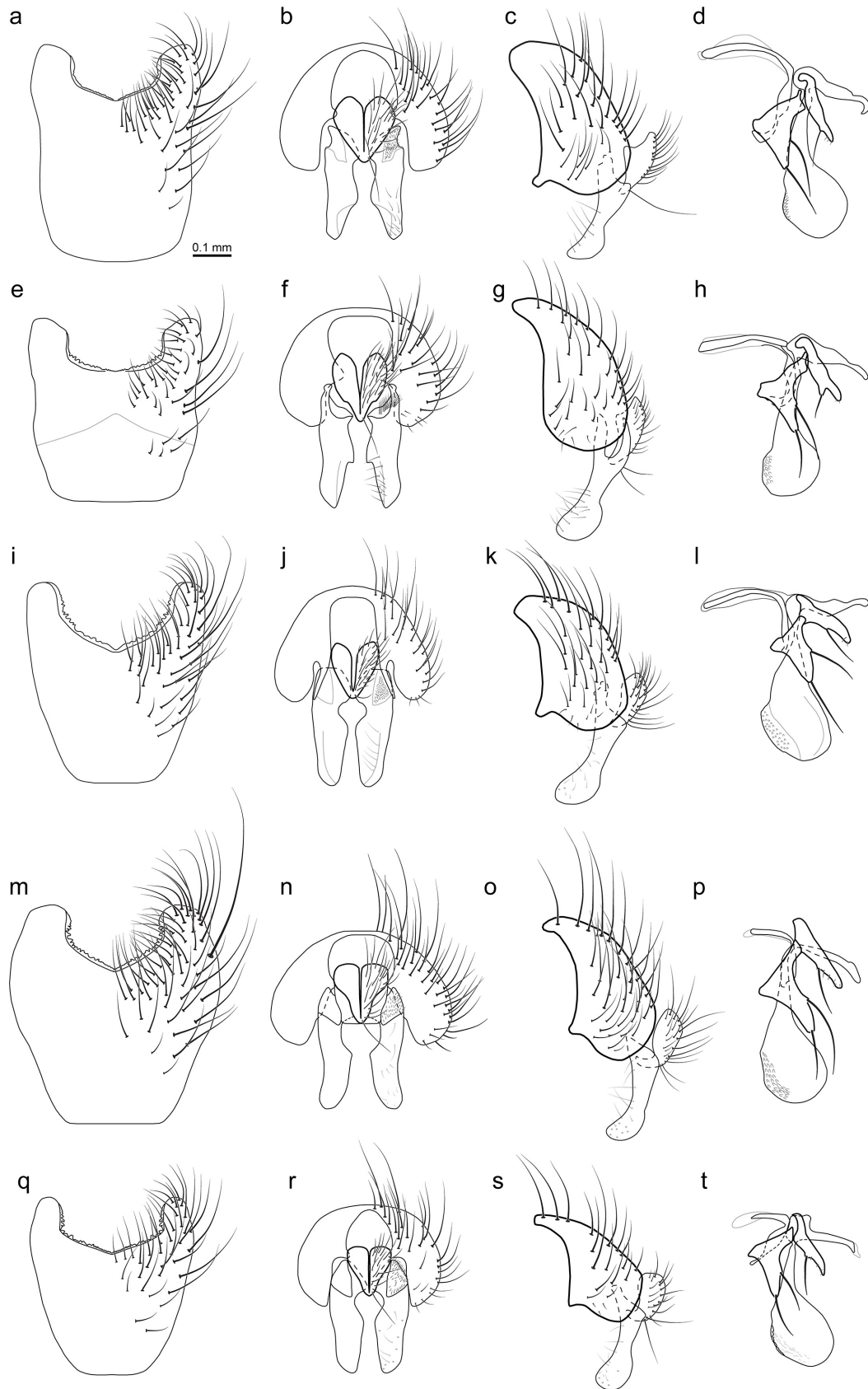


Figure 4 *Calythea* male terminalia: *C. andina* new species: sternite 5, dorsal view (A); epandrium, cerci and surstyli dorsal (B) and lateral (C) view; aedeagus and associated structures, lateral view (D). *Calythea cochlearis* new species: sternite 5, dorsal view (E); epandrium, cerci and surstyli dorsal (F) and lateral (G) view; aedeagus and associated structures, lateral view (H). *Calythea comis*: sternite 5, dorsal view (I); epandrium, cerci and surstyli dorsal (J) and lateral (K) view; aedeagus and associated structures, lateral view (L). *Calythea crenata*: sternite 5, dorsal view (M); epandrium, cerci and surstyli dorsal (N) and lateral (O) view; aedeagus and associated structures, lateral view (P). *Calythea micropteryx*: sternite 5, dorsal view (Q); epandrium, cerci and surstyli dorsal (R) and lateral (S) view; aedeagus and associated structures, lateral view (T).

