

A Revision of *Cresson* Pate (Hymenoptera, Apoidea, Bembicidae) with the description of two new species

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Abstract

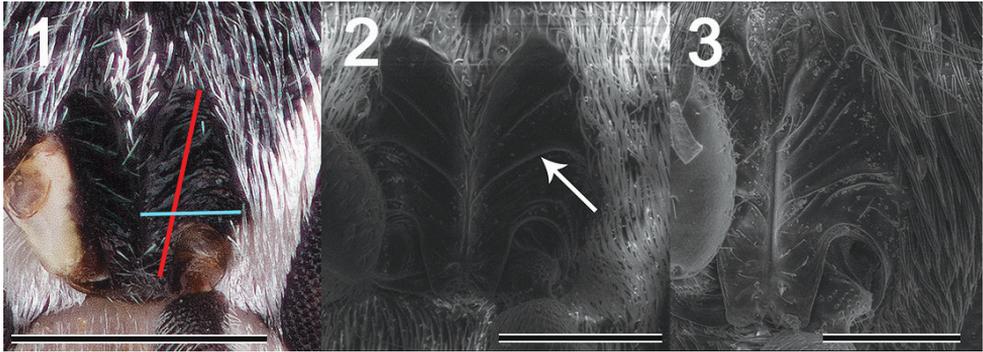
I describe two new species of the previously monotypic, Chilean endemic nyssonine genus *Cresson*: *C. mariastea* Packer, **sp. nov.** and *C. salitrera* Packer, **sp. nov.**, redescribe the type species *C. parvispinosus* (Reed) and provide an identification key for the three species. I clear up the confusion associated with the original type material of the latter species by designating a specimen from the type locality as the **lecto-type**. The new species extend the range of the genus northwards, one by over 1000 km. I suggest putative hosts for all three species, all of which are in the genera *Tachysphex* or *Parapiagetia*.

Keywords

Apoiid wasp, Chile, cleptoparasite, host association, identification key, taxonomy

Introduction

The nyssonine genera *Cresson* Pate, 1938, *Perisson* Pate, 1938 and *Antomartinezzius* Fritz, 1955 contain one, one and three described species, respectively (Fritz 1973; Bohart and Menke 1976). Amarante (1993) noted a fourth, still undescribed, species of the latter genus. The last two of these genera were originally described as subgenera of *Cresson* but were raised to generic level by Fritz (1955) and Bohart and Menke (1976), respectively. Bohart and Menke (1976) noted both the superficial similar-



Figures 1–3. Supra-antennal areas of *C. parvispinosus* **1** standard light photomicrograph of male, red line indicates measurement of length of the area, the blue line indicates its width. Scale bar: 0.5 mm. **2** ESEM of female, the white arrow indicates the lamella. Scale bar: 300 μm . **3** ESEM of another female showing different number of carinae to that in figure 2. Scale bar: 200 μm .

ity among the five species of the three genera as well as putatively more substantive shared features such as the Y-shaped frontal crest (Figs 1–3) and double-edged posterior margins to the metasomal terga in both sexes (Fig. 4, yellow curly bracket) and the sternal setal fringes in males (Fig. 5). They (Bohart and Menke 1976) also noted the differences among these three taxa which they considered sufficient to support generic level status for all of them. These differences include *Cresson* and *Perisson* having arolia that are lacking in *Antomartinezius*; *Perisson* and *Antomartinezius* with lateral lobes to the sterna in both sexes (see Bohart and Menke, 1976, fig. 154) and two midtibial spurs in males, whereas *Cresson* has no lateral sternal lobes (Fig. 5) and but one midtibial spur in the male.

Antomartinezius and *Perisson* are restricted to Argentina, although Amarante's (1993) undescribed species of the former was from NE of Brasilia. In contrast, *Cresson* is endemic to Chile, known from the central region of the country. Extensive trapping and net collecting of aculeate Hymenoptera by members of my laboratory in Chile over the past two decades has resulted in the discovery of two new species of *Cresson* and the purpose of this paper is to describe them, redescribe the type species: *C. parvispinosus* (Reed), designate a lectotype for the latter, provide an identification key and updated diagnosis and description for the genus and suggest likely hosts for all three.

Methods

Classification

I use the generic level classification of apoid wasps of Pulawski (2020), while considering the family level status of nyssonines as being in some flux: they would have been Crabronidae for most recent authors, but Sann et al. (2018) suggest that this family

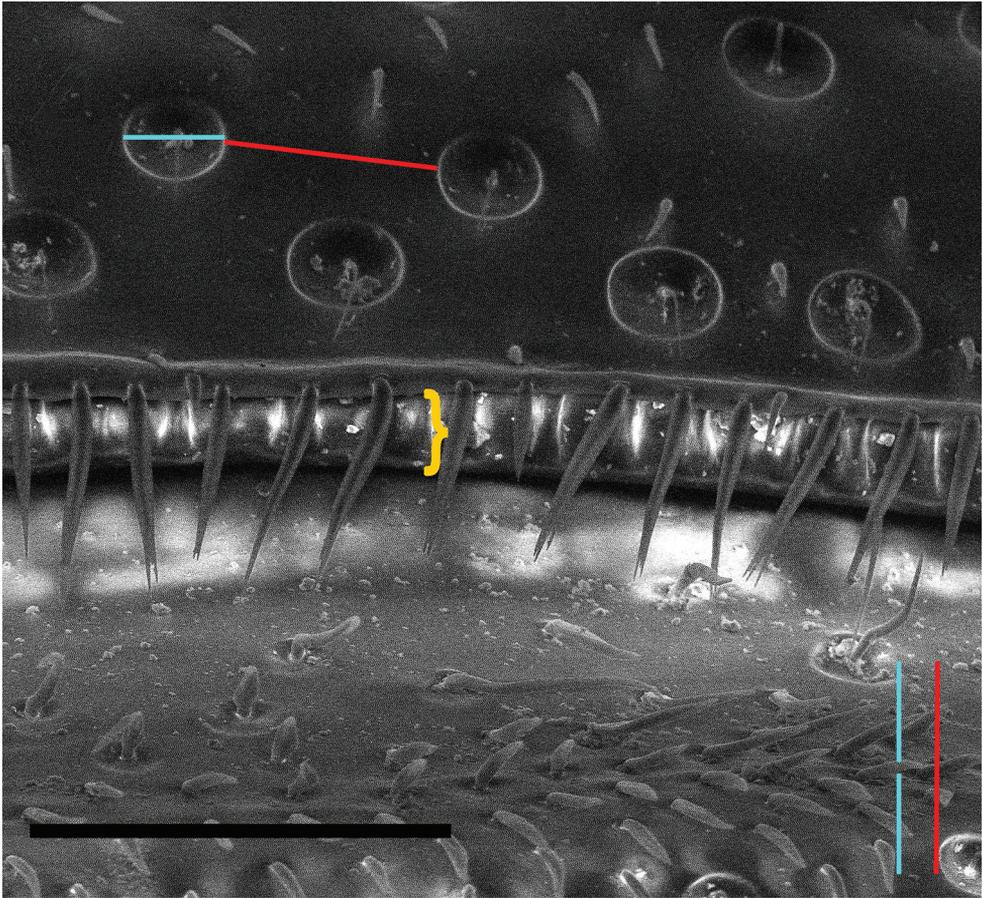


Figure 4. Apex of T1 and base of T2 of female *C. parvispinosus* to show measurement of puncture spacing (diameter (**d**) – blue line, interspace length (**i**) red line (here $i-2d$ as indicated to the bottom right) and the double-edged nature of the apex of the tergum, indicated by the yellow curly bracket. Scale bar: 100 μ m.

should be divided into additional families among which the nyssonines belong to the Bembicidae. The latter classification is followed here.

Collecting

Wasps were collected mostly in pan traps or deep cup traps (a deeper version of the standard pan trap – see Packer and Darla-West 2021; fig. 3.1d). The dimensions of the most commonly used of the latter are 84 mm in diameter at the mouth, 52 mm at the base and 110 mm in depth. They were partially dug into the ground (for -half their depth) and left out for varying durations, often for weeks. Blue vane traps (Stephen and Rao 2005; Kimoto et al. 2012; Packer and Darla-West 2021, fig. 3.1f) were employed at some sites, particularly in areas with very limited rainfall and difficult to access. Both trap types permit chronologically extensive sampling in areas where daily

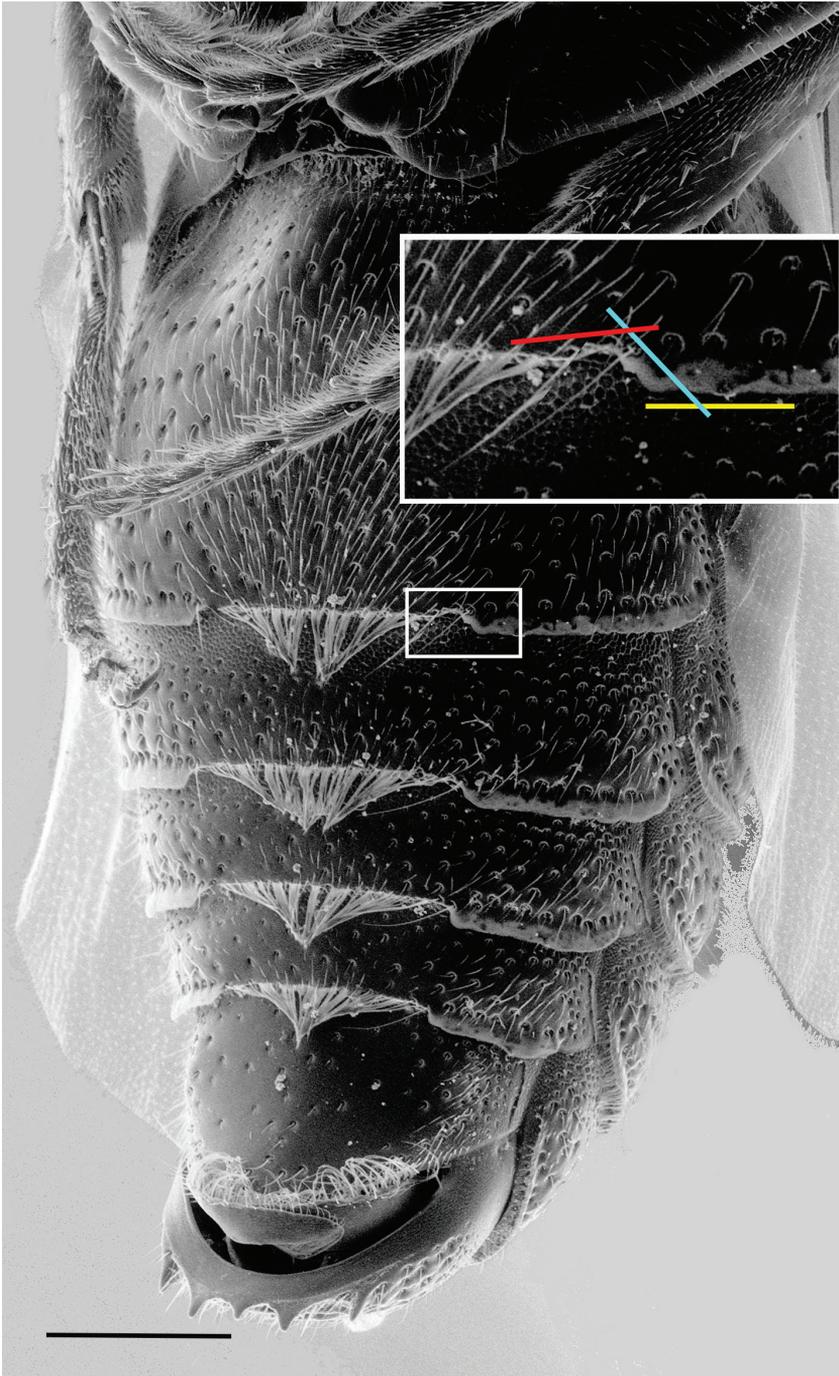


Figure 5. Oblique ventral view of metasoma of male *C. parvispinosus* to show apicomedial setal fringes situated within the medial gap in apical sternal depressions along with the angles formed at the margin of the gap (inset). The angle formed by the red and blue lines indicates the anterior angle, that formed by the blue and yellow lines the posterior angle. Scale bar: 0.5 mm.

