

Taxonomic revision of *Parasarus* (Hymenoptera: Apidae s.l.: Protandrenini), a South American genus of bees

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ABSTRACT. *Parasarus* Ruz, 1993 comprises small black bees (3–5 mm long) endemic to xeric regions of South America, mainly along of the Andean Cordillera. Prior to this study, the genus included only the type-species *P. atacamensis* Ruz, 1993 (from northern Chile) which has mesoscutum strongly reticulated and inner hind tibial spur curved apically. In this paper, a taxonomic revision of *Parasarus* is presented and two new species are described: *P. specularis* sp. nov. (from central to northwest Argentina) diagnosed mainly by pygidial plate of female extremely acute apically and labral plate yellow in male; and *P. spiniventris* sp. nov. (only recorded from central portion of Chile) diagnosed by antennal socket below middle of face, subantennal area as long as broad, metapostnotum smooth, and sternum 3 of male with a tuft of stiff hairs. The morphological variation related to the type-species was studied and not considered sufficiently to recognize distinct species into *P. atacamensis*. Distribution maps, floral associations, key to species of the genus, and illustrations of general external morphology and genitalia are also provided.

KEY WORDS. Andreninae; Apoidea; new species; taxonomy.

Protandrenini is the most diverse group of Andreninae bees (Hymenoptera: Apidae s.l.) in the Neotropical region by number of genera with more than 400 species described (MOURE *et al.* 2012, ASCHER & PICKERING 2014). The tribe is restricted to the Americas, being diverse in temperate and xeric areas (MICHENER 2007). Among Protandrenini genera of South America, *Parasarus* Ruz, 1993 comprises small black bees (3–5 mm long) endemic to xeric regions of Argentina and Chile (RUZ & ROZEN 1993, MICHENER 2007). *Parasarus* was proposed by RUZ (in RUZ & ROZEN 1993) for a single species – *P. atacamensis* Ruz, 1993. Nests of this species are built in soil and shared by a number of females, and parasitized by bees of the genus *Kelita* Sandhouse, 1943 (Apidae: Nomadini) (RUZ & ROZEN 1993). Species of *Parasarus* can be collected from September to February and are apparently polylectic in relation to floral hosts. Males fly actively around flowers near nesting sites, searching for mates (RUZ & ROZEN 1993). Although the mature larvae exhibit unique features (such as a globose antennal prominence and minute spiracles), they generally resemble other Protandrenini larvae in having dorsal thoracic tubercles, well-developed maxillae, large maxillary palpi, and strongly recessed labial region (RUZ & ROZEN 1993).

Parasarus remained monotypic until the present study, although RUZ & ROZEN (1993) mentioned the existence of additional undescribed species from Chile and Argentina, and called attention to morphological variability observed among populations of *P. atacamensis*. In this paper, a taxonomic revision of *Parasarus* is presented with description of two new species and the study of morphological variation related to the type-species. Floral associations, distribution map, illustrations, and a key to species are also provided.

MATERIAL AND METHODS

The material examined belongs to the following collections: AMNH – American Museum of Natural History, New York, USA; DZUP – Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil; IMLA – Fundación Miguel Lillo, San Miguel de Tucumán, Argentina; MZSP – Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil; PCYU – Packer Collection at York University, Toronto, Canadá; PUCV – Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile; and RPSP – Departamento de Biología, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, Brazil.

General morphological terminology follows URBAN (1967) and MICHENER (2007); labral plate is characterized by an elevated and glabrous area in the central portion of the labrum; antennal flagellomeres are indicated as F1–F11, and metasomal terga and sterna as T1–T7 and S1–S8, respectively. The antennal flagellomeres and labial palpomeres were numbered from the base to the apex. The density of punctation refers to the relative puncture diameter, pd (e.g., <2 pd: less than 2x the puncture diameter between punctures). All measurements are given in millimeters.

The labels of the specimens examined are exactly transcribed in the sections Type material and Additional material, where one inverted bar (\) indicates different lines on the label and quotation marks (") indicate different labels of the same specimen. Photographs were taken with a Leica video camera (DFC 295) attached to a Leica stereomicroscope (M205C). Series of images were combined in the software LEICA LAS (Leica Application Suite V3.6.0) and CombineZP to produce confo-

cal images. Male genitalia and associated sterna were detached from the metasoma, cleared in a 10% KOH solution for 16h, neutralized in acetic acid, and stored in a vial with glycerin. Floral records for species of *Parasarus* were compiled from labels of examined specimens and cited references in the catalographic list. The plant names are according to the International Plant Names Index (www.ipni.org). Distribution maps were produced using the software Quantum GIS (<http://www.qgis.org>); the locality coordinates were traced using the Global Gazetteer Version 2.2 (<http://www.fallingrain.com/world/index.html>) when not provided on specimen labels.

TAXONOMY

Parasarus Ruz, 1993

Figs 1-50

Parasarus Ruz, 1993 in Ruz & Rozen, 1993: 2. Type-species: *Parasarus atacamensis* Ruz, 1993 by original designation.

Parasarus; Neff & Rozen, 1995: 13 (comparative note); Rozen & Ruz, 1995: 9 (citation); Rozen, 1997: 346 (citation); Moure *et al.*, 2007: 34 (catalog); Montalva & Ruz, 2010: 20 (distribution).

Protandrena (*Parasarus*); Michener, 2000: 269 (systematics, distribution); Fernández, 2001: 105 (citation); Fernández, 2002: 127 (citation); Ruz & Chiappa, 2004: 790 (comparative note); Ramos & Melo, 2006: 43 (citation); Michener, 2007: 281 (systematics, distribution); Gonzalez & Engel, 2011: 59 (comparative note).