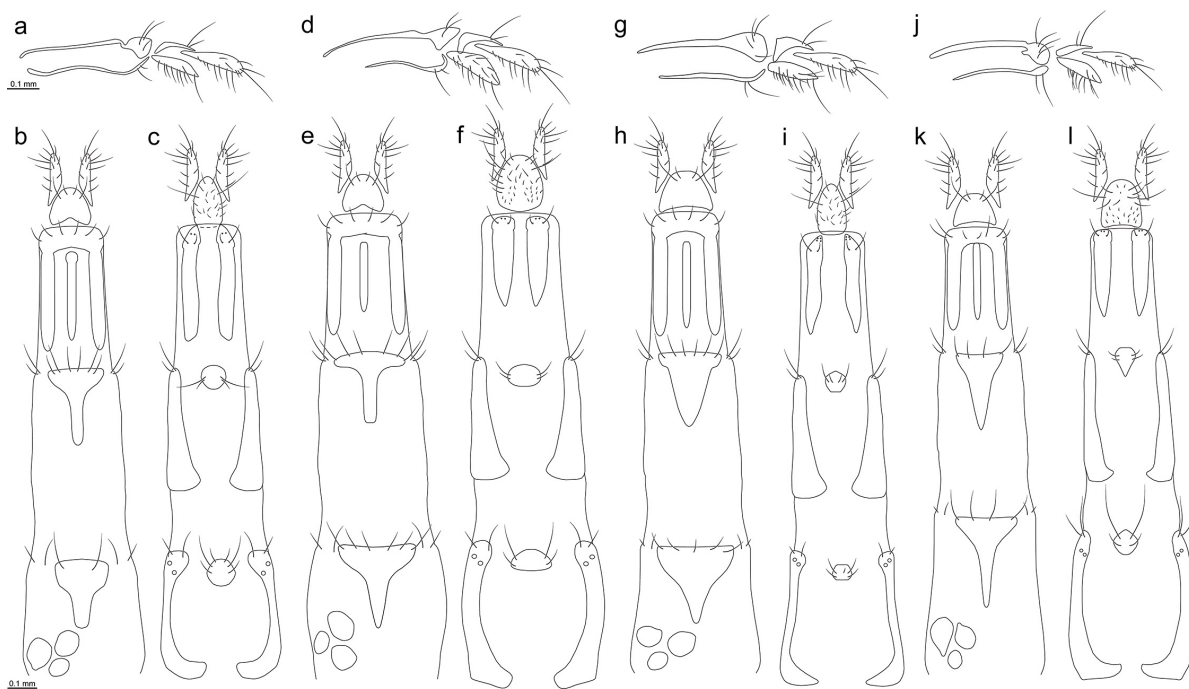


Figure 5 Ovipositor *Calythea*. *C. cochlearis* new species: lateral view (A), dorsal view (B) and ventral view (C); *C. comis*: lateral view (D), dorsal view (E) and ventral view (F); *C. crenata*: lateral view (G), dorsal view (H) and ventral view (I); *C. micropteryx*: lateral view (J), dorsal view (K) and ventral view (L).

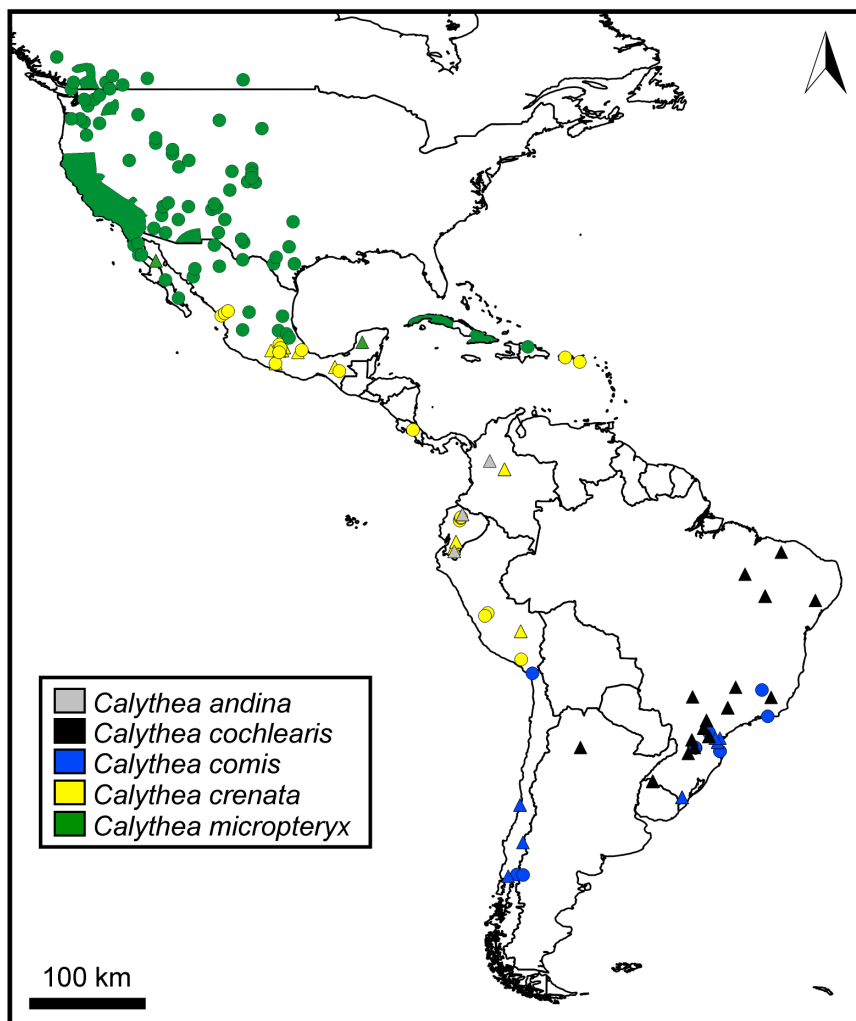


Figure 6 Map of *Calythea* species from Neotropical region. Circles= literature records; triangle= new records.

