

A NEW SPECIES AND NEW GENUS OF CLAUSILIIDAE (GASTROPODA: STYLOMMATOPHORA) FROM SOUTH-EASTERN HUBEI, CHINA

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ABSTRACT: A new clausiliid species, in a newly proposed genus, *Probosciphaedusa mulini* gen. et sp. nov. is described from south-eastern Hubei, China. The new taxon is characterised by having thick and cylindrical apical whorls, a strongly expanded lamella inferior and a lamella subcolumellaris that together form a tubular structure at the base of the peristome, and a dorsal lunella connected to both the upper and the lower palatal plicae. Illustrations of the new species are provided.

KEY WORDS: new species, new genus, systematics, Phaedusinae, central China

INTRODUCTION

In the past decades, quite a few authors have conducted research on the systematics of the Chinese Clausiliidae. Their research hotspots were mostly located in southern China, namely the provinces Sichuan, Chongqing, Guizhou, Yunnan, Guangxi and parts of Guangdong and Hubei, which have a rich malacofauna (GREGO & SZEKERES 2011, 2017, 2019, 2020, HUNYADI & SZEKERES 2016, NORDSIECK 2001, 2003, 2005, 2006, 2007, 2012a, 2016). Other regions have been less intensively explored for the Clausiliidae. Recently, the second author and Di Yu conducted a preliminary survey of the hilly area in

south-eastern Hubei, which is rarely visited by malacologists or collectors, and collected some terrestrial molluscs. Among them, a clausiliid was identified as a new genus and new species, and its respective descriptions and illustrations are presented herein. Although some molecular phylogenetic studies have focused on the Phaedusinae in East Asia (MOTOCHIN et al. 2017, MAMOS et al. 2021), data on the continental species are still extremely scanty, and because the morphological features of the new genus are sufficiently diagnostic, molecular biology work was not carried out in this study.

MATERIAL AND METHODS

Photographs were taken using a Canon® 5D Mark IV camera with a Canon® 100 mm Macro lens (for overview of shell, genitalia) or Laowa® 25 mm Ultra Macro lens (for internal lamellae and palatal plicae), stacked with Zerene Stacker® 1.04 and modified in Adobe Photoshop® CS6. Type specimens of the new species are deposited in the Mollusc collection of the

Museum of Hebei University (HBUMM, Baoding, China), Zhe-Yu Chen's private collection (CZYC, Wuhan, China), Kai-Chen Ouyang's private collection (OKCC, Kunming, China), Lu Qiu's private collection (QLC, Luzhou, China), and Yung-Ching Wang's private collection (WYCC, Liaoning, China).

SYSTEMATIC PART

Family Clausiliidae Gray, 1855

Subfamily Phaesusinae A. J. Wagner, 1922

Probosciphaedusa Z.-Y. Chen, gen. nov.

Type species. *Probosciphaedusa mulini* sp. nov.

Diagnosis. Shell slender, with thick and cylindrical apical whorls. Lamella inferior and lamella subcolumnaris strongly expanded, together forming a tubular projection at the base of peristome. Dorsal lunella situated extremely shallow (close to aperture) and connected to both the upper and lower palatal plicae.

Etymology. Named for its extreme form of aperture with tubular structure resembling a nose; the Latin word *proboscis* (proboscis, snout) is combined with the common suffix *phaedusa*. The name is feminine.

Affinities. The characteristic lamellar structure, the thick, cylindrical apex and the dorsal lunella distinguish the new genus from all the other Phaesusinae. *Fuchsiana* Gredler, 1887 and *Miraphaedusa* H. Nordsieck, 2005 share the thick and cylindrical apex with the new genus, but these two genera lack lunella (SCHILEYKO 2000, NORDSIECK 2005, 2012b).

Hemiphaedusa O. Boettger, 1877, *Selenophaedusa* Lindholm, 1924 and *Falsiluna* Grego et Szekeres, 2011 are characterised by the presence of a lunella, but none of them shares the extremely shallow situated lunella and the special lamellar structure of the new genus (SCHILEYKO 2000, GREGO & SZEKERES 2011, NORDSIECK 2012b).

