

Review of Chilean Cyrtinae (Diptera: Acroceridae) with the Description of Three New Species and the First Record of *Villalus inanis* from Argentina

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Received 29 June 2020 / Accepted 6 April 2021 / Published 7 July 2021

Communicated by Y. Miles Zhang

Acrocerid flies are endoparasitoids of spiders that are distributed in all ecosystems except deserts and the poles. This group was historically classified into three subfamilies. However, molecular analyses have indicated two new subfamilies. One of these is Cyrtinae Newman, which is made up of two clades: the north, with Palearctic species, and the south, with Chilean species (except for the fossil genus *Villalites* Hennig). In the southern clade, endemic genera *Holops* Philippi and *Villalus* Cole have been poorly described over time by different authors. The aim of this study is to re-describe the known species of *Holops* and *Villalus* and describe three new *Holops* species based on collected material: *Holops grezi* sp. nov., *Holops anarayae* sp. nov., and *Holops pullomen* sp. nov. In addition, an identification species key with updated distributions for all species and the first record of *Villalus inanis* from Argentina is also provided. New species are mainly characterized by the length of flagellum; colors of the postocellar lobe and thoracic segments, pilosity and legs; wing cells and veins, and shape of the abdomen. *Holops* and *Villalus* do not share morphological traits with any other known extant genus of Acroceridae in the southern hemisphere. The real biodiversity of this group must be evaluated with a molecular phylogeny in the future. In addition, the new species in the Pehuén and Valdivian forest provinces, areas considered to have been sheltered during the last glacial period, promoting speciation in several taxa. New and cryptic *Holops* species open the doors to disentangling the real biodiversity of spider flies in Chile.

Key words: *Holops*, Maule province, Spider flies, Valdivian forest province, Pehuén and Valdivian districts.

BACKGROUND

The life cycle of Acroceridae corresponds to obligate parasitoids of spiders, which attack up to 26 families around the world (Schlinger 1987; Gillung and Borkent 2017). Exceptionally, the Chilean genus *Carvalhoa* Koçak & Kemal, was recorded as an ectoparasitic species that specifically attacks *Ariadna* Audouin (Schlinger 1987; Schlinger et al. 2013). In the classic taxonomy systematic based on endoparasitism lifestyle to other arthropod orders, spider flies (Diptera:

Acroceridae) have been placed in the Nemestrinoidea superfamily (Hennig 1973). However, molecular phylogenetic studies have demonstrated that spider flies are sister to Hilarimorphidae and both families are sister to Stratiomyomorpha (Wiegmann et al. 2011). Historically, spider flies have been separated into three subfamilies: Philopotinae, Panopinae and Acrocerinae (Schlinger 1981; Schlinger et al. 2013). However, some recent phylogenetic analyzes have shown that Acrocerinae is a polyphyletic group and that the other two spider fly subfamilies are monophyletic

(Winterton et al. 2017; Gillung and Winterton 2019). These molecular analyses suggest a change in the number of subfamilies known from three to five, raising Ogcodinae, a wide group of cosmopolitan, tiny and swollen fly species; and Cyrtinae, a medium size fly species characterized for attack spiders of the subfamily Entelegynae (Gillung and Borkent 2017; Gillung et al. 2018; Gillung and Winterton 2019).

In these phylogenetic studies, Cyrtinae is composed of two main clades: the ‘north’ clade includes Holarctic genera such as *Cyrtus* Latreille, *Paracyrtus* Schlinger and *Turbopsebius* Schlinger, while the ‘south’ clade is mainly represented by the Chilean genera *Villalus* Cole and *Holops* Philippi, both endemic (with the exception of Palearctic and fossil genus *Villalites* Hennig; Gillung and Winterton 2019). *Villalus* was proposed by Cole (1918) and is currently composed of a single species: *Villalus inanis* Philippi. This genus is characterized by upper wing cells covered with microtrichia, and veins R_{4+5} and M_{3+4} not forked (Gillung and Winterton 2019). This species is currently distributed from Valparaíso to the Los Ríos region (González et al. 2018). On the other hand, the genus *Holops* is composed of three species: *H. cyaneus* Philippi, *H. frauenfeldii* Schiner and *H. virens* Bigot. This genus is morphologically characterized by the globose abdomen and short body, antennae inserted in the middle frons, very short proboscides, metallic colors and dense pilosity on the body (Philippi 1865; Schiner 1868; Edward 1930; Gillung and Winterton 2019), and is mainly distributed between Coquimbo and Los Ríos Region (González et al. 2018). The biology of both genera is poorly known and only the flower-visiting *H. virens* to *Podanthus mitique* Lindl (Stuardo 1980) has been recorded. These species are only known to parasitize spiders of the genus *Exlinea* (Araneae: Amaurobiidae) have been recorded as host of *H. cyanea* (Schlinger 1987).

Unfortunately, over time, few works have treated this subfamily, and the descriptions of all species known are poor (Philippi 1865; Schiner 1868; Bigot 1878; Cole 1918; Edwards 1930). In this work, the main aim was to review the Chilean Cyrtinae species and re-describe the known species and describe three new cryptic species of *Holops*: one of the Pehuén district in the Maule province and two from the Valdivian forest province in the subantarctic subregion. In addition, an updated identification key for all Chilean species with images and new records of distribution is provided.

MATERIALS AND METHODS

The terminology used for the description of the

new species follows Cumming and Wood (2017). The morphological characters all new species were compared to the original descriptions and pinned specimens for all *Holops* species. The acronyms for the institutions housing the material examined in this study or cited are: Francisco Ramírez personal collection, Las Condes, Santiago, Chile (FRPC); Instituto de Entomología, Universidad Metropolitana de Ciencias de la Educación, Ñuñoa, Santiago, Chile (IEUMCE); Museo Nacional de Historia Natural de Santiago, Santiago, Región Metropolitana, Chile (MNHNCL); Museo de Zoología of the Universidad de Concepción, Concepción, Región del Biobío, Chile (MZUC); Naturhistorisches Museum Wien, Vienna, Austria (NMW); Rodrigo Barahona Segovia personal collection, Recoleta, Santiago, Región Metropolitana (RBSPC); Ernesto Krahmer collection, Universidad Austral de Chile, Valdivia, Chile (UACH); Oxford University Museum of Natural History, Oxford, United Kingdom (UMO). In addition, the records of citizen scientists were taken from the Moscas Florícolas de Chile Citizen Science Program, Valdivia, Chile (CSP) in order to fill distributional gaps.

Measurements were taken with a 1 mm precision ruler in the objective of a Leica S6 D microscope. The total length of the specimens was measured from the head to the end of the terminal abdominal tergite. Wing length was measured from the wing base to the apex. Photographs were taken both with a Nikon D7200 camera equipped with an AF-S DX Micro-NIKKOR 40mm f/2.8G lens.

For the new species, the contents of each specimen label are enclosed within double quotation marks (“ ”) and individual lines of information are separated by a single slash (/). Square brackets ([]) add information on specimen condition and repository collection. Asterisks (**) represent new distributional records. Distribution maps for all species were created with ArcGIS v.10.4.1.

RESULTS

Identification key for Chilean Cyrtinae species

1. Orange-brown species (Figs. 28–36); head with half size of the maximum height of the thorax; meron elongated and grey; upper part of the wings with microtrichia; R_{4+5} not forked and cell m_3 absent (Figs. 29, 33) *Villalus inanis* Philippi
- Blue, black or green species; head with 3/4 or similar size of the maximum height of the thorax; meron barely elongated with dark colors; wings without microtrichia; R_4 and R_5 forked; cell m_3 present (*Holops* species) 2
2. Abdomen elongated and not protruded from the thorax margins in dorsal view (Fig. 1) 3
- Abdomen globose or with oval shape and protruded from the thorax margins in dorsal view (Figs. 3, 11) 4
3. Flagellum 3-fold longer than scape and pedicelum together;

- yellow pilosity in scutum (Fig. 13); wings slightly smoked (Fig. 14); inner calypter brownish with dense and long brown pilosity (Fig. 13) *Holops virens* Bigot
- Flagellum 4-fold longer than scape and pedicelum together; brownish pilosity in scutum (Fig. 2); wings hyaline (Figs. 1–2); inner calypter whitish with dense and long yellow pilosity *Holops anarayae* Barahona-Segovia sp. nov.
4. Abdomen with oval shape in dorsal view and 2-fold widest than thorax (Fig. 3) *Holops cyanea* Philippi
- Abdomen with globose shape in dorsal view and slightly wider than thorax (Fig. 6) 5
5. Scutum with rufous pilosity; abdomen bicolor: tergites 1–2 golden-greenish and rufous pilosity; tergites 3–6 blackish with rufous-black pilosity (Figs. 5–7) *Holops frauenfeldi* Schiner
- Scutum with brown or yellowish pilosity; abdomen not bicolored with pilosity of the same color of the scutum 6
6. Flagellum 2-fold longer than scape and pedicelum together; scutum and abdomen shiny dark green with dark brownish pilosity (Figs. 9–10); postocellar lobe shiny dark green; wings smoked; cell r_{4+5} elongated, with five sides (Fig. 18) *Holops grezi* Barahona-Segovia sp. nov.
- Flagellum 3-fold longer than scape and pedicelum together; scutum shiny blue with yellowish pilosity (Fig. 11); postocellar lobe violet; abdomen violet with yellowish pilosity (Fig. 12); wings hyaline; cell r_{4+5} elongated, with six sides (Fig. 19) *Holops pullomen* Barahona-Segovia sp. nov.

Family Acroceridae Leach
Subfamily Cyrtinae Newman
Genus *Holops* Philippi

***Holops anarayae* sp. nov. Barahona-Segovia**

(Figs. 1–2, 15, 25–26)

urn:lsid:zoobank.org:act:E641677F-66FA-46A0-B797-5FA1073404D2

Material examined: *Holotype*: male, in excellent condition, found in the Ernesto Krahmer's collection from UACH and finally deposited in the MNHNCL; with the following labels: "Prov. Valdivia / Santo Domingo / 08.ix.1963 / Leg. E. Krahmer"; "Holotypus / *Holops anarayae* / sp. nov. ♂ / det. Barahona-Segovia 2020" [red].

Paratype: male, in excellent condition, found in the Ernesto Krahmer's collection from UACH and finally deposited in the MNHNCL; with the following labels: "Prov. Valdivia / Santo Domingo / 27.ix.1987 / Leg. E. Krahmer"; "Paratype / *Holops anarayae* / sp. nov. ♂ / det. Barahona-Segovia 2020" [yellow].

