Arch. Molluskenkunde | **135** | (1) | 91–99 | 12 figs., 2 tabls. | Frankfurt am Main, 30.06.2006

A rare endemic land-snail from Argentina: *Plagiodontes rocae* DOERING 1881

(Gastropoda: Orthalicidae: Odontostominae)

JULIA PIZÁ, NATALIA S. GHEZZI AND NÉSTOR J. CAZZANIGA

Abstract

Plagiodontes rocae DOERING 1881 is a strictly endemic species from the Paleozoic mountains of southern Buenos Aires province (Argentina). Its identity has been never controversial, but its description and discrimination from related species was still incomplete. A quantitative analysis of its measurements was advisable to locate the species in the frame of a morphological re-analysis of all species in genus *Plagiodontes* DOERING 1876. In this study, Protoconch sculpture is illustrated by SEM micrographs to rectify previous descriptions. Shell measurements and angles are studied by Multivariate Discriminant Analysis to discriminate it from other small-sized species. Genital anatomy of *P. rocae* is described for the first time, its quantitative data being discriminated by multivariate methods from those of the only co-existing Odontostominae, i.e., *Plagiodontes patagonicus.*

Key words: Orthalicidae, redescription, *Plagiodontes rocae*, Argentina, conchometrical analysis, anatomy.

Kurzfassung

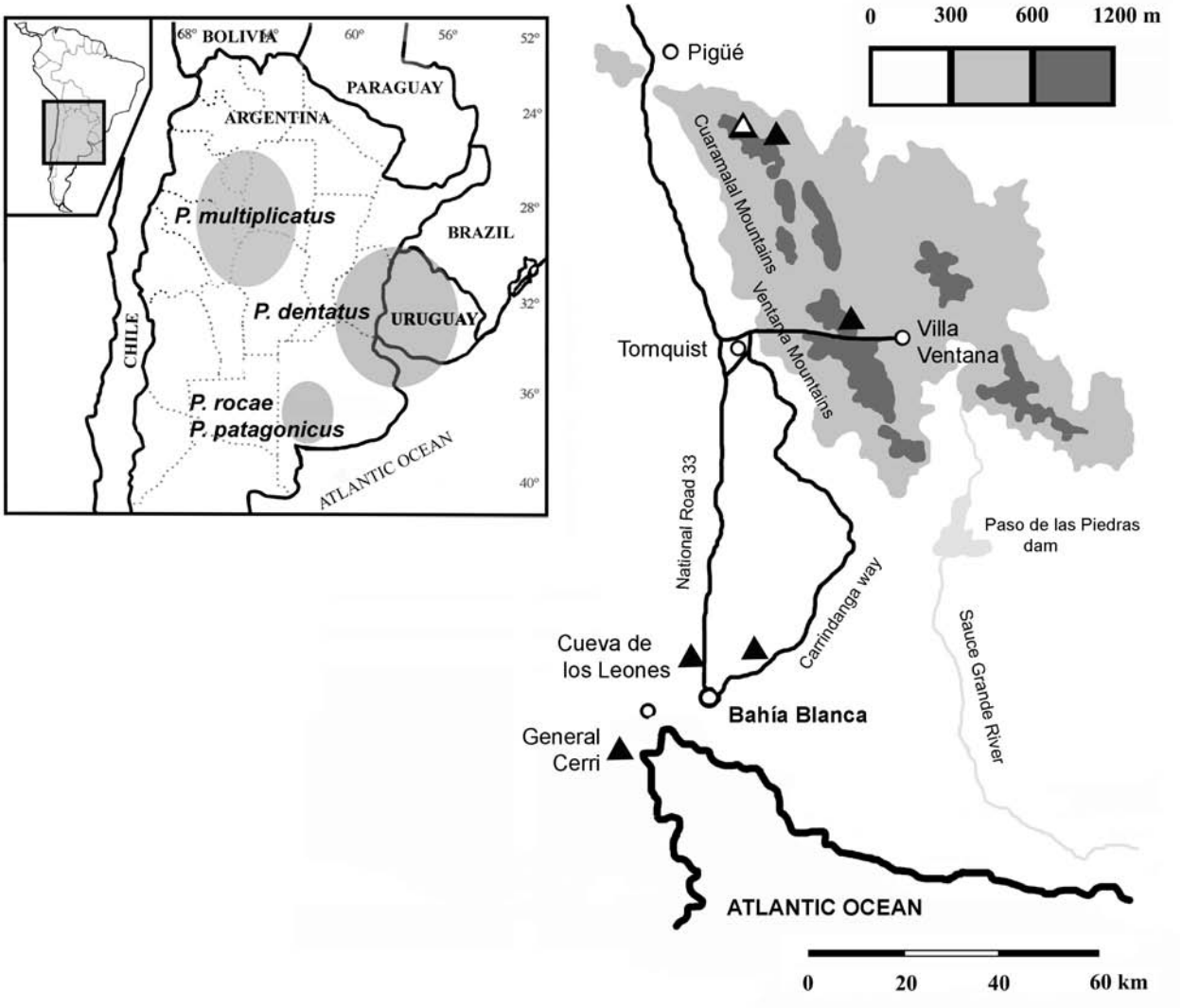
Plagiodontes rocae DOERING 1881 ist eine endemische Art des paläozoischen Berglandes im Süden der Provinz Buenos Aires, Argentinien. Ihr Status als eigenständige Art ist nie in Frage gestellt worden, doch ist ihre Beschreibung und Differenzierung von nahestehenden Arten nicht abgeschlossen. Im Rahmen der Revision aller *Plagiodontes*-Arten, die wir derzeit durchführen, ist daher eine morphometrische Analyse angebracht, um die Art korrekt einzuordnen. Die Skulptur des Embryonalgehäuses wird mittels SEM-Mikrographie dargestellt. Gehäusemaße und -winkel werden mit Hilfe der Multivariaten Diskriminanzanalyse mit denen anderer kleingehäusiger Arten verglichen. Die Genitalanatomie von *P. rocae* wird hier zum ersten Mal beschrieben; ihre morphometrischen Daten werden mit Hilfe der Multivarianzanalyse mit *P. patagonicus*, des einzigen sympatrischen Vertreters der Odontostominae, verglichen.

