

Two new species of the genus *Pupina* (Caenogastropoda: Pupinidae) from Northwestern Vietnam

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Abstract. Two new species of the genus *Pupina* are described from Son La Province, Northwestern Vietnam. *Pupina sonlaensis*, new species, has a small shell devoid of prominent sculpture on its highly glazed surface. It has a well-developed triangular parietal tooth and a funnel-like anterior canal, appearing as a slit on the inside, widened on outer margin, and bordered by a thickened collumellar margin. *Pupina thaitranbairi*, new species, has small shell sculptured with dense radial striae, and a unique spike-like protrusion at the anterior canal.

Key words. Pupinidae, *Pupina*, new species, Son La, Vietnam

INTRODUCTION

The Pupinidae Pfeiffer, 1853, is a rather large family of terrestrial snails generally characterised by their “pupoid” shell (Kongim et al., 2013; Páll-Gergely et al., 2014). Approximately twenty pupinid genera are recognised, and they are widely distributed from South and East Asia to Melanesia, Micronesia and northern Australia (Kobelt, 1902; Vaught 1989; Kongim et al., 2013; Egorov, 2013). In Vietnam, some 10 genera of the pupinids have thus far been reported (Kobelt, 1902; Varga, 1972; Pain, 1974; Vermeulen et al., 2007; Páll-Gergely et al., 2015). Of these, the genus *Pupina* Vignard, 1829, is the most speciose with 13 nominal species recorded in Vietnam so far (Kobelt, 1902; Dautzenberg & Fischer, 1905, 1908).

Members of the *Pupina* are distributed from Southeast Asia to China, Japan, Australia and Papua New Guinea (Bavay & Dautzenberg, 1899; Kobelt, 1902; Dautzenberg & Fischer, 1905; Yen, 1939; Egorov, 2013). The genus is generally characterised by their rather small, elongate-ovate pupoid shell, with lustrous enamel-like coating, a thickened or reflected peristome, presence of an anterior canal at the base of the columella and a parietal tooth at the angular corner of the aperture (sometimes forming a posterior canal in the peristome) near the suture (Kobelt, 1902; Egorov, 2013). In Vietnam, there have been very few taxonomic studies on *Pupina*. All of the known pupinid fauna was described during the late 19th to early 20th century, and often based on very brief descriptions (Morelet, 1862; Mabilie, 1887a; Mabilie, 1887b; Möllendorff, 1901).

Recent terrestrial snail surveys in the Son La Province, Northwestern Vietnam surveys have yielded a large number of species including several pupinids (see Do et al., 2015). However, two of these could not be classified with any known species known from Vietnam. They are described as new species based on their shell morphology in this paper.

MATERIAL AND METHODS

The studied material was collected from the limestone area of Muong La, Thuan Chau, and Van Ho Districts, Son La Province, Vietnam. Elevation and geographical coordinates for localities were obtained using a Garmin map 76CSx GPS unit. Empty shells were recovered from rock crevices and under leaf litter deposited at the base of limestone outcrops. The collecting localities are situated between 700–1200 m above mean sea level, with mixed deciduous and limestone forests.

Descriptions are based on the external shell morphology and colouration of 33 empty shells. Complete adult specimens (i.e. shells with a thickened peristome) were used to determine whorl number and dimensions. Shell height (SH) and shell width (SW) were measured using Vernier calipers. These specimens were deposited in the following institutions: Soil Organism Research Center (SORC) and Museum of Biology of Hanoi National University of Education (HNUE), Vietnam, and Zoological Reference Collection (ZRC), of the Lee Kong Chian Natural History Museum, Singapore.

TAXONOMY

Superfamily Cyclophoroidea Gray, 1847

Family Pupinidae Pfeiffer, 1853

Genus *Pupina* Vignard, 1829

Type species. *Pupina keraudreni* Vignard, 1829.

