Article
Artículo

www.biotaxaorg/RSEA. ISSN 1851-7471 (online) Revista de la Sociedad Entomológica Argentina 83 (3): 14-20, 2024

A remarkable new species of *Praocis* (Coleoptera: Tenebrionidae) from Patagonia, with zoogeographical and ecological remarks

FLORES, Gustavo E.[1*] & CHELI, Germán H.[2,3]

[1] Laboratorio de Entomología, Instituto Argentino de Investigaciones de las Zonas Áridas, Centro Científico Tecnológico CONICET, Mendoza, Argentina.

[2] Grupo de Entomología Patagónica (GENTPAT), Instituto Patagónico para el Estudio de los Ecosistemas Continentales (IPEEC), Centro Científico Tecnológico CENPAT -CONICET, Puerto Madryn, Chubut, Argentina.

[3] Universidad Nacional de la Patagonia San Juan Bosco, Puerto Madryn, Chubut, Argentina.

*E-mail: gflores@mendoza-conicet.gob.ar

Received *19 - VII - 2024* | Accepted *30 - VIII - 2024* | Published *30 - IX - 2024*

https://doi.org/10.25085/rsea.830304

Una notable nueva especie de *Praocis* (Coleoptera: Tenebrionidae) de Patagonia, con observaciones zoogeográficas y ecológicas

RESUMEN. Se describe una nueva especie del género *Praocis* Eschscholtz subgénero (*Praonoda*) Flores & Pizarro-Araya (Pimeliinae: Praociini) de la Patagonia Argentina: *Praocis (Praonoda) crassicollis* **sp. nov.**. Se incluyen un mapa de distribución, foto del adulto y la comparación de caracteres con otra especie conocida del género y subgénero. Se presenta una discusión sobre su hábitat, biogeografía y conservación.

PALABRAS CLAVE. Argentina. Conservación. Estepa patagónica. Praociini. Zoogeografía.

ABSTRACT. A new species of the genus *Praocis* Eschscholtz subgenus (*Praonoda*) Flores & Pizarro-Araya (Pimeliinae: Praociini), *Praocis (Praonoda) crassicollis* **sp. nov.**, is described from Argentinean Patagonia. Distributional map and photograph of adult habitus are included, with comparisons to other known species of the genus and subgenus. A discussion is presented on distributional habitat records, biogeography and conservation.

KEYWORDS. Argentina. Conservation. Patagonian steppe. Praociini. Zoogeography.

INTRODUCTION

The Neotropical tribe Praociini (Pimeliinae) comprises 150 species arranged in 15 genera endemic to arid and semiarid environments of western and southern South America in Peru, Bolivia, Chile and Argentina (Flores & Pizarro-Araya, 2014; Flores & Giraldo, 2020). Together with the Neotropical tribes Nycteliini and Scotobiini they are dominant elements of the tenebrionid fauna of the Patagonian steppe (Kuschel, 1969). Among the Praociini, endemic genera or subgenera in this area are *Platesthes* Waterhouse, 1845, *Praocis* (*Hemipraocis*) Flores & Pizarro-Araya, 2014, and *Praocis* (*Praonoda*) Flores & Pizarro-Araya, 2014.

Praocis Eschscholtz is the most species-rich genus of the tribe (56% of the species) with 77 species and 8 subspecies arranged in nine subgenera (Flores & Pizarro-Araya, 2014). Its species are distributed from central and southern Peru to the southern part of Patagonia in Argentina and Chile (Flores & Pizarro-Araya, 2014). *Praocis* (*Praonoda*) comprises two species inhabiting the Patagonian steppe in Neuquén, Rio Negro, Chubut, and Santa Cruz provinces in Argentina and Magallanes Region in Chile from sea level to an altitude of 1250 m (Flores & Pizarro-Araya, 2014).

In recent years, we performed two entomological collecting field trips on Santa Cruz province in Argentinean Patagonia using pitfall traps and manual collection. As a result, we found some specimens of *Praocis* (*Praonoda*) in Santa Cruz, Argentina that constitute a new species of the subgenus. Additionally, we reviewed three scientific collections finding more specimens of this new species. The main objectives of this paper are to describe and illustrate a new species of *Praocis* (*Praonoda*) living in

west Argentinean Patagonia, and to perform some conservation remarks based on its geographical distribution.