Schlüsselworte: Orthalicidae, Beschreibung, *Plagiodontes rocae*, Argentinien, Gehäusemorphometrie, Anatomie.

Introduction

Plagiodontes rocae DOERING 1881 is mentioned in several monographic works and catalogues, but only DOERING (1881) and PARODIZ (1939) gave original, significant information on this rare species. It lives in the

Address of corresponding author: Julia Pizá, Universidad nacional del Sur, Departamento de Biologia, Bioquimica y Farmacia, Laboratorio de Invertebrados I, San Juan 670, RA-8000 Bahia Blanca, Repúplica Argentina; email: jpiza@uns.edu.ar



Figures 1: Map of the studied area in southern Buenos Aires province (Argentina), showing the distribution of *Plagiodontes rocae* (empty triangles) and the sampling localities for *Plagiodontes patagonicus* (filled triangles).

"faunal island" formed by the Paleozoic mountains that outcrop in the extensive flat grassland (pampas), which are characteristic of the Buenos Aires province, Argentina (Fig. 1; "area 3" according PIZÁ & CAZZANIGA 2003).

The original description mostly refers to the shell, with some comments on the general aspect of the living animal and its mandible. In 1881, DOERING gave measurements for four specimens from Sierra de "Currumalan" (= Curamalal; type locality) which are the only morphometric information available until today. According to literature records, this is the least abundant species within the genus. PARODIZ (1939) adds a description of the radula and a new locality in Sierra de la Ventana. This is the only firsthand information published on *P. rocae* until now.

The aims of this paper are to describe for the first time the genital system of *P. rocae*; to re-describe the protoconch, which is not smooth in young specimens; and to analyse quantitative characters of the shell and genital system to assess its morphological discrimination from other small-sized *Plagiodontes* species, i.e., *P. dentatus* (WOOD 1828), *P. patagonicus* (ORBIGNY 1835), and *P. multiplicatus* (DOERING 1874).

Material and methods

Shell variability was analysed on 168 adult shells of: *P. rocae* (n = 19), *P. patagonicus* (n = 41), *P. multiplicatus* (n = 61), and *P. dentatus* (n = 47).

Snail adulthood was assumed for shells showing full development of apertural teeth and presence of a reflected outer aperture lip. Protoconch sculpture from juvenile and adult shells was examined with stereoscopic and scanning electronic microscope at CRIBABB (Centro Regional de Investigaciones Básicas y Aplicadas de Bahía Blanca, CONICET); characteristics of the apertural teeth were determined through direct observation

under stereoscopic microscope. Seven lineal and angular variables were measured on shell drawings made with a camera lucida device on a stereoscopic microscope: shell length (SL), shell width (SW), length of the last whorl (LWL), aperture length (AL) and aperture width (AW); major angle and spiral angle were also determined as described in Pizá & Cazzaniga (2003). Shell measurements were analyzed by MDA (multivariate discriminant analysis), using the SPSS statistical package, to separate *P. rocae* from the remaining species within its size range, i.e., *P. patagonicus*, *P. dentatus* and *P. multiplicatus* (Pizá & Cazzaniga 2003, Cazzaniga & al. 2005). MDA is a technique that generates discriminant functions based on lineal combinations of the predictor variables that provide the best discrimination among the groups. The functions are generated from cases for which group membership is known and can then be applied to classify new cases with unknown group membership (Harris 1985). Significance of differences of lineal measurements and their proportions between pairs of species was checked by Bonferroni's corrected t test (global $\alpha = 0.05$, individual $\alpha = 0.0083$) using the SPSS statistical package.

Genital quantitative data were gathered from 15 fresh specimens from Cerro Curamalal Chico and scrutinized by multivariate discriminant analysis (MDA) together with data of *P. patagonicus* from four localities in southern Buenos Aires province: Ventana Mountain, Curamalal Chico Mountain, Cueva de los Leones (11 km to the north of Bahía Blanca city), and General Cerri Town (Figure 1). The measured variables, taken with a micrometre on a stereoscopic microscope, were: penis length, epiphallus length, length of the bursa copulatrix duct, and diameter of the bursa copulatrix.

Studied material: Ten out of the 19 specimens of *P. rocae* were collected alive at Cerro Curamalal Chico (741 m alt.; 37º41′S–62º18′W), and compared to the collections of the Museo Argentino de Ciencias Naturales, Buenos Aires (MACN): MACN 14199, Pigüé, Sierra de Curamalal, L. Hauman leg., 1924, 5 specimens; MACN 11084, Sierra de Curamalal, near Pigüé, Kraglievich leg., 1892, 1 specimen; MACN 9844, Sierra de la Ventana, L. Hauman leg., no date, 3 specimens [doubtful locality: it might refer to the "Ventania Mountain system", which comprises both Sierra de Curamalal and Sierra de la Ventana; *P. rocae* was never found at Sierra de la Ventana by the authors]. Material of *P. patagonicus* consists of 18 specimens from: La Carrindanga way, Km 15 (38º35′S–62º04′W; set 32 in Pizá & Cazzaniga 2003); 23 specimens from Cerro Destierro, Sierra de la Ventana (38º01′40″S–62º01′53″W, set 6 in Cazzaniga et al. 2005). Both localities are situated in Southern Buenos Aires province. The remaining material was borrowed from MACN and MLP (sets 6, 14, 18, 19, and 21 in Pizá & Cazzaniga 2003).

