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AKADÉMIAI KIADÓ

A new species of *Petraeomastus* Möllendorff, 1901 (Gastropoda: Stylommatophora: Enidae) with a varied shell from the Daduhe River Valley in southwest China

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ABSTRACT

A new enid land snail, *Petraeomastus liuzhengpingi* Z.-G. Chen & Z.-Y. Chen, sp. n. is described from Danba County, Sichuan Province, China based on shell and genital morphology. The new species displays a varied shell morphology with some individuals exhibiting a completely detached last whorl, which is the first record of this phenomenon in the family Enidae. The discovery contributes to our understanding of the high species diversity of Enidae in the dry-hot river valleys in China.

KEYWORDS

conchology, morphology, taxonomy, land snails, Sichuan

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INTRODUCTION

Several dry-hot river valleys in southwestern China have nurtured a large number of endemic genera and species of Enidae Woodward, 1903, making it one of the most diverse regions of the family (Wu 2018, Chen et al. 2024a, 2024b, 2024c, 2024d). Since the late 19th century, a considerable number of new species have been continuously discovered in the region (Pfeiffer 1857, Deshayes 1870, Heude 1882, 1885, Ancey 1883, 1884, Hilber 1883, Sturany 1899, 1900, Möllendorff 1901, Annandale 1923, Pilsbry 1934, Yen 1938, 1939, Chen & Zhang 2000, 2001, Wu & Wu 2009, Wu & Zheng 2009, Wu & Gao 2010, Zhang et al. 2003, 2010, Wang & Wu 2012, Wu & Fang 2012, Wu & Xu 2012, Fang & Wu 2013, Wang & Wu 2013, Wu & Xu 2013, Wu 2018, Chen 2020, Chen et al. 2024a, 2024b, 2024c, 2024d). The genus *Petraeomastus* Möllendorff, 1901 is a group of medium to large-sized enid land snails defined by the nearly cylindrical shell and consisted of 22 species (Pfeiffer 1857, Heude 1882, 1890, Ancey 1883, 1884, Hilber 1883, Sturany 1899, 1900, Möllendorff 1901, Wang & Wu 2013, Wu 2018, Chen et al. 2024c, MolluscaBase Eds. 2024). It is widely distributed in the Bailongjiang River Valley, the Daduhe River Valley, the Jinshajiang River Valley and the Lancangjiang River Valley in southwest China (Wang & Wu 2013, Wu 2018). In comparison to the other three valleys, the species diversity of *Petraeomastus* in the Daduhe River Valley is relatively low, with only one recorded (Möllendorff, 1901, Wu 2018). The lower diversity may be attributed to insufficient sampling on the up-river (Deshayes 1870, Möllendorff 1901, Pilsbry 1934, Zhang et al. 2003, Wu 2018).

Based on the land snails survey conducted in 2022, we discovered that the *Petraeomastus* specimens with a varied shell from the Danba section of the Daduhe River Valley represents an undescribed species. Here, we give a full description of this new species. The discovery of this new taxon contributes to our understanding of the high species diversity of Enidae in the region and represents the first recorded case of a completely detached last whorl in the family Enidae.

MATERIAL AND METHODS

Specimens were collected from Danba County, Sichuan Province, China in 2022. Specimens were fixed in 70% ethanol. Measurements were taken with digital callipers to the nearest 0.1 mm. Whorls were counted as described by Kerney and Cameron (1979). Terminology follows Wu (2018), defining the genital atrium as proximal. Photographs were taken under a camera and processed in Adobe Photoshop CC 2015 (Adobe Systems, San Jose, US). Maps were made in ArcGIS Pro (Esri, Redlands, US).

ABBREVIATIONS

NCUXPWU	Laboratory of Xiao-Ping Wu, Nanchang University
At	atrium
AR	retractor muscle of the appendicular branch
A-1	most proximal section of penial appendix
A-2	penial appendix section between and thicker than A-1 and A-3, usually bulb-shaped

A-3	section of the penial appendix connecting proximally A-2 and distally A-4
A-4	thinnest part of the penial appendix between A-5 and A-3
A-5	distal part of the penial appendix, more or less swollen
BC	bursa copulatrix
BCD	bursa copulatrix duct
D	diverticle of the bursa copulatrix duct
Ep	epiphallus
EpC	epiphallic caecum
Fl	flagellum
FO	free oviduct
P	penis
PR	retractor muscle of the penial branch
Va	vagina
VD	vas deferens

RESULTS

Family Enidae Woodward, 1903

Genus *Petraeomastus* Möllendorff, 1901

Type species. *Buliminus heudeanus* Ancey, 1883, by original designation.