Diagnosis. The diagnostic characters presented by Ruz & ROZEN (1993) and MICHENER (2000, 2007) that are common to all species of *Parasarus* here recognized are the following: small body size (3-5 mm); integument predominantly black or dark brown with some yellow markings on legs; pubescence in general short and white; face without yellow marks in either sex; glossa shorter than prementum; segment 1 of labial palpus with similar length or shorter than segments 2-4 combined; lower half of face of males densely pilose; anterior tentorial pit at intersection between outer subantennal and epistomal sutures; supraclypeal area weakly produced between antennal sockets; mesosoma sparsely punctate; submarginal cells two; outer margin of hind tibia of males toothed; mid tibial spur of females finely serrate; metasoma of males broader than mesosoma; lateral foveae of T2 weakly depressed; T7 of male without pygidial plate (Fig. 29); S8 of male gradually tapering to a distal projection (Figs 31, 34, and 37); volsellae with denticles; gonostyli of male less than half length of gonocoxites (Figs 39-47). However, two additional characters cited by Ruz (*in* Ruz & ROZEN 1993) as diagnostic for *Parasarus* were not found in all species recognized here: the hind tibial spurs strongly curved, only observed in females of *P. atacamensis* and *P. specularis* **sp. nov.**, and males of *P. atacamensis* (inner spur); and the small tubercle between antennal sockets of males, exclusively found in *P. atacamensis* and its presence is variable among individuals. Additional features observed that complement the recognition of this genus are: antennal flagel-

lum of males as long as maximum head width (similar to females); pronotal lobe almost black in both sexes; metapostnotum slightly depressed with some minute hairs laterally (Figs 15-20); lateral line of T1 evident; metasomal terga of males with postgradular area weakly depressed (Fig. 28); S8 of males with enlarged disc (Figs 31, 34, and 37); volsella with short cusps; gonostylus with sparse pilosity (Figs 39-47); penis valve acute distally and fused basally.

Remarks. The phylogenetic relationships among genera of Protandrenini are poorly understood and the current generic classification is not consensual. *Parasarus* was recognized as a subgenus of the North American genus *Protandrena* Cockerell, 1896 by MICHENER (2000, 2007). However, morphological and molecular phylogenetic analyses provided substantial support for recognizing *Parasarus* as a phylogenetic independent lineage from *Protandrena* (J.S. Ascher, unpubl. data, K.S. Ramos, unpubl. data). *Parasarus* differs from *Protandrena* s.s. mainly in having integument with shallow and sparse punctures, face without yellow marks, mid tibial spur of females finely serrate, metasoma of males broader than mesosoma, metasomal terga without basal hair bands, postgradular area of metasomal terga of males weakly depressed, and S8 of males with broad disc (not constricted in the middle). Males of *Parasarus* exhibit intraspecific variation in the width of head, which may vary from narrower to broader than mesosoma. These wide-headed males look like those of the genus *Cephalurgus* Moure & Lucas de Oliveira, 1962, but they differ principally by the lateral foveae of T2 weakly depressed, supraclypeal area slightly produced, genital capsule without basal sclerite, and gonocoxite without an oblique lateral impression (Figs 39-47).

Variation. As mentioned above, males of *Parasarus* show variation in head width. In comparison to males with small head, wide-headed specimens have more sparsely distributed punctures and hairs, distinctly longer mandibles, vertex more swollen above ocelli, and gena broader than compound eyes (Figs 5 and 6).

Distribution. Species of *Parasarus* are restricted to xeric regions of South America, occurring from lowlands to high mountains (above 4000 m) of northern Chile to southern Argentina, mainly along both sides of the Andean Cordillera (Fig. 48). According to the biogeographical classification of Latin America (see MORRONE 2006, 2014, FERRO & MORRONE 2014), the genus is distributed essentially in the Andean region and South American transition zone. *Parasarus atacamensis* occurs mainly in the Central Chilean sub-region (Andean region) from Alto Patache (Tarapacá, Chile) to Caleu (Región Metropolitana, Chile), the first being the northernmost distribution record for the genus, with few records from the South American transition zone. *Parasarus specularis* **sp. nov.** is widely distributed in the South American transition zone from Salta to Río Negro (Argentina), the latter being the southernmost distribution record for the genus, with scarce records from the Neotropical region (Córdoba, Argentina). *Parasarus spiniventris* **sp. nov.** is only known from Central Chilean sub-region (Andean region).

Identification key to species of *Parasarus*

1. Antennal socket below middle of face and subantennal area as long as broad (Figs 11 and 13); metapostnotum smooth (Figs 17 and 20). Female: lower portion of face with dense hairs (Fig. 11); ventral portion of mesepisternum with straight hairs apically; hind tibial spurs straight apically. Male: S3 with a tuft of stiff hairs (Figs 26 and 27) (Chile)....
..... *P. spiniventris* sp. nov.
- 1'. Antennal socket above middle of face and subantennal area longer than broad; metapostnotum striate. Female: lower portion of face with sparse pubescence; ventral portion of mesepisternum with curved hairs apically (Fig. 21); outer hind tibial spurs strongly curved apically. Male: S3 with sparse fine hairs (Figs 25 and 28) 2
2. Mesoscutum strongly reticulated between punctures (Figs 15 and 18); pterostigma and wing veins pale yellow. Female: pygidial plate rounded at apex (Fig. 23); lateral portions of metasomal terga and disc of T3-T4 with sparse finely branched hairs. Male: labrum light brown and clypeus entirely black; inner hind tibial spur strongly curved apically (Chile) *P. atacamensis* Ruz
- 2'. Mesoscutum shiny, with weak reticulation between punctures (Figs 16 and 19); pterostigma and wing veins light brown. Female: pygidial plate with acute apex (Fig. 22); lateral portions of metasomal terga and disc of T3-T4 covered by dense plumose pilosity. Male: labrum and distal margin of clypeus yellow; inner hind tibial spur straight apically (Argentina) *P. specularis* sp. nov.

Parasarus atacamensis Ruz, 1993

Figs 1-6, 15, 18, 21, 23-24, 28, 30-32, 39-41, 48-50

Parasarus atacamensis Ruz, 1993 in Ruz & Rozen, 1993: 5. Holotype male, Chile: Atacama, Paipote (AMNH, examined); Ruz & Rozen, 1993: 5 (description, flower record, nest, larva); Neff & Rozen, 1995: 13 (comparative note); Rozen & Ruz, 1995: 9 (citation); Toro *et al.*, 1996: 68 (flower record); Michener 2000: 269 (systematics, distribution); Ruz & Chappa, 2004: 790 (comparative note); Michener, 2007: 281 (systematics, distribution); Moure *et al.*, 2007: 34 (catalog); Montalva & Ruz, 2010: 20 (distribution).

Diagnosis. A detailed description of this species was provided by Ruz (*in* ROZEN & RUZ 1993). In addition to the characters listed on the key to species, females of *P. atacamensis* have the clypeus with a longitudinal groove and mid tibial spur as long as mid basitarsus. *Parasarus atacamensis* resembles *P. specularis* sp. nov. in the external overall appearance, although the morphology of genitalia and associated sterna of males are similar to *P. spiniventris* sp. nov. (Figs 30-32 and 39-41).

