NEW TAXA AND DISTRIBUTION DATA OF CLAUSILIIDAE (GASTROPODA: PULMONATA) FROM KARST REGIONS OF SOUTHEAST ASIA

Duc Sang Do[1], Jozef Grego[2] & Miklós Szekeres[3]

[1]Department of Zoology, Faculty of Biology, Tay Bac University, Quyet Tam, Son La, Vietnam
[2]Horná Mičiná 219, SK-97401 Banská Bystrica, Slovakia
[3]Institute of Plant Biology, Biological Research Centre of the Hungarian Academy of Sciences, Temesvári krt. 62, H-6726 Szeged, Hungary
urn:lsid:zoobank.org:pub:53EA50AF-AF2C-4D0E-BDE4–714FF1B8BC31

Abstract Recently obtained mollusc samples provided valuable new information on the Clausiliidae of Laos, Vietnam, and China's Yunnan Province. Grandinenia dautzenbergi abdoui *Grego & Szekeres subsp. nov.,* Grandinenia muratovi *Grego & Szekeres sp. nov.,* Oospira duci smidai *Grego & Szekeres subsp. nov.,* Phaedusa micropaviei hmongorum *Grego & Szekeres subsp. nov.,* Synprosphyma phuonganhae *Do & Szekeres sp. nov., and* Synprosphyma thachi *Grego & Szekeres sp. nov. are described as new taxa, and the zoogeographical partitioning of the Southeast Asian clausiliid fauna is discussed in the light of the novel distribution data of these and some other noteworthy members of the family.*

Key words Garnieriinae, Phaedusinae, new taxa, Southeast Asia, zoogeography

Introduction

This decade saw a remarkably increased interest in the Clausiliidae fauna of Southeast Asia (Grego & Szekeres, 2011; Nordsieck, 2011, 2012, 2014, 2016, 2018; Schileyko, 2011; Grego *et al*., 2014; Do & Do, 2015; Nguyen, 2016, 2017; Páll-Gergely & Szekeres, 2017). In addition to revealing a unique diversity, the results of these publications highlighted environmental factors that limit the distribution of the family or some of its genera, and also helped defining geographic ranges of hitherto little-known species. The present study is based mainly on material that was collected in remote karst regions by Do Duc Sang in Vietnam's Son La Province between 2013 and 2017, as well as by Jozef Grego in the central Xiangkhouang, Xaisomboun and Bolikhamsai Provinces of Laos in 2017.

Materials and Methods

The localities mentioned in the text are numbered (in square brackets) and shown on the map of Fig. 1 with the same numbering. The material from Laos included only empty shells, which were collected in the framework of the International Caving Expedition 'Pha Soung Project' (https://www.lochstein.de/hoehlen/asien/laos/laos2017.htm) toward the end of the dry season.

The type material of the new taxa is housed in the collections of the Field Museum of Natural History, Chicago (FMNH), Florida Museum of Natural History, Gainesville (UF), Hungarian Natural History Museum, Budapest (HNHM), Muséum National d'Histoire Naturelle, Paris (MNHN), Museu de Zoologia da Universidade de São Paulo (MZUSP), Natural History Museum, London (NHMUK), Naturalis Biodiversity Centre, Leiden (RMNH), Naturhistorisches Museum, Vienna (NHMW), Naturhistorisches Museum Bern (NMBE), Naturmuseum Senckenberg, Frankfurt am Main (SMF), Ohio State University Museum of Biological Diversity, Columbus (OSUM), Terrestrial Animal Research Centre, Hanoi (TARC), Jozef Grego (GR), and Miklós Szekeres (SZ).

Systematics

CLAUSILIIDAE
GARNIERIINAE
Garnieria Bourguignat, 1877

Type species: Clausilia mouhoti Pfeiffer, 1862; OD

Garnieria mouhoti (Pfeiffer, 1862)

This species has been recorded from a few locations of Luangprabang Province in Laos

