

PLAGIODONTES PARODIZI, A NEW SPECIES FROM ARGENTINA (GASTROPODA: ODONTOSTOMIDAE)

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Abstract *Plagiodontes parodizi* sp. nov. inhabits Sierra de Guasayán, a restricted biogeographical area in Argentina and presents as diagnostic characters an elongate-ovate medium-large shell, a reticulated teleoconch sculpture, and a long convoluted free portion of the FPSC forming two circumvolutions. Previously assigned to *P. brackebuschii* (Doering 1877), the shells from Guasayán differ from the type specimens of *Plagiodontes brackebuschii* in shell shape, teleoconch sculpture and suture characteristics.

Key words *Stylommatophora, Orthalicoidea, taxonomy, Plagiodontes brackebuschii, internal anatomy*

INTRODUCTION

Some species in the genus *Plagiodontes* Doering 1877 are difficult to identify from shell characters and show a wide overlap of linear measurements, which however can be unravelled through multivariate statistics and internal anatomy information. Except for *P. daedaleus* (Deshayes 1851), which spreads over a very wide area, most species in this genus are endemic to certain mountain ranges (Cazzaniga *et al.*, 2005; Pizá & Cazzaniga, 2009, 2010, 2012).

Some elongate-ovate shells collected from Sierra de Guasayán (Argentina) were identified as *Plagiodontes brackebuschii* (Doering 1877) by Parodiz (1939) although they differed from the original description and from the then known illustrations (Kobelt, 1880; Pilsbry, 1902). A revision of the collections at the main museums of Argentina revealed several dubitative labels and confusions of *P. brackebuschii* with *P. weyenberghii* (Doering 1877), *P. daedaleus* (Deshayes 1851), and *P. strobilii* (Doering 1877). An exhaustive search over different localities, including the type localities of most species in the genus (Pizá & Cazzaniga, 2009, 2010, 2012; Pizá *et al.*, 2006) only yielded snails identifiable as *P. brackebuschii* in the sense of Parodiz (1939) at Sierra de Guasayán, Santiago del Estero.

Plagiodontes brackebuschii was originally described as a medium sized cylindrical shell from a subhumid temperate bushland area in San Luis province (Argentina) (Doering, 1877: 321–322, 1878: 240–241). Neither shell variability

data nor illustrations were originally included. The drawings of two specimens published by Kobelt (1880) did not fit the original description; nevertheless they were later reproduced by Pilsbry (1902), and remained as the main source for species recognition. The same two specimens (housed at the Senckenberg Museum: SM; Frankfurt, Germany) were appointed as the lectotype and para[lecto]type by Zilch (1971) (Figs 1, 2).

The shells named *Plagiodontes brackebuschii* [sic] Doering by Parodiz (1939), from Guasayán, in Santiago del Estero province, were collected under a more humid forest condition, in an area with a quite different climate and vegetation condition from the type locality. He briefly restated that the shell is cylindrical, but the accompanying three photographs show a different, not cylindrical but elongate-oval form, and a significantly larger size (32–39mm long).

Breure (2013) discovered a specimen at the Museum für Naturkunde Berlin (ZMB 28511: Fig. 3), labelled "*Bul. (Plagiodontes) Brakebuschii*" (sic). He identified it as a previously disregarded paralectotype, and stated this label was handwritten by Doering, though the specific name is incorrectly spelled on it. Unlike the rest of the type series, this shell is actually cylindrical and accurately fits the original description.

The aim of this study is to demonstrate that the shells from Sierra de Guasayán (Argentina) are recognizable and have shell characters that allow considering them a different species from *P. brackebuschii*.



Figures 1–3 Type series of *Plagiodontes brackebuschii* (Doering 1877). **Fig. 1** lectotype designated by Zilch (1971): SMF 9350/1. **Fig. 2** paralectotype designated by Zilch (1971): SMF 9351/1. **Fig. 3** paralectotype designated by Breure (2013): ZMB 28511.