MATERIAL AND METHODS

Type specimens and material examined are deposited in the following collections:

FMNH: Field Museum of Natural History, Chicago, USA

IADIZA: Instituto Argentino de Investigaciones de las Zonas Áridas, Mendoza, Argentina

IPEEC: Instituto Patagónico para el Estudio de los Ecosistemas Continentales, Puerto Madryn, Argentina

MACN: Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina

Body length was measured dorsally, along the midline, from the anterior margin of the labrum to the apex of elytra. Terminology used in description follows recent papers dealing with the genus *Praocis* (Flores & Pizarro-Araya, 2014, 2022) without including the characters used at generic and subgeneric levels (Flores & Pizarro-Araya, 2014). Digital images were taken with a camera Leica DFC 290 adapted to a Leica M165 C stereomicroscope. Final image (Fig. 1) was merged with the image stacking freeware Combine ZP (Hadley, 2024). Type material information is cited on separate labels, indicated in brackets.

The distribution map (Fig. 2) was created using latitude and longitude coordinates of each specimen locality (both from the sites where specimens were collected obtained with GPS *Garmin Etrex Legend* or from data on the label of those individuals hosted on scientific collections) plotted on the map of vegetation units for extra Andean Patagonia created by Oyarzabal et al. (2018). The map was performed using the freeware Q-GIS 3.34 (QGIS Development Team, 2024). The distribution of the species was interpreted according to the biogeographic classification of Morrone (2015), the Patagonian biozone classification of del Valle et al. (1995) modified by INTA (Instituto Nacional de Tecnologia Agropecuaria) (2006), and the vegetation units defined by Oyarzabal et al. (2018).

RESULTS

***Praocis* (*Praonoda*) *crassicollis* sp. nov.**

urn:lsid:zoobank.org:pub:61F96038-B9C4-40C6-A65C-FE4526508377

(Figs. 1-2)

Etymology. Named *crassicollis* from latin *crassus* (= thick) and *collaris* (= neck) to indicate lateral margins of pronotum elevated and thick.

Fig. 1. Dorsal habitus of *Praocis (Praonoda) crassicollis* sp. nov., holotypus male.

Diagnosis. *Praocis* (*Praonoda*) *crassicollis* **sp. nov.** is the unique species of Praociini having lateral margins of pronotum up-righted and thick, forming an angle of 90°, with a longitudinal groove between disc and lateral margins. Elytron with two thin and sharp carinae, lateral margin thin and sharp; antennomeres 8-9 wider than long, antennomere 9 wider than 10 and 11, disc with punctures on all its surface.

Description

Length 13.50-15.50 mm. Body black, shiny; antennae, legs black to reddish brown. Head. Labrum with anterior margin "V"-shaped, glabrous, with abundant small punctures on all surface and big punctures (twice than the small) on anterior half separated by two to four puncture diameters; clypeus glabrous with punctures small and big (twice than the small) on all surface, separated by two to four puncture diameters; frons with punctures on all surface each bearing a short setae separated by two to six puncture diameters; epicanthus subtrapezoidal, with short setae, anterior margin oblique; eyes oval, slightly emarginate anteriorly by epicanthus, with supraocular groove continued also between frons and postgena; antennae reaching half of lateral margin of pronotum; antennomeres 1-5 longer than wide, 6-7 longer than wide or as wide as long, 8-11 wider than long, antennomere 9 wider than 10 and 11.