Type locality: Valdivia Province, Santo Domingo, Los Ríos región, Chile.

Etymology: the specific epithet "*anarayae*" refers to Ana Clara Luz Araya (1941–2020), the grandmother of the first author, which raised and helped pay for their university studies.

Diagnosis: dark blue species. Scutum with brown-yellowish pilosity. Postocellar lobe dark blue as well as all thorax segment excepting anepimeron, which is

violet-brownish. Coxa and trochanter brownish. Femora bicolor (brown-yellow). Wings hyaline. M_1 shorter than M_2 . Cell r_{4+5} elongated and thin. Abdomen elongated longitudinally and at same level of the maximum margins of thorax. All tergites dark blue.

Description: male: Length: 5.1 mm; width: 1.8 mm (head), 2.5 mm (thorax) and 2.5 mm (abdomen); wing: 5.0 mm; head: eyes brownish (Figs. 1–2); the size is more than 3/4 of the maximum height of the thorax (Fig. 2); antenna inserted in the middle of the head; scape and pedicelum blackish with similar size; flagellum styliform approximately four times longer than pedicelum and scape together; antennae with similar length to head; eyes with long and brown pilosity; three ocelli dark bluish with ocellar triangle shiny blue somewhat protuberant; occiput dark and shiny blue with long and brownish pilosity; mouth parts yellowish with abundant brownish hairs; thorax: dark blue scutum with some shiny parts; long, dense and brownish pilosity, sparse but uniformly distributed (Figs. 1–2); postocellar lobe dark blue with 8–12 long and yellowish hairs (Fig. 2); anterior spiracle barely visible and darkish; anepisternum, kataposternum, katatergite, meron, katapimeron and anatergite shiny blue with long and yellowish pilosity (Fig. 2); anepimeron violet-bluish with some yellowish hairs; subalar sclerite brownish and; scutellum shiny blue with long and brownish hairs; legs: coxa and trochanters dark blue; femora almost completely dark bluish excepting anterior which yellow (Fig. 2); tibiae yellow and tarsi brownish with dense and short pale pilosity (Fig. 2); black claws; wings: hyaline and membranous appearance; all veins dark brown; R_1 and R_{2+3} closer between them; R_4 and R_5 not petiolated, inward position (Fig. 15) and separated in the distal part for the half of length of each vein; M_1 , M_2 and M_{3+4} not reaching the wing margin; M_1 shorter than M_2 ; cell r_{4+5} elongated and thin, with 3/4 length of R_{2+3} vein and five sides; cell m_3 with 1/3 length of r_{4+5} connected to cell bm with a very short projection of m-cu vein; halteres brownish with apex some yellowish; calypter rim blackish and inner part is whitish with dense and long yellowish pilosity; abdomen: not curved (Figs. 1–2); oval shape similar in size to head and thorax together (Fig. 1); in dorsal view, the abdomen not protruded laterally from the thorax margins; all tergites completely rough and covered with short and brownish pilosity: tergites 1–4 with similar width; all sternites darkish; genitalia: not detached and partially everted; cerci, part of the epandrium and gonocoxa visible; cerci light yellow with many short and yellow pilosity; aedeagus yellowish; gonocoxa brownish, enlarged (Fig. 25) and bifurcated (Fig. 26) with several setae in ventral view; female: unknown

Distribution: only known from the type locality

(Fig. 27).

Remarks: this endemic species belongs to Valdivian district inside Valdivian forest province, subantarctic subregion (Morrone 2015). The Valdivian evergreen forest is mainly dominated by *Aextoxicum punctatum* Ruiz et Pav., Myrtaceae trees species and *Nothofagus* species. The species present high variability in color legs and length of R_4 , R_5 and M veins of wings (Shaun Winterton, pers. comm.). The host is unknown.

***Holops cyaneus* (Philippi, 1865: 645)**

(Figs. 3–4, 16, 21)

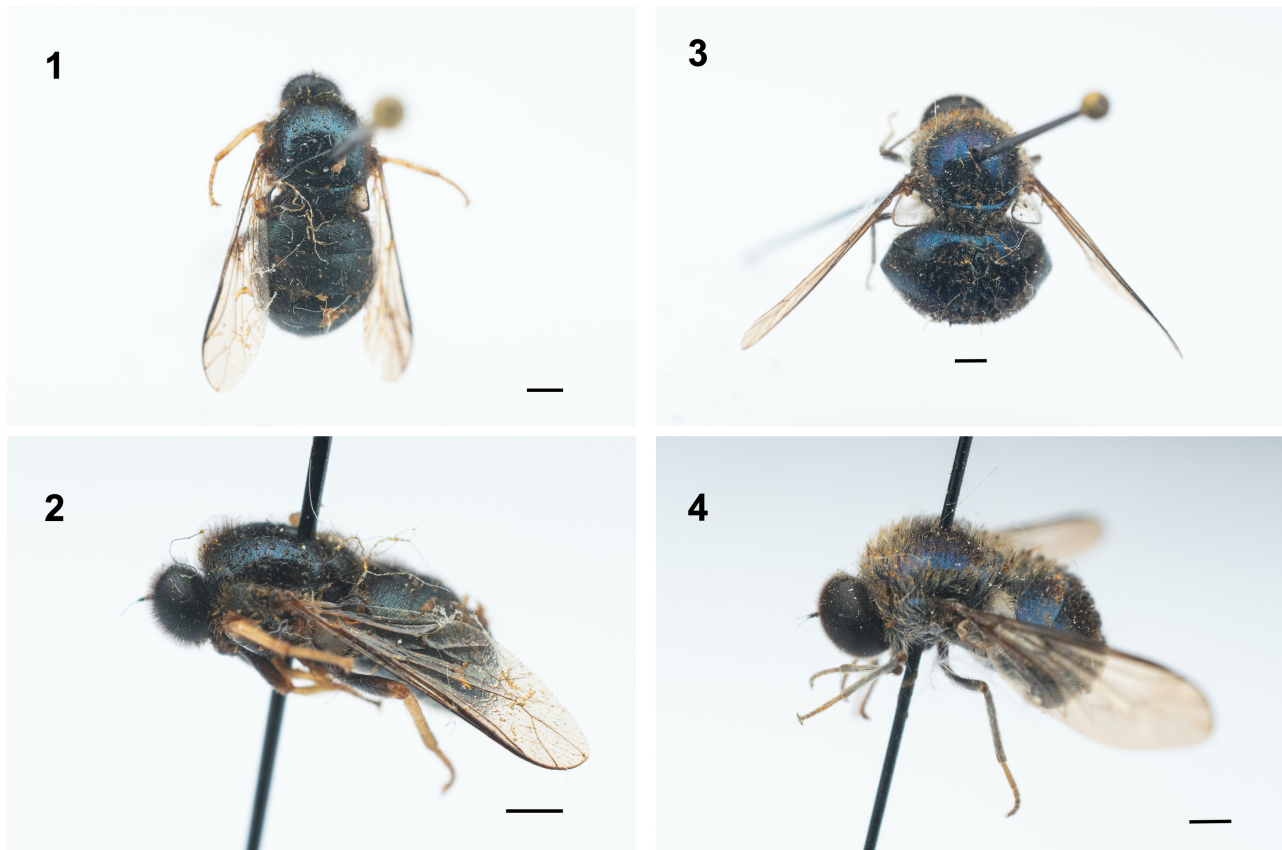
Material examined: syntype: “San Juan, Valdivia, Chile” (MNHNCL); other specimens: Chile. *Coquimbo*: El Ñague, 18.x.1976, Leg. K. Lohmar (IEUMCE); El Ñague, 26.10.1991, Leg. J. Solervicens (IEUMCE); *Valparaíso*: Valparaíso, xi.1967, Leg. W.H. Sifalí (MNHNCL); Caleta Horcón, 2.ii.1969, Leg. M. Cerda; Marga-Marga, x.1927, Leg. NN (MNHNCL); Santo Domingo, xii.1970, Leg. P. Ramírez (MNHNCL); *Metropolitana*: La Obra, 1.xii.1991, Leg. NN (MNHNCL); La Obra, 850 m, 26.xii.2011, Leg. A.

Ramírez (FRPC); *Maule*: Constitución, 5.ii.1984, Leg. C. de la Cuadra (MNHNCL); *La Araucanía*: Nahuelbuta National Park, 20.i.1981, Leg. M. Cerda (MNHNCL); Conguillio National Park, 13.ii.1979, Leg. J. Solervicens (IEUMCE); *Los Ríos*: Santo Domingo, Valdivia, 31.xii.1989, Leg. E. Krahmer (UACH); Valdivia, 12.xii.1976, Leg. E. Krahmer (UACH).

Type locality: San Juan, Valdivia, Chile (Philippi, 1865).

Diagnosis: shiny blue-violet species. Head black. Eyes with long blackish pilosity. Scutum with long and brownish pilosity. Katepisternum, meron, katatergite, katepimeron and anatergite opaque violet-bluish color. Legs dark brownish, excepting the tarsi, which are light brown-yellowish. Cell r_{4+5} elongated and wide. Abdomen with oval shape in dorsal view and with double size of thorax.

Description: Length: 6.10 ± 0.19 mm; width: 2.06 ± 0.02 mm (head), 3.14 ± 0.05 mm (thorax) and 4.42 ± 0.08 mm (abdomen); wing: 6.00 ± 0.07 mm ($n = 10$); **female:** head: black; the size is similar to the height of thorax; antenna inserted in the middle of the head; scape and pedicelum black with similar size among them (Figs.



Figs. 1–4. *Holops anarayae* sp. nov.: (1) dorsal view and (2) lateral view; *Holops cyaneus* (Philippi, 1865): (3) dorsal view and (4) lateral view. Scale bars = 1 mm.