MATERIAL AND METHODS

The analysed material of actual and alleged *Plagiodontes brackebuschii* shells consisted of the type material housed at the Senckenberg Museum (SM, Frankfurt, Germany) and Museum für Naturkunde (ZMB, Berlin, Germany), and specimens in the collections of three Argentinean museums: Instituto y Fundación Miguel Lillo, Tucumán (IFML); Museo Argentino de Ciencias Naturales, Buenos Aires (MACN), and Museo de La Plata (MLP). Of these, three samples were labelled as *P. brackebuschii* (MACN, unnumbered set: 20 shells from Dique de la Viña, San Javier, Córdoba; MLP, unnumbered set: 20 shells from Ongamira, Córdoba, and MLP, unnumbered set: 20 shells from Chancaní, Córdoba), while other two shell samples were mentioned as *P. brackebuschii* in the literature (IFML 1304: 17 shells from Cerro del Rosario, San Luis [cited by Cuezco & Dragh, 1995], and MACN 3242: 34 shells from Dique de la Viña, San Javier, Córdoba [cited by Fernández, 1973]).

Fresh shells and living specimens recognizable as *P. brackebuschii* sensu Parodiz, 1939 (Figs 4–6) were collected on January, 2007 at Sierra de Guasayán, Santiago del Estero province. This sample (n=31) was complemented with 89 shells from Sierra de Guasayán housed at the Fundación Miguel Lillo (Tucumán) and the Museo Argentino de Ciencias Naturales (Buenos Aires).

Shell variability was analysed on 109 adult specimens through the following shell parameters: shell length (SL), shell width (SW), last whorl length (LWL), aperture length (AL), aperture width (AW), major angle (MA), spiral angle (SA), and number of whorls. Measurements are quoted as: mean \pm standard deviation (coefficient of variation) [minimum–maximum]. The internal anatomy of the pallial complex and the reproductive system was studied on ten specimens as in Pizá & Cazzaniga (2009, 2010, and 2012). Terminology for the aperture lamellae, pallial complex and genital system as in Pizá & Cazzaniga (2009).

SYSTEMATICS

Family Odontostomidae Pilsbry and Vanatta
1898

Genus *Plagiodontes* Doering 1877

Type species *Plagiodontes dentatus* Wood 1928,
[subsequent designation by Pilsbry, 1898]

Type locality Uruguay, Montevideo.

Plagiodontes brackebuschii (Doering 1877)

Bulimus (*Plagiodontes*) *brackebuschii* Doering 1877:
240; Doering, 1878: 321; Kobelt, 1878: 133.

Bulimus brackebuschii– Kobelt, 1880: 288.

Odontostomus (Plagiodontes) brackebuschii– Pilsbry, 1902: 99.

Odontostomus brackebuschi– Holmberg, 1912: 26.

Odontostomus (Plagiodontes) brackebuschi– Parodiz, 1939: 728 (partim).

Cyclodontina (Plagiodontes) brackebuschi– Parodiz, 1957: 28 (partim).

Scalarinella (Plagiodontes) brackebuschii– Zilch, 1971: 198.

Plagiodontes brackebuschii– Fernández, 1973: 145 (partim); Breure, 2013: 8, 89.

Odontostomus brackebushii– Breure, 1974: 112.

Odontostomus brackenbuschi– Richardson, 1993: 44.

Bulimus (Odontostomus) brackebuschii– Neubert & Janssen, 2004: 202.

Plagiodontes brackebushii– Breure, 2013: 14.

Correct spelling The original material was collected by the German geologist Ludwig or Luis Brackebusch (1849–1906), who lived in Argentina from 1874 up to his death. Breure (2013: 14) quoted his name as *D.L. Brackebush. The initial “D.” is the abbreviation of the Spanish honorific *Don*, a formal treatment often used that time. Doering (1877: 301, 322; 1878: 220, 241) always wrote correctly the name of his colleague and fellow countryman Brackebusch, and the specific name was uniformly *Brackebuschii* in Doering (1877: 319, 321; 1878: 240, 241), but several incorrect subsequent spellings were slipped later: *Brakebuschii* in Kobelt (1880: 288) and in two of the handwritten labels reproduced by Breure (2013: 89); *Brakebuschi* in the label of the lectotype at the Senckenberg Museum (Fig. 1); *brackebuschi* in Holmberg (1912: 26) and Parodiz (1939: 728; 1957: 28); *brackenbuschi* in Richardson (1993: 44); *brackebushii* in Breure (1974: 112; 2013: 14).