Thorax black, silvery pruinose on postpronotal lobe and notopleuron; pronotum pruinose basally, parallel to notopleural suture and extending to transverse suture (Fig. 1b). Calypters white with basal edge brown and apical edge white. Halter basally brownish and yellow apically. Legs black with pulvillus yellowish. Abdomen black, silvery pruinose on tergites 2-5, forming two dorsal almost triangular spots, segments 3 and 4 with prolonged spots laterally and apically.

Head. Eyes bare. Frontal vitta very narrow, distance between eyes shorter than width of anterior ocellus (Fig. 1a). 4-5 pairs of frontal setae. Face projecting beyond frontal angle. Gena shorter than length of pedicel. Parafacialia very narrow, with about 1/5 of postpedicel width. Postpedicel twice longer than pedicel. Pedicel with long dorsal setae, shorter than pedicel.

Thorax. 2 postpronotals; dorsocentrals 2+3; acrostichals 4+8 setulae-like, with only prescutellar developed; prealar absent. Anepisternum with row of 4 posterior setae and upward anterior seta below anterior notopleural seta. Scutellum with a pair of basal, preapical and apical setae; apical seta almost twice as long as basal seta. Meron with a tuft of 4-5 setulae. Katepimeron with 7-8 setulae.

Legs. Fore tibia with 1 submedian *p* seta; 1 preapical *d* seta, and 1 apical *pv*; fore pretarsus with 1 basal *v* seta. Mid femur with 4 *v* setae at base; and 2 *p* preapical setae; midtibia with 1 median *pv* seta, 1 submedian *p* seta; preapical seta on *av*, *d*, *pv*, and *v*. Hind femur with 2 *av* rows, 1 long and stout and 1 long fine; 2 *ad*, 2 *d*, and 1 *pd* preapicals; 1 *pv* row long and sparse setae; hind tibia with a submedian *av*, 1 supramedian and 1 submedian *ad*, and a long submedian *pd* seta three times longer than tibia width; preapical seta on *av* and *d*; hind pretarsus with 1 basal *v* seta.

Abdomen. With many covered setulae; sternite 1 setulose, setulae twice longer than length of sternite; tergite 3-5 with long median and lateral marginal seta, terminal segment with apical and discal setae; sternite 5 rectangular with a serrated edge on its posterior incision (Fig. 4a).

Terminalia. Cerci triangular from posterior view (Fig. 4b); surstyli, from posterior view, long and straight with rounded median projection on inner surface (Fig. 4b), and from lateral view, slightly curved and slightly enlarged apically (Fig. 4c); Hypopygium on lateral view with phalopodema long and slightly curved, pregonite with two long setae, postgonite with median long seta and three apical setulae, epiphallus distally curved and as long as postgonite, distiphallus very large and rounded (Fig. 4d).

Female. Unknown.

Etymology. The specific epithet *andina* refers to the Andean distribution of this species. The specific epithet *andina* (nominative, adjective feminine) is derived from the Andes Mountains, where the specimens were collected. Gender female.

Material examined. Holotype. Male. Ecuador. Imbabura, N. Perueho. Otavalo [0.2360, -78.2622], 2000m, L. E. Peña, i.1971 (MZUSP). Paratypes (3♂♂). Colombia. Antioquia, Alejandría [6.3759, -75.1414], A. Vélez, ii.1972, #catal 2005 (CEUA); Ecuador. Imbabura, N. Perueho. Otavalo [0.2360, -78.2622], 2000m, L. E. Peña, i.1971, (DZUP); Loja, La Toma, W. de Loja [-4.0081, -79.2110], 1500m, L. E. Peña, xi.1970 (MZUSP).

Distribution. Colombia and Ecuador (Fig. 6).

Remarks. There are some male specimens from Costa Rica with 2-5 setulae on meron, which probably belong to this new species (V. Michelsen, pers. comm.).

Calythea cochlearis new species

urn:lsid:zoobank.org:act:64E1A537-E4E1-4564-B65F-B76C90692EEC (Figs. 2, 4e-h, 5a-c, 6)

Diagnosis. *Calythea cochlearis* new species can be separated from the other species of the genus in having the distance between

the presutural acrostichal rows, at least the two first pairs, longer than their distance to dorsocentral rows; and postgonite bilobate.

Description. Male holotype. Body length: 4.2 mm. Wing length: 4.0 mm. Thorax black, silvery pruinose on postpronotal lobe and notopleuron; pronotum pruinose basally parallel to notopleural suture and extending to transverse suture (Fig. 2b). Calypters white with edge yellow. Halter basally brownish and yellow apically. Legs black with pulvillus yellowish. Abdomen black with silvery pruinose on tergites 2-5, forming two dorsal almost triangular spots, segments 3 and 4 with laterally and superiorly prolonged spots.

Head. Eyes bare. Frontal vitta very narrow, distance between eyes shorter than width of anterior ocellus (Fig. 2a). 6-7 pairs of frontal setae. Face projecting beyond frontal angle. Gena shorter than length of pedicel. Parafacialia very narrow, with about 1/5 of postpedicel width. Postpedicel twice longer than length of pedicel. Pedicel with a long dorsal seta, shorter than length of pedicel.

Thorax. 2 postpronotals; dorsocentrals 2+3; acrostichals 4+8 setulae-like, with only the prescutellar developed; prealar absent. Anepisternum with a row of 4 posterior setae and an upward anterior seta below anterior notopleural seta. Scutellum with a pair of basal, preapical and apical setae; the apical seta almost twice as long as basal seta. Meron with a tuft of 4-6 setulae, located posteriorly below spiracle. Katepimeron with 6-9 setulae.