Although the lamellar structure of the new genus shows some similarity with the strongly exposed basal lamellae of *Hemiphaedusoides ringens* (Schmacker et Boettger, 1890) (YEN 1939), those do not extend beyond the margin of the peristome. A similar fold (originally described as 'keel-like compressed') at the neck of *Miraphaedusa* also does not distort the shape of the peristome (NORDSIECK 2005). In the Asian Phaesusinae, tubular structure of peristome can be observed in species like *Synprospheyma* (*Excussispira*) *fargesianella* (Heude, 1885) and *Zaptyx* (*Tyrannozaptyx*) *takarai* Kuroda, 1960, but in these species the tubular structure is derived from the sinulus and formed by the lamella superior and principal plica (HEUDE 1885, HABA & INABA 1996).

Distribution. South-eastern Hubei.



Fig. 1. Shell of *Probosciphaedusa mulini* Z.-Y. Chen et Ouyang, gen. et sp. nov., holotype HUBMM 10046. Scale bar 10 mm



***Probosciphaedusa mulini* Z.-Y. Chen
et K.-C. Ouyang, sp. nov.**

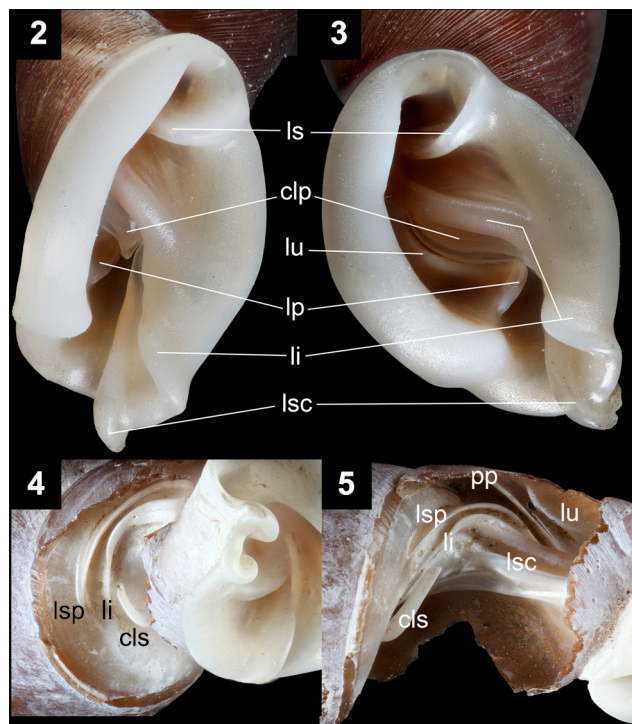
(Figs 1–10)

Type material. Holotype, HBUMM 10046 (dry shell with separated soft part in 75% ethanol), Xuansu Cave (玄素洞), Chibi City (赤壁市), Xianning City (咸宁市), Hubei Province, China, $29^{\circ}37.85'N$, $113^{\circ}52.17'E$, leg. DI YU, 2020-XI-29. Paratypes: HBUMM 10047 (1 dry shell with dissected soft part in 75% ethanol), same data as holotype; HBUMM 10048 (15 dry shells), CZYC (one dry shell), OKCC (5 dry shells), WYCC (1 dry shell), QLC (3 dry shells with separated soft parts in 75% ethanol), south shore of Lushui Lake (陆水湖), Chibi City (赤壁市), Xianning City (咸宁市), Hubei Province, China, $29^{\circ}40.20'N$, $113^{\circ}58.58'E$, leg. DI YU & KAI-CHEN OUYANG, 2020-X-4.

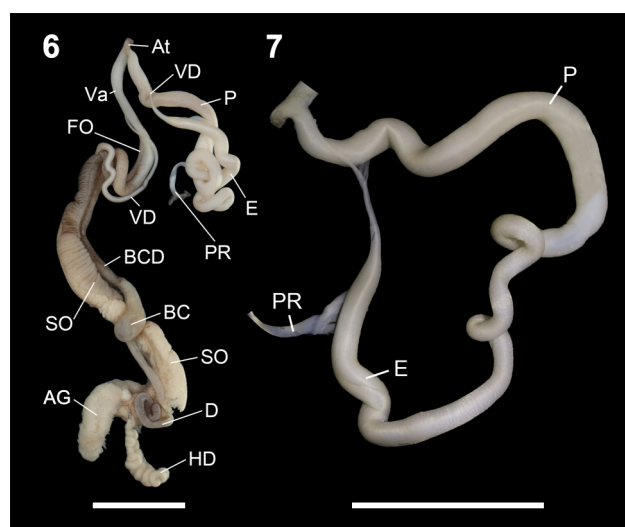
Diagnosis. See diagnosis of the genus.