3–4); flagellum styliform two times and half longer than pedicelum and scape together approximately; in the last flagellomere, a thin black arista raise from apex; antennae shorter than total head length; eyes black with short and brownish ommatrichia; three small ocelli brownish with ocellar triangle shiny black, some protuberant and 5–12 yellowish hairs; occiput blackish with long brownish pilosity; mouth parts yellow; *thorax*: shiny violet-blue scutum with long, dense and brownish pilosity, sparse but uniformly distributed (Figs. 3–4); postocellar lobe shiny blue with long and brownish pilosity (Fig. 4); anterior spiracle with yellow pilosity; proepimeron and anepisternum shiny blue-violet color; katapisternum, meron, katatergite, katepimeron and anatergite opaque violet-bluish color; anepimeron with some pale hairs (Fig. 4); subalar sclerite brownish without pilosity; scutellum shiny blue-violet color with long and brownish pilosity; *legs*: coxa, trochanters, femora, tibiae and tarsi have violet-brownish color and covered with short and brown-yellowish pilosity; femora not swollen; tarsi have dense and light brownish pilosity (Fig. 4); black claws; *wings*: smoky and membranous appearance; all veins dark brown; R_1 and R_{2+3} are closer among them; R_4 and R_5 slightly petiolated and separated in the distal part for 1/3 of length of each vein; M_1 , M_2 and M_{3+4} not reaching the wing margin and similar in size; cell r_{4+5} elongated, with five sides and half of length of R_{2+3} vein; cell m_3 with triangular shape and 1/3 length of r_{4+5} , connected to cell bm by a projection of $m-cu$ vein (Fig. 16); halteres brownish; calypter rim blackish and interior part is pale brownish with dense and long brownish pilosity; *abdomen*: strongly curved in 3rd tergite; in dorsal view oval shape with double size of thorax (Fig. 3); fully rough; all tergites shiny blue; tergites 1–4 with the same length and width; tergite 5–6 greatly reduced and not visible in dorsal view; all with long and black pilosity; all sclerite with brownish color; *genitalia*: cerci rounded in apex and brownish with short blackish pilosity; in dorsal view gonocoxa are brownish and posterior process of the gonocoxa curved inside (Fig. 21); *male*: similar to female, excepting the total size.

Distribution: from Coquimbo region to Los Ríos region (Fig. 27).

Remarks: endemic species that inhabits several vegetation formations. The specific epithet “*cyaneus*” (= blue (English); *azul* (Spanish)) is a masculine adjective refers to the color of the body of this species. Following to Morrone (2015), this species inhabits from the Coquimban and Santiagan province in central Chile sub-region to Valdivian forest province in the subantarctic sub-region. Schlinger (1987) reported that this spider fly parasites *Exlinea* (Amaurobiidae) spiders.

***Holops frauenfeldi* Schiner 1868: 143**

(Figs. 5–8, 17, 23)

= *Holops nigrapex* Bigot, 1878: lxxi.

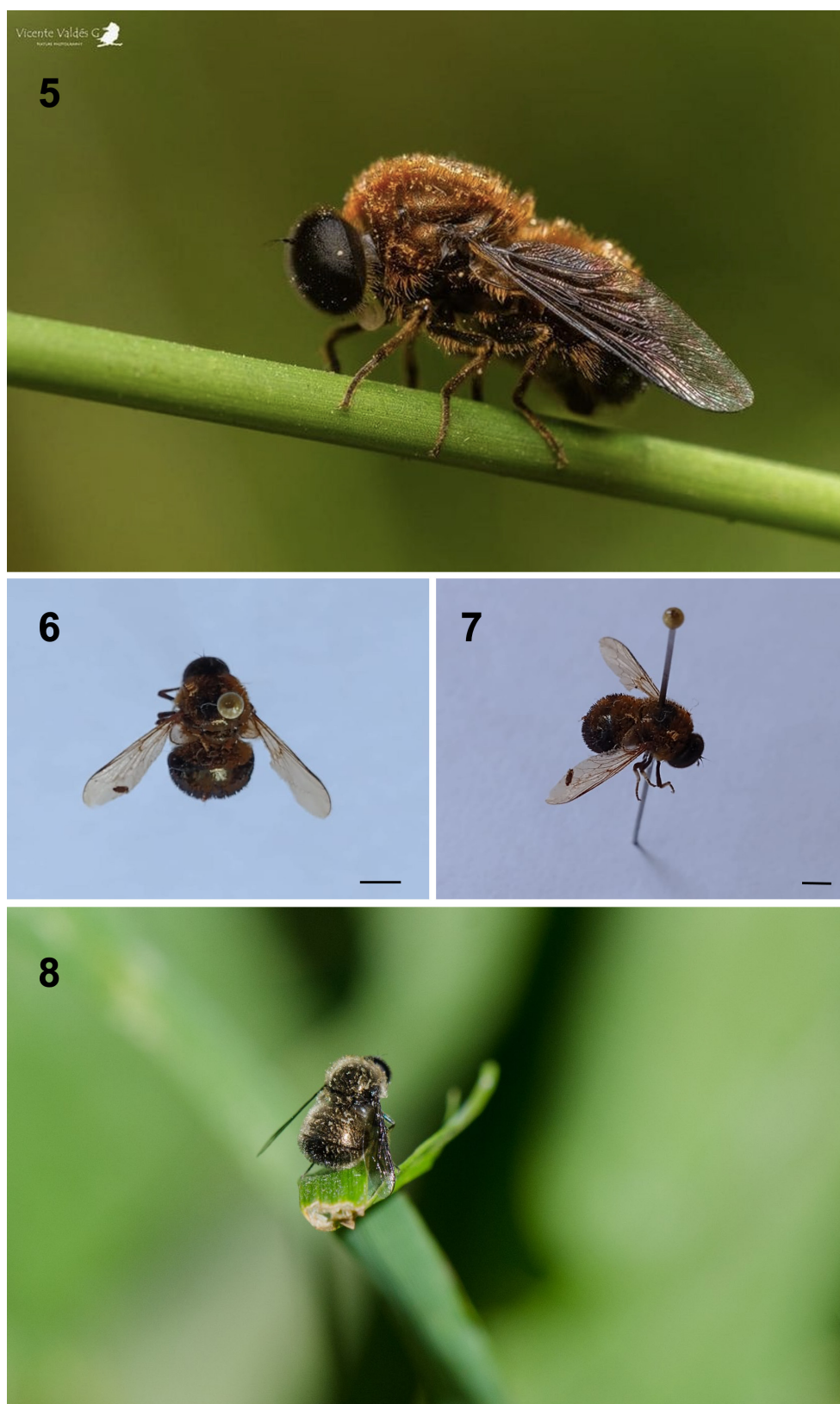
Material examined: Holotype: “Chile” (NMW).

Other specimens: Chile. *Valparaíso*: Quintero Bosque, 31.x.1979, Leg. Cerda (MNHNC); Sporting Club, Viña del Mar, x.2018, Leg. Gabriela Germain (CSP, electronic voucher: <https://figshare.com/s/eed9244bc6b4f368f552>); Colliguay, ii.1933, Leg. NN (MNHNC); Perales, no data, Leg. NN (MNHNC); Las Rocas de Santo Domingo, 4.xi.1973, Leg. P. Ramírez F. (MNHNC); Caleta Horcón, 2.ii.1969, Leg. M. Cerda (MNHNC); Reñaca, 19.x.1975, Leg. Cerda (MNHNC); Mantagua, 27.x.1975, Leg. M. Cerda (MNHNC); *Metropolitana*: **Vallecito, 7 km, Farellones, 2.ii.2015, Leg. Rodrigo Barahona S. (RBSPC); **Rio Clarillo National Reserve, 28.11.2017, Leg. Ricardo Varela (CSP, electronic voucher: <https://figshare.com/s/d7d3bc8b56c84be42196>); La Obra, 850 msnm, 5.xii.2009, 17.xii.2009, 10.xi.2017, 27.xi.2014; Leg. A. Ramírez (FRPC); Fundo El Manzano, Leg. Rodrigo Barahona S. (PCRBS); Cajón del Maipo, x.2013, Leg. Álvaro Cuevas (CSP, electronic voucher: <https://figshare.com/s/56d3707733ac4eb6589d>); *Maule*: Altos de Vilches, 1280 m, 24.xi.1971, Leg. J. Solervicens (MNHNC); Ñuble: Los Lleuques, 15.i.1996, Leg. S. Roitman (MNHNC); Piedras Comadres, 12.i.1995, Leg. S. Roitman (MNHNC); *Araucanía*: **Sierra Nevada, Conguillio National Park, 15.i.2006, Leg. Rodrigo Barahona (RBSPC); *Los Ríos*: Panguipulli, 9.ii.1993, Leg. Rodrigo Barahona S. (RBSPC); Santo Domingo, Valdivia, 19.i.1985, Leg. E. Krahmer (MNHNC); Valdivia, 28.ii.1982, Leg. E. Krahmer (UACH).

Type locality: Chile (Pape and Thompson 2013).

Diagnosis: blackish species with golden gloss. Head and eyes black. Thorax and abdomen with dense, long and rufous pilosity. All thoracic segments blackish with golden gloss. Legs dark brownish with short and yellowish pilosity. Wings smoky and brownish. Cell r_{4+5} width. First tergite blackish with golden gloss and brownish pilosity. Tergites 3–6 black with pilosity of same color. Abdomen globose in dorsal view and slightly widest than maximum margin of the thorax.

Description: Length: 6.12 ± 0.27 mm; width: 2.02 ± 0.06 mm (head), 3.38 ± 0.08 mm (thorax) and 3.92 ± 0.22 mm (abdomen); wing: 5.86 ± 0.22 mm; *male*: head: the size is 3/4 of the maximum height of the thorax (Fig. 5); antenna inserted in the middle of the head; scape and pedicelum blackish with similar size; flagellum styliform almost three times longer than pedicelum and scape together; arista with the half of size of flagellum;



Figs. 5–8. *Holops frauenfeldi* Schiner, 1868: (5) resting in a shrub branch in Rio Clarillo National Reserve. Photographed by Vicente Valdés Guzmán; (6) dorsal view and (7) lateral view. Photographed by Rodrigo Barahona-Segovia, and (8) individual with golden pilosity resting in a branch in Viña del Mar. Photographed by Gabriela Germain Fonck. Scale bars = 1 mm.

antennae shorter than head length; eyes with long and brown ommatrichia; apparently two ocelli dark bluish with ocellar triangle bluish and some protuberant; occiput shiny blue with long black pilosity; mouth parts yellow; *thorax*: black-golden scutum covered with dense rufous pilosity, sparse but uniformly distributed (Figs. 5–7); postocellar lobe shiny golden-greenish; anterior spiracle yellow; proepimeron, anepisternum, katapisternum, meron, katatergite, katepimeron and anatergite blackish with golden reflects and with long and rufous pilosity; subalar sclerite brownish without pilosity; scutellum blackish with golden reflects and rufous pilosity; *legs*: coxa, trochanters, femora, and tibiae blackish covered with brownish pilosity; tarsi are brownish covered with long and brown-yellowish pilosity; black claws; *wings*: smoky brownish and membranous appearance (Fig. 5); all veins dark brown; R_1 and R_{2+3} are closer among them; R_4 and R_5 forked; R_4 and R_5 slightly petiolated; R_4 and R_5 separated in the distal part for 1/3 of length of each vein; M_1 , M_2 and M_{3+4} not reaching the wing margin and similar in size; cell r_{4+5} width, with more than 1/2 length of R_{2+3} vein; cell m_3 with conic shape and 1/3 length of r_{4+5} and connected to cell bm by a projection of $m-cu$ (Fig. 17); halteres brownish with some parts yellowish; calypter rim blackish and interior part is pale with dense and long brownish pilosity; *abdomen*: strongly curved in third tergites; in dorsal view, oval shape and similar in length at thorax; widest than maximum margins of thorax; fully rough; first and second tergite golden-greenish with dense and rufous pilosity, sometimes golden (Fig. 8); tergites 3–6 blackish with dense and rufous-black or golden pilosity (Figs. 6–8); tergites 1–4 similar in length and width among them; tergite 6 greatly reduced; all sclerite with dark-brownish color; *genitalia*: cerci brownish and width in the apex, covered with abundant pilosity in dorsal view (Fig. 23, dorsal view); aedeagus brownish; gonocoxa black and widest in basal area (Fig. 23, lateral view).

