BOSTRYX HENNAHI (GRAY, 1828) THE LARGEST CHILEAN BULIMULID (MOLLUSCA: PULMONATA), REDISCOVERED AMONG *TILLANDSIA* COMMUNITIES IN NORTHERN CHILE

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Abstract *The majority of the terrestrial molluscs of Chile have been scarcely studied, and several of them are only known from their original descriptions. In this work we present new records of the bulimulid land snail* Bostryx hennahi *(Gray, 1828), rediscovered in sand among* Tillandsia *communities (Tillandsiales) in northern Chile. This extant land snail is the northernmost terrestrial mollusc found in the country and the largest documented Chilean* Bostryx *species.*

Key words *Bulimulidae, Atacama Desert, Lomas formations, Peru.*

INTRODUCTION

The majority of the terrestrial molluscs of Chile are still scarcely studied and, apart from some early works from the nineteenth century, only a few recent works have reviewed the species from central or northern Chile (Rehder, 1945; Breure, 1978; Stuardo & Valdovinos, 1985; Valdovinos & Stuardo, 1988, 1989; Miquel & Araya, 2013, 2015; Araya, 2015a; Araya & Catalán, 2014; Araya & Aliaga, 2015). The land snails present in northern Chile belong to seven families (Bothriembryontidae, Bulimulidae, Charopidae, Ellobiidae, Pupillidae, Strophocheilidae and Systrophiidae) with only 19 non-bulimulid indigenous species. The family Bulimulidae is represented solely by the speciose genus *Bostryx* Troschel, 1847, of which most species have narrow distribution ranges in the country, some of them only known from their respective type localities, and all of them (about 34 species) found exclusively in the arid coastal areas of the northern part of the country, from Arica (18º29' S; 70º20' W), Región de Arica y Parinacota, to Coquimbo (29º57' S; 71º20' W), Región de Coquimbo (Araya, 2015b).

Bostryx hennahi Gray, 1828 was described, and later re-described as *Helix cactorum*, from specimens collected from "Plains near Arica" (Gray, 1828; d'Orbigny, 1838 [1834–1847]) and, as *Bulimus virginalis*, from shells collected at Tacna, Peru (Morelet, 1860); it was recorded subsequently from further northern Peruvian localities up to near Pisco, Ica, Peru (Dall, 1909). Further records have only mentioned *Bostryx hennahi* as part of a synonymic list of Chilean bulimulids by Stuardo & Valdovinos (1985), in a synopsis of the land Mollusca of Chile (Stuardo & Vega, 1985), in a general revision of bulimulid species (Breure, 1979), and it has been depicted in annotated type catalogues for the Natural History Museum, London (Breure & Ablett, 2014) and for the Muséum d'Histoire Naturelle, Geneva (Breure, 2016). This species, since its description as *Helix cactorum* as well as *Bulimus virginalis*, does not appear to have been collected again in the field since Dall (1909) and Breure (1978), who mention specimens from Peru. This species is the northernmost land snail and the largest (or tallest) *Bostryx* species found in Chile, differing from most of their congeneric Chilean species in details of shell morphometry and sculpture; and it can be distinguished by its thick chalky shell and by the lack of shell colour patterns (or the stripped or variegated shell in some cases). In this work, as part of ongoing studies documenting the land snails of northern Chile, we provide new records and a redescription for this species, and highlight its association with communities

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"*tillandsiales*" of the endemic bromeliad species *Tillandsia landbecki* and *Tillandsia marconae* in a fog oasis near Arica, Región de Arica y Tarapacá, northern Chile. This particular habitat is found in one of the most arid regions in the country, with a cold desert climate (Köppen Cold desert climate) with coastal fogs and negligible precipitations (Peel *et al*. 2007).

