# Systematics of Cauquenia (Araneae : Zoropsidae), with comments on the patterns of evolution of cribellum and male tibial crack on Lycosoidea 

Luis N. Piacentini ${ }^{\mathrm{A}, \mathrm{C}}$, Martín J. Ramírez $^{\mathrm{A}}$ and Diana Silva ${ }^{\mathrm{B}}$<br>ADivisión Aracnología, Museo Argentino de Ciencias Naturales ‘Bernardino Rivadavia’, Av. Angel Gallardo 470, C1405DJR, Buenos Aires, Argentina.<br>${ }^{B}$ Departamento de Entomología, Museo de Historia Natural, Apartado 14-0434, Lima 14, Peru.<br>${ }^{\text {C Corresponding author. Email: piacentini@macn.gov.ar }}$


#### Abstract

A new genus of the spider family Zoropsidae, Cauquenia, gen. nov., is proposed for Cauquenia maule, sp. nov., from the Maule region in central Chile. The familial placement is tested through the inclusion of Cauquenia in the latest major published morphological analyses of the superfamily Lycosoidea, and the subfamily placement of the South American zoropsid genus Itatiaya Mello-Leitão is also tested including them in the Raven and Stumkat (2005) analysis. Cauquenia and Itatiaya are closely related to the African genera Griswoldia Dippenaar-Schoeman \& Jocqué and Phanotea Simon, with which it shares a cup-shaped median apophysis on the male pedipalp and tooth-like projections on the lateral lobes of the epigyne in females. The patterns of evolution of the cribellum and the male tibial crack in Lycosoidea are explored; the cribellum shows up as primitively present, with three losses and four independent acquisitions, and the male tibial crack is lost twice. An asymmetric cost in cribellum gain : loss of $6: 1$ produces a primitive cribellum with 12 losses.


Additional keywords: cladistics, morphology, phylogeny, systematics, taxonomy.
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## Introduction

The lycosoid spiders, a group of mainly nocturnal hunters with a peculiar conformation of the tapetum forming parallel, convoluted lines like the grill of an oven, were first recognised by Homann (1971) as a monophyletic group. After the seminal cladistic analysis of Griswold (1993), lycosoids attracted considerable attention, but subsequent works produced trees with remarkable differences (Silva 2003; Griswold et al. 2005; Raven and Stumkat 2005; Polotow and Brescovit 2010). Zoropsidae includes 14 genera and 86 species currently known from America, Africa, Asia, Australia and Europe (Platnick 2013). Raven and Stumkat (2005) advocated the addition of the five genera and 42 species previously listed in Zorocratidae from Sri Lanka, tropical Africa, Madagascar and North America, all united by having a suture line in the basal part of the male leg tibiae, a character discovered by Griswold (1993) but absent in some zorocratids (e.g. Zorocrates Simon, 1888; see Platnick and Ubick 2007). In the present work we follow the extended family concept proposed by Raven and Stumkat (2005), but the low support values of this group suggest that a broader analysis with new characters is needed to establish the limits and the composition of Zoropsidae.

The zoropsid fauna of the southern hemisphere is diverse and phylogenetically interesting. Two of the subfamilies, the

Griswoldiinae and the Zoropsinae, are well represented in South Africa and Australia, respectively (Griswold 1993; Raven and Stumkat 2005), and at least two genera occur in South America. The genus Itatiaya Mello-Leitão, 1915 was recently transferred from Ctenidae Keyserling, 1877 to Zoropsidae by Polotow and Brescovit (2010), and Silva (2003) included in her analysis an undescribed lycosoid from Chile, which appeared to be related to the zoropsid genera Griswoldia Dippenaar-Schoeman \& Jocqué, 1997 and Phanotea Simon, 1896. In this contribution we describe this species under the new genus Cauquenia and test its relationships among the lycosoid lineages, by including Griswoldia and Itatiaya in the latest phylogenetic dataset of the Lycosoidea Sundevall, 1833 of Raven and Stumkat (2005) as modified by Jocqué (2009).

