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A new species of the genus *Sinoennea* Kobelt, 1904 (Pulmonata: Diapheridae) from Son La, Northwestern Vietnam

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Abstract. A new species of diapherid snail in the genus *Sinoennea* Kobelt, 1904, is described from Son La Province, Northwestern Vietnam. *Sinoennea copiaensis*, new species, has a cylindrical glassy white shell sculptured with regularly spaced axial ribs. The parietal side of the peristome extends over part of the penultimate whorl. Three apertural teeth are present, including one large parietal, one basal, and one columellar. This new species is similar to *Sinoennea hippocrepis* (Bavay & Dautzenberg, 1912), but clearly differs from the latter by its larger shell with more whorls, and an additional parietal tooth. This is the first species of genus *Sinoennea* to be reported from Son La province.

Key words. Diapheridae, *Sinoennea,* new species, Son La, Vietnam

INTRODUCTION

The pulmonate land snail family Diapheridae Panha & Naggs in Sutcharit et al., 2010, have been established as a sister group to the Streptaxidae sensu stricto. Only two genera, *Diaphera* Albers, 1950, and *Sinoennea* Kobelt, 1904, were provisionally included (Sutcharit et al., 2010). The Diapheridae can generally be recognised by their small sized, cylindrical or ovoid, high-spired shells. About 100 nominal species are found in India, China, Japan, South Korea, Thailand, Malaysia, Indonesia, Myanmar, Philippines, and Vietnam (Yen, 1939; Berry, 1963; Panha & Burch, 1998, 2005; Schileyko, 2000; Sutcharit et al., 2010; Tanmuangpak et al., 2015).

The most prominent conchological characteristics of the diapherid genus *Sinoennea* are the very small to small white glassy cylindrical or ovoid shell, sculptured with numerous axial ribs on the whorls, a usually closed umbilicus, and impressed suture (van Benthem Jutting, 1961). Shells of *Sinoennea* Kobelt, 1904, differ mainly from *Diaphera* Albers, 1850, in the last whorl, which is not partially detached (Albers, 1850; van Benthem Jutting, 1961; Sutcharit et al., 2010).

Six nominal species of the genus *Sinoennea* are thus far known from Vietnam (Bavay & Dautzenberg, 1912; Schileyko, 2011). Most species have narrow distributions (Schileyko, 2011). Three species, *S. atomaria*, *S. calva*, and *S. plagiostoma* are recorded in coastal areas of Northeastern Tonkin (Hai Phong & Quang Ninh) (Dautzenberg, 1893; Möllendorff, 1901). Two species, *S. hippocrepis* and *S. macrodonta* are recorded from Northwestern Tonkin (Lao Cai & Lai Chau) (Bavay & Dautzenberg, 1912). *Sinoennea ovulum* is recorded in Northeastern Tonkin (Lang Son) (Bavay & Dautzenberg, 1912).

During terrestrial snail surveys in several locations in the Son La Province, Northwestern Vietnam, shells of an unknown *Sinoennea* species were collected from limestone karst at Copia Natural Reserve (Fig. 1). Based on these specimens, a new species of this genus is herein proposed.

MATERIAL AND METHODS

Terrestrial snails were sampled throughout Son La Province, Northwestern Vietnam from 2010–2014. Collecting was done in various habitats including limestone forests, caves, and limestone karsts. Fifty seven empty shells of an unidentified diapherid were collected from the surface leaf litter at the foot of limestone outcrops as part of the sampling efforts. Complete adult shells were counted for whorl number (W), and measured for shell height (SH), shell width (SW), aperture height (AH), and aperture width (AW). The terminology used in the description of their shell characters follow Dautzenberg (1893), Möllendorff (1901), Bavay & Dautzenberg (1912), van Benthem Jutting (1961), and Tanmuangpak et al. (2015). The shell mentioned in the examined material refers to empty shell.