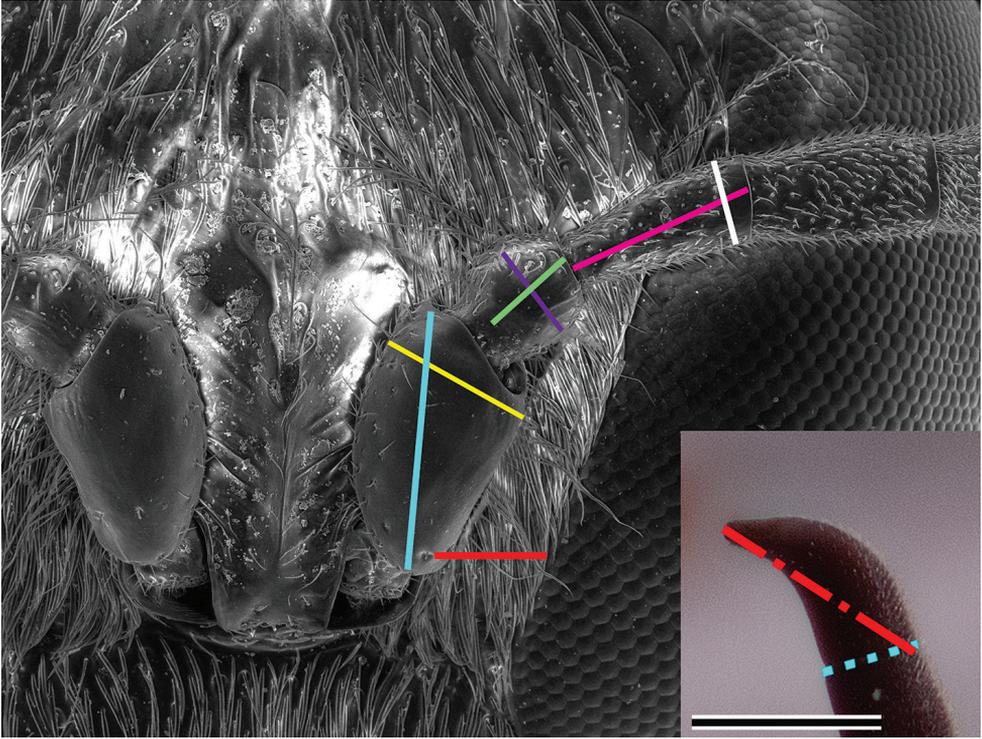


Figure 6. Part of face and parts of antenna of male *C. parvispinosus* to show landmarks used in some measurements. Red line: AOD; blue line: scape length; yellow line: scape width; green line: pedicel length (note only the swollen part contributes to this measurement); purple line: pedicel width; pink line: F1 length; white line: F1 width; inset red dashed line: F11 length; blue dashed line: F11 width. Scale bars: 0.25 mm.

catch rates are likely to be very low. Propylene glycol was used as the collecting fluid in both trap types due to its slow evaporation rate even under hot arid conditions.

Descriptions

Observations were made with a Leica MZ 12.5 microscope with 16× Leitz Wetzlar eyepiece lenses. Measurements were taken with an eyepiece graticule of unknown provenance. Lighting was from an AmScope LED-80-AM light source, except for surface sculpture features for which a Luminus PLY1223 energy saving bulb was used because of its superior ability to avoid bright reflection and to cast the light more evenly over the specimen.

I use a descriptive format and the morphological terminology that is consistent with our recent work (albeit on bees; e.g. Mir Sharifi and Packer 2018; Packer and Graham 2020) which incorporates some terms from Prentice's (1998) work on apoid wasps (such as vertexal area, apical sternal and tergal depressions) while otherwise largely agreeing with Michener (2007). Following the first three of those citations,

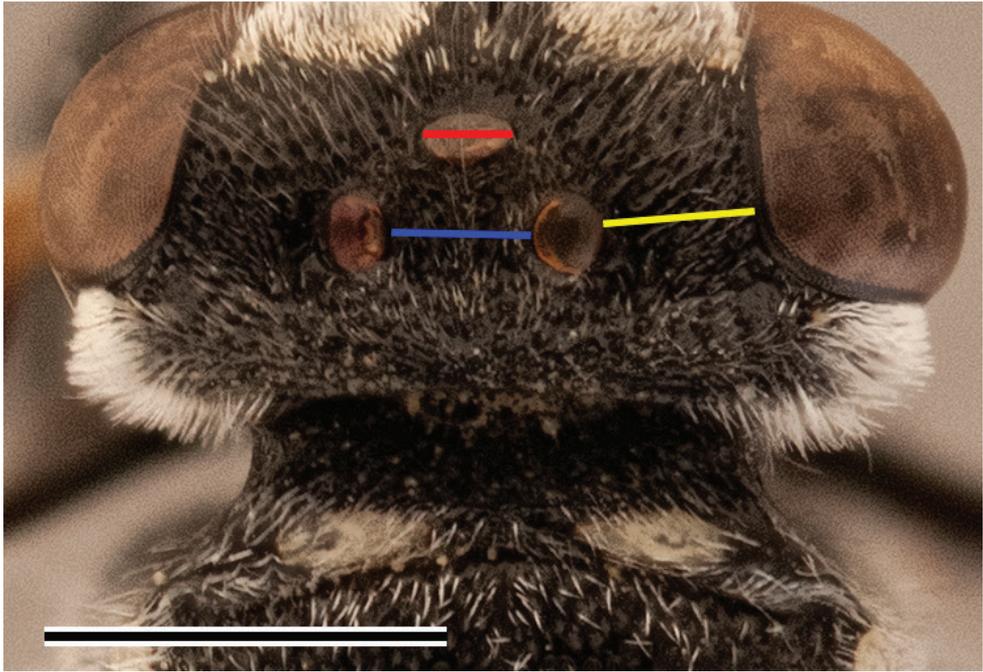


Figure 7. Top of head of female *C. salitreira*. Red line: MOD; blue line IOD; yellow line OOD. Scale bar: 1.0 mm.

based upon the findings of Brothers (1976), the term metapostnotum is used. Its dorsal surface is what has often been termed the propodeal triangle or propodeal enclosure in studies of apooid wasps. On either side of the metapostnotum there is a densely setose area above the almost vertical lateral surface of the propodeum. I call this densely setose area the dorsolateral area of the propodeum. Surface sculpture terminology follows Harris (1976) except that stria and associated terms (striae, striate etc.) are taken to mean raised, rather than depressed linear features. For the newly designated lectotype of *C. parvispinosus*, some features could not be observed, being hidden behind other structures or damaged; such parts were described from a different specimen [Valparaiso, MCZ-ENT 00731886] and such data are given in square brackets.

The following acronyms are used: F, S and T followed by a number for flagellomeres, sterna and terga; AOD: transverse distance between outer margin of antennal socket and inner margin of compound eye (Fig. 6, red line); IOD: shortest distance between lateral ocelli (Fig. 7, blue line); LOD: distance between inner margin of compound eyes at posterior mandibular articulation in frontal view (Fig. 8, pale blue line); MINOD: minimum distance between compound eyes (Fig. 8, purple line); MOD: transverse diameter of median ocellus Fig. 7, red line); OOD: minimum distance between outer margin of lateral ocellus and compound eye (Fig. 7, yellow line); UOD: distance between inner margins of compound above in frontal view (Fig. 8, yellow line). Puncture spacing is given in terms of the distance between punctures (interspaces) and the diameter of nearby

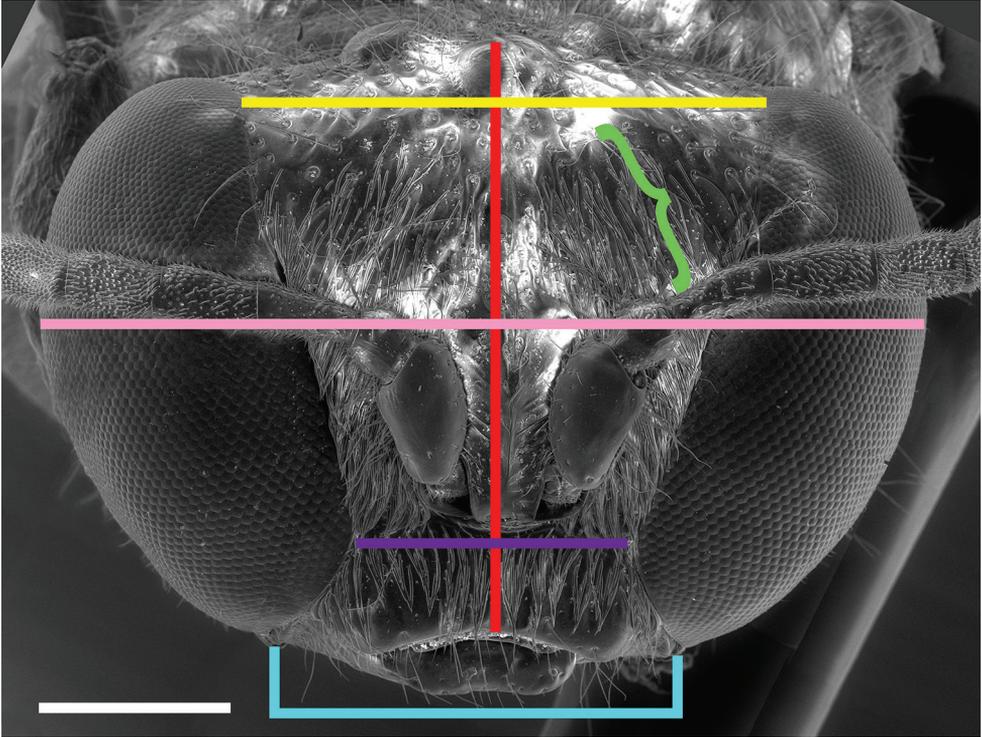


Figure 8. Face of *C. parvispinosus* to show landmarks used in some measurements. Red line: head length; pink line: head width; yellow line: UOD; purple line: MINOD; blue line: LOD; green curly bracket shows extent of frontal depression. Scale bar: 0.5 mm.

punctures, such that $i-2d$ indicates the interspaces (Fig. 4, red line) approximately two puncture diameters apart (Fig. 4, blue line), $i = 1-5d$ indicates irregular spacing of equal to one to five times the puncture diameters. Additional landmarks used in the definitions of some other head parameters are indicated in Figs 1, 6–8. Some measurement and other observations are made of the head “in frontal view”, this is defined as having both the apex of the clypeal lip and the top of the head in focus simultaneously. Two morphological terms are defined: 1) the supra-antennal area, which is defined by the medial and dorsolateral arms of the frontal crest, it is slightly concave, bears oblique carinae (usually with one developed into a lamella) and lacks setae (Figs 1–3); 2) the frontal depression a slightly concave area between the recurved arm of the frontal crest and the compound eye (Fig. 8, green curly bracket). Mesosomal measurement landmarks are shown in Fig. 9. Terminology for leg surfaces follows Aguiar and Gibson (2010).

Light microscopy images used a Visionary Digital BK Plus imaging system with a Canon EOS 5D digital SLR camera. Environmental scanning electron micrographs (ESEMs) were taken with a Thermofisher Quanta 3D FEG DualBeam microscope, no coating and both Low Vacuum and Gaseous Sensory Electron Detectors. Images were processed with Adobe Photoshop CS6.