***Pupina sonlaensis* Do, new species**

(Figs. 1, 2A, 3A; Table 2)

Pupina sp.1 – Do et al., 2015: 126, fig. 6D.

Type specimens. Holotype: 1 ex. (SH 10.8 mm, SW 5.6 mm) (HNUE-OC 00108), limestone karst in Muong Bu Commune, Muong La District, Son La Province, Vietnam (21°25'26"N, 104°01'34"E; at elevation 711 m), coll. Do Duc Sang & Nguyen Thanh Lap, 12 October 2013. Paratypes: 7 ex. (SORC 1045), 3 ex. (HNUE-OC), 3 ex. (ZRC.MOL. 9377), same data as holotype.

Non-type material examined. 7 ex. (SORC 1046), 3 ex. (SORC 1046), limestone forests in Quynh Thuan Village, Bo Muoi Commune, Thuan Chau District, Son La Province (21°27'48"N, 103°49'26"E; elevation 631 m), coll. Do Duc Sang, 4 October 2014; 8 ex. (SORC 1047), limestone forests in Pa Cop Village, Van Ho Commune, Van Ho District, Son La Province (20°45'56"N, 104°44'33"E; elevation 1013 m), coll. Tran Thi Quynh & Do Duc Sang, 26 October 2013.

Etymology. The specific epithet “*sonlaensis*” is derived from its type locality Son La Province of Vietnam, with the Latin suffix “-ensis” added to form an adjective.

Diagnosis. Anterior canal funnel-like, appearing as a slit on the inside, widened on outer margin, bordered by a thickened collumellar margin. Parietal tooth well-developed, triangular. Umbilicus closed.

Description. Shell small (SH 10.23–10.80 mm), elongate-ovate, solid, glassy-white to brownish yellow, and devoid of prominent sculpture on the highly glazed smooth surface. Apex obtuse. Shell surface with rather regular, inconspicuous growth lines. Microscopic radial ridges about two times denser on last whorl than on penultimate whorl. Whorls 6–6½, early whorls slightly convex, last whorl large, about two-thirds of shell height, and relatively convex in front. Spire somewhat extended and strongly convex. Sutures moderately impressed, but shallow. Aperture circular; outer lip thickened and moderately flaring. Parietal callus sharply defined and thickened with whitish or pale yellow tint. Peristome simple, thickened, somewhat reflexed, and interrupted by two canals. Posterior canal continues vertically upward and forming narrow groove, which is bordered by thickened lip and parietal tooth. Anterior canal funnel-like, appearing as a slit on the inside and widening towards the outer margin, with thickened collumellar margin overhanging in the inner margin. Parietal tooth triangular, well-developed, and obliquely positioned. Umbilicus closed.

Distribution. The new species is known from several limestone karsts in Muong La District, Thuan Chau District and Van Ho District, Son La Province, Northwestern Vietnam.

Remarks. The new species is somewhat similar to *P. tonkiana* Bavay & Dautzenberg, 1899 (Figs. 2C, 3C, from Lang Son Province, Vietnam), but the latter is more slender

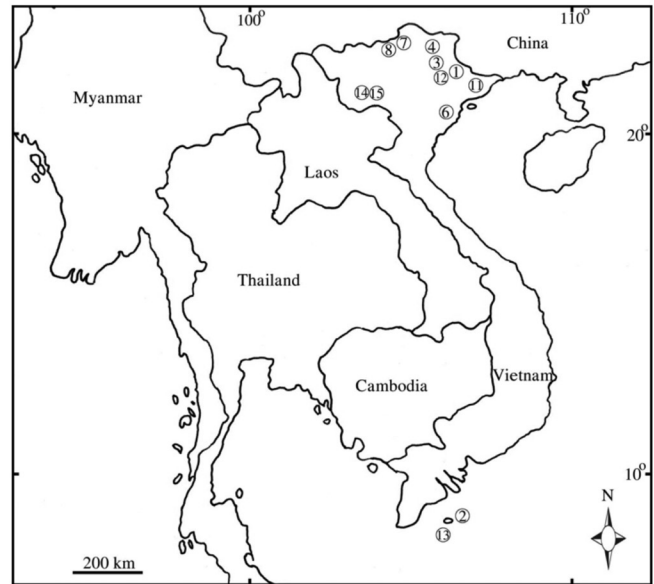


Fig. 1. Approximate geographic positions of the type localities of *Pupina* species of Vietnam. The numbers correspond to the species list in Table 1.