Results

Family Orthalicidae Albers 1860

Subfamily Odontostominae Pilsbry & Vanatta 1898

Genus ***Plagiodontes*** Doering 1876

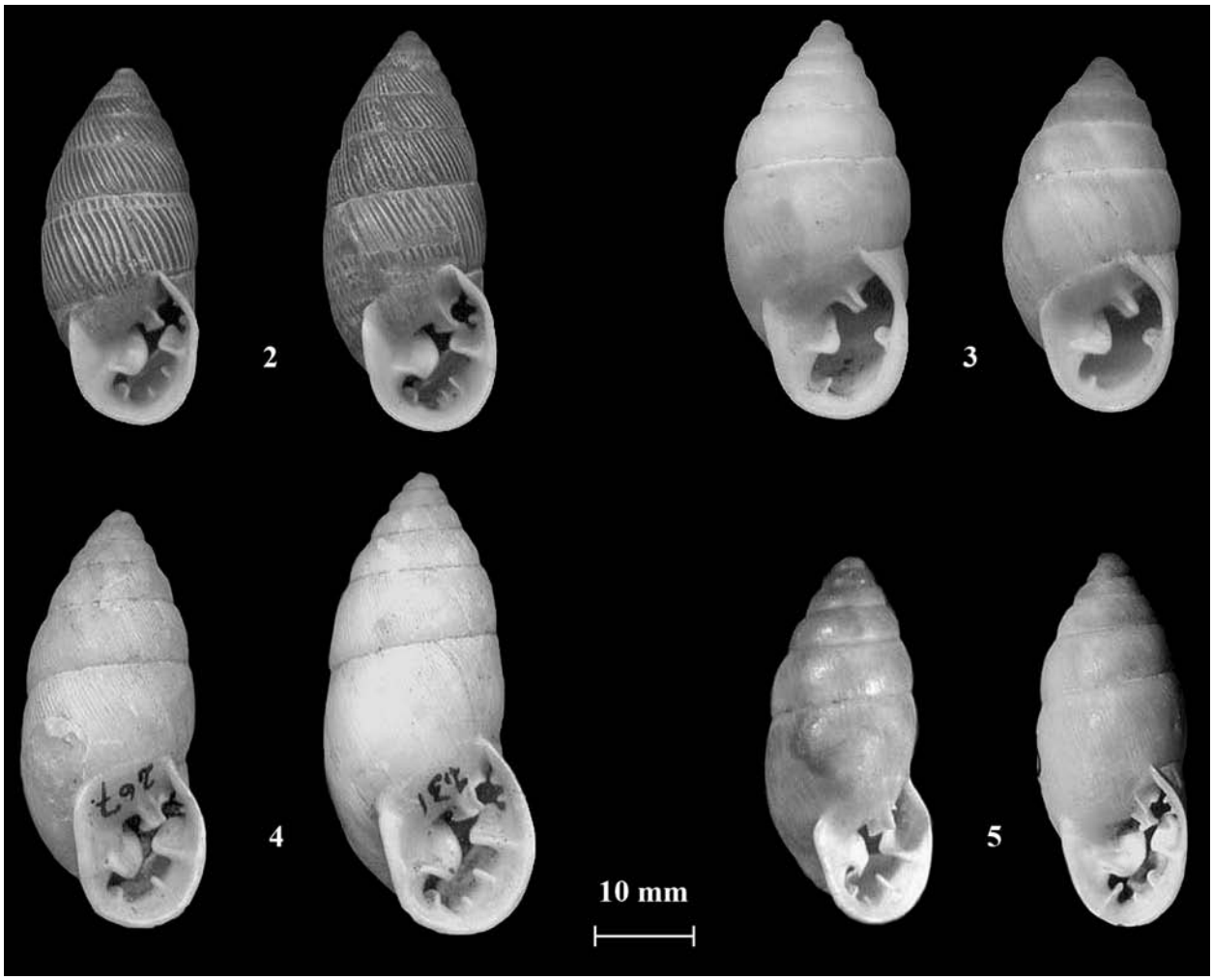
Plagiodontes rocae Doering 1881

1881 *Plagiodontes rocae* Doering, Informe Oficial de la Comisión Científica de la Expedición al Río Negro bajo las órdenes del General D. Julio A. Roca: 65–68

Literature records: Doering 1881 [original Latin diagnosis, comments in Spanish: description of shell and habitat, measurements of four specimens, and a brief comment on the mandible]; Pilsbry 1902: 97 [description: basically an English translation from Doering 1881]; Parodiz 1939: 715, 718 [redescription, in Spanish: shell, radula]; Parodiz 1942: 339–340 [geographic distribution]; Parodiz 1957: 28 [catalogue]; Fernández 1973: 153 [catalogue]; Breure 1974: 122 [catalogue]; Richardson 1993: 56 [catalogue]; Cuezzo & Dragh 1995: 196 [catalogue].