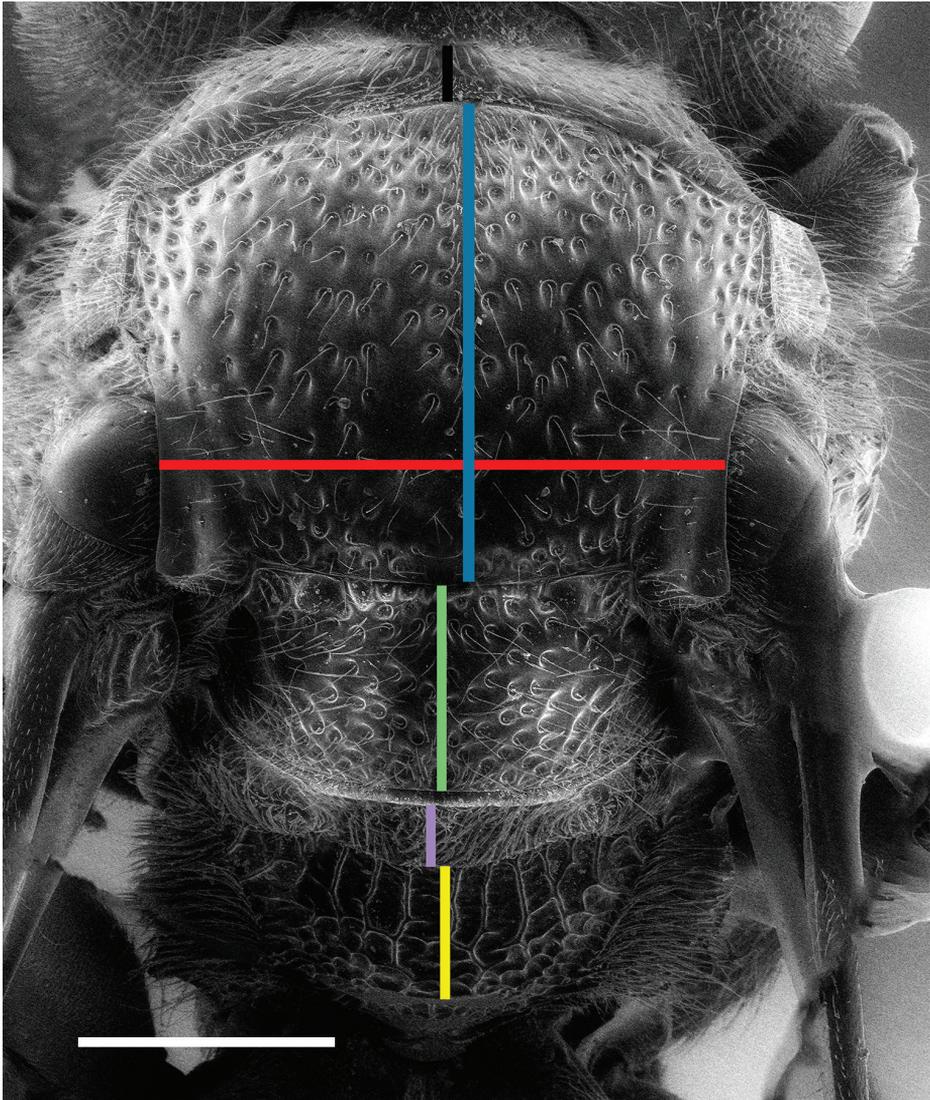


Figure 9. Dorsal view of mesosoma of *C. parvispinosus* to show landmarks for some measurements. Black line: length of pronotal collar; blue line: length of mesoscutum; red line: ITW; green line: length of scutellum; purple line length of metanotum; yellow line: length of dorsal surface of metapostnotum (note that the latter is taken from the metanotal-metapostnotal suture to the transverse carina closest to the change in angulation from approximately horizontal to approximately vertical surfaces of the metapostnotum). Scale bar: 0.5 mm.

Geography

Chile is divided into Regions which receive both a Roman numeral (except for the area around Santiago – Region Metropolitana) as well as a name. We use the Roman numerals for regions where we have collected and when such data can be gleaned from

the information provided on labels affixed to material collected by others. In instances of the latter, the region is given in square brackets and the label data are as given but re-organized to follow a standardized format. Coordinates are given in decimal degrees to three decimal places when known with that level of precision. Coordinates estimated from collection locality names are given in square brackets at a lower level of accuracy. The map was prepared using SimpleMapp (Shorthouse 2010).

Institutional abbreviations

- AMNH** American Museum of Natural History, New York, New York, United States of America
CAS California Academy of Sciences, San Francisco, California, United States of America
CUIC Cornell University Insect Collection, Ithaca, New York, United States of America
MNHN Museo Nacional de Historia Natural, Santiago, Chile
MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, United States of America
PCYU Packer Collection at York University, Toronto, Ontario, Canada
UCDC R.M. Bohart Museum of Entomology, Davis, California, United States of America
ZMHB Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

Results

Taxonomy

Cresson Pate, 1938

Cressonius Bradley, 1956: 257. Unnecessary emendation.

Type species. *Nysson parvispinosus* Reed, 1894: 641, by original designation and monotypy.

Diagnosis. *Cresson* can be separated from other South American nyssonine wasps by the combination of i) metatibia lacking teeth, with bristles that clearly arise from an articulation in a socket; ii) metasomal sterna lacking lateral lobes as opposed to lobes present (compare Fig. 5 herein with fig. 154 in Bohart and Menke 1976); iii) metasomal terga with posterior margins thickened and appearing double-edged (Fig. 4, yellow curly bracket) versus simple and iv) a Y-shaped crest on the lower frontal area with the apices of the paired arms recurved (Figs 1–3). Feature i) separates *Cresson* from *Idionysson* Pate, 1940, *Metanysson* Ashmead, 1899, *Neonysson* Bohart, 1968, and *Zanysson* Rohwer, 1914, ii) separates it from both *Antomartinezius* and *Perisson*, iii) separates it from *Losada* Pate, 1940 and *Nysson* and iv) from *Epinysson* Pate, 1935, *Foxia* Ashmead, 1898 and all aforementioned genera except *Antomartinezius* and *Perisson*.

Description. Colouration: Black with white to cream coloured markings on face, pronotal collar (rarely absent), pronotal lobe, scutellum (rarely absent), legs, subapical bands on most terga, sometimes on sterna; red markings on metasoma absent to extensive. Both sexes with labrum and base of mandible pale, female with clypeus pale laterally, black medially, male clypeus entirely pale except lip orange-brown.

Pubescence: Silvery appressed to subappressed setae extensive on face, genal area, dorsal surface of pronotum, most of mesopleuron (sparser anteriorly and ventrally, absent posteriorly), posterolaterally on scutellum, metanotum, dorsolateral area of propodeum and sometimes on T1, setae of scutellum and metanotum anteriorly or anterolaterally oriented; fine erect setae longer on upper part of face, shorter on mesoscutum and mesopleuron, vertically oriented dense row of short setae occupying space between extreme apical margin of terga and base of succeeding tergum, metasomal sterna with scattered longer erect setae; male with median setal fringes on S2–S5 situated in a gap in the apical sternal depressions, lateralmost fringe setae longest, posteromedially oriented but sparser than more posteriorly oriented remaining fringe setae.

Surface sculpture: Microsculpture largely absent, integument shiny, punctures bimodal in size on face and mesoscutum, minute punctures sparsely scattered among interspaces between larger mostly dense punctures; larger punctures especially on face and mesoscutum with minute punctures at their bottoms and often with several punctures aggregated in groups with edges raised, sometimes giving somewhat striate appearance; minute punctures more numerous on metasomal terga and sterna among distinct larger punctures; junctions between mesoscutum and scutellum and between meso- and metapleuron foveate, the latter finely so; lateral surface of pronotum and posterodorsal part of lateral surface of propodeum obliquely costate; posterior portion of mesopleuron, metapleuron and rest of lateral surface of propodeum generally lacking sculpture, glassy smooth; posterior surface of propodeum coarsely sculptured; metapostnotum rugoso-striate dorsally. Portion of metasomal terga posterior to graduli (usually hidden beneath preceding tergum) imbricate, dull; sterna with similar imbricate areas more extensive. Metasomal terga and sterna with most punctures separated by distance greater than their diameters, except last metasomal tergum with coarse, irregularly shaped, almost crowded punctures; last visible sternum with small, scattered punctures; apical impressed tergal and sternal depressions with row of punctures at their base.

Structure: Head 1.3–1.5 × wider than long; labrum short, transverse, apical margin slightly concave to transverse medially; clypeus short, apicomediaally concave with pronounced bevelled edge, lip approximately half as wide as clypeus; supraclypeal area small, sometimes hidden beneath ventral expansion of frontal crest, crest Y-shaped, ventral margin of crest swollen with angulate ventral incision, in frontal view crest obscures the medial margin of the antennal socket lateroventrally, medially the crest is conspicuously developed, almost lamellate, dorsal arms less developed, recurved, space between median lamella and entire recurved arm with one dorsolaterally oriented lamella and varying number of subparallel carinae; space between lateral margin of supra-antennal area and compound eye with frontal depression extending upwards for a variable distance below lower tangent of median ocellus, dorsal margin of depres-

sion often ill defined; inner margin of compound eyes markedly convergent below, shortest distance between them at base of clypeus; occipital and hypostomal carinae complete, lamellate. Scape longer than wide, slightly produced basoventrally, integument somewhat translucent for apicoventral one-third of length; pedicel with medial surface globose, conspicuously narrowed towards base, lateral surface straighter; male apical flagellomere falcate, concave below narrowing to acute apex. Pronotum with vertical carina that in dorsal view appears as a tooth, pronotal collar in dorsal view transverse anteromedially, convex anterolaterally; in profile gradually rounded onto anterior declivitous surface except abruptly and angulately so medially. Mesoscutum posterolaterally markedly reflexed upward, projecting over medial margin of tegula. Lateral propodeal spine conspicuous, acute. Mesotibia of male with one apical spine, mesobasitarsus of male with ventral setal fringe; female lacking rake spines on protarsus; metatibia slightly concave apicodorsally, extreme apex angulate dorsally, lacking robust spines or teeth; arolia in both sexes small. Three submarginal cells, second cell petiolate; stigma subequal in size to prestigma; hindwing media diverging beyond cu-a by more than twice the length of the latter; jugal lobe somewhat larger than tegula. Metasomal terga posterior margins double-edged. T2 transversely depressed anteriorly. Apical tergum of both sexes with apicolateral margin spinose; in females, the medial pair longer than others, in males the single median spine is short. S2 swollen anteromedially and depressed anterolaterally. Metasomal sterna not extended laterally as lobes, male S2–S5 with apical sternal depression abruptly absent medially, this area in female sometimes slightly concave.

Cresson parvispinosus (Reed)

Figures 1–6, 8–21, 34

Nysson parvispinosus Reed, 1894:641, ♀ Lectotype (here designated): ♀, Chile, Colchagua Province; no specific locality (MCZ); Dalla Torre 1897: 573, catalog; Pate 1938: 155, description of genus; Maidl and Klima 1939: 149, catalog; Fritz 1955: 14, redefinition of genus; Bohart and Menke 1976: 476, generic key, diagnosis, range, systematic position, checklist; Sielfeld 1980: 74, catalog; Amarante 2002: 20, catalog; Chiappa 2012: 9, catalog.

Material examined. 55 ♀, 47 ♂: **Lectotype** ♀; CHILE, Colchagua Province [Region VI]; 1890; E.C. Reed; MCZ-ENT-17200; Additional material: 1 ♂; • CHILE [Region IX], 20 km E. of Temuco; [-38.7 – 72.35]; 7.i.1951; Ross and Michelbacher; CAS; • 1 ♀; [Region VII] Curicó Prov., Fundo La Montaña, Estero La Palma at Rio Teno, 6 km E. of Los Queñes; [-35.00 – 70.75]; 4.i.1967; M.E. Irwin; CAS; • 1 ♀; Valparaiso Province [Region V], Valparaiso; [-33 – 71.5]; 26.xi.1919; P. Herbst; MCZ; MCZ-ENT 00731885; • 1 ♀; identical data as previous; CAS; • 1 ♀; identical data as previous; 12.i.1921; MCZ (MCZ-ENT 00731886); • 2 ♀, 3 ♂; identical data to MCZ-ENT 00721886; CAS; • 1 ♀; Valparaiso [Region V], Concon; [-32.9 – 71.5];

74.xii.1910; P. Herbst; MCZ; MCZ-ENT 00731884; • 1 ♂; identical data to MCZ-ENT 00731884; CAS; • 1 ♂; [Region V], Rio Blanco; 7.xii.1917; P. Herbst; CAS; • 1 ♀; Valparaiso Province, [Region V] Olmué; [-33.0 – 71.2]; 4.ii.1920; P. Herbst; MCZ; MCZ-ENT 00731883; • 1 ♂ (dissection code 65-xi-250); [Region V] Perales, Quilpué; [-33.05 – 71.4]; 4.ii.1925; P. Herbst; CAS; • 1 ♀; Valparaiso Province [Region V]; Marga-Marga; 9.i.1919; P. Herbst; MCZ; MCZ-ENT 00731880; • 1 ♂; Santiago Province [Region Metropolitana], Cerros de Tiltil; [-33.1 – 70.9]; 18.i.1919; P. Herbst; MCZ; MCZ-ENT 00731881; • 1 ♂ identical data as previous; 2000m; i.1920; MCZ; MCZ-ENT 00731882; • 1 ♂ (“homotype” A.R. Menke); [Region V], Valparaiso; 19.i.1921; P. Herbst; UCDC; • 1 ♀; [Region V], Altos de Lliu Lliu; [-33.1 – 70.9]; 20.i.1919; P. Herbst; UCDC; • 1 ♂; [Region Metropolitana], Santiago; 1922; F. Jaffuel; UCDC; • 1 ♀; [Region Metropolitana], Santiago, Maipu, Quebrada de La Plata; 26.xii.1966; L. Stange; UCDC; • 1 ♀; [Region IV], 10 km E. of Fray Jorge Nat[ional] P[ark]; [-30.6 -71.6]; 28.xii.1966; dry wash; M.E. Irwin; CAS; • 2 ♂, 1 ♀; Region IV, El Pangue; -30.164 -70.664; 1700m; A Ugarte; PCYU; • 33 ♂, 40 ♀; Region III, 13.5 km W. of Los Sapos; -28.019 -70.554; 500m; 22–25.x.2010; pan traps; L. Packer; CAS, MNHN, PCYU, UCDC and ZMBH; • 1♂; Region III, Rd. to Pastos Largos; -28.164 -69.791; 2100m; 6.xi.–11.xii.2013; S. Monckton and J. Postlethwaite; pan trap; PCYU; • 1 ♀; CHILE; UCDC.