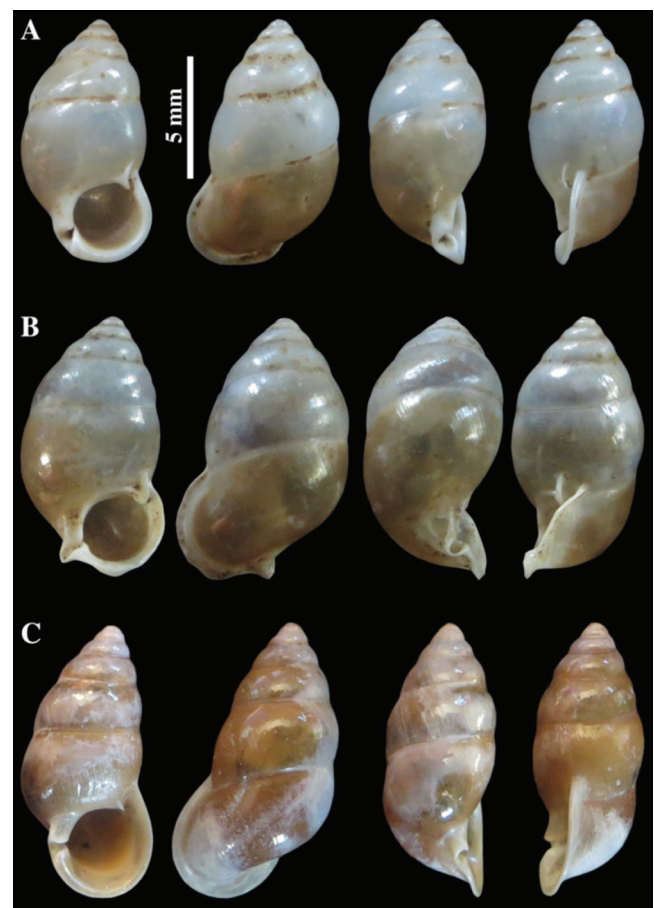


Fig. 2. Shells of *Pupina* spp.: A, *Pupina sonlaensis* n. sp. (holotype HNUE-OC 00108); B, *Pupina thaitranbaii*, n. sp. (holotype, HNUE-OC 00109); C, *Pupina tonkiana* Bavay & Dautzenberg, 1899 (HNUE-OC 00106).

Table 1. Known species of *Pupina* and their reported distribution from Vietnam (References: 1, Bavay & Dautzenberg (1899); 2, Fischer (1898); 3, Bavay & Dautzenberg (1903); 4, Dautzenberg (1893); 5, Dautzenberg & Fischer (1905); 6, Mabille (1887b); 7, Möllendorff (1884); 8, Möllendorff (1901); 9, Morelet (1862).

