

Taxonomy of the South American genus *Phyllopetalia* (Odonata: Austropetaliidae)

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ABSTRACT

This synopsis of adult *Phyllopetalia* includes the synonymy of four genera (*Phyllopetalia* senior subjective synonym of *Rheopetalia*, *Odontopetalia*, *Eurypetalia* and *Ophiopetalia*), four species and one subspecies (*P. apicalis* senior subjective synonym of *Rheopetalia rex* and *R. apicalis decorata*, and *P. pudu* senior subjective synonym of *Ophiopetalia araucana*, *O. auregaster* and *O. diana*). *P. excrescens* and *P. alta-rensensis* are redescribed, and a neotype is designated for the latter. Keys to adults, illustrations of all diagnostic characters, and distribution maps of all species are provided.

INTRODUCTION

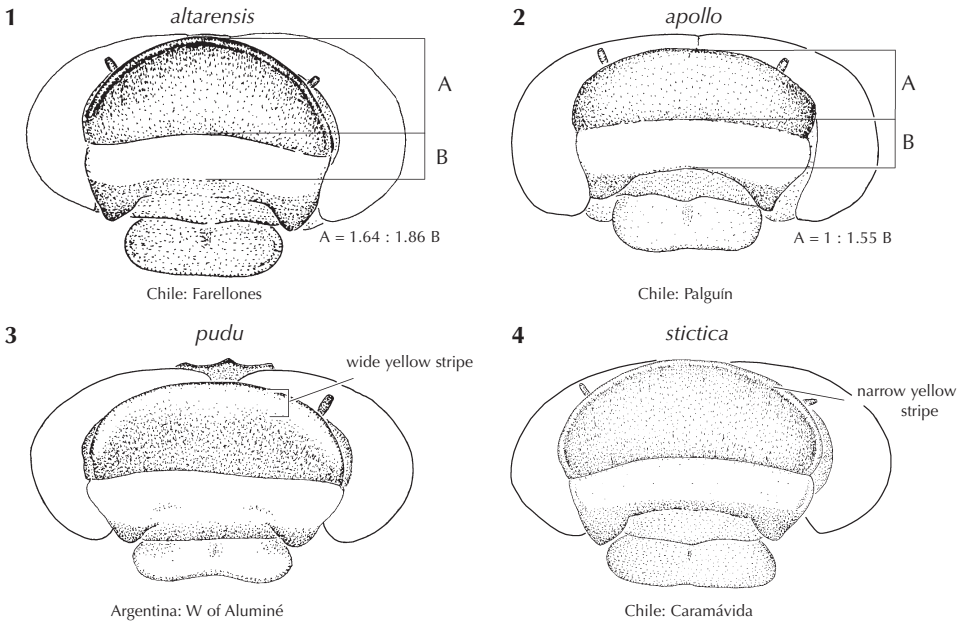
The family Austropetaliidae is distributed in the Austral or Notogeic biogeographic region, with representatives in Tasmania: *Archipetalia auriculata* Tillyard, 1917, Australia: *Austropetalia patricia* Tillyard, 1916 and *Austropetalia tonyana* Theischinger, 1995, and southern Chile and southwestern Argentina in South America. The number of described species and genera from southwestern South America was recently increased from five species and two genera to 11 and six, respectively (Carle 1996).

As Carle & Louton (1994) and Carle (1996) clearly pointed out, the taxonomic history of the family Austropetaliidae has been complex; the scattered literature on the group is plagued with misidentifications and errors that misled latter researchers (Selys 1858, 1859, 1878; Tillyard 1910; Fraser 1933, 1957; Schmidt 1941; Dunkle 1985). Austropetaliids were linked for many years to the libelluloid *Neopetalia punctata* (Hagen in Selys, 1854) within the family Neopetaliidae, which they resemble superficially in wing color pattern, until Carle & Louton (1994) made the aeshnoid lineage of Austropetaliidae evident and placed them in their own family.

Carle's revision (1996) was the first synoptic work since Fraser's (1933) to include all species of the family; in it he described four new subfamilies, two new tribes, four new genera, two new subgenera, seven new species, and revived two subspecies. Unfortunately, the diagnoses for his new genera and species were provided only in the keys, and his new names were not accompanied by any further descriptions or illustrations (in contravention to recommendation 16.F and general

recommendations 3, 5 and 8; International Commission on Zoological Nomenclature 1999). According to F.L. Carle (in litt.), most type specimens were lost in the mail and therefore never returned to the original collections or to the depository institutions (i.e. MNHS, USNM) indicated in his paper, making association of the new names to particular taxa very difficult or impossible for later workers.

The present study of the South American genus *Phyllopetalia* started in an attempt to solve this apparent nomenclatorial barrier and allow further research in the group. After examining all available specimens from different collections, numerous characters used in Carle's (1996) keys were found to be variable and diagnostic differences to represent intraspecific variability. As a result, four of his new species and the two subspecies are here synonymized (a fifth new species from Australia, *Austropetalia victoria* Carle, 1996 was synonymized with *A. tonyana* by Lohmann in 1996). After removing variable characters, Carle's (1996) four new genera are supported at most by just a few color or ratio characters, which in my opinion do not merit generic rank, and I treat them as junior synonyms of *Phyllopetalia*. A phylogenetic analysis based on sound characters, including if possible also larval and molecular characters, is necessary to establish the relationships between the species prior to even taking into consideration the possibility of naming species groups.



Figures 1-4: Head of four *Phyllopetalia* spp., frontal view, hairs omitted — (1) *P. altarensis* ♂; (2) *P. apollo* ♂; (3) *P. pudu* ♀; (4) *P. stictica* ♀.

MATERIAL AND METHODS

For each species synonymy, a diagnosis, a list of examined specimens, and distribution are provided.

All available type specimens of newly described taxa (Dunkle 1985; Carle 1996) were examined. The only names for which no type specimen is extant (F.L. Carle in litt.) are *Ophiopetalia auregaster* Carle, 1996 and *Eurypetalia altarensis* Carle, 1996; for the remaining names at least some paratypes or para- and allotypes are deposited in the USNM (*Ophiopetalia araucana* Carle, 1996, *O. diana* Carle, 1996, *Eurypetalia excrescens* Carle, 1996) and FSCA (*Phyllopetalia pudu* Dunkle, 1985). *O. auregaster* is here synonymized with *P. pudu* based on circumstantial evidence, and for *E. altarensis* a neotype is designated (deposited at MHNS) in order to provide stability to the name (Art. 75; International Commission on Zoological Nomenclature 1999).

All available specimens were examined to establish variability of characters, and diagnostic characters sensu Carle (1996) were tabulated per specimen for all species here synonymized (Tables 1, 2). Measurements are in mm. All characters were illustrated with the aid of a camera lucida and drawings are not to scale. Following characters were evaluated to determine specific status:

Head: Shape of occipital triangle; posterior margin either transverse (Figs 5, 6) or projected anteriorly (Figs 7-9), with (Figs 8, 9) or without (Fig. 7) a dorsally directed spine. Presence (Fig. 9) or absence (Figs 5-8) of post-occipital projections is diagnostic. Ratio antefrons (Figs 2A, 4A) : yellow stripe of postclypeus (Figs 2B, 4B) is diagnostic for some species pairs. Color of hairs at occipital triangle can be variable (i.e. *P. apollo* yellowish orange to yellow; *P. apicalis*, from all yellow, to black with some median yellow hairs, to all black; see Table 1). Color of labrum and frons can also be variable (light brown to yellow and black to reddish brown, respectively; frontal carina margined by a variable extent of yellow).

Thorax: Presence/absence and extension of mesanepisternal stripes (Figs 11, 13, 14) and of lateral spots or stripes on pterothorax (Figs 10, 12) is variable. Wing venation (Figs 15-25), color of wing spots (red to reddish brown) and their extension (i.e. in *P. apicalis* basal costal spots separated to confluent, distal costal spot covering from 1 to 20 cells, and relative size of nodal and pterostigmal spots are also variable (Figs 15-18; Table 1); in *P. pudu* (Table 2) a series of small subcostal spots at antenodal crossveins absent to present.

Abdomen: Presence/absence and extension of lateral flanges on S7-8 is diagnostic (Figs 28-35). Male cerci may lack (Fig. 40) or have (Figs 37, 38, 41) a sub-basal swelling or keel and a medio-ventral branch (Fig. 42), and their tips may be horizontal (Fig. 38) or upturned (Fig. 45). Female cerci and epiproct are intraspecifically variable, and can be rounded or pointed (Figs 67-74). Morphology of vesica spermalis and female ovipositor is of no diagnostic value, and neither is color pattern, displaying intraspecific variation in the extension and color of pale spots and stripes (see Tables 1, 2).

Under specimens examined, asterisks indicate those that have been illustrated. Maps represent distribution records from collections and reliable references. Maps were created electronically from the Digital Chart of the World (1:1,000,000) using ArcView 8.2. Elevation data and longitude/latitude coordinates were culled from the Global Gazetteer website <<http://www.fallingrain.com>> and placed into a Microsoft FoxPro data base linked to ArcView.

Acronyms used in the text are as follows:

- DRP – D.R. Paulson personal collection, Seattle, WA, USA
 FSCA – Florida State Collection of Arthropods, Gainesville, FL, USA
 RWG – R.W. Garrison personal collection, Sacramento, CA, USA
 MLP – Museo de Ciencias Naturales de La Plata collection, La Plata, Argentina
 MHNS – Museo Nacional de Historia Natural de Santiago collection, Santiago, Chile
 NVE – N. von Ellenrieder personal collection, Sacramento, CA, USA
 UCD – University of California-Davis collection, Davis, CA, USA
 UMMZ – University of Michigan, Museum of Zoology collection, MI, USA
 USNM – U.S. National Museum collection, Washington D.C., USA

Phyllopetalia Selys, 1858

Phyllopetalia Selys, 1858: 549 – type species: *P. stictica* Hagen in Selys, 1858 [by subsequent designation by Kirby 1890: 82].

Eurypetalia Carle 1996: 237 – type species: *E. altarensis* Carle, 1996 [by original designation]. New synonymy.

Odontopetalia Carle, 1996: 236-237 – type species: *O. apollo* (Selys, 1878) [by original designation]. New synonymy.

Ophiopetalia Carle 1996: 237 – type species: *O. diana* Carle, 1996 [by original designation]. New synonymy.

Rheopetalia Carle, 1996: 236 – type species: *R. rex* Carle, 1996 [by original designation]. New synonymy.

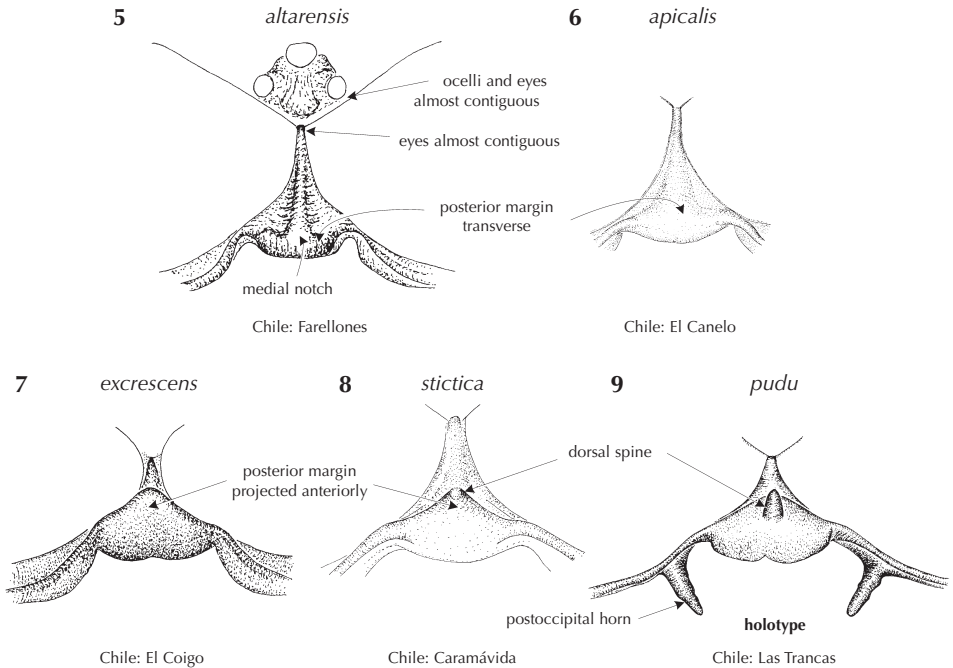
Generic diagnosis

Medium to large austropetaliids (total length 57-78 mm), known as ‘redspots’ (English common name) or ‘matapiojos con manchas rojas en las alas’ (Chilean common name). Characterized by (differences from other genera indicated in square brackets): eyes (Fig. 5) almost contiguous [separated by the width of median ocellus in *Archipetalia*]; lateral ocelli and eyes almost contiguous [separated by ocelli width in *Hypopetalia*, *Archipetalia* and *Austropetalia*]; posterior margin of occipital triangle either transverse (Figs 5, 6) or anteriorly projected (Figs 7-9), with (Figs 8, 9) or without (Fig. 7) a spine; pterothorax laterally with yellow stripes (Figs 10, 12) [with whitish spots in *Hypopetalia*], and dorsally with yellow stripes on smooth mesanepisternum (Figs 11, 13, 14) [lacking pale markings in *Hypopetalia*, and with coarse tubercles]; medio-dorsal carina on pterothorax of normal development [hypertrophied in *Hypopetalia*]; wings (Figs 15-25) with five (six when most basal one is divided into two) reddish spots along costal area [seven to eight in *Archipetalia*], brace vein at proximal end of pterostigma [proximal to pterostigma in *Hypopetalia*, near middle of pterostigma in *Austropetalia*]; and subtriangles with 1 cell [with 2-3 cells in *Hypopetalia*]; lateral margins of central depression of basal segment of vesica spermalis strongly uplifted (projected portion higher than segment height in lateral view), surpassing level of genital lobe in lateral view (Fig. 27) [lower in *Hypopetalia*]; contour of lateral projections of basal segment of vesica spermalis ‘U-shaped’ in posterior view [‘V-shaped’ in *Archipetalia*, *Austropetalia*]

and *Hypopetalia*]; male auricles oblong, about one and a half to twice as long as wide (Fig. 26) [about as long as wide in *Hypopetalia*], female lacking auricles [present in *Austropetalia*]; abdominal S7-8 with latero-ventral flanges in both males and females, those of S8 always well developed (Figs 28-35) [absent in females of *Archipetalia*; very narrow in *Hypopetalia*]; female sternum 10 with denticles (Fig. 66) [smooth in *Hypopetalia*].

Generic synonymies

All of the new genera proposed by Carle (1996), with the exception of *Eurypetalia*, are monotypic, and the characters used to diagnose them represent, in my opinion, nothing more than interspecific differences. The two species included in *Eurypetalia*, *E. altarensis* and *E. excrescens*, do share some of the characters mentioned in Carle's (1996) key, such as occiput not tripartite and ridgelike with anterodorsal spine, and male cerci without ventral keel-like spine. However, the occiput of *E. altarensis* (Fig. 5) is transverse as in *P. apicalis* (Fig. 6) and *P. apollo*, while in *E. excrescens* (Fig. 7) it is projected anteriorly as in *P. pudu* and *P. stictica* (Figs 8, 9), and the male cerci of *E. excrescens* (Fig. 44) have a strong sub-basal swelling as in *P. apollo* (Fig. 41), while in *E. altarensis* (Fig. 37) the swelling is weak. The remaining characters are variable, i.e. antefrons color varies from black to brown with or without a yellow stripe along antefrontal carina; basal blotch on wings is

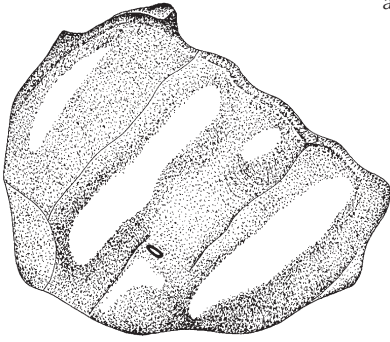


Figures 5-9: Occipital triangle of five *Phyllopetalia* spp., dorsal view, hairs omitted — (5) *P. altarensis* ♂; (6) *P. apicalis* ♀; (7) *P. excrescens* ♂; (8) *P. stictica* ♂; (9) *P. pudu* ♂.