Thorax. Pronotum with anterior angles rounded, produced, anterior margin straight, lacking carinate edge, lateral margins oblique, converging anteriorly or concave in anterior half, straight in posterior half, up-righted and

thick, with a longitudinal groove between disc and lateral margins; disc convex lower than lateral margins along, disc with small sparse punctures, each bearing a short seta, visible at higher magnification (50x) separated by two to four puncture diameters, lateral thirds with big punctures (twice than the small) separated by one to two puncture diameters, punctures smaller than punctures of elytron; posterior margin bisinuate, posterior angles acute, produced, extended over elytral humeri and extending beyond central area of posterior margin. Hypomeron with straight, horizontal grooves, with tubercles each bearing a short seta. Prosternum, meso, metaventrite, meso, and metepisternum with short setae arising on tubercles. Prosternum horizontal, prosternal process subrectangular forming a straight angle, not produced backwards, not reaching midpoint space between pro, mesocoxae, prosternal process with a complete groove. Meso, metepisternum lacking grooves. Scutellum visible.

Elytron with two carinae straight, thin and sharp, almost equidistant between suture and lateral margin, external carina higher and thin than internal; both carinae elevated in anterior 2/3 of elytron, external between base and anterior 2/3 of elytron, internal not reaching the base but reaching the elytral apex, in posterior third not elevated; first interval between suture and external carina wider than remaining, first and second intervals with a longitudinal area smooth, weakly elevated and sparse punctures close to carinae and suture, each puncture bearing a short seta, visible at higher magnification (50x) separated by two to four puncture diameters; third interval with transverse grooves, punctures and setae; lateral margin thin and sharp, pseudopleuron with sparse punctures separated by two to six puncture diameters of which emerge long, erect setae, and a row of punctures below lateral margin; epipleuron conspicuous, finely ridged throughout, glabrous, lacking punctures, anterior quarter twice as wide as posterior half, anterior margin not reaching elytral humeri nor posterior angle of pronotum and texture similar to that of elytra.

Legs. Trochanters, femora and dorsal surface of tarsomeres with sparse setae arising on punctures; tibiae and ventral surface of tarsi with sparse stout setae; protibiae explanate, inner and outer margins armed with a row of stout setae, protibial length twice the width of protibial distal margin.

Abdomen. Ventrites 1-5 glabrous, with abundant tubercles separated by two to four puncture diameters.

Type material. Holotype, male: [Argentina: Santa Cruz/ Dto. Perito Moreno, Ruta 40/ 1 km S Rio Ecker, 734 m/ 47.12944º S, 70.86637º W/ 29-XI-2016, R. Carrara G./ Cheli, G. Flores, S. Roig] (IADIZA) (site 2 in Fig. 2) [*Praocis /(Praonoda)/ crassicollis* n. sp./ HOLOTYPUS male/ Det. G. Flores and/ G. Cheli 2024]. Allotype, female: [Rca. Argentina/ Gob. Chubut/ 3-1895/ C. Bruch] [Foto] [Nyctelia?/ Fairm. v.] (handwrite of Bruch) [C2] [*Praocis*/ (*Praonoda*)/ n. sp./ Det. G. Flores 2006] [MACN-En/ 40322] (MACN). Two paratypes males (1 IADIZA, 1 IPEEC) and one female (IADIZA) same data as holotype. One paratype female: [Argentina: Santa Cruz/ Dto. Lago Buenos Aires, Ea. El/ Sauce Rio Ecker/ 47.151351º S, 1222 m/ 71.234456º W, 08-II-2013/ Coll: G. Cheli] (IADIZA) (site 3 in Fig. 2); one paratype male [Argentina: Chubut prov/ 19.5 km E Shaman, 650 m/ 19-XI-1966, E.I. Schlinger/ & M.E. Irwin] [ex collection/ UCRC 1972] (FMNH) (site 1 in Fig. 2); note: this locality is in Department Tehuelches, intersection of Shaman river with state route 20: 44.441644° S, 70.716608° W, 690 m.