Distribution: From Valparaíso region to Los Ríos region (Fig. 27).

Remarks: endemic species with similar distribution and Andean sub-regions occupied by *H. cyanea* (Morrone 2015). The specific epithet is in honor of Georg von Frauenfeld (1807–1873), an Austrian naturalist in zoology, specifically in Entomology and Malacology. In his entomological studies, he emphasized specially in Diptera. Adults have been observed interacting in the sclerophyllous forest characterizing by the presence of native trees or shrubs such as *Kageneckia oblonga* Ruiz and Pav., *Lithraea caustica* (Molina) Hook. et Arn., *Trevoa trinervis* Gillies and Hook., and *Colliguaja odorifera* Molina. This spider fly has a territorial behavior where the flies

use the same dry branches or leaves to watch potential competitors or females (Ricardo Varela and Vicente Valdés com pers.). Adults present two types of flight: one slowly, especially when choosing dry branches and another faster, where attacking to other conspecific flies (Vicente Valdés com pers.). Some areas in which it has been captured have a large number of *Alstroemeria ligtu* var. *simsii* flowers when this species has been observed sleeping (Rodrigo Barahona-Segovia, pers. obs.). Individuals present high variability in total length. In addition, the pilosity color of scutum and abdomen ranges from rufous (typical) to golden (less frequent). The host is unknown.

***Holops grezi* sp. nov. Barahona-Segovia**

(Figs. 9–10, 18)

urn:lsid:zoobank.org:act:0DD291B6-7C65-44F8-9BC4-7E590B10F3FE

Material examined: *Holotype*: male, in regular condition (see notes below), found in the Ernesto Krahmer's collection from UACH and finally deposited in the MNHNCL; with the following labels: “Col. 2.ii.1983 / Conguillio / Leg. E. Krahmer”; “Holotypus / *Holops grezi* / sp. nov. ♂ / det. Barahona-Segovia 2019” [red].

Type locality: Cautín province, Conguillio National Park, La Araucanía region, Chile.

Etymology: specific epithet ‘*grezi*’ refers to Audrey A. Grez Villarroel, a recognized Chilean entomologist, member of Ecology Society of Chile and full professor at the University of Chile. Audrey Grez has significantly contributed to the knowledge of both native and exotic ladybugs species and their impact on the composition and function of the native species in the agricultural landscape. In addition, she has contributed to the study of native beetles in the fragmented landscape, specifically in Maulino forest, where she has driven several theses both undergraduate as well as postgrad students.

Diagnosis: shiny dark greenish species. Head and eyes black. Flagellum 2-fold longer than scape and pedicelum together. Scutum, thoracic segments and abdomen are shiny dark green with brown pilosity. Coxa, trochanter and femora brownish. Tibia and tarsi light brownish. Wings smoked. Cell r_{4+5} elongated and thin. Cell m_3 with conic shape and directly connected cell bm . Abdomen globose in dorsal view and slightly wider than maximum margins of thorax.

Description: *female*: Length: 6.2 mm; width: 2.1 mm (head), 3.1 mm (thorax) and 4.5 mm (abdomen); *wing*: 7.3 mm; *head*: the size is 3/4 of the maximum height of the thorax (Fig. 7); antenna inserted in the middle of the head; scape and pedicelum blackish

with similar size; flagellum styliform two times longer than pedicel and scape together; antennae shorter than head length; eyes with long and brown ommatrichia; apparently two ocelli dark bluish with ocellar triangle bluish and some protuberant; occiput shiny blue with long black pilosity; mouth parts yellow; *thorax*: shiny blue-blackish scutum with long, dense and black pilosity, sparse but uniformly distributed (Figs. 9–10); postocellar lobe shiny blue with long and black pilosity; anterior spiracle light yellow; proepimeron, anepisternum, katapisternum, meron, katatergite, katapimeron and anatergite dark blue with long and black-brownish pilosity (Fig. 10); subalar sclerite brownish without pilosity; scutellum shiny blue, some collapsed due to manage of the pin; *legs*: coxa, trochanters and femora dark brownish, and tibiae and tarsi are light brownish, both covered with long and brown-yellowish pilosity, especially in the femora (Fig. 10); tarsi have dense pilosity (Fig. 10); black claws; *wings*: smoky and membranous appearance; all veins dark brown; R_1 and R_{2+3} are closer among them (Fig. 18); R_4 slightly petiolated; R_5 straight; R_4 and R_5 in the distal part are separated for 1/3 of length of each vein; M_1 , M_2 and M_{3+4} not reaching the wing margin (Fig. 18); M_1 and M_2 are similar in size; cell r_{4+5} elongated, with five sides and thin, with 3/4 length of R_{2+3} vein; cell m_3 with conic shape and 1/3 length of r_{4+5} connected to cell bm directly (Fig. 18); halteres bicolor with stem light yellow and knob brownish; calypter rim blackish and interior part is brownish with dense and long brownish pilosity; *abdomen*: blackish, globose and similar in size at thorax (Fig. 9); fully rough with brownish pilosity; all tergites blackish with some blue-green tints; tergites 1–5 with same width and tergite 6 greatly reduced; all with long and yellow-brownish pilosity; all sclerite with greenish color; *genitalia*: not detached; cerci barely visible and covered with yellow and short pilosity.

Distribution: only known from the type locality (Fig. 27).

Remarks: endemic species that belongs to Pehuén district in the Maule province, subantarctic subregion (Morrone 2015). This area is characterized by the presence of *Araucaria araucana* and *Nothofagus* species, forming forests with high structural complexity. The host is unknown.

Curatorial note: thorax somewhat collapsed and abdomen something separated due to the pin management by collector.

***Holops pullomen* sp. nov. Barahona-Segovia**

(Figs. 11–12, 19, 22)

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Material examined: *Holotype*: male, in excellent condition, found in the Ernesto Krahmer's collection from UACH and finally deposited in the MNHNCL; with the following labels: "Prov. Valdivia / Santo Domingo / 04.x.1987 / Leg. E. Krahmer"; "Holotypus / *Holops pullomen* / spec. nov. ♂ / det. Barahona-Segovia 2019" [red].

Type locality: Chile: Valdivia Province, Santo Domingo.

Etymology: the specific epithet '*pullomen*' is taken from Mapuche mythology and refers to *Pullomeñ*, a large blue fly identified by the Mapuches as souls' bearer of the dead who wish to live again. For this reason, it is forbidden to kill the insect. The *machi* (= shaman or woman sorcerer) requires his presence when she must heal people with walking problems or who walk with the same movement as the blue fly.

Diagnosis: shiny dark blue-violet species. Head and eyes black. Scutum dark blue with yellowish pilosity. Postocellar lobe violet. Anepisternum, meron, katatergite and subalar sclerite are brownish. Coxa and trochanter dark brownish. Femora bicolor (brown-yellow). M_1 vein shorter than M_2 . The cell r_{4+5} elongated and thin. Abdomen globose in dorsal view and slightly widest than maximum margins of thorax. First tergite dark violet color. Tergites 2–6 with light violet color.

Description: Length: 7.1 mm; width: 1.3 mm (head), 2.4 mm (thorax) and 4.0 mm (abdomen); *wing*: 7.4 mm; *male*: *head*: eyes brownish (Figs. 11–12); the size is 3/4 of the maximum height of the thorax; antenna inserted in the middle of the head; scape and pedicel blackish with similar size; flagellum styliform approximately three times longer than pedicel and scape together; antennae shorter than head length; eyes with long and brown pilosity; three ocelli dark brownish with ocellar triangle black somewhat protuberant; occiput bright grey with long brown pilosity; mouth parts dark brownish; *thorax*: shiny dark blue scutum with long, dense and whitish pilosity, sparse but uniformly distributed (Figs. 11–12); postocellar lobe violet-brownish with long and yellowish pilosity (Fig. 12); anterior spiracle light yellow; anepisternum and katapisternum shiny blue with long and yellowish pilosity; posterior basalare and anepisternum violet-brownish with yellowish pilosity; subalar sclerite violet-brownish; meron and katapimeron without pilosity and with shiny blue-violet color; katatergite and anatergite with shiny blue color and yellowish pilosity (Fig. 12); *legs*: coxa, trochanters and femora brown excepting

posterior part which is yellow (Fig. 12); tarsi are light yellow-brownish with dense brown pilosity; black claws; wings: hyaline; all veins dark brown; R_4 and R_5 forked and separated for the half of length of each vein; M_1 , M_2 and M_{3+4} not reaching the wing margin; M_1 shorter than M_2 ; cell r_{4+5} elongated, with six sides, thin and $3/4$ length of R_{2+3} vein; cell m_3 with $1/3$ length of r_{4+5} connected to cell bm by a very short projection of $m-cu$ vein (Fig. 19); halteres brownish with apex some yellowish; calypter rim blackish and interior part is brownish with dense and long brownish pilosity **abdomen**: curved in 5th tergite; globose slightly wider than margins thorax (Fig. 11); fully rough; first tergite blackish and 2–6 tergites with violet color (Figs. 11–12); tergites 2–5 with same width and tergite 6 greatly reduced; all with long and yellow-brownish pilosity; all sclerite of violet color; **genitalia**: not detached; cerci brownish and globose in dorsal view, covered with sparse pilosity; epandrium and gonocoxa barely visible and covered with yellow and short pilosity (Fig. 22).

Distribution: only known from the type locality (Fig. 27).

Remarks: endemic species that inhabit in similar

biogeographical province, subregion and forest type that *H. anarayae*. The host is unknown.