Description: Shell ovate-oblong, solid, reddish brown, rather opaque, with regularly spaced striae (Figs. 2, 7). Measurements and proportions as shown in Table 1. Ovate subcylindrical spire, with a conic apex. Protoconch of young specimens (Fig. 8) axially striated, with slightly waved ribs, sometimes branched (Fig. 9); they gradually become less irregular and more prominent, to be replaced by straight prominent ribs in the teleoconch, without a clear boundary to the protoconch. Protoconch sculpture shows early signs of erosion, so adult specimens have smooth protoconchs with almost no remains of ribs; its surface is porous with a weak spiral cord or thread partially bordering the suture (Fig. 6).

Shell aperture subvertical, ovate. Apertural teeth well developed, closely resembling those of *P. multiplicatus* and *P. dentatus* in number (10–11 folds) and degree of aperture occlusion (Fig. 7). Parietal lamella angular, L to C shaped, with the outer part curved and slightly joining the angular fold; it is smaller than in *P. multiplicatus* and *P. dentatus*. The largest fold occluding the aperture is the curved and expanded columellar lamella. Basal fold small and acutely compressed, followed by two or three lower palatal folds (68.42 % of the specimens with two); two of them are parallel and equally sized, the third one, if present, is generally smaller. A big and twisted upper-palatal lamella, the second tooth in size, is in the middle of the outer lip, below two unconnected suprapalatal folds. The transverse lamella, characteristic of the genus, is always short, well developed, laterally expanded, and



Figures 2–5: Representative shells of the species of *Plagiodontes* under comparison. 2: *P. rocae* DOERING 1881. 3: *P. patagonicus* (ORBIGNY 1835). 4: *P. multiplicatus* (DOERING 1874). 5: *Plagiodontes dentatus* (WOOD 1828).

located deeply behind the lower palatal folds. The position of the transverse lamella can be inferred externally from a white half-moon shaped mark.

Figure 10 shows the results of the MDA based on shell measurements of four species similar in shape and size, i.e., *P. rocae* (Fig. 2), *P. patagonicus* (Fig. 3), *P. multiplicatus* (Fig. 4), and *P. dentatus* (Fig. 5). All species showed a high degree of discrimination on the plane determined by the two first discriminant functions, with a total of 82.74% of correctly classified cases. The species living in southern Buenos Aires province, i.e., *P. rocae* and *P. patagonicus,* scored positively on the first axis, mainly because of their wider shells and their longer apertures. In turn, *P. rocae* mostly located in the quadrant of the positive values of both discriminant functions, mainly due to its comparatively low values of the shell-width/shell-length and aperture-width/aperture-length proportions, and its high major angles. *Plagiodontes rocae* has thus the most slender aperture and a significantly higher major angle among the species under consideration (Table 1). It has a significantly wider shell, but a lower shell-width/shell-length proportion than *P. multiplicatus;* the aperture is proportionally shorter in *P. rocae* than in *P. multiplicatus. Plagiodontes rocae* and *P. dentatus* significantly differ in most meristic parameters, but not in the ratios describing their general shape (Table 1). The sympatric *P. rocae* and *P. patagonicus* differ from each other in most of their measurements and proportions (Table 1).

Genital system (Fig. 11): Ovotestis arranged in small lobes, immersed in the digestive gland. Ovotestis duct initially slender, becoming convoluted and swollen in its central portion, and ending in the fertilization pouch-spermathecal complex (FPSC) that lies on the concave part of the albumen gland. The latter is yellow, hyaline, elongated and bent on its base. Spermoviduct long and convoluted; the yellow, opaque prostatic portion originates in the initial portion of the spermoviduct. Spermoviduct swollen and pale orange. Distally, the spermoviduct splits into a vas deferens and a free oviduct that leads to the basis of the duct of the bursa copulatrix and the beginning of the muscular vagina. Bursa copulatrix spherical, about 2 mm in diameter. Duct of the bursa copulatrix with a uniform diameter along the 4/5 of its