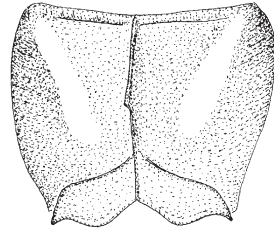
10

apicalis

11



Chile: Macul

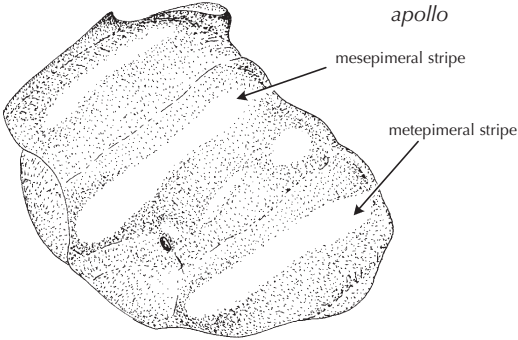


Chile: Manzano

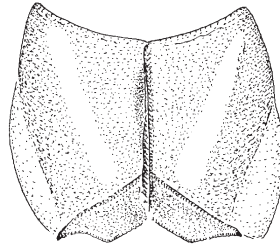
12

apollo

13



Chile: Palguín

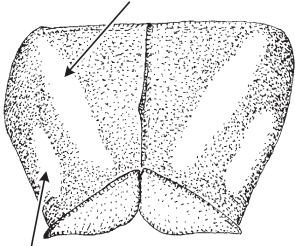


Chile: Palguín

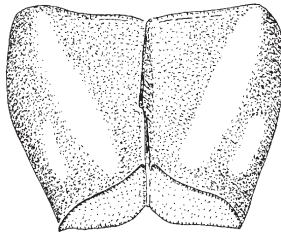
14

dorsal mesanepisternal stripe

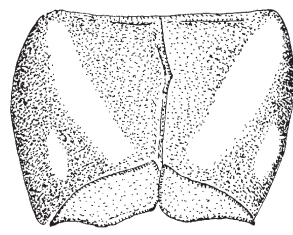
pudu



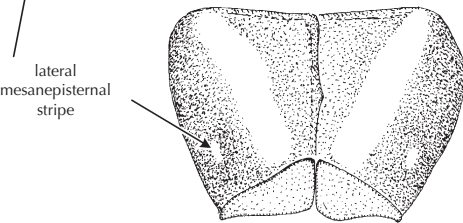
Argentina: Los Notros



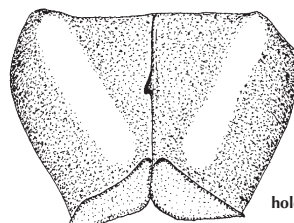
Argentina: Currhué



Argentina: Currhué



Argentina: W of Aluminé



Argentina: Las Trancas

holotype

Figures 10-14: Pterothorax of three *Phyllopetalia* spp., lateral and dorsal views — (10, 11) *P. apicalis* ♂10, ♀11; (12, 13) *P. apollo* ♂; (14) *P. pudu* ♂.

red wine to brown; dorsal mesanepisternal and dorsal abdominal stripes are yellow to yellowish-green or yellowish-blue; and widest point of S7 lateral flanges is variable. The relationships among the species are not yet clear, and the species included in *Eurypetalia* may not represent sister groups; i.e. adults of *P. excrescens* are more similar to *P. stictica* than to *P. altarensis*.

The characters Carle (1996) suggested for his new tribes Rheopetaliini, including *P. apicalis* and *P. apollo*, and Eurypetaliini, including *P. altarensis*, *P. excrescens*, *P. pudu* and *P. stictica*, were also found to be variable. Antefrons and postclypeus height ratio overlaps for *P. apollo* and *P. pudu* (see Table 4); ratio of frons : clypeus width without a clear gap in 'Eurypetaliini'; occiput is transverse not only in *P. apicalis* and *P. apollo* but also in *P. altarensis*; lateral thoracic yellow stripes are not always ventrally margined with black in *P. apollo*; mesepimeral stripes are not always strongly constricted above middle in *P. apicalis* and *P. apollo*; membranule development is variable; width : length ratio of S7 flange overlaps for *P. apollo* and *P. stictica* (0.15-0.22 in *P. apollo* and 0.17-0.24 in *P. stictica*); degree of development of dorsal stripes on S3-6 is variable; anal brace origin to cubito-anal crossvein varies from slightly proximal to slightly distal; male hind wing margin distal to tornus varies from almost straight to slightly concave (Figs 15-17, 19-21, 23, 25); ratio of male epiproct : cerci length follows a gradient without clear gap into two groups (i.e. epiproctal rami considerably distal to cerci tips in *P. apollo* (Fig. 41), distal in *P. apicalis* (Fig. 39), slightly distal in *P. altarensis* (Fig. 36), at about the same level in *P. excrescens* (Fig. 43), and proximal in *P. pudu* (Figs 48, 51, 56, 61) and *P. stictica*).

Key to adults of *Phyllopetalia*

1. Lateral flange of S8 semicircular, that of S7 rectangular and very narrow (Fig. 29) *P. apicalis*
- 1'. Lateral flanges of S7-8 both semicircular (Figs 28, 30-35) 2
2. Posterior margin of occipital triangle transverse (Figs 5, 6) 3
- 2'. Posterior margin of occipital triangle projected anteriorly (Figs 7-9) 4
3. Ratio height antefrons : postclypeus of about 1.08-1.55 (Fig. 2); male cerci with large medio-ventral branch (Fig. 42) and strong sub-basal swelling (Fig. 41) *P. apollo*
- 3'. Ratio height antefrons : postclypeus of about 1.64-1.86 (Fig. 4); male cerci lacking medio-ventral branch (Fig. 38) and with weak sub-basal swelling (Fig. 37) *P. altarensis*
4. Occipital triangle with antero-dorsal spine (Figs 8, 9); male cerci with sub-basal keel (Figs 46, 50, 53, 55, 58, 60, 63, 65) 5
- 4'. Occipital triangle lacking antero-dorsal spine (Fig. 7); male cerci with strong sub-basal swelling (Figs 41, 44) *P. excrescens*
5. Postocciput smooth (Fig. 8); lateral flange of S7 slightly wider than that of S8 (Figs 34, 35); antefrons black with narrow yellow stripe along carina (Fig. 1) *P. stictica*
- 5'. Postocciput with a pair of curved dorso-medial processes (Fig. 9); lateral flange of S7 slightly narrower than that of S8 (Figs 32, 33); anterior surface of antefrons with wide dorsal yellow stripe (Fig. 3) *P. pudu*

Phyllopetalia altarensis (Carle, 1996)

(Figs 4, 5, 20, 28, 36-38, 75)

Eurypetalia (Eurypetalia) altarensis Carle, 1996: 244 [type: Chile, Santiago Prov., Cordillera Santiago near Estero de Yerba Loca (La Leonera)], description of ♂, ♀ in key.

Specimens examined

Total number: 2 ♂. — Chile, Metropolitan region, Santiago Prov.: 1 ♂ designated as neotype (see below); 1 ♂ Farellones, 1,800-2,200 m, Ugarte leg., xii 1997 (MHNS*).

Diagnosis

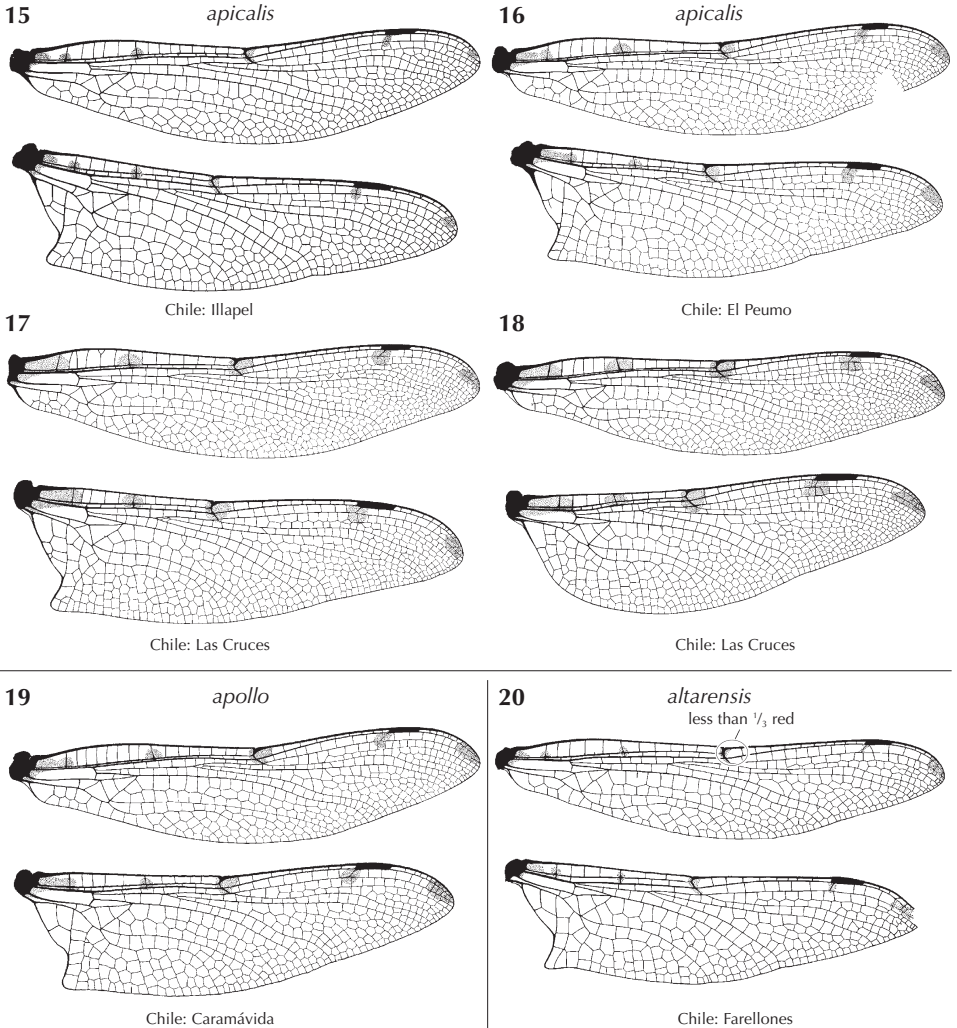
Transverse posterior margin of occipital triangle (Fig. 5) separates this species from *P. excrescens*, *P. pudu* and *P. stictica*, in which it is projected anteriorly (Figs 7-9); sub-equal semicircular flanges of S7-8 (Fig. 28) separate it from *P. apicalis*, in which S7 flange is rectangular and very narrow (Fig. 29), and male cerci lacking medio-ventral branch and with weak sub-basal swelling (Figs 39, 40) separate it from *P. apollo*, in which they have a prominent medio-ventral branch and a strong sub-basal swelling (Figs 41, 42), as well as higher antefrons relative to postclypeus, with a ratio of 1.64-1.86 vs 1.08-1.55 respectively (Fig. 4 vs 2).

Comments

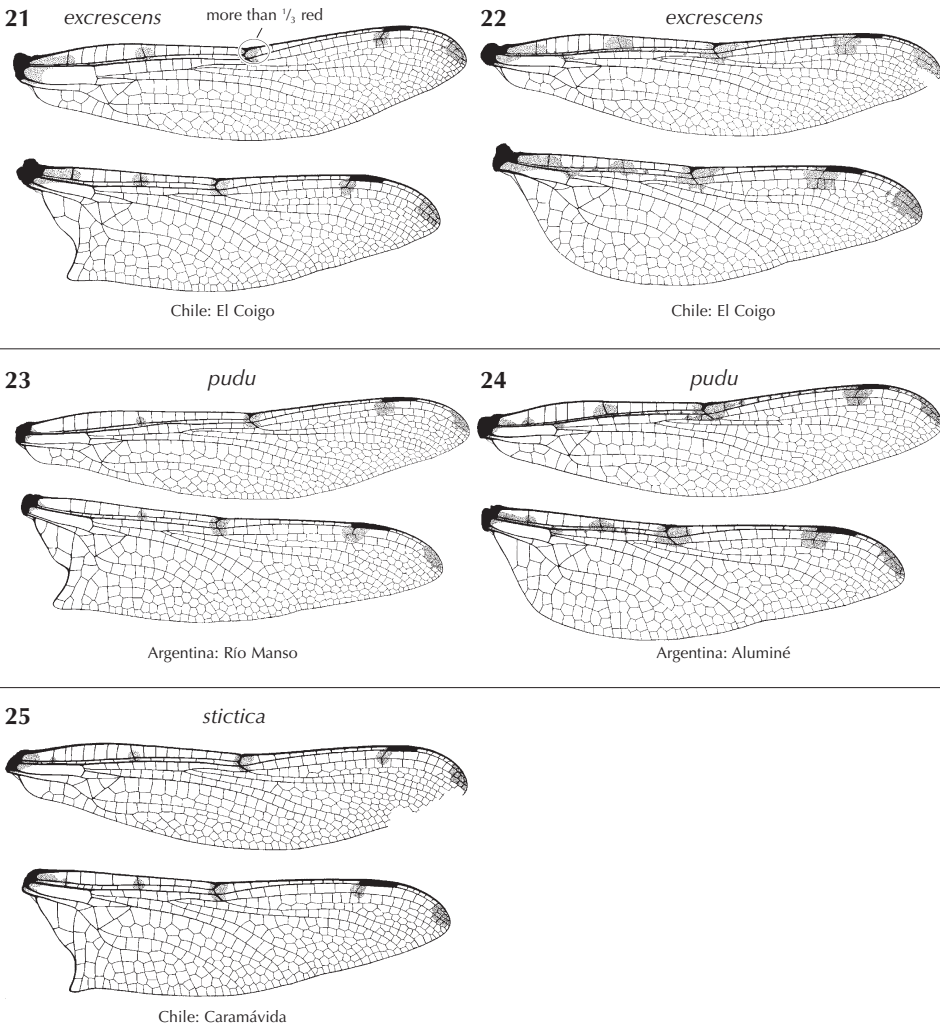
Of all the characters mentioned by Carle (1996) to differentiate *P. altarensis* from *P. excrescens*, only the shape of the posterior margin of the occiput was found to be reliable in the small series of specimens of both species examined here (see Table 3). The horizontal surface of the frons is more convex in *P. altarensis* than in *P. excrescens*, but this character is hard to quantify. Color of antefrontal carina was found to be intraspecifically variable, as well as color of occipital setae. Only one female of *P. excrescens* and none of *P. altarensis* was available for examination, so it was not possible to determine if the differences mentioned for females in wing color – brown blotches on subcostal area present vs absent – and abdominal color pattern – distance separating dorsally abdominal longitudinal stripes and extension of lateral stripes on S2 – are of diagnostic value at the specific level. I was also unable to determine if they are intraspecifically variable, as is the case for these characters in other species of the genus (i.e. *P. apicalis*, *P. pudu*). Extension of costal red spot in the first postnodal cell of males seems to be different also (less than $\frac{1}{3}$ red in *P. altarensis*, Fig. 20; more than $\frac{1}{3}$ red in *P. excrescens*, Fig. 21), but examination of a larger series of specimens may show intermediate values, as extension of red spots has been found variable in other species, i.e. *P. apicalis* and *P. pudu* (see Tables 1, 2). Shape of male cerci is diagnostic, with tips horizontal in *P. altarensis* and upturned in *P. excrescens*, and sub-basal surface with weak swelling in *P. altarensis* vs with strong swelling in *P. excrescens*; however, the description provided by Carle (1996) is inadequate, since the ratio between cercus basal width and width at mid-length for the two species overlaps (Table 3). The ratio width : length of the medial portion of the epiproct distal to the epiproct apical branches ('epiproctal shelf') was also found to be slightly different between the two species, but the measurements do not agree with Carle's tabulations (Table 3), and examination of a larger series of specimens may show this character to be variable.

Neotype designation

The holotype of this species was stated to be deposited at the USNM collection (Carle 1996), but it never reached that Institution according to its curators (N. Adams & O. Flint in litt.), nor is to be found at the Natural History Museum in Chile (A. Camousseigh in litt.). According to F. Carle (in litt.) it was unfortunately lost in the mail in transit from Chile to the Smithsonian Institution in the USA.



Figures 15-20: Wings of three *Phyllopetalia* spp., right pair — (15-18) *P. apicalis* ♂15-17, ♀18; (19) *P. apollo* ♂, (20) *P. altarensis* ♂.



Figures 21-25: Wings of three *Phyllopetalia* spp., right pair — (21, 22) *P. excrescens* ♂21, ♀22; (23, 24) *P. pudu* ♂23, ♀24; (25) *P. stictica* ♂.

As first revisor I feel the necessity to designate a neotype in order to define the nominal taxon objectively and ensure that all future researchers have access to the name-bearing specimen at a recognized scientific collection in case of nomenclatural questions.

Neotype and type locality by present designation: ♂ from Chile, Metropolitan region, Santiago Prov., Farellones (33°17'S, 70°15'W; 1,800 m), Fichet leg., xii 1988 (MHNS). No specimens from the type series are available (F. Carle in litt.), and in consequence the specimen selected as neotype is the one in best preservation state. The type locality 'Farellones' is located at the same latitude as the holotype locality and separated by only 3 minutes of longitude.