Diagnosis. The type species of the genus can be differentiated from the new species most easily by the more extensive red colouration of the metasoma in both sexes with T1–T2 entirely red (except for the extreme anterior margin and one male has a small posteromedial dark mark on T2) (Figs 12–14). Females usually also have T3 entirely red. The other species have T1 and T2 black at least medially, although T1 is usually almost entirely black (see Figs 24, 31). The pronotal collar is relatively longer, at least two-thirds as long as MOD, whereas in the two other species it is approximately ½ as long as MOD (compare Figs 34 and 35).

Redescription. Lectotype Female (Fig. 10)

Dimensions: Body length 6.1 mm, head width 2.05 mm, forewing length 4.4 mm, ITW 1.15 mm.

Colouration: Black except as follows: cream to pale yellow on labrum, basal half of mandible (rest orange to red-brown), clypeus lateral one-third (entire apical bevelled region and lip orange-brown), small semicircular-triangular mark on upper paraocular area adjacent to compound eye, small spot on genal area above adjacent to compound eye; large lateral marks on pronotal collar almost twice as wide as the space that separates them, pronotal lobe, lateral spot on scutellum, narrow oblique mark in front of mesocoxa, small apicolateral mark on meso- and metacoxae, apicoventral two-thirds of profemur, narrow stripe on anterior surface of pro- and mesotibiae (suffused with orange on protibia), narrow dorsal stripe on metatibia (rest of legs dark brown, except metatibia posterior surface and all tarsi orange to orange-brown), medially interrupted narrow subapical bands on T1–T5. Most of ventral surface of scape yellow brown. Following parts orange-red: T1 and T2, T3 laterally; S1 and S2 (both suffused with red-brown medially), S3 narrowly subapically, S4 narrowly apicolaterally. Apical tergal and sternal depressions pale translucent brown to straw; T6 teeth pale brown.



Figures 10–11. *Cresson parvispinosus* specimens used in the redescription of the species **10** lectotype female **11** male from Cerros de Tiltit (MCZ–ENT 00731881). Scale bars: 1.0 mm.

Pubescence: [described from female from Valparaiso, MCZ–ENT 00731886]: Silver, appressed, obscuring integument only on lower paraocular area, genal area close to compound eye, most of mesopleuron and dorsolateral area of propodeum; sparser



Figures 12–14. Metasomas of *C. parvispinosus* to show variation in colour **12** male with T1–T2 red **13** female with T1–T3 and sides of T4 red **14** female with T1–T2 and sides of T3 red. Scale bars: 1.0 mm.

on clypeus, sparser and suberect on genal area posteriorly. Face with erect to suberect pale setae < 1.2 MOD, those of lower frontal area curved ventrally; pronotal collar and mesoscutum anteriorly with sparse, posteriorly oriented appressed setae; mesoscutum, scutellum, metanotum and mesopleuron with sparse erect setae $< \text{MOD}$. Metasomal terga and sterna with sparse short subappressed posteriorly oriented setae ≤ 0.4 MOD; suberect setae intermixed on terga < 0.5 MOD, these longer and denser on more posterior sterna, $< \text{MOD}$ on S6.]

Surface sculpture [described from female from Valparaiso MCZ-ENT 00731886: Head, mesoscutum and mesoscutellum with minute punctures scattered in interspaces among large dense (mostly $i \leq d$) areolate-punctate background; frontal area punctures denser, in rows with interspaces almost absent; upper paraocular area punctures smaller, irregularly spaced $i < d$; vertexal area punctate-reticulate; genal area with small punctures dense $i < d$ sparser below, larger punctures scattered. Mesoscutum densely punctate $i \leq d$ except for a few larger interspaces posteriorly on disc, scutellum densely punctate $i < d$ except punctures sparse on pale lateral portion. Mesopleural punctures coarse $i < d$ except posterior glabrous portion with few scattered punctures restricted to ventral half and a subvertical row anterior to meso-metapleural suture; metapleuron with few short horizontal carinae posterodorsally; side of propodeum posterodorsally with irregularly sized shallow punctures among costae; metapostnotum horizontal portion longitudinally carinate-rugose with numerous faint transverse striae between carinae, areolate posterodorsally. Metasomal terga doubly punctate, minute punctures abundant; large coarse punctures dense $i \leq 2d$ on T1, $i \leq 4d$ on T2; T3–T6 punctures increasingly dense, $i < 1.5d$ on T5, T6 areolate-punctate; S2 minute punctures sparse and obscure, larger punctures $i = 0.5\text{--}2d$; S3–S5 minute punctures distinct, larger punctures mostly $i \leq 1.5d$; S6 $i < d$ somewhat sparser along midline.]

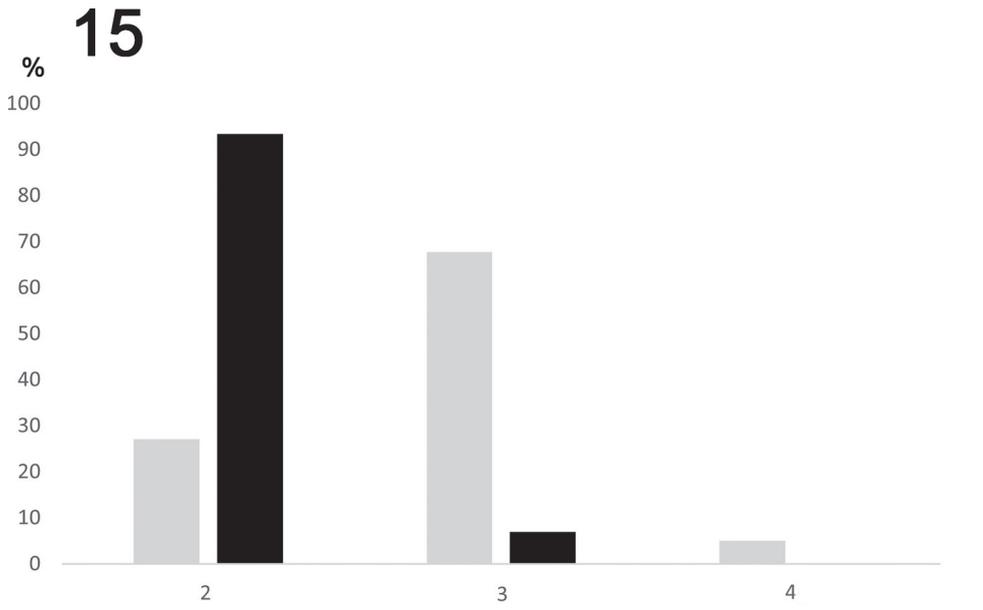
Structure. Head $\sim 1.3 \times$ as wide as long, 83:60; [labrum transverse, narrowly oval, $\sim 3 \times$ as wide as medial length, W:L 41:14, aboral surface somewhat and apical margin conspicuously concave;] clypeus more than $2.5 \times$ as wide as medial length, 63:24, lip \sim half as wide as maximum width of clypeus 32:64; supraclypeal area median length one-quarter that of clypeus, 6; AOD $1.5 \times$ maximum width of F1 (18:12); supra-antennal area with a complete somewhat dorsolaterally oriented lamella at lower third and several similarly oriented carinae above it and a few smaller ones below, area longer than maximum width 35:26, shorter than scape 37; frontal depression continuing above to somewhat below lower tangent of median ocellus; inner margin of compound eyes markedly convergent below UOD:LOD:MINOD 64:45:33; IOD = OOD; scape less than twice as long as greatest width (37:20); pedicel length = width; F1 $\sim 2 \times$ as long as greatest width 25:12; F2 $\sim 1.5 \times$ as long as greatest width 24:14, [remaining flagellomeres longer than wide, decreasing in length from F3 to F9, F10 longer L:W 22:16]; pronotal collar shorter medially than MOD, 15:19; [admedian line more than half medial length of mesoscutum], scutellum not depressed medially but with large posteromedial pit; length of scutellum:metanotum:metapostnotum 40:18:23. T6 somewhat triangular, sides slightly less than right angular to each other, with five teeth on each side, two apicomедial teeth the longest with length and basal width subequal, separated by somewhat more than their length. S2–S4 apical sternal depressions < 0.25 MOD, narrower medially, absent medially on S5.

Male: based upon the specimen from Cerros de Tiltit (MCZ-ENT 00731881), this specimen bears a minute red label devoid of script. (Fig. 11).

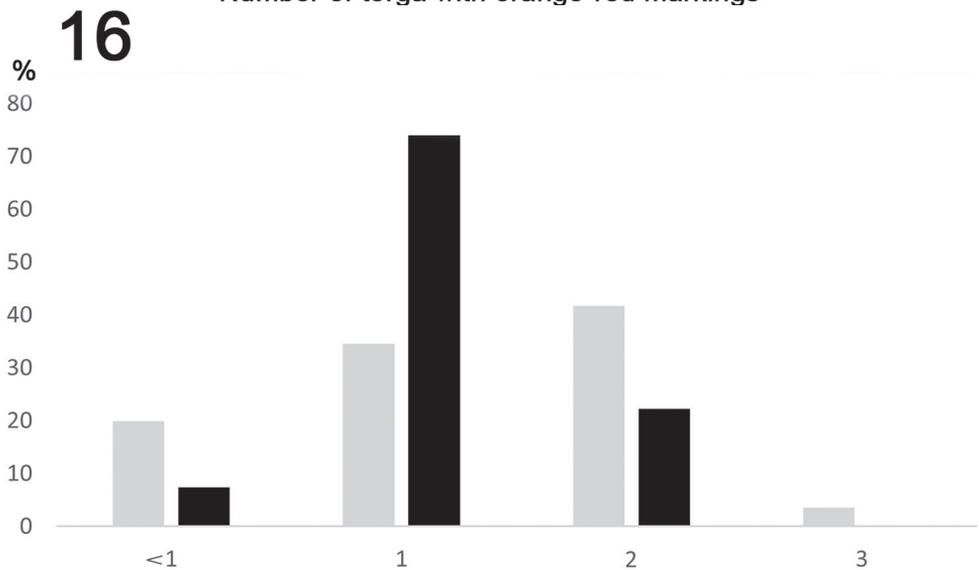
Dimensions Body length 4.93 mm, head width 1.47 mm, forewing length 3.45 mm, ITW 0.8 mm.

Colouration: Black except as follows: cream to pale yellow on basal two-thirds of mandible (rest orange to red-brown), clypeus (except lip orange-brown), supra-clypeal area, lower paraocular area mark narrowly extending along inner eye margin to 1 MOD below lower tangent of median ocellus, small spot on genal area above adjacent to compound eye, ventral half of scape, small spot on pedicel, large lateral marks on pronotal collar twice as wide as space that separates them, pronotal lobe (margined with orange-brown dorsally), large lateral spot on scutellum, most of propodeal spine, mark in front of mesocoxa as large as ventral surface of mesocoxa, most of ventral surfaces of all coxae, most of ventral surface of profemur, dorsal surface of pro- and mesotibiae extending onto posterior surfaces apically, narrow ventral stripe on apical half of mesofemur, most of anterior surface of metatibia, anterior surfaces of all basitarsi (rest of metatibia and maining tarsomeres orange to pale orange-brown), medially interrupted narrow subapical bands on T1–T6, most widely separated on T2 and most narrowly on T6. Following parts orange-red: T1 and T2, T3 apicolaterally; S2 (suffused with red-brown medially), S3–S5 subapical markings increasingly narrow on more apical sterna. Apical tergal and sternal depressions pale translucent orange-brown.

Pubescence: As in female except for S2–S5 with dense apicomедial setal fringes, setae long, medially 0.75 MOD.



Number of terga with orange-red markings



Number of sterna with extensive orange-red markings

Figure 15–16. Frequency histograms of different colour patterns of *C. parvispinosus* **15** for metasomal terga **16** for metasomal sterna. Females in grey, males in black.