Contact author : szekeres@brc.hu

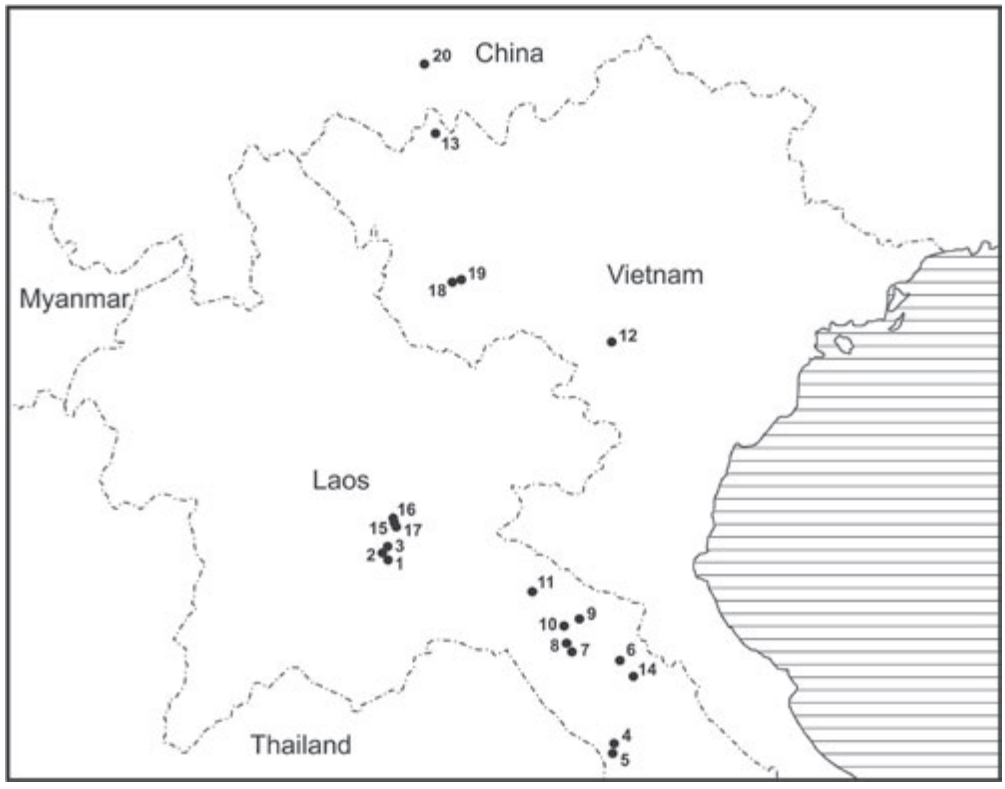

Figure 1 Localities of *Garnieria mouhoti* (Pfeiffer) (1, 2, 3), *Grandinenia amoena* (Nordsieck) (4), *Grandinenia dautzenbergi dautzenbergi* (Morlet) (5, 6, 7, 8, 9, 10), *Grandinenia dautzenbergi abdoui* Grego & Szekeres subsp. nov. (11), *Grandinenia muratovi* Grego & Szekeres sp. nov. (7, 8, 10), *Oospira abstrusa abstrusa* (Szekeres) (12), *Oospira mairei* (Bavay & Dautzenberg) (13), *Oospira duci smidai* Grego & Szekeres subsp. nov. (14), *Phaedusa micropaviei hmongorum* subsp. nov. (1, 15, 16, 17), *Synprosphyma phuonganhae* Do & Szekeres sp. nov. (18, 19), and *Synprosphyma thachi* Grego & Szekeres sp. nov. (20).

(Nordsieck, 2002; Páll-Gergely & Szekeres, 2017), and also from the southern Mengla Xian of Yunnan Province in China (Nordsieck, 2012; Chen, 2016). The known populations vary considerably in size and their tendency to decollate. However, these differences do not seem to follow recognisable geographic patterns, therefore they may not have much taxonomic value (Páll-Gergely & Szekeres, 2017).

The species has been collected by J. Grego at the following further localities in Laos: Xaisomboun Province, 1km from Long Tieng toward Sanasomboun, small cave on the right side of the road (19°05'53.2" N 102°56'19.5" E, 980m) [1] (decollated, GR/12, SZ/2); 10km from Long Tieng toward Phonsavan, caves in a narrow gorge on the right side of the road (19°09'02.5" N 102°53'36.1" E, 1030m) [2] (non-decollated, GR/8, SZ/1); Xiangkhouang Province, 15km from Long Tieng toward Phonsavan, caverns on the left side of the road (19°12'16.3" N 102°55'58.9" E, 1350m) [3] (non-decollated, GR/2).

The new localities in Xaisomboun and Xiangkhouang Provinces considerably extend the known range of the species toward southeast. One may expect that *G. mouhoti* would also occur in unresearched limestone regions of northern Laos, filling a roughly 200km wide gap between the reported occurrences in Laos and China.

Grandinenia Minato & Chen, 1984

Type species: *Steatonenia mirifica* Chen & Gao, 1982; OD.

Grandinenia amoena (Nordsieck, 2002)

Hitherto the only well identifiable occurrence record of this small *Grandinenia* was at Nakai (17°35'09.1" N 105°10'18.2" E, 180m) in Khammouan Province, Laos (Páll-Gergely & Szekeres, 2017). Here another locality is reported from the entrance of a cave at the NE slope of the

Pha Soung Massif (17°33'06.5" N 104°52'18.1" E, 150m) [4] (GR/1) in the same province (leg. J. Grego), about 30km W of the former site.

Grandinenia dautzenbergi (Morlet, 1892)

So far *G. dautzenbergi* has been known only from a few localities in Laos, Khammouan Province (Nordsieck, 2002; Páll-Gergely & Szekeres, 2017). Our data show that the geographic range of the species extends much farther north, almost to the border between Bolikhamsai and Xiangkhouang Provinces. A large form at the northernmost occurrence site represents a new subspecies.

Grandinenia dautzenbergi dautzenbergi (Morlet, 1892)
(Fig. 2a)

The recently discovered new localities of the nominotypical subspecies are as follows:

Laos, leg. J. Grego: Khammouan Province, Thakhek to Ban Na Hoanghoua road, sinkholes at the foot of the Phou Pheomanghong 0.5km N of the Golden Buddha Cave junction (17°29'33.9" N 104°52'02.0" E, 200m) [5] (GR/2); Bolikhamsai Province, NE foot of the Pha Hông limestome massif 7km N of Lak Sao (18°13'54.6" N 104°56'24.5" E, 520m) [6] (GR/2 fragments); 1km from Na Di toward the Vangxouay Dam, isolated limestone hill adjacent to the Pha Gnotsan Massif (18°16'31.4" N 104°42'49.3" E, 440m) [7] (GR/40, SZ/3); right side of the Na Di to Na Xuong road 2km S of Na Xuong, small cave of an isolated karst cone (18°19'20.5" N 104°31'29.2" E, 400m) [8] (GR/1); 16km from Viengthong toward Ban Samsok Noy, cave entrance 500m N of the road (18°33'03.5" N 104°34'11.4" E, 690m) [9] (GR/2); 1km from Viengthong toward Na Di, caves along Road 1D (18°30'16.7" N 104°27'28.4" E, 290m) (GR/3 body whorls) [10].