Materials examined in this study are deposited in the following institutions: SORC, Soil Organism Research Center of Hanoi National University of Education (HNUE); VNMN,

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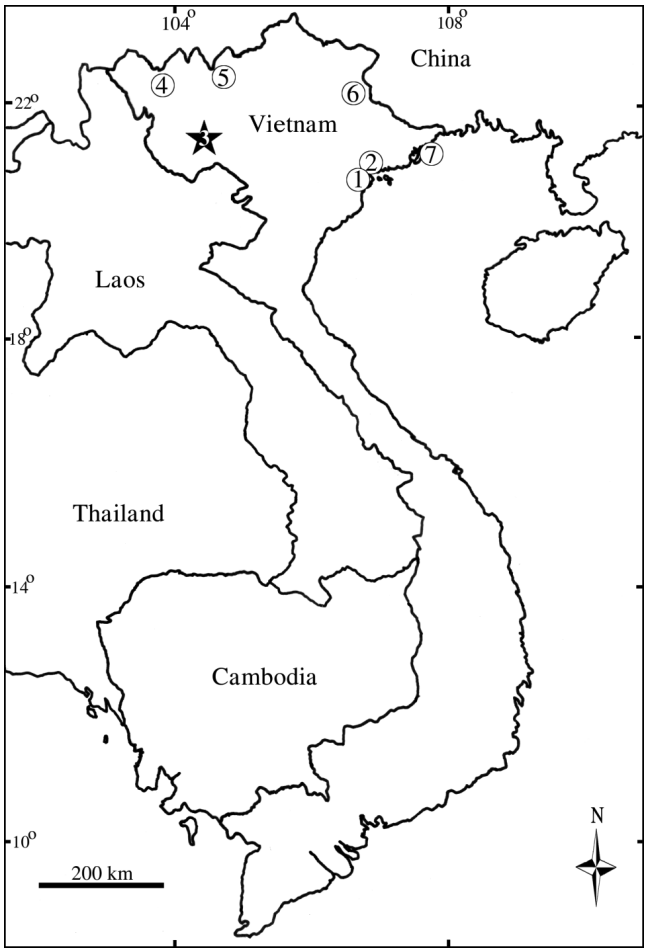

Fig 1. Map showing the type localities of known species of *Sinoennea* from Vietnam with Copia Natural Reserve, Thuan Chau District, Son La Province, Vietnam, the type locality of *Sinoennea copiaensis* n. sp., marked with a star: 1, *S. atomaria*; 2, *S. calva*; 3, *S. copiaensis*; 4, *S. hippocrepis*; 5, *S. macrodonta*; 6, *S. ovulum*; 7, *S. plagiostoma*.

The Vietnam National Museum of Nature; HNUEM, Hanoi National University of Education Museum of Biology.

Abbreviations. B, basal tooth; C, columellar tooth; P, parietal tooth; PL, palatal tooth.

TAXONOMY

Family Diapheridae Panha & Naggs in Sutcharit, Naggs, Wade, Fontanilla & Panha, 2010

Genus *Sinoennea* Kobelt, 1904

Type species. *Ennea strophioides* Gredler, 1881

Sinoennea copiaensis, new species
(Fig. 2A–E, Table 2)

Material examined. Holotype: SORC 1130 (Fig. 2). Measurements: shell height (SH) 13.56 mm, shell width (SW) 3.43 mm; type locality: limestone karst in Copia Natural Reserve, Thuan Chau District, Son La Province, Northwestern Vietnam (21°25’25”N, 103°31’18”E, 1.246 m),

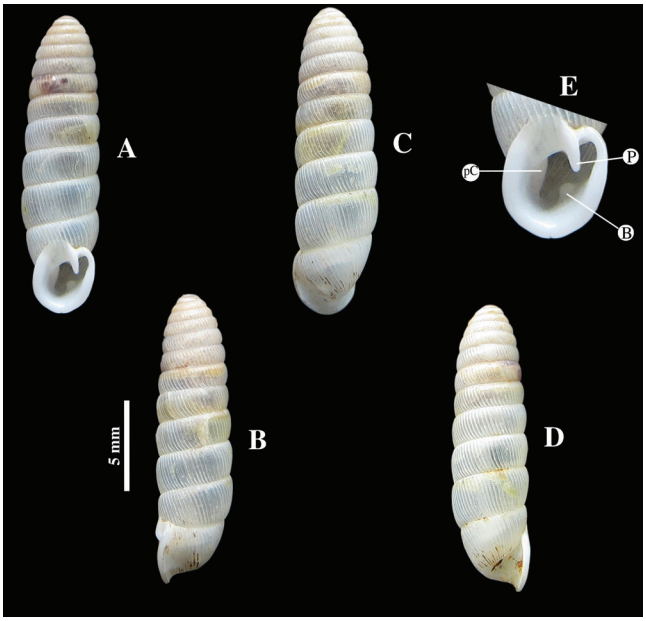

Fig. 2. *Sinoennea copiaensis*, new species, holotype (SORC 1130) ((SH 13.56 mm, SW 3.43 mm, AH 3.11 mm, AW 2.85 mm): A, apertural view; B and D, side view; C, dorsal view; E, close up view of the aperture (P, parietal tooth; pC, plate-like tooth; b, basal tooth).

coll. Do Duc Sang & Nguyen Thi Huyen, 8 June 2013. Paratypes: SORC 1131 (8 shells), HNUEM (3 shells), same data as holotype.