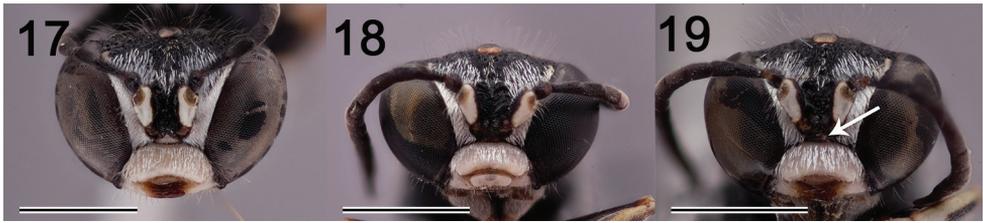
Surface sculpture: As in female except as follows: micropunctures almost absent on face and mesoscutum; upper paraocular area more sparsely punctate i > d; vertexal area punctures variable in size; lateral surface of propodeum punctures among carinae deeper.

Structure. Head $\sim 1.3 \times$ as wide as long, 81:60; labrum transverse, narrowly oval, less than $2.5 \times$ as wide as medial length, W:L 37:16, apical margin somewhat concave medially; clypeus $\sim 2.5 \times$ as wide as medial length, 69:27, lip almost half as wide as whole clypeus, 33:69; supra-clypeal area minute, median length one-quarter as long as clypeus 7:27; AOD equal to maximum width of F1; supra-antennal area much longer than maximum width 31:18, shorter than scape 34; frontal depression poorly demarcated above; UOD:LOD:MINOD 60:40: 29; IOD greater than OOD 28:23; scape almost twice as long as greatest width 34:18; pedicel length subequal to width; F1 more than twice as long as greatest width 23:10; F2 less than twice as long as greatest width 20:12, remaining flagellomeres longer than wide, increasingly shorter from F3 to F10, F11 L:W 18:11, F11 somewhat falcate, ventral surface markedly concave. Pronotal collar shorter medially than MOD, 13:19; [admedian line more than half medial length of mesoscutum], scutellum narrowly impressed medially, with large posteromedial pit; length of scutellum:metanotum:metapostnotum 35:14:18. T7 somewhat semicircular with five apical teeth, median one shortest, submedian ones longest. Apical sternal depressions short; anterior angle of all medial interruptions of apical sternal depressions acute, posterior angles obtuse, less markedly so on more posterior sterna.

Variation. In both sexes there is variation in the colour of the propodeal spine, ranging from mostly semi-translucent white through cream to partially or entirely black. The extent of the pale subapical cream bands on the metasomal terga also varies: on T1 and T4 in females, T1 and T5 in males, the band may be interrupted medially or entire, it is always interrupted on T2–T3 in females and T2–T4 in males but may also be entire on T5 in females and T6 in males. The number of metasomal terga and sterna that are orange-red varies (Figs 12–16). For terga, both sexes always have T1 and T2 orange, both sexes sometimes have T3 entirely orange, but only in females does this sometimes extend to the entirety of T4. For the sterna, S2 is sometimes not entirely orange in both sexes, females sometimes have S2–S4 entirely orange, though in males only S2–S3 may be entirely orange (Fig. 16). Figures 15 and 16 show the relative frequency of the number of terga or sterna that are red separately for males and females. Clearly females, on average, have more extensive orange markings.

The frontal depressions are often almost obscured by silvery setae and vary somewhat in extent sometimes reduced such that their dorsal margin is 1 MOD below the lower tangent of the medial ocellus. The mesoscutal punctation varies from being fairly uniformly dense $i < 0.5d$, to having quite a few interspaces at least as wide as the adjacent punctures especially on the posterior third.

In males: 1) The supra-clypeal area varies from entirely whitish to entirely black with intermediate conditions of brown or dappled pale and dark (Figs 17–19). 2) There is variation in the extent of pale colouration on the antenna, pronotum and scutellum. Some individuals have pale spots on the ventral surface of the pedicel and F1 and F2, while others have these lacking or restricted to the pedicel. The colour of these markings also varies from pale cream to orange-brown. The markings on the pronotum and scutellum, while always present, vary somewhat in size.



Figures 17–19. Heads of male *C. parvispinosus* to show variation in colour of supraclypeal area **17** area entirely white **18** area entirely black **19** area dappled with asymmetrical white mark (white arrow). Scale bars: 1.0 mm.

In females the extent of the pale marking along the inner margin of the compound eye is variable: it is subequal in length to MOD in the lectotype but may extend more narrowly to below the upper tangent of the supra-antennal area. There is minor variation in the extent of yellow-brown on the scape and of pale colouration on the clypeus, pronotum and scutellum.

Two males (MCZ-ENT 00731882) have an additional cross-vein towards the apex of the second discoidal cell. This can be seen in figure 11 as forming a wishbone shaped outline that is almost a mirror image of the second submarginal cell on either side of the median vein. In the second specimen the additional cell is much smaller. There is variation in the size of the second submarginal cell such that the petiole can be almost absent to extending for more than two-thirds the distance between the marginal and second discoidal cells. One female has the right forewing with an additional vein that separates off a small quadrate cell towards the distal extremity of the second submarginal cell. Another has this additional vein incomplete, and on the left wing. One male from El Pangue has the second submarginal cell sufficiently reduced it is almost circular with a diameter of less than three vein widths.

The two sexes average sizes are very similar; for the head width for the large sample from Region III females average 2.32 mm, SD. 0.215, n = 33, maximum 2.77 mm, minimum 1.82 mm; males average 2.33 mm, SD 0.16, n = 28, maximum 2.65 mm, minimum 2.03 mm. The series from the MCZ contains some smaller specimens: the smallest male has a head width of 1.45 mm, and the smallest female 1.48 mm. The smallest of all males available, the individual from El Pangue noted above, has a head width of 1.3mm.

Comments. There has been confusion over the nature of the type material of this species. Reed (1894) described a female specimen: his description starts with the female symbol. This is confirmed by the statement that the clypeus is pale marked on either side “una punta en cada lado del marjin anterior del cípeo amarillo blanquizco”; the male, in contrast, has an entirely pale clypeus. However, at the end of the description he implies that he has seen only two males, both from Colchagua “[H]e encontrado dos ejemplares, machos, de esta especie en Colchagua”. This is the only statement made about the provenance of any material of this species he studied. In the material from MCZ there is a single specimen from Colchagua and it is the only specimen bearing a red “type” label



Figure 20. Labels from the lectotype of *C. parvispinosus*.

(Fig. 20). Seemingly confirming Reed's confusion over the gender of the material he described, it bears a label stating that it is a male (Fig. 20). Consequently, I designate this specimen, which is a female, as the lectotype. As no other specimen from Colchagua is among the MCZ material, no paralectotype is designated at this time. Indeed, as none of the remaining MCZ material was available to Reed at the time of his publication (1894), they cannot be considered as syntypes. Pate (1938) was correct in noting that the "type" was a female, but implied that Reed had also described a male even though none of the males he listed had been collected prior to 1919, 25 years after Reed's publication.

The lectotype female (Fig. 10) is in reasonably good condition, albeit with some apparent damage from mould with dried mycelia obscuring some features and it is missing the following parts: left antenna, right antenna beyond F4, left tegula, left mesotarsus beyond the 3rd tarsomere, entire left metatarsus, right metatarsus beyond 2nd tarsomere. Its condition necessitated some parts of the redescription to be made from a different specimen; the MCZ specimen from Valparaíso: MCZ-ENT 00731885 being chosen for this purpose.

Additional records for specimens not examined in this study but cited by Pate (1938) are as follows: CHILE • 1 ♂; Valparaiso Province [Region V], Valparaiso; 25.xii.1919; P. Herbst; • 1 ♂, 1 ♀; Limache; [-33.0 -71.3]; 31.i.[no year]; A. Faz; AMNH; • 2 ♂ same collector as previous; CUIC.

Pate (1938) listed a female specimen from the MCZ with the locality "VALPARAISO PROVINCE, Concepcion, 4. Dec. 1910", I believe that Pate misread the label, as it actually states "Concon", with the gender of the specimen and date of its collection being the same, this specimen is listed in the material examined section above. Concon is just north of Valparaiso, there is no location known as "Concepcion" in Chile's Region V (Ugarte, pers. comm.). The well known Chilean Concepción [Concepción de la Madre Santissima de la Luz] is the capital of Region VIII.

The type species of the genus is known from low altitudes in Central Chile, from 28°S in Region III in the north to ~38.7°S in Region IX in the south, Santiago to the

east and Valparaiso and near Temuco to the west (Fig. 21). Despite our having collected extensively around Santiago and in the area between Santiago and Valparaiso, we have found no specimens of *C. parvispinosus* here. This area has been severely impacted by agricultural intensification since the time of the earlier collections of this species, but there remain large areas of good quality habitat especially in the more rugged areas, such as around Til-til (where we have collected frequently). Instead, most of our material comes from the southern Atacama Desert, over 500 km further north than the previous most northerly record for the species. Despite the distance and more arid habitat, it seems clear that the populations are conspecific, in that extensive study failed to reveal any consistent morphological differences among specimens from Region III and those from Regions V, VI, VII, IX and Metropolitana.

The Los Sapos locality where large numbers of *C. parvispinosus* were collected was a small, vegetated patch situated within a large area that was very dry and otherwise devoid of greenery over the time the samples were collected. It seems that roadwork immediately adjacent to the site had resulted in concentration of runoff in a small area (see fig. 30 in Mir Sharifi et al. 2018). Considerable numbers of bees and wasps were collected in traps (mostly bright blue) left out here for a few days and these included putative hosts for this cleptoparasitic nyssonine. The most likely hosts are among the following species for which large numbers of individuals were collected in the same traps as *C. parvispinosus*: two species of *Tachysphex*, identified using Pulawski (1974) as *T. rufitarsis* (Spinola) and a species perhaps allied to *T. reedi* Menke and two undescribed species of *Parapiagetia* Kohl.

***Cresson mariastea* Packer, sp.nov.**

<http://zoobank.org/053F859C-30DD-4FFD-8479-7998CEB8EAB7>

Figs 21–25, 27, 29

Material examined. 9 ♀, 9 ♂ (several males missing apical metasomal segments):

Holotype: ♀; CHILE, Region I, 73 km E. Pozo Almonte; -20.312 -69.129; 3150m; 16.–21.iv.2012; pan trap; L. Packer; MNHN. **Paratypes:** • 6 ♂, 7 ♀ paratypes identical data to previous; CAS, MNHN, PCYU, UCDC; • 1 ♂, 1 ♀ paratype; identical data to previous; 10.v.2012; net; PCYU; • 1 ♂ paratype; identical data to previous; 21.iv.–10.v.2012; PCYU.

Diagnosis. This species, as well as the following new species, is most readily distinguished from *C. parvispinosus* by the reduced areas of red on the metasomal terga (Figs. 22–24); T2 with at least a broad medial black band for the entire length of the tergum (Figs 23–24) and usually mostly black, sometimes entirely so other than for the subapical cream band, most of T1 is also black whereas *C. parvispinosus* has T1 and T2 entirely red (Figs 12–14), with at most the extreme base of the anterior declivitous surface of T1 black and T2 with at most a small apicomedial dark mark (in one male). Females can be differentiated from those of *C. salitrrera* Packer sp.nov described below by the structure of T6. In *C. mariastea* the apicomedial spines are relatively long, sub-

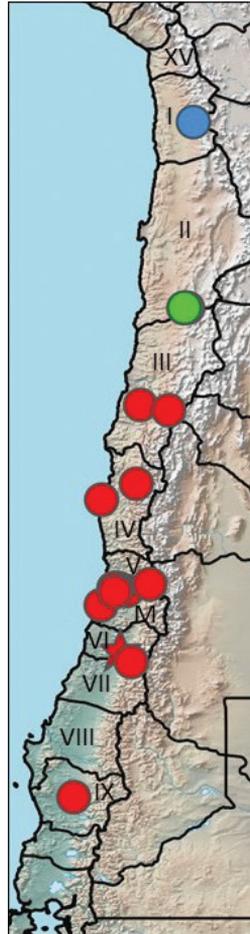


Figure 21. Distribution map of all records of *Cresson* spp. Red symbols: *C. parvispinosus*, star: the type locality for *C. parvispinosus*; blue: *C. mariastea*; green: *C. salitrera*. Scale bar: 500 km.

equal to, to longer than, the space that separates them (compare Figs 25 and 26), the lateral spines are usually less numerous, most commonly with 4 in *C. mariastea* (range 2 to 6) and 6 in *C. salitrera* (range 4 to 7) and they are also relatively shorter, less sharp and extend less than half the way up the side of the postgradular portion of the tergum as opposed to \sim three-fifths the distance in *C. salitrera*. In males, the easiest distinguishing feature is the degree of curvature of the apical flagellomere. In *C. mariastea* the ventral surface towards the apex is at an angle of $\sim 40^\circ$ to the long axis of the flagellum, while this is $\sim 80^\circ$ in *C. salitrera* (compare Figs 27 and 28). There are also differences in surface sculpture between the two species, most clearly shown in the basal depressed area of T2 in both sexes which has large, distinct, deep and dense ($i < d$) punctures in *C. mariastea* (Fig. 29) but minute, sparse ($i > 5d$) punctures in *C. salitrera* (Fig. 30) which are largely imperceptible with the light microscope.