Grandinenia dautzenbergi abdoui Grego & Szekeres subsp. nov.
(Fig. 2b)

urn:lsid:zoobank.org:act:A6775DA9-CDFF-4900-B95F-C7FA16ED7D74

Differential diagnosis Differs from the nominotypical subspecies by its larger shell that has a finer surface sculpture, more exposed lamella subcolumellaris, and strong lower palatal plica.

Type material Holotype: Laos, Bolikhamsai Province, limestone cliffs near Ban Houai Xieng, 10km NW of Pak Ngeun (18°48'27.8" N 104°11'36.0" E, 360m) [11], leg. J. Grego 20.02.2017 (NHMUK 20180143).

Description The holotype is a shell fragment comprised of the last two whorls. The reddish-brown surface is covered by dense and very fine striae, which do not become stronger at the neck. At the basis there is a weak but well discernable crest. The rounded and detached peristome has a wide whitish margin with reflexed rim. The strong, marginally ending lamella superior is continuous with the much less emerged spiralis. The similarly robust lamella inferior is well visible in front view. Its end part has a straight and thickened section, and then becomes narrower and bends abruptly upward before reaching the peristome. The lamella subcolumellaris descends almost vertically, bending only at its terminal part that is strongly exposed in front view of the aperture. The plica principalis initiates laterally, at the same depth as the start of the arched superior-lunella complex. The latter is fused to a lower plica with long anterior and somewhat shorter posterior part. The clausilium plate with pointed tip is well visible through the aperture.

Measurements Holotype: shell height (H_s) 22.5mm (fragment), shell width (W_s) 8.0mm, aperture height (H_a) 7.5mm, aperture width (W_a) 8.0mm.

Etymology The new subspecies is named after Ahmed Abdou (Muséum National d'Histoire Naturelle, Paris), who collected with Igor V. Muratov during several biodiversity surveys in Laos.

Remarks The type locality of *G. d. abdoui* subsp. nov. represents the northernmost occurrence of the species (Fig. 1), a site that is separated from those of the nominotypical form by the abounding Nam Kading River. The distinctive shell characters and this geographic separation from the other populations seem to justify the classification of this form as a subspecies.