Petraeomastus liuzhengpingi Z.-G. Chen & Z.-Y. Chen, sp. n.

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Figures 1–4

Type material: *Holotype:* NCUXPWUAN240001, Songda Village [宋达村], Danba County [丹巴县], Ganzi Tibetan Autonomous Prefecture [阿坝藏族羌族自治州], Sichuan Province [四川省], China, 101°55′50″E, 30°50′47″N, leg. Zhong-Guang Chen, September, 2022. *Paratypes*: NCUXPWUAN240002–50, other information same as holotype.

Measurements: holotype: shell height 20.1 mm, width 8.3 mm, aperture height 6.3 mm, width 5.5 mm; paratypes: shell height 15.9–19.2 mm, width 6.3–8.2 mm, aperture height 5.3–6.7 mm, width 4.4–5.6 mm.

Diagnosis: Shell pointed-cylindrical. Suture well impressed. Peristome insertions connected, with a shallow channel at upper insertion. The last 0–1.0 whorls detached. Bursa copulatrix ovoid. Diverticle slightly expanded.

Description: Shell. Shell medium, pointed-cylindrical with apex pointed; shell most swollen (broadest) at body whorl; dextral; solid; opaque; matte; not speckled; not spirally grooved; with 7.5–8.5 whorls. Whorls inflated. Protoconch whorls smooth; polished. Teleoconch smooth. Growth lines distinct. Suture well impressed, without a narrow band on beneath whorl. The last 0–1.0 whorls detached. Body whorl gradually ascending towards aperture; rounded at periphery; without spiral peripheral depression. Aperture in a slightly wavy; ovate; oblique; without tooth; without angular tubercle. Peristome insertions connected, with a shallow channel at upper insertion. Peristome yellowish-white and reflexed; sharp. Columellar margin reflected.