Variation. This species shows a remarkable variation in overall body size and integumental surface in both sexes. In particular, the first labial palpus vary in length from similar to

shorter than segments 2-4 combined, and the small tubercle between antennal sockets is absent in many individuals, a variation not correlated with distribution. Specimens from Tarapacá province (Tarapacá region) are small (approximately 3 mm), and show strongly reticulated integument between punctures. Males from Diego de Almagro (Atacama) differ in having a yellow labral plate, and females are more robust and shiny, with slightly longer proboscis than specimens from the type locality (Paipote, Atacama region). Females from the Metropolitan region of Santiago have a narrow lateral fovea of T2 in comparison to *P. atacamensis* found in Northern Chile. In spite of this, the variation reported is not considered consistent as to split *P. atacamensis* into two or more unequivocal, morphologically distinct species. Further integrative approaches using other data sources (e.g., nucleotide sequences) will help investigate whether morphological variation reflects divergent lineages (cryptic species) of *P. atacamensis*.

Distribution. CHILE: Antofagasta (Paposo, Talabre, and Taltal), Atacama (Algarrobal, Alto del Carmen, Caldera, Canto del Agua, Castilla, Chañaral, Chañarillo, Conai, Copiapó, Diego de Almagro, Domeyco, Freirina, Las Bombas, Las Juntas, Maitencillo, Pan de Azúcar, Paipote, Pinte, Puquios, Totoral, Travesía, Obispito, and Vallenar), Coquimbo (Carrizalillo, Choros Bajos, Coquimbo, El Pangue, El Tambo, El Tofo, Incahuasi, Illapel, La Higuera, La Serena, Los Choros, Los Hornos, Los Loritos, Rivadavia, Seron, Totoral, Tres Cruces, and Vicuña), Tarapacá (Alto Patache), Valparaíso (Punta Molles and Vinã del Mar), and Región Metropolitana (Caleu) (Fig. 48). Altitudinal ranges from lowlands to 3600 m.

Floral records. *Alona filifolia* (Hook. & Arn.) I. M. Johnst and *Nolana rostrata* Miers ex Dunal (Solanaceae), *Baccharis paniculata* DC. and *Gutierrezia taltalensis* Phil. (Asteraceae), *Calandrinia* sp. (Portulacaceae) (Fig. 49), *Cristaria* sp. (Malvaceae), *Cordia decandra* Hook. & Arn. (Boraginaceae) – **new record** (Fig. 50), *Dinemandra ericoides* A.Juss. (Malpighiaceae), *Mesembryanthemum crystallinum* L. (Aizoaceae), and *Pleurophora pungens* D. Don (Lythraceae).

Type material examined. Holotype male, CHILE, Atacama (AMNH), 'Chile, Atacama: \Paipote\X-11-1971\Rozen & Pena' 'Holotype\Parasarus\atacamensis\Luisa Ruz'. Paratypes, CHILE, Atacama: 1 female (PUCV), 'Algarrobal\Atacama\11-X-1977' 'Balart, col\Chile'; 1 male (PUCV), 'Algarrobal\Atacama\11-X-1977' 'H. Flores\col. Chile'; 1 male (PUCV), 'Algarrobal\Atacama\11-X-1977' 'Chile\H. Toro'; 1 female (AMNH), 'Chile, Atacama: \14km N. Caldera\X-9-1971\Rozen & Pena' 'Paratype\Parasarus\atacamensis\Luisa Ruz 1993'; 1 male (AMNH), 'Chile, Atacama: \Canto del Agua\X-21-1969' 'Rozen & Pena\Collectors' 'Paratype\Parasarus\atacamensis\Luisa Ruz 1993'; 1 female (PUCV), 'Canto Agua\Atacama\9-X-1977' 'De La Hoz\Chile'; 1 male (PUCV), 'Canto Agua\Atacama\9-X-1977' 'H. Flores\Col. Chile'; 1 male (AMNH), 'Chile, Atacama: \vicinity of Freirina\X-14-1969' 'Rozen & Pena\Collectors' 'Paratype\Parasarus\atacamensis\Luisa Ruz 1993'; 2 females



Figures 1-6. *Parasarus atacamensis*: (1) head of female in frontal view (Freirina, Atacama, Chile); (2) habitus of female (Freirina, Atacama, Chile); (3) head of male in frontal view (holotype); (4) habitus of male (holotype); (5) large head male in frontal view (Las Juntas, Atacama, Chile); (6) habitus of male (Las Juntas, Atacama, Chile). Scale bar: 1 mm.

and 3 males (AMNH), 'Chile, Atacama:\Paipote\X-15-1969' 'Rozen & Pena\Collectors' 'Paratype\Parasarus\atacamensis\Luisa Ruz 1993'; 2 males (PUCV), 'Paipote\Atacama\10-X-1977' 'V. Cabeza\Col. Chile. Coquimbo: 1 female (PUCV), 'Choros Bajos\Coquimbo\12-X-1977' 'H. Flores\Col. Chile'; 1 female

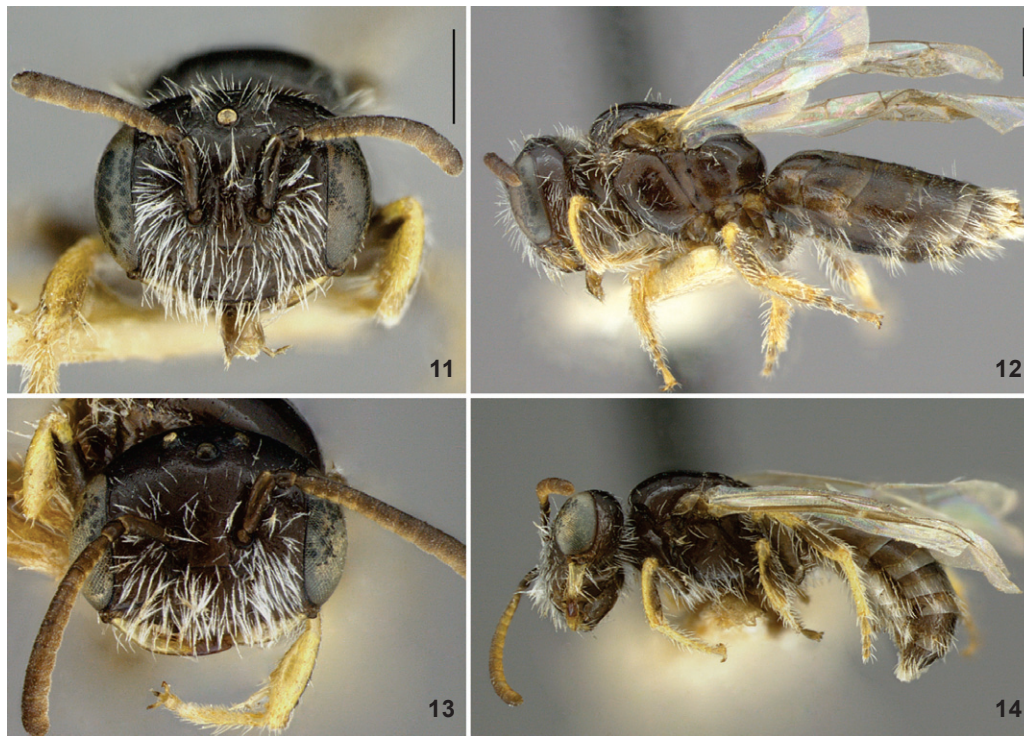
and 2 males (PUCV), 'Choros Bajos\Coquimbo\12-X-1977' 'Balart, col\Chile'; 3 females and 1 male (AMNH), 'Chile, Coquimbo:\Llano de la Higuera\N. of El Tofo\X-14-1971\Rozen & Pena' 'Paratype\Parasarus\atacamensis\Luisa Ruz 1993'.