Redescription of neotype male (Table 3, Figs 28, 36-38)

Head: labium and labrum pale brown; anteclypeus brown, postclypeus brown with wide yellow stripe at dorsal $\frac{2}{3}$ of its extension; antefrons reddish brown, with a faint yellowish stripe along antefrontal carina, postfrons pale brown medially, reddish brown to the sides. Occipital triangle transverse, with a medially notched posterior ridge (as in Fig. 5); postoccipt smooth.

Thorax: legs black except for reddish brown basal $\frac{4}{5}$ of femora. Pterothorax reddish brown, dorsally with pale yellow, complete, and almost straight mesanepisternal stripes diverging basally; laterally with pale yellow, complete, and almost straight mesepimeral and metepisternal stripes and a dorsal pale yellow metepisternal spot, all of them margined with dark brown; mesepimeral stripe slightly constricted at distal third. Wings with five reddish costal spots (larger than those in Fig. 20), the basal one almost completely divided into two in FW, incompletely divided in HW.

Abdomen: reddish brown, with some dark areas dorsally, carinae, margins of auricles and flanges black, and paired dorsal and lateral pale yellow stripes at basal portion of S2-8, only small paired dorsal and lateral basal spots on S9. Genital fossa and vesica spermalis as described for the genus (as in Figs 26, 27). Flanges of S7-8 semicircular and of subequal width (Fig. 28). Cerci tips horizontal, and sub-basal surface with weak swelling (Figs 36-38).

Distribution

33°17' – 33°34'S, 70°15' – 70°34'W, 630-2,200 m a.s.l. (Fig. 76) – Chile: Metropolitan region, Santiago Prov.: El Canelo (Carle 1996); Las Condes (Carle 1996); Estero Yerba Loca, 1,900 m (Carle 1996); Farellones (MHNS).

Biology

Carle (1996) reported males feeding amid tree tops or low brush; one male was captured while resting obliquely on a twig ca 6 m from the ground, and the only known female while ovipositing in soft herbaceous plants at the head of a steep sloped seep. Recorded flight period extends from October to December. According to Carle (1996) the larvae are semi-terrestrial, and he found them at a single small seepage slope. Larvae remain undescribed. Due to its restricted distribution in a highly populated area, where the larval habitat is threatened by mining, grazing, recreational development, and diversion of streams and springs for irrigation (Carle 1996), this species was included in the Red List as endangered (IUCN 2005).

Phyllopetalia apicalis Selys, 1858
(Figs 6, 10-11, 15-18, 29, 39-40, 70-71, 75)

Phyllopetalia apicalis Selys, 1858: 550 [type: Valdivia, Chile], unknown number of ♂; — Kirby (1890: 82, mention from Chile); — Ris (1904: 21, record from Chile, Valdivia); — Schmidt (1915): 121-122, 125, 129, 132-133, 137, 139, 152, 154, 158, 186, 188, fig. 4, description and illustration of ♂ secondary genitalia); — Navás (1918: 212, record from Los Perales, Marga-Marga, Chile); — Martin (1921: 22, record from Chile); — Fraser (1933: 221-222, fig. 8, redescription

and illustration ♂ caudal appendages); — Schmidt (1942: 242-244, figs 6a, 6c, 6d, key, redescription); — Needham & Bullock (1943: 358-359, key); — Herrera et al. (1956: 81, 85, figs 9, 30, mention from Santiago, Chile, key, illustration labium and wings); — Fraser (1957: 155, 159, 163, record from El Canelo, Chile, key); — Dunkle (1985: 195-198, fig. 1, key, illustration male cercus, diagnosis from other species of genus); — Jurzitza (1989b: 12, distribution, information on habitat, flight period and behavior); — Carle (1996: 242-243, diagnosis in key); — Muzón (1997: 132, listed from Chile); — Steinmann (1997: 232, listed from Chile).

Petalia apicalis (Selys). — Hagen (1861: 313, mention from Valdivia, Chile); — Hagen (1877: 56, mention from Valdivia, Chile).

Phyllopetalia decorata McLachlan in Selys, 1878: 695-696 [type: Chile], description based on 1 ♂; — Kirby (1890: 82, mention from Chile); — Ris (1904: 21, record from Chile); — Martin (1921: 22, record from Chile); — Pirion (1933: 81, record from Marga-Marga); — Fraser (1933: 221-222, synonymy with *P. apicalis*); — Needham & Bullock (1943: 358-359, key); — Fraser (1957: 161, synonymy with *P. apicalis*); — Jurzitza (1989b: 13, distribution, information on flight period).

Neopetalia decorata (McLachlan in Selys). — Herrera et al. (1956: 81, mention from Lo Aguirre, Santiago, Chile).

Rheopetalia apicalis (Selys). — Carle (1996: 242, diagnosis in key).

Rheopetalia apicalis apicalis (Selys). — Carle (1996: 242-243, diagnosis in key, designation of ♂ from Valdivia, Chile, in Hagen's collection at MCZ as lectotype).

Rheopetalia apicalis decorata (McLachlan in Selys). — Carle (1996: 243, diagnosis in key).

Rheopetalia rex Carle, 1996: 236, 242 [type: Curicó Prov.: Las Tables at Puente Los Morongos], diagnosis in key. New synonymy.

Specimens examined

Total number: 55 ♂, 13 ♀. — Chile: Coquimbo region, Elqui Prov.: 1 ♀ Cerro La Campana, Jerez leg., 18 x 1977 (MHNS); 2 ♂ 8 km N of Laguna Dam, 2,440 m, Ross & Michelbacher leg., 05/06 xii 1950 (FSCA); Limarí Prov.: 1 ♂ Río Los Molles, Andes mountains, 2,400 m, C. Cook leg., 26 xi 1963 (DRP); Choapa Prov.: 1 ♂ Hacienda Illapel, El Bato, 900 m, L. Peña leg., 20 x 1958 (UMMZ*). Valparaíso region, Los Andes Prov.: 1 ♂ Los Andes, 784 m, B. Aborich leg., ix 1940 (FSCA). Metropolitan region, Santiago Prov.: 3 ♂ Colina, 573 m, xi 1966 (MHNS); 1 ♂ Farellones, Villa Paulina, 1,800 m, Cerdá leg., 11 i 1981 (MHNS); El Peumo, 464 m, 1 ♂, 1 ♀ 20 xi 1949 (MLP), 3 ♂, C. Cook leg., xii 1961 (DRP, FSCA, RWG*), 3 ♂ Perez de Arce leg., 13 ii 1974 (MHNS), 1 ♂ xi 1949 (MHNS); 1 ♂ Valle San Ramon, 1,610 m, 16 xi 1953 (MHNS); 1 ♀ La Obra, Roitman leg., 17 xii 1968 (MHNS); Macul, 648 m, 3 ♂ Ramírez leg., 27 xi 1967 (MHNS), 1 ♂ 27 ii 1967 (MHNS), 1 ♂ L. Peña leg., xii 1976 (RWG*), 1 ♂ J.E. Barriga leg., 22 xii 1979 (RWG), 2 ♂ same data (NVE*), 5 ♂ same data (MLP), Peñalolén, 1,200 m, 1 ♂ xi 1954 (UMMZ), 1 ♂ 01 xi 1945 (MHNS), El Canelo, 970 m, 1 ♂, 1 ♀ Valencia leg., 09 xi 1975 (MHNS), 1 ♂ Valencia leg., 16 xi 1953 (MHNS), 1 ♂ Valencia leg., xii 1952 (MHNS), 6 ♂, 1 ♀ L. Peña leg., 23/29 xi 1954 (UMMZ*); Cordillera Prov.: 1 ♀ El Clarillo, river to the S of Santiago, flowing S of El Maipo River, 1,100 m, L. Peña leg., 18 xi 1953 (UMMZ*); 2 ♂, 1 ♀ El Manzano, 896 m, L. Peña leg., 25/28 x 1951 (UMMZ*). Maule region,

Curico Prov.: 3 ♂ El Coigo, deep forest in Andes, 800 m, L. Peña leg., x 1959 (UMMZ); 1 ♀ El Coigo, Cordillera de Curico, 800 m, L. Peña leg., x 1964 (USNM); Talca Prov.: 1 ♂ Cuesta Zapata, Fichet leg., 29 x 1987 (MHNS); Linares Prov.: 2 ♂, 2 ♀ Las Cruces, Cordillera Parral, 162 m, L. Peña leg., 01/31 x 1958 (RWG*), 3 ♂, 2 ♀ Las Cruces, Andes in Parral Cordillera, 162 m, L. Peña leg., x 1958 (UMMZ*); 1 ♀ Tranque de Bullileo, 800 m, M. & D. Davis & B. Akersbergs leg., 10/12 i 1979 (USNM). — Unknown region/Prov.: 1 ♂ Alcahuaz, 12 x 1992 (MHNS).

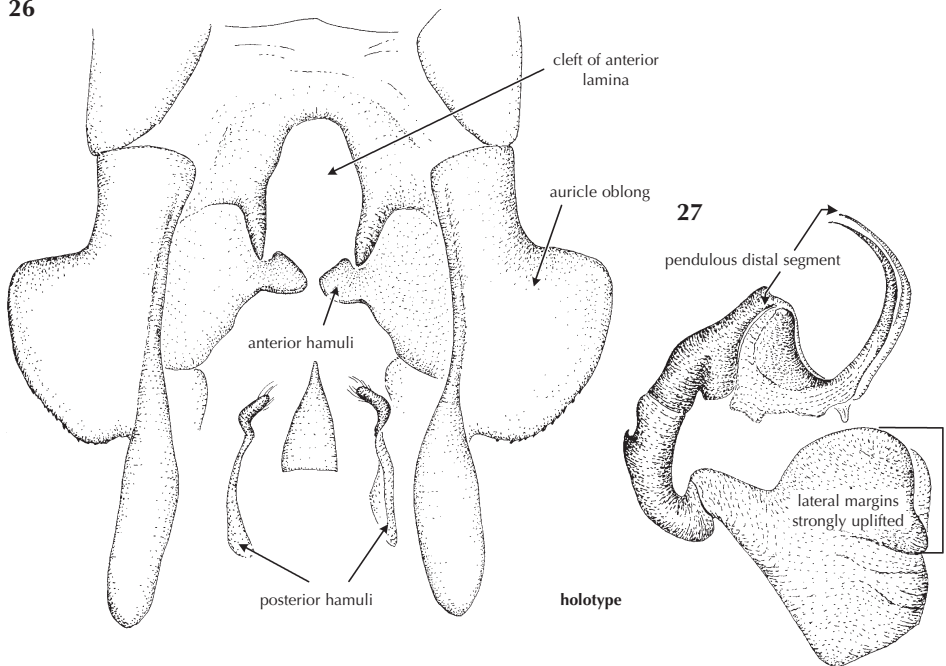
Diagnosis

Lateral flange of S7 rectangular and narrow (Fig. 29) and sub-basal surface of male cerci lacking any swelling or keel (Fig. 40) are unique for this species.

Synonymies

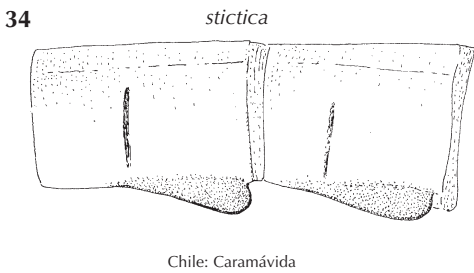
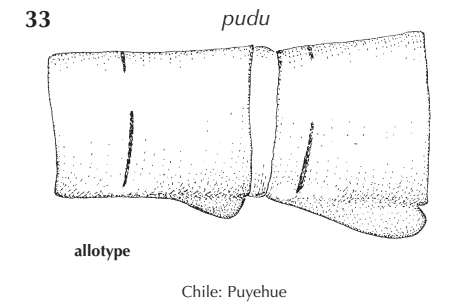
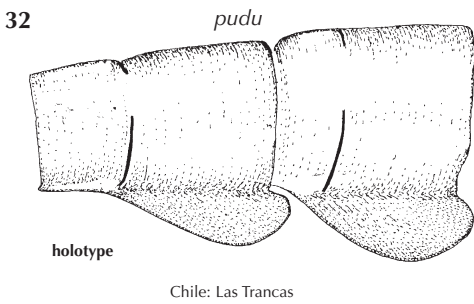
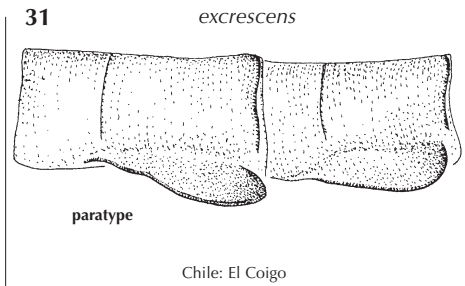
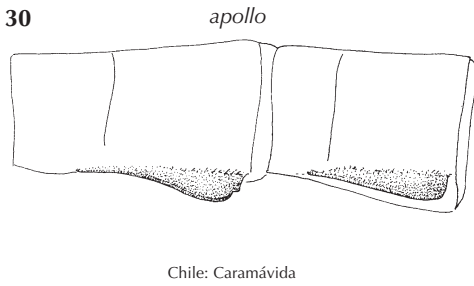
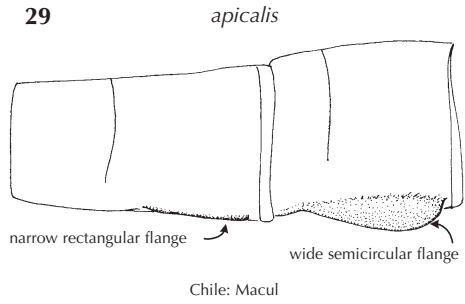
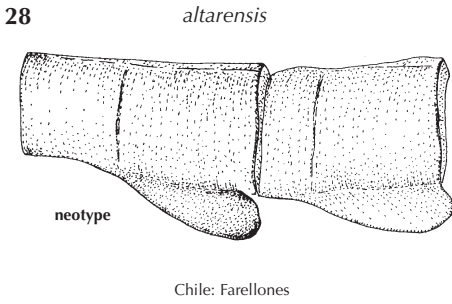
Examination of over 60 specimens matching characters of *Rheopetalia* showed *P. a. apicalis*, *P. a. decorata* and *R. rex* to be synonyms. Most of the specimens here examined display a mosaic of the characters proposed by Carle (1996) as diagnostic for these names (see Table 1), and I was unable to find a single character which would consistently allow for separation into two distinct species.

26



Chile: Las Trancas

Figures 26, 27: Male secondary genitalia of *Phyllopetalia pudu* — (26) ventral view of genital fossa; (27) lateral view of vesica spermalis.



Figures 28-35: S7-8 of six *Phyllopetalia* spp., lateral view — (28) *P. altarensis* ♂; (29) *P. apicalis* ♂; (30) *P. apollo* ♂; (31) *P. excrescens* ♂; (32, 33) *P. pudu* ♂32, ♀33; (34, 35) *P. stictica* ♂34, ♀35.

Overall, populations from dryer areas include a higher proportion of specimens with paler coloration – ‘blond’ hair at posterior margin of occipital triangle, paler yellow color on antefrons, greater extent of pale abdominal stripes and spots, smaller extent of red spots of wings- whereas populations from forested areas show a greater proportion of darker specimens – more black hair at posterior margin of occipital triangle and less ‘blond’ hair, darker yellow color on antefrons, smaller extent of pale abdominal stripes and spots, greater extent of red spots of wings.

However, I regard these differences – which were similarly documented for other groups of dragonflies in the same region, i.e. *Phenes raptor* (Petaluridae – Jurzitza 1989a), *Rhionaeschna variegata* (Aeshnidae – von Ellenrieder 2003), and *Gomphomacromia paradoxa* (Corduliidae – von Ellenrieder & Garrison 2005) – as the result of geographic variability reflecting regional adaptations, and since I found no characters justifying the separation of two species, I consider *R. rex* to be a junior synonym of *P. apicalis*.

According to Carle (1996), *P. a. apicalis* is the typical form found in Santiago Prov. and *P. a. decorata* is the typical form found in Atacama, Aconcagua and Coquimbo Provs. He mentioned ‘Los Andes’ as type locality of *P. a. decorata*, even though McLachlan did not indicate any locality for the specimen on which he based the original description, and considered that since the lectotype specimen of *P. a. apicalis* from Valdivia shows characters of a “typical *Rheopetalia* from 800 km to the north near Santiago” it had to be mislabeled. Valdivia is less than 200 km south of Victoria, the southernmost locality given by Carle for the species, and I do not see any reason why *P. apicalis* could not occur there. Fraser (1933, 1957) had already synonymized *P. a. apicalis* and *P. a. decorata*, realizing that the color differences on which the names were based represented just intraspecific variability.