Legs. Fore tibia with 1 submedian *p* seta; 1 preapical *d* seta, and 1 apical *pv*; fore pretarsus with 1 basal *v* seta. Mid femur with 4 *v* setae at base; and 2 *p* preapical setae; midtibia with 1 median *pv* seta, 1 submedian *p* seta; preapical seta on *av*, *d*, *pv*, and *v*. Hind femur with 2 *av* rows, 1 long and stout and 1 long fine; 2 *ad*, 2 *d*, and 1 *pd* preapicals; 1 *pv* row long and sparse setae; hind tibia with a submedian *av*, 1 supramedian and 1 submedian *ad*, and a long submedian *pd* seta three times longer than tibia width; preapical seta on *av* and *d*; hind pretarsus with 1 basal *v* seta.

Abdomen. With many covered setulae; sternite 1 setulose, setulae slightly longer than length of sternite; tergite 3-5 with long median and lateral marginal seta, terminal segment with apical and discal setae; sternite 5 quadrangular with a serrated edge on its posterior incision (Fig. 4e).

Terminalia. Cerci triangular from posterior view (Fig. 4f); surstyli, from posterior view, long and straight with an acute median projection on inner surface (Fig. 4f), and from lateral view, slightly curved and enlarged apically (spoon-like) (Fig. 4g); Hypopygium on lateral view with phalopodema long and slightly curved, pregonite with two long setae, postgonite bilobate with a median long seta and two apical setulae, epiphallus as long as postgonite, distiphallus very large and rounded (Fig. 4h).

Female. Similar to male, except: Body length: 4.0-4.5 mm. Wing length: 3.8-4.0 mm. Thorax with 3 conspicuous dorsal stripes, the central stripe twice wider than the laterals and exceeding the line of acrostichal setae; and 2 dotted strips on dorsocentral setae region between the central stripe and the laterals (Fig. 2e). Scutellum fully covered by pruinose, except basally on lateral region and dorsally on the basal third. Anepisternum with a row of 3 posterior setae. Meron with a tuft of 3-4 setulae, located posteriorly below spiracle. Katepimeron with 4-5 setulae. Terminalia with cerci dilated distally, with long setae; epiproct subtriangular, as long as its wide; hypoproct subconical, twice longer than its wide; sternite 6 and 7 trapezoid; tergite 6 and 7 T-shaped dorsally; sternite 8 as long as tergite 8 (Fig. 5a-c).

Etymology. The specific epithet refers to the spoon-like shape of the surstyli in lateral view (latin word *cochlearis* = spoon). Gender neuter.

Material examined. Holotype. Brazil. Paraná. Jundiá do Sul, Fazenda Monte Verde [-23.423531, -50.281910], Lev. Ent. PROFAUPAR, Malaise trap, 22.ix.1986 (DZUP 099249).

Paratypes (n= 55). Argentina: Tucumán, V. Padre Monti, Burruyacú [-26.4998, -64.7412], R. Golbach, 17.i-7.ii.1948, 1♂ (DZUP); Brazil: Maranhão. Parque Estadual Mirador, Base da Geraldina [-6.623888, -45.869166], J. A. Rafael & F. L. Oliveira, 28-30.ix.2006, 1♀ (INPA); Mato Grosso do Sul. Bodoquena Fazenda California [-20.698333, -51.881955], Van Someren modified, Lamas, C. J. E., 07-08.viii.2011, 1♀ (MZUSP); Minas Gerais. Araxá [-19.5934, -46.9411], C. T. & C. Elias, 22.xi.1965, 1♂ (DZUP 099242); Viçosa [-20.7536, -42.8761], G. R. Lima, 12.viii.1986 (N°68), 1♂ (DZUP); Paraná. Guarapuava, Est.Sta. Clara [-25.632814, -51.964977], Lev. Ent. PROFAUPAR, 15.ix.1986, 1♀ (DZUP 099273); Jundiá do Sul, Fazenda Monte Verde [-23.423531, -50.281910], Lev. Ent. PROFAUPAR, Malaise trap, 02.xi.1987, 1♀ (DZUP 099276); same label information, except: 22.ix.1986, 1♀ (DZUP 099280); 07.ix.1987, 1♀ (DZUP 099281); light trap, 04.x.1986, 2♂♂ (DZUP 099241; 099248); light trap, 02.ix.1986, 1♂ (DZUP 099243); Palmas, Linha Alegre, Fazenda Cerro Chato [-26.50252, -51.67033], Malaise, 1224m, M. Savaris & A. L. Norrbom, 3-4.iii.2015, 3♂♂ and 2♀♀ (DZUP); Ponta Grossa, V. Velha, IAPAR [-25.244012, -50.011530], Ganho & Marinoni, Malaise trap, 06.ix.1999, 1♀ (DZUP 099274); same label information, except: 10.vii.2000, 2♀♀ (DZUP 058573, 099275); 01.xi.1999, 1♀ (DZUP); 28.viii.2000, 1♀ (DZUP); Lev. Ent. PROFAUPAR, 18.viii.1986, 1♀ (DZUP 463152); Lev. Ent. PROFAUPAR, 01.x.1986, 1♀ (DZUP 058557); light trap, Lev. Ent. PROFAUPAR, 04.viii.1986, 1♀ (DZUP 099279); Lev. Ent. PROFAUPAR, 04.x.1986, 1♂ (DZUP 058550); Telêmaco Borba, Res. Biol. Klabin [-24.297941, -50.618785], Malaise trap, Lev. Ent. PROFAUPAR, 12.x.1987, 1♀ (DZUP 058495); Piauí. Guaribas, Parque Nacional Serra das Confusões, Andorinha; 09°08'27.8"S; 43°33'42.1"W, 515m, Malaise trap, J. A. Rafael & F. Limeira-de-Oliveira, 01-10.ix.2013, 1♂ (CZMA). Same label information, except: 11-20.viii.2013, 1♂ (CZMA); 20-31.viii.2013, 1♂ (DZUP); Piracuruca, P. N. de Sete Cidades, Posto ICMBio, 04°05'57"S; 41°42'34"W, F. Limeira-de-Oliveira & J. S. Pinto Júnior, 01-14.ii.2013, 1♂ (CZMA); Rio Grande do Sul. Quaraí [-30.384608, -56.448744], J. R. Cure, 21.xi.1985, 2♂♂ and 4♀♀ (DZUP 099239-40, 099269, 099277, 462901, 462909); Santa Catarina. Nova Teutônia [-27.1833, -52.3833], 300-500 m, Fritz Plaumann, 6.v.1961, 1♀ (MZUSP); São Paulo. São Carlos, EMBRAPA, Faz. Canchim [-21.954680, -47.847250], Airton S. Soares, xii.2010, 9♂♂ and 7♀♀ (MZUSP, 5♂♂ and 4♀♀; DZUP, 4♂♂ and 3♀♀); Sergipe. Canindé do São Francisco, Res. CHESF, Tabuleiro Argiloso Plano, área 1 [-9.6296, -37.8028], Malaise trap, Luciana Ianuzi, 14.ix.2000, 1♂ Projeto Xingó (DZUP).