Non-type material examined. Limestone forests in Quyet Thang, Co Noi, Mai Son, Son La (21°19’23”N; 104°08’12”E; 687 m): SORC 1132 (5 shells), HNUEM (3 shells), coll. Phung Thi Ngoc & Do Duc Sang, 25 September 2013; Natural forest in Pa Kha, Long Luong, Van Ho, Son La (20°46’35”N; 104°50’48”E; 1.017 m): SORC 1133 (12 shells), HNUEM (4 shells), coll. Vu Thu Phuong & Tran Thi Quynh, 5 August 2014; Limestone forests in Na Hoi, Chieng Khoang, Quynh Nhai, Son La (21°33’20”N; 103°41’06”E; 376 m): SORC 1134 (8 shells), coll. Do Duc Sang, 16 September 2014; Limestone mountain in Nang Phai, Muong Bu, Muong La, Son La (21°28’26”N; 103°01’34”E; 721 m): SORC 1135 (13 shells), coll. Do Duc Sang & Nguyen Thanh Lap, 27 October 2013.

Etymology. The specific epithet is derived from the type locality of this new species, the Copia Natural Reserve, Son La Province.

Diagnosis. Shell high-spired, cylindrically pupiform with regular vertical ribs; glassy white and shiny. Parietal side of the peristome extended over a part of the penultimate whorl. Umbilicus narrow, hidden by the last part of the last whorl. Aperture oblique, quadrangular with rounded angles. Peristome smooth, continuous; lip thickened and expanded. Aperture with one large parietal tooth, which points towards the basal tooth.

Description. Shell small to medium sized (SH 11.00–14.60 mm, SW 3.10–4.02 mm, AH 3.10–3.40 mm, AW 2.51–2.90

Table 1. Known species of *Sinoennea* and their reported distribution from Vietnam.

Species name	Localities	Reference
S. atomaria	Hai Phong	Dautzenberg, 1893
S. calva	Hai Phong	Dautzenberg, 1893
S. copiaensis, new species	Son La	This study
S. hippocrepis	Phong Tho, Lai Chau	Bavay & Dautzenberg, 1912
S. macrodonta	Muong Kong, Muong Khuong, Lao Cai	Bavay & Dautzenberg, 1912
S. ovulum	That Khe, Trang Dinh, Lang Son	Bavay & Dautzenberg, 1912
S. plagiostoma	Ha Long Bay, Quang Ninh	Möllendorff, 1901

Table 2. Shell size variation of *Sinoennea copiaensis*, new species, shell height (SH), shell width (SW), aperture height (AH), aperture width (AW). Specimen collections and catalogue numbers are indicated in parentheses.

Locality (SORC nos.)	No. of Specimens	Ranges, Mean ± S.D. (mm) of the Shell			
		SH	SW	AH	AW
Copia, Thuan Chau, Son La (1130, 1131)	9	13.51–14.60 13.92 ± 0.54	3.42–4.02 3.55 ± 0.36	3.08–3.40 3.11 ± 0.18	2.66–2.90 2.85 ± 0.12
Co Noi, Mai Son, Son La (1132)	5	11.12–14.23 12.86 ± 0.79	3.31–3.60 3.42 ± 0.17	3.04–3.32 3.26 ± 0.14	2,69–2.89 2.83 ± 0.08
Long Luong, Van Ho, Son La (1133)	12	12.30–14.51 13.89 ± 0.61	3.32–3.89 3.60 ± 0.46	3.13–3.37 3.22 ± 0.12	2,72–2,83 2.78 ± 0.05
Muong Bu, Muong La, Son La (1135)	13	11.00–12.63 12.35 ± 0.32	3.10–3.64 3.22 ± 0.38	3.02–3.35 3.30 ± 0.15	2.51–2.78 2.62 ± 0.12
Chieng Khoang, Quynh Nhai, Son La (1134)	8	11.42–13.04 12.57 ± 0.40	3.22–3.91 3.51 ± 0.31	3.10–3.28 3.19 ± 0.09	2.61–2.74 2.65 ± 0.06

Table 3. Shell measurements and apertural teeth of *Sinoennea* spp., shell height (SH), shell width (SW), number of whorls (W) (Reference: 1 = Dautzenberg (1893); 2 = Bavay & Dautzenberg (1912); 3 = Möllendorff (1901); 4 = Gredler (1885); 5 = Ouyang et al. (2012); 6 = Tanmuangpak et al. (2015); 7 = Dumrongrojwattana & Wongkamhaeng (2013); 8 = van Benthem Jutting (1961).