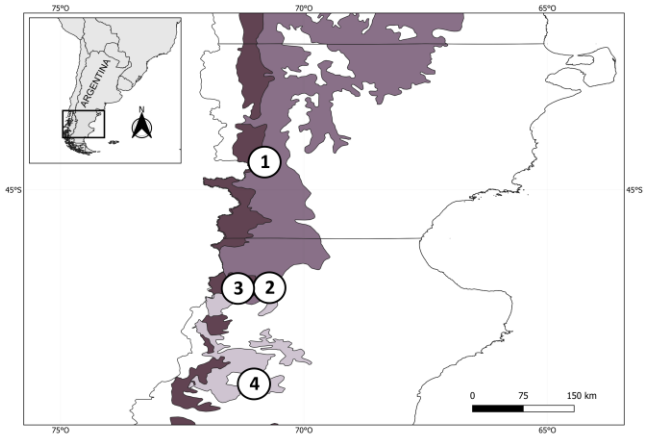

Fig. 2. Geographic distribution of *Praocis (Praonoda) crassicollis* sp. nov. in western Patagonia, Argentina. References= 1 and 2: shrub-grassy steppes, 3: grassy steppe, 4: low shrub steppe with *Nardophyllum bryoides* (vegetation units from Oyarzabal et al., 2018).

Other material examined: Argentina: Santa Cruz, Dto. Río Chico, Ruta 40, Lago Cardriel, Ea. La Primera Argentina, 573 m, 49.05205º S, 71.06290º W, 29-XI-2016, G. Cheli, G. Flores, S. Roig, R. Carrara (1 IADIZA) (site 4 in Fig. 2).

DISCUSSION

Praocis (*Praonoda*) *crassicollis* **sp. nov.** superficially resembles *Praocis* (*Praonoda*) *bicarinata* Burmeister by having elytron with two fine and sharp carinae and lateral margin of elytra fine and sharp. *Praocis* (*P.*) *crassicollis* **sp. nov.** differs from *P.* (*P.*) *bicarinata* by having antennomeres 8-9 wider than long, antennomere 9 wider than 10 and 11, disc convex lower than lateral margins along, disc with punctures on all surface, lateral margins of pronotum up-righted and thick, and with a longitudinal groove between disc and lateral margins, while *P.* (*P.*) *bicarinata* has antennomeres 8-9 longer than wide, antennomere 9 equal width than 10 and 11, disc convex higher than lateral margins along, disc with a sagittal longitudinal area smooth, lacking punctures, lateral margins of pronotum not elevated and thin, lacking a longitudinal groove between disc and lateral margins.

Distribution comments. *Praocis* (*Praonoda*) and *Praocis* (*Hemipraocis*) are the only *Praocis* subgenera

inhabiting grasslands and shrubs of the Patagonian steppe (Flores & Pizarro-Araya, 2014). *Praocis* (*P.*) *crassicollis* **sp. nov.** is widespread in west Patagonia (Fig. 2), living in the provinces of Chubut and Santa Cruz. This species shares its habitat with other *Praocis* species as *P.* (*P.*) *bicarinata* and *Praocis* (*Hemipraocis*) *fimbriata* Burmeister and other tenebrionid species such as *Epipedonota tricostata* Burmeister, *E. subplana* Gebien, *Platesthes kuscheli* Kulzer, *P. burmeisteri* Haag-Rutenberg, *Scotobius akidioides* Waterhouse, *Nyctelia fitzroyi* Waterhouse, *N. darwini* Waterhouse, and *Mitragenius araneiformis* Curtis. In addition, the recently described ground beetle *Cnemalobus inacayali* Roig-Juñent, Silvestro & Cheli also inhabits the same areas.