Description. Holotype Female (Fig. 22)

Dimensions: Body length 7.3 mm, forewing length 5.1 mm, head width 2.15 mm, ITW 1.3 mm.

Colouration: Black, following parts white to pale yellowish: mandible (except apical half increasingly dark towards apex, yellowish at midlength, red-brown at apex), labrum, lateral one-quarter of clypeus, narrow club-shaped mark on upper paraocular area adjacent to inner margin of compound eye extending from above upper tangent of antennal socket to below level of lower tangent of median ocellus, small mark on genal area above adjacent to posterior margin of compound eye, small mark towards side of pronotal collar separated by more than twice the width of the mark, pronotal lobe (margined with black above), small anterolateral mark on scutellum, triangular mark on mesopleuron anterior to mesocoxa, apical mark on all coxae (most extensive on mesocoxa where it occupies the outer third of the ventral surface), apicoventralless than two-thirds of profemur, anterodorsal surface of all tibiae (mostly pale yellow on pro- and mesotibiae, mostly white on metatibiae), transverse subapical bands on T1–T5, entire only on T5, most broadly interrupted on T2, the interruptions are orange to orange-brown and narrower than the adjacent white bands. Scape yellow-orange apicoventrally. Following parts orange to orange-brown: torulus, all tarsi (probasitarsus suffused with yellowish, successive tarsomeres increasingly darker), posterior surface of metatibia entirely towards base, narrowing apically to absent at extreme apex; T1 and T3 narrow anterior margin to subapical pale transverse band, substantially broadened laterally on T1; T2 broadly towards side. Apical tergal and sternal depressions translucent straw laterally, orange-brown medially; T6 spines translucent orange-brown. S2 red brown, orange-brown towards margins; S3–S5 dark brown except red-brown towards apices.

Pubescence: Silver appressed and obscuring, or almost obscuring, underlying integument on lower paraocular area, genal area adjacent to compound eye, mesopleuron (sparser anteriorly and ventrally, absent posteriorly), scutellum posteriorly and dorsolateral portion of propodeum; somewhat less dense on clypeus, pronotal collar, anterior half of horizontal portion of T1; suberect longer setae ~ 0.7 MOD on most of genal area; sparse erect long whitish setae \leq MOD on upper face, posterolaterally on pronotum, mesopleuron; similar setae somewhat shorter on mesoscutum and scutellum. Metasomal terga with short subappressed posteriorly oriented setae with sparse suberect setae intermixed, longest on T6, 0.3 MOD; short setae

Surface sculpture: Micropunctures very sparse on head and thorax except on vertexal and genal areas, abundant on metasomal terga and sterna; punctation mostly coarse and dense, almost crowded on face with interspaces raised among linear groups of punctures; genal area with dense small punctures $i < d$ among irregularly spaced large ones, surface uneven somewhat rugose posteriorly. Mesoscutum densely punctate $i < d$ except posteriorly on disc $i \leq 2d$; punctures of scutellum as on upper face except sparser laterally; metapostnotum longitudinally rugoso-striate on horizontal portion,



Figures 22–24. *Cresson mariastea* **22** a paratype female, lateral view **23** holotype female, dorsal metasoma **24** male, dorsal metasoma. Scale bars: 1.0 mm.

areolate posteriorly. Larger punctures of terga mostly dense $i < d$ with some sparser areas laterally on T1 and towards apex of T2 and T3; basal depressed area of T2 deeply, coarsely and densely punctate $i < d$; sculpture of T6 similar to that of face; sterna punctures dense towards sides $i < d$, less regularly spaced medially, $i = 1-4d$ on S2, mostly $i < 2d$ on S3–S5, $i < d$ on S6 except midline largely impunctate.

Structure: Head almost $1.5 \times$ as wide as long, 89:61; [labrum transverse, narrowly oval, three times as wide as medial length, W:L 36:12 apical margin transverse]; clypeus almost $3 \times$ as wide as medial length, 61:21, lip almost half as wide as clypeus, 28; supraclypeal area minute, median length third as long as clypeus; AOD $1.7 \times$ maximum width of F1 (17:10); supra-antennal area longer than maximum width 27:20, shorter than scape 32; frontal depression poorly defined dorsally; UOD:LOD:MINOD 66:47:35; IOD:OOD 27:25; scape twice as long as greatest width 32:16; pedicel shorter than wide 11:13; F1 more than twice as long as greatest width 22:10; F2 less than twice as long as greatest width 22:12, remaining flagellomeres decreasing in length from F3 to F9 (F9 L = W), F10 18:12; pronotal collar approximately 0.5 MOD medially, 10:19; [admedian line distinct anteriorly for less than half medial length of mesoscutum], scutellum with faint medial line with large shallow depression postero-medially; length of scutellum:metanotum:metapostnotum 39:15:30. T6 triangular, sides forming an angle of $\sim 60^\circ$, with three acute teeth on each side, restricted to less than apical one-third of side of tergum, two apicomedial teeth longer than their basal width 7:5, separated by a distance subequal to their basal width. S2–S5 apical depressions ~ 0.3 MOD, narrowed medially, abruptly so on S4–S5.

Male. Dimensions: Body length 6.6 mm; forewing length 4.1 mm; head width 1.75 mm; intertegular width 1.1 mm.

Colouration: Black, following parts white to pale yellowish: mandible basal third (mid third orange, apical third red-brown), labrum, clypeus, supraclypeal area, paracocular area completely filling space between antennal socket and compound eye below, extending narrowly along eye margin above to just below lower tangent of median ocellus, small oval mark on genal area above behind compound eye, ventral surface of scape, ventral spot on pedicel, pair of small spots on pronotal collar separated by more than 2 MOD and $< 0.2 \times$ the space that separates them, pronotal lobe (margined with black), large mark anterior to mesocoxa approximately equal in area to ventral surface of mesocoxa, ventral surface of all coxae except at base, ventral surface of profemur except basal fifth, apicodorsal mark on pro- and mesofemora, dorsal and most of posterior surfaces of pro- and mesotibiae, most of anterior surface of metatibia (posterior surface orange basally, orange-brown apically, blackish ventrally), anterior surface of all basitarsi and most of anterior surface of all second tarsomeres (remaining tarsomeres red brown), transverse subapical bands on T1–T6, very narrowly interrupted medially on T1, T4 and T5, more broadly interrupted on T2 and T3, complete on T6; S2 subapical band broad, S3 band narrow, S4 with small faint pale subapical mark. Pale marking on T1 narrowly margined with orange-brown, T2 with lateral orange brown spot anterior to pale band. Apical tergal; depressions translucent, largely colourless except orange-brown medially, apical sternal depressions pale straw except on S5 yellowish.

Pubescence: Silver appressed and obscuring, or almost obscuring, underlying integument on clypeus, lower paraocular area, frontal depressions, mesopleuron, metanotum posterolaterally, dorsolateral area of propodeum; somewhat sparser on genal area, pronotal collar, laterally on pronotum, anteromedially on mesoscutum, posterolaterally on scutellum, metanotum, most of horizontal surface of T1, anterior depressed area of T2. Longer, $< 1.5 \text{ MOD}$, erect whitish setae on frontal and vertexal areas, mesoscutum and scutellum; similar setae somewhat shorter and sparser on mesopleuron; metasomal terga with sparse suberect setae posteriorly on T4–T7, longest on T7 $< 0.5 \text{ MOD}$. Mesobasitarsal fringe setae $< 1.3 \times$ as long as greatest width of mesobasitarsus. S2–S5 apicomedial setal fringe $\sim 0.7 \text{ MOD}$ in length medially.

Surface sculpture: As in female except as follows: Micropunctures absent on head and thorax, abundant on metasomal terga and sterna; genal area densely punctate, vertexal area and scutellum rugoso-punctate, mesoscutum more sparsely punctate posteriorly on disc, $i \leq 3d$; lateral surface of propodeum somewhat rugulose below propodeal spine. Larger punctures of S2 denser $i \leq 2d$; S6 sparsely punctate except anterolaterally $i \leq d$.

Structure: Head $\sim 1.4 \times$ as wide as long, 86:62; labrum transverse, narrowly oval, almost $3 \times$ as wide as medial length, W:L 35:13, apical margin transverse; clypeus less than $3 \times$ as wide as medial length, 61:22, supraclypeal area almost entirely obscured by frontal crest in frontal view, only extreme lower margin visible medially; AOD slightly greater than maximum width of F1, 12:10; supra-antennal area longer than maximum width 28:20, shorter than scape 31; frontal depression extending to $< 0.5 \text{ MOD}$ below lower tangent of median ocellus; UOD:LOD:MINOD 55:38:26; IOD greater than OOD 23:16; scape more than $1.5 \times$ as long as greatest width (31:18); pedicel length subequal to width; F1 twice as long as greatest width 20:10; F2 $\sim 1.5 \times$ as long as greatest width 19:12, remaining flagellomeres longer than wide, increasingly shorter from F3 to F10, F11 L:W 23:11, F11 somewhat falcate, ventral surface concave, apicoventral surface at $\sim 40^\circ$ to longitudinal axis of flagellum; pronotal collar approximately 0.5 MOD , 11:20; admedian line distinct anteriorly, obscure posteriorly, posteromedial scutellar pit obscure; length of scutellum:metanotum:metapostnotum 33:13:23. T7 somewhat semicircular with five narrow apical teeth, the median one shortest, the others subequal in length. Apical sternal depressions long, on S2 longer than the diameter of the largest punctures on the sternum; anterior and posterior medial angles of apical sternal depressions acute and obtuse, respectively on S2–S3, both approximately right angular on S4–S5.

Variation. The extent of red colouration on the metasoma varies, four males have the red restricted to a narrow line immediately anterior to the apical whitish tergal bands on T1 and T2 (as in Fig. 24), four have the mark on T2 expanded into a lateral patch and one has even more extensive red marks quite similar to the male imaged for the following species (Fig. 33). Five females have an expanded lateral red mark on T2 and the anterior edge of the white mark on T1 margined with red while four have large lateral marks on T1 and T2 (as in Fig. 23). Some specimens have more broadly interrupted tergal bands on T2–T4. Two female paratypes have whitish subapical transverse bands on S2 and one has such marks also on S3. Females vary in the size of the lateral pale mark on the scutellum from absent to extending for approximately half the length of the

lateral margin. One male paratype has the pale spots on the pronotal collar extensive, almost as wide as the space that separates them, while three of them have these marks entirely absent. One male has a small pale lateral mark on the scutellum. One male lacks the pale mark on the pedicel while two also have pale marks ventrally on F1 and F2. The larger males have the lateral surface of the propodeum with dorsolaterally oriented carinae above as in the female. One male has the petiole of the second submarginal cell duplicated on one side, forming an additional, small, quadrate cell anterior to the normal second submarginal cell. One female has the petiole on the right forewing second submarginal cell almost absent.

Males vary in size from a head with of 1.6 to 2.02 mm; females vary in head width from 1.65 to 2.15 mm.

Etymology. This species is named in honour of the late Maria Stea. During her too-short time at York University she was tireless in her efforts to assist the hymenopterists in the Biology Department.

Comments. All specimens of *Cresson mariastea* are from the mountainous area Northeast of the oasis town of Pica, and almost due South of Mamiña (less than 30 km from either) in an area known as the Pica Highlands (Fig. 21). This area has yielded many interesting species of Apoidea in recent years, including a new genus of fideliiine (Praz and Packer 2017) and a new species of *Colletes* (Ferrari 2017) as well as its presumptive cleptoparasite, a recently described species of *Isepeolus* (Packer and Graham 2020).

An undescribed species of *Parapiagetia* and a species of *Tachysphex* I have not been able to identify were found simultaneously with *C. mariastea* and are its potential hosts.