Figures 7-10. *Parasarus specularis* sp. nov.: (7) head of female in frontal view (Chelforó, Río Negro, Argentina); (8) female in lateral view (Chelforó, Río Negro, Argentina); (9) head of male in frontal view (holotype); (10) habitus of male (holotype). Scale bar: 1 mm.

Additional material examined. CHILE, *Antofagasta*: 3 females and 2 males (PUCV), 'II Región\Paposo\1-X-1983'; 2 males (PUCV), 'II Región\Paposo\16-X-1981' 'B. Dyer\Chile'; 1 male (PUCV), 'Chile, Antofagasta\Talabre\6-XII-1992' 'H. Toro, col.'; 2 males (PUCV) (1 with terminalia dissected), 'Chile, Antofagasta\Taltal\Octubre 1991' 'H. Toro, col.'; 1 female (RPSP), 'Chile, Reg.III, Prov. Taltal\Rt.1 ~15 km N Taltal\25.27824 -70.44476\16m, 15.x.2010\E.Almeida & L.Packer, leg.'. *Atacama*: 1 male (PUCV), 'III Región\A. El Carmen\2-X-1982'; 1 female and 1 male (PUCV), 'III Región\A. El Carmen\2-X-1982' 'B. Dyer\Col. Chile'; 1 male (RPSP), 'Chile, Reg. III, Prov. Copiapó\5 km N Aeropuerto\Desierto de Atacama\27.27698 -70.76376\224m, 14.x.2010\E.Almeida & L.Packer, leg.'; 1 male (PUCV), 'Chile, Atacama, Via\Panam N of Caldera\leg. J.L. Neff\2-X-1972' 'Cristaria sp.'; 4 females and 4 males (PUCV), 'III Región\Castilla\3-X-1982'; 1 female (PUCV), 'III Región\Castilla\2-XI-1989' 'L. Ruz E.\Col. Chile' 'Col. en\Calandrinia'; 1 female and 1 male (RPSP), 'Chile, Reg.III, Prov. Chañaral\~8 km N Chañaral\26.29503 -70.65750\200m, 16.x.2010\E.Almeida & L.Packer, leg.'; 3 males

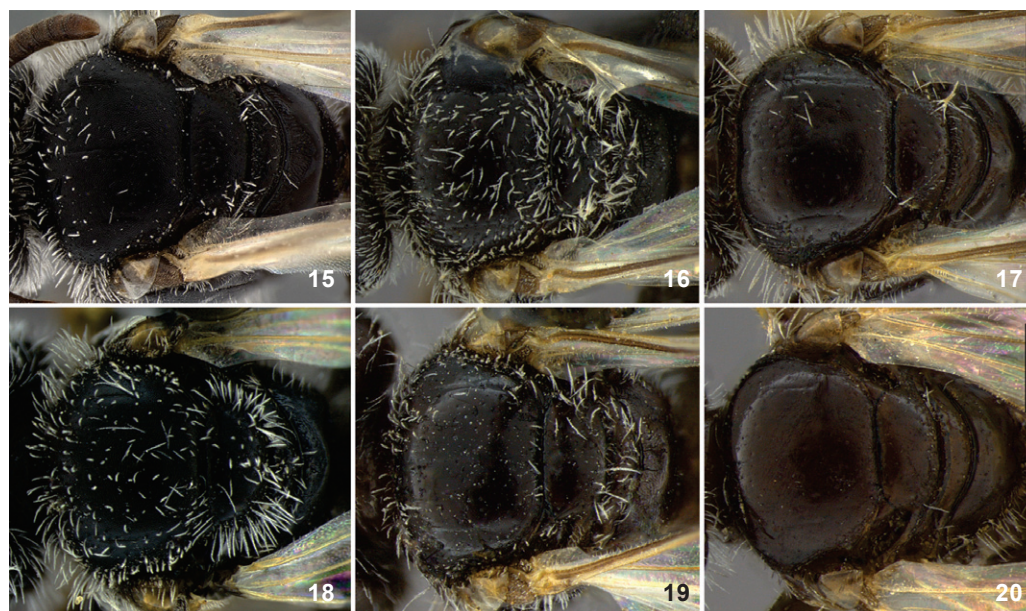
(PUCV), 'III Región\Chanarcillo\22-X-88' 'M.Rojas\col. Chile'; 4 males (PUCV), 'Atacama\Chañaral\D. de Almagro\21-01-92' 'L.Peña\colector'; 2 females and 2 males (RPSP) (1 male with terminalia dissected), 'Chile, Reg.III, Prov. Chañaral\4 km E Diego de Almagro\26.36756 -70.00626\860m, 17.x.2010\E. Almeida & L.Packer, leg.'; 14 females and 1 male (RPSP), 'Chile, Reg.III, Prov. Chañaral\46 km E Diego de Almagro\26.3961 -69.63645\1750m, 17.x.2010\E.Almeida & L.Packer, leg.'; 1 female and 3 males (MZSP) (1 male with terminalia dissected), 'Chile: III Región,\Domeyco, 28.ix.2011\28°51'16"S 70°49'4"W\K. Ramos & R. Kawada\ (MZSP); 3 females and 14 males (MZSP) (1 male with terminalia dissected), 'Chile: III Región, Ruta para\Freirina C-46, 28°31'8.2"S, 71°02'4"W, 159m, coleta>manual, 28.ix.2011, K. Ramos & R. Kawada col.'; 1 female and 2 males (DZUP), 'Chile, III Região,\Freirinha 11.x.2008\28°30'22" W71°07'41"\K.S.Ramos leg.'; 3 males (RPSP) (1 with terminalia dissected), 'Chile, Reg.III, Prov. Chañaral, 3 km SE Las Bombas\25.99527 -70.42799\641m, 15.x.2010\E.Almeida & L.Packer, leg.'; 1 female and 1 male (RPSP), 'Chile, Reg.III. Prov. Taltal\Rt.5, SSE of Las Bombas\



Figures 11-14. *Parasarus spiniventris* sp. nov.: (11) head of female in frontal view (El Manzano, Región Metropolitana, Chile); (12) habitus of female (El Manzano, Región Metropolitana, Chile); (13) head of male in frontal view (holotype); (14) habitus of male (holotype). Scale bar: 1 mm.