Habitat and ecological notes. *Praocis (P.) crassicollis* **sp. nov.** lives in sandy habitats of Chubut and Santa Cruz provinces at altitudes ranging from 570-1230 m (Fig. 2). Almost all sites where the new species was found (sites 1, 2, and 4 in Fig. 2) are located in the biozone *Sierras, Colinas y Planicies Occidentales* (del Valle et al., 1995; INTA, 2006). The exception was a site in the province of Santa Cruz that is an ecotone area in *Pastizales Subandinos* biozone situated very close to the mentioned biozone (site 3 in Fig. 2). Biogeographically, these habitats correspond to Central Patagonia (*Sierras, Colinas y Planicies Occidentales* biozone) and Sub Andean Patagonia provinces (*Pastizales Subandinos*) in the Patagonian subregion of the Andean Region (Morrone, 2015). Physiographically, *Sierras, Colinas y Planicies Occidentales*, located in areas with annual precipitation between 200 and 300 mm, are shrub-herbaceous steppe with 30-60% of vegetation cover, dominated by the grasses *Stipa speciosa* (Trin. & Rupr.) Romasch., *Pappostipa humilis* (Cav.) Romasch., *Poa ligularis* Nees ex Steud. and *Poa lanuginose* Poir., and the shrubs *Adesmia volckmannii* Phil. and *Berberis microphylla* G. Forst (Oyarzabal et al., 2018). Specifically, vegetation on site 4 located on the plateau near Lago Cardiel differs somewhat from this general pattern as is characterized by a low shrub steppe dominated by the cushion-shaped shrub *Nardophyllum bryoides* (Lam.) Cabrera, accompanied by *Festuca pallescens* (St.-Yves) Parodi (Oyarzabal et al., 2018). On the other hand, the site belonging to *Pastizales Subandinos* biozone (site 3 in Fig. 2), represents a patchy ecotone area limiting with *Sierras, Colinas y Planicies Occidentales* (located less than 5 kilometers from this biozone). Fig. 3 shows main habitats where *Praocis* (*P.*) *crassicollis* sp. nov. was recorded. In this area the typical soils belong to both the Aridisols and Entisols orders. However, in all the sites where this new species was found, the soil profiles were covered by a continuous layer of sand of alluvial-aeolian origin several centimeters thick. And it is precisely in these microhabitats that we have found the specimens of this new species. The existence of this continuous mantle of sand is explained by the fact that all sites are located in alluvial plains: in Chubut that of the Arroyo Shamán, while in Santa Cruz, in that of the Ecker River and in that of Lake Cardiel.

Zoogeographical and conservation remarks. According to our field observations of the habitat, this new species can be considered to inhabit mainly the hilly areas shown in Fig. 2, and probably the grasslands near them. This finding, in addition to the other Coleoptera species recently described by our working group in the same biozone (*Nyctelia recteplicata* Flores & Cheli and *Cnemalobus inacayali*), postulates *Sierras, Colinas y Planicies Occidentales* biozone as one of the most diverse regions of the biogeographic subprovince of Central Patagonia (Morrone, 2015). These hills, some over 1800 m high, represent only 25% of the surface of the Patagonian steppe, but constitute the main geographic features that interrupt the extensive plains that characterize this biogeographic subprovince (Bouza & Bilmes, 2020). Thus, this hilly area contains the most heterogeneous sites in the region, which makes it of great importance from an ecosystemic point of view. This area, originated by Andean contractional tectonics during the early-middle to late Miocene, formed a complex landscape with exhumed plains surfaces with mountain ranges and basaltic plateaus associated with shield volcanoes from the late Oligocene to early Miocene (Bouza & Bilmes, 2020); the environments generated by these uplifts have been isolated from each other for a long time. Thus, the finding of *Praocis* (*P.*) *crassicollis* **sp. nov.** in this biozone would confirm the diversification of terrestrial arthropods in this region at a regional level.

Extensive sheep production on arid and semi-arid natural pastures, both for its territorial extension and economic income, has been the main activity of the agricultural sector in the Argentinean provinces of Chubut and Santa Cruz since the end of the 19th century (del Valle et al., 1995; Williams, 2004; Plan Ganadero Ovino Santa Cruz, 2016). Continuous grazing without adjusting the stocking rate according to the availability of forage resources for more than 120 years has led to an unsustainable use of pastures (Ormaechea et al., 2019). These conditions, together with excessive stocking rates in grazing areas, have resulted in moderate to severe degradation of almost 80% of the soils and vegetation in the provinces of Chubut and Santa Cruz (Fig. 3) (del Valle et al., 1995, Ormaechea et al., 2019). In particular, Sierras, Colinas y Planicies Occidentales biozone is vulnerable to other current anthropogenic disturbances, such as metalliferous mining, oil, natural gas and for the production of wind energy and green hydrogen (Aprea & Bolcich, 2020; Castillo et al., 2021).