I examined specimens matching the description of *P. a. apicalis* from Elqui Prov. in Coquimbo region and Cordillera Prov. in Metropolitan region, and most of the specimens from Santiago Prov. I examined show at least some characters of *P. a. decorata* (see Table 1). Specimens matching both names and intermediates were found at the same localities throughout the ranges of both ‘subspecies’, which invalidates the use of the subspecies concept – subspecies are allopatric by definition, with at most an intermediate hybridization zone in-between their geographic ranges.

Distribution

28°55' - 34°32'S, 73°15' - 70°03'W, 146-2,440 m a.s.l. (Fig. 76) — Chile: Atacama region, Huasco Prov.: Conay, 1,808 m (Carle 1996). Coquimbo region, Elqui Prov.: Cerro La Campana (MHNS); 8 km N of Laguna Dam (FSCA); El Pidén (Carle 1996); Limarí Prov.: Río Los Molles, Andes mountains (DRP); El Pangue, 535 m (Carle 1996); Choapa Prov.: Hacienda Illapel, El Bato (UMMZ). Valparaiso region, Los Andes Prov.: Los Andes (FSCA); Guardia Vieja, 1,543 m (Carle 1996); Aconcagua Prov.: Cerro Robles, near Caleu (Carle 1996); Resguardo de Los Patos, 1,228 m (Carle 1996); San Felipe, 636 m (Carle 1996); Quillota Prov.: río Marga-Marga, Los Perales, 330 m (Navás 1918). Metropolitan region, Santiago Prov.: Colina (MHNS); Farellones, Villa Paulina (MHNS); El Peumo (DRP, FSCA, MLP, MHNS, RWG), Valle San Ramon (MHNS); La Obra (MHNS); Macul (MLP, MHNS, NVE, RWG), Peñalolén (MHNS, UMMZ); El Canelo (MHNS, UMMZ); Cordillera Prov.: El Clarillo, river to the S of Santiago, flowing S of El Maipo River (UMMZ); El Manzano (UMMZ); El Volcán (Carle 1996); Los Maitenes, Río

Colorado, 1,850 m (Carle 1996); Melipilla Prov.: El Membrillo (Carle 1996). Maule region, Curicó Prov.: Las Tables at Puente Los Morongos (Carle 1996); El Coigo, deep forest in Andes (UMMZ, USNM); Los Queñes (Carle 1996); Talca Prov.: Cuesta Zapata (MHNS); Vilches (Carle 1996); Linares Prov.: Las Cruces, Cordillera Parral (RWG, UMMZ); Tranque de Bullileo (USNM). Biobío region, Ñuble Prov.: Cordillera de Chillán (Carle 1996); Los Cheuques, 1,090 m (Carle 1996); Arauco Prov.: Contulmo, 146 m (Schmidt 1941). Araucanía region, Malleco Prov.: Victoria, 334 m (Carle 1996). O' Higgins region, Colchagua Prov.: Las Nieves, 1,858 m (Carle 1996). — Unknown region/Prov.: Alcahuaz (MHNS).

Biology

This seems to be the most common and widespread *Phyllopetalia* species in Chile, being very abundant in collections. Flight is recorded as close to water surface (Dunkle 1985; Jurzitza 1989b), and linear at about 0.5-1 m above the water surface (G. Fleck pers. comm.), following narrow streams within forest and along forest paths and streets. Flight period extends from September to February according to available collection data.

Phyllopetalia apollo Selys, 1878 (Figs 2, 12, 19, 30, 41, 42, 66-69, 76)

Phyllopetalia apollo Selys, 1878: 695 [type: Chile], description based on unknown number of ♂; — Kirby (1890: 82, mention from Chile); — Ris (1904: 21, record from Chile); — Martin (1921: 22, record from Chile); — Fraser (1933: 222-224, fig. 9, redescription and illustration ♂ caudal appendages); — Schmidt (1942: 242, key); — Needham & Bullock (1943: 358-359, key); — Fraser (1957: 159, 163, listed from Chile, key); — Dunkle (1985): 195-199, fig. 1, key, illustration ♂ cercus, diagnosis); — Jurzitza (1989b: 12-13, distribution, information on habitat, flight period and behavior); — Muzón (1997: 132, listed from Chile); — Silsby (2001: 142, photograph of adult male).

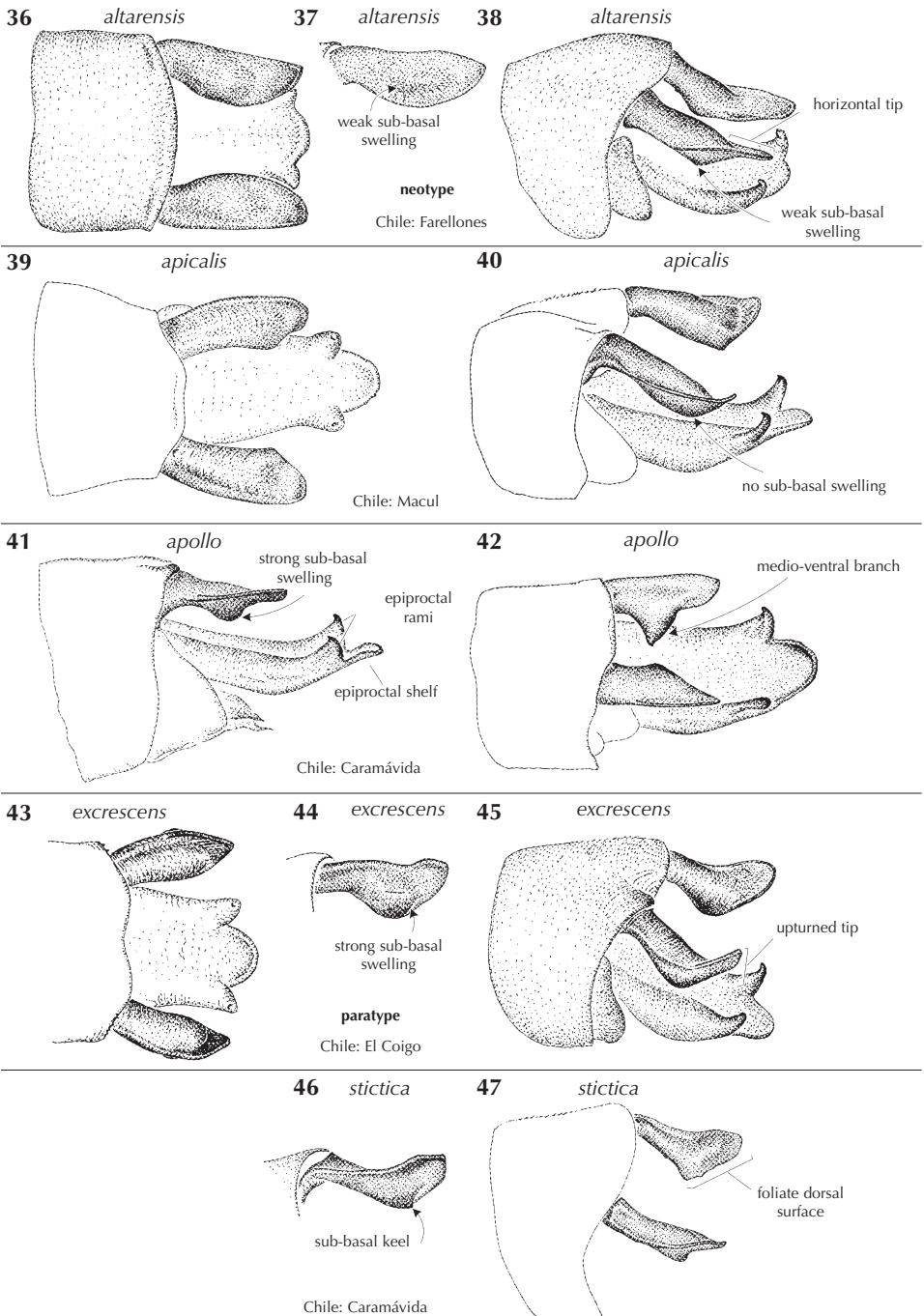
Phyllopetalia apollo. — Herrera et al. (1956: 81, 84, mention from Concepción and Valparaíso, Chile). Misprint of species name.

Odontopetalia apollo (Selys). — Carle (1996: 236-237, diagnosis in key).

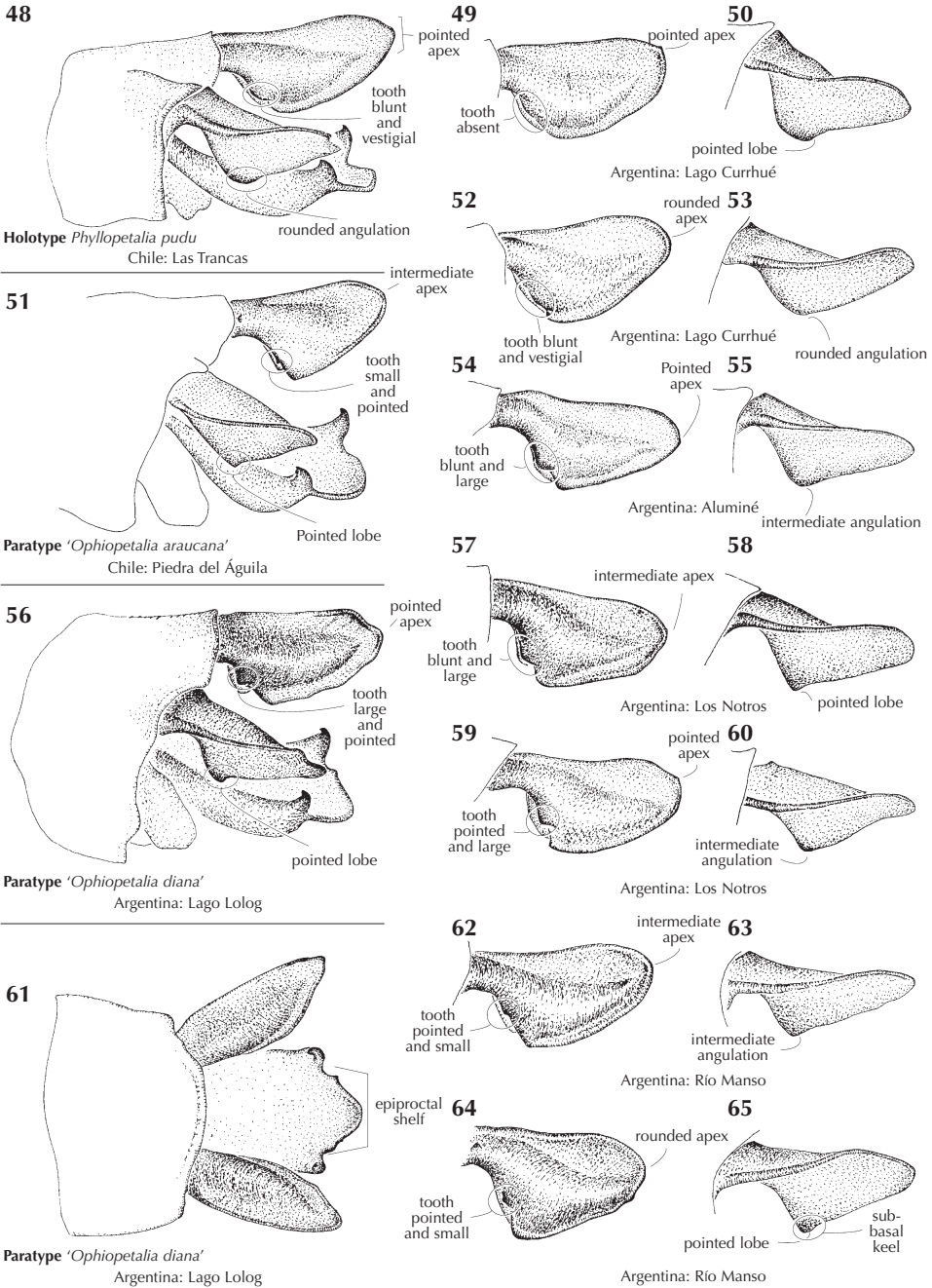
Phyllopetalia stictica nec Hagen in Selys, 1858. — Jurzitza (1975: 12, male from Santo Domingo, S of Valdivia, Chile). Misidentification.

Specimens examined

Total number: 6 ♂, 6 ♀. — Chile: Biobío region, Arauco Prov.: 2 ♂, 1 ♀ Caramávida, 152 m, O. Flint & Barria leg., 17/18 x 1969 (FSCA, USNM*). Araucanía region, Malleco Prov.: 1 ♂, 1 ♀ Angol, 1,000 m, M. Cerdá G. leg., 1 ♂ 26 x 1942, 1 ♂ xi 1954 (FSCA); Cautín Prov.: 1 ♂ Quillem, 263 m, H. Seiffert leg., 22 ix 1942 (FSCA); 1 ♂ Cholchol, 23 m, D. Cayun leg., 20 ix 1940 (FSCA); 1 ♂ Salto León, Termas de Palguín, 400 m (FSCA*). De Los Lagos region, Llanquihue Prov.: 2 ♀ 15 km E Puerto Varas, 288 m, H. Seiffert leg., 22 ix 1942 (FSCA*).



Figures 36-47: Male caudal appendages of five *Phyllopetalia* spp. — (36-38) *P. altarensis* ♂; (39, 40) *P. apicalis* ♂; (41, 42) *P. apollo* ♂; (43-45) *P. excrescens* ♂; (46, 47) *P. stictica* ♂. — (36, 39, 43) dorsal view of cerci and epiproct; (37, 44, 46) medio-ventral view of left cercus; (38, 40, 42, 45, 47) medio-dorsal view of cerci and epiproct.



Figures 48-65: Male caudal appendages of *Phyllopetalia pudu* — (48, 51, 56) medio-dorsal view of cerci and epiproct; (61) dorsal view of cerci and epiproct; (49, 52, 54, 57, 59, 62, 64) medio-dorsal view of left cercus; (50, 53, 55, 58, 60, 63, 65) lateral view of left cercus (flipped).

Diagnosis

Prominent medio-ventral branch of male cercus (Fig. 42) is unique within genus. *P. apollo* differs from *P. excrescens*, *P. pudu* and *P. stictica* by the transverse posterior margin of occipital triangle (as in Figs 5, 6), vs projected anteriorly in those species (Figs 7-9), from *P. apicalis* by the wide semicircular flange of S7 (Fig. 30), which is narrow and rectangular in *P. apicalis* (Fig. 29), and from *P. altarensis* by the lower antefrons relative to postclypeus, with a ratio of 1.08-1.55 vs 1.64-1.86 respectively (Fig. 2 vs 4).

Comments

The record of *P. apollo* from Peru given by Schmidt (1942) and repeated by Steinmann (1997) was based on a comment by Fraser (1933) on a doubtful locality label for one of the female specimens of *P. apollo* in the Selys collection. Since the genus *Phyllopetalia* is restricted to the Austral biogeographic region, the presence of this species in Peru would be extremely unlikely, and the specimen was most likely mislabeled.

Distribution

42°44' - 33°10'S, 71°00' - 73°35'W, 0-1,700 m a.s.l. (Fig. 77) — Chile: Metropolitan region, Valparaíso Prov.: Valparaíso (Herrera et al. 1956); Hacienda Las Mercedes, 322 m (Gazulla & Ruíz 1928). Maule region, Cauquenes Prov.: Tregualemu, 400 m (Carle 1996); Linares Prov.: Linares, 164 m (Carle 1996). Biobío region, Concepción Prov., Concepción, 150 m (Herrera et al. 1956); Arauco Prov., Caramávida (USNM). Araucanía region, Malleco Prov.: Angol (FSCA); Victoria, 334 m (Carle 1996); Troyo, 899 m (Carle 1996); Las Raíces (Carle 1996); Cautín Prov.: Quillem (FSCA); Cholchol (FSCA); Salto León, Termas de Palguín (FSCA*). De Los Lagos region, Valdivia Prov.: Valdivia (Jurzitza 1989b); Santo Domingo (Jurzitza 1975, 1989b); Pilicahuín (Carle 1996); Llanquihue Prov.: Peulla (Carle 1996); 15 km E Puerto Varas (FSCA); Chiloé Prov.: Dalcahue (Carle 1996); Ahoni, 0 m (Carle 1996).

Biology

Flight recorded as slow close to water surface, following narrow streams within forest (Jurzitza 1989b); feeding flight observed during late afternoon over pasture lands (Dunkle 1985). Flight period extends from September to January (Jurzitza 1989b).

Phyllopetalia excrescens (Carle, 1996)

(Figs 7, 21, 22, 31, 43-45, 76)

Eurypetalia (*Crenopetalia*) *excrescens* Carle, 1996: 244 [type: Chile, Curicó Prov., Las Tables near Puente Los Morongos], description of ♂, ♀ in key.