25.99527 -70.42799, 650m\16.x.2010 on *Nolana* sp.\E.Almeida & L.Packer, leg'; 2 females and 3 males (PUCV), 'II Region\Las Juntas\5-X-1982' 'R. Aldunate\Col. Chile'; 1 female (RPSP), 'RPSP\11.0103' 'Chile, Reg.III, Prov. Chañaral\Rd. to Pan Azúcar\26.06067 -70.51684\350m, 16.x.2010\E.Almeida & L.Packer, leg.'; 1 female and 1 male (PUCV), 'Qda. Cóndores\Atacama\9-X-1977' 'Magunacelaya\col. Chile'; 1 male (PUCV), 'III Region\Pajonales\23-X-88' 'H. Toro\Col. Chile'; 1 female (PUCV), 'Chile, Atacama:\Puquios\X-16-1969' 'Rozen & Pena\Collectors'; 3 females (PUCV), 'Atacama\Rio Pinte\1200, 1400Mt.\1,2-Dic.1967\Coll: L.E.Pena'; 1 female and 1 male (RPSP), 'Chile, Reg.III, Prov. Chañaral\Rt.5 (Pan American Hwy)\26.25064 -70.47983\545m, 16.x.2010\E.Almeida & L.Packer, leg.'; 1 male (MZSP), 'Chile: IV Region, Ruta 41,\30°01'0.5"S 70°37'0.3"W, 736m, coleta manual,\29.ix.2011, K. Ramos & R.\Kawada col.'; 1 female (RPSP), 'Chile, Reg.III, Prov. Taltal\Rt.1 ~15 km N Taltal\25.27824 -70.44476\16m, 15.x.2010\E.Almeida & L.Packer, leg.'; 2 females and 3 males (PUCV), 'III Region\Totoral\6-X-1982'. *Coquimbo*: 2 males (DZUP) (1 with terminalia dissected), 'Chile-Coquimbo\Carrizalillo\25 Oct. 1957\ (L. Peña)'; 2 females (PUCV), 'IV Region\El Pangue\22-X-1989' 'H.Toro G.\Col. Chile'; 2 males (PUCV), 'Chile, IV Región,\El Pangue, 29-XI-1992. H.Toro, col.'; 2 females and 1 male (MZSP), 'Chile, IV

Region, El Tambo,\estrada para Observatorio\Interamericano de Cerro Tololo,\30°02'41.4"S, 70°49'4.2"W,\565m, 29.ix.2011, coleta ativa,\K. Ramos & R. Kawada col.'; 1 female and 3 males (PUCV), 'IV Region\Incahuasi\1-X-1982' 'H. Donoso\Col. Chile'; 3 males (PUCV), 'IV Region\La Serena\28-XII-88' 'L. Ruz E.\Col. Chile'; 2 males (PUCV), 'Peñuelas\La Serena\1-XI-67\R.W.H.'; 1 female (DZUP), 'Chile-Coquimbo\Lanos al Este de El Tofo\26 September 1957\ (L. Peña)'; 1 male (PUCV), 'Chile: S. Cuesta\Los Hornos, N.\Illapel, Coquimbo\Prov. XI-19-1961' 'L.E. Pena\collector'; 1 female (DZUP), 'Chile-Coquimbo\Portezuelo Tres Cruces\1900m Vicuña\30/31 October 1957\ (L. Peña)'; 1 female and 3 males (DZUP) (1 male with terminalia dissected), 'Rio Claros\78km. E\La Serena\31/X/1981'; 4 females and 5 males (PUCV), 'Coquimbo\Seron\27-IX-80'; 3 females and 2 males (PUCV), 'IV Reg.\Vicuna\19-X-89' 'H. Toro G.\Col. Chile'; 1 female and 1 male (DZUP), 'Chile, IV Região, 6km S\Vicuña 7-8.x.2008\30°02'12" W70°48'53"\540m K.S.Ramos leg'; 1 male (DZUP), 'Chile, IV Região,\Vicuña, 4.x.2008\K.S. Ramos leg'. *Región Metropolitana*: 4 females and 1 male (RPSP) (1 male with terminalia dissected), 'Chile. Reg. Metropolitana\nr. Caleu (10 km NW Til Til)\33.00029, -70.98341\1085m. 11.x.2010\E.Almeida & L. Packer, leg.'. *Tarapacá*: 2 males (PUCV), 'Chile, I Región\Alto Patache XI-97\W. Sielfeld, col'.



Figures 15-20. Mesosoma of *Parasarus* species, dorsal view. (15-17) female: (15) *P. atacamensis* (Paipote, Atacama, Chile – Paratype); (16) *P. specularis* **sp. nov.** (Chelforó, Río Negro, Argentina); (17) *P. spiniventris* **sp. nov.** (El Manzano, Región Metropolitana, Chile) (18-29) male: (18) *P. atacamensis* (holotype); (19) *P. specularis* **sp. nov.** (holotype); (20) *P. spiniventris* **sp. nov.** (holotype). Scale bar: 0.2 mm.

Parasarus specularis **sp. nov.**

Figs 7-10, 16, 19, 22, 25, 29, 33-35, 42-44, 48

Parasarus sp.; Michelette & Camargo, 2000: 656 (flower record).

Diagnosis. This species can be easily distinguished from the other species of *Parasarus* by the following combination of characters: integument smooth and shiny between punctures (especially on clypeus, supraclypeal area, and mesoscutum) (Figs 7-10, 16, and 19); labral plate and distal margin of clypeus yellow in male (Fig. 9); clypeus of female with median longitudinal groove; lower portion of face of female with sparse hairs; ventral portion of mesepisternum of female with curved hairs apically; apex of hind tibial spurs curved apically in female and straight in male; mid tibial spur as long as mid basitarsus. Additionally, males of *P. specularis* **sp. nov.** have distinctive morphology of genitalia and hidden sterna, mainly by lobes of S7 retrorse and enlarged apically with coarse hairs (Fig. 33), S7 with relatively less constriction at base (Fig. 33), and S8 with acute projection on basolateral apodeme (Figs 34 and 35).