In addition, natural protected areas in extra-Andean Patagonia are very scarce, occupying less than 5% of its surface (Chehébar et al., 2013), and hill environments are very poorly represented among them (Matteucci, 2018). For example, among the 29 natural protected areas in the province of Chubut, only four are located in *Sierras,*

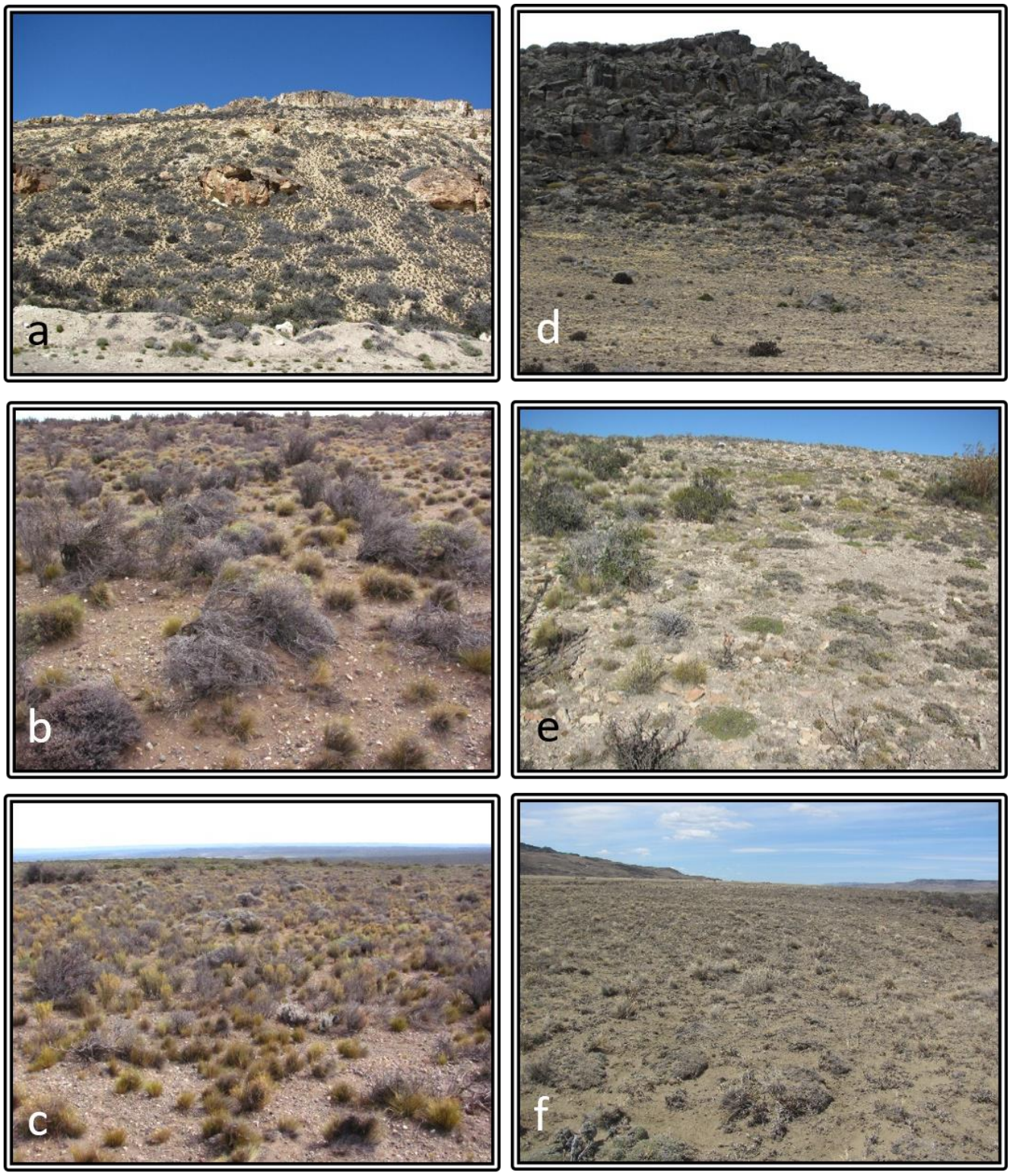

Fig. 3. Main habitats where *Praocis (Praonoda) crassicollis* sp. nov. has been found. a: Typical hills with rocky outcrops covered by shrub steppes, b: rocky outcrops, c: shrub steppe in healthy condition, d: shrub steppe deteriorated by sheep overgrazing, e: grassland in healthy condition, f: grassland deteriorated by sheep overgrazing.