Specimens examined

Total number: 4 ♂, 1 ♀. — Chile: Maule region, Curicó Prov.: 1 ♂ holotype, 1 ♂ paratype El Coigo (= Puente Los Morongos), 35°13'S, 71°00'W, C. & O. Flint, Jr. leg., 10 xii 1993 (USNM*); 1 ♂, 1 ♀ El Coigo, deep forest in Andes, 800 m, L. Peña leg., x 1959 (UMMZ*); Linares Prov.: 1 ♂ Vilches Alto, Cordillera de Talca, 676 m, Fichet leg., 1 xi 1990 (MHNS).

Diagnosis

Occipital triangle with posterior margin anteriorly projected and lacking a dorsal spine characterizes this species (Fig. 7); in *P. pudu* and *P. stictica* the posterior margin is also anteriorly projected, but in both it is armed with a dorsal spine (Figs 8, 9).

Redescription of holotype male (Table 3)

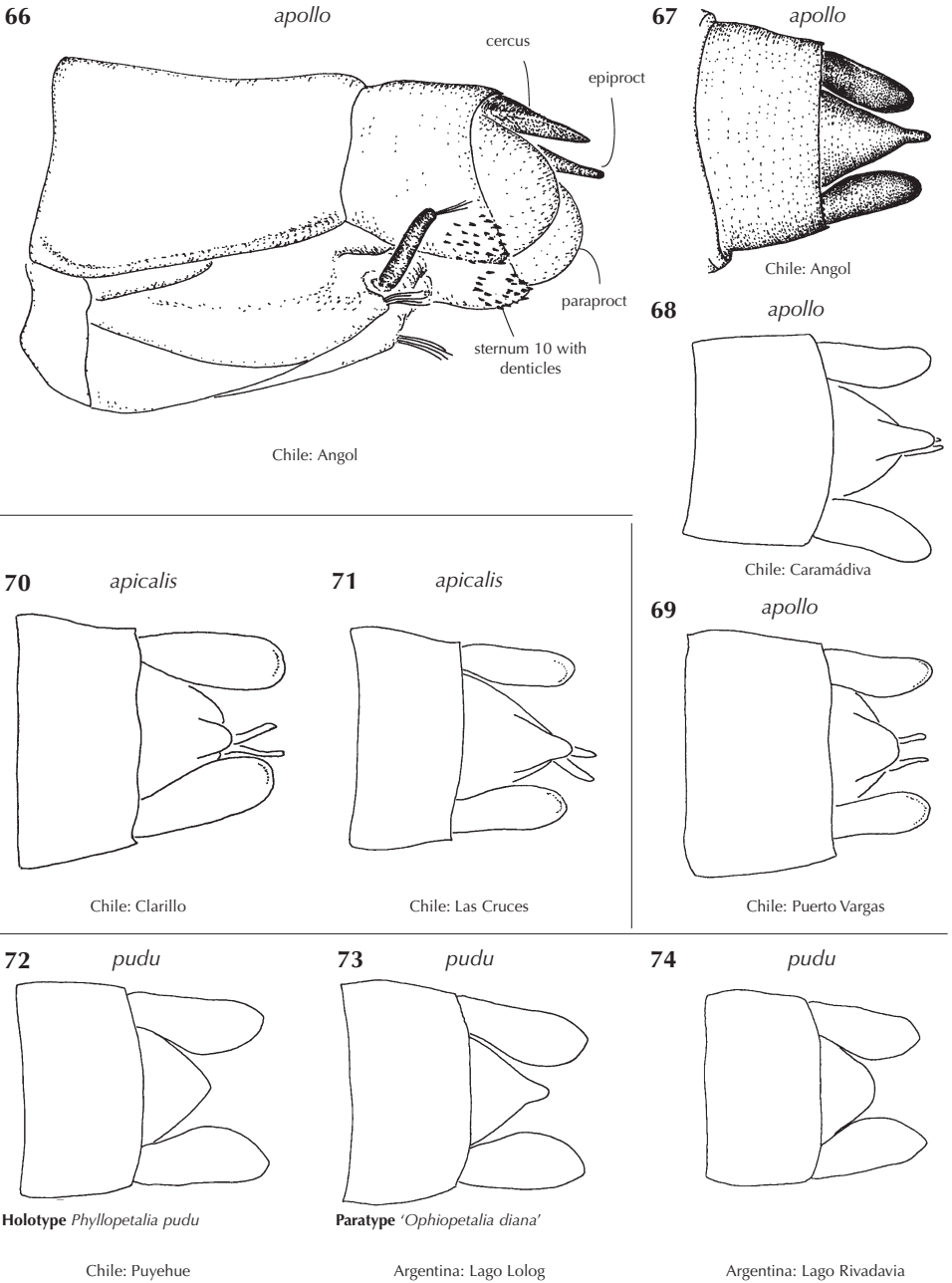
Head: Labium and labrum pale brown; anteclypeus brown, postclypeus brown with wide yellow stripe at dorsal $\frac{1}{2}$ of its extension; antefrons black, postfrons reddish brown medially, black to the sides. Occipital triangle projected anteriorly (as in Fig. 7); postocciput smooth.

Thorax: Legs black except for reddish brown basal $\frac{4}{5}$ of femora. Pterothorax reddish brown, dorsally with pale bluish-yellow, complete, and almost straight mesanepisternal stripes diverging basally; laterally with pale yellow, complete, and almost straight mesepimeral and metepisternal stripes and a dorsal pale yellow metepisternal spot; mesepimeral stripe slightly constricted at distal third. Wings with five reddish costal spots (as in Fig. 21).

Abdomen: Dark brown, reddish brown ventrally, carinae, margins of auricles and flanges black, and paired dorsal and lateral pale yellow stripes at basal portion of S2-10, paired dorsal stripes on S9+10 very faint. Genital fossa and vesica spermalis as described for the genus (as in Figs 26, 27). Flanges of S7+8 semicircular and of subequal width (as in Fig. 31). Cerci tips (as in Fig. 45) upturned (left cercus tip broken), and sub-basal surface with strong swelling (as in Fig. 44).

Distribution

33°17' - 36°08'S, 70°18' - 71°49'W, 162-1,900 m a.s.l. (Fig. 77) — Chile: Metropolitan region, Santiago Prov.: Cordillera Santiago near Estero de Yerba Loca, 1,900 m (Carle 1996). Maule region, Curicó Prov.: Las Tables near Puente Los Morongos (Carle 1996); El Coigo (UMMZ; USNM); Linares Prov.: Vilches Alto, Cordillera de Talca (MHNS); Cordillera de Talca near Vilches (Carle 1996); Las Cruces, Andes in Parral Cordillera, near Villegas, 162 m (Carle 1996).



Figures 66-74: Female caudal appendages of three *Phyllopetalia* spp. — (66-69) *P. apollo* ♀; (70, 71) *P. apicalis* ♀; (72-74) *P. pudu* ♀. — (66) Latero-ventral view of S9-10; (67-74) dorsal view of cerci and epiproct.

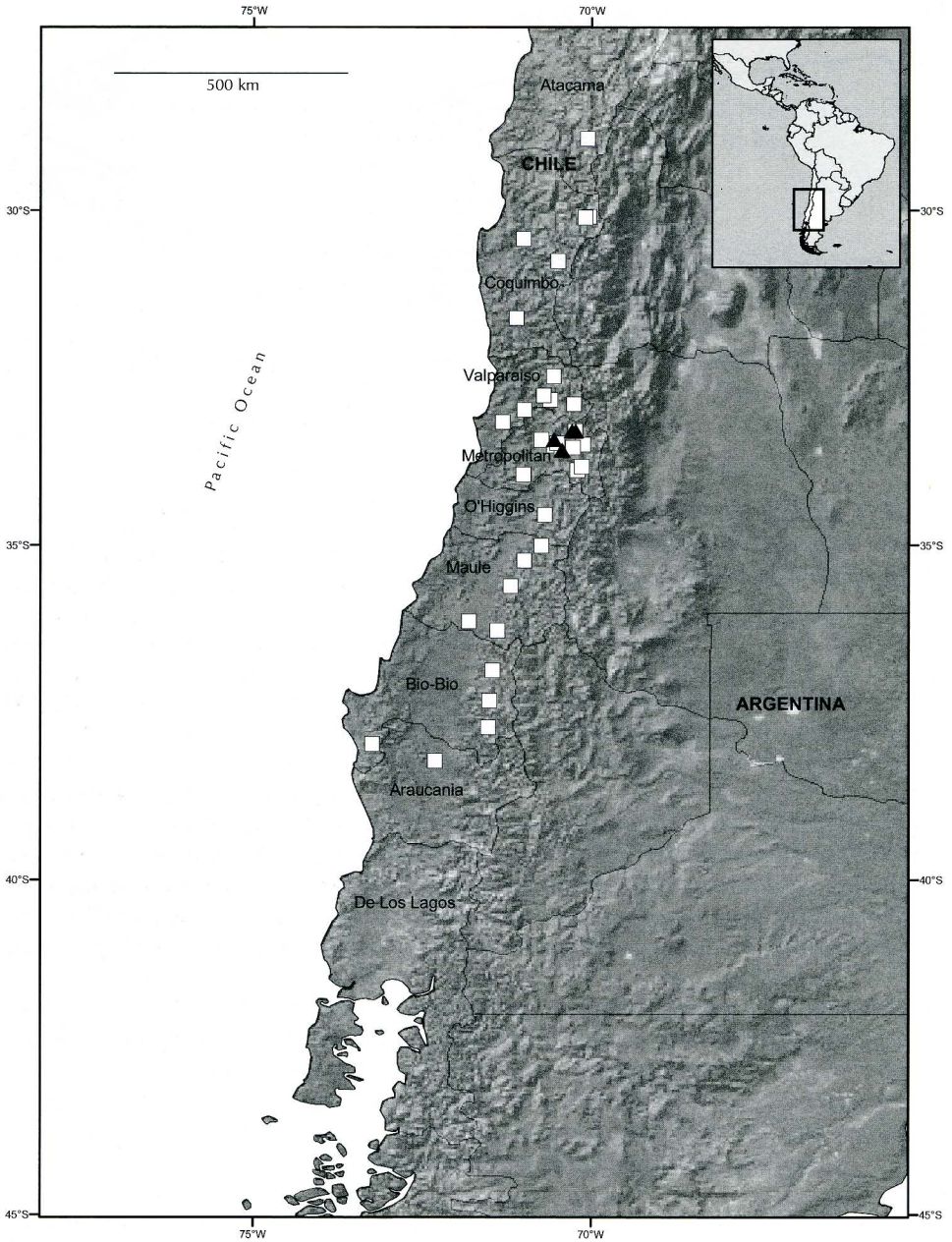


Figure 75: Distribution of *Phyllopetalia altarensis* (black triangles) and *P. apicalis* (open squares).

Biology

According to Carle (1996), larvae are semi-terrestrial; he reported a full-grown larva about 30 cm from a small spring, and small larvae clinging to the underside of damp rocks and sticks along tiny rivulets. Larvae remain undescribed. Carle (1996) observed a male hovering momentarily 1-2 m above a small stream at a road crossing, and reported most males as having been collected “near dusk while flying along a stream 0.5-1 m above its surface”, and females “while plunging into a riverine pool after having oviposited in seeps high up on canyon walls”. Flight period extends from October to December based on collection data. Due to the larval habitat being threatened by mining, grazing, recreational development, and diversion of streams and springs for irrigation (Carle 1996), this species was included in the Red List as vulnerable (IUCN 2005).

Phyllopetalia pudu Dunkle, 1985

(Figs 3, 9, 14, 23, 24, 26, 27, 32, 33, 48-65, 73-75, 77)

Phyllopetalia pudu Dunkle, 1985: 191-194, 196-199, fig. 1 [type: Chile, Ñuble prov., Las Trancas], description of ♂, ♀, key, illustration male cercus, diagnosis. — Jurzitza (1989b: 13, distribution, information on flight period); — Carle (1996: 245, in key); — Muzón (1997: 132, listed from forest for Argentina and Chile); — Muzón & von Ellenrieder (1998: listed from Neuquen, Argentina); — Muzón & von Ellenrieder (1999: 128, listed as an Argentinean conservation priority species).

Ophiopetalia pudu (Dunkle) — Carle (1996: 245, in key).

Ophiopetalia aregaster Carle, 1996: 245 [type: Chile, Santiago Prov., Cordillera Santiago near Estero de Yerba Loca], description of ♂ in key. New synonymy.

Ophiopetalia araucana Carle, 1996: 245 [type: Chile, Malleco Prov., Cordillera Nahuelbuta near Piedra del Águila], description of ♂, ♀ in key. New synonymy.

Ophiopetalia diana Carle, 1996: 245-246 [type: Chile, Osorno Prov., small Valley ca 10 km along road from Rio Nauto to Antillanca], description of ♂, ♀ in key. New synonymy.

Phyllopetalia stictica nec Hagen in Selys, 1856. — Muzón & Debandi (1992: 171, record of a ♀ from Argentina); — Muzón (1995: 7, listed for *Nothofagus* forest in Neuquen, Argentina); — Muzón (1997: 132-133, listed from forest for Argentina and Chile); — Muzón & von Ellenrieder (1998: listed from Neuquen, Argentina); — Muzón & von Ellenrieder (1999: 128, listed as an Argentinean conservation priority species). Misidentification.

Phyllopetalia sp. — Muzón (1997: 133, listed from Patagonian steppe for Argentina); — Muzón & von Ellenrieder (1999: 128, listed as an Argentinean conservation priority species).

Specimens examined

Total number: 11 ♂, 11 ♀. Chile: Biobío region, Ñuble Prov.: 1 ♀ Termas de Chillán, S. Heydon & E. Arias leg., 22 xi 1994 (UCD); 1 ♂ holotype Las Trancas, L. Peña leg., xii 1976 (FSCA*). Araucanía region, Malleco Prov.: 1 ♂ [paratype

O. araucana, 1 ♀ [allotype *O. araucana*] Cordillera de Nahuelbuta, Piedra del Águila, C. & O. Flint leg., 17 xii 1993 (USNM*); 1 ♂ Cordillera de Nahuelbuta, Fichet leg., 16/20 xii 1988 (MHNS). Maule region, Talca Prov.: 1 ♀ Alto Vilches, 676 m, Vera leg., 08/09 xii 2000 (MHNS). De Los Lagos region, Osorno Prov.: 1 ♀ allotype [paratype *O. diana*] Aguas Calientes, P.N. Puyehue, O. Flint, Jr. leg., 07/08 ii 1978 (USNM*). Aisén region, Coihaique Prov.: 1 ♀ rivulet and marsh 5 km W of Puerto Ramírez by route 231, R. Garrison leg., 19 i 1995 (RWG). — Argentina: Neuquén Prov.: 1 ♂, 1 ♀ spring in steppe with gallery forest, which waters into Río Rucachoroi, 20 km W of Aluminé, 920 m, J. Muzón leg., 14 xi 1994 (MLP*); 1 ♀ P.N. Lanín, Lago Tromen, 1,000 m, G. Debandi leg., 13 xi 1991 (MLP); 1 ♀ P.N. Lanín, Lago Huechulafquen, spring bordered by bamboo that crosses route 61 and waters into lake, 910 m, J. Muzón leg., 18 xi 1994 (MLP); 2 ♂ P.N. Lanín, margin S of Lago Curruhué Grande, spring bordered by bamboo and *Nothofagus* that waters into lake, 950 m, J. Muzón leg., 20 xi 1994 (MLP*); 1 ♂, 1 ♀ [paratypes *O. diana*] stream on N shore of Lago Lolog, 19 km N of San Martín de los Andes, C. & O. Flint, Jr. leg., 03 i 1994 (USNM*); 1 ♀ P.N. Nahuel Huapi, Lago Queñi (MLP). Río Negro Prov.: 2 ♂ P.N. Nahuel Huapi, Arroyo Los Notros, 20 km W of Bariloche (Malaise trap in *Nothofagus* forest), H. Bhat & L. Quate leg., 28 xi 1994 (MLP*); 2 ♂ P.N. Nahuel Huapi, Río Manso (in Malaise trap), 800 m, L. Quate leg., 14/16 xii 1994 (MLP*); 1 ♀ P.N. Los Alerces, Lago Rivadavia, L. Quate leg., 12 xii 1994 (MLP*).

Diagnosis

Presence of postoccipital horns (Fig. 9) is unique for this species. It shares the anteriorly projected occipital triangle and foliate male cerci (with expanded dorsal surface, Figs 47-49, 51, 52, 54, 56, 57, 59, 62, 64) with *P. stictica*.