Description. Holotype male. Approximate body length: 3.7 mm; maximum head width: 1.6 mm; maximum mesoscutum width: 0.9 mm; forewing length: 2.9 mm; T2 maximum width: 1.4 mm. **Coloration.** Integument dark brown with the following parts yellow: mandible (except for apex), labrum, distal margin of clypeus, posterior portion of flagellum, basitibial plate, spurs, apex of femur, most of foretibia, basitarsus, basal and distal portion of mid- and hind tibia (Figs 9 and 10). Anterior portion of flagellum, wing veins, tegula,

and tarsus light brown; marginal zone of metasomal terga translucent brown. **Pubescence.** Predominantly short, sparse, white, finely branched (Figs 9 and 10); few long hairs behind ocelli and anterior border of mesoscutum (Figs 10 and 19); lower portion of face, around and below antennal socket, mesepisternum, border of mesoscutum and scutellum with dense and long hairs (about 2x as long as ocelli diameter); metapostnotum glabrous (Fig. 19); metasomal terga with tiny hairs, becoming denser towards apex of metasoma (Fig. 10); premarginal line with sparse long hairs; metasomal sterna with fine hairs, and S2-S5 with group of lateral plumose hairs pointed towards glabrous mesal area (Fig. 25). **Integumental surface.** Predominantly smooth and shiny between punctures. Upper portion of face, vertex, gena, mesoscutum, and scutellum sparsely punctate (>4 pd) (Figs 9, 10, and 19); metanotum densely punctate (≤ 2 pd); metapostnotum with few fine transverse striae (Fig. 19); propodeum reticulate; metasoma slightly reticulate between punctures; disc of metasomal terga with fine, shallow, and sparse punctures (≤ 3 pd); marginal zone of metasomal terga slightly reticulate; metasomal sterna weakly reticulate between punctures; distal half of metasomal sterna densely punctate (≤ 1 pd). **Structures.** Head 1.2x broader than long (1.6:1.3); first labial palpomere shorter than the three distal palpomeres combined; glossa shorter than prementum; labral plate 1.8x broader than long (0.7:0.4); compound eyes 2x as long as broad (0.8:0.4), upper to lower interorbital distance, 1.1:1.2; clypeus 4x broader than long (1.2:0.3); frontal line indicated as evident sulcus; facial fovea 5x longer than broad



Figures 21-29. External morphology of *Parasarus* species: (21) mesepisternum of *P. atacamensis*, female (Paipote, Atacama, Chile); (22) pygidial plate of *P. specularis* **sp. nov.** (Chelforó, Río Negro, Argentina); (23) pygidial plate of *P. atacamensis* (Paipote, Atacama, Chile); (24) hind leg *P. atacamensis*, male (Paipote, Atacama, Chile); (25) metasomal sterna of *P. specularis* **sp. nov.**, male (Pituil, La Rioja, Argentina); (26) metasomal sterna of male of *P. spiniventris* **sp. nov.**, hind tibial spurs indicate by the setae (El Manzano, Región Metropolitana, Chile); (27) metasoma of male of *P. spiniventris* **sp. nov.**, in lateral view, tuft of stiff hairs indicate by the setae (El Manzano, Región Metropolitana, Chile); (28) metasoma of male of *P. atacamensis* in lateral view (Paipote, Atacama, Chile); (29) T7 of *P. specularis* **sp. nov.**, male (Pituil, La Rioja, Argentina).

(0.1:0.02); gena, in lateral view, broader than compound eyes; hind tibial spurs straight apically. Genitalia and associated sterna as illustrated in Figs 33-35 and 42-44.

Paratype female (from Chelforó, Río Negro, Argentina). Approximate body length: 4.1 mm; maximum head width: 1.4 mm; maximum mesoscutum width: 1.1 mm; forewing length: 2.9 mm; maximum T2 width: 1.4 mm. Similar to male in color and punctuation. Labrum and clypeus dark brown (Fig. 7); basitibial plate, basitarsus, and basal portion of mid- and hind tibia light brown (Fig. 8); vertex coarsely punctate and reticulate between punctures (≤ 1 pd); mesepisternum reticulate.

Pubescence generally denser than in male, especially on mesosoma; lower portion of face with sparse hairs (Fig. 7); scopa with long, sparse, and simple hairs (Fig. 8); pygidial fimbria with dense, long, and plumose hairs (Fig. 8). Head about 1.2x broader than long (1.4:1.1); labral plate 1.5x broader than long (0.3:0.2); compound eye about 2x as long as broad (0.8:0.4), upper to lower interorbital distance, 0.9:0.9; clypeus about 2.2x broader than long (1.4:1.1); frontal line indicated as sulcus; facial fovea deep and narrow, about 7x as long as broad (0.2:0.03); gena, in lateral view, narrower than compound eyes; hind tibial spurs strongly curved apically; lateral fovea of T2



Figures 30-38. (30-32) *Parasarus atacamensis* (Paipote, Atacama, Chile): (30) S7 in ventral view; (31) S8 in ventral view; (32) S8 in lateral view. (33-35) *Parasarus specularis* **sp. nov.** (Pituil, La Rioja, Argentina): (33) S7 in ventral view; (34) S8 in ventral view; (35) S8 in lateral view. (36-38) *Parasarus spiniventris* **sp. nov.** (El Manzano, Region Metropolitana, Chile): (36) S7 in ventral view; (37) S8 in ventral view; (38) S8 in lateral view. Scale bar: 0.2 mm.

shallow, ellipsoid; pygidial plate V-shaped with strong acute apex (Fig. 22).

Variation. The yellow distal margin of male clypeus can be completely absent or very conspicuous. Although this new species is distributed in distinct altitudinal ranges, individuals from lowland and high altitude do not present morphological variation.

Distribution. ARGENTINA: Catamarca (Andalgalá, Copacabana, Minas Capillitas, and Santa Maria), Córdoba (Córdoba and Guanaco Muerto), La Rioja (Guayapa, Pituil, and Villa

Union), Mendoza (Uspallata, Punta del Agua, and Villaviciencia), Río Negro (Chelforó and San Antonio Oeste), Salta (Angastaco and Tastil), San Juan (Iglesia and Valle del Zonda), and Tucumán (Tafí del Valle) (Fig. 48). Altitudinal ranges from lowlands to 4200 m.