Materials and Methods

The specimens were hand-collected from sand and under *Tillandsia* communities; voucher specimens are deposited in the collections of the Museo Paleontológico de Caldera, Caldera, Chile (MPCCL). The terminology of shell morphology is based upon Araya (2015) and the measurements follow Breure and Ablett (2012) for the whorl counts and Pizá & Cazzaniga (2003) for the spiral angle. Dimensions of the shells were measured with Vernier calipers (± 0.1mm). Further abbreviations for depositories of material: MHNG, Muséum d'histoire naturelle, Department of Invertebrates, Geneva, Switzerland; NHMUK, Natural History Museum, London, U.K.; RMNH, Naturalis Biodiversity Center, Leiden, the Netherlands; USNM, Smithsonian Institute, National Museum of Natural History, Washington DC, U.S.A.

Systematics

Family Bulimulidae Tryon, 1867

Subfamily Bostrycinae Breure, 2012
Genus ***Bostryx*** Troschel, 1847

Type species *Bulimus* (*Bostryx*) *solutus* Troschel, 1847, by monotypy.

Bostryx hennahi (Gray, 1828)
Figs 1A–1V.

Bulimus hennahi J. E. Gray, 1828: 5, pl. 5, fig. 5; d'Orbigny 1837 [1834–1847]: 283, pl. 30, figs. 3–4; Morelet, 1863: 184; Hidalgo, 1870: 52.
Helix cactorum d'Orbigny, 1835: 10; d'Orbigny, 1847: 283, pl. 30, figs. 3,4; Breure & Ablett, 2014: 36, figs. 6D, L10iv; Breure, 2016: @, fig. 74.
Bulimus virginalis Morelet, 1860: 372; Breure, 2016: @, fig. 75.
Bulimulus (*Lissoacme*) *hennahi* Pilsbry, 1896 [1895–1896]: 156, pl. 47, figs. 65–68.
Bulimulus hennahi Hidalgo, 1893: 270; Dall, 1909: 164.
Bostryx (*Lissoacme*) *hennahi* Stuardo & Valdovinos, 1985: 56; Stuardo & Vega, 135.
Bostryx hennahi Breure, 1978: 82; Breure, 1979: 54; Richardson, 1995: 27.

Diagnosis A *Bostryx* species characterized by a slender and large (up to 32mm in height), elongate-ovate, thick chalky shell, of whitish color or variegated with fine, irregular, reddish and caramel brown streaks, with six to seven slightly distorted whorls and a prominent last whorl, which encompasses about 0.7 of the shell length. Umbilicus small, shallow; last half-whorl expanding rapidly; aperture elongate, about 0.4 of shell length, lip simple.

Differential diagnosis Identified from most congeneric species by its larger, thicker and chalky shell (Except *Bostryx affinis*, which has a corneous, lighter and more spindle-shaped shell) which have slightly distorted whorls, a character state not observed in any other Chilean *Bostryx* species.

Redescription Shell thick, chalky, whitish, pinkish or variegated with fine reddish streaks; large for the genus (measuring up to 32mm in height), around 3.3 times as long as wide, spindle-shaped, spire elevated (spire angle 42°to 44°), with five slightly distorted and convex whorls. Protoconch small, of about one and a half whorls, smooth, usually eroded, differentiated from the sculptured teleoconch. Teleoconch of five to seven whorls, sculptured only by irregular growth marks. Suture deep and well-marked, slightly plicated in the earlier whorls. Aperture elongate-subovate, 1.5 times as long as wide, about 0.40 of shell height; callus a mere glaze, slightly pinkish-colored; umbilicus very small, shallow, last half-whorl expanding rapidly; columellar margin straight, folding over umbilicus. Peristome simple, sharp. Soft parts unknown.

Type locality Plains near Arica, Chile (Gray, 1828).