***Holops virens* Bigot 1878: lxxii**
(Figs. 13–14, 20)

Material examined: *Syntype*: “Chile” (A F UMO); other specimens: Chile: *Atacama*: Los Loros, 19.viii.1966, Leg. C. Vivar (MNHCL); *Metropolitana*: Cerro San Cristobal (Stuardo 1980); Laguna Aculeo, 400 m, 22.viii.2014, Leg. A. Ramírez (FRPC); Ñuble: Cerro Malalcura, San Fabián de Alico, VIII Reg. 1100 m. 11 X 2014, Leg. A. Ramírez (FRPC); *La Araucanía*: Camping Pehuenco, Parque Nacional Nahuelbuta, 16.x.2013, Leg. F. Ramírez (FRPC).

Type Locality: Chile (Pape and Thompson 2013).

Diagnosis: head and eyes black. Thorax and abdomen shiny green metallic color; dense and short whitish pilosity. Tibia and tarsi yellowish with short pilosity of same color. Wing hyalines.

Description: Length: 5.1 mm; width: 1.53 mm (head); 3.6 mm (thorax); 4.46 mm (abdomen); wing: 5.31 mm; **male**: **head**: black; the size is $3/4$ of the



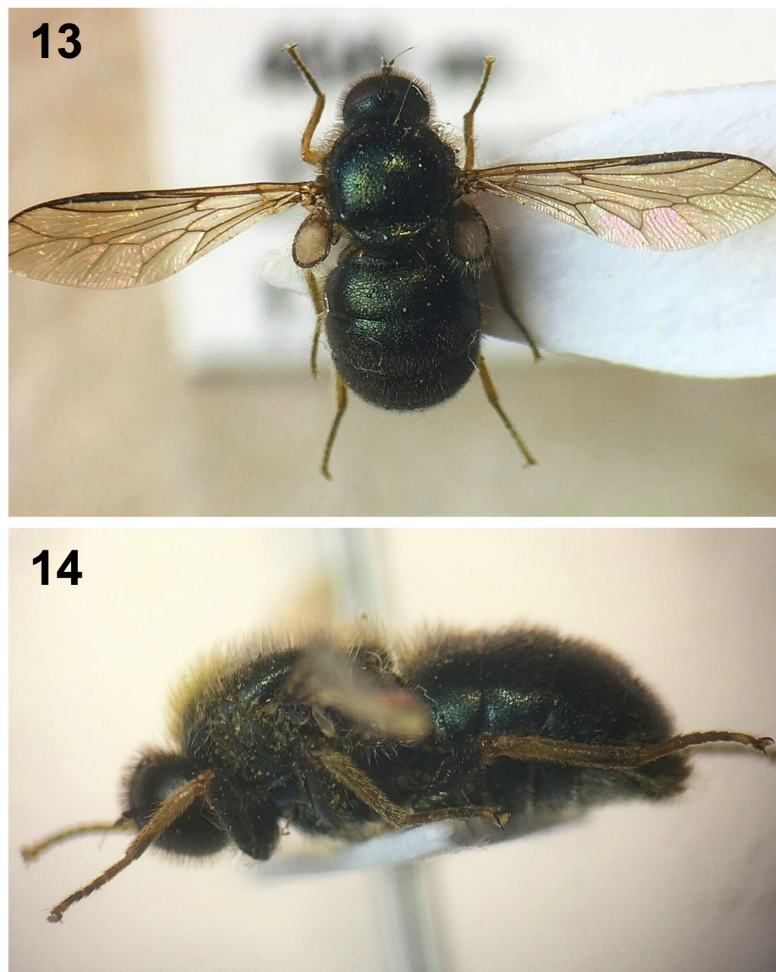
Figs. 9–12. *Holops grezi* sp. nov.: (9) dorsal view and (10) lateral view; *Holops pullomen* sp. nov.: (11) dorsal view and (12) lateral view. Scale bars = 1 mm.

maximum height of the thorax; antenna inserted in the middle of the head; scape and pedicelum blackish with similar size; flagellum styliform three times longer than pedicelum and scape together; antennae approximately 1/4 shorter of maximum head length; eyes black with long and brown pilosity (Figs. 10–11); three ocelli dark brownish with ocellar triangle black somewhat protuberant; occiput brownish with brown pilosity; mouth parts dark brownish; *thorax*: dark green scutum with long, dense and yellow-brownish pilosity, sparse but uniformly distributed (Figs. 10–11); postocellar lobe dark green with long and yellowish pilosity; anterior spiracle yellowish; proepimeron, anepisternum, katapisternum, anepimeron, meron, katatergite, anatergite dark green with long and yellowish pilosity (Fig. 11); scutellum dark green with whitish pilosity (Fig. 11); *legs*: coxa, trochanters and femora are brownish excepting anterior part which is yellow; tibiae are yellowish; tarsi are brownish with dense brown pilosity; black claws (Figs. 10–11); *wings*:

smoky and with membranous appearance; all veins dark brown; R_4 and R_5 forked and outward separated for the half of length of each vein (Fig. 20); M_1 , M_2 and M_{3+4} not reaching the wing margin; M_1 shorter than M_2 ; cell r_{4+5} elongated, with five sides and thin, with approximately more than the half of total length of R_{2+3} vein; cell m_3 with 1/3 length of r_{4+5} and connected directly with m-cu vein (Fig. 20); halteres brownish with apex somewhat yellowish; calypter rim blackish and interior part is brownish with dense and long brownish pilosity; *Abdomen*: elongated; slightly wider than thorax margins; fully rough; all tergites with dark green color and yellowish pilosity; all sclerite of greenish color (Figs. 10–11); *Genitalia*: not detached.

Distribution: from Atacama region to La Araucanía region (Fig. 27).

Remarks: Endemic species barely collected. The specific epithet “*virens*” means green (in English) or *verde* (in Spanish). This spider fly species is distributed from Coquimban province to Pehuén



Figs. 13–14. *Holops virens* Bigot: (13) dorsal view and (14) lateral view. Scale bars are not available.

district in Maule province, both belong to central Chile subregion (Morrone 2015). This species inhabits several vegetation types along its distribution (Andrés Ramírez com. pers.). Following Stuardo (1980) this species visits the flowers of *Podanthus mitique* Lindl. At same that *H. frauenfeldi*, *H. virens* could use dead branches of *Cryptocarya alba* (Molina) Looser and *Podocarpus saligna* D. Don to rest and watch potential competitors (González et al. 2018). The species present high variability in color legs and length of R₄, R₅ and M veins of wings (Shaun Winterton, pers. comm.). The Host is unknown.

Genus *Villalus* Cole, 1918: 61

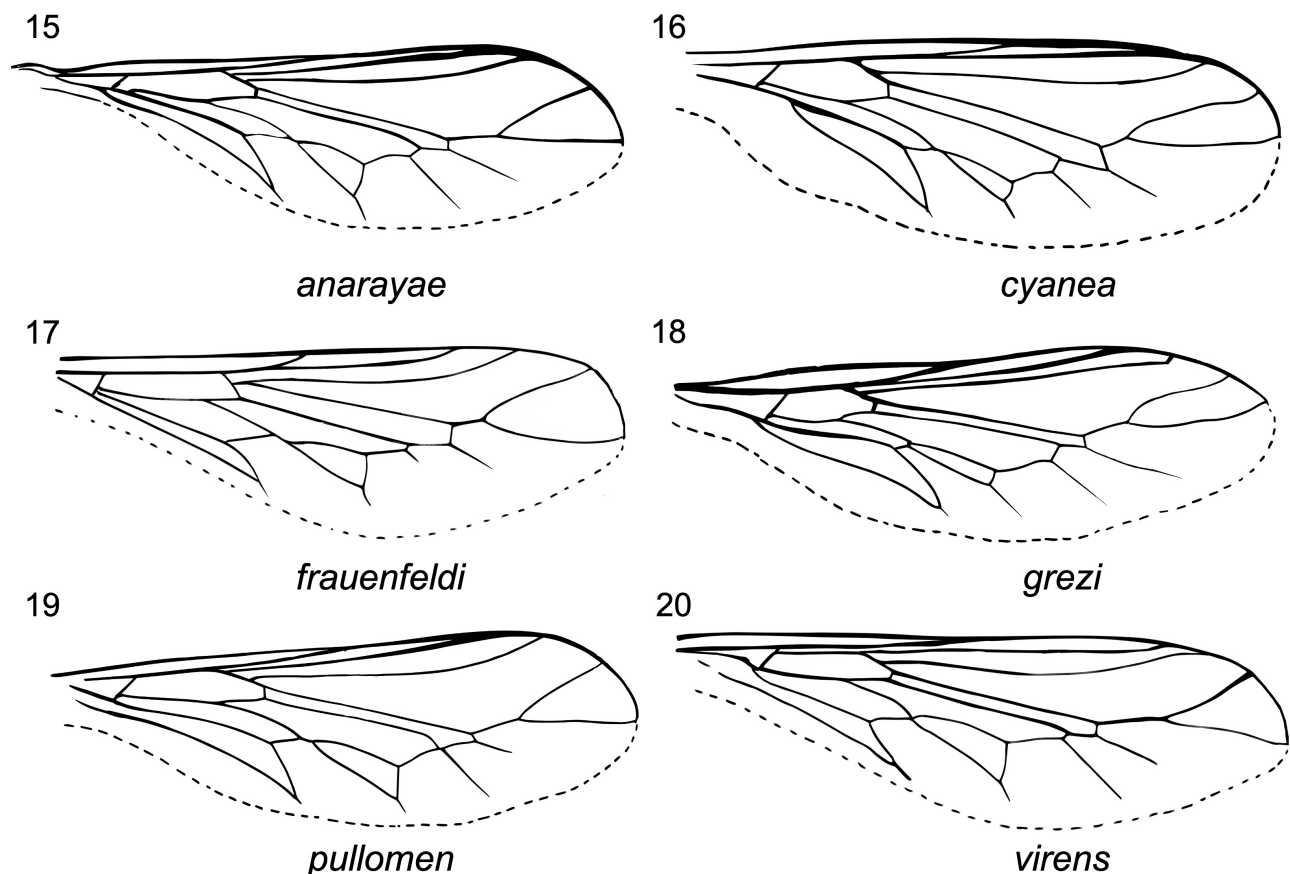
Villalus inanis (Philippi, 1865): 645–646 (Figs. 24, 28–36)

= *Villalus chilensis* Cole, 1918: 63–64.

= *Lasia dimidiata* Cole, 1918: 61 (*nomen nudum*).

Material examined: *Holotype*: “Valdivia, Chile” (A MNHNCL); other specimens: CHILE.