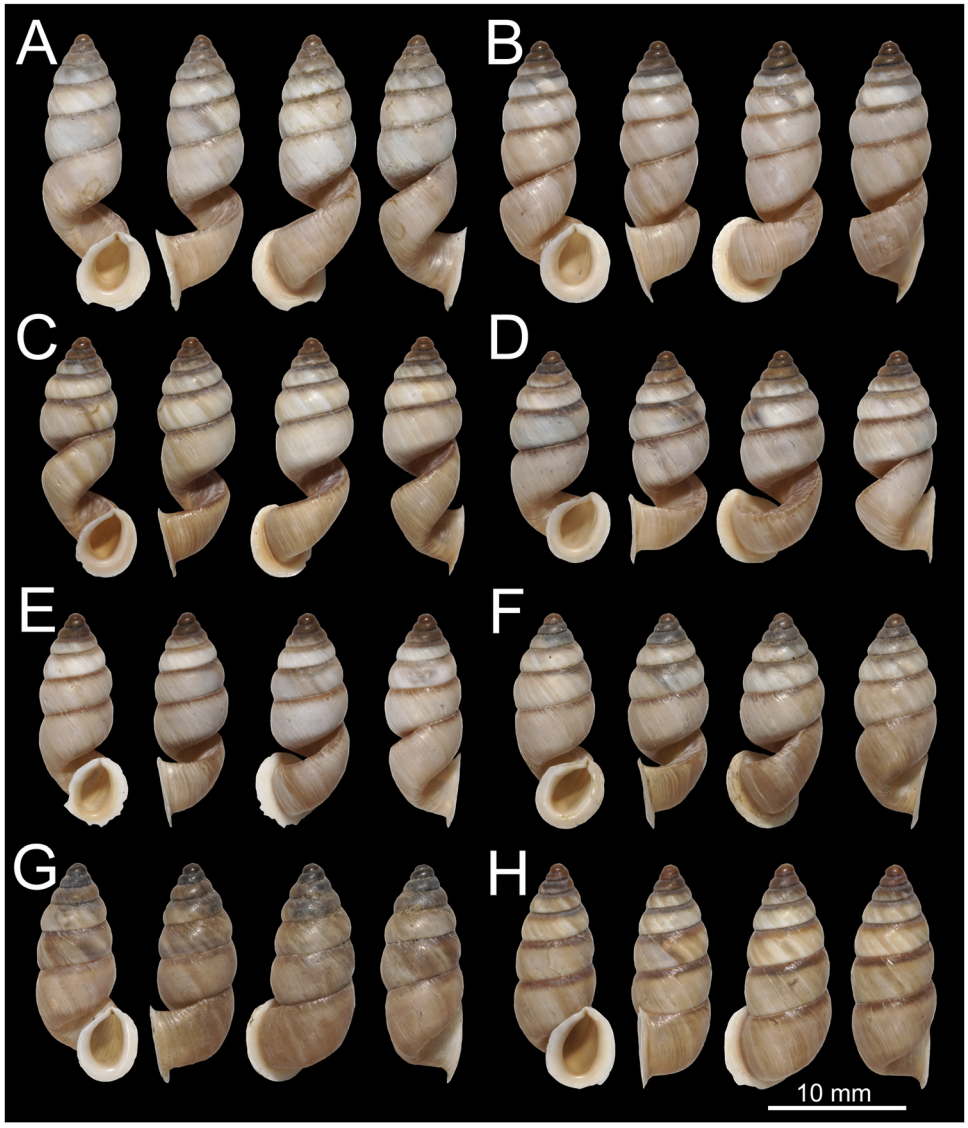

Fig. 1. Morphological variation of *Petraeomastus liuzhengpingi* sp. n. A, holotype (NCUXPWUAN240001); B–H, partial paratypes (NCUXPWUAN240002–08)

Columella vertical to oblique; without tooth. Umbilicus open. Shell multicoloured, background yellowish-white to light brown, with a brown spiral band below the suture and some indistinct brown radial bands across the whorl.

Genitalia. $N = 18$. No discernible difference was noted between the genitalia of the compact-shelled and detached-shelled specimens. Vas deferens relatively short, uniform