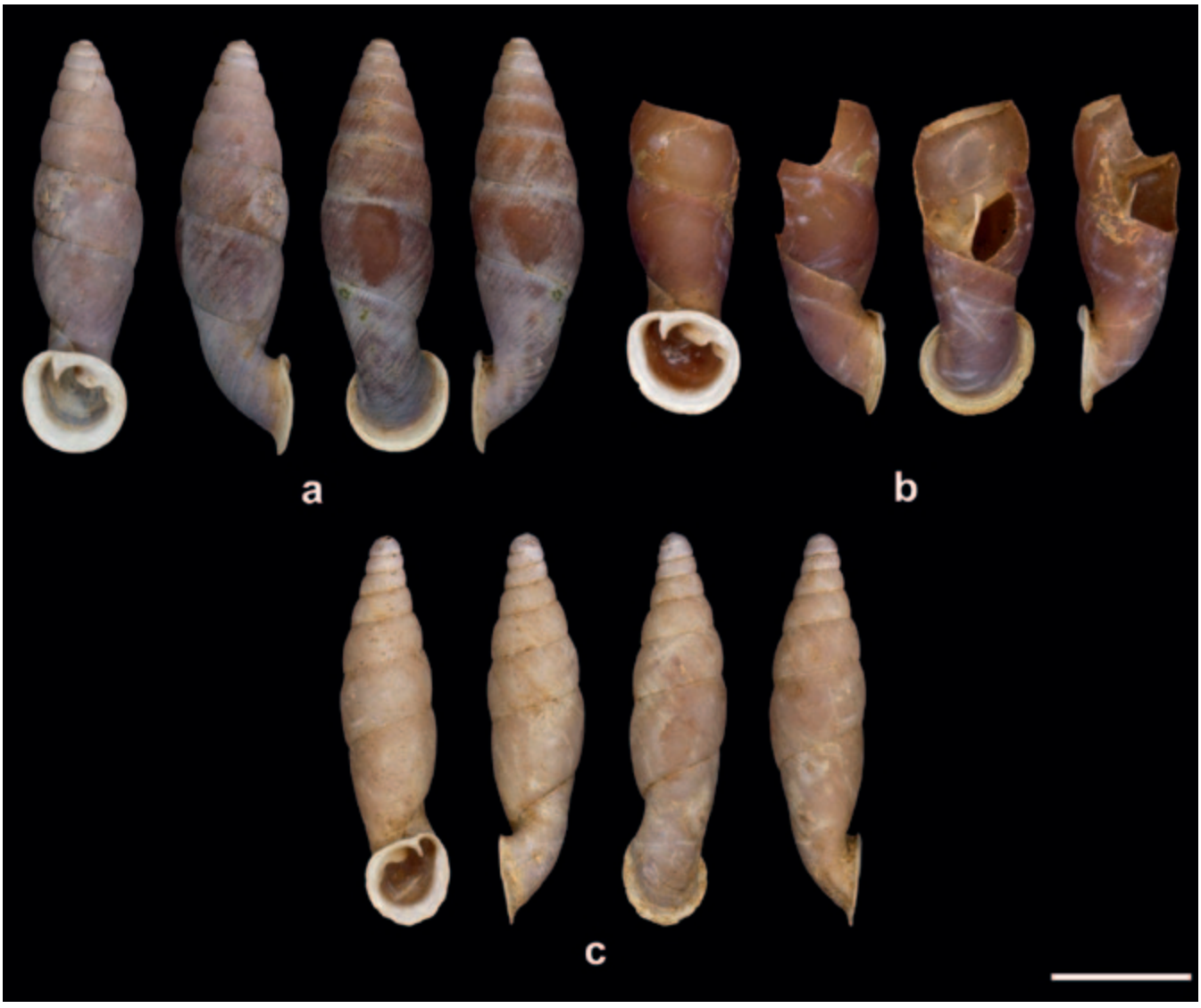

Figure 2 *Grandinenia dautzenbergi dautzenbergi* (Morlet), Laos, Bolikhamsai Province: Na Di to Na Xuong road 2km S of Na Xuong (a); *Grandinenia dautzenbergi abdoui* Grego & Szekeres subsp. nov., holotype, NHMUK 20180143 (b); *Grandinenia muratovi* Grego & Szekeres sp. nov., holotype, NHMUK 20180144 (c). Scale bar: 10mm.

Grandinenia muratovi Grego & Szekeres sp. nov. (Fig. 2c)

urn:lsid:zoobank.org:act:74D8DAAB-EA1C-4DB6–85DA-2F95E38F0879

Differential diagnosis A non-decollated *Grandinenia* that differs from other Laotian species of the genus by its finely and densely costate shell with concave outline, wide, high positioned sinulus, and down-bent outer end of the lamella inferior, whereas from all congeneric species by its dextral coil direction.

Type material Holotype: Laos, Bolikhamsai Province, right side of the Na Di to Na Xuong road 2km S of Na Xuong, small cave of an isolated karst cone (18°19'20.5" N 104°31'29.2" E, 400m) [8], leg. J. Grego 18.02.2017 (NHMUK 20180144). Paratypes: same locality and data (FMNH 384810/1, HNHM 103049/1, MNHN IM-2014–6893/1, MZUSP 138304, NHMW 111664/1, NMBE 554114/1, RMNH MOL.290816/1, SMF 349574/1, UF 516462/1, GR/8, SZ/2).

Further material All from Laos, Bolikhamsai Province (leg. J. Grego): 1km from Na Di toward the Vangxouay Dam, isolated limestone hill adjacent to the Pha Gnotsan Massif (18°16'31.4" N 104°42'49.3" E, 440m) [7] (GR/2, SZ/1), and 1km from Viengthong toward Na Di, caves along

Road 1D (18°30'16.7″ N 104°27'28.4″ E, 290m) [10] (GR/8 body whorls, SZ/1 body whorl).

Description The dextral, non-decollated shell of concave outline consists of 7⅓ to 8¼ whorls. The dark reddish-brown surface of the whorls is covered by fine and dense striae, which do not become stronger or less regular at the neck. The rounded base has a well recognisable crest. The peristome is pyriform with broad, detached margin, its sinulus reaches much higher than the position of the lamella superior. The inner end of this lamella and the outer end of the more peripheral lamella spiralis form a wave at their fusion. The lamella inferior descends to the aperture along a smooth arch. Its end does not bend upward before reaching the peristome. The lamella subcolumellaris is well visible in front view, and can be viewed deep inside the last whorl through the aperture. The quarter-whorl-long plica principalis initiates dorsolaterally. Below it, starting at the same depth, runs the smoothly curved, dorsal-dorsolateral lunella complex. The basal end of the lunella is fused to a very short lover plica with equal anterior and posterior parts. The clausilium plate with a pointed tip is almost entirely visible through the aperture.

Measurements Holotype: H_s 27.7mm, W_s 7.7mm, H_a 6.6mm, W_a 6.0mm. Paratype (1 complete shell): H_s 24.0mm, W_s 6.4mm, H_a 5.9mm, W_a 5.6mm; further paratypes (17 body whorls): H_a 5.7–6.8mm, W_a 5.2–6.5mm.

Etymology The new subspecies is named after Igor V. Muratov (KwaZulu-Natal Museum, Pietermaritzburg), who collected with Ahmed Abdou during several biodiversity surveys in Laos.

Remarks As all known members of the subfamily Garnieriinae, Grandinenia muratovi sp. nov. is also an obligate limestone-dwelling species. Its mostly broken shells were collected at three locations within a narrow range in Bolikhamsai Province. At each of these the new species was found together with similarly worn shells of *G. d. dautzenbergi*, indicating sympatric occurrence of these clausiliids. The specimens sampled near Viengthong are larger (H_a 7.2–7.8mm) than those of the other two localities.

PHAEDUSINAE

Oospira Blanford, 1872

Type species: *Clausilia philippiana* Pfeiffer, 1847; OD.

A recent molecular phylogenetic analysis of Asiatic Phaedusinae (Motochin, Wang & Ueshima, 2017) revealed that the genus *Oospira*, as defined by Nordsieck (2007), is not a monophyletic group of species. The scarcity of molecular data does not yet allow better classification, therefore we follow Nordsieck's system with the understanding that it will require major corrections.

Oospira abstrusa abstrusa (Szekeres, 1970)

A population of this clausiliid was discovered in Vietnam, Hoa Binh Province, Mai Chau District, Pa Co, Xa Linh (20°51'26″ N 104°56'11″ E, 1310m) [12], leg. Do Duc Sang & Nguyen Thanh Binh (SZ/1). Hitherto this subspecies was known only from the type locality, the Cuc Phuong National Park divided between Vietnam's Ninh Binh, Hoa Binh and Thanh Hoa Provinces (Szekeres, 1970). The new locality record considerably narrows the nearly 300km gap between the occurrences *O. a. abstrusa* and *O. a. ginkae* Grego & Szekeres, 2014, which is known from Tay Trang in Dien Bien Province of Vietnam (Grego *et al*., 2014) and the Phoufa Mts. of Phongsaly Province, Laos (Páll-Gergely & Szekeres, 2017).