S/N	Species name	Localities	Reference
1	<i>P. anceyi</i> Bavay & Dautzenberg, 1899	Lang Son, Vietnam	1
2	<i>P. laffonti</i> Ancey, 1899	Ba Ria - Vung Tau, Vietnam	1
3	<i>P. tonkiana</i> Bavay & Dautzenberg, 1899	Lang Son, Vietnam	1
4	<i>P. billeti</i> Fischer, 1898	Cao Bang, Vietnam	2
5	<i>P. brachysoma</i> Ancey, 1903	Northern, Vietnam	3
6	<i>P. dorri</i> Dautzenberg, 1893	Hai Phong, Vietnam	4
7	<i>P. douvillei</i> Dautzenberg & Fischer, 1905	Ha Giang, Vietnam	5
8	<i>P. verneui</i> Dautzenberg & Fischer, 1905	Ha Giang, Vietnam	5
9	<i>P. exclamationis</i> Mabille, 1887	Northern, Vietnam	6
10	<i>P. illustris</i> Mabille, 1887	Northern, Vietnam	6
11	<i>P. flava</i> Möllendorff, 1884	Quang Ninh, Vietnam	7
12	<i>P. solidula</i> Möllendorff, 1901	Lang Son, Vietnam	8
13	<i>P. vescoi</i> Morelet, 1862	Ba Ria - Vung Tau, Vietnam	9
14	<i>P. sonlaensis</i> , n. sp.	Son La, Vietnam	This study
15	<i>P. thaitranbaii</i> , n. sp.	Son La, Vietnam	This study