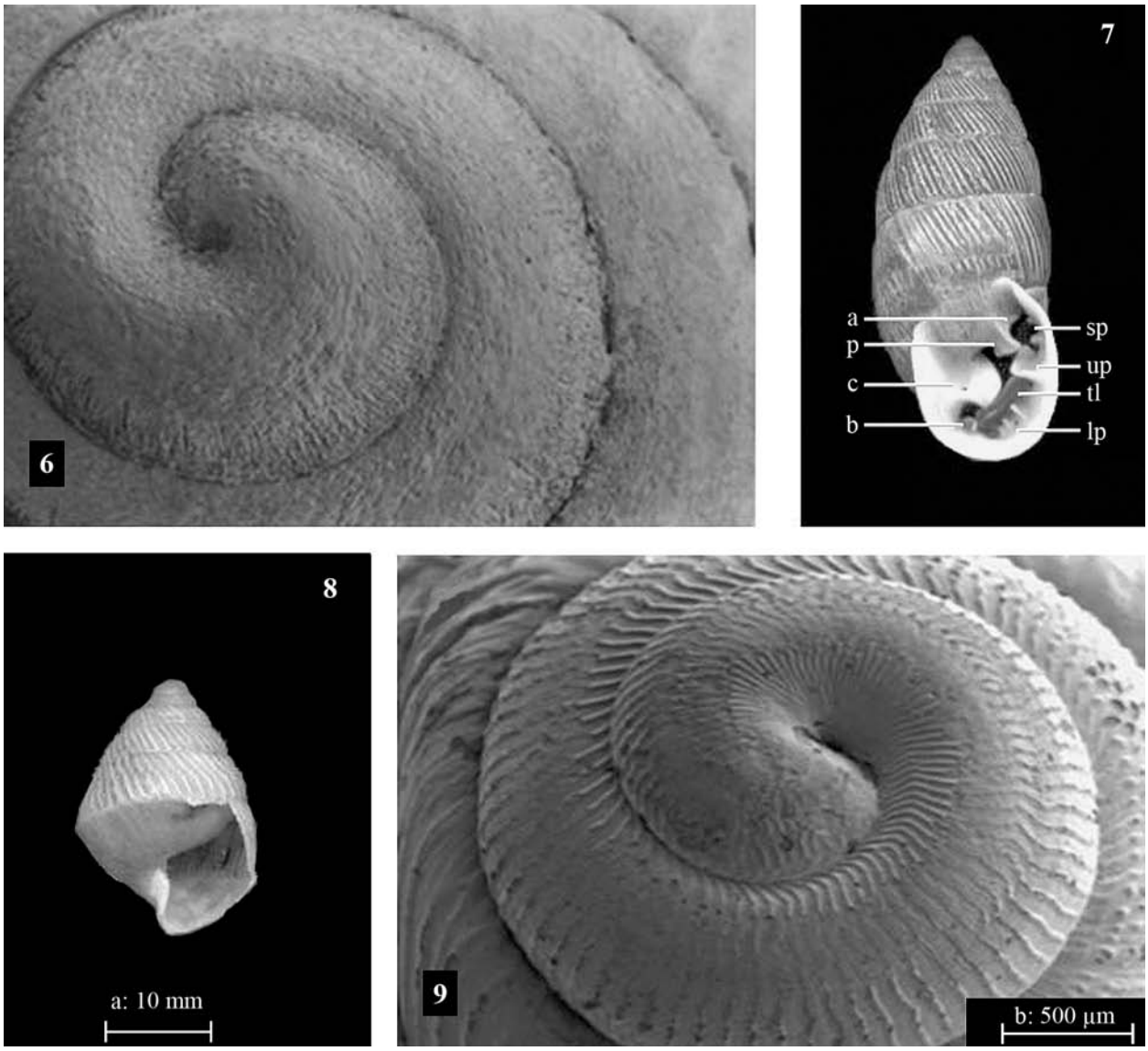


Figure 6–9: Young and adult specimens and protoconchs of *P. rocae* Doering 1881. 6: Scanning electron micrograph of the protoconch of an adult specimen. 7: Adult specimen, with indication of the apertural teeth. 8: young specimen. 9: Scanning electron micrograph of the protoconch sculpture of a young specimen. Scale bar "a" for figures 7 and 8, scale bar "b" for figures 6 and 9.— Abbreviations: a = angular; b = basal; c = collumelar; lp = lower palatal; p = parietal; sp = suprapalatal; tl = transverse lamella; up = upper palatal.

distal length; it gradually enlarges along the basal fifth to join the free oviduct and the basis of the vagina. The duct of the bursa copulatrix and the spermoviduct are almost of the same diameter at their base. The vagina is rather short, broad and tapering towards the genital atrium. Vas deferens shorter than the penial complex. Penis muscular, curved, and strongly swollen at the distal part, with a short muscular sheath at its base; retractor muscle inserted at the distal end of the penis. The transition between penis and epiphallus is constricted. Epiphallus slightly longer than the penis, proximately swollen, but otherwise subcylindrical. Flagellum more or less subcylindrical, same average length as the epiphallus, though this proportion is highly variable (Table 2). Vas deferens shorter than the penis and epiphallus together.

Table 2 shows the results of genital morphometry. A preliminary MDA on genital data of *P. rocae* from Curamalal mountains and four populations of *P. patagonicus* (General Cerri, Cueva de los Leones, Ventania Mountains and Curamalal Mountains), yielded 73.3 % of right classification of the former, with 20 % of the specimens classifying with *P. patagonicus* from Cueva de Los Leones. In turn, 25 % of the snails from Cueva de Los Leones were classified as *P. rocae* in that analysis. The other populations of *P. patagonicus* were clearly differentiated from *P. rocae*. Figure 12 shows the distribution of the

Table 1: Summary of the shell variables and proportions of *Plagiodontes rocae* DOERING 1881 and its morphologically similar species from Argentina and Uruguay. Mean standard deviation [±, minimum-maximum]. Measurements in mm. BONFERRONI's corrected t-test: different letters indicate significant differences (global α: 0.05, individual α: 0.0083).— Abbreviations: AL = Aperture length; AW = Aperture width; LWL = Last whorl length; MA = Major angle; SA = Spiral angle; SL = Shell length.