Oospira mairei (Bavay & Dautzenberg, 1909)

This clausiliid was collected by Do Duc Sang & Sin Van Thuong in Vietnam, Lai Chau Province, Phong Tho District, Khong Lao (22°35'02″ N 103°23'52″ E, 1290m) [13], leg. Do Duc Sang & Sin Van Thuong (SZ/3). Though the site is within the known distribution range of the species (Bavay & Dautzenberg, 1909), its importance is due to the lack of any recently published finding of this species.

Oospira duci Maassen & Gittenberger, 2007

This species, known to have an extended range in Vietnam along the eastern slopes of the Ammanite Mountains, has been divided into four subspecies (Nordsieck, 2016). Namely, the nominotypical one and *O. d. pentaptychia* Nordsieck,

2016 of northern Thanh Hoa Province, *O. d. khanhi* Nordsieck, 2011 of southeastern Son La and western Ha Noi Provinces, and *O. d. tetraptychia* Nordsieck, 2016 of southern Quang Binh Province.

Oospira duci smidai Grego & Szekeres subsp. nov.
(Fig. 3a)

urn:lsid:zoobank.org:act:D3AA53CA-60D8–432B-A5DF-96735E02ED10

Differential diagnosis Differs from *O. d. tetraptychia* by the short plica principalis and palatal plicae, from other subspecies by the less tumid shape, and from all these by the much smaller size.

Type material Holotype: Laos, Bolikhamsai Province, caves near a quarry at the Phou Phako Massif, 2km E of Nong Long and 10km SE of Lak Sao (18°06'53.6" N 105°03'05.5" E, 510m) [14], leg. J. Grego 17.02.2017 (NHMUK 20180145). Paratype: same locality and data (GR/1).

Description The dextral, decollated shell consists of 6 to 7½ gradually widening whorls. The surface of all whorls is densely and uniformly striate. The basis is rounded. The oval peristome with whitish, almost attached margin is somewhat angular and retracted at the columellar side. The marginally ending lamella superior is smoothly fused to the lamella spiralis of the same height. The lamella inferior is retracted, in front view of the aperture only its very end is visible as a small lump. The lamella subcolumellaris can only barely, or not at all be seen in oblique view. The short plica principalis initiates ventrolaterally and terminates dorsally. Below it there are four, downward gradually shortening ventrolateral plicae. The clausilium plate could not be examined.

Measurements Holotype: H_s 20.1mm, W_s 5.8mm, H_a 5.3mm, W_a 4.2mm. Paratype: H_s 21.0mm, W_s 5.4mm, H_a 5.0mm, W_a 4.0mm.

Etymology The new subspecies is named after the Slovak speleologist Branislav Šmída, who was instrumental in organising the karst expedition during which it was collected.

Remarks Though the new taxon is described here as subspecies of the morphologically similar and geographically close *O. duci*, it remains to be clarified whether it represents a distinct species. The striking resemblance to the sinistral *O. decollata* (Likharev, 1962) from western Burma (Likharev, 1962) shows that the few plesiomorphic shell characters may not provide solid ground for classification. The phylogenetic relationship of these taxa, and also of most other *Oospira* species, will require clarification by molecular means.

Phaedusa Adams & Adams, 1855

Type species: *Clausilia corticina* Pfeiffer, 1842; SD Martens in Albers, 1860.

Phaedusa micropaviei Nordsieck, 2011

Phaedusa micropaviei hmongorum Grego & Szekeres subsp. nov.
(Fig. 3b)

urn:lsid:zoobank.org:act:B29AB656-1545-4E44–93BF-726E6AAF7DCA

Differential diagnosis Differs from the nominotypical subspecies by the lower positioned lamella inferior, less retracted lamella subcolumellaris, and the less deep, better developed palatal plicae.

Type material Holotype: Laos, Xiangkhouang Province, limestone cliff above a cave 4km SW of Ban Khong (19°22'40.2" N 102°58'44.5" E, 1230m) [15], leg. J. Grego 23.02.2017 (NHMUK 20180148). Paratypes: same locality and data (FMNH 384809/1, HNHM 103048/1, MNHN IM-2014–6892/1, MZUSP 138305, NHMW 111663/1, NMBE 554113/1, OSUM 45503/1, RMNH MOL.290815/1, SMF 349573/1, UF 516461/1, GR/37, SZ/2).

Further material All from Laos (leg. J. Grego): Xaisomboun Province, 1km from Long Tieng toward Sanasomboun, small cave on the right side of the road (19°05'53.2" N 102°56'19.5" E, 980m) [1] (GR/3, SZ/1); Xiangkhouang Province, caverns 3.5km W of Ban Khong (19°23'15.9" N 102°58'31.3" E, 1060m) [16] (GR/20); limestone cliffs 8km S of Ban Khong (19°21'56.1" N 102°59'22.8" E, 1140m) [17] (GR/1).