Colinas y Planicies Occidentales biozone, protecting less than 1.5% of their surface area (Wikipedia, 2024). Thus, taking into account the ecological importance of coleopteran in arid and semiarid ecosystems of Patagonia (Cheli et al., 2009, 2022), their proved sensitivity to environmental changes (Cheli et al., 2021), and that their knowledge is still scarce in several areas, the study of insect species assemblages on Sierras, Colinas y Planicies Occidentales biozone in relation to natural heterogeneity and anthropogenic disturbances can be

very useful to detect new priority areas for protection, and strengthen their current conservation programs (Chehébar et al., 2013).

ACKNOWLEDGMENTS

We acknowledge Ministerio de Comercio Exterior, Turismo e Inversiones (Dirección General de Recursos Naturales, Consejo Agrario Provincial) and Ministerio de Industria, Agricultura y Ganadería (Dirección de Fauna Silvestre) of Santa Cruz province (Argentina) which awarded us a collection permit; Rodolfo Carrara, Sergio Roig-Juñent and Nicolás Martínez Román for their assistance in the field; Diego Miras for taking the picture at IADIZA; Lucas Castelli for his help with QGis; Violeta A. Silvestro and Jaime Pizarro-Araya for suggestions improving the manuscript. This study was supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET, Argentina), PIP 112-201101-00987 (CONICET, Argentina), PUE-IPEEC-CONICET N◦ 22920160100044, and the grant "Preservación, recuperación y digitalización de colecciones de interés científico de Argentina 2023" (Fundación Williams and Fundación Bunge y Born).

REFERENCES

Aprea, J.L., & Bolcich, J.C. (2020) The energy transition towards hydrogen utilization for green life and sustainable human development in Patagonia. *International Journal of Hydrogen Energy*, **45(47)**, 25627-25645. http://dx.doi.org/10.1016/j.ijhydene.2020.01.246

Bouza, P.J., & Bilmes, A. (2020) Landscapes and Geology of Patagonia: An Introduction to the Land of Reptiles. *Lizards of Patagonia*: *Diversity, Systematics, Biogeography and Biology of the reptiles at the end of the World* (eds. Morando, M., & Avila, L.J.), pp. 59-83. Springer International Publishing, Berlin.

Castillo, M., & Alvarez Manriquez, L. (2021) Ordenamiento territorial y conflictos socioambientales vinculados a la minería: provincias de Huasco y Chubut en defensa del territorio. *Perspectiva Geográfica*, **26**, 63-86.

Chehébar, C., Novaro, A., Iglesias, G., Walter, S., Funes, M., Tammone, M., & Didier, K. (2013) *Identificación de áreas de importancia para la biodiversidad en la estepa y el monte de Patagonia*. APN, WCS, NC, Argentina. http://dx.doi.org/10.13140/2.1.2066.9446

Cheli, G.H., Corley, J., Castillo, L., & Martínez, F. (2009) Una aproximación experimental a la preferencia alimentaria de *Nyctelia circumundata* (Coleoptera: Tenebrionidae) en el Noreste de la Patagonia. *Interciencia*, **34**, 771-776.

Cheli, G.H., Carrara, R., Bandieri, L., & Flores, G.E. (2021) Distribution and environmental determinants of darkling beetles assemblages (Coleoptera: Tenebrionidae) in Península Valdés (Argentinean Patagonia). *Anais da Academia Brasileira de Ciencias*, **93(3)**, e20201282. https://doi.org/10.1590/0001-376520212020128

Cheli, G.H., Bosco, T., & Flores, G.E. (2022) The role of *Nyctelia circumundata* (Coleoptera: Tenebrionidae) on litter fragmentation processes and soil fertility in Northeastern arid Patagonia. *Geoderma*, **415**, 115770. https://doi.org/10.1016/j.geoderma.2022.115770

del Valle, H.F., Labraga, J.C., & Goergen, J. (1995) Biozonas de la región patagónica. *Evaluación del estado actual de la desertificación en áreas representativas de la Patagonia,* Informe final de la etapa I (ed. Proyecto INTA-GTZ), pp. 33-55. INTA, Buenos Aires.