Floral records. *Bulnesia retamo* Griseb., *Larrea divaricata* Cav., and *L. cuneifolia* Cav. (Zygophyllaceae).

Type material. Holotype male, ARGENTINA, Río Negro, San Antonio Oeste (DZUP), 'RA: Río Negro\S.A. Oeste (60 km



Figures 39-47. Genital capsule of males of *Parasarus* species. (39-41) *P. atacamensis* (Paipote, Atacama, Chile): (39) ventral view; (40) dorsal view; (41) lateral view. (42-44) *P. specularis* sp. nov. (Pituil, La Rioja, Argentina): (42) ventral view; (43) dorsal view; (44) lateral view. (45-47) *P. spiniventris* sp. nov. (El Manzano, Región Metropolitana, Chile): (45) ventral view; (46) dorsal view; (47) lateral view. Scale bar: 0.2 mm.

So.)\24-xi-73 J.L. Neff '88220'. Paratypes, ARGENTINA, *Catamarca*: 1 male (DZUP), 'RA: Catamarca\Andalgala\23-x-73 J.L. Neff' '81662'; 2 males (DZUP), 'Argentina, Pr. Catamarca\Andalgala\collector J.L. Neff\20-iii-73'; 2 females (DZUP), 'RA:

Catamarca\Andalgala\23-iii-73 J.L. Neff'; 1 male (DZUP), 'Argentina, Pr. Catamarca\Andalgala, IBP Program\Desert Scrab Site\collector J.L. Neff\# refers to host & Date\21-I-73'; 1 female (AMNH), 'Argentina, Catamarca:\Copacabana Nov.4,

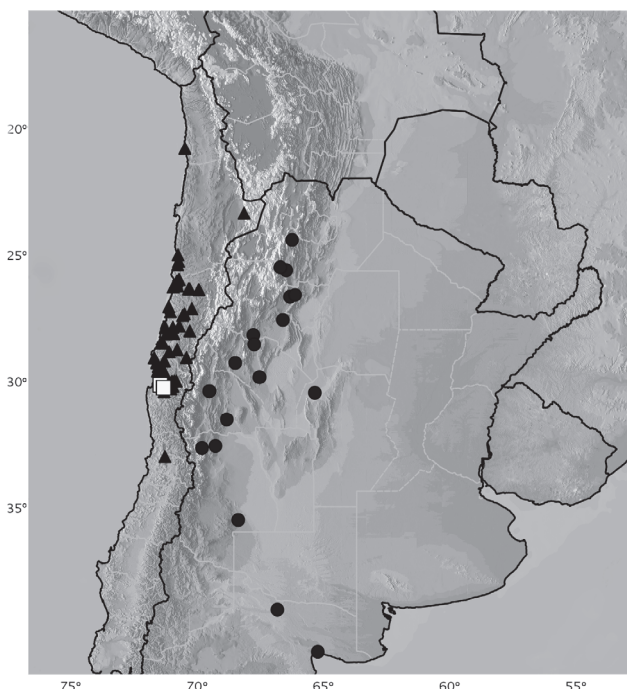


Figure 48. Distribution map for the species of *Parasarus*: (▲) *P. atacamensis*; (●) *P. specularis* sp. nov., and (□) *P. spiniventris* sp. nov.

1991\J.G. Rozen, L. Peña & A. Ugarte'; 1 female (DZUP), 'RA: Catamarca\El Racorá\1-I-74 J.L. Neff'; 7 males (DZUP), 'Argentina, Pr. Catamarca\Minas Capillitas\collector J.L. Neff\21-xii-72'; 2 males (PCYU), 'Argentina, Catamarca\7km NE of Santa Maria\S26.38.784 W066.00.558\1895m 18.ii.03 L. Packer'; 1 female (AMNH), 'Argentina, Catamarca:\S. of Santa Maria,\2000 m., Nov.26-28,\1983 Luis Peña'. *Córdoba*: 1 female and 1 male (DZUP), 'Dpt° Zool\UF-PARANÁ' 'Cordoba\Argentina\27.xii.1970\Fritz leg'; 1 female (DZUP), 'Dpt° Zool\UF-PARANÁ' 'ARG. Cordoba\Cruz del Eje\Guanaco Muerto\25-12-70. Fritz'. *La Rioja*: 2 males (IMLA), 'RA, La Rioja\Guayapa\17-18.x.954\Coll: Hayward'; 5 females and 7 males (AMNH) and 4 females and 4 males (MZSP), 'Argentina\La Rioja: 10km S Pituil\XI-26-1993 J.G. Rozen\On *Larrea*'; 1 male (AMNH), 'Argentina, La Rioja\Pr. 45km E Va.Union,\14 Nov. 1998, Rozen\Ugarte, Navarrete'. *Mendoza*: 1 female (RPSP), 'Argentina, Prov. Mendoza\6km WSW Uspallata (Rt.7)\32°36.945'S 69°23.958' 1698m\30.xi.2004 E.Almeida. on *Larrea*' '*Parasarus* n.sp.\det. J. S. Ascher'; 1 female (AMNH), 'Argentina, Mendoza:\E. of Picheuta,\January 27, 1970\L. E. Peña'; 1 female (AMNH), 'Argentina, Mendoza:\E Punta de Agua\Nov.10, 1987 L. Peña'; 3 females (IMLA), 'Argentina, Pr. Mendoza\Villavicencio 4200\coll. J.L. Neff 14.xi.73\#refers to host & date' 'On flowers of *Zuccagnia\divenicata*'; 2 females (DZUP), 'RA: Mendoza\Bajada Villavicencia\19-xi-73 J.L. Neff '87802'; 3 males (IMLA), 'Argentina, Pr. Mendoza\Villavencio 4200\coll. J.L. Neff 14.xi.73\#refers to host & date' 'On flowers

of *Zuccagnia\punctata*'; 1 female and 1 male (PUCV), 'Argentina, Pr. Mendoza\Villavencio 4200\coll. J.L. Neff 14.xi.73\#refers to host & date'. *Río Negro*: 2 females (DZUP), 'RA: Río Negro\Chelforó\23-xi-73 J.L. Neff'; 1 female (DZUP), 'RA: Río Negro\S. A. Oeste (60 km So.)\24-xi-73 J.L. Neff'. *Salta*: 1 female (AMNH), 'Argentina, Salta:\34km, S.E. Angastaco\Río Calchaquí\Dec. 18, 1971 800\Lee Herman'; 1 female (IMLA), 'R.A. Salta\Tacuil\23/27-i-1968\A. Terán coll'; 1 male (AMNH), 'ARG. - Salta\Tastil - 1.91\Fritz-3.000m'. *San Juan*: 1 male (AMNH), 'Argentina, San Juan:Iglesia, 2000 m.,\December 3, 1983\Luis E. Peña'; 1 female and 1 male (RPSP), 'Valle de Zonda-SJ\ARG 06/10/96\E. Michelette leg.'; 5 females and 9 males (RPSP), same data except '11/03/94'; 1 female and 1 male (MZSP), same data except '11/03/94'. *Tucumán*: 1 female (IMLA), 'Argentina: Pr. Tucumán:Depto. Taquí del Valle:\Ampimpa\18.xii.2002\col. Charlotte Skov'.