Description The elongate, yellowish-corneous shell with slightly concave outline consists of 11⅓ to 13 whorls. The surface of the whorls has

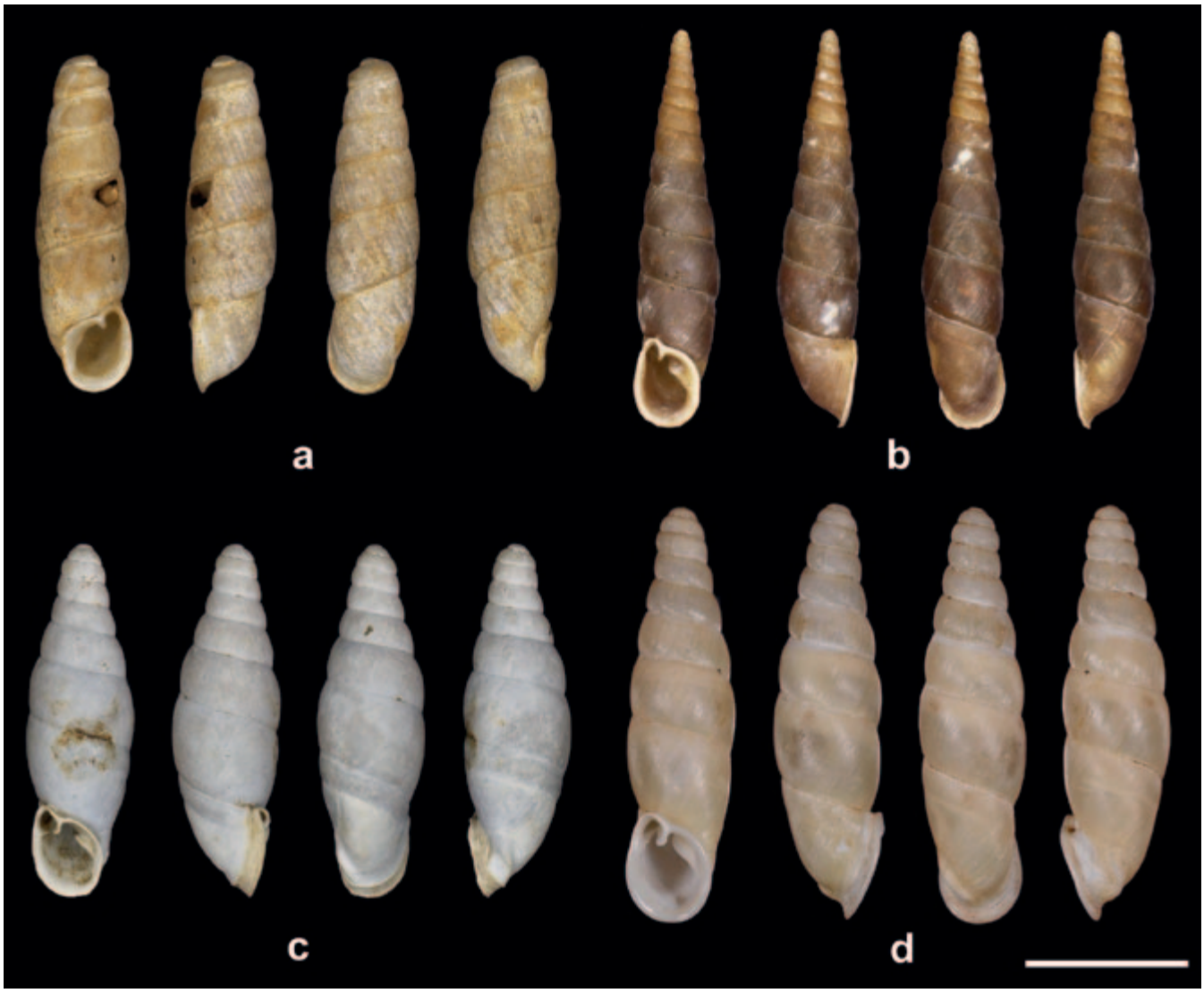

Figure 3 *Oospira duci smidai* Grego & Szekeres subsp. nov., holotype, NHMUK 20180145 (a); *Phaedusa micropaviei hmongorum* Grego & Szekeres subsp. nov., holotype, NHMUK 20180148 (b); *Synprosphyma phuonganhae* Do & Szekeres sp. nov., holotype, NHMUK 20180146 (c); *Synprosphyma thachi* Grego & Szekeres sp. nov., holotype, NHMUK 20180147 (d). Scale bar: 10mm.

dense striae with spiral incision in between, a pattern that becomes stronger and less regular at the neck. The oval, light brownish peristome has broad, detached margin. The long lamella superior continues straight in the lamella spiralis, with a trough at their contact. The spirally descending lamella inferior is well emerged. Behind it the end of the lamella subcolumellaris is well visible in side view of the aperture. The half whorl long plica principalis initiates ventrolaterally. Lateral-dorsolaterally there are six to eight distinct plicae, of which the uppermost is much longer than the others. The clausilium plate with a well-developed hook is partly visible through the aperture.

Measurements Holotype: H_s 24.1mm, W_s 5.2mm, H_a 5.4mm, W_a 4.0mm. Paratypes (12): H_s 21.5–24.7mm, W_s 4.7–5.4mm, H_a 4.6–5.5mm, W_a 3.7–4.2mm.

Etymology The name refers to the Hmong ethnic group that is native to the distribution area of this subspecies.

Remarks Whereas *P. micropaviei* is known from southern Son La Province in Vietnam (Nordsieck, 2011), the new subspecies occurs nearly 200km farther southwest in Xaisomboun and Xiangkhouang Provinces of Laos. A shell fragment (MNHN-IM-2012–27192) that was

identified earlier as *P. micropaviei* from Mt. Phou Xuang in Luangprabang Province (Páll-Gergely & Szekeres, 2017) also belongs to *P. m. hmongorum* subsp. nov.