Synonymies

Diagnostic characters proposed by Carle (1996) for his three new species of '*Ophiopetalia*' were found to represent intraspecific variability within *P. pudu*. Color of antefrons varies from brown to black; of abdominal terga from golden brown, to brown or black; of pale abdominal stripes from yellow to yellowish-green; of wing spots from brown to red wine; both colors can even be present in the same individual; i.e. female from Aluminé with brownish spots on Fw and reddish on Hw. Ratios of antefrontal carina/postfrontal suture distance, of cerci length/distance between epiproctal rami, of width/length epiproctal shelf, of width/length flanges S7+8, of Ha triangle anterior/posterior side length, of length/width dorsal mesanepisternal stripe, and of lateral/dorsal mesanepisternal stripe length (Fig. 14) overlap (see Table 2). Male cerci shape – contour, degree of development of sub basal tooth/lobe and trough – shows all possible combinations of characters (Figs 48-65, Table 2). All these characters vary independently from one another, and no correlation among structure, color or geography was found, making it impossible to unambiguously assign different names to the specimens (see Table 2). Consequently I consider *O. araucana*, *O. auregaster* and *O. diana* junior synonyms of *P. pudu*.

Intraspecific variability in the shape of postoccipital horns, which can be more or less curved medially, orientation of spine of occipital triangle, which can be more or less inclined anteriorly or dorsally, and female epiproct and cerci shape,

which can have pointed to rounded tips (Figs 73-75) was also observed. There exists also marked sexual dimorphism in the extension of wing spots, which are much larger in females than in males of the same localities (Figs 23, 24), and of flanges of S7+8, which are smaller in females (Figs 32, 33).

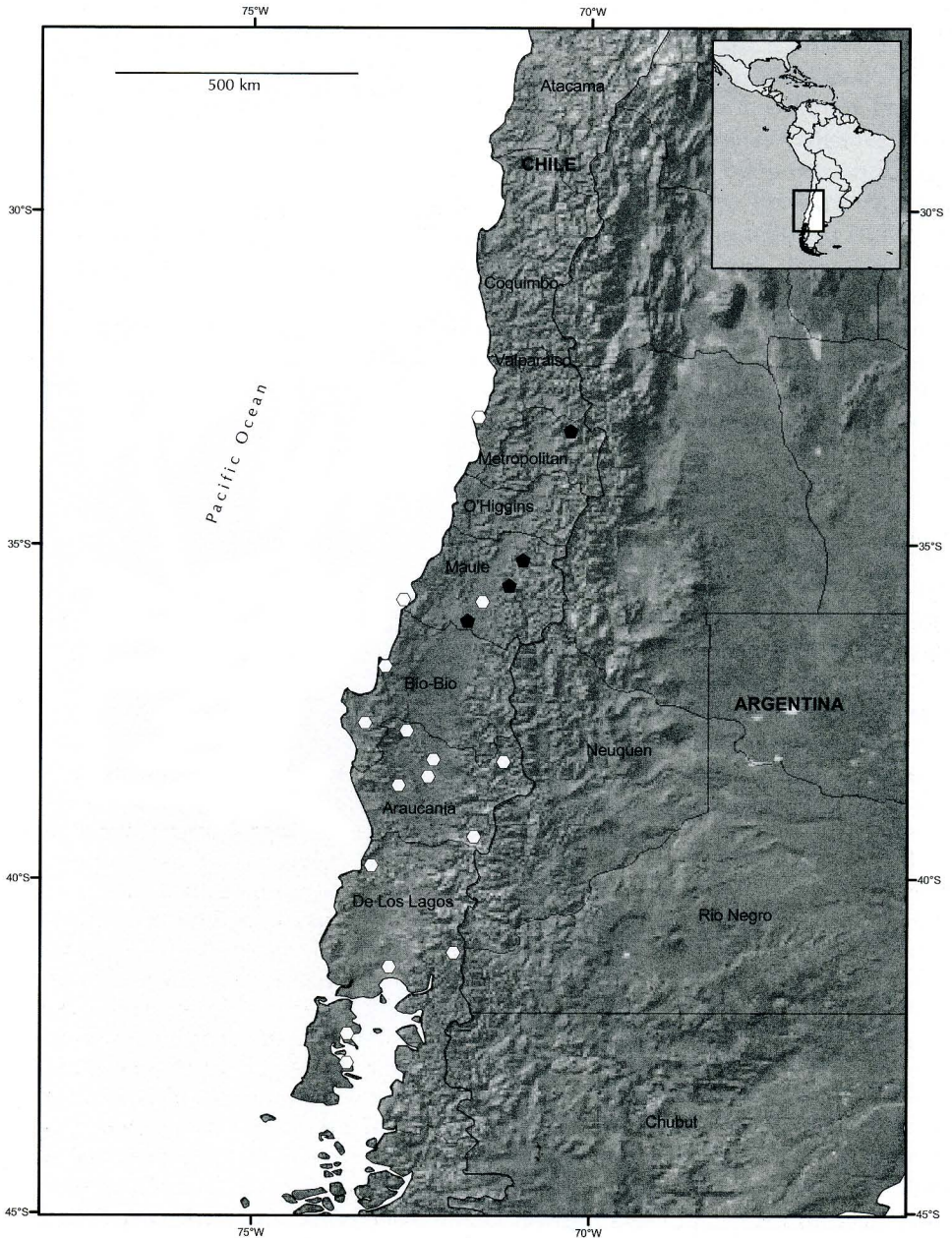


Figure 76: Distribution of *Phyllopetalia apollo* (open hexagons) and *P. excrescens* (black pentagons).

Examination of the female recorded as *P. stictica* from Argentina (Muzón & Debandi 1992) proved it to be *P. pudu*, thus *P. pudu* is so far the only *Phyllopetalia* found in that country.

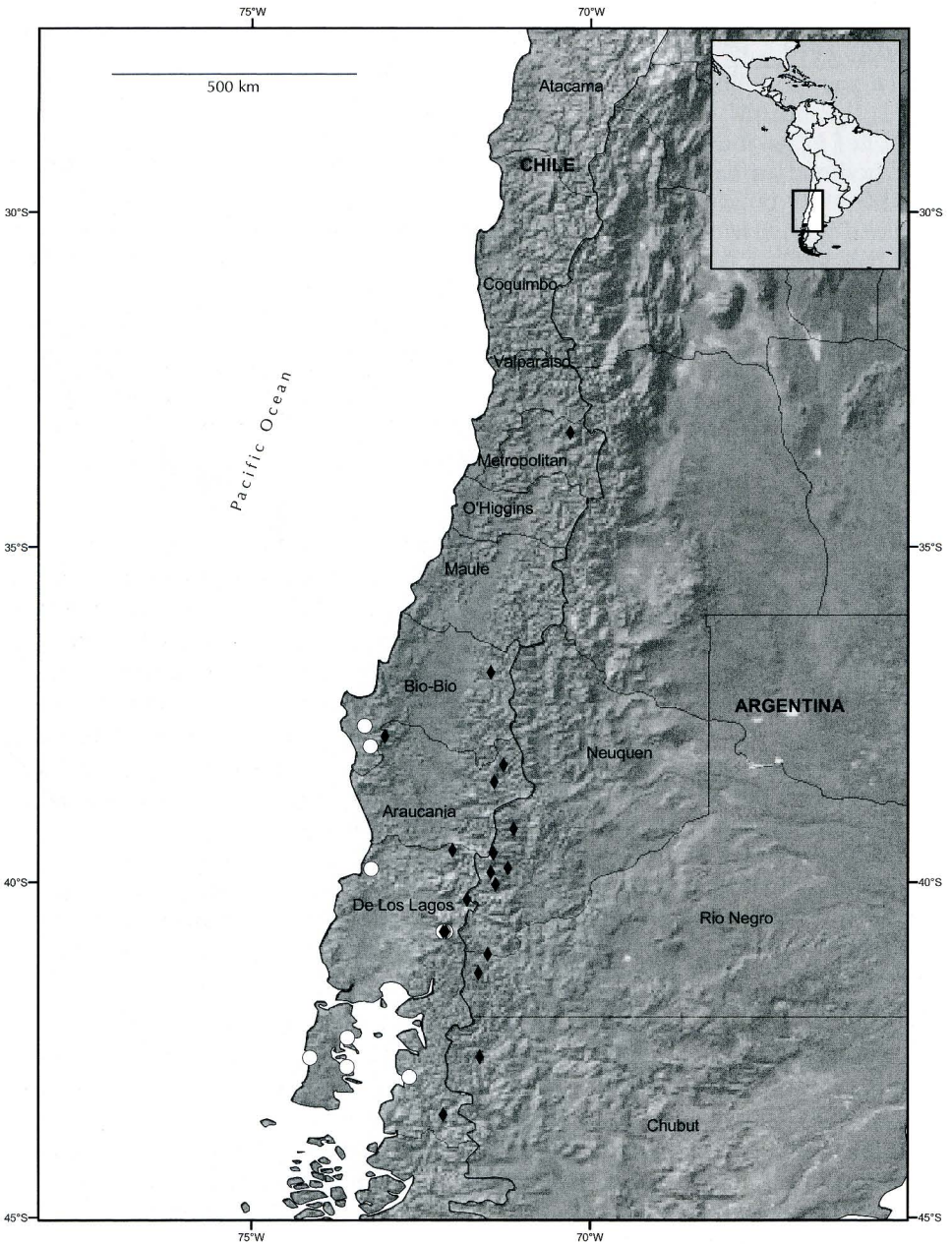


Figure 77: Distribution of *Phyllopetalia pudu* (black diamonds) and *P. stictica* (open circles).

Distribution

33°17' - 43°28'S, 70°18' - 73°02'W, 453-1,900 m a.s.l. (Fig. 78) — Chile: Metropolitan region, Santiago Prov.: Cordillera near Estero de Yerba Loca (USNM). Biobío region, Ñuble Prov.: Termas de Chillán (UCD); Las Trancas (FSCA). Araucanía region, Malleco Prov.: Cordillera de Nahuelbuta, Piedra del Águila (USNM); Cordillera de Nahuelbuta (MHNS); Troyo, 899 m (Carle 1996); Manzanar (Carle 1996). Maule region, Talca Prov.: Vilches Alto (MHNS). De Los Lagos region, Valdivia Prov.: Pucura, 453 m (Carle 1996); Osorno Prov.: Aguas Calientes, P.N. Puyehue (USNM); small valley ca 10 km along road from Río Nauta to Antillanca (USNM). Aisén region, Coihaique Prov.: 5 km W of Puerto Ramírez (RWG). — Argentina: Neuquén Prov.: spring which waters into Río Rucachoroi, 20 km W of Aluminé (MLP); P.N. Lanín, Lago Tromen (MLP); P.N. Lanín, Lago Huechulafquen, spring at Route 61 (MLP); P.N. Lanín, spring at margin S of Lago Currhué Grande (MLP); stream on N shore of Lago Lolog, 19 km N of San Martín de los Andes (USNM); P.N. Nahuel Huapi, Lago Queñi (MLP). Río Negro Prov.: P.N. Nahuel Huapi, Arroyo Los Notros, 20 km W of Bariloche (MLP); P.N. Nahuel Huapi, Río Manso (MLP*); P.N. Los Alerces, Lago Rivadavia (MLP*).

Biology

Carle (1996) indicated that larvae are “typically found in streams less than 50 cm wide, under rocks and logs, wet or submerged”. Larvae remain undescribed. Carle (1996) also reported that the majority of specimens of this species were collected while flying in a slightly undulating fashion at 0.3-1.5 m along forest paths near the upper end of small forested stream valleys. According to G. Fleck (pers. comm.) the species flies only while the sun is shining; he observed male flight as linear, somewhat undulating vertically, rather fast and unidirectional over small rapid mountain streams, and one female flying rather fast, with some zigzags, 2.0-2.5 m above the stream, in a circular path returning to the same point after a few seconds. Known flight period extends from November to February.

Phyllopetalia stictica Hagen in Selys, 1858

(Figs 1, 8, 25, 34-35, 46-47, 77)

Phyllopetalia stictica Hagen in Selys, 1858: 550 [type: Valdivia, Chile], description based on unknown number of ♂; — Selys (1878: 694-695, description of ♀ based on 2 specimens from Chile); — Kirby (1890: 82, mention from Chile); — Ris (1904: 21, record from Chile, Valdivia); — Martin (1921: 22, record from Chile); — Fraser (1933: 219-221, fig. 7, redescription and illustration ♀ wings); — Schmidt (1942: 242, 244-245, 253-256, figs 1c, 6b, 10b, 10d, 10e, 11, 12b, 12c, key, redescription, description of larva by supposition, illustrations female body, abdominal flanges, larva); — Needham & Bullock (1943: 358-359, key); — Fraser (1957: 159, 163, listed from Chile, key); — Jurzitza (1975: 12, redescription ♂ from Santo Domingo, Valdivia, Chile); — Dunkle (1985: 194-195,

197-199, fig. 1, key, illustration male cercus, diagnosis); — Jurzitza (1989b: 13, distribution, information on habitat, flight period and behavior); — Carle (1996: 237, in key); — Steinmann (1997: 232, listed from Chile).

Petalia stictica (Hagen in Selys). — Hagen (1861: 313, mention from Valdivia, Chile); — Hagen (1877: 56, mention from Valdivia, Chile).

Phyllopetalia sticta. — Herrera et al. (1956): 84, listed from Chile). Misprint of species name.

Specimens examined

Total number: 2 ♂, 3 ♀. Chile: Biobío region, Arauco Prov.: 1 ♂, 1 ♀ Caramávida, 152 m, O. Flint & Barria leg., 17/18-x-1969 (USNM*). De Los Lagos region, Valdivia Prov.: 1 ♀ Santo Domingo, E. Kramer leg., 10-v-1980 (MHNS); Palena Prov.: 1 ♂, 1 ♀ El Volcán, Parque Pumalín, Escurrimientos hacia el lago Blanco, Vera & Toledo leg., 09/14-ii-2004 (MHNS).

Diagnosis

Differs from *P. altarensis*, *P. apicalis* and *P. apollo* by posterior margin of occipital triangle projected anteriorly (Fig. 8, vs not projected, Figs 5, 6); from *P. excrescens* by presence of a dorsal spine on center of posterior margin of occipital triangle (Fig. 8, vs lacking spine, Fig. 7), and from *P. pudu* by absence of postoccipital horns (Fig. 8, vs with horns, Fig. 9).

Distribution

37°40' - 42°53'S, 72°08' - 74°08'W, 0-402 m a.s.l. (Fig. 78) — Chile: Biobío region, Arauco Prov.: Caramávida (USNM); Contulmo, 146 m (Schmidt 1941). Araucanía region, Malleco Prov.: Las Raíces (Carle 1996). De Los Lagos region, Valdivia Prov.: Valdivia (Selys 1858); Santo Domingo (Carle 1996); Osorno Prov.: Antillanca (Carle 1996); Aguas Calientes (Carle 1996); Chiloé Prov.: Dalcahue (Carle 1996); Cúcau (Carle 1996); Ahoni (Carle 1996); Palena Prov.: El Volcán, Parque Pumalín, Escurrimientos hacia el lago Blanco (MHNS); Chaitén (Carle 1996).

Biology

Patrol flight of males recorded as slow and close to water surface, following narrow streams within forest (Jurzitza 1989b); feeding flight observed during late afternoon over pasture lands (Dunkle 1985). Flight period extends from October to February based on collection data.

The description of the larva by Schmidt (1942), so far the only one known for the genus, was based on specimens collected at “Comudes”, and was presumed to belong to that species by association with adults collected at the same locality. I was unable to find out the exact location of Comudes in Chile, but I still consider the identity of the described larvae as tentative, since *Phyllopetalia apollo*, *P. pudu* and *P. stictica* are sympatric and the described larvae could belong to any of these three species.

DISCUSSION

Carle (1996) diagnosed Austropetaliidae based on the following characters: costal series of 5-8 blood red or brown blotches and leaf-like lateral expansions of terga 7-8 in adults, and distally widened labrum, massive ventrolateral development of occipital ridge, dorsally excrescent femora, obsolete transverse abdominal muscles, extensively granulate body surface, and well developed lateral lobes on abdominal S1-10 in larvae. There are no doubts as to the close association of austropetaliids to aeshnids (Carle & Louton 1994; Bechly 1996; Carle 1996), both sharing anterior lamina with elongate anterior cleft, anterior hamuli directed medially, vestigial posterior hamuli (Fig. 26), abdomen bearing dorso-longitudinal carinae and proventricular lobes of larval gizzard small and mound-like with 8 or fewer clustered teeth.

Carle (1996) suggested the possibility of austropetaliid's paraphyly, arguing that their shared characters could be the result of correlated adaptations to lotic environments, i.e. some larval characters shared with lotic *Epiophlebia* (Epiophlebiidae) and mimicry or warning coloration in the adults, i.e. red wing spotting, shared with *Neopetalia* (Neopetaliidae) and *Allopetalia* (Aeshnidae). Considering that Austropetaliidae could be paraphyletic, Carle (1996) suggested splitting extant aeshnids into four families: Archipetaliidae, Eurypetaliidae, Austropetaliidae and Aeshnidae. He considered the structure of the male secondary genitalia in Austropetaliidae as plesiomorphic and homologous to that of primitive aeshnids. However there is no aeshnid with a pendulous distal segment of vesica spermalis, and neither the posteroventrally directed paired flagella – mistakenly homologized by some authors to the flagella found in some Aeshnidae, i.e. *Gomphaeschna*, *Boyeria*, *Limnetron*, *Allopetalia* – nor a distal segment lacking lateral lobes are found in any aeshnid (von Ellenrieder 2002). Although wing color pattern and larval body shape could be the result of adaptive convergence, the uniformity of vesica spermalis morphology in austropetaliids, different from that of aeshnids and unique for the group, could well be an autapomorphy for family Austropetaliidae.