Non-type material. Rio Grande do Sul. Quaraí [-30.384608, -56.448744], J. R. Cure, 19-20.xi.1985, 2♂♂ (DZUP 099251-52).

Distribution. Argentina (Tucumán) and Brazil (Mato Grosso do Sul, Minas Gerais, Paraná, Piauí, Rio Grande do Sul, Santa Catarina, São Paulo, Sergipe) (Fig. 6).

Remarks. Two male specimens from Quaraí (Rio Grande do Sul, Brazil) have the surstyli slightly narrower, this was considered as morphological variation and these specimens were not included as paratypes.

Calythea comis (Stein, 1911)

(Figs. 3a-c, 4i-l, 5d-f, 6)

Diagnosis. *Calythea comis* can be separated from the other Neotropical species of the genus in the frons with fronto-orbital plates separated by frontal vitta (Fig. 3a); distance between presutural acrostichal rows, even anteriorly in the first pair, shorter than their distance to dorsocentral rows; and pattern of pruinosity, which extends forward covering the region of dorsocentral setae, forming an inconspicuous stripe (Fig. 3b).

Redescription. Male. Body length: 4.5-5.0 mm. Wing length: 4.0-4.5 mm.

Thorax black with silvery pruinose on postpronotal lobe and notopleuron; pronotum pruinose basally running parallel to the

notopleural suture, extending to transverse suture with forward projection, reaching the anterior dorsocentral presutural seta (Fig. 3b). Calypters white with the edge yellow. Halter basally brownish and yellow apically. Legs black with pulvillus yellowish. Abdomen black with silvery pruinosity on tergites 2-5, forming two dorsal almost triangular spots, segments 3 and 4 with laterally and superiorly prolonged spots.

Head. Eyes bare. Frontal vitta narrow, distance between eyes subequal to width to anterior ocellus (Fig. 3a). 6-7 pairs of frontal setae. Face not projecting beyond frontal angle. Gena shorter than length of pedicel. Parafacialia relatively broad, with about 1/3 of postpedicel width. Postpedicel twice longer than pedicel. Pedicel with long dorsal setae, shorter than pedicel.

Thorax. 2 postpronotals; dorsocentrals 2+3; acrostichals 4+8 setulae-like, with only the prescutellar developed; prealar absent. Anepisternum with a row of 5 posterior setae and an upward anterior seta below anterior notopleural seta. Scutellum with a pair of basal, preapical and apical setae; the apical seta almost twice longer than the basal one. Meron with a tuft of 4-5 setulae, located posteriorly below spiracle. Katepimeron with 4-5 setulae.

Legs. Fore tibia with 1 submedian *p* seta; 1 preapical *d* seta, and 1 apical *pv*; fore pretarsus with 1 basal *v* seta. Mid femur with 4 *v* setae at base; and 2 *p* preapical setae; midtibia with 1 median *pv* seta, 1 submedian *p* seta; preapical seta on *av*, *d*, *pv*, and *v*. Hind femur with 2 *av* rows, 1 long and stout and 1 long fine; 2 *ad*, 2 *d*, and 1 *pd* preapicals; 1 *pv* row of long and sparse setae; hind tibia with a submedian *av*, 1 supramedian and 1 submedian *ad*, and a long submedian *pd* seta three times longer than tibia width; preapical seta on *av* and *d*; hind pretarsus with 1 basal *v* seta.

Abdomen. With many covered setulae; sternite 1 setulose, setulae twice longer than sternite length; tergite 3-5 with long median and lateral marginal seta, terminal segment with apical and discal setae; sternite 5 rectangular with a serrated edge on posterior incision (Fig. 4i).