Synprosphyma Wagner, 1920

Type species: *Clausilia suilla* Bavay & Dautzenberg, 1909; SD Lindholm 1924.

Synprosphyma phuonganhae Do & Szekeres sp. nov. (Fig. 3c)

urn:lsid:zoobank.org:act:06F0D8A4-D602-4598-9A1F-CFF359755A37

Differential diagnosis Differs from *S. incrustata* Nordsieck, 2016, the only other species of the genus with double peristome, by its spindle-shaped shell and strong basal crest.

Type material Holotype: Vietnam, Son La Province, Thuan Chau District, Co Ma Commune, Hua Luong Village (21°21'25.6" N 103°31'17.7" E, 1250m) [18], leg. Do Duc Sang & Nguyen Thi Huyen 12.06.2013 (NHMUK 20180146). Paratypes: same locality and data (TARC 1227/7, GR/1, SZ/1); Thuan Chau District, Chieng Bom Commune (21°22'19.8" N 103°37'27.0" E, 1570m) [19], leg. Do Duc Sang & Nguyen Thi Huyen 12.06.2013 (TARC 1228/5).

Description The spindle-shaped, tumid shell with thick apex consists of 8 to 8½ whorls. The surface of the whorls is covered by fine, dense striae, which become wider-spaced weak riblets toward the neck. The basal crest is strong and sharp. The oval, duplicated peristome is detached, the sinulus is retracted. The lamella superior is continuous with the much less emerged lamella spiralis. The arched lower part of the lamella inferior bends slightly downward before terminating at the peristome. The lamella subcolumellaris is well visible in front view. The plica principalis starts ventrolaterally and ends almost marginally at the peristome. The short plica superior initiates very close to the principalis, and then turns abruptly downward at its fusion with the weakly bent lunella. The basal end of the lunella is attached to a strong lower plica having shorter anterior and longer posterior branches. The clausilium plate is almost entirely visible through the aperture.

Measurements Holotype: H_s 21.6mm, W_s 6.5mm, H_a 5.6mm, W_a 4.3mm. Paratypes (type locality, 9): H_s 22.7–25.0mm, W_s 6.2–7.0mm, H_a 5.8–6.3mm, W_a 4.3–5.0mm.

Etymology The new species is dedicated to Do Phuong Anh, daughter of the first author.

Remarks This species is very similar to *S. cervicalis* (Bavay & Dautzenberg, 1909), with which it was identified earlier (Do & Do, 2015). However, *S. phuonganhae* sp. nov. differs from that species by its duplicated peristome, fine and dense neck ribs, almost marginally ending lamella subcolumellaris, and the long posterior branch of the lower palatal plica. Within the genus its conspicuous duplicated peristome is shared only with *S. incrustata* Nordsieck, 2016 that, intriguingly, also occurs in Son La Province. As has been reported (Do & Do, 2015), at its type locality the new species was found living together with *Oospira vanbuensis pocsi* (Szekeres, 1969).

Synprosphyma thachi Grego & Szekeres sp. nov. (Fig. 3d)

urn:lsid:zoobank.org:act:CCC609BC-FC31–4DC5–8F4B-E37474C1E466

Differential diagnosis A *Synprosphyma* with thick apex, simple, finely striate neck, and almost marginally ending plica principalis.

Type material Holotype: China, Yunnan Province, Honghe Zhou, Mengzi Xian [20], leg. local people 07.2015, ex Yang Hao (NHMUK 20180147). Paratypes: same locality and data (GR/1, SZ/1).

Description The spindle-shaped, tumid shell of 8 to 8½ whorls has a thick apex. The light corneous surface of all teleoconch whorls is covered by fine, dense and uniform striae. The basal crest is strong. The whitish, oval peristome is detached, the sinulus is not retracted. The lamella superior is continuous with the lamella spiralis emerged to the same height. The lower, arched part of the lamella inferior turns downward before ending at the peristome. The lamella subcolumellaris is only obliquely visible through the aperture. The plica principalis starts ventrolaterally and ends almost marginally at the peristome. The plica superior is well separated from the principalis. Its fusion with the dorsolateral lunella forms a smoothly bent arch. The basal plica of equal

anterior and posterior parts is as long as the lunella to which it is also fused. The clausilium plate with strongly forward-bent parietal edge is partly visible through the aperture.

Measurements Holotype: H_s 25.4mm, W_s 6.6mm, H_a 6.9mm, W_a 5.1mm. Paratypes (2): H_s 24.3 and 25.3mm, W_s 6.7 and 7.0mm, H_a 7.0 and 7.1mm, W_a 5.1 and 5.2mm.

Etymology The new species is dedicated to Nguyen Ngoc Thach, a committed researcher of the marine and terrestrial gastropods of Southeast Asia.

Remarks By their ventricose spindle-shaped shell, wide apex, and to the peristome reaching plica principalis this species and *S phuonganhae* spec. nov. show striking resemblance to *S. cervicalis* occurring in Vietnam's Lao Cai Province, as well as in Wenshan Zhou of China's Yunnan Province. However, *S. cervicalis* differs from *Synprosphyma thachi* sp. nov. by its long, weakly bent, dorsally positioned lunella and not forward bent clausilium edge, whereas from both new species by its very strong neck ribs and the basal plica that is much shorter than the lunella.