The presence of grate-shaped tapeta in Cauquenia suggests that this genus is a member of the Lycosoidea as classically defined (Homann 1971). The dorsal cymbial patch in the male palpal cymbium, the male tibial crack and the sclerotised plates on the anterior part of the male abdomen indicate the placement of Cauquenia in the expanded concept of Zoropsidae as proposed by Raven and Stumkat (2005). The similarity in the morphology of the male copulatory bulb of Cauquenia and the genera that compose the Griswoldiinae suggests a close relationship with them, as proposed by Silva (2003). Here we test the relationships
of Cauquenia maule, sp. nov. by adding the species into a previous phylogenetic analysis of zoropsids and their putative close relatives.

We will take this opportunity to explore the evolutionary hypothesis in lycosoids of the male tibial crack and the cribellum. Griswold (1993) reported the occurrence of a suture near the tibia-patella joint of unknown function, appearing only in adult males of some lycosoids, in a somatic region where sexually dimorphic variants had not previously been described in spiders. The male tibial crack was proposed as a synapomorphy of Zoropsidae (Griswold 1993; Raven and Stumkat 2005), and it may involve a second, independent origin in some zorocratids, depending on the phylogenetic hypotheses (see Polotow and Brescovit 2010: 6).

Many zoropsids and their putative relatives retain a welldeveloped cribellum, a plate derived from the anterior median spinnerets, densely covered by minute spigots, much smaller than any of the various spigot types present on the spinnerets (see Silva 2003: fig. 32; Griswold et al. 2005: figs 101a, 113c-e). The cribellum is used to spin complex, adhesive bands of silk that are laid on webs and serve to adhere to prey (Griswold et al. 2005: figs 118-125). Cribellar bands are carded with a comb on the fourth metatarsi, named the calamistrum, using highly stereotyped movements (Eberhard 1988), and the complex is a synapomorphy of araneomorph spiders. The cribellum has been lost many times in spider evolution (Lehtinen 1967), either to be replaced by simpler mechanisms to produce adhesive, viscid silk (Opell 1997), or, as in the case of lycosoids, in a change to more cursorial life styles, less dependent on webs to hunt their prey (Wolff et al. 2013). Recent phylogenetic analyses containing a wide sample of representatives with and without cribellum have confirmed the occurrence of many independent losses of the cribellum, but also opened the possibility of secondary reacquisitions (Silva 2003: 29; Spagna and Gillespie 2008; Miller et al. 2010; see also Ledford and Griswold 2010). Reacquisition of complex structures, although not common, has been reasonably well documented in the wings of stick insects (Whiting et al. 2003), and compound eyes of crustaceans (Oakley and Cunningham 2002).

## Materials and methods

## Specimens and figures

Specimens examined for this study are deposited in the arachnological collection of the Museo Argentino de Ciencias Naturales 'Bernardino Rivadavia', Buenos Aires (MACN-Ar), Museo Nacional de Historia Natural, Santiago de Chile (MHNS) and American Museum of Natural History (AMNH). The female internal genitalia were cleared in clove oil for examination, and digested with warm $10 \% \mathrm{KOH}$ solution to dissolve soft tissues. The photographs of the preserved specimens were taken with a Leica DFC 290 digital camera mounted on a Leica M165 C stereoscopic microscope (Leica Microsystems, Switzerland), or a Nikon DXM1200 camera (Nikon Instruments Inc., Melville, NY, USA) coupled in an Olympus B-2 compound microscope (Olympus Optical, Tokyo, Japan) for transmitted light photographs. The images of different focal planes were
combined with Helicon Focus 4.62 Pro (www.heliconsoft. com). All SEM images were taken with a FEI XL30 TMP. Measurements are given in millimetres.