Valparaíso: Parque Peñuelas, 23.iv.1965, Leg. N. Hichins (MNHNCL); *Valparaíso*, vii.1966, Leg. W.H. Sielfield (MNHNCL); *Biobío*: **Tirúa, Lago Lleu-Lleu, 25.iii.2020, phot. Leg. Ignacio Valeria (CSP, electronic voucher: <https://figshare.com/s/0e733c2cecb30b0de50b>); *La Araucanía*: **Parque Nacional Nahuelbuta, 7.iii.1982, Leg. L.H. Pincheira (MZUC); **Fundo El Carmen, Temuco, iv.2016, phot. Leg. Lucas Nuñez (CSP, electronic voucher: <https://figshare.com/s/aba8eb49b2a1a1bf3999>); **Gorbea, 29.iii.2020, phot. Leg. William Tarrant (CSP, electronic voucher: <https://figshare.com/s/c98c392e4847aedbe437>); *Los Ríos*: **Panguipulli, 1983, Leg. G. Piel (UACH); **Pichoy, 30.ii.1991, Leg. E. Krahmer (UACH); **Parque Llancahue, 25.iii.1978, Leg. E. Krahmer (UACH); **Santo Domingo, 8.iv.1984, 3.iv.1987, 2.iv.1989, Leg. E. Krahmer (UACH); *Valdivia*, 5.IV.1977, 3.iv.1981, 30.iii.1983, 13.iii.1985, 2.v.1985, Leg. Krahmer (UACH, MNHNCL); **Chahuilco, 11.iii.1990, Leg. E. Krahmer (UACH); **Reumen, 15.iii.1991, Leg. Lula Mata (UACH); *Los Lagos*: **San Pablo, Osorno, 24.iii.2020, phot. Leg. Claudia Veas (CSP, electronic voucher: <https://figshare.com/s/0e733c2cecb30b0de50b>).



Figs. 15–20. *Holops* wing details: (15) *H. anarayae* sp. nov.; (16) *H. cyanea* (Philippi); (17) *H. frauenfeldi* Schiner; (18) *H. grezi* sp. nov.; (19) *H. pullomen* sp. nov., and (20) *H. virens*.

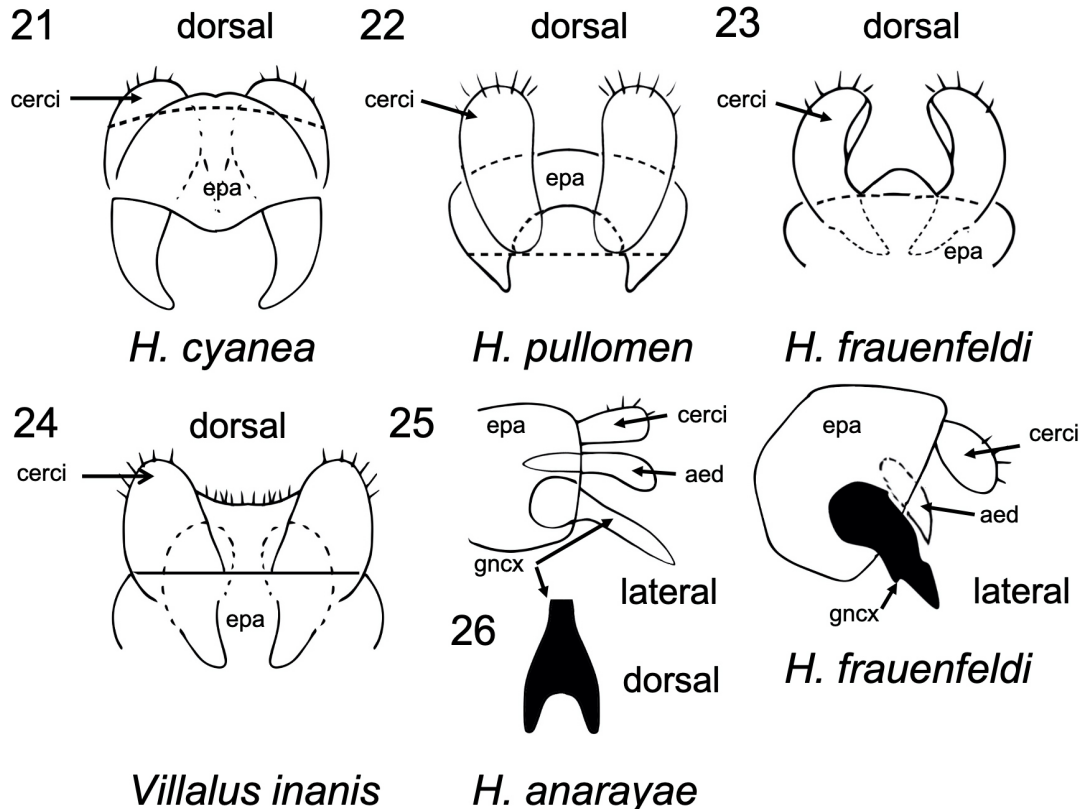
com/s/d771abe10446bd766c93). ARGENTINA. Chubut: **S. Argentina, El Puelo, Topal, Nr. 354, 25.iii.1961, Leg. NN (USNM); **S. Argentina, Rio Negro, El Bolson, Topal, Nr. 322, 15.iii.1961, Leg. NN (USNM).

Type locality: Valdivia, Chile (Pape and Thompson 2013).

Diagnosis: Orange-yellowish species. Head and eyes black. Head with half that maximum height of thorax. Scutum with two black, but very light longitudinal bands. Yellowish pilosity in all thoracic segments. Katepisternum brownish in ventral part. Meron grey and elongated with yellow margin. Legs completely yellowish. The cells sc , c , br , r_1 , r_{2+3} , r_{4+5} and m_1 smoked with microtrichia. R_4 and R_5 not forked. Abdomen globose and slightly longer than thorax in dorsal view. Tergites and sclerites orange-yellowish with pilosity similar in color.

Description: Length: 6.49 ± 0.18 mm; width: 1.78 ± 0.05 mm (head), 3.13 ± 0.09 mm (thorax) and 4.36 ± 0.16 mm (abdomen); wing: 6.96 ± 0.16 mm; *female:* head: black; the size is approximately the half of the maximum height of the thorax; antenna inserted in the middle of the head; scape and pedicel orange

and similar in size among them; flagellum styliform and 3 times longer than pedicel + scape together; antenna shorter than head length; eyes with short and yellowish pilosity; three ocelli brownish with ocellar triangle black, protuberant and with 6–8 yellow hairs; occiput black with long yellowish pilosity; mouth parts brownish; *thorax:* globose shape (Figs. 28–29); orange scutum with two dark longitudinal bands slightly visible; scutum covered with long and dense orange-yellowish pilosity; pilosity sparse but uniformly distributed; postocellar lobe orange and yellowish pilosity; anterior spiracle light yellow; anepisternum globose and orange; katepisternum brownish in ventral part; anepisternum yellowish; meron grey and elongated with yellow margin; katepimeron and anatergite orange-yellow with few pilosity; scutellum orange and widest than long with yellowish pilosity; (Figs. 28–29, 33–34); *legs:* coxa, trochanters, femora, tibia and tarsi yellow covered by dense yellow pilosity; black claws; *wings:* all veins brownish; cell sc , c , br , r_1 , r_{2+3} , r_{4+5} and m_1 smoked with microtrichia; other cell hyaline and membranous appearance; R_4 and R_5 not forked; M_1 , M_2 and M_{3+4} are long, but not reaching the wing margin; all M veins similar in size; cell r_{4+5} elongated and width,



Figs. 21–26. Genitalia of *Holops* and *Villalus*: (21) dorsal view of *H. cyanea* (Philippi), female; (22) dorsal view of *H. pullomen* sp. nov.; (23) dorsal and lateral view of *H. frauenfeldi* Schiner, male; (24) dorsal view of *V. inanis* (Philippi), female; (25) lateral view of *H. pullomen*, male; (26) dorsal view of gonocoxa of *H. anarayae* sp. nov. epa = epandrium; gncx = gonocoxa.

with more than 1/2 length of R_{2+3} vein; cell m_3 absent; halteres brownish; calypter rim blackish and interior part is brownish with dense and yellowish pilosity; *abdomen*: globose and slightly longer than thorax; in dorsal view the width is the double of thorax and rough; all tergites orange with dense yellowish pilosity; tergites 1–3 similar in length; in dead animals, all sternites yellow with pilosity of same color and a big brown

maculae in the middle (Fig. 32); in living animals, tergites 3–6 present a large brownish area in the middle (Figs. 30–31); interior parts of tergites 4–6 covered with black and granulate plates; *genitalia*: cerci globose and yellow with pilosity of the same color in dorsal view (Fig. 24).

Male: *head*: similar to female; *thorax*: postocellar lobe yellow; scutum and scutellum brownish with short