Lectotype (designation by Zilch, 1971) SM 9350/1 (Fig. 1). SL: 25.8, SW: 12.28, LWL: 17.51, AL: 11.62, AW: 9.7, MA: 125°, SA: 49°.

Paralectotype 1 (designation by Zilch, 1971) SM 9351/1 (Fig. 2.). SL: 25.44, SW: 12.86, LWL: 16.68, AL: 11.36, AW: 8.96, MA: 125°, SA: 46°.

Paralectotype 2 (designation by Breure, 2013) ZMB 28511 (Fig. 3). SL: 25.1, SW: 11.50, LWL: 15.89, AL: 10.62, AW: 8.84, MA: 128°, SA: 40°.

Type locality Argentina, San Luis province, Sierra de San Luis near San Francisco [del Monte de Oro].

Original description (Doering, 1877: 240; 1878: 321) *T[esta] cylindrica, longitudinaliter striata, opaca, subcalcareo, corneo-albida, apice breve-conica, obtusiuscula; sutura vix impressa, filiformis; anfractus 7 planulati, primi duo sublaevigati, caeteri eleganter confertimque striati; ultimus $\frac{2}{5}$ longitudinis subaequans; apertura verticalis, ovata, dentibus 7 fere clausa; omnibus a margine remotis; dentibus 3 crassis, lamelliformibus: primo, angulato, tortuoso, sulcato, in pariete aperturali, secundo, linguaeformi, in columella, tertio, tortuoso in medio marginis dextri, 2–4 minutis in parte supero marginis dextri; lamella transversa valida in fundo aperturae; peristoma labiatum, expansum, marginibus callo tenui junctis, dextro superne subangulato. Long. 26^{mm}; lat. 11^{mm}; apert. 10 $\frac{1}{2}$ ^{mm} longa; 8 $\frac{3}{4}$ ^{mm} lata.*

[Cylindrical shell, longitudinally striated, opaque, subcalcareous, corneous whitish, with a briefly conic apex, slightly obtuse; barely impressed, filiform suture; seven slightly flattened whorls, the first two almost smooth, the other ones neatly and narrowly striated, the last one near two fifths of the length; vertical, ovate aperture, almost closed by seven apertural teeth, all of them away from the margin; three thick, plate-like teeth: the first one angular, twisted, grooved, on the apertural wall, the second one tongue-shaped, in the columella, the third one twisted in the middle of the right margin, two to four little [teeth] in the upper part of the right margin; strong transverse plate in the aperture depth; lipped, expanded peristome, with the margins faintly joining the callus, the right one subangulous above. Length: 26mm; width: 11mm; aperture length: 10.5mm; aperture width: 8.75mm.]

Description based on the whole type series Shell elongate-ovate to cylindrical, solid, white, opaque. Teleoconch sculpture with strong axial ribs regularly spaced. Spire elongate-ovate to cylindrical. Apex is a short and obtuse cone, sometimes slightly elongated. Seven whorls with a threadlike carina in the suture. Subvertical, ovate aperture, with a thick, reflected peristome in adult specimens; 9 to 11 apertural lamellae and folds.

Plagiodontes parodizi sp. nov.

Plagiodontes brackebuschi– Parodiz, 1939: 728 (shells from Guasayán, Santiago del Estero province, Argentina).

Cyclodontina (Plagiodontes) brackebuschi– Parodiz, 1957: 28 (partim).

Plagiodontes brackebuschii– Fernández, 1973: 145 (partim).