## Abbreviations and terminology

Species descriptions, measurements and macrosetae notation follow Griswold (1991). The following abbreviations are used in species descriptions: ALE, anterior lateral eye; ALS, anterior lateral spinneret; AME, anterior median eye; PLS, posterior lateral spinneret; PME, posterior median eye; PMS, posterior median spinneret; RTA, retrolateral tibial apophysis.

## Cladistic analysis

To determine the familial placement and relationships of Cauquenia maule, sp. nov. we included the species as an additional terminal in the Raven and Stumkat (2005) matrix as modified by Jocqué (2009). ${ }^{1}$ We also added Itatiaya modesta Mello-Leitão, 1915 as a further terminal, which was included in Zoropsidae by Polotow and Brescovit (2010); the codification of characters to this species was made through the data available published by Polotow and Brescovit (2006, 2010). The resulting matrix has 66 characters and 47 terminals. The analysis was performed under parsimony using implied weights with a constant of concavity $k=6$ (Goloboff 1993), using TNT version 1.1 (Goloboff et al. 2008). We calculated the sensitivity of clades to several weighting regimes (equal weights and implied weighting with constant of concavity $k$ from 1 to 9 ). As heuristic searches we used 20 random addition sequences each followed by 100 iterations of ratchet and tree-bisection reconnection (TNT commands ratchet: iter 100 mult $=t b r$ ratchet replic 20). This search strategy obtained the same optimal trees in $50-100 \%$ of the replications. With such a rate of convergence on the same result, it is likely that the optimal tree was found. As support measures we used the Bremer support (Bremer 1994) and jackknifing frequencies (Goloboff et al. 2003) based on 1000 pseudoreplicates. We calculated the number of times a cribellum was re-evolved either as convergence or reversal, over a range of transformation costs. We searched for the minimum cost ratio (gain : loss) that would produce a reconstruction of a homologous cribellum with subsequent losses. We considered all optimal dichotomous trees for this calculation.

## Relationships

The analysis under implied weights produces a single tree (for concavity values with $k$ between 4 and 9), with Cauquenia + Itatiaya sister to Griswoldia + Phanotea (Fig. 1A), and also recovered the monophyly of Zoropsidae sensu Raven and Stumkat (2005). Pseudoctenus Caporiacco, 1949 is placed as a basal member of Zoropsinae (Fig. 1B). The more basal outgroups, including Senoculidae, Oxyopidae, Zoridae, Miturgidae and Ctenidae show profound changes in topology. The analysis under equal weights produces nine trees, with the strict consensus of such trees preserving the composition of Griswoldiinae and the monophyly of zorocratines (not shown). The reference tree implies primitive presence of the cribellum, with four losses and three independent acquisitions; the male

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Fig. 1. (A) Section of the cladogram obtained as the result of the analysis under implied weights (with constant of concavity $k=4$ to 9 ), after the addition of Cauquenia maule, sp. nov. and Itatiaya modesta to Raven and Stumkat (2005) and Jocqué (2009) matrices. The boxes below the branches indicate the sensitivity of clades to changes in character weighting regime: $\mathrm{E}=$ equal weights; $1-9$ is the value of $k$ for implied weights; black means monophyletic. Values of Bremer support and jackknifing frequency are also displayed on each branch. ( $B$ ) Common mapping of cribellum and male tibial crack: greyed box indicates the position of Griswoldiinae.
tibial crack is lost twice (Fig. 1B). Asymmetric costs in cribellum gain : loss of $6: 1$ produce a primitive cribellum with 12 losses.

## Patterns of evolution of cribellum and male tibial crack

In general, these analyses reproduce the finding of Miller et al. (2010) of a most parsimonious hypothesis of multiple reacquisitions of the cribellum, when gains and losses are considered of the same cost. The cost ratio of gain:loss as large as $6: 1$ to produce a homologous cribellum, implying no less than 12 losses. This is comparable to the results of Miller et al. (2010) ( 15 losses, but with a cost ratio of $\sim 2: 1$ ), and is the same cost ratio found by Whiting et al. (2003) to avoid any recurrence in wing origin in stick insects.