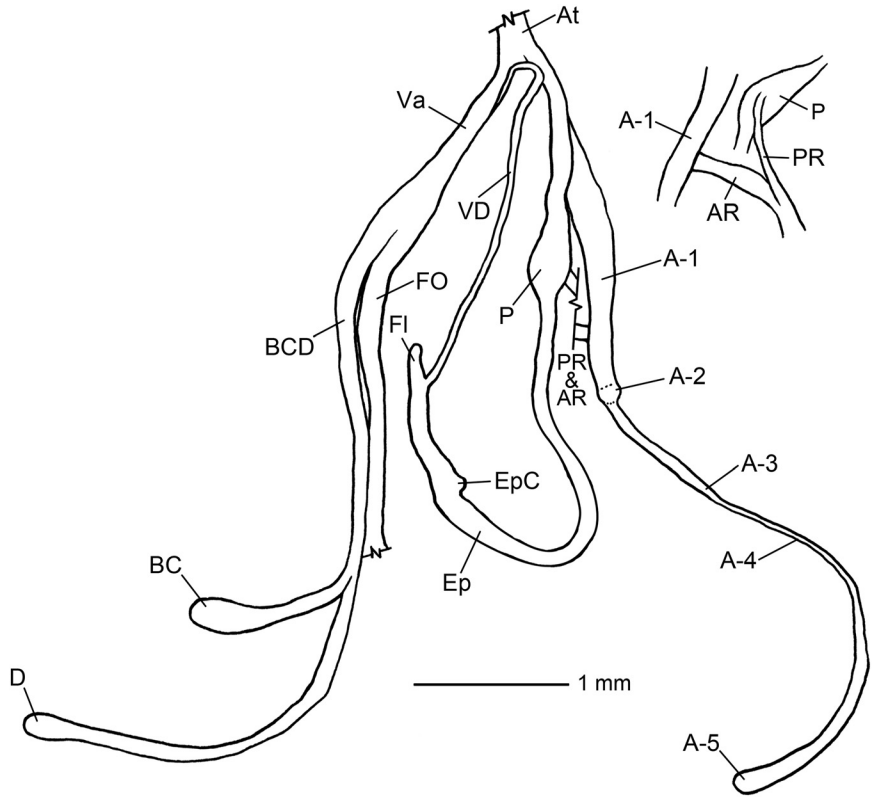

Fig. 2. Genital anatomy of *Petraeomastus liuzhengpingi* sp. n

thickness; entering epiphallus apically with distinct demarcation. Epiphallus long; cylindrical; forming a loop; externally smooth. Epiphallic caecum present; blunt apically; located near vas deferens entrance. Flagellum short; tubular; proximally normal; with tip blunt. Penis with terminal entrance of epiphallus; clavate; distally expanded. Penial caecum absent. Penial appendix long; branched off from penis at some distance from atrium; divided into sections including A-1+A-2, A-3 and A-4+A-5. A-1 and A-2 fused. A-2 and A-3 not fused. Boundary between A-4 and A-5 indistinct. A-5 long; slightly convoluted. Appendicular retractor and penial retractor long; biramous; attached to the penis in the middle part and to A-1+ A-2; with penial retractor arms arising from diaphragm closed to each other. Additional retractor other than penial or appendicular absent. Muscular band connecting vagina and epiphallus absent. Atrium short; without retractor. Free oviduct longer than vagina. Vagina relatively long; not swollen; straight; unpigmented. Bursa copulatrix duct long; proximally straight. Bursa copulatrix ovoid, with stalk; without apical ligament; normal in size; with short neck; well defined. Diverticle normally present; longer than bursa copulatrix; slightly expanded. Bursa copulatrix and diverticle distinguishable; forked more distally from their base.

Fig. 3. Living specimens of *Petraeomastus liuzhengpingi* sp. n. on the bushes and grass

Etymology: The species is named after Zheng-Ping Liu, an amateur Chinese conchologist who provided sample locality and assisted in the field survey.

Vernacular name: 正平鸟唇螺 zhèng píng niǎo chún luó.

Distribution and ecology. The new species is only known from the Daduhe River Valley around the Danba County (Figs 5 and 6). It inhabits on rocks, bushes and grass on the cliff facing the river at the right bank and often co-occur with *Bradybaena controversa danbaensis* Chen & Gao, 1980, *B. kangdingensis* Chen & Zhang, 2004, *Subzebrinus fultoni* (Möllendorff, 1901), *Subzebrinus* sp., *Holcauchen micropeas* (Möllendorff, 1901), *Holcauchen brookedolani* (Pilsbry, 1934) and *Serina* sp. (Figs 3 and 4). Individuals exhibiting a detached last whorl and those displaying a normal phenotype typically do not occur in sympatry. The last whorl of this species is fully attached in populations at both the southernmost and northernmost parts of its distribution. However, in the river valley between these two points, the last whorl shows a gradual detachment towards the middle of the area. Therefore, the specimens with the highest degree of detachment are found in the middle of the distributional area.

Remarks: The assignment of the new species in *Petraeomastus* is supported by its morphology: shell pointed-cylindrical, absence of teeth, peristome connected. The new species can easily be distinguished from *P. gredleri* (Hilber, 1883), *P. moellendorffi* (Hilber, 1883), *P. pantoensis* (Hilber, 1883), *P. perrieri* (Ancey, 1884), *P. vidianus* (Heude, 1890), *P. commensalis* (Sturany, 1899), *P. teres* (Sturany, 1899), *P. xerampelinus* (Sturany, 1899), *P. diaprepes*

Fig. 4. Living specimens of *Petraeomastus liuzhengpingi* sp. n. on the rock cliffs

(Sturany, 1900), *P. breviculus* (Möllendorff, 1901), *P. mucronatus* (Möllendorff, 1901), *P. oxyconus* (Möllendorff, 1901), *P. platychilus* (Möllendorff, 1901), *P. semifartus* (Möllendorff, 1901) and *P. qii* Wang & Wu, 2013 by the connected peristome (vs. not connected); from *P. limenghuai* Chen, Dai, Wu & Ouyang, 2024 by the smooth shell (vs. ribbed). It is similar with *P. desgodinsi* (Ancey, 1884), *P. giraudelianus* (Heude, 1882), *P. heudeanus* (Ancey, 1883), *P. neumayri* (Hilber, 1883) and *P. tibetanus* (Pfeiffer, 1857) by the connected peristome, but differs from *P. desgodinsi* and *P. neumayri* by the dextral shell (vs. sinistral), from *P. giraudelianus*, *P. heudeanus* and *P. tibetanus* by the more pointed shell, the more inflated whorls and the deeper suture. Besides, *P. rochebruni* (Ancey, 1884) was described based on a juvenile shell, so the morphology of its peristome is unclear, but the new species can be easily distinguished from it by the dextral and broader shell (vs. sinistral and thinner). The new species was mis-identified as *Pupinidius porrectus pygmaea* (Blume, 1925) by some amateur Chinese conchologist informally. However, *P. porrectus porrectus* (Möllendorff, 1901) and *P. porrectus pygmaea* have a much broader shell (Fig. 7). Based on the examination of 86 specimens, the width of *P. porrectus* is relatively stable and distinct from that of the new species (9.8–13.2 mm vs. 6.3–8.3 mm). Furthermore, the distribution of the two species is not contiguous, with *P. porrectus* occurring in the Kangding section of the middle reaches of the Daduhe River, and the new species present in the Danba section of the upper reaches.