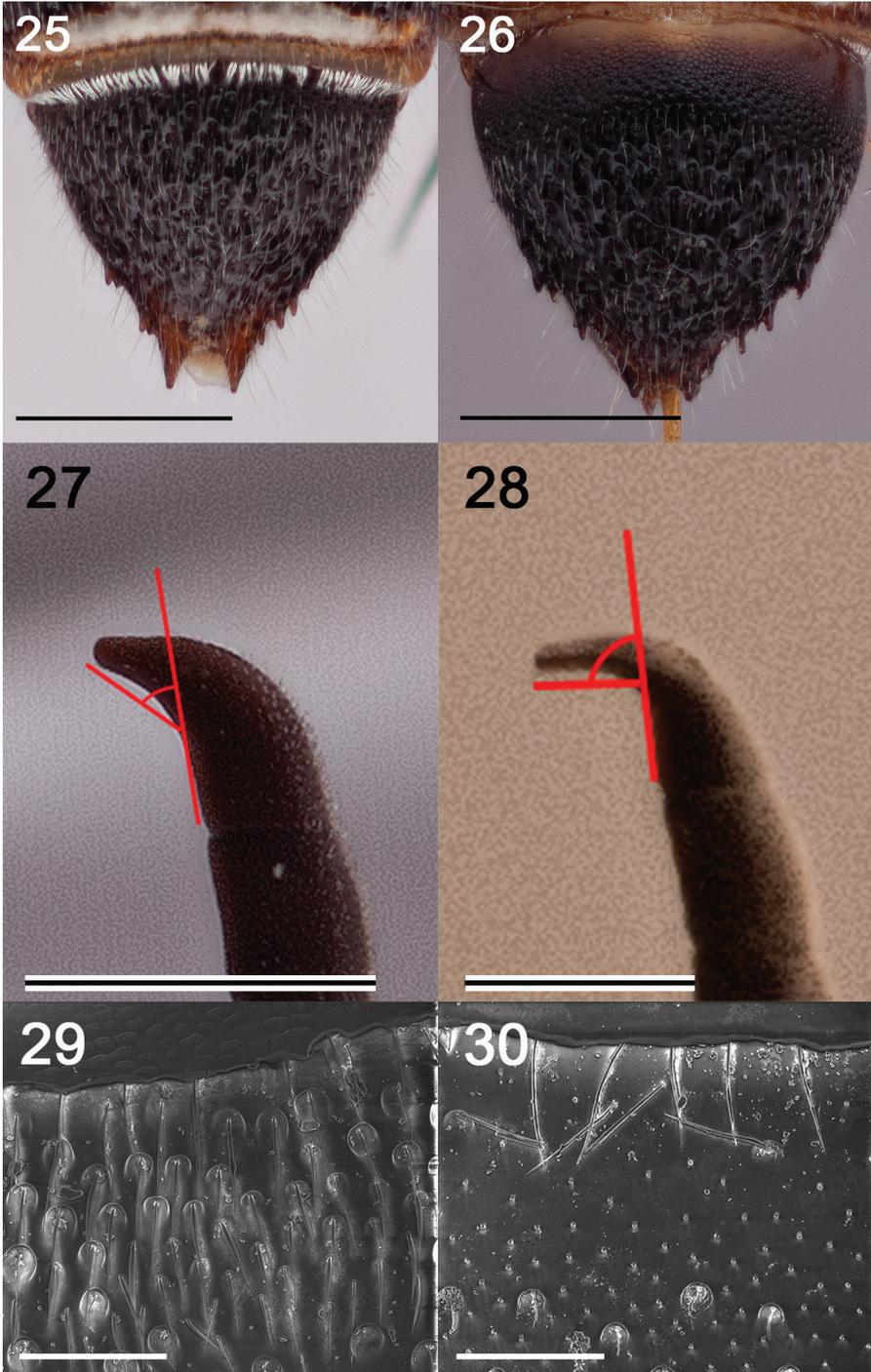
***Cresson salitrera* Packer, sp.nov.**

<http://zoobank.org/D9159A6E-2CBE-4271-BF0B-58FEAA37DA9C>

Figs 7, 21, 26, 28, 30–33, 35

Material Examined. 7 ♀, 7♂. • **Holotype:** ♀; CHILE, Region II, km 26.7, Rd. to Aguas Calientes (N. of Mina Vaquillas); -25.375 -69.288; 3350m; 31.x.2015–6.ii.2016; L. Packer, blue vane trap; MNHN. **Paratypes:** CHILE • 1 ♀, 2 ♂ paratypes identical data as holotype; PCYU; • 1 ♂; Region II, Rd to Plato de Sopa, km 51.2; -25.379 -69.388; 3040m; 31.x.2015–6.ii.2016; L. Packer; yellow pan trap; PCYU; • 3 ♀, 1 ♂; CAS, PCYU; Region II, W. of Mina Vaquillas; -25.370 -69.372; 3130m; 31.x.2015–3.ii.2016; L. Packer; white pan trap; PCYU; • 1 ♂; Region II, S. of Cerro dos Hermanos; -25.404 -69.040; 4020m; 17.xi.–7.xii.2013; S. Monckton; PCYU.

Diagnosis. Most readily distinguished from *C. parvispinosus* by the reduced areas of red on the metasomal terga (Figs 31–33), although usually not as reduced as in *C. mariastea*; T1 and T2 are at least black medially, although in one male only narrowly so. In contrast, *C. parvispinosus* has T1 and T2 entirely red, with at most the extreme base of the anterior declivitous surface of T1 black and T2 with a small apicomedial dark mark. Compared to *C. mariastea*, the apicomedial spines of T6 in the females are shorter, at most as long as their basal width, but the lateral spines are relatively longer



Figures 25–30. Characters used to differentiate *C. mariastea* and *C. salitrella* **25** T6 of female *C. mariastea*, **26** T6 of female *C. salitrella*. Scale bars: 0.5 mm. **27** F11 of male *C. mariastea* **28** F11 of male *C. salitrella*. Scale bars: 0.25 mm. **29** base of T2 *C. mariastea* **30** base of T2 of *C. salitrella*. Scale bars: 100 μ m.

and sharper (compare Figs 26 and 25). In both sexes the basal depressed area of T2 is minutely, sparsely punctate in *C. salitrera* (Fig. 30) but more coarsely and densely, $i < d$, punctate in *C. mariastea* (Fig. 29). The degree of curvature of F11 differs, in *C. salitrera* the ventral surface is at an angle of $\sim 80^\circ$ to the longitudinal axis of the flagellum (Fig. 28) while this is $\sim 40^\circ$ in *C. mariastea* (Fig. 27).

Description. Holotype female (Figs 31–32)

Dimensions: Body length 7.1 mm, forewing length 5.1 mm, head width 2.18 mm, ITW 1.35 mm.

Colouration: Black, following parts white to pale yellowish: mandible basal one-third (rest red brown), labrum, lateral $\frac{1}{4}$ of clypeus, narrow club-shaped mark on upper paraocular area adjacent to inner margin of compound eye extending from upper tangent of supra-antennal area almost to dorsal tangent of frontal depression, small spot on genal area above adjacent to posterior margin of compound eye, transverse mark towards side of pronotal collar separated by slightly less than width of the mark, pronotal lobe (margined with black above, red–brown below), mark on scutellum occupying less than lateral one-quarter, posterior extremity of axilla, broadly divided transverse mark on mesopleuron anterior to mesocoxae, outer half of ventral surface of procoxa, outer half of mesocoxa, extreme apex of metacoxa, apicoventral and posterior two-thirds of profemur, anterodorsal surface of all tibiae (mostly pale yellow on pro- and mesotibiae, mostly white on metatibia), probasitarsus anteriorly, mesobasitarsus basal half; transverse subapical bands on T1–T5, entire on T1, T4 and T5, medial interruptions of T2–T3 blackish; narrow subapical bands on S2–S4 interrupted medially and incomplete laterally (replaced by orange-brown). Following parts orange to orange-brown: torulus, scape apicoventrally, most of posterior surface of metatibia (blackish ventrally), all remaining tarsomeres, T1 triangular marking anterior to subapical cream band broadest laterally, T2 lateral three-tenths red except anterior depression; apical tergal depressions pale straw to transparent.

Pubescence: Silver appressed and obscuring, or almost obscuring, underlying integument on lower paraocular area, frontal depressions, genal area adjacent to compound eye, mesopleuron, scutellum posterolaterally, metanotum except anteromedially and dorsolateral portion of propodeum; somewhat less dense on clypeus, pronotal collar, anterior one eighth of mesoscutum, most of horizontal portion of T1; suberect longer whitish setae ~ 1.2 MOD on most of genal area and mesepisternum; erect long whitish setae < 1.7 MOD on upper face; short < 0.5 MOD erect pale setae on dorsal surface of mesoscutum and T4–T6, similar setae shorter on T1–T3 and metasomal sterna with a few longer setae subapically ≤ 0.7 MOD.

Surface sculpture: Micropunctures absent on face except on vertex, sparse on mesoscutum and scutellum, abundant on metasomal terga, sparse on sterna and dense, $i < d$ on genal area; punctuation mostly coarse and dense, almost crowded on face with interspaces raised among linear groups of punctures, appearing almost striate, striae radiating from ocellar area; genal area larger punctures irregularly spaced $i = 0.2\text{--}4d$. Mesoscutum densely punctate $i < d$ except posteriorly on disc $i \leq 2d$; scutellum punc-



Figures 31–33. *Cresson salitreira* **31** male, lateral view **32** holotype female, dorsal metasoma **33** male, dorsal metasoma. Scale bars: 1.0 mm.

tures $i < d$; mesopleuron large punctures $i < 2d$, posteriorly almost impunctate, metapleuron lacking sculpture except for a few short longitudinal carinae posterodorsally; lateral surface of propodeum carinate for posterodorsal two-thirds. Larger punctures

of T1 irregularly spaced $i < 3d$, on T2 $i < 4d$ except with areas lacking large punctures posteromedially; basal depressed area of T2 with shallow, sparse minute punctures $i > 5d$; T3 $i < 3d$, T4–T5 $i > 2d$, T6 $i < 0.5d$; S2 $i < 2d$, S3 $i < 1.5d$, S4 $i \leq d$, S5 $i < 2d$, S6 $i < d$ except midline largely impunctate.

Structure: Head almost $1.5 \times$ as wide as long, 89:61; labrum W:L 36:13 apical margin somewhat concave medially; clypeus W:L 62:23, lip less than half as wide as clypeus, 28, distinctly narrower medially than towards sides; supraclypeal area median length approximately one sixth as long as clypeus; AOD almost $1.5 \times$ maximum width of F1 (15:11); supra-antennal area longer than maximum width 30:18, as long as scape; frontal depression extending to ~ 0.5 MOD below lower tangent of median ocellus above; UOD:LOD:MINOD 71:45:35; IOD = OOD; scape less than twice as long as greatest width (30:17); pedicel shorter than wide 11:13; F1 $2.5 \times$ as long as greatest width 25:10; F2 less than twice as long as greatest width 20:11, remaining flagellomeres increasingly shorter from F3 to F9 except F10 16:12; pronotal collar almost half as long medially as MOD, 10:18; admedian line complete, more distinct for anterior half, scutellum with irregular medial line and large shallow depression posteromedially; length of scutellum:metanotum:metapostnotum 41:15:23. T6 triangular, sides forming an angle of $\sim 80^\circ$, with four (left) to five acute teeth (right) extending to midlength of side of tergum, two apical teeth short, equal in length to their basal width, 4:4, separated by a distance clearly greater than their length, 7.5. S2–S5 apical depressions ~ 0.5 MOD, somewhat narrower medially but not abruptly so.

Male (Fig. 33)

Dimensions: Body length 7.8 mm, forewing length 5.2 mm, head width 2.25 mm, ITW 1.42 mm.

Colouration: Black, following parts white to pale yellowish: mandible basal half (rest red-brown), labrum, clypeus, supraclypeal area, paraocular area completely filling space between antennal socket and eye below, extending narrowly along eye margin above to approximately 1 MOD below lower tangent of medial ocellus, tiny spot on genal area above behind compound eye, ventral surface of scape, ventral spot on pedicel, pair of small spots on pronotal collar separated by $2 \times$ MOD, pronotal lobe (margined with black), large mark anterior to mesocoxa approximately equal in area to ventral surface of mesocoxa, ventral surface of procoxa, mesocoxa except base, apical two-thirds of ventral surface of metacoxa, ventral and much of posterior surface of profemur except basal one-quarter, apicodorsal mark on pro- and mesofemora, dorsal surface and apical one-third of anterior surface of pro- and mesotibiae, anterior surface of metatibia (posterior surface orange basally, orange-brown apically, blackish ventrally), anterior surface of all basitarsi, transverse subapical bands on T1–T6, narrowly interrupted medially on T1, T4 and T5, more broadly interrupted on T2 and T3, complete on T6; irregularly-shaped subapical mark on S2, S3 band narrow and interrupted medially, junction of disc and apical sternal depressions narrowly orange brown. Second tarsomere on all legs yellowish, increasingly dark on more apical tarsomeres to red brown on pretarsus. Posterior surface of metatibia orange. Pale marking on T1 margined with orange anteriorly, marking broad laterally, restricted to narrow line medially; T2 orange for more than

lateral one-third width of tergum. S2 with large orange spot on each side. Apical tergal depressions translucent, somewhat orange medially, on T1, T2 and T6 pale straw, on T3–T5 colourless all somewhat orange medially, apical sternal depressions straw yellow except of S5 yellowish.