Etymology. The specific epithet refers to the shiny mesoscutum of male, from the Latin *specularis* (mirror).

Parasarus spiniventris sp. nov.

Figs 11-14, 17, 20, 26-27, 36-38, 45-48

Diagnosis. This is the only species of *Parasarus* with a tuft of stiff hairs on S3 of the males (Figs 26 and 27), antennal socket just below middle of face (Figs 11 and 13), clypeus of female without longitudinal sulci, ventral portion of mesepisternum of female without curved hairs, middle tibial spur shorter than mid basitarsus, and hind tibial spurs of female straight apically.

Description. Holotype male. Approximate body length: 3.1 mm; maximum head width: 1.2 mm; maximum mesoscutum width: 0.8 mm; forewing length: 2.5 mm; T2 maximum width: 1.7 mm. **Coloration.** Integument predominantly brown, with the following parts yellow: mandible (except apex), posterior portion of flagellum, basitibial plate, spurs, apex of femur, large part of fore- and mid tibia, basal and distal portion of hind tibia, and tarsus (Figs 13 and 14). Metasomal terga light brown, translucent. **Pubescence.** Predominantly white, sparse, finely branched (Figs 13 and 14). Lower part of face and mesepisternum with dense and long hairs (about 2x as long as ocelli diameter); metapostnotum glabrous (Fig. 20); metasomal terga with very short and sparse hairs, becoming denser towards apex of metasoma; marginal zone glabrous; premarginal line of T3-T6 with long and sparse hairs; metasomal sterna predominantly with fine hairs; S3 with tuft of stiff hairs (Figs 26 and 27). **Integumental surface.** Integument smooth and shiny between punctures, with very sparse fine punctures, more than 4 pd on upper portion of face, vertex, gena, mesoscutum, and scutellum (Figs 13, 14, and 20); metanotum densely punctate (≤ 2 pd); vertex and propodeum finely reticulate; metapostnotum smooth (Fig. 20); metasoma smooth and shiny between punctures; disc of metasomal terga with fine, shallow, and sparse punctures (2 pd); marginal zone of metasomal terga smooth; metasomal sterna shiny (Fig. 26);



Figures 49-50. *Parasarus atacamensis* on flowers: (49) female on flower of *Calandrinia* sp. (Portulacaceae) in Rivadavia, Coquimbo, Chile; (50) male on flower of *Cordia decandra* (Boraginaceae) in Vicuña, Coquimbo, Chile.

distal half of metasomal sterna densely punctate (≤ 1 pd). **Structures.** Head about 1.5x longer than broad (1.2:0.8); first labial palpomere shorter than the three distal palpomeres combined; glossa shorter than prementum; labral plate 2x broader than long (0.2:0.1); compound eyes 2x as long as broad (0.6:0.3), upper to lower interorbital distance, 0.8:0.8; clypeus 4x broader than long (0.8:0.2); frontal line inconspicuous; facial fovea 3.3x longer than broad (0.1:0.03); gena (0.17:0.3), in lateral view, about 0.6x broader than compound eyes; hind tibial spurs straight apically (Fig. 26). Genitalia and associated sterna as illustrated in Figs 36-38 and 45-47.

Paratype female (from El Manzano, Región Metropolitana, Chile). Approximate body length: 4.1 mm; maximum head width: 1.4 mm; maximum mesoscutum width: 1.0 mm; forewing length: 2.7 mm; T2 maximum width: 1.3 mm. Female similar to male, except for the following characters: mesoscutum slightly reticulate between punctures and sparsely punctate (≥ 4 pd) (Fig. 17); clypeus, vertex, and metasoma coarsely punctate; mesepisternum shiny, with sparse and shallow punctures; scopa with long, sparse, simple hairs; pygidial fimbria with dense, long, plumose hairs; metasoma reticulate between punctures. Head 1.4x broader than long (1.4:1.0); first labial palpomere 2x longer than the three distal palpomeres combined; labral plate 2x broader than long (0.27:0.13); compound eyes 1.7x as long as broad (0.7:0.4), slightly divergent below (upper to lower interorbital distance, 0.97:0.94); clypeus 3x broader than long (0.88:0.3); facial fovea shallow and ellipsoid, 2.6x as long as broad (0.18:0.07); gena (0.3:0.4), in lateral view, 0.7x as broad as compound eyes; hind tibial spurs straight apically; T2-T5 with lateral line; lateral fovea of T2 minute, shallow, and narrow; pygidial plate V-shaped with rounded apex.

Distribution. CHILE: Región Metropolitana (El Manzano and El Volcán) (Fig. 48), occurring at altitudes from 1200 to 2500 m.

Floral records. No available data.

Type material. Holotype male, CHILE, Región Metropolitana, El Manzano (DZUP), 'El Manzano\Chile 1.200\mts. II-9-1951\Luis E. Pena'. Paratypes, CHILE, Región Metropolitana: 6 females and 3 males (DZUP), same data as holotype; 1 male (PCYU), 'Chile, Region Metro\E. of El Volcan 1953m\S33.49701 W70.02628\7.i.2009 L. Packer\PCYU CHI09-9-3-013'. BOLIVIA, Cochabamba: 1 female and 2 males (DZUP), 'Bolivia\Cochabamba\IX-20-1951\Luis Pena'. Apparently, specimens of *P. spiniventris* with locality label of Cochabamba (Bolivia) seem to have been erroneously labeled. The collector and year data of these specimens from Cochabamba (Bolivia) are the same of the series from El Manzano (Chile). Additionally, the distribution of specimens in the central region of Chile with a disjunct population in Cochabamba is unknown for Protandrenini species.

Etymology. The species name refers to the distinct projections on metasomal sterna of males, from the Latin *spina* (spine) and the suffix *ventris* (abdomen).

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