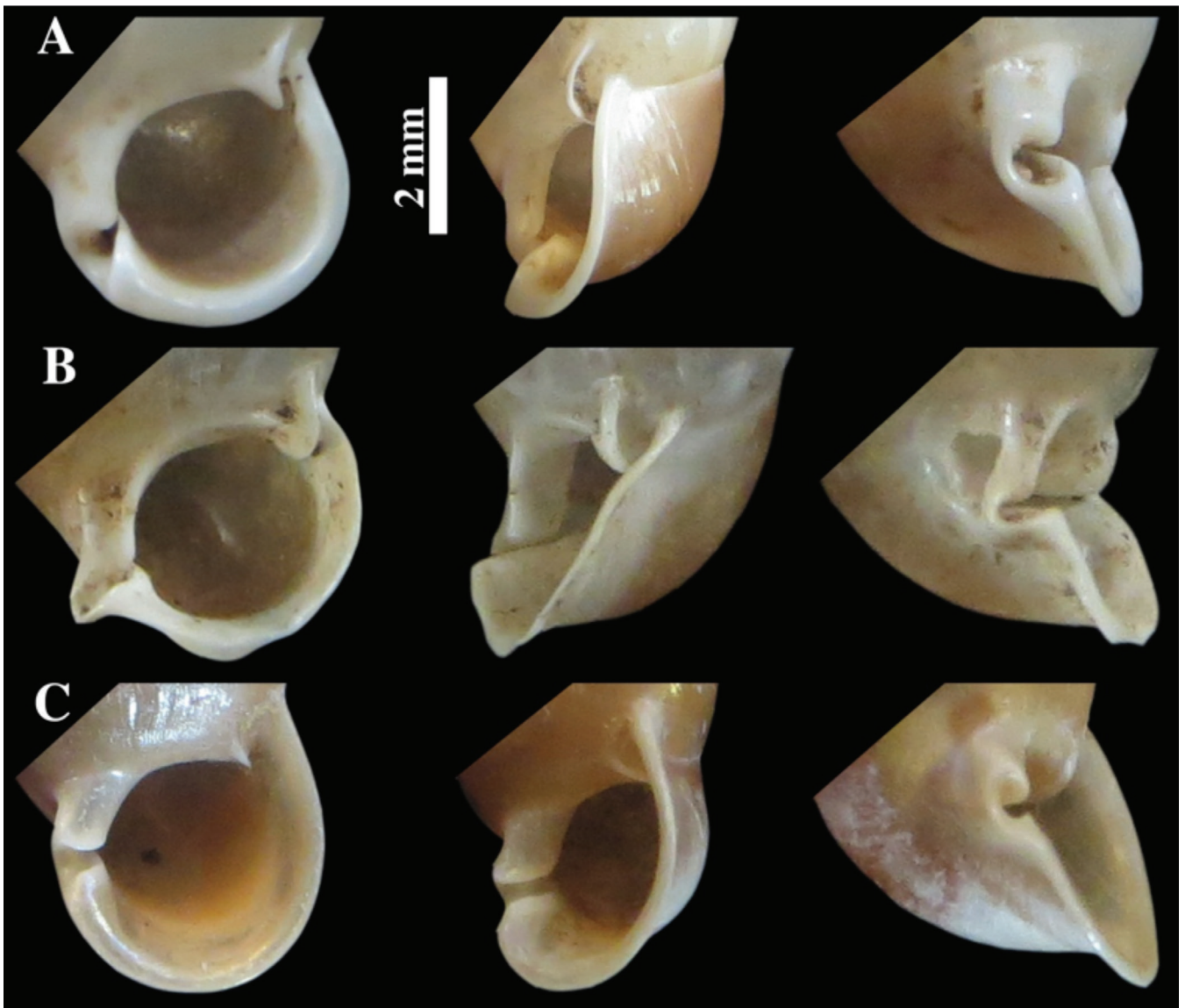


Fig. 3. Close-up views of the apertures of the different species: A, *Pupina sonlaensis* n. sp. (holotype HNUE-OC 00108); B, *Pupina thaitranbaii*, n. sp. (holotype, HNUE-OC 00109); C, *Pupina tonkiana* (HNUE-OC 00106).

Table 2. Shell size variation of *Pupina sonlaensis* n. sp. and *P. thaitranbairi* n. sp. (SH= shell height, SW= shell width). Specimen collections and catalogue numbers are indicated in parentheses.

Species, Locality and (SORC nos.)	No. of Specimens	Ranges, Mean \pm S.D. (mm) of the Shell			Whorl ranges
		SH	SW	SH/SW Ratio	
<i>P. sonlaensis</i> , n. sp.					
Muong Bu, Muong La (1045)	7	10.40–10.80 10.60 \pm 0.40	5.30–5.60 5.5 \pm 0.28	1.9–2.0	6–6½
Bo Muoi, Thuan Chau (1046)	7	10.51–10.72 10.59 \pm 0.39	5.28–5.56 5.40 \pm 0.22	1.8–2.0	6–6½
Van Ho, Van Ho (1047)	8	10.23–10.71 10.48 \pm 0.43	5.27–5.51 5.41 \pm 0.26	1.9–2.0	6–6½
<i>P. thaitranbairi</i> , n. sp.					
Van Ho, Van Ho (1048)	6	9.90–10.20 10.12 \pm 0.31	5.20–5.30 5.27 \pm 0.20	1.8–1.9	6–6¼

Table 3. Comparison of the number of whorls, sizes and colouration of the shells of *Pupina* species of Vietnam (References: 1, Bavay & Dautzenberg (1899); 2, Fischer (1898); 3, Bavay & Dautzenberg (1903); 4, Dautzenberg (1893); 5, Dautzenberg & Fischer (1905); 6, Mabilie (1887b); 7, Möllendorff (1884); 8, Möllendorff (1901); 9, Morelet (1862). Abbreviations: W, number of whorls; SH, shell height; SW, shell width.

Species	W	SH (mm)	SW (mm)	SH/SW Ratio	Shell Colour	Reference
<i>P. anceyi</i>	6½	8.0	5.0	1.60	Orange	1
<i>P. laffonti</i>	6	6.5	4.0	1.62	Pale yellow	1
<i>P. tonkiana</i>	7	10.5	5.0	2.10	Pale brown	1
<i>P. billeti</i>	5½	7.0	4.5	1.55	Brown	2
<i>P. brachysoma</i>	5	5.5	4.0	1.37	Pale red	3
<i>P. dorri</i>	6	6.5	4.0	1.62	Dark orange	4
<i>P. douvillei</i>	5	8.0	5.0	1.60	White	5
<i>P. verneai</i>	5	7.0	4.0	1.75	Pale yellow	5
<i>P. exclamationis</i>	5½	7.0	4.5	1.55	Reddish yellow	6
<i>P. illustris</i>	6	11.0	5.0	2.20	Yellow	6
<i>P. flava</i>	6	7.25	4.0	1.81	Brownish yellow	7
<i>P. solidula</i>	5	6.6	3.7	1.78	Pale yellow	8
<i>P. vescoi</i>	5	11.0	6.0	1.83	Dark yellow	9
<i>P. sonlaensis</i> n. sp.	6½	10.8	5.6	1.93	Brownish yellow	This study
<i>P. thaitranbairi</i> n. sp.	6¼	10.2	5.3	1.92	Brownish yellow	This study