Pubescence: As in female except as follows: suberect longer whitish setae \sim MOD on genal area above and sides of mesopleuron; \sim 1.7 MOD on genal area below and scutellum; shorter \sim MOD erect pale setae on mesoscutum, short 0.5 MOD suberect setae on T2–T6 and metasomal sterna, similar setae shorter on T1.

Surface sculpture: As in female except as follows: micropunctures abundant on S2; lateral surface of propodeum carinate for dorsal $\frac{1}{2}$. Larger punctures of T1–T3 $i \leq 4d$, T4 $i \leq 3d$, T5–T6 $< 2d$, T7 $i < d$, crowded towards apex. S2 and S5 $i < 6d$, S3–S4 $i < 2d$, S6 with scattered punctures $i = 1\text{--}6d$.

Structure: Head almost $1.5 \times$ as wide as long, 93:64; [labrum W:L 32:14, apical margin shallowly concave;] clypeus more than $2.7 \times$ as wide as medial length, 66:24, lip less than half clypeal width 29, slightly shorter medially than towards side; supra-clypeal area entirely obscured by frontal crest in frontal view; supra-antennal area L:W 27:18, shorter than scape 31; AOD greater than maximum width of F1 13:11; frontal depression almost reaching lower tangent of median ocellus; UOD:LOD:MINOD 73:49:33; IOD:OOD 19:17; scape $\sim 1.5 \times$ as long as greatest width, 31:20; pedicel almost as long as maximum width 13:12; F1 $2.5 \times$ as long as greatest width 32:13; F2 shorter than F1, $> 1.5 \times$ as long as greatest width 28:16, remaining flagellomeres $\sim 1.5 \times$ as long as wide except F11 26:10, somewhat falcate, downcurved and narrowing from base to apex, apicoventral surface at $\sim 80^\circ$ to longitudinal axis of flagellum; pronotal collar more than 0.5 MOD medially, 12:20; admedian line impressed for anterior two-thirds; length of scutellum:metanotum:metapostnotum 42:16:29; scutellum posteromedial pit absent. T7 semicircular with five teeth, medial tooth the shortest and broadest, submedial teeth as long as lateral ones but broader. S2–S5 apical depressions broad submedially > 0.3 MOD on S2, longer than largest punctures on sternum, impunctate apical portion clearly longer than diameters of basal punctures. Apical sternal depressions long, on S2 longer than diameter of largest punctures on sternum; anterior and posterior angles of medial interruption of apical sternal depressions slightly acute and slightly obtuse, respectively on S2, both approximately right angular on S3–S5.

Variation. There is minor variation in the extent of pale marking in females, some lack the medial interruption to the pale marking in front of each mesocoxa or have the metacoxa narrowly pale medially on the ventral surface. All have the red markings on T1 and T2 completely interrupted by black medially although in one male the dark marks are narrowed to < 0.5 MOD on T2 and are dark brown.

Etymology. The species is known only from moderate to high altitude in an area of the Atacama Desert that is famous for its sodium nitrate (chile saltpeter) mines. These “salitreras” give the species its name, which is a noun in apposition. These mines dotted the landscape, especially in the late 1890s and early 1900s; but are now abandoned, mostly indicated by ruins and/or just their cemeteries. The

known localities for the species are all from the sides of roads that form networks among these abandoned mines in a part of the country that would otherwise be almost inaccessible.

Comments. Two unidentified species of *Tachysphex* and an undescribed species of *Parapiagetia* were found in association with this species; none of them seem to be the same as those found associated with the other species of *Cresson* treated above.

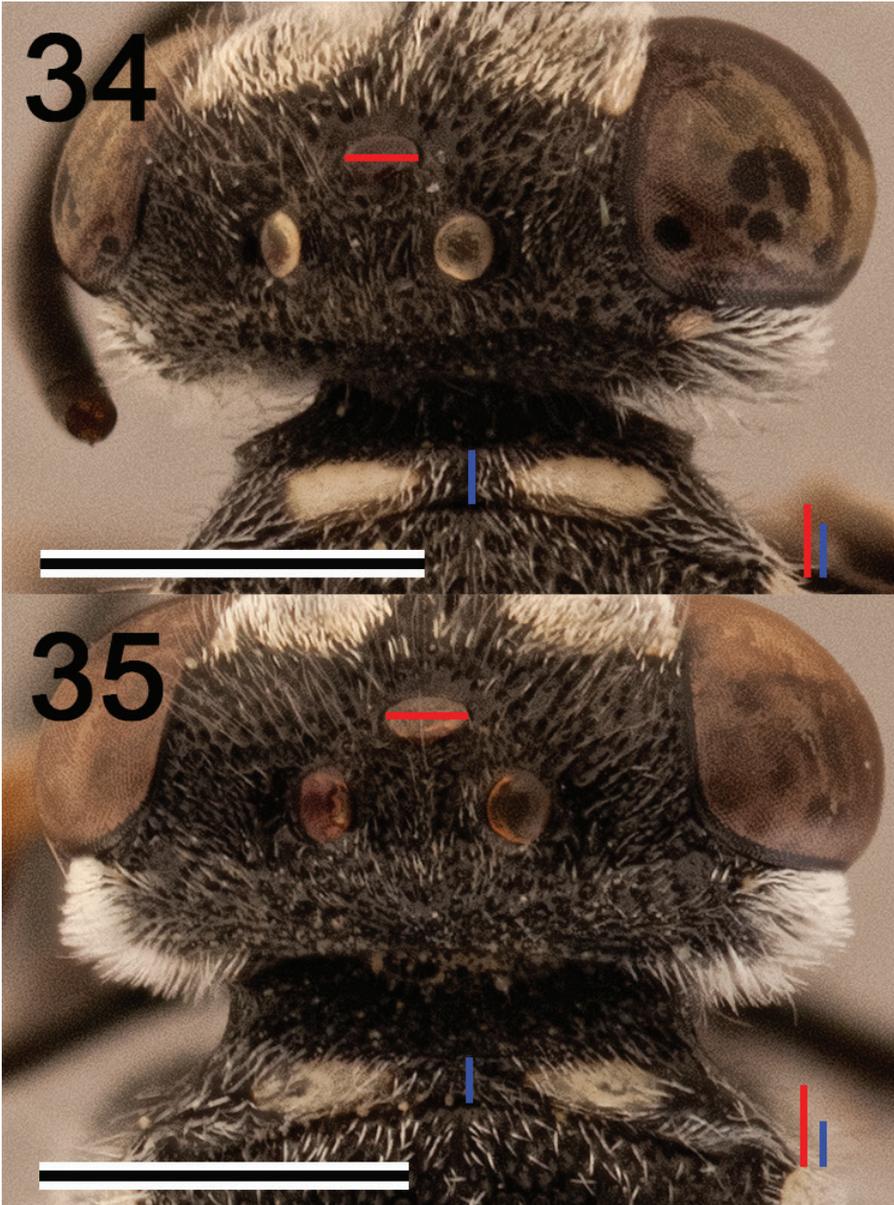
This species comes from the part of the Atacama Desert where the absolute desert (rainfall less than 10 mm/yr) gets furthest inland, almost to the border with Argentina. Other species of interest from this area include the wasps just mentioned and a recently described cuckoo bee, *Melectoides desiccata* Packer and Graham. The type locality was imaged by Packer and Graham (2020; Fig. 9). The Cerro dos Hermanos locality is even drier and inhospitable.

Identification key

- 1 T1 and T2 entirely red except sometimes T1 with extreme base of anterior declivitous surface and a small apicomedial spot dark (Figs 10–14); pronotal collar medial length clearly more than $0.5 \times \text{MOD}$ (Fig. 34) ***C. parvispinosus* (Reed)**
- T1 and T2 broadly black medially to mostly black (Figs 23, 24) pronotal collar medial length approximately $0.5 \times \text{MOD}$ (Fig. 35) **2**
- 2 Both sexes with punctures of basal transverse depression of T2 large, coarse and dense, $i < d$ throughout (Fig. 29). Male: F11 shallowly curved, apicoventral surface $\sim 40^\circ$ from longitudinal axis of flagellum (Fig. 27). Female, T6 apicomedial spines long, subequal in length to the space that separates them; lateral spines extending at most halfway from apex of tergum to base, spines usually short and blunt (Fig. 25) ***C. mariastea* Packer sp.nov.**
- Both sexes with punctures of basal transverse depression of T2 minute and sparse, $i > 5d$, contrasting with the densely punctate posterodorsally sloping portion (Fig. 30). Male: F11 markedly curved, apicoventral surface $\sim 80^\circ$ from longitudinal axis of flagellum (Fig. 28); Female T6 apicomedial spines short, clearly shorter than the distance separating them; lateral spines extending more than halfway from apex of tergum to base, spines usually long and sharp (Fig. 26) ***C. salitreira* Packer sp.nov.**

Discussion

Nyssonini with known ecologies are cleptoparasitic on other apoid wasps (Bohart and Menke 1976, table 18). All specimens we have collected recently have been associated with *Tachysphex* Kohl, 1883 and/or *Parapiagetia* Kohl, 1897 and it is suspected that one or both genera include hosts for *Cresson*. The former genus has been revised for South America (Pulawski 1974) while the latter has no described species from Chile, although its presence there has been known for some time (e.g. Bohart and Menke 1976, p. 277).



Figures 34–35. Relative dimensions of MOD and pronotal collar medial length for couplet 1 of identification key of *Cresson* species **34** *C. parvispinosus* and **35** *C. salitrea*. Red lines MOD, blue lines medial length of pronotal collar. Scale bars: 1.0 mm.

At least six *Parapiagetia* species have been discovered as a result of our collecting in Chile and descriptions of these species (among others) are in progress. Of the various *Cresson*-associated *Tachysphex* species, I have been able to identify only one with any confidence, suggesting that new species of this genus also await description from Chile. Bohart

and Menke (1976) suggested Heliocausini as potential hosts for *Cresson* (also for *Antomartinezius* and *Perisson*). Our collections suggest that Heliocausini are unlikely to be hosts for *Cresson*. One species of *Heliocausus* Kohl, 1892 was quite common at the Los Sapos locality for *C. parvispinosus* but almost all individuals seem too small compared to the size of the cleptoparasite.

While I did find variation in some details of S8, the apex of the volsella and the apex of the penis valve among specimens of the species discussed herein, variation among specimens of the type species of *Cresson* suggested that intraspecific variation is too great for these structures to be of species-level taxonomic value.

Traps with propylene glycol as the preservative fluid can be left out in arid areas for weeks to months (Packer and Darla-West 2021). As noted previously (Packer and Graham 2020) this is a particularly useful strategy for sampling in remote areas with very low primary productivity and hence low abundances of insects and now can be said to be potentially as useful for sampling apoid wasps as they are for bees.

Conclusion

There are now three species in the genus *Cresson*, all from Chile. It seems probable that their hosts are Larrini of the genera *Parapiagetia* and/or *Tachysphex*. The new species would not have been discovered without the use of traps with propylene glycol left out for long periods in inhospitable habitat.

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Completion of this work would have been impossible without the prompt response of Crystal Maier of the MCZ who sent me the series of *C. parvispinosus* from that museum just before both our institutions were locked down due to COVID19. I am also grateful to Lynn Kimsey, Steven Heydon, Robert Zuparko and Chris Grinter who sent me material from UCDC and CAS during the pandemic. The fieldwork that resulted in the new species being discovered was funded by a Natural Sciences and Engineering Research Council of Canada Discovery Grant to the author, some carried out by Spencer Monckton and James Postlethwaite, and facilitated by Alfredo Ugarte and Rolando Humire Coca. I am particularly grateful to Liam Graham for taking the images of wasps herein and amalgamating them into plates, his contribution was funded by a generous donation from Robert and Cecily Bradshaw for which I am extremely grateful and his use of the ESEM system was facilitated by Magdalena Jaklewicz. Both Wojciech Pulawski and Matthias Buck provided very useful comments that improved the manuscript and I am extremely grateful to both of them.

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