Material examined Approximately 1km from Portezuelo de Poconchile (18°28' S; 70°05' W), Arica, Región de Arica y Tarapacá, northern Chile, collected by M. Madrid, Feb. 2013: MPCCL

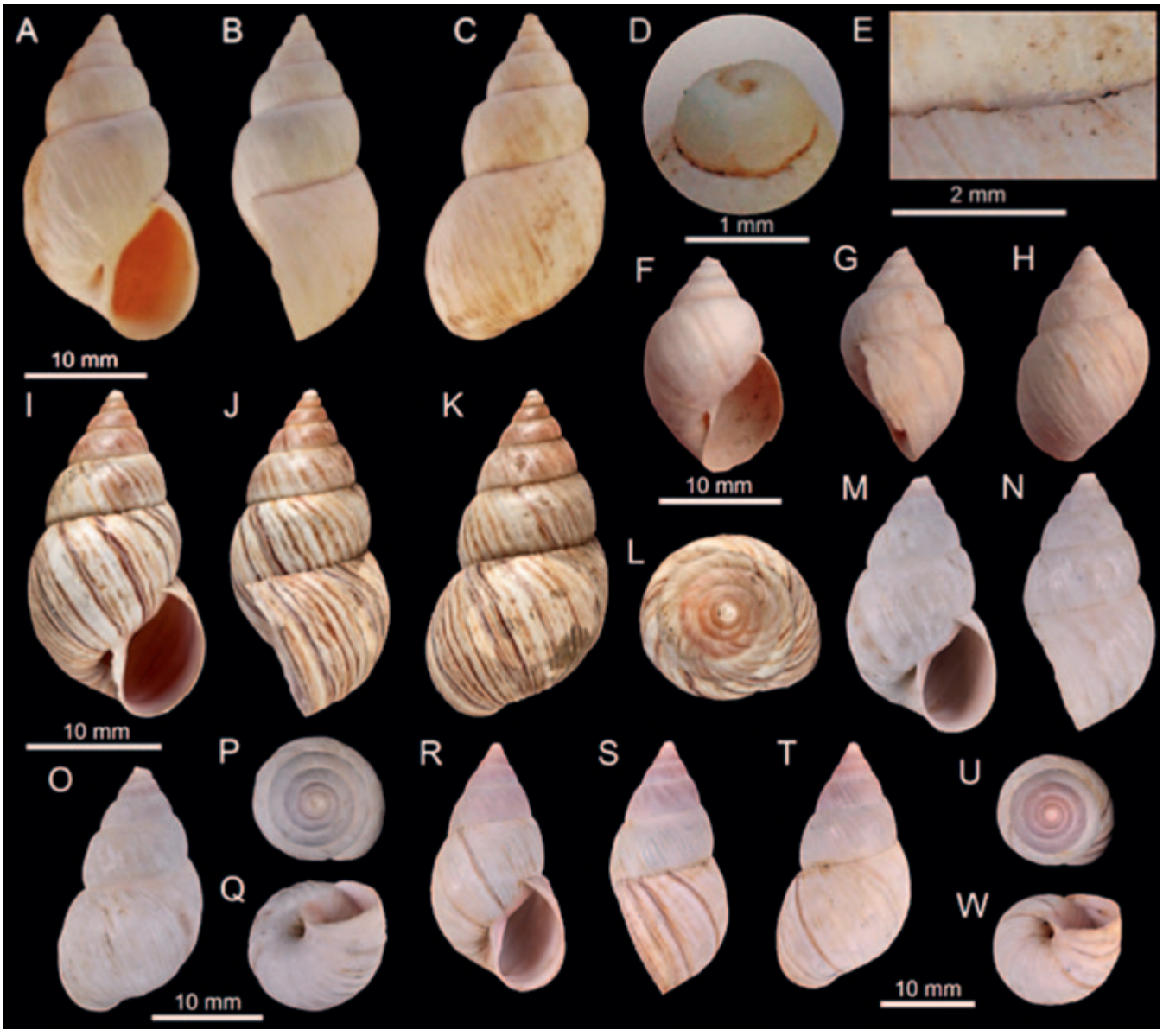

Figure 1 *Bostryx hennahi* (Gray, 1828) MPCCL 11012016. **A–H** specimens from Arica, northern Chile (MPCCL 12122016): **A** apertural view; **B** side view; **C** abapertural view; **D** detail of protoconch; **E** detail of suture; (MPCCL 12122016): **F** apertural view, **G** side view, **H** abapertural view; **I–L** lectotype of *Helix cactorum* from "Tacna, Pérou" (NHMUK 1854.12.4.189): **F** apertural view; **B** side view; **C** abapertural view; **D** apical view; **M–Q** specimen from "Cabija, Peru" (USNM 307660): **M** apertural view; **N** side view; **O** abapertural view; **P** apical view, **Q** umbilical view; **R–W** specimen from Peru (unknown location; USNM 105176): **R** apertural view; **S** side view; **T** abapertural view; **U** apical view, **V** umbilical view

11012016, 12012016 (two specimens), plus twenty specimens, all collected in the same locality. Lectotype and 6 paralectotypes of *Helix cactorum* deposited in the NHM (NHMUK 1854.12.4.189), four paralectotypes of *Helix cactorum* deposited at the MHNG (MHNG-INVE-20659 from "Pérou"). The following specimens examined from photographs; two specimens deposited at the SI NMNH (USNM 307660 from "Peru, Cabija") and USNM 105176 (from "Peru"); the latter two lots are tentatively referred to as this species, see remarks below.

Distribution This species is restricted to coastal areas from Tacna (18°03'20" S; 70°14'54" W), Peru, to Arica (18°28'30" S; 70°18'52" W), Chile (Morelet, 1860; Breure, 1978, 2016 and the present study). See also remarks.

Figure 2 Plains near Arica, Atacama Desert, northern Chile; the type locality of *Bostryx hennahi* (Gray, 1828). Note in the foreground the communities of *Tillandsia* plants (Tillandsiales) growing on sand dunes.