Species name	W	SH (mm)	SW (mm)	Apertural teeth	Reference
Sinoennea species from Vietnam					
S. atomaria	5	2.50	1.33	4: 1P, 1PL, 1B, 1C	1
S. calva	6	4.00	2.00	4: 1P, 1PL, 1B, 1C	1
S. copiaensis, new species	12–13	11.0–14.6	3.10–4.02	3: 1P, 0PL, 1B, 1C	This study
S. hippocrepis	10	8.00	2.50	2: 1P, 0PL, 0B, 1C	2
S. macrodonta	6.5	3.00	1.30	4: 1P, 2PL, 0B, 1C	2
S. ovulum	6.5	3.00	1.75	5: 1P, 2PL, 1B, 1C	2
S. plagiostoma	7.5	3.80	1.80	4: 1P, 1PL, 1B, 1C	3
Sinoennea species from China					
S. fuchsi	8	5.00–5.50	2.00	2: 1P, 1PL, 0B, 0C	4
S. longtanensis	6	4.10–4.50	2.35–2.45	6: 1P, 2PL, 1B, 2C	5
Sinoennea species from Thailand					
S. loeiensis	6.3	4.10–4.92	2.00–2.27	6: 1P, 2Pl, 1B, 2C	6
S. stunensis	8	3.53–3.61	1.37–1.41	4: 1P, 2PL, 0B, 1C	7
Sinoennea species from Malaysia					
S. perakensis	6-7	4.00–4.60	1.90–2.10	4: 1P, 2PL, 0B, 1C	8
S. tiarella	7	3.00–3.50	1.50–1.70	4: 1P, 2PL, 0B, 1C	8

mm (see also Table 2), dextral, high-spired cylindrically pupiform, glassy, rather transparent and shiny (Fig. 2A–D). Apex obtuse, apical whorls smooth. Profile of shell whorls slightly convex, sculptured with closely set regular axial ribs numbering about 50–52 on the last whorl, 4 ribs or more partially obscured by the parietal callus; suture distinct and deep. Umbilical ribs, which are continuations connect of the external ribs of the last whorl are axially aligned and crowded, and extend into the umbilicus. Shell whorls numbering 12 to 13, and regularly increasing in height towards the last whorl. Umbilicus narrow, almost hidden by the last part of the last whorl and reflected outer lip. Aperture oblique, quadrangular with rounded angles. Peristome smooth, continuous, the leading edges thickened and expanded into a reflected lip (Fig. 2E). Aperture with one large tooth projecting from the middle of parietal side and pointing towards the basal tooth (B). The basal tooth (B) is set deeply in the aperture, and on the columellar side is one plate-like tooth (pC) that lies well inside the aperture (Fig. 2E).

Distribution. The new species is known from several limestone karsts in Son La Province, Northwestern Vietnam: Mai Son District, Co Noi Commune; Thuan Chau District, Copia Natural Reserve; Muong La District, Muong Bu Commune; Quynh Nhai District, Chieng Khoang Commune; Van Ho District, Long Luong and Van Ho Commune (Fig. 1).

Remarks. *Sinoennea copiaensis*, new species, belongs to the group with cylindriform shells. The new species differs from congeners in Vietnam by its larger shell with more whorls. The shell shape of the new species is fairly similar to *S. hippocrepis* (of which a population was discovered at Lai Chau Province), but *S. copiaensis* has an additional apertural tooth. Compared to other congeneric species from Vietnam (*S. atomaria*, *S. calva*, *S. macrodonta*, *S. ovulum*, and *S. plagiostoma*), China (*S. fuchsi* and *S. longtanensis*), Thailand (*S. loeiensis* and *S. stunensis*), and Malaysia (*S. perakensis* and *S. tiarella*), the shell of *S. copiaensis* possesses distinctly more whorls (12 to 13 whorls) than the others (see Table 3). *Sinoennea copiaensis*, new species, also differs from all other *Sinoennea* species known from China, Thailand and Malaysia by its larger shell. *Sinoennea copiaensis*, new species, shows little intraspecific conchological variation, except for shell size (see Table 2).

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