In comparison, the male tibial crack is a much simpler structure than the cribellum; so far no associated anatomical modifications are known beyond the mere cuticular suture. Unlike the cribellum, which is a functional structure during most of the spider's lifetime, the tibial crack appears just after males reach maturity. The analyses here presented are compatible with a single origin and several losses of the male tibial crack. Even
if the character is quite remarkable and occurs in a rather uniform body region, it is also quite simple and a convergent evolution would be less noticeable than in the case of the cribellum. The tibial crack is moreover not restricted to zoropsids and zorocratids; it has also been observed in other widely distant entelegyne spiders, namely Anuvinda Lehtinen, 1967, Pandava Lehtinen, 1967 (Almeida-Silva et al. 2009, 2010) (Titanoecidae) and Penestomus Simon, 1902 (Penestomidae) (Miller et al. 2010). With this taxonomic distribution it is most probable that the tibial crack was independently acquired in those families.

## Discussion

The analysis of lycosoid relationships are coincident with Silva's (2003) result in the placement of Cauquenia among Zoropsidae sensu Raven and Stumkat (2005), in the subfamily Griswoldiinae (Fig. 1), and closely related to Griswoldia and Phanotea, thus confirming the placement suggested by the similarity of their copulatory organs. We also obtain a placement of Itatiaya within griswoldiines, as sister of Cauquenia, with which it shares the median lobe of the epigyne as a swollen lobe extending to the


Fig. 2. Cauquenia maule, sp. nov.,, , habitus of preserved specimens from R. N. Federico Albert, Cauquenes, Región del Maule: $(A-C)$ habitus of female paratype (MHNS); $(D)$ vulva in clove oil, paratype (MHNS); $(E)$ paratype (MHNS); $(F)$ vulva, dorsal. ( $A$ ) Dorsal; $(B)$ lateral; $(C)$ ventral; $(E)$ left spermatheca detail; $(F)$ epigyne ventral. Abbreviations: LT, lateral teeth; CO, copulatory opening; AP, anterior pocket; MF, median field; FD, fertilisation ducts; HS, spermathecae. Scale bars: $A-C=2.00 \mathrm{~mm} ; D, F=0.50 \mathrm{~mm}$.
posterior margin, a dense claw tuft obscuring the pretarsus and the absence of dorsal spigots on the female posterior median spinnerets.

The combination of a cup-shaped median apophysis and tooth-like projections on the lateral lobes of the epigyne could help to distinguish the Griswoldiinae from Zoropsinae or Zorocratinae sensu Raven and Stumkat (2005), although those characters also occur together in other families (e.g. some Ctenidae; see Griswold 1993). The epigynal teeth, for example, have been proposed as part of the basic pattern of a large group of entelegyne families by Lehtinen (1967: 315, his Amauriobioidea; see also Silva 2003: char. 57; and Griswold et al. 2005: char. 132). We propose the placement of Cauquenia in Zoropsidae by the presence of the synapomorphies provided by Raven and Stumkat (2005), and endorse its more precise placement in Griswoldiinae, near Itatiaya, Griswoldia and Phanotea, as indicated by the analysis. The male tibial crack seems to have a promising phylogenetic signal, although it is not free of homoplasy, and most likely was acquired convergently in some distantly related clades of spiders. Cauquenia and Itatiaya are the first confirmed representatives of Griswoldiinae reported
thus far from the Americas. The general hypotheses of evolution of the cribellum in lycosoid spiders fit well with the pattern observed in other clades of araneomorph spiders, with many independent losses and perhaps also some re-acquisitions. This poses the cribellum as an interesting candidate for study cases of recurrence of lost structures.

## Taxonomy

Family ZOROPSIDAE Bertkau

## Genus Cauquenia, gen. nov.

Type species: Cauquenia maule, sp. nov., here designated.