Terminalia. Cerci triangular in posterior view (Fig. 4j); surstyli in posterior view long and straight, with proximal rounded incision (Fig. 4j), and in lateral view, slightly curved and slightly enlarged apically (Fig. 4k); Hypopygium in lateral view with phallopodema long and slightly curved, pregonite with two long setae, postgonite with a median long seta and two apical setulae, epiphallus as long as postgonite, distiphallus very large and rounded (Fig. 4l).

Female. Similar to male, except: Thorax with 3 conspicuous dorsal stripes, width of central stripe not exceeding the line of acrostichal setae; and 2 inconspicuous thin stripes close to central stripe, with about 1/5 the width of central stripe (Fig. 3c). Scutellum fully pruinose, except basally on lateral region. Anepisternum with a row of 3 posterior setae. Meron with a tuft of 3-5 setulae, located posteriorly below spiracle. Katepimeron with 3 setulae. Terminalia with cerci dilated distally, with long setae; epiproct subtriangular, as long as its wide; hypoproct subconical, 1.3 times longer than its wide; sternite 6 and 7 trapezoid; tergite 6 and 7 T-shaped dorsally; sternite 8 shorter than tergite 8 (Figs. 5d-f).

Material examined. Brazil: Paraná, Antonina, Reserva Sapitanduva [-25.439498, -48.746125], Lâmpada [light trap], Lev. Ent. PROFAUPAR, 02.xi.1986, 1♀ (DZUP 099272); Castro [-24.7978, -49.9976], S. Loroca, ix.1961, 3♂♂ (DZUP 099245-47); Curitiba [-25.4332, -49.2667], P. D. Hurd, xi.1959, 2♀♀ (DZUP 099270-71); same label information, except: 900m, Dept. Zoologia, 14.i.1986, 1♀ (DZUP 099278); Palmas [Palmas Grasslands Wildlife Refuge], 1115m, grasslands, -26.5025, -51.6755, A. C. Pereira, 9.xii.2013, 1♂ (DZUP); same label information except: 29.x.2014, 2♀♀ (DZUP); 28.iv.2014, 1♀ (DZUP); 16.i.2014, 1♂ (DZUP); 20.x.2014, 1♂ and 1♀ (DZUP); 29.x.2014, 1♀ (DZUP); inside forest, -26.5022, -51.6738, 12.vii.2014, 1♂ (DZUP); regeneration area, -26.5572, -51.5422, 03.xii.2013, 1♀ (DZUP); 21.ix.2012, 1♂ (DZUP); Tijucas do Sul, Morro

do Araçatuba, -25.8997, -49.0096, 1200 m, P. C. Grossi, 01.xi.2010, 2♂♂ and 22 ♀♀ (DZUP); Rio Grande do Sul, Arroio Grande, Distrito Mauá [-32.233483, -53.086682], Malaise trap, R. F. Krüger, 22.xi.2002, 2♀♀ (DZUP 099253; 099256); same label information, except: P. B. Ribeiro, 6♀♀ (DZUP 099259-64); 15.xi.2002, 2♀♀ (DZUP 099254-55); 07.ii.2003, 1♀ (DZUP 099257); 31.i.2003, 1♀ (DZUP 099258); Santa Catarina, Itajaí, EMPASC [-26.9534, -48.7358], C. Paloschi, ix.1988, 1♂ (DZUP 099244); same label information except: xi.1989, 4♀♀ (DZUP 099265-68). Chile: Bío-Bío, Lag. Laja [-37.4042, -71.3415], Luis Peñas, 13.ii.1957, 1♂ (WSU); Los Lagos, Maullín, Llanquihue [-41.2675, -73.0240], Luis Peñas, 16-21.ii.1957, 2♂♂ (WSU); Valparaíso, Laguna Verde [-33.1054, -71.6676], L. E. Peña, x.1969, 15♂♂ and 6♀♀ (MZUSP).

Distribution. Argentina (Río-Negro), Brazil (Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul*, Santa Catarina), Chile (Bío-Bío*, Los Lagos, Valparaíso*) and Peru (Tacna) (Malloch, 1934; Albuquerque, 1953; Pont and Ackland, 2009; Gomes et al., 2019) (Fig. 6). * = new records.

Remarks. The type-locality indicated as Tacna, Chile (Stein 1911; Pont and Ackland 2009) is a region that currently belongs to Peru. Some specimens from Chile have the body covered by pollen. There are some male specimens from Argentina, Brazil and Chile with 1-4 setulae on meron, which probably belong to this species (V. Michelsen, pers. comm.).

Calythea crenata (Bigot 1885)

(Figs. 3d-f, 4m-p, 5g-i, 6)

Diagnosis. *Calythea crenata* can be separated from the other species of the genus by the setulose eyes; face projecting beyond frontal angle; parafacialia very narrow, with about 1/5 of postpedicel width (Fig. 3d); thorax without pruinose near transversal suture (Fig. 3e); distance between presutural acrostichal rows twice longer than to dorsocentral rows; acrostichal setae thin, similar to covered setulae; hind tibia with a posterodorsal seta 4 times longer than tibia width.