Plagiodontes brackebuschii– Cuezco & Dragh, 1995: 196 (partim).

Holotype IFML-MOLL 16749/01 (Fig. 4) 1 sp. SL: 27.65, SW: 12.31, LWL: 17.32, AL: 11.26, AW: 9.35, MA: 125°, SA: 45°, 8 whorls.

Paratypes IFML-MOLL 16750/15 (Fig. 5), 10 sp and 5 sh. SL: 27.46±1.14 (0.042) [25.4–29.3]; SW: 12.80±0.66 (0.042) [12.00–14.16]; LWL: 17.44±0.64 (0.036) [16.50–18.58]; AL: 11.68±0.57 (0.049) [11.04–12.93]; AW: 9.74±0.40 (0.042) [9.05–10.79]; MA: 125.60±4.16 (0.033) [118–133]; SA: 44.2±3.55 (0.080) [38–51].

The whole type series was collected by J. Pizá and M. Carrizo on January 2007.

Type locality Argentina, Santiago del Estero province, Sierra de Guasayán, on the National Road # 64, at 28° 8' 15,756" S; 64° 49' 6,636" W, 617m a.s.l., about 5km to the West of Santa Catalina town.

Material examined from Sierra de Guasayán (n=109) IFML 769: 19 shells; IFML 1610: 18 shells; MACN 12952: 34 shells; MACN 25845: 18 shells; personally collected material from type locality: 31 shells and living specimens. SL: 27.75±2.35 (0.085) [22.75–33.12]; SW: 13.10±1.10 (0.084) [11.25–17.125]; LWL: 17.93±1.44 (0.086) [15.125–22]; AL: 12.04±1.22 (0.101) [9.75–16.125]; AW: 10.04±1.05 (0.105) [7.5–12.75]; MA: 122.39±3.97 (0.032) [114–134]; SA: 44.54±5.03 (0.113) [30–57].

Distribution Sierra de Guasayán, Santiago del Estero province.

Habitat Living specimens were attached to rock walls and shrubs trunks.