## Diagnosis

Cauquenia differs from the other genera of Zoropsidae by the following combination of characters: three tarsal claws and dense claw tufts; strong dorsobasal projection of the cymbium; absence of cribellum and calamistrum; tegulum notched probasally; anterior pocket in the median lobe of the epigyne.


Fig. 3. Cauquenia maule, sp. nov., $\&$ (MACN-Ar 28484), epigynum: (A) ventral; (B) dorsal; (C) posterior; ( $D$ ) vulva, anterior. Abbreviations: LT, lateral teeth; CO, copulatory opening; AP, anterior pocket; MF, median field; FD, fertilisation ducts; HS, spermathecae; BS, base of spermathecae. Scale bars: $A, C, D=0.50 \mathrm{~mm} ; B=1.00 \mathrm{~mm}$.

## Description

Medium-sized spiders, total length 11.84-16.22, males smaller with relatively longer legs. Carapace oval in dorsal view (Figs 2A, $4 A$ ), convex in lateral view (Figs $2 B, 4 B$ ), fovea longitudinal, deep. Eyes in two recurved rows, indirect eyes with grate-shaped tapeta. Posterior eye row strongly recurved, ALE anterior to PME; ALE rounded, smallest in size and with well developed lenses, ocular quadrangle trapezoidal, wider posteriorly. Clypeus height 0.8 times AME diameter (Fig. 4D). Chelicerae with three promarginal and three retromarginal teeth. Chilum divided (Fig. 4D). Sternum anteriorly truncated and posteriorly rounded. Labium subquadrangular, endites slightly converging anteriorly, serrula subapical, in a single submarginal row.

Leg formula 4123. All trochanters deeply notched, males with a suture line on the basal part of the tibiae (i.e. tibial crack; Fig. $4 E$ ). Tarsus and apical part of the metatarsus with ventral scopula, three tarsal claws (Fig. 8C, D). Superior tarsal claws pectinate, with 3-4 small teeth, inferior tarsal claw simple, small (Fig. $8 D$ ). Dense claw tufts on independent, movable plates. Trichobothrial plate with transversal grooves (Fig. $8 B$ ), tarsal organ keyhole-shaped (Fig. 8A). Abdomen oval, without scuta, males with abdominal shields developed.

Colulus as a fleshy triangular lobe, with several setae, cribellum absent (Figs $6 A, 7 A$ ). Six spinnerets, ALS and PLS
two-segmented, PMS a single segment (Figs 6A, 7A). Anterior lateral spinneret with two major ampullate gland spigots on the mesal margin (the posterior one reduced to a nubbin in the male) and more than 30 piriform gland spigots (Figs $6 B, 7 B$ ). Posterior median spinnerets with aciniform and cylindrical gland spigots (absent in male), with a few setae between them, one minor ampullate gland spigot with a nubbin and a tartipore close to it (Figs 6C, 7C). Posterior lateral spinnerets with the distal segment short, cylindrical gland spigots on the basal part (absent in male) and aciniforms on the apical part, with setae among them (Figs 6D, 7D).

Tracheal system composed of four simple, unbranched tubes limited to abdomen. Male palpal patella without processes, tibia stout, same length as cymbium, RTA well sclerotised, short and simple, with a rounded process covered by long hairs on the prolateral side of RTA base (Fig. 5D); ventral apical apophysis curved retrolaterally (Fig. 5D); cymbium with a large dorsobasal projection and a small retrobasal one, interlocking with the ventral tibial apophysis (Fig. 5D), apical part of cymbium truncated, without dorsal macrosetae, dorsal patch of chemosensory setae dense but not well delimited (Figs $4 F-H, 5 C$ ). Tegulum oval, notched basally, with the tegular-subtegular interlocking lobes visible in prolateral view; subtegulum oval, visible in ventral view (Fig. 5A). Conductor hyaline, originating from broad base at