As the result of examination of all purported diagnostic characters sensu Carle (1996) in all available specimens of South American austropetaliids, the characters on which several species descriptions were based are found to represent only grades of intraspecific variability. *Eurypetalia* was created to include two new species (each one of them in its own subgenus), *E. (Eurypetalia) altarensis* and *E. (Crenopetalia) excrescens*. Although no phylogenetic analysis is performed in the present study, it is possible to conclude that these two species are most likely not sister groups, since the characters on which the genus *Eurypetalia* was based are found to be variable, and one of the species shares more characters with a different species of *Phyllopetalia*. The morphological differences among *Phyllopetalia* sensu Selys / *Hypopetalia* / *Austropetalia* and *Archipetalia* are numerous, and I would expect the same degree of differences to be present among the South American *Phyllopetalia* in order to recognize new genera. Based on adult morphology I can find no support to justify any of Carle's (1996) new generic names.

Based on my study, all South American austropetaliids are represented by two genera: *Hypopetalia* and *Phyllopetalia*, and seven species: *H. pestilens* McLachlan, 1870, *P. altarensis*, *P. apicalis*, *P. apollo*, *P. excrescens*, *P. pudu* and *P. stictica*.

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Table 1. Examined specimens of *Phyllopetalia apicalis* (n = 68), ordered from north to south. For each specimen, character states are indicated as 'a' for *apicalis*, 'aa' for *a. apicalis*, 'ad' for *a. decorata*, and 'r' for 'rex' when they fit Carle's (1996) concepts for these names; no letter implies intermediate state. — Characters for species (1-9) and for subspecies (10-12), **1**: ratio of antefrons : postclypeus height; **2**: ratio of width : length of dorsal surface of male antefrons; **3**: occipital hair fringe; **4**: in Fw, proportion of red Pt blotch to distal costal brace vein and nodus blotches; **5**: # cells under apical red blotch; **6**: yellow marks on terga 4-9 posterior to antecostal suture; **7**: ratio of width : length of male S9; **8**: ratio of width : length of male flanges of S8; **9**: ratio of width of male flanges of S8 : ventral surface of S8; **10**: postclypeus; **11**: wing blotches; **12**: proportion of basal blotch to proximal costal brace blotch. — Abbreviations, c/n: contiguous or nearly; sep: separated; ves: vestigial; wd: well-developed; y: yellow; y-w: yellowish-white.

	1	2	3	4	5	6	7	8	9	10	11	12
<i>apicalis apicalis</i> [diagnosis from Carle 1996]												
♂	1.0	2.8	blond,	<	0-8	4-5	< 1	0.2	0.5	y	wd	c/n
♀	0.9		black behind eyes			large rectangular, 6-7 triangular, 8-9 full length						
<i>apicalis decorata</i> [diagnosis from Carle 1996]												
♂	1.0	2.8	blond,	<	0-8	4-5	< 1	0.2	0.5	y-w	ves	sep
♀	0.9		black behind eyes			large rectangular, 6-7 triangular, 8-9 full length						
'rex' [diagnosis from Carle 1996]												
♂	1.1	0.33	black	=	10-20	ves	> 1	0.25	0.75			
♀	1.0		with narrow medial blond tuft									

1	2	3	4	5	6	7	8	9	10	11	12
♀ [Campana MHNS]											
a 1.00		a	r	r 12-15	r				aa	aa	aa
♂ [Laguna FSCA (1)]											
a 1.00	0.29	a	a	-	a	r 1.05	a 0.18	0.53	ad	ad	ad
♂ [Laguna FSCA (2)]											
a 0.94	0.31	a	a	a 5	a	r 1.2	0.22	r 0.76	ad	ad	ad
♂ [Los Molles DRP]											
a 1.00	r 0.38	a	a	a 4	a	r 1.21	a 0.19	r 0.76	ad	ad	ad
♂ [Illapel UMMZ]											
a 1.00	0.30	a	a	a 6	a	r 1.20	a 0.16	r 0.88	ad	ad	ad
♂ [Los Andes FSCA]											
1.05	0.3	a	r	r 13-16	< a	1.00	r 0.30	r 0.92	ad	ad	aa
♂ [Colina MHNS (1)]											
r 1.10	r 0.36	a	r	a 6	a	r 1.14	a 0.17	a 0.46	aa	ad	ad
♂ [Colina MHNS (2)]											
1.05	r 0.35	a	r	7-10	a	r 1.2	r 0.25	0.66	aa	aa-ad	ad
♂ [Colina MHNS (3)]											
a 1.00	0.32	a	r	6-9	< a	r 1.23	r 0.27	r 0.84	ad	aa-ad	ad
♂ [Farellones MHNS]											
a 1.00	0.32	a	a	a 6-8	a	r 1.34	0.21	r 0.77	ad	ad	ad
♂ [El Peumo MLP (1)]											
r 1.11	0.3	a	r	8-10	a	1.00	0.23	r 0.83	ad	ad	aa
♀ [El Peumo MLP (2)]											
r 1.00	0.29	a	r	r 11-12	< a				ad	aa-ad	aa
♂ [El Peumo MLP (1)]											
a 1.00	0.31	a	r	r 13-14	a	a 0.92	0.22	0.59	ad	aa-ad	aa
♂ [El Peumo DRP]											
r 1.13	r 0.37	a	a	9-10	a	r 1.09	r 0.25	r 0.81	ad	ad	aa
♂ [El Peumo FSCA]											
a 1.00	0.30	a	a	8-9	< a	a 0.95	r 0.26	r 0.78	ad	ad	aa
♂ [El Peumo NVE]											
a 1.00	0.29	a	a	9-10	< a	r 1.11	r 0.31	r 0.79	ad	aa-ad	aa
♂ [El Peumo MNHS (1)]											
1.05	a 0.28	a	a	r 10-11	< a	a 0.86	0.21	0.6	ad	aa-ad	ad
♂ [El Peumo MNHS (2)]											
a 1.00	0.32	a	a	8-9	< a	r 1.02	r 0.25	r 0.78	ad	aa-ad	aa
♂ [El Peumo MNHS (3)]											
1.05	0.30	a	r	9-10	< a	r 1.21	0.24	r 0.78	aa	aa	ad
♂ [El Peumo MNHS (4)]											
a 1.00	0.29	a	r	a 3-5	< a	r 1.13	0.24	0.64	ad	ad	ad
♂ [San Ramon MNHS]											
a 1.00	a 0.28	a	a	a 5-7	a	r 1.22	0.21	0.71	aa	ad	ad
♀ [La Obra MNHS]											
0.95	0.30	a	a	r 12-13	a				aa	aa	aa
♂ [Macul MNHS (1)]											
a 1.00	a 0.28	a	r	a 2-3	a	r 1.11	a 0.18	0.66	ad	ad	ad
♂ [Macul MNHS (2)]											
r 1.10	a 0.27	a	a	a 2-4	< a	a 0.87	0.24	0.69	ad	ad	aa
♂ [Macul MNHS (3)]											
a 1.00	r 0.34	a	a	a 6-7	< a	a 0.81	r 0.25	r 0.76	ad	ad-aa	ad
♂ [Macul MNHS (4)]											
r 1.11	0.29	a	a	6-10	a	r 1.05	r 0.25	0.69	aa	ad	ad

1	2	3	4	5	6	7	8	9	10	11	12
♂ [Macul RWG (1)]											
a 1.00	0.29	a	r	8-10	a	a 0.97	0.21	r 0.75	ad	ad	aa
♂ [Macul RWG (2)]											
1.05	-	a	a	9-11	< a	1.00	a 0.19	r 0.82	ad	ad	aa
♂ [Macul NVE (1)]											
r 1.16	0.31	a	a	9-10	a	r 1.15	0.24	0.69	ad	ad	ad
♂ [Macul NVE (2)]											
1.05	0.29	r	r	8-9	< a	a 0.89	r 0.28	r 0.85	ad	ad	aa
♂ [Macul MLP (1)]											
a 0.90	r 0.33	a	a	a 3	< a	a 0.92	0.24	r 0.77	ad	ad	ad
♂ [Macul MLP (2)]											
a 1.00	r 0.33	a	a	8-9	a	r 1.34	0.24	0.71	ad	ad	aa
♂ [Macul MLP (3)]											
1.06	-	a	a	9-10	a	a 0.80	0.23	0.64	ad	ad	aa
♂ [Macul MLP (4)]											
r 1.10	0.29	a	r	a 8	a	a 0.91	0.23	0.71	aa	aa-ad	aa
♂ [Macul MLP (5)]											
r 1.10	0.29	a	r	r 10-13	a	a 0.86	0.24	r 0.75	aa	ad	aa
♂ [Peñalolén MHNS]											
a 1.00	0.30	a	a	a 6-8	a	r 1.21	a 0.27	0.71	ad	aa-ad	aa
♂ [Peñalolén UMMZ]											
r 1.16	0.31	a	a	7-9	a	r 1.08	0.21	0.67	aa	ad	ad
♂ [El Canelo MHNS (1)]											
1.04	0.30	a	a	8-10	< a	a 0.97	r 0.25	0.73	ad	aa	aa
♂ [El Canelo MHNS (2)]											
a 1.00	r 0.33	a	a	8-11	a	r 1.05	a 0.19	0.57	ad	aa-ad	aa
♂ [El Canelo MHNS (3)]											
a 0.90	0.27	a	a	a 6.8	< a	r 1.20	0.21	0.60	ad	aa-ad	aa
♂ [El Canelo MHNS (4)]											
a 0.87	0.31	a	a	r 10-12	< a				aa	aa	aa
♂ [El Canelo UMMZ (1)]											
a 0.94	r 0.33	a	a	9-11	< a	r 1.14	0.21	r 0.82	aa	ad	aa
♂ [El Canelo UMMZ (2)]											
a 0.95	0.30	a	a	a 8	a	r 1.09	0.21	0.69	aa	ad	aa
♂ [El Canelo UMMZ (3)]											
a 1.00	0.31	a	r	8-10	< a	r 1.03	a 0.17	0.58	ad	ad	ad
♂ [El Canelo UMMZ (4)]											
1.06	r 0.33	a	r	a 6-7	a	1.00	0.22	r 0.91	ad	ad	ad
♂ [El Canelo UMMZ (5)]											
1.06	r 0.35	a	r	r 10-11	< a	r 1.06	0.24	r 0.83	ad	ad	aa
♂ [El Canelo UMMZ (6)]											
1.06	r 0.36	a	a	r 12	a	r 1.09	0.24	r 0.82	ad	aa-ad	aa
♀ [El Canelo UMMZ (7)]											
r 1.00	0.30	a	r	9-13	a				aa	aa-ad	aa
♀ [El Clarillo UMMZ]											
a 0.90	a 0.28	a	a	r 11-12	< a				aa	aa	aa
♂ [El Manzano UMMZ (1)]											
a 0.95	r 0.33	a	a	a 5-6	a	a 0.88	a 0.18	0.69	aa	aa	aa
♂ [El Manzano UMMZ (2)]											
r 1.12	r 0.37	a	r	r 11-12	a	r 1.21	0.23	r 0.91	aa	aa	aa
♀ [El Manzano UMMZ (3)]											
r 1.17	0.31	a	r	r 12	< a				aa	aa-ad	aa

1	2	3	4	5	6	7	8	9	10	11	12
♂ [El Coigo UMMZ (1)]											
r 1.10	0.31	r	r	r 11-12	< a	r 1.37	r 0.27	r 0.87	aa	aa	aa
♂ [El Coigo UMMZ (2)]											
r 1.19	0.31	a	a	r 10-11	< a	r 1.20	r 0.26	r 1.00	aa	aa	aa
♂ [El Coigo UMMZ (3)]											
1.05	r 0.34	a	r	r 11-12	a	-	0.24		aa	aa	aa
♀ [El Coigo USNM]											
r 1.00	0.29	a	r	r 12-13	< a				aa	aa	aa
♂ [Zapata MHNS]											
r 1.10	0.30	r	r	r 12-13	a	r 1.17	0.22	0.68	aa	aa	aa
♀ [Parral RWG (1)]											
r 1.15	0.28	r	r	r 18-19	r				ad	aa	aa
♀ [Parral RWG (2)]											
r 1.17	-	r	r	r 19-20	< a				aa	aa	aa
♂ [Parral RWG (3)]											
a 1.00	0.30	r	r	r 14-15	< a	r 1.09	r 0.27	r 1.17	ad	aa	aa
♂ [Parral RWG (4)]											
1.09	r 0.34	r	r	r 12-14	> r	1.00	a 0.17	0.71	aa	aa	aa
♀ [Parral UMMZ (1)]											
a 0.92	0.30	r	r	r 18-21	r				aa	aa	aa
♀ [Parral UMMZ (2)]											
r 1.10	0.31	all black	r	r 15-18	> r				aa	aa	aa
♂ [Parral UMMZ (3)]											
r 1.18	0.32	r	r	r 13-14	r	a 0.86	0.24	r 0.83	aa	aa	aa
♂ [Parral UMMZ (4)]											
1.05	0.31	r	r	r13	> r	r 1.13	r 0.28	r 1.00	aa	aa	aa
♂ [Parral UMMZ (5)]											
1.09	0.32	r	r	r15	r	r 1.28	0.24	r 0.87	ad	aa	aa
♀ [Bullileo USNM]											
r 1.00	0.31	r	r	r 12-16	< a				ad	aa	aa
♂ [Alcahuaz MHNS]											
1.05	a 0.28	a	a	6-9	a	-	0.21	0.69	ad	ad	ad

Table 2. Examined specimens of *Phyllopetalia pudu* (n = 22), ordered from north to south. — Characters, **1**: antefrons dorsally; **2**: ratio of medial distance of antefrons-postfrons suture : width antefrons; **3**: S3-6 laterally-posterior to antecostal suture; **4**: ♂ cerci, medioventral sub-basal lobe; **5**: ♂ ratio of cerci length : distance between apices of epiproct rami; **6**: ♂ epiproct shelf, ratio of length : width; **7**: total length [mm]; **8**: abdomen length [mm]; **9**: Hw length [mm]; **10**: Hw triangle, ratio of anterior side : proximal side; **11**: ratio of distal costal brace blotch : pterostigmal brace vein blotch; **12**: ♂ small brown blotch at proximal costal braces; **13**: ♀ small blotches on subcostal Ax; **14**: ♂ flange on S8; **15**: ♂ flange on S7; **16**: ratio of width of flange S7 : width of flange S8; **17**: ♂ sub-medially dorsal stripe on S2; **18**: ♀ posterior stripes on S3-7 to posterior carina; **19**: ♂ cerci ventro-basal ridge; **20**: dorsal mesanepisternal stripe, ratio of length : width; **21**: lateral mesanepisternal stripe, ratio of length of lateral : dorsal mesanepisternal stripes; **22**: ♀ Fw, Pt length [mm]; **23**: distal costal brace blotch; **24**: dorsal abdominal stripes; **25**: ♂ sub-medial stripe posterior to suture on S2; **26**: ♂ dorso-medial profile of cerci; **27**: ♂ dorso-medial sides of cerci; **28**: ♂ cerci in dorso-medial view, ratio of angle basal slope : dorsal carina; **29**: ♂ cerci, trough between ventral carina and basal lobe; **30**: ratio of antefrons : post-clypeus. — bl: blunt; div: divergent; int: intermediate; lg large; nq: non quantifiable; -: absent; +: present; pt: pointed; rod: rounded; sm: small; ves: vestigial.