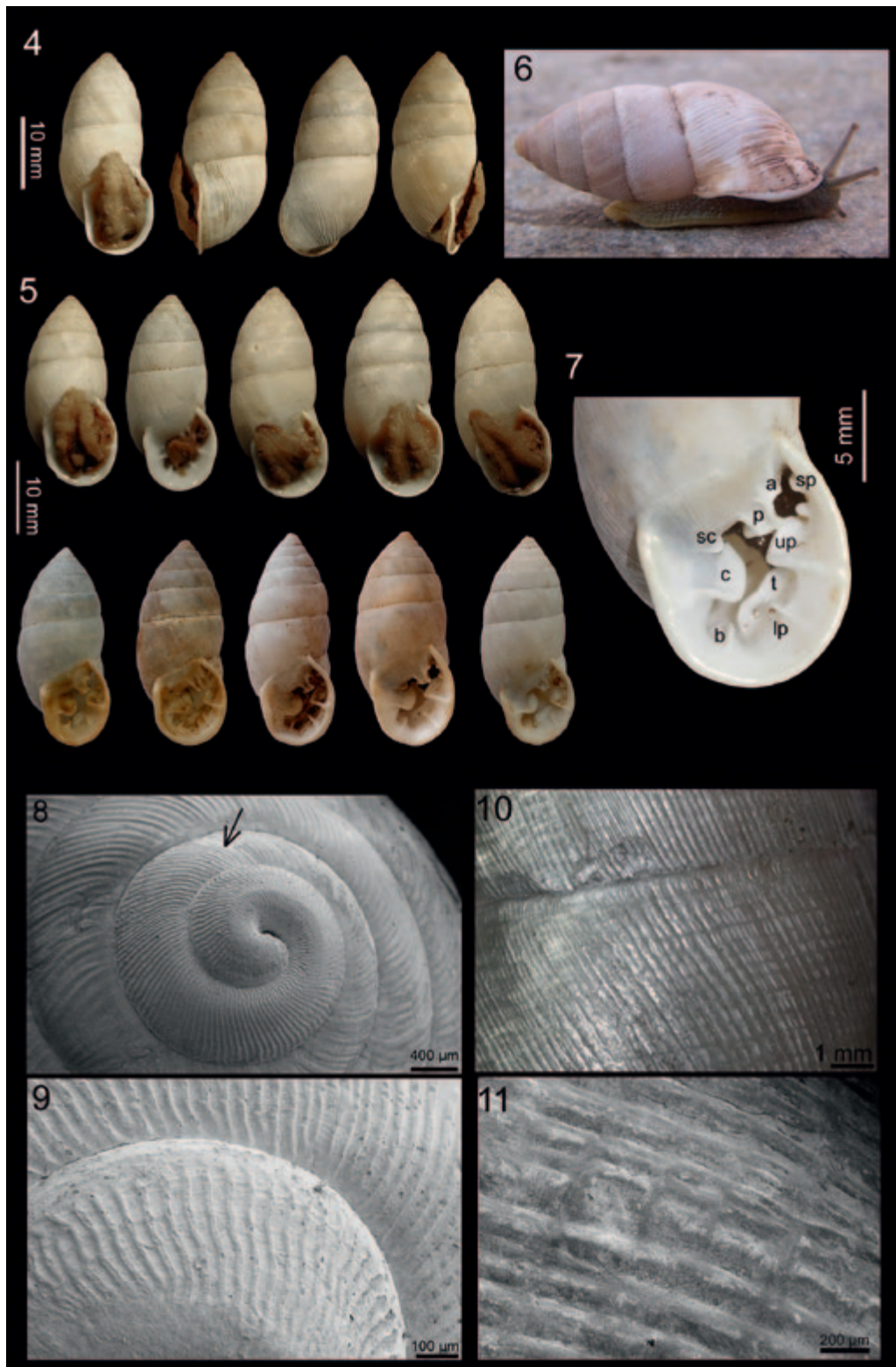
Etymology Dedicated to the memory of Juan José Parodiz (1911–2007), outstanding Argentinean malacologist and Curator of Invertebrate Biology at the Carnegie Museum for about 30 years.

Diagnosis Elongate-ovate to subcylindrical shell of medium-large size, with a blunt short apex; protoconch and teleoconch sculptures sharply

limited; 6.5–9 slightly convex whorls, with poorly marked sutures. Teleoconch sculpture forming a reticulated pattern composed of thick, straight ribs and spiral striae. Free portion of the FPSC long and convoluted forming two circumvolutions. Bursa copulatrix duct with a constant diameter along its length. Penial papilla with an accessory lobe markedly shorter than the papilla. Vagina centrally swollen with reticulated inner surface.

Description Shell (Figs 4–11) rimate, solid, white to pink-brownish, opaque; 6.5 to 9 slightly convex whorls, with sutures scarcely incised. Spire elongate-ovate to subcylindrical, 30–44% the shell length depending on whorl number. Apex short forming an obtuse cone, sometimes slightly elongated. Protoconch of 2–2.5 whorls, with noticeable axial, slightly wavy ribs, crossed by less marked spiral lines (Figs 8, 9). Protoconch-teleoconch boundary well defined (Fig. 8). Teleoconch with thick, straight ribs with spiral striae forming a reticulated pattern (Figs 10, 11). Aperture subvertical, ovate, with a thick, reflected peristome in adult specimens, and 8 to 13 apertural lamellae and folds (mode=10) (Fig. 7). Supracolumellar knob present in 69.72% of the studied specimens. Parietal lamella dihedral, with a C to L-shaped face. Angular fold united to the parietal lamella in some specimens. Suprapalatal folds not basally connected. Upper palatal lamella rectangular, with the external border thickened and elevated, and the lateral ones curved downwards. Basal fold laterally compressed, larger than the lower palatal folds.