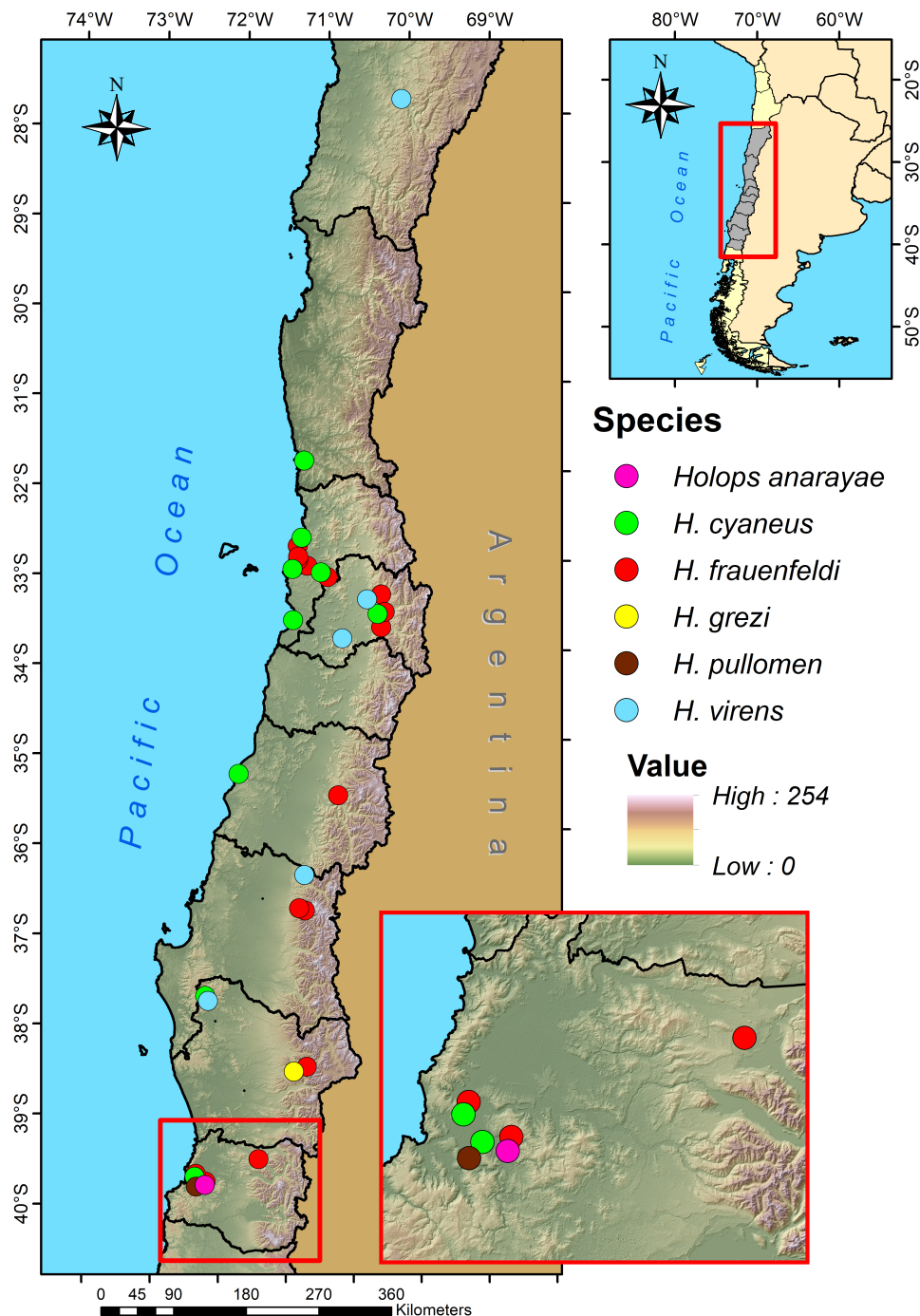


Fig. 27. Distributional map of *Holops* species.

yellowish pilosity; anterior spiracle yellow; superior part of anespisternum yellow and inferior brownish; katepisternum, anepimeron, meron, katatergite and anatergite brown (Figs. 35–36); *legs and wings*: similar to female; *abdomen*: all tergites brown with long and yellow pilosity; sclerites yellowish; tergites 1–4 with same width; all sternites yellow with short pilosity of the same color. *Genitalia*: not detached. However, cerci and epandrium have globose shape and yellow color (Fig. 35).

Distribution: Chile, from Valparaíso region to Los Ríos region and Argentina (first record; Shaun Winterton, pers. comm.) (Fig. 37).

Remarks: native species distributed from the Santiaguan province in central Chile subregion to Valdivian forest province in subantarctic subregion (Morrone 2015). We extend the historical distributional range 224 km to north from Valdivia (type locality) to Nahuelbuta National Park and we fill the gaps in the La Araucanía region and also, we extend in 65.83 km southeast from Valdivia to San Pablo, Los Lagos region (new distribution record). This species has been recently observed associated to semi-rural environments thanks

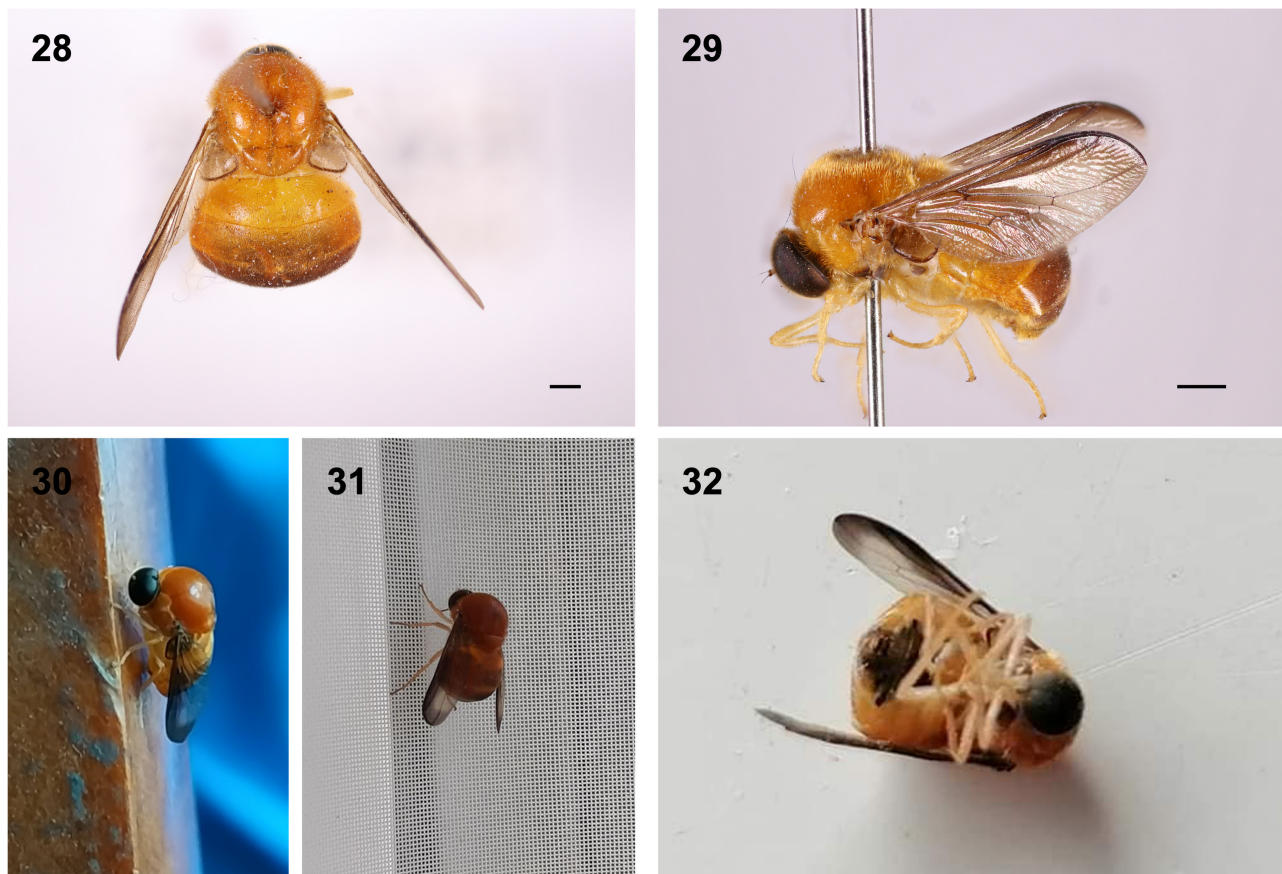
to the citizen science program (Figs. 30–32). *Villalus inanis* seems to be mainly distributed by the coastal forest which has been highly fragmented by forestry, urbanization and crops. The host is unknown.

The female holotype of *V. chilensis* described by Cole (1918; Figs. 33–34), looks as all *V. inanis* examined for this work and therefore both species were considered the same. All morphological characteristics, especially wing veins are completely similar to specimens reviewed. According with Shaun Winterton (pers. comm.), two males of this species possess sexual dimorphism because they are smaller than females with many brown (mainly thorax and tergites) and yellow segments (Figs. 35–36).

Curatorial note: According to González et al. (2018) the type specimen is not deposited in MNHNCL. Currently, the holotype is in the California Department of Food and Agriculture and on loan from USNM.

DISCUSSION

The genera *Holops* and *Villalus* represent Chilean

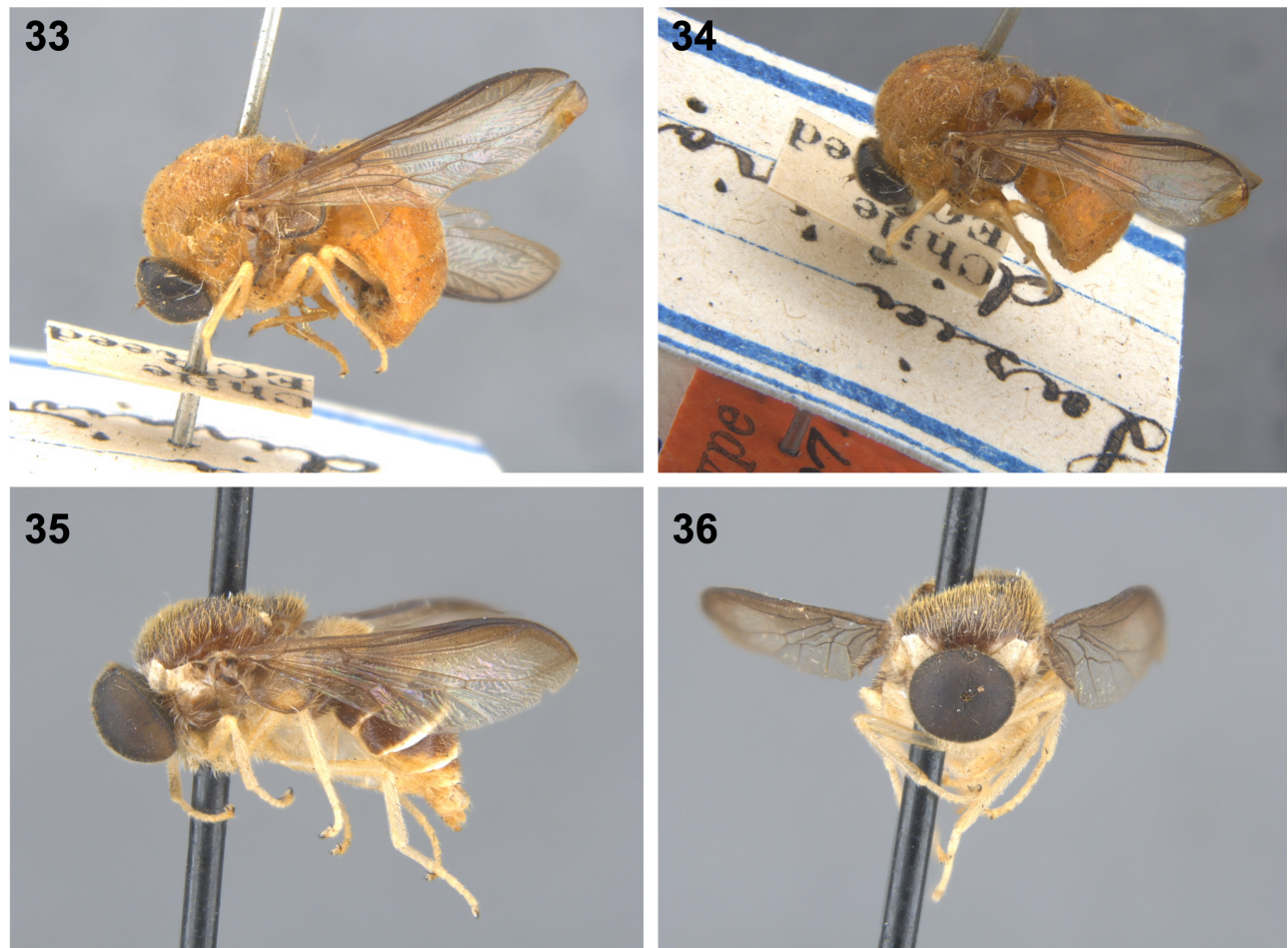


Figs. 28–32. *Villalus inanis* (Philippi, 1865): (28) dorsal view; (29) lateral view; (30) *in situ*, lateral view (photo: William Tarrant); (31) *in situ*, dorsal view (photographed by Ignacio Valeria), and (33) dead, ventral view (photographed by Claudia Veas). Scale bars = 1 mm.