Concluding remarks

The material from northwestern Vietnam and, particularly, central Laos provided valuable information on the distribution and relationship of the Clausiliidae in these poorly studied regions. The results fill gaps in an emerging picture that Southeast Asia was colonised by this family from more than one direction, and that this process was limited by climatic, orographic and geological factors (Páll-Gergely & Szekeres, 2017). Members of the Garnieriinae subfamily are obligate limestone-dwellers, whereas those of the Phaedusinae require microenvironments with constant high humidity. Due to these constrains there is an abrupt decrease of diversity on the western side of the Annamite Range, and an apparent lack of species in Cambodia and eastern Thailand. In the eastern part of Southeast Asia (Laos and Vietnam) the Phaedusinae with northern relatives become replaced by endemic elements of uncertain origin (*i.e.*, *Oospira naggsi* Grego & Szekeres, 2014, species of *Castanophaedusa* Páll-Gergely & Szekeres, 2017 and *Messageriella* Páll-Gergely & Szekeres, 2017) south of the 15°N latitude. By contrast, in the western part of the region (Myanmar, western Thailand, Malay Peninsula) the members of this subfamily belong to another group that shows close relationship with species of the Greater Sunda Islands. Once available, molecular phylogenetic data will certainly help elucidating how Clausiliidae colonised the different areas of Southeast Asia.

Acknowledgements

The authors are thankful to Yang Hao for providing material of *Synprosphyma thachi* sp. nov., Jonathan Ablett, Anita Eschner, Virginie Héros and Ronald Janssen for granting access to the public collections at their care, Zoltán Fehér for his valuable help in preparing the photographic material, and two anonymous reviewers for their helpful comments. The Biodiversity Heritage Library (http://www.biodiversitylibrary.org/) is acknowledged for making old and rare publications available.

References

BAVAY A & DAUTZENBERG P 1909: Description de coquilles nouvelles de l'Indo-Chine. *Journal de Conchyliologie* **57**: 81–105.

CHEN Y 2016 *Terrestrial molluscs in Yunnan*. China Science Publishing and Media Ltd., 276 pp. (in Chinese)

DO DS & DO VN 2015 The terrestrial snail family Clausiliidae (Gastropoda: Pulmonata) from Son La, Vietnam, with description of a new subspecies. *Ruthenica* **25**: 1–9.

GREGO J, LUONG HV, PHAM SV & SZEKERES M 2014 Vietnamese Clausiliidae (Gastropoda: Pulmonata): new taxa and novel distribution data. *Journal of Conchology* **41**: 749–757.

GREGO J & SZEKERES M 2011 New taxa of Asiatic Clausiliidae (Mollusca: Gastropoda). *Visaya* **3**: 4–22.

LIKHAREV IM 1962 A new species of the Clausiliidae (Gastropoda, Pulmonata) from Burma. *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR* **30**: 11–13. (in Russian)

MAASSEN WJM & GITTENBERGER E 2007 Three new clausiliid land snails from Tonkin, northern Vietnam (Gastropoda: Pulmonata: Clausiliidae). *Zoologische Mededelingen* **81**: 175–186.

MORELET L 1892 Descriptions d'espèces nouvelles provenant de l'Indo-Chine. *Journal de Conchyliologie* **40**: 315–329.

MOTOCHIN R, WANG M & UESHIMA R 2017 Molecular phylogeny, frequent parallel evolution and new system of Japanese clausiliid land snails (Gastropoda: Stylommatophora). *Zoological Journal of the Linnaean Society* **181**: 795–845.

NGUYEN NT 2016 *Vietnamese new mollusks*. 48HrBooks, Akron, OH, 205 pp.

NGUYEN NT 2017 *New shells of Southeast Asia*. 48HrBooks, Akron, OH, 128 pp.

NORDSIECK H 2002 Revision of the Garnieriinae (Gastropoda: Stylommatophora: Clausiliidae), with description of new taxa. *Stuttgarter Beiträge zur Naturkunde* (Serie A) **640**: 1–23.

NORDSIECK H 2007 *Worldwide door snails*. ConchBooks, Hackenheim, 214 pp.

NORDSIECK H 2011 Clausiliidae of Vietnam with the description of new taxa (Gastropoda: Stylommatophora). *Archiv für Molluskenkunde* **140**: 149–173.

NORDSIECK H 2012 Note on Garnieriini (Gastropoda, Stylommatophora, Clausiliidae, Garnieriinae). *Acta Conchyliorum* **12**: 57–62.

NORDSIECK H 2014 Description of the first right-coiled Garnieriinae (Gastropoda, Pulmonata, Clausiliidae), with a synopsis of the Tropidauchenia group. *Conchylia* **44**: 11–15.

NORDSIECK H 2016 New species taxa of Clausiliidae (Gastropoda, Stylommatophora) from China and Vietnam. *Conchylia* **47**: 37–57.

NORDSIECK H 2018 The door snail from the banana tree in Laos (Gastropoda, Stylommatophora, Clausiliidae, Phaedusinae). *Conchylia* **48**: 47–50.

PÁLL-GERGELY B & SZEKERES M 2017 New and little-known Clausiliidae (Gastropoda: Pulmonata) from Laos and southern Vietnam. *Journal of Conchology* **42**: 507–521.

SCHILEYKO AA 2011 Check-list of land pulmonate molluscs of Vietnam (Gastropoda: Stylommatophora). *Ruthenica* **21**: 1–68.

SZEKERES M 1969 Neue Angaben zur Kenntnis der Clausiliiden Südostasiens. *Archiv für Molluskenkunde* **99**: 313–317.

SZEKERES M 1970 Zwei neue Clausiliidae aus Südtonkin. *Archiv für Molluskenkunde* **100**: 81–82.