	P. rocae (n = 19)	*P. patagonicus* (n = 41)	*P. multiplicatus* (n = 61)	*P. dentatus* (n = 47)
SL	22.11 ± 1.97 [18.86–25.01] a	21.61 ± 2.53 [17.11–26.97] a	19.57 ± 1.86 [16.14–23.75] b	18.38 ± 1.25 [15.91–21.70] c
SW	9.84 ± 0.59 [8.71–11.00] a	10.73 ± 1.04 [9.36–12.83] b	9.25 ± 0.65 [8.18–10.91] c	8.29 ± 0.44 [7.50–9.32] d
LWL	13.64 ± 0.92 [12.57–15.71] a	14.48 ± 1.37 [12.43–17.64] b	13.36 ± 0.97 [11.48–15.34] a	11.75 ± 0.75 [10.23–13.98] c
AL	8.98 ± 0.79 [7.86–10.57] a	9.98 ± 1.01 [8.33–12.10] b	8.73 ± 0.71 [7.39–10.34] a	7.61 ± 0.50 [6.36–8.98] c
AW	6.68 ± 0.86 [5.29–8.57] a	8.06 ± 0.78 [7.02–9.77] b	7.24 ± 0.54 [5.91–8.75] b	6.58 ± 0.35 [5.91–7.27] a
MA	124.84 ± 4.14 [119–134] a	119.63 ± 4.24 [102–127] b	121.30 ± 3.45 [112–129] b,c	122.38 ± 2.78 [116–131] c
SA	47.95 ± 5.61 [40–59] a	49.59 ± 4.34 [39 –60] a	48.41 ± 5.39 [35–66] a	43.87 ± 3.49 [36–53] b
Whorl number (mode)	6.5 [6.25–7.5] a	7 [6.25–7.75] a,b	6.5 [6–7.75] a	7 [6.5–7.5] b
SW/SL*100	44.74 ± 3.43 [39.20–50.76] a	49.99 ± 4.50 [37.79–59.83] b	47.46 ± 3.31 [37.32–57.04] c	45.22 ± 2.28 [41.18–49.68] a
LWL/SL*100	61.86 ± 3.34 [57.38–67.16] a	67.47 ± 6.42 [52.67–76.80] a	68.46 ± 3.13 [60.40–75.00] a	63.98 ± 2.04 [60.13–68.15] a
AL/SL*100	40.71 ± 2.86 [36.18–44.85] a	46.45 ± 4.33 [37.04–52.63] b	44.73 ± 2.47 [38.76–50.88] c	41.44 ± 1.62 [38.22–45.39] a
AW/AL*10 0	74.51 ± 7.89 [63.75–88.33] a	80.93 ± 3.08 [73.61–90.16] b	83.05 ± 3.97 [73.24–96.92] b	86.56 ± 3.65 [77.61–94.64] c

Table 2: Summary of the genital variables and proportions of *Plagiodontes rocae* DOERING 1881 AND FOUR POPULATIONS OF *Plagiodontes patagonicus* (ORBIGNY 1835) from southern Buenos Aires province, Argentina. Mean ± standard deviation [minimum-maximum]. Measurements in mm.— Abbreviations: DBc = Bursa copulatrix diameter; EL = Epiphallus length; FL = Flagellum length; LBC = Length of the bursa copulatrix duct; PL = Penis length.

	Plagiodontes rocae	*Plagiodontes patagonicus*			
		Cueva de los Leones	General Cerri	Ventania Mountains	Curamalal Mountains
PL	9.8 ± 1.1 (8.3–11.3)	9.9 ± 1.4 (7.1–13.1)	8.3 ± 0.8 (6.5–10.1)	11.5 ± 1.2 (8.3–13.1)	11.2 ± 0.9 (8.9–14.3)
LBC	26.4 ± 2 (21.4–30.4)	25.1 ± 2.9 (20.2–32.1)	20.6 ± 3.6 (11.9–26.2)	32.3 ± 3.3 (27.4–41.7)	28.9 ± 6.7 (12.5–28.6)
FL	11.9 ± 1.7 (9.5–15.5)	13.4 ± 1.6 (10.1–16.7)	10.9 ± 1.8 (7.1–14.3)	16.1 ± 1.9 (13.7– 20.2)	14.3 ± 1.7 (11.3–17.9)
EL	11.7 ± 1.7 (10.1–16.1)	12.1 ± 1.6 (9.5–15.5)	9.4 ± 1.1 (7.1–11.3)	13.5 ± 1.6 (10.7–16.7)	12.5 ± 1.5 (9.5–13.1)
DBc	2.03 ± 0.58 (1.32–3.29)	1.64 ± 0.30 (1.32–2.50)	1.34 ± 0.31 (0.79–1.97)	2.20 ± 0.44 (1.45–3.42)	1.97 ± 0.35 (1.32–3.16)
FL/EL	10.3 ± 2 (6.3–14.1)	1.12 ± 0.14 (0.94–1.44)	1.16 ± 0.13 (0.86–1.33)	1.20 ± 0.15 (0.89–1.43)	1.15 ± 0.17 (0.79–1.36)
EL/PL	1.21 ± 0.16 (1.59–1.00)	1.23 ± 0.17 (0.82–1.56)	1.14 ± 0.16 (0.86–1.45)	1.18 ± 0.13 (1.00–1.43)	1.12 ± 0.10 (0.92–0.92)
FL/PL	1.24 ± 0.29 (1.86–0.89)	1.37 ± 0.23 (0.95–1.83)	1.33 ± 0.25 (0.86–1.71)	1.41 ± 0.18 (1.10–1.70)	1.28 ± 0.16 (1.00–1.25)

discriminant scores of *Plagiodontes rocae* and its morphologically closest population of *P. patagonicus* (Cueva de los Leones), which is in the lower limit of the size range of the species. They mainly differ because *P. rocae* has a larger bursa copulatrix ($F = 6.68$, $p_{1, 33} = 0.014$) and a shorter flagellum ($F = 7.69$, $p_{1, 33} = 0.009$).

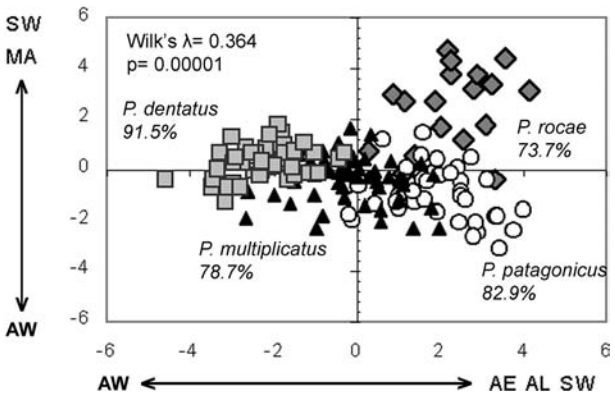


Figure 10: Scatter plot of the scores of the discriminant functions 1 and 2 of the MDA performed on shell measurements of *Plagiodontes rocae*, *P. patagonicus*, *P. multiplicatus* and *P. dentatus*.