endemic species that lack closely-related taxa in other countries of South America. In the southern hemisphere, Edwards (1930) suggested that the genus *Apsona* Wetswood (Panopinae), a monotypic and endemic genus of New Zealand, is similar to *Holops*, especially in R_4 and R_5 forked. However, *Apsona* presents R_4 strongly curved upward as in almost all Panopinae species and closer to R_{2+3} (Winterton 2012). On the other hand, *Holops* has the R_4 slightly petiolated and closer to R_5 , which is straight. Edwards (1930) also mentioned that the last flagellomere is similar among both genera, but in *Holops* this is slenderer than in *Apsona*. Finally, according to Winterton (2012) *Apsona* present long proboscides and is closer to *Eulonchus* Gerstaecker. This is confirmed by the molecular phylogeny studies carried out by Gillung and Winterton (2019). Therefore, the genus *Holops* (and all Cyrtinae) is sister to Panopinae. On the other hand, fossil *Villalites* Hennig was recovered in the phylogeny as sister to *Villalus* and shares several morphological characteristics as R_{4+5} is

not forked, cell m_3 is absent, spherical head and antenna inserted in the middle of frons (Gillung and Winterton 2019). No similar genus to *Villalus* has been described to date, and the genus could represent a unique survivor from an ancient lineage of Cyrtinae, now almost extinct.

Edwards (1930) mentioned that, when he reviewed the specimens available of *H. cyanea* for Diptera of Patagonia and South Chile book, he found differences in color and wing venation in two specimens. These differences probably could represent some new species described here but also, could represent morphological variability. All new *Holops* species proposed in our study are considered cryptic of *H. cyanea* or *H. virens* because of their morphological resemblance to this species. The review of several morphological traits such as size of flagellum, and the shape of abdomen was essential to separating species and generating an identification key for the species. In the last decades, the development of molecular tools has become important for revealing cryptic species in countries or zones with



Figs. 33–36. *Villalus inanis* (Philippi, 1865): (33) female, lateral view, holotype, (34) female, dorsal view, holotype, (35) male, lateral view and (36) male, frontal view. Scale bars are not available.

particular biogeographical history such as Chile. For example, in recent years, problematic genera such as *Ectinogonia* or *Callyntra* have been treated from a classic morphological view and have been clarified using DNA analyses, limiting new species and revealing the real biodiversity of these groups (Anguita-Salinas et al. 2017; Zúñiga-Reinoso and Méndez 2018). For this reason, in the following years, the collection of new material for molecular phylogeny will be essential to clarify the species proposed or increase the spider fly diversity in some unexplored Chilean ecosystems.

In this study, we increase the number of known Cyrtinae species of Chile by 75%. All new species belong to the central Chile hotspot, which is characterized by the presence of many endemic insect species present in the Coquimban, Santiagan, Maule and Valdivian forest province (Morrone 2015). *Holops grezi* only has been recorded from the Pehuén district in the Maule province, and *H. anarayae* and *H. pullomen* have been recorded from the Valdivian evergreen forest

in the Subantarctic Subregion. High endemism of Chilean flora and fauna has been recorded in Valdivian forest province because it was a shelter during the last glacial period and promoted speciation (Villagrán and Armesto 2005; Morrone 2015; Smith-Ramírez et al. 2019). Therefore, it is not rare that many endemic fly species have been recently described from this forest type as the flower fly *Cepa simonettii* (Barahona-Segovia and Barceló 2019) or thick-headed fly *Physoconops tentenvilu* (Barahona-Segovia et al. 2020). It is probable that many other Chilean spider flies will be described soon due to the sheltered condition of Valdivian evergreen forest in ancient times.

CONCLUSIONS

This study proposes the re-description of known species of *Holops*—poorly described in the past—to delimit three new species using morphological traits

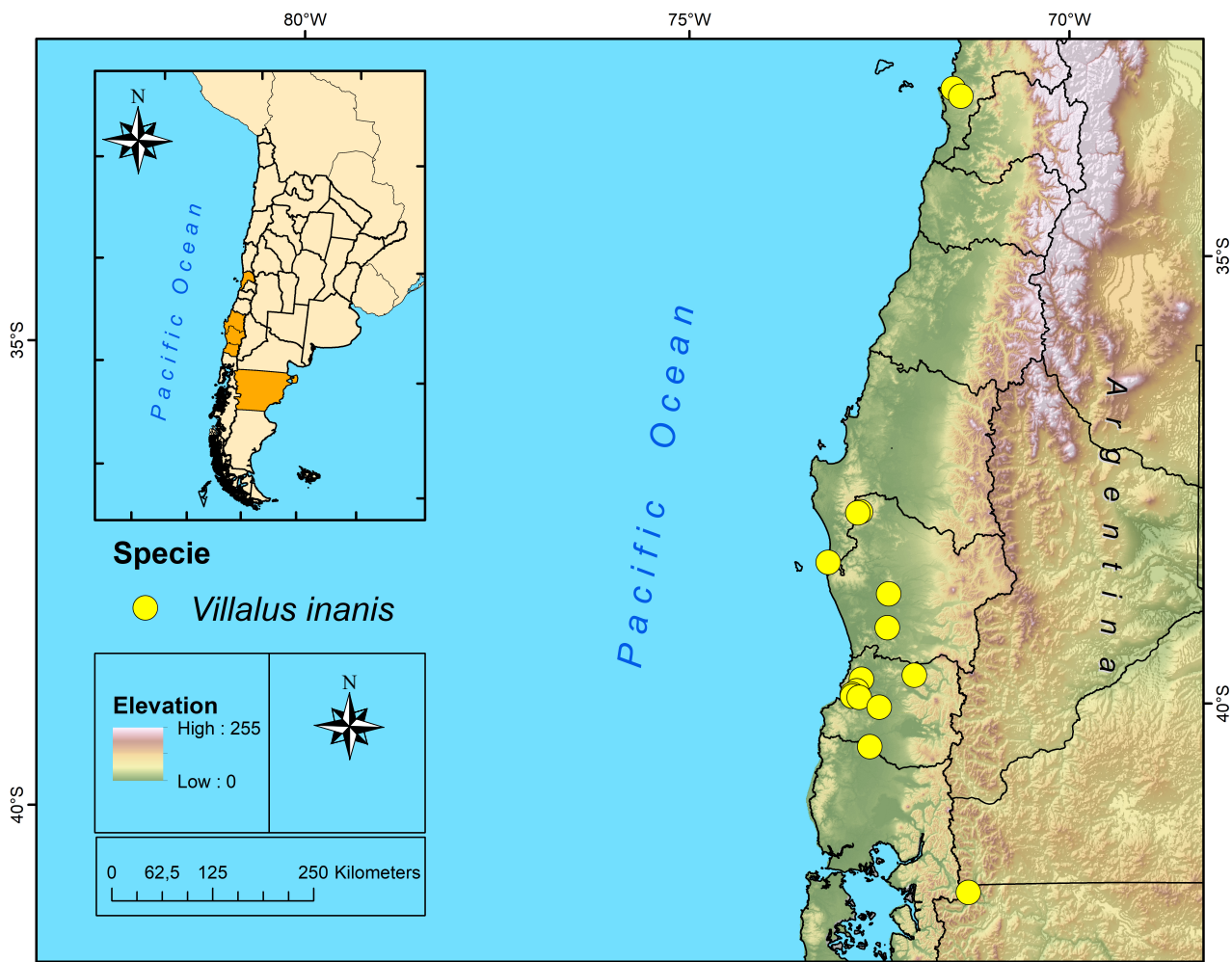


Fig. 37. Distributional map of *Villalus inanis* (Philippi, 1865).

and generate a species key for their identification. We conclude that new and cryptic *Holops* species opens the opportunity of disentangling the real biodiversity of spider flies in Chile and that molecular tools are necessary for the future, thus confirming our proposed species.

Acknowledgment: This work and the new species names have been registered with ZooBank under urn:lsid:zoobank.org:pub:7F6FE302-CA02-43D8-88FC-95C99AD37A85. Thank to Shaun Winterton that provide all Cyrtinae type material photos for this review; to Ricardo Varela for provide natural history remarks of *Holops frauenfeldi*; to Alonso “Loncho” Salazar for provide the pictures of genitalia and wing veins; to Andrés and Francisco Ramírez for provide photos of *H. virens* from his personal collection. We thank also to Peter D. Lewis for English review. This work was supported by PhD CONICYT scholarship 21160404 and ANID-FONDECYT 3200817.

Authors' contributions: RMBS conceive the idea, reviewed and examined material, and describe the *Holops* species; VVG took the photos and reviewed material; LPM generated maps and review material. All author contributes equally to discussion and elaboration of final draft.

Competing interests: The study is original research carried out by the authors and all agreed with the contents of the manuscript and its submission to the journal. We declare that this article has not been published before and is not currently being considered for publication elsewhere and this article does not violate any copyright or other personal proprietary right of any person or entity, and it contains no abusive, defamatory, obscene or fraudulent statements, nor any other statements that are unlawful in any way. We declare no actual or potential conflict of interest including financial, personal or other relationships with other people or organizations within three years of beginning the submitted study that could inappropriately influence, or be perceived to influence, the manuscript submitted. All appropriate ethics and other approvals were obtained for the research.

Availability of data and materials: Photos stored in Figshare (links in the text).

Consent for publication: Not applicable.

Ethics approval consent to participate: Not applicable.

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