Flores, G.E., & Giraldo, A.E. (2020) Taxonomic status of *Parapraocis*, a new genus of Praociini from Peru (Coleoptera: Tenebrionidae: Pimeliinae). *Revista de la Sociedad Entomológica Argentina*, **79(3)**, 34-40. https://doi.org/10.25085/rsea.790305

Flores, G.E., & Pizarro-Araya, J. (2014) Towards a revision of the South American genus *Praocis* Eschscholtz (Coleoptera, Tenebrionidae), with estimation of the diversity of each subgenus. Proceedings of the Third International Tenebrionoidea Symposium, Arizona, USA, 2013 (Bouchard, P., & Smith, A.D.). *ZooKeys*, **415**, 53-80. https://doi.org/10.3897/zookeys.415.6656

Flores, G.E., & Pizarro-Araya, J. (2022) Revision of the subgenus *Mesopraocis* Flores & Pizarro-Araya of the Neotropical genus *Praocis* Eschscholtz (Coleoptera: Tenebrionidae: Pimeliinae). *ZooKeys*, **1100**, 29-55. https://doi.org/10.3897/zookeys.1100.78769

Hadley, A. (2024) CombineZP public domain image processing software. http://micropics.org.uk/Czimps_web/CombineZP.msi (Accessed 11 June 2024).

INTA (Instituto Nacional de Tecnología Agropecuaria) (2006) *Programa Nacional Ecorregiones, Ecorregion Patagonia, Documento Estratégico*. Editorial EEA Bariloche, INTA, Argentina.

Kuschel, G. (1969) Biogeography and ecology of South American Coleoptera. *Biogeography and ecology in South America*, Vol. 2 (ed. Fittkau, E.J., Illies, J., Klinge, H., Schwabe, G.H., & Sioli, H.), pp. 709-722. Junk, The Hague.

Matteucci, S.D. (2018) *Estepa Patagónica*. E*corregiones y Complejos Ecosistémicos Argentinos*. Orientación Gráfica Editora, Buenos Aires. Argentina.

Morrone, J.J. (2015) Biogeographical regionalisation of the Andean region. *Zootaxa*, **3936(2)**, 207-236. http://dx.doi.org/10.11646/zootaxa.3936.2.3

Ormaechea, S.G., Peri, P.L., Cipriotti, P.A., & Distel, R.A. (2019) El cuadro de pastoreo en los sistemas extensivos de Patagonia Sur. Percepción y manejo de la heterogeneidad. *Ecología Austral*, **29**,174-184. https://doi.org/10.25260/EA.19.29.2.0.829

Oyarzabal, M., Clavijo, J.R., Oakley, L.J., Biganzoli, F., Tognetti, P.M., Barberis, I.M., & León, R.J.C. (2018) Unidades de vegetación de la Argentina. *Ecología Austral*, **28**, 40-63. https://doi.org/10.25260/EA.18.28.1.0.399

Plan Ganadero Ovino Santa Cruz. (2016) https://www.magyp.gob.ar/sitio/areas/d_ovinos/informes_/nacionales (Accessed 11 June 2024).

QGIS Development Team (2024) QGIS 3.34. Geographic Information System. QGIS Association. http://www.qgis.org (Accessed 11 June 2024).

Wikipedia (2024) https://es.wikipedia.org/wiki/Categoría:Áreas_naturales_protegidas_de_la_provincia_de_Chubut (Accessed 11 June 2024).

Williams, M. (2004) Santa Cruz. La ganadería ovina; situación actual y perspectivas. *IDIA XXI*, **7**, 22-26.