Pallial complex (Fig. 12) 32 to 43mm long and similar to those already described for other *Plagiodontes* species (Pizá & Cazzaniga, 2009, 2010, 2012). Pericardium of variable length (4.75–6mm; 60% the kidney length). Kidney triangular, occupying ¼ of the pallial complex length. The primary ureter runs along the rectal side of the kidney up to the top of the lung cavity; it then turns down along the rectum and forms the secondary ureter, which opens in the ureteric pore above the level of the midpoint of the kidney. From this point on, the secondary ureter is open and it is delimited by two ridges forming a ureteric groove that ends at the pneumostome. Pulmonary vein conspicuous, 18 to 29mm long. Afferent marginal vein branching near the midpoint of the pulmonary vein and equalling 47 to



Figures 4–11 *Plagiodontes parodizi* sp. nov. **Fig. 4** holotype (IFML-MOLL 16749/01). **Fig. 5** ten out of 15 paratypes (IFML-MOLL 16750/15). **Fig. 6** living specimen. **Fig. 7** aperture and apertural lamellae and folds. **Fig. 8** scanning electron micrograph of the protoconch and first teleoconch whorls, arrow indicates protoch-teleoconch boundary. **Fig. 9** close-up of (8) showing spiral lines crossing the axial wavy striae. **Fig. 10** teleoconch sculpture. **Fig. 11** SEM micrograph of the teleoconch sculpture. **a**, angular fold; **b**, basal fold; **c**, columellar lamella; **lp**, lower-palatal fold; **p**, parietal lamella; **up**, upper-palatal lamella; **sc**, supracolumellar knob; **sp**, suprapalatal folds; **t**, transverse lamella.

70% of its length. Vascularisation evident in the adrectal area and between the pulmonary vein and the marginal afferent vein. Marginal vein poorly vascularised. Mantle collar with a brown, spongy pallial gland and some dents corresponding to the position of the apertural lamellae and folds.

Genital system (Fig. 13) similar in its general arrangement to that of *Plagiodontes daedaleus* (cf. Pizá & Cazzaniga, 2010, 2012). Ototestis pale orange to cream colour, composed of 6–7 groups of digitiform acini. Hermaphroditic duct brown and convoluted with a swollen central portion forming the vesicula seminalis. Fertilization pouch-spermathecal complex (FPSC) white, conspicuously visible on the basal side of the albumen gland, proximally swollen, and distally composed of a long and curved blind sac forming two circumvolutions (Fig. 14). Bursa copulatrix round to ovoid, 1.5 to 3.8mm in diameter. Bursa copulatrix duct about 27mm long, presenting straight folds or lamellae in its inner surface, intermingled with thinner and undulated lamellae on the distal portion. Vagina slightly wider than the penis and centrally swollen, with the inner surface reticulated by anastomosed lamellae (Fig. 15). Penial complex 30 to 47mm long; epiphallus and flagellum equalling in length the bursa copulatrix duct. Club-shaped penis, variable in length, as long as the epiphallus. Internally it has a fleshy penial papilla with an accessory lobe (Fig. 16). Inner surface with thick longitudinal and undulated pilasters with several branches. Penis sheath short and muscular. Multiple, thin and straight lamellae present in the area surrounded by the penis sheath and genital atrium, while the area beneath the penial papillae is smooth or presents thin longitudinal lamellae (Fig. 17). Epiphallus cylindrical, distally swollen, but otherwise of constant diameter. The portion of constant diameter bears thin and straight longitudinal lamellae and is separated from the swollen portion by a partition at a point where the folds joined to form a minute hollow papilla. The swollen part continued in a cylindrical tube running into the fleshy penial papilla. This tube had an internal sculpture of elevated and branched, anastomosed folds. Flagellum cylindrical with an internal straight longitudinal lamella. Epiphallus diameter higher than that of the flagellum.