Description. Female. Thorax with a dorsal stripe, covering the lines of acrostichal setae (Fig. 3f). Scutellum fully pruinose, except for a central triangle basally. Anepisternum with a row of 3 posterior setae. Meron with a tuft of 0-2 setulae, located posteriorly below spiracle. Katepimeron with 6-9 setulae. Terminalia with cerci dilated distally, with long setae; epiproct subtriangular, as long as wide; hypoproct subconical, twice longer than wide; sternite 6 and 7 trapezoid; tergite 6 and 7 subtriangular dorsally; sternite 8 slightly shorter than tergite 8 (Figs. 5g-i).

Material examined. Colombia: Boyacá, SFF [Santuario de Flora y Fauna] Iguaque Cabeña Chaina, 5.4166, -73.45, 2600m, P. Rema, 17.v-5.vi.2001, 1♂ (DZUP 099250); same label information, except: A. Roberto, 9-31.viii.2001, 1♂ (DZUP); A. Roberto, 31.viii-16.ix.2001, 1♀ (DZUP). Ecuador: Azuay, Portete de Tarqui, Sur de Cuenca [-2.9012, -79.0070], L. E. Peña, xii.1970, 3♂♂ and 2♀♀ (MZUSP); 1♂ (DZUP 462892); Loja, La Toma, W. de Loja [-4.0081, -79.2110], 1500m, L. E. Peña, xi.1970, 4♂♂ and 4♀♀ (MZUSP); Saraguro [-3.6217, -79.2380], 2900m, L. E. Peña, xi.1970, 5♂♂ and 1♀ (MZUSP). Mexico: Chiapas, Pueblo Nuevo, Arroyo Grande [17.1582, -92.8972], F. Árias, 15.xii.1985, 1♂ and 1♀ (CNIN); Guerrero, Omiltemi [17.5564, -99.6869], F. Árias, 10.vii.1985, 2♂♂ and 7♀♀ (CNIN, 1♂ and 4♀♀; DZUP, 1♂ and 3♀♀); same label information, except: 11.vii.1985, 2♀♀ (CNIN; DZUP); Hidalgo, km 90, Pachuca-Tampico [20.7961, -98.7091], F. Árias & R. Medina, 14.iii.1986, 2♀♀ (CNIN; DZUP); Mexico, Dexcanic Alto [19.4306, -99.1342], F. Árias, 29.iii.1986, 1♀ (CNIN); km15 carretera Periferica Ajusco [19.2155, -99.2468], J. Butze, 1.v.1979, 1♂ (CNIN); Mexico D.F. km30 carretera Sn. Gregorio-Oaxtepec, [19.2084, -99.0688], 2750m, J. Butze, 7.xii.1979, 2♂♂ (CNIN; DZUP); Tequesquahuac, C. Tlaloc [19.3987, -98.7085], J. Butze, 15.iv.1982, 1♂ and 1♀ (CNIN); Temascaltepec, Real de Arriba [19.0428, -100.2261], A. Cadena & L. Cervantes, 4.vi.1988, 1♀ (CNIN);

Morelos, Huitzilac [19.0313, -99.2671], E. Olucra, 17.xi.1978, 1♂ (CNIN); same label information, except: E. Ramirez, 18.vii.1984, 1♂ (CNIN); E. Jimenez, 17.xi.1978, 1♀ (CNIN); 2km NW, Huitzilac [19.0313, -99.2671], 2750m, J. Butze & A. Ibarra, 18.vii.1984, 3♂♂ (CNIN, 2♂♂; DZUP, 1♂); same label information, except: J. Butze & E. Ramirez, 4♂♂ (CNIN; DZUP); J. Butze & V. Hernández, 2♂♂ (CNIN; DZUP); A. Ibarra, 1♀ (CNIN); km 58 Carretera Xochimilco-Caxtepec [19.0397, -98.9562], J. Butze, 8.xii.1978, 1♀ (CNIN); Nicolas Zapata [19.0375, -98.9115], J. Butze, 6.xii.1978, 1♀ (CNIN); Veracruz, km 120 Autopista Puebla Orizaba [18.8358, -97.1389], 2800m, J. Butze, 17.vii.1978, 2♂♂ (CNIN; DZUP). Peru: Cuzco, Est. Biol. Wayqecha, jct. Trochas Schefflera & Picaflor [-13.17385, -71.58808], 2905 m, A. L. Norrbom, B. D. Sutton & O. Quispe, 1-12.vi.2012, 2♀♀ (DZUP, USNM); same label information, except: Campo de Futbol [-13.17445, -71.5880], 2900m, 4-7.vii.2016, 3♂♂ and 7♀♀ (DZUP, 1♂ and 3♀♀; USNM, 2♂♂ and 4♀♀).

Distribution. Colombia (Boyacá*), Costa Rica, Ecuador (Azuay*, Loja* and Pichincha), Mexico (Durango, Estado de Mexico*, Guerrero, Hidalgo, Mexico, Morelos, Sinaloa, Veracruz), Puerto Rico, Peru (Arequipa, Chanchamayo, Cuzco*, Tarma) and Saint Thomas Island (Stein, 1904, 1911; Curran, 1928; Albuquerque, 1953; Griffiths, 1986; Michelsen, 2010; Grisales et al., 2016) (Fig. 6). * = new records.

Remarks. Redescribed by Albuquerque (1953) and Griffiths (1986). The geographical information about the previous record from Colombia is only indicated as Colombia's Cordillera (Stein, 1904) and was not included in the map. The records from North America are based on Griffiths' (1986) map. There is morphological variation in the calypters of this species, which range from light to dark brown.