Fig. 4. Cauquenia maule, sp. nov., ô (MACN-Ar 28482): $(A-C)$ habitus; $(D)$ carapace frontal; $(E)$ right leg I, patella-tibia joint, retrolateral view; $(F-H)$ left palp. $(A)$ Dorsal; $(B)$ lateral; $(C)$ ventral. Scale bars: $A-E=2.00 \mathrm{~mm} ; F-H=0.50 \mathrm{~mm}$.
retroapex of tegulum, fan-shaped, embracing apex of embolus (Figs $4 F-G, 5 A-C$ ). Median apophysis concave, cup-shaped bimarginate, with retrolateral and a dorsal projections, attached in the middle of tegulum and opposite to the embolus (Figs $4 F-H$, $5 A-C$ ). Reservoir and ejaculatory duct simple, without loops or switchbacks, spiralling around outer margin of tegulum. Embolus long, stout, apex tapering, simple, with membranous cuticle
extending only on the base, prolateral side with a groove (Fig. $5 A$ ). Epigyne formed by a swollen median field, with an anterior transversal pocket, and lateral lobes with teeth in median position (Fig. $3 A$ ). Vulva (Figs $2 D-F, 3 B-D$ ) with deep median fossa corresponding to interior of median field, epigynal groove broad, parallel to copulatory ducts (Fig. 2D, E). Head of spermathecae small and simple (Fig. 3C, D).


Fig. 5. Cauquenia maule, sp. nov., left male palp (MACN-Ar 28482): (A) ventral; $(B)$ retrolateral; (C) prolateral; ( $D$ ) tibia. Abbreviations: C conductor; CDP, cymbial dorobasal projection; CDS, cymbial dorsal scopula; CRG, cymbial retrolateral groove; E, embolus; MA, median apophysis; ST, subtegulum; T, tegulum; VA, ventral apophysis. Scale bars: $A-C=1.00 \mathrm{~mm} ; D=0.50 \mathrm{~mm}$.

## Composition

One species, C. maule, sp. nov.

## Etymology

The generic name is a noun in apposition referring to the type locality and is feminine in gender.

Cauquenia maule, sp. nov.
(Figs 1-8)

## Material examined

Holotype. $\widehat{\delta}$, Reserva Nacional Federico Albert, Chile, Región del Maule (VII), Cauquenes province, $35^{\circ} 43^{\prime} 53.6^{\prime} \mathrm{S}, 72^{\circ} 32^{\prime} 11.9^{\prime} \mathrm{W}$ (datum WGS84), elev. 45 m (GPS), 17.vii. 2010 Ojanguren, A., Piacentini, L. Soto, E., Valdivia, D., Pizarro Araya, J., day, general collecting (MHNS).

Paratypes. $1 q$ (MHNS), and $2 \hat{\gamma}$ and $1 q$ (MACN-Ar 28481), collected with the holotype.
Other material examined. Chile: Región del Maule, Cauquenes: collected with the holotype: 3 ô (MHNS, MACN-Ar 28482, and MACN-Ar 28483); 2 ㅇ (MACN-Ar 28484 and MNHN); 2 immatures (MACN-Ar 28485 and MACN-Ar 28486); Reserva Nacional Los Ruiles, $35^{\circ} 50^{\prime} 02.6^{\prime} \mathrm{S}, 72^{\circ} 30^{\prime} 35.7^{\prime} \mathrm{W}$ (WGS84), elev. 174 m (GPS), 17.vii. 2010 Ojanguren, A., Piacentini, L. Soto, E., Valdivia, D., Pizarro Araya, J. one female (MNHN); Tregualemu, elev. 520 m, 6-7.xi. 1993 L. E. Peña \& A. Ugarte, 7 \& 1 § (AMNH); Región de Biobío (VIII), Concepción province, Hualpén, 11.i.1989, Ramírez M., 1 q (MACN-Ar 29980).