Description. The medium-sized, sinistral and spindle-shaped shell of 12 whorls is brown or reddish-brown with lighter colour at the thick apical part. The protoconch is comprised of four smooth whorls. The shell is almost cylindrical at the first six whorls, thereafter the outline of the shell becoming somewhat inflated; widest at the penultimate whorl. The entire teleoconch surface is densely and obliquely rib-striated. The base of the neck is enlarged and

folded backwards, forming a tubular structure. This conspicuously extended lobe is formed by the terminal parts of the lamella inferior and the lamella subcolumellaris. The oval aperture joins a detached peristome and has a wide and strongly reflexed white margin. The lamella inferior starts laterally, at the same depth as the lamella spiralis. It reaches the peristome at mid-height of the aperture, then bends downward and extends far beyond the curve of the aperture. The lamella subcolumellaris descends along a straight line and reaches downward farther than the lamella inferior, with which it forms the extended tubular structure. The strong, oblique lamella superior is continuous with the lamella spiralis. The lunella is situated at the dorsal side, extremely close to aperture margin. The principal plica starts dorso-laterally and extends almost to the peristome. The long, dorsal upper palatal plica runs almost parallel to the principal plica. Its front end is fused to the arched lunella, which is also connected to the central part of the long lower palatal plica, which is almost parallel to the lamella subcolumellaris. The anterior part of the lower palatal plica (basalis) is well visible in apertural view. The clausilium plate with a pointed tip is partly visible through the aperture. Its distal end is inserted into the groove formed by the lower palatal plica and the lamella subcolumellaris. The body is brown with an orange hue. The foot margin is greyish-white. Skin patches are dark brown.



Figs 2–5. Shell characters of *Probosciphaedusa mulini* Z.-Y. Chen et Ouyang, gen. et sp. nov. Abbreviations: clp – clausilium plate; cls – clausilium stalk; li – lamella inferior; lp – lower palatal plica; ls – lamella superior; lsc – lamella subcolumellaris; lsp – lamella spiralis; lu – lunella; pp – principal plica



Figs 6–7. Genital anatomy of *Probosciphaedusa mulini* Z.-Y. Chen et Ouyang, gen. et sp. nov.: 6 – general view; 7 – male part. Scale bars 5 mm. Abbreviations: AG – albumen gland; At – atrium; BC – receptacle of bursa copulatrix; BCD – bursa copulatrix duct; D – diverticulum of bursa copulatrix; E – epiphallus; FO – free oviduct; HD – hermaphroditic duct; SO – spermoviduct; P – penis; PR – penial retractor muscle; VA – vagina; VD – vas deferens



Figs 8–10. *Probosciphaedusa mulini* Z.-Y. Chen et Ouyang, gen. et sp. nov.: 8 – satellite image of southern China indicating the geographic position of the type locality of *P. mulini* (yellow triangle); 9 – habitat of *P. mulini*; 10 – live specimen of *P. mulini*, paratype HBUMM 10047

Measurements (in mm). Shell height 23.74–30.00, shell width 4.50–5.68, aperture height 4.37–5.77, aperture width 3.82–4.71 ($n = 18$).

Etymology. Named after its collector Di Yu's son, Mu-Lin Yu.

Remarks on the genitalia. Paratype HBUMM 10047 was dissected to examine the structure of the genitalia. The result is as follows: penis long, folded near the atrium. No clear boundary between penis and epiphallus. The penis-epiphallus part is long, coiled, and has obviously thickened muscular inner wall. The penial retractor muscle is attached at the transition between epiphallus and vas deferens. The vas deferens is distinctly thickened in the female part, muscular, and thickest close to the spermoviduct. Spermoviduct is long. The bursa copulatrix duct is relatively short, ca. 5 mm, accounting for only half of the length of the spermoviduct. The receptacle of

bursa copulatrix is ovoid, separated from spermoviduct. The diverticulum of bursa copulatrix much longer than the bursa copulatrix duct, ca. 14 mm, its end is coiled and uninflated, and attached by connective tissue to the spermoviduct. The albumen gland is relatively small compared to the spermoviduct. The hermaphroditic duct is nearly as long as the albumen gland.

Distribution. This species is known only from a limited area in south-eastern Hubei.

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