Calythea micropteryx (Thomson 1869)

(Figs. 3g-i, 4q-t, 5j-l, 6)

Diagnosis. *Calythea micropteryx* can be separated from the other species of the genus in having face not projecting beyond frontal angle; parafacialia very narrow, with about 1/5 of postpedicel width (Fig. 3g); distance between presutural acrostichal rows, except anteriorly in the first pair of setae, shorter than their distance to dorsocentral rows; hind tibia with a posterodorsal seta twice longer than tibia width. Also, this is the smaller neotropical species (body length: 3.3-3.5; wing length: 3.2-3.5).

Type-material examined. Paralectotypes. United States, California, Kinb., 3♂♂ (NHRS: 459 67; 464 67; 460 67).

Material examined. Mexico. Baja California, Golfo California, Isla Angel de la Guarda, Puerto Refugio [29.3407, -113.4311], F. Árias, 6.ii.1986, 1♂ and 1♀ (CNIN); Campeche, Grutas de Ixta, Cambilxunau [19.9911, -89.7642], F. Árias, 21.vi.1986, 1♂ (CNIN).

Distribution. Canada (Alberta, British Columbia, Manitoba); United States (Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, Wyoming); Mexico (Baja California Norte, Baja California Sur, Campeche*, Chihuahua, Hidalgo, Jalisco, Mexico, San Luis Potosí, Sonora, Zacatecas); Cuba, Dominican Republic (Griffiths, 1986; Michelsen, 2010) (Fig. 6). * = new record.

Remarks. Redescribed by Griffiths (1986). The records from North America are based on Griffiths (1986) map. The record from Costa Rica (Michelsen, 2010) is based on a misidentification (V. Michelsen, pers. comm.).

Discussion

The genera *Calythea*, *Pegoplata*, *Enneastigma* Stein, *Nupedia* Karl [= *Pegoplata*], and *Myopina* Robineau-Desvoidy, form a well-defined lineage known as *Nupedia*-group. The monophyly of this group is based

mainly on characteristics of the male terminalia, as the club-shaped and distally expanded distiphallus. The differentiated balloon-like distiphallus of *Calythea* is considered as being derived from the ground plan of this group (Hennig, 1976; Michelsen, 1988).

The short, but broad distiphallus, which is evenly sclerotized, with spinules on the distal region (Figs. 4d, h, l, p, t) and the surstyli short and spoon-like (Figs. 4c, g, k, o, s) are diagnostic of *Calythea*. The spoon-like surstyli are also present in few other species of the *Nupedia*-group (Hennig, 1976). In the drawings published by Séguy (1934) for *C. costana*, the structures in the male terminalia are difficult to identify and this species probably it is not an Anthomyiidae due to dorsocentrals 2+4 and male terminalia shape.

For the most part, while males can be identified based on their terminalia, the identification of females is more challenging, since the ovipositor is very similar among species. We observed differences in the sternite 8, which is shorter than tergite 8 in *C. comis* (Fig. 5d), *C. crenata* (Fig. 5g) and *C. micropteryx* (Fig. 5j), while in *C. cochlearis* the sternite 8 is subequal in length to tergite 8 (Fig. 5a). The remaining sternites are rounded to trapezoid and we observed variations in different specimens of the same species even from the same locality. Tergites 6 and 7 form a T-shape pattern dorsally (Figs. 5b, e, h, k). The epiproct is very similar among *C. cochlearis*, *C. comis*, *C. crenata*, and *C. micropteryx* (Figs. 5b, e, h, k), while the hypoprocts of *C. comis* and *C. micropteryx* (Figs. 5f, l) are wider than those of *C. crenata* and *C. cochlearis* (Figs. 5c, i).

Besides the terminalia, the species of *Calythea* present sexual dimorphism in the eyes and frons; and the pulvilli are slightly larger in males than in females (Griffiths 1986). In addition, the pruinose pattern of the thorax and abdomen differs between male and female, as well as the chaetotaxy of the katapimeron, katapisternum and meron. While the pruinosity of the thorax has some taxonomically important differences among species (see below), the abdomen of both male and female are very similar among species, without conspicuous differences that help in identification.

The pruinose pattern on the male thorax is similar among the studied species, with pruinosity on the notopleural region and two basal triangles on the posterior half of the dorsocentral setae region. While these basal triangles are connected in *C. andina* (Fig. 1b), *C. cochlearis* (Fig. 2b), and *C. micropteryx* (Fig. 3h), they are not connected in *C. comis* (Fig. 3b) and *C. crenata* (Fig. 3e). The region separating the triangles is two times wider in *C. comis*. In addition, the only species without pruinosity on the transversal suture, intra-alar and postalar setae regions is *C. crenata* (Fig. 3e). *C. comis* is the only species with the pruinosity extending to the dorsocentral setae region (Fig. 3b).

The pruinosity on the female thorax also differs among the studied species. *C. crenata* and *C. cochlearis* have a wider central stripe (Figs. 2e, 3f), when compared with *C. comis* and *C. micropteryx* (Figs. 3c, i). In addition, *C. comis* has three dorsal stripes, with two inconspicuous stripes near to the central one (Fig. 3c), while all three dorsal stripes of *C. micropteryx* are inconspicuous (Fig. 3i). The pattern of *C. cochlearis* diverges from all the other species by two dotted lines on the region of the dorsocentral setae (Fig. 2e).

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Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

CIBC and LRPQ designed the study. LRPQ made the images and illustrations. Both authors contributed to the writing, revised the manuscript, and approved the final version.

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