## Diagnosis

As per genus diagnosis. Males can be also recognised by having a median apophysis with a finger-like projection (Fig. 5A), a peculiar cymbium-tibia interlocking structure and cymbium with


Fig. 6. Cauquenia maule, sp. nov., $q$ (MACN-Ar 28484): $(A)$ spinnerets overview; $(B)$ anterior lateral spinneret (ALS); ( $C$ ) posterior median spinneret (PMS); (D) posterior lateral spinneret (PLS). Abbreviations: AC, aciniform gland spigots; CY , cylindrical gland spigots; mAP , minor ampullate gland spigots; MAP, major ampullate gland spigots; NU, nubbin; PI, piriform gland spigots; TP, tartipore. Scale bars: $A=0.50 \mathrm{~mm} ; B-D=0.10 \mathrm{~mm}$.
a large dorsobasal projection (Fig. 5C); females have a large median epigynal field with an anterior transversal pocket and reduced lateral lobes with teeth in median position (Fig. 3A).

## Description

## Male (holotype)

Colour in ethanol (Fig. 4A-C): carapace with a dorsal, palebrown median band with irregular borders and dark marginal brown bands, with irregular submarginal pale brown shapes and arrow-shaped central mark pointing to the fovea. Ocular area dark, with black pigment surrounding each eye and extending between AME and PME; chelicerae reddish-brown, labium and endites reddish brown, labium lighter at the tip; sternum, coxae and trochanters uniform pale brown; femora ventrally uniform pale brown and dorsally with irregular brown spots. Patellae, tibiae, metatarsi and tarsi brown. Total length 12.51, carapace
5.99 long, 6.52 wide, 2.52 high; clypeus 0.13 high; ocular area 0.83 long, 1.93 wide; ratio of eyes ALE:AME:PME: PLE, 1.00:1.31:2.54:3.01. Chelicerae 2.27 long; sternum 2.47 long, 2.20 wide; labium 0.97 long, 0.83 wide. Spination pattern: as per genus. Scopulae strong beneath entire length of tarsi and apical part of metatarsi. Legs: length of segments (femur + patella/tibia + metatarsus + tarsus $=$ total length ): pedipalp $2.00+0.73+-+0.80=3.53$, I $5.40+7.60+4.73+2.33=20.06$, II $4.80+6.53+4.53+2.00=17.86$, III $4.53+5.20+4.00+$ $1.67=15.40$, IV $5.33+6.67+5.93+2.33=20.26$. Leg formula IV $>$ I $>$ II $>$ III. Palp as for genus. Spination pattern: femur palp d $1-1-3$, I p 0-0-1-d1 d 1-1-0-1 r d1-d1-d1-d1, II p d1-d1-d1-d1 d 1-1-0-1 rd1-d1-d1-d1, III p d1-d1-d1-d1 d 1-1-0-1 rd1-d1-d1-d1, IV p 0-d1-d1-d1 d 1-1-0-1 r 0-0-d1-d1; patella palp p 0-1-0 r 0-10 , Ip 0-1-0r 0-1-0, IIp 0-1-0r0-1-0, IIIp 0-1-0 r0-1-0, IV p 0-1-0 r $0-1-0$; tibia palp p 1-0-0, Ip 0-1-0-0 r 1-0-1-0 v 2-2-2-2-2ap, IIp $0-$ 1-0-0 r 1-0-1-0 v 2-2-2-2-2ap, III p 1-0-1-0 d 1-0-1-0 r 1-0-1-0 v 2-

Fig. 7. Cauquenia maule, sp. nov., ô (MACN-Ar 28482): (A) spinnerets overview; (B) anterior lateral spinneret (ALS); ( $C$ ) posterior median spinneret (PMS); $(D)$ posterior lateral spinneret (PLS). Abbreviations: AC, aciniform gland spigots; MAP, major ampullate gland spigots; mAP, minor ampullate glands spigots; NU, nubbin; PI, piriform gland spigots; TP, tartipore. Scale bars: $A=0.50 \mathrm{~mm} ; B=0.20 \mathrm{~mm} ; C, D=0.10 \mathrm{~mm}$.