Habitat This species was found buried in fine sand, with some shells scattered among communities of the desert-dwelling bromeliads *Tillandsia landbecki* and *Tillandsia marconae* in a fog oasis near the Valle de Azapa, in Arica, northern Chile (Fig. 2). The area is so extremely arid (less than 2mm of mean annual rainfall over nearly 100 years) that no other vascular plants are able to survive (Rundel *et al*. 1997). Although no live specimens of *B. hennahi* were found, some shells retained a glossy aperture and parietal callus; and it is thus very possibly that this species is restricted to humid seasons or years, such as those related with the El Niño Southern Oscillation (ENSO) events.

Remarks The specimens cited by Breure (1978) from Atico (16°12'34" S; 73°37'20" W), Arequipa Department, Peru (RMNH.MOL 241071) and by Dall (1909) for a specimen from San Gallan Island [=Isla de Sangayán] (13°50'20" S; 76°27'01" W), Peru (USNM 307660) correspond to different, unidentified species. The two USNM lots mentioned above are labelled from Peru, but originate from historical collections; we regard them tentatively as *Bostryx hennahi*. During the 19th century northern Chile has been a disputed area between Peru, Bolivia and Chile (Breure, 2011), which explains why one of the lots is labelled "Peru, Cabija [= Cobija]". These historical records have to be considered as having imprecise localities, despite the mentioning of Cobija, northern Chile, seems the best approximation for these specimens.

This species has a complex taxonomy, having been described several times, perhaps due to its variable coloration (see Pilsbry, [1895–1896]: 157). For instance, a variegated specimen found in a *Melocactus* according to Orbigny (1837 [1834–1847]), was subsequently described as *Helix cactorum* (Figs 1I–L), and plain white specimens were described as *Bulimus virginalis* by Morelet (1860). Juvenile shells of *Bostryx hennahi* have more lightweight and wider shells; with a less elevated spire and a slanted columellar lip (Figs 1F–H). From the c. 34 species of *Bostryx* distributed in Chile, most of them differ from *Bostryx hennahi* in rough shell sculpture characteristics, including general shell proportions and sculpture; this species has a distinctive large and thick shell, with slightly distorted whorls. Further sampling in coastal and Andean areas of northern Chile will hopefully reveal more snail species to be discovered and, perhaps, even new species to be described.

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