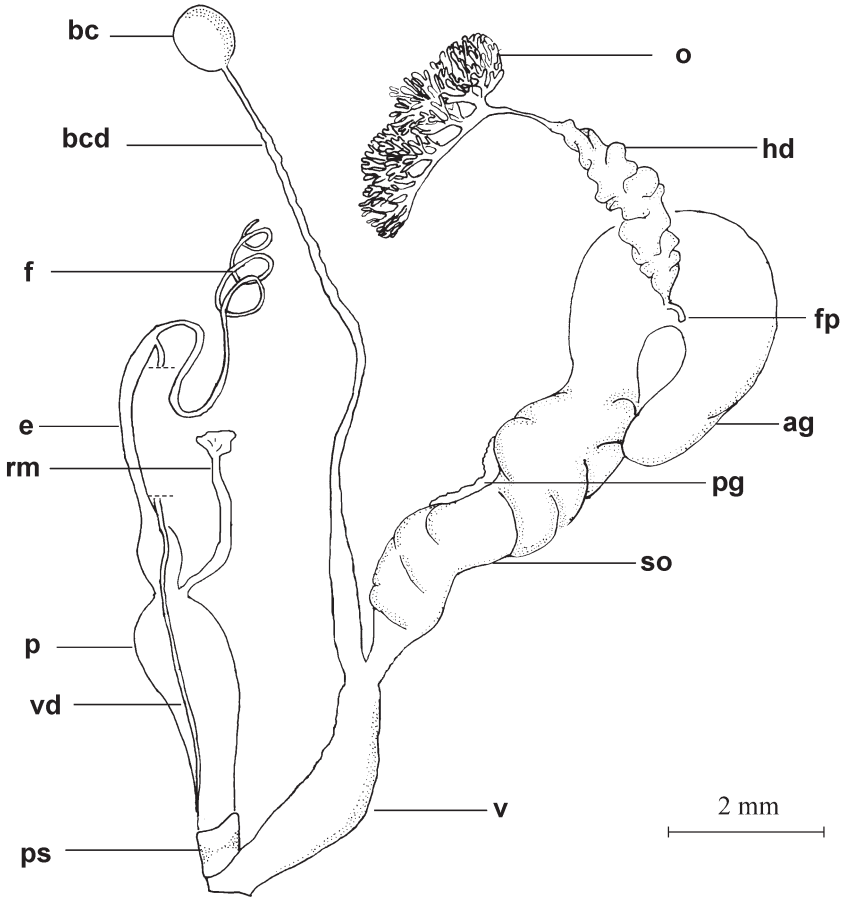


Figure 11: Genital system of *Plagiodontes rocae* Doering 1881.— Abbreviations: ag = albumen gland, bc = bursa copulatrix, bcd = duct of the bursa copulatrix, e = epiphallus, f = flagellum, fp = fertilization pouch-spermathecal complex, hd = hermaphrodite duct, o = ovotestis, p = penis, pg = prostatic gland, ps = penis sheath, rm = penis retractor muscle, so = spermoviduct, v = vagina, vd = vas deferens.

Discussion

Plagiodontes rocae is easily identifiable because it is the species with the strongest and most uniform teleoconch sculpture within the genus, its distribution area being extremely reduced (Sierra of Curamalal, in the Ventania Mountain system, Buenos Aires province, Argentina). Its colour is also characteristic, and it has a

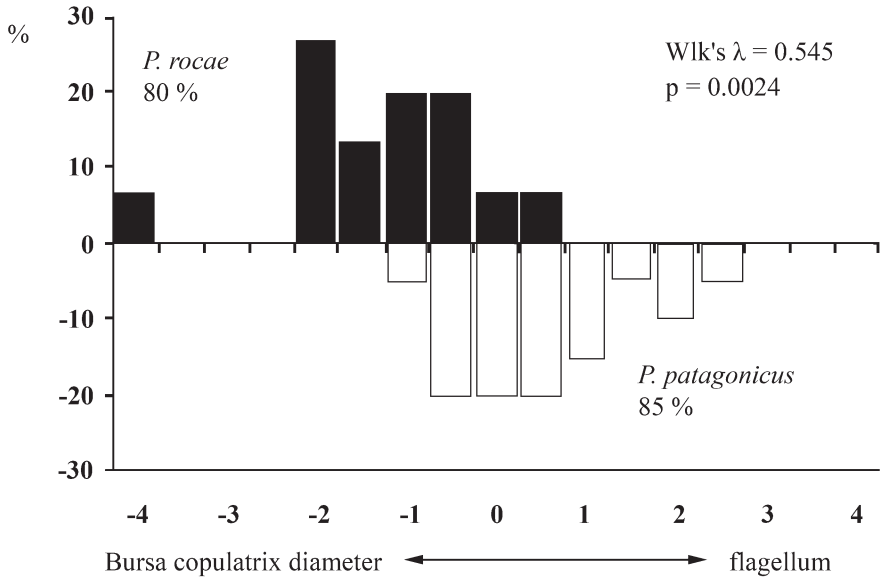


Figure 12: Bar chart of the MDA discriminant function based on genital anatomy data of *Plagiodontes rocae* and a sample of *P. patagonicus* from Cueva de los Leones.

large number of apertural teeth in an area where the only co-occurring toothed Odontostominae is *P. patagonicus,* i.e., the species with the lesser number of teeth within the genus (PIZÁ & CAZZANIGA 2003, CAZZANIGA & al. 2005). Our data demonstrate that, beyond differences in sculpture, colour and aperture dentition, shells of *P. rocae* consistently differ from their co-generic small-sized species, i.e., *P. dentatus, P. multiplicatus* and *P. patagonicus,* in shell proportions.