COMPARISONS AND DISCUSSION

Only the paralectotype ZMB 28511 fits accurately the original description of *Plagiodontes brackebuschii* (Doering 1877). Despite the intensive search performed in January 2005, January 2007, and August 2009 over the type locality (San Francisco del Monte de Oro) and other localities at the San Luis province, no snail identifiable as *P. brackebuschii* was found across that area; neither a cylindrical shell like in Doering's original description, medium sized shells like the lectotype, nor shells with an obtuse apex and a reticulated sculpture in the teleoconch. Holmberg (1912: 25) illustrated a cylindrical shell from San Luis province, which fitted the original description of *P. brackebuschii*. However, he identified it as *P. weyenberghii* (Doering 1877) and that specimen could not be traced later.

None of the specimens labelled or cited as *P. brackebuschii* in the literature was confirmed as pertaining to this species: IFML 1304, from Cerro del Rosario, San Luis; MACN 3242 and MACN unnumbered set from Dique de la Viña are *P. strobilii*; MLP unnumbered set from Ongamira is *P. daedaleus*; MLP unnumbered set from Chancaní, Córdoba is *P. weyenberghii*.

Besides, no *Plagiodontes* shell from San Luis province housed at any Argentinean museum corresponds to *P. brackebuschii*. Until shells or living specimens of this species are found in San Luis province and further studies can be performed, we cannot confirm its current occurrence nor re-describe it.

The shell of *Plagiodontes parodizi* sp. nov. differs from the type specimens of *P. brackebuschii* in shape, teleoconch sculpture and suture characteristics. The specimens from Guasayán are more elongated, with a longer conical portion of the apex, the teleoconch sculpture presents an evident reticulation with thinner spiral lines. Besides, the shells from Guasayán do not present a threadlike carina in the suture, present in the type specimens of *P. brackebuschii*.

Plagiodontes parodizi sp. nov. differs from the remaining *Plagiodontes* species by its white to pink-brownish elongate-ovate shell with an obtuse apex and a reticulated sculpture in the teleoconch, differing from the whitish obese, ovate-elongated shells of *P. daedaleus* and the whitish slender, elongate-ovate shells of *P. strobilii*. The protoconch-teleoconch boundary is well

defined in *P. parodizi* sp. nov. as in *P. daedaleus*, while it presents a short transition area in *P. strobilii*. Lamellae and folds are similar in size, shape and number in these three species, but the mode was slightly higher in *P. parodizi* sp. nov. (10). The supracolumellar knob was present in 69.72% of the specimens of *P. parodizi* sp. nov., 50% of *P. weyenberghii*, 23.38% of *P. daedaleus* and 15.85% of *P. strobilii*. *P. parodizi* sp. nov. differs from *P. weyenberghii* ($\chi^2=25.99$; $fd=4$; $p < 0.00001$), *P. daedaleus* ($\chi^2=10.46$; $fd=4$; $p=0.03$) and *P. strobilii* ($\chi^2=21.10$; $fd=4$; $p < 0.001$) in the distribution of frequencies of lower palatal folds.

The main anatomical diagnostic character of *P. parodizi* sp. nov. is the shape of the free portion of the FPSC, long and convoluted forming two circumvolutions. *P. parodizi* sp. nov. differs from *P. strobilii* by the presence of an accessory lobe to the penial papilla. It is markedly shorter than the penial papilla, as in *P. daedaleus*, *P. multiplicatus parvus* and *P. weyrauchii*, contrary to *P. weyenberghii*, which has an accessory lobe almost as long as the penial papilla, and *P. rocae*, with an accessory lobe longer than the papilla. *P. parodizi* sp. nov. also differs from *P. weyenberghii* in the characteristics of the distal portion of the bursa copulatrix duct (swollen in *P. weyenberghii* and of constant diameter in *P. parodizi* sp. nov.) and the shape of the spermoviduct, which presented two characteristic circumvolutions in the latter. The vagina is centrally swollen, as in *P. strobilii*, but differing from *P. daedaleus*, with a distally swollen vagina, and from *P. weyenberghii*, which has a subcylindric vagina with a medial longitudinal depression.

The diagnostic characters of the specimens from Sierra de Guasayán, i.e. mainly the teleoconch striation and the shape of the FPSC, support their identity, cohesion and specific status.

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