Fig. 8. Cauquenia maule, sp. nov., $q$ (MACN-Ar 28484): $(A)$ tarsal organ left leg I; $(B)$ socket of trichobothria left leg I; ( $C$ ) left leg I prolateral view; ( $D$ ) tarsal claws of leg IV, retrolateral view. Scale bars: $A, B=0.01 \mathrm{~mm} ; C=1.00 \mathrm{~mm} ; E=0.20 \mathrm{~mm}$.


Fig. 7.

(C)

Fig. 8.

0-2-0-2ap, IV p 0-1-0-1 d 1-0-1-0 r 0-d1-0-d1 v 2-0-2-0-2ap; metatarsus Iv 2-2-2, II v 2-2-2, III p 1-2-2 r 0-1-0-2 v 2-0-2-0-2ap, IV p d1-0-1-0-2ap r d1-0-2-0-2ap v 2-r1-r1-rl-2ap.

## Female (paratype)

Colour in ethanol (Fig. 2A-C): as in male. Total length 15.56, carapace 6.78 long, 5.45 wide, 2.53 high; clypeus 0.17 high; ocular area 1.17 long, 2.33 wide; ratio of eyes ALE:AME:PME:PLE, $1.00: 1.50: 2.17: 2.67$. Chelicerae 2.93 long; sternum 2.80 long, 2.40 wide; labium 1.10 long, 1.00 wide. Spination pattern: as per genus. Scopulae strong beneath entire length of tarsi and metatarsi I and II, weakly developed on metatarsi III and IV. Legs: length of segments (femur + patella/tibia + metatarsus + tarsus $=$ total length $)$ : pedipalp $2.20+2.6+-+2=6.80$, I $5.20+7.07+3.87+1.87=$ 18.01, II $5.00+6.67+3.73+1.67=17.07$, III $4.53+5.33+$ $3.67+1.67=15.20$, IV $5.33+6.67+5.73+2.07=19.80$. Leg formula IV $>$ I $>$ II $>$ III. Spination pattern: femur palp d 0-1-3, Ip 0-0-1-d1 d 1-1-0-1 rd1-d1-0-d1, II p d1-0-1-d1 d 1-1-0-1 rd1-d1-0-d1, III p 0-d1-d1-d1 d 1-1-0-1 rd1-d1-0-d1, IV p d1-d1-0-d1 d 1-1-0-1 r 0-0-0-d1; patella palp p 0-1-0 r 0-1-0, III p 0-1-0 r 0-10 , IV p 0-1-0 r 0-1-0; tibia palp p 2-0 d 1-0, Iv 2-2-2-2-2ap, IIr 0-1-$0-0-0$ v 2-2-2-2-2ap, III p 1-0-1-0 d 0-1-0 r 1-0-1-0 v 2-2-0-2ap, IV p 0-1-0-1 d 0-0-1-0 r 0-1-0-1 v 2-0-2-0-2ap; metatarsus Ip $0-0-1$ r $0-0-1$ v 2-2-0, II p 0-0-1 r 0-0-1 v 2-2-0, III p 1-2-0-2 rd1-p1-0-2ap v 2-2-2ap, IV p 1-0-1-0-2 rd1-2-0-2ap v 2-r1-2-2ap. Genitalia as for genus.

## Distribution

Only known from central Chile, in the Maule and Bío Bío regions.

## Natural history

The specimens from Reserva Nacional Federico Albert were collected during the day, under bark in a eucalypt forest located over dunes in a coastal locality.

## Etymology

The specific epithet is a noun in apposition from the type locality.

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[^0]:    ${ }^{1}$ Available to reviewers in http://purl.org/phylo/treebase/phylows/study/TB2:S14392?x-access-code $=$ c $918173 \mathrm{~d} 64 \mathrm{e} 37513 \mathrm{~d} 519 \mathrm{f4c} 1 \mathrm{da} 3 \mathrm{fd} 028 \& \mathrm{format}=\mathrm{html}$