The protoconch was described as smooth by DOERING (1881), PILSBRY (1901) and PARODIZ (1939), a condition observable in adult shells. However, young specimens show the same kind of protoconch sculpture as *P. patagonicus,* which was described and discussed by PIZÁ & CAZZANIGA (2003) and CAZZANIGA & al. (2005). The fast erosion of the protoconchs, and probably the reddish colour of the shells, may be interpreted as a consequence of calcium shortage in the typically quartz-stony habitat of *P. rocae* (SLOTOW & al. 1993, CAZZANIGA & al. 2005).

The genital system of *P. rocae* is basically similar to that of *P. patagonicus,* as described by HYLTON-SCOTT (1951), CAZZANIGA & FERNÁNDEZ-CANIGIA (1985), and CAZZANIGA & al. (2005). It is also very similar to the descriptions by BREURE and SCHOUTEN (1985) of *P. daedaleus, P.weyenberghi*, and *Plagiodontes* sp. The main qualitative differences are the enlarged basis of the duct of the bursa copulatrix and the relatively longer albumen gland which has a characteristic bend in *P. rocae*. The genital system also shows significant differences with *P. patagonicus* in some relative sizes, as revealed by the statistical multivariate analysis.

Acknowledgments

We are very grateful to VIVIANA SORRIVAS for her help in obtaining the micrographs. To ROLF and VALDEMAR DELHEY for translating the Kurzfassung. To LEA CAZZANIGA for revising English grammar. JP is a fellow of Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET, Argentina), and NJC is a staff researcher in CIC (Comisión de Investigaciones Científicas de la provincia de Buenos Aires, Argentina). UNS and CIC funded this paper.

References

BREURE, A. S. H. (1974): Catalogue of Bulimulidae (Gastropoda: Euthyneura), II. Odontostominae.— Basteria, **38:** 109–127.

BREURE, A. S. H. & SCHOUTEN, J. R. (1985): Notes on and descriptions of Bulimulidae (Mollusca, Gastropoda), III.— Zoologische Verhandelingen, **216:** 1–98.

CAZZANIGA, N. J. & FERNÁNDEZ-CANIGIA, M. V. (1985): Aporte al conocimiento de *Plagiodontes patagonicus* (ORBIGNY) y *P. magnus* HYLTON-SCOTT (Gastropoda: Odontostomidae).— Spheniscus, **1:** 35–51.

CAZZANIGA, N. J., PIZÁ, J. & GHEZZI, N. S. (2005): Clinal variation from *Plagiodontes patagonicus* to *P. magnus* (Gastropoda: Orthalicidae, Odontostominae), a single species from Argentina.— Journal of Natural History **39** (24): 2203 – 2216.

CUEZZO, M. G. & DRAGH, F. (1995): Moluscos depositados en la colección de la Fundación MIGUEL LILLO, Argentina.— Acta Zoologica Lilloana, **43** (1): 185–205.

DOERING, A. (1881): Moluscos. In: Informe Oficial de la Comisión Científica de la Expedición al Río Negro

bajo las órdenes del General D. Julio A. Roca (Buenos Aires): 61–75, pl. 1.

Fernández, D. (1973): Catálogo de la malacofauna terrestre argentina.— Monografías de la Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, **4:** 1–197.

Harris, R. J. (1985): A primer of multivariate stadistics. 2nd edition; New York (Academic Press).

Hylton-Scott, M. I. (1951): Nuevos moluscos terrestres del norte argentino.— Acta Zoologica Lilloana, **10:** 5–29.

Parodiz, J. J. (1939): Revisión de *Plagiodontes* y *Scalarinella* (Odontostominae).— Physis, **17** (49): 711–734.

— — — (1942): Los Odontostominos en la Argentina (Segunda parte).— Physis, **19:** 319–343, 4 pls.

— — — (1957): Catalogue of the land Mollusca of Argentina (continued).— The Nautilus, **71** (1): 22–30.

Pilsbry, H. A. (1902): Oriental Bulimoid Helicidae; Odontostomidae; Cerionidae. Classification of Bulimulidae and Index to volumes 10–14.— Manual of Conchology, 2nd series: Pulmonata, vol. **14:** i–xcix + 1–302 pp.; Philadelphia.

Pizá, J. & Cazzaniga, N. J. (2003): Redescription, shell variability and geographical distribution of *Plagiodontes dentatus* (Wood, 1828) (Gastropoda: Odontostomidae) from Uruguay and Argentina.— Zootaxa, **154:** 1–23.

Richardson, C. L. (1993). Bulimulacea: Catalogue of species. Amphibulimidae, Anadromidae, Grangerellidae, Odontostomidae, Orthalicidae.— Tryonia, **27:** 1-164; Philadelphia.

Slotow, R., Goodfriend, W. & Ward, D. (1993): Shell colour polymorphism of the Negev desert landsnail, *Trochoidea seetzeni*: the importance of temperature and predation.— Journal of Arid Environments, **24:** 47–61.

Manuscript submitted: 11.02.2005
Revised manuscript accepted: 05.12.2005