and more tapering in shape. The anterior canal of *P. tonkiana* is a simple open groove, but is thickened and overhanging at the leading edges in *P. sonlaensis* n. sp. Moreover, *P. tonkiana* has a short, small and thin parietal tooth, while the parietal tooth of *P. sonlaensis* n. sp. is distinctly larger and forms a distinct narrow posterior canal. *P. sonlaensis* n. sp. shows little intraspecific conchological variation, except shell size (Table 2). The operculum is unknown.

***Pupina thaitranbairi* Do, new species**
(Figs. 1, 2B, 3B; Table 2)

Pupina sp.2 – Do et al., 2015: 126, fig. 6E.

Type specimens. Holotype: 1 ex. (SH 10.2 mm, SW 5.3 mm) (HNUE-OC 00109), limestone forest in Pa Cop Village, Van Ho Commune, Van Ho District, Son La Province, Vietnam

(20°45'56"N, 104°44'30"E; elevation 1,013 m), coll. Do Duc Sang & Vu Thu Phuong, 26 October 2013. Paratypes: 6 ex. (SORC 1048), same data as holotype.

Etymology. The new species is dedicated to Professor Thai Tran Bai, of the Hanoi National University of Education, who has continuously supported terrestrial snail research in Vietnam.

Diagnosis. Anterior canal appears as a slit on the side, forming a long gutter, and extends into a spike-like protrusion. Parietal side of peristome thickened, with a prominent keeled edge. Umbilicus open and deep.

Description. Shell small (SH 9.9–10.2 mm), elongate-ovate, brownish yellow to glassy-white. Apex obtuse. Shell surface sculptured with rather regular radial striae, which are slightly

oblique, distinct, thin, densely placed, and usually slightly more widely spaced on the last whorl. Whorls 6–6¼, early whorls slightly convex, last whorl large about two-thirds of shell height and relatively convex in front. Spire somewhat extended and convex. Sutures shallowly impressed. Aperture circular, the parietal side with a low ridge, which merges into the parietal tooth. Outer lip thickened and broadly expanded. Parietal callus white, sharply defined and thickened. Peristome simple, thickened, somewhat reflexed, and interrupted by two canals. Posterior canal continues vertically upward and forming narrow groove, bordered by thickened lip and parietal tooth. Anterior canal appearing as a slit on the side, forming a long gutter that terminates as a spike-like process. Parietal tooth well-developed, whitish and triangular shape. Umbilicus open and deep.

Distribution. The new species is thus far known only from the limestone forest in Pa Cop Village, Van Ho Commune, Van Ho District, Son La Province, Vietnam.

Remarks. The unique and prominent spike-like protrusion at the anterior canal is most diagnostic in distinguishing *P. thaitranbaii* sp. n. from other congeneric species in Vietnam. Operculum unknown.

ACKNOWLEDGEMENTS

I wish to express sincere gratitude to Páll-Gergely Barna for his suggestions, kind help and encouragement to carry out this study. I sincerely thank Nguyen Thanh Lap, Vu Thu Phuong, and Tran Thi Quynh for assistance during fieldwork. I would like to express my gratitude for the comments of the anonymous referees and Tan Siong Kiat that improved the manuscript.

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