	1	2	3	4	5	6	7	8
<i>araucana</i> [diagnosis from Carle 1996]								
black		0.4	dark brown or black	+	1.40	0.4-0.6	♂ 69.0-74.0 ♀ 68	♂ 53.0-57.0 ♀ 53
<i>auregaster</i> [diagnosis from Carle 1996]								
brown		0.33	gold brown	-	1.20	0.3	♂ 67.0	♂ 50.0
<i>diana</i> [diagnosis from Carle 1996]								
black		0.4	dark brown or black	+	1.40	0.4-0.6	♂ 62.0-69.0 ♀ 60.0-67.0	♂ 48.0-54.0 ♀ 46.0-51.0
<i>pudu</i> [diagnosis from Carle 1996]								
black		0.40	dark brown or black	+	1.40	0.4-0.6	♂ 66.0-72.0 ♀ ?	♂ 51-56 ♀ 49.5-50.5
♀ <i>pudu</i> [Chillán UCD]								
black		0.27	brown				68.0	51.0
♀ <i>pudu</i> [Vilches MHNS]								
black		0.27	brown				62.0	44.0
♀ <i>pudu</i> [Tromen MLP]								
dorsally brown			brown				64.0	49.5
♂ <i>pudu</i> [Águila USNM]								
black		0.27	brown ventrally, black dorsally	sm/pt	1.25	0.45	71.0	54.0
♀ <i>pudu</i> [Águila USNM]								
black		0.25	black				68.0	52.7
♂ <i>pudu</i> [Nahuelbuta MHNS]								
black			brown	sm/pt	1.50	0.57	72.0	50.0
♂ <i>pudu</i> [Aluminé MLP]								
black		0.24	gold brown	lg/bl	1.36	0.46	63.5	48.5
♀ <i>pudu</i> [Aluminé MLP]								
brown		0.23	gold brown				63.0	45.5
♀ <i>pudu</i> [Huechulafquen MLP]								
brown		0.27	gold brown				60.0	45.0
♂ <i>pudu</i> [Currhué MLP (1)]								
black		0.27	gold brown	-	1.17	0.56	62.5	49.5
♂ <i>pudu</i> [Currhué MLP (2)]								
black		0.27	brown ventrally, black dorsally	bl/ves	1.31	0.46	64.0	48.0

	1	2	3	4	5	6	7	8
♂ <i>pudu</i> [Lolog USNM]	black	0.26	brown ventrally, black dorsally	lg/pt	1.26	0.41	64.5	51.0
♀ <i>pudu</i> [Lolog USNM]	dorsally brown	0.27	brown ventrally, black dorsally				62.5	47.0
♀ <i>pudu</i> [Queñi MLP]	dorsally brown	0.23	brown ventrally, black dorsally				65.0	48.0
♂ <i>pudu</i> holotype [Trancas FSCA]	black	0.27	brown dorsally	bl/ves	1.44	0.43	66.0	50.0
♀ <i>pudu</i> allotype [Puyehue USNM]	dorsally brown	0.24	brown ventrally, black dorsally				63.0	47.0
♂ <i>pudu</i> [Notros MLP (1)]	dorsally brown	0.25	brown ventrally, black dorsally	lg/pt	1.54	0.50	67.0	52.0
♂ <i>pudu</i> [Notros MLP (2)]	dorsally brown	0.27	brown ventrally, black dorsally	lg/bl	1.52	0.39	67.5	52.5
♂ <i>pudu</i> [Manso MLP (1)]	black	0.27	brown ventrally, black dorsally	sm/pt	1.78	0.50	68.5	51.5
♂ <i>pudu</i> [Manso MLP (2)]	black	0.25	brown ventrally, black dorsally	sm/pt	1.37	0.42	65.0	50.0
♀ <i>pudu</i> [Rivadavia MLP]	black		brown ventrally, black dorsally				65.0	49.0
♀ <i>pudu</i> [Ramírez RWG]	dorsally brown	0.27	3 gold brown, 4-7 brown ventrally, black dorsally				64.0	49.5
	9	10	11	12	13	14	15	16
<i>araucana</i> [diagnosis from Carle 1996]								
♂ 40.0-42.0	1.3-1.5	distinctly smaller	-	-	0.9 of acrotergite	no anterior to antecostal suture	1	
♀ 43.0								
<i>auregaster</i> [diagnosis from Carle 1996]								
♂ 39.0	?	?	?	?	?	?	?	?
<i>diana</i> [diagnosis from Carle 1996]								
♂ 37.0-39.0	1.3-1.5	distinctly smaller	-	-	0.5 of acrotergite	no anterior to antecostal suture	0.6	
♀ 39.0-42.0								
<i>pudu</i> [diagnosis from Carle 1996]								
♂ 37.0-40.0	1.1-1.3	nearly as large	+	+	full length	anterior to antecostal suture	0.5	
♀ 41.5-43.5								

9	10	11	12	13	14	15	16
♀ <i>puđu</i> [Chillán UCD]	42.5	1.47	<		+		0.75
♀ <i>puđu</i> [Vilches MHNS]	40.0	1.39	<		+		0.93
♀ <i>puđu</i> [Tromen MLP]	42.5	1.48	=		at primary ax		1.00
♂ <i>puđu</i> [Águila USNM]	40.0	1.35	=	-		0.90	-
♀ <i>puđu</i> [Águila USNM]	42.0	1.55	=		+		1.00
♂ <i>puđu</i> [Nahuelbuta MHNS]	40.0	1.40	<	-		0.90	-
♂ <i>puđu</i> [Aluminé MLP]	38.5	1.27	<	+		full length	-
♀ <i>puđu</i> [Aluminé MLP]	39.0	1.42	<		+		0.83
♀ <i>puđu</i> [Huechulafquen MLP]	40.5	1.63	=		at primary ax		1.00
♂ <i>puđu</i> [Currhué MLP (1)]	38.0	1.34	=	-		full length	-
♂ <i>puđu</i> [Currhué MLP (2)]	38.0	1.50	<	+		full length	-
♂ <i>puđu</i> [Lolog USNM]	38.5	1.43	<	-		0.90	+
♀ <i>puđu</i> [Lolog USNM]	40.0	1.60	<		at primary ax		0.94
♀ <i>puđu</i> [Queñi MLP]	41.0	1.51	<		+		0.86
♂ <i>puđu</i> holotype [Trancas FSCA]	38.0	1.13	=	+		full length	+
♀ <i>puđu</i> allotype [Puyehue USNM]	41.0	1.66	<		+		0.55
♂ <i>puđu</i> [Notros MLP (1)]	39.0	1.78	=	-		0.86	-
♂ <i>puđu</i> [Notros MLP (2)]	39.0	1.48	<	-		0.85	-
♂ <i>puđu</i> [Manso MLP (1)]	39.0	1.57	<	-		0.82	-
♂ <i>puđu</i> [Manso MLP (2)]	38.0	1.35	<	-		0.90	-
♀ <i>puđu</i> [Rivadavia MLP]	42.5	1.66	<		at primary ax		0.77
♀ <i>puđu</i> [Ramírez RWG]	41.5	1.53	<		at primary ax		0.88
	17	18		19	20	21	22
	17	18		19	20	21	22
<i>araucana</i> [diagnosis from Carle 1996]	0.66, narrower than in S3	ves		ends at angulation to form pt lobe	6	ves / -	3.00
							red

17	18	19	20	21	22	23
<i>auregaster</i> [diagnosis from Carle 1996]						
?	?	?	?	?	?	?
<i>diana</i> [diagnosis from Carle 1996]						
0.66, narrower than in S3	ves	ends at angulation to form pt lobe	3-4	oval spot of dorsal stripe	4.00	brown
<i>pudu</i> [diagnosis from Carle 1996]						
full length, wider than in S3	to posterior carina as wide as anterior stripes	extends posterior to form rod basal angulation	?	[absent in holotype]	?	?
♀ <i>pudu</i> [Chillán UCD]						
	half length		6.66	0.16	3.00	
♀ <i>pudu</i> [Vilches MHNS]						
	-		6.00	-	2.40	red
♀ <i>pudu</i> [Tromen MLP]						
	full length				2.70	
♂ <i>pudu</i> [Águila USNM]						
0.8/wider		pt lobe	5.16	-		red
♀ <i>pudu</i> [Águila USNM]						
	3-4 half, 5-7 full length, narrower		5.25	-	2.75	red
♂ <i>pudu</i> [Nahuelb MHNS]						
0.9/wider	-	int	5.00	-		red
♂ <i>pudu</i> [Alumine MLP]						
1.0/wider		int	4.30	ves		red
♀ <i>pudu</i> [Alumine MLP]						
	full length, same width		6.30	0.20	2.80	red
♀ <i>pudu</i> [Huechulaf MLP]						
	4 0,75, 3, 5-7 full length		5.16	0.30	3.60	red
♂ <i>pudu</i> [Currhue MLP (1)]						
1.0/wider		pt lobe	4.46	0.34		red
♂ <i>pudu</i> [Currhue MLP (2)]						
1.0/wider		rod angulation	4.28	0.38		red
♂ <i>pudu</i> [Lolog USNM]						
1.0/wider		pt lobe	3.27	0.50		brown
♀ <i>pudu</i> [Lolog USNM]						
	-		4.33	0.50	3.80	brown/red
♀ <i>pudu</i> [Queñi MLP]						
	-		5.00	0.47	3.60	red
♂ <i>pudu</i> holotype [Trancas FSCA]						
1.0/wider		rod angulation	5.72	-		red
♀ <i>pudu</i> allotype [Puyehue USNM]						
	-		4.33	0.44	3.00	red
♂ <i>pudu</i> [Notros MLP (1)]						
0.4/wider		int	4.95	0.50		red
♂ <i>pudu</i> [Notros MLP (2)]						
		pt lobe	4.33	0.53		red
♂ <i>pudu</i> [Manso MLP (1)]						
0.8/wider		int	4.77	0.48		red
♂ <i>pudu</i> [Manso MLP (2)]						
0.4/wider		pt lobe	4.41	0.46		red
♀ <i>pudu</i> [Rivadavia MLP]						
	-		4.75	0.41	3.50	brown/red
♀ <i>pudu</i> [Ramirez RWG]						
	3 full length, 4-7 ves, 6-7 absent		4.95	0.48		brown red

	24	25	26	27	28	29	30	
<i>araucana</i> [diagnosis from Carle 1996]								
	light green	+	arrow head pt apex	div	70	wide	?	
<i>auregaster</i> [diagnosis from Carle 1996]								
	?	?	?	?	?	?	?	
<i>diana</i> [diagnosis from Carle 1996]								
	yellow	-	bullet rod apex	sub-parallel	90	narrow	?	
<i>pudu</i> [diagnosis from Carle 1996]								
	?	?	?	?	?	?	?	
♀ <i>pudu</i> [Chillan UCD]								
	green-yellow							
♀ <i>pudu</i> [Vilches MHNS]								
	yellow							1.38
♀ <i>pudu</i> [Tromen MLP]								
	yellow?							
♂ <i>pudu</i> [Águila USNM]								
	green-yellow	+	int	div	70	nq	1.42	
♀ <i>pudu</i> [Águila USNM]								
	green-yellow							1.50
♂ <i>pudu</i> [Nahuelbuta MHNS]								
	yellow	+	rod	div	70	nq	1.32	
♂ <i>pudu</i> [Aluminé MLP]								
	yellow	+	pt	div	70	nq		
♀ <i>pudu</i> [Aluminé MLP]								
	yellow							1.52
♀ <i>pudu</i> [Huechulafquen MLP]								
	yellow							
♂ <i>pudu</i> [Currhué MLP (1)]								
	yellow	+	pt	div	80	nq	1.55	
♂ <i>pudu</i> [Currhué MLP (2)]								
	yellow	+	rod	div	70	nq	1.30	
♂ <i>pudu</i> [Lolog USNM]								
	yellow-green	+	pt	div	80	nq	1.61	
♀ <i>pudu</i> [Lolog USNM]								
	yellow-green							1.28
♀ <i>pudu</i> [Queñi MLP]								
	yellow							1.38
♂ <i>pudu</i> holotype [Trancas FSCA]								
	yellow?	+	pt	div	70	nq	1.44	
♀ <i>pudu</i> allotype [Puyehue USNM]								
	?							1.40
♂ <i>pudu</i> [Notros MLP (1)]								
	yellow	-	int	div	70	nq	1.55	
♂ <i>pudu</i> [Notros MLP (2)]								
	green-yellow	+	pt	div	70	nq	1.55	
♂ <i>pudu</i> [Manso MLP (1)]								
	green-yellow	+	int	div	70	nq	1.61	
♂ <i>pudu</i> [Manso MLP (2)]								
	green-yellow	-	rod	div	90	nq	1.47	
♀ <i>pudu</i> [Rivadavia MLP]								
	yellow							
♀ <i>pudu</i> [Ramírez RWG]								
	yellow							1.50

Table 3. Examined specimens of *Phyllopetalia altarensis* and *P. excrescens*. — Characters, **1**: antefrons/postfrons surface; **2**: ♂ antefrons carina; **3**: occiput; **4**: occipital setae; **5**: wing blotches; **6**: ♂ cerci inflated ventrally near mid-length; **7**: ♂ epiproct shelf; **8**: ♀ dorsal abdominal stripes; **9**: laterally yellow stripes on ♀ S2; **10**: total length [mm]; **11**: abdominal length [mm]; **12**: Hw length [mm]. — nq: not quantifiable.

1	2	3	4	5	6
<i>altarensis</i> [diagnosis from Carle 1996]					
strongly tumose, in ♀ produced to 1/2 length of median ocellus	yellow	rounded transverse highest postero-dorsally	no median fringe of dark hair overlaying blond hair	vestigial, ♂ 1st Px cell less than 1/3 red, ♀ lacking brown blotches	gradually to 1.4 of basal width
<i>excrescens</i> [diagnosis from Carle 1996]					
slightly tumose, in ♀ produced to length of median ocellus	at most tinted white/yellow laterally	raised anteriorly into v-shaped elevation	with median fringe of dark hair overlaying blond hair	well developed, ♂ 1st Px cell more than 2/3 red, ♀ with brown blotches on Subcosta	abruptly to twice basal width
♂ <i>altarensis</i> [Farellones MNHS]					
nq	yellowish	transverse	no dark setae	vestigial	1.14
♂ <i>altarensis</i> neotype [Farellones MNHS]					
nq	yellowish	transverse	with dark setae	vestigial	1.44
♂ <i>excrescens</i> [Vilches Alto MNHS]					
nq	yellow laterally	raised	no dark setae	well developed	1.66
♂ <i>excrescens</i> holotype [El Coigo USNM]					
nq	black, yellowish at laterally 1/6	raised	with dark setae	well developed	1.60
♂ <i>excrescens</i> paratype [El Coigo USNM]					
nq	black	raised	with dark setae	well developed	1.37
♂ <i>excrescens</i> [El Coigo USNM]					
nq	yellowish laterally	raised	no dark setae	well developed	1.50
♂ <i>excrescens</i> [El Coigo USNM]					
nq	yellowish laterally	raised	a few dark setae	wel developed	
7	8	9	10	11	12
<i>altarensis</i> [diagnosis from Carle 1996]					
< 1/2 as long as wide	separated by less than width	3/4 length	♂: 58.5 - 65.0 ♀: 65.5	♂: 45-50.5 ♀: 50	♂: 34-37 ♀: 42
<i>excrescens</i> [diagnosis from Carle 1996]					
> 1/2 as long as wide	separated by more than width	full length	♂: 61-64 ♀: 57-63	♂: 46-50 ♀: 44-50	♂: 35-37 ♀: 38-41

	7	8	9	10	11	12
♂ <i>altarensis</i> [Farellones MNHS]	0.80			63	48	37.0
♂ <i>altarensis</i> neotype [Farellones MNHS]	0.88			67.3	50.3	37.0
♂ <i>excrescens</i> [Vilches Alto MNHS]	0.63			63.5	49.0	37.5
♂ <i>excrescens</i> holotype [El Coigo USNM]	0.54			65.0	50.0	38.0
♂ <i>excrescens</i> paratype [El Coigo USNM]	0.70			61.5	50.5	36.0
♂ <i>excrescens</i> [El Coigo USNM]	0.65			62.0	48.0	37.5
♂ <i>excrescens</i> [El Coigo USNM]		2-3 more, 4-7 = or less	full length	67.0	49.0	40.5

Table 4. Diagnostic characters for species of *Phyllopetalia*. — Characters, **1**: antefrons/postclypeus height [mm]; **2**: antefrons color; **3**: posterior margin of occipital triangle; **4**: antero-dorsal spine on occipital triangle; **5**: post-occipital horns; **6**: flange on S7; **7**: proportion of width of flanges S7 : S8; **8**: ♂ sub-basal surface of cerci; **9**: ♂ medio-ventral branch of cerci. — tr: transverse; pa: projected anteriorly; -: absent; +: present, sc: semicircular, ra: rectangular.

	1	2	3	4	5	6	7	8	9
<i>altarensis</i>	1.64-1.86	black or brown, carina narrowly yellowish	tr	-	-	sc	= (♂)	with weak swelling	-
<i>apicalis</i>	0.90-1.19	black or brown	tr	-	-	ra	<<<<	smooth	-
<i>apollo</i>	1.08-1.55	black or brown	tr	-	-	sc	= (♀ < ♂)	with strong swelling	+
<i>excrescens</i>	2.00-2.30	black or brown, carina narrowly	pa	-	-	sc	= (♂), > (♀) (♀ < ♂)	with strong swelling	-
<i>pudu</i>	1.30-1.70	black, wide yellow stripe	pa	+	+	sc	<	with keel	-
<i>stictica</i>	1.60-2.20	black, carina narrowly yellow	pa	+	-	sc	>	with keel	-