Fig. 5. Distribution of *Petraeomastus liuzhengpingi* sp. n

Fig. 6. Type locality of *Petraeomastus liuzhengpingi* sp. n

Only four species of Enidae in China exhibit a trend of the detached last whorl: *P. porrectus*, *Serina soluta* (Möllendorff, 1901), *S. prostoma* (Ancey, 1884) and the new one, all of which are distributed in the dry-hot river valleys (Yen 1938, Wu 2018). Except for the new species, the remaining three species exhibited a maximum detachment of 1–2 mm in the body whorl at the vicinity of the aperture, akin to the specimen NCUXPWUAN240007 (Fig. 1G). The special morphological character may be attributed to specific environmental influences. Based on field

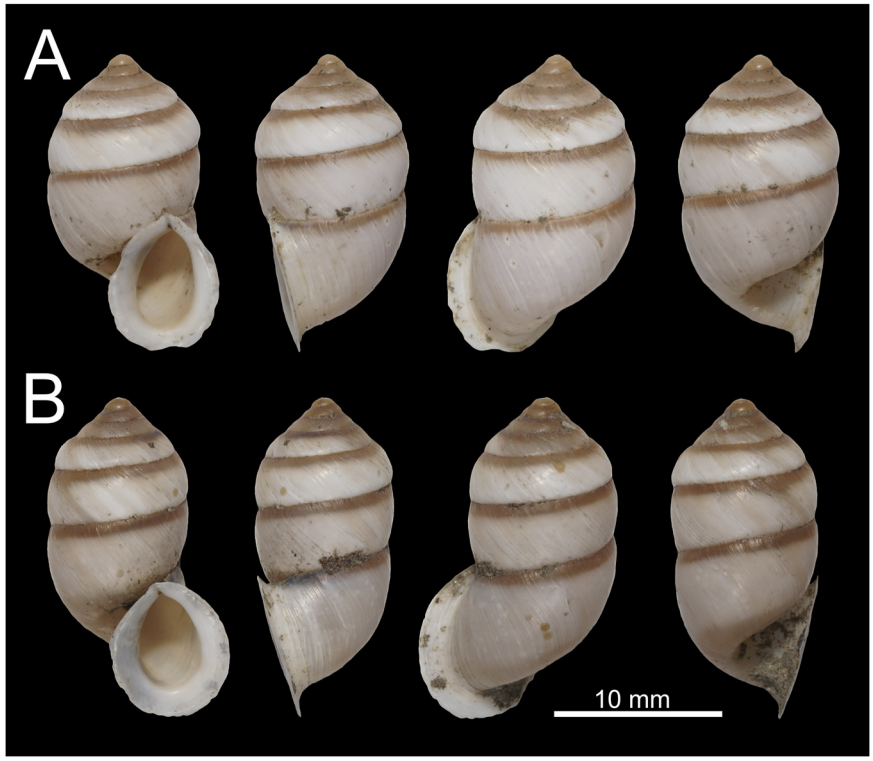

Fig. 7. Pupinidius porrectus. A, *P. porrectus porrectus*; B, *P. porrectus pygmaea*

observations, it was noted that when these species are in a dormant state, the detached last whorl allows their shells to hang in the air (Figs 3 and 4). A similar phenomenon has been observed in *Stenogyropsis chorismenostoma* Chen, Huang & Páll-Gergely, 2022, a species belonging to the family Camaenidae Pilsbry, 1895, which also exhibits a detached last whorl and has an overlapping distribution (Chen, Huang & Páll-Gergely 2022). After measurement, it was found that the rock and soil surfaces in the dry-hot river valleys can exceed 70°C during the summer months. The detached last whorl may assist land snails in dissipating heat and avoiding burns, thereby enabling them to survive in extremely hot environments.

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