

## New species of *Moellendorffia* Ancey, 1887 and *Moellendorffiella* Pilsbry, 1905 from China (Gastropoda: Eupulmonata: Camaenidae)

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**Abstract.** Two new species of *Moellendorffia* Ancey, 1887 and one new species of *Moellendorffiella* Pilsbry, 1905 are described from China, namely *Moellendorffia gulinensis* sp. nov. from southeastern Sichuan Province, *Moellendorffia wuchaoi* sp. nov. from eastern Hainan Island, and *Moellendorffiella yifengi* sp. nov. from southeastern Yunnan Province. Shell characters and habitats are illustrated, and a distribution map of the new species is provided. *Moellendorffia trisinuata trisinuata* and *Moellendorffiella erdmanni* are re-examined and illustrated using newly collected specimens. The generic diagnosis of *Moellendorffiella* is supplemented.

**Key words.** China, taxonomy, new species, systematics, snail

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### INTRODUCTION

The camaenid genus *Moellendorffia* Ancey, 1887 is endemic to southern continental Asia, mainly from China and Vietnam (Sutcharit *et al.* 2020). This genus is remarkable for its depressed-globular to sub-lenticular shell, distinctive periostracal hairs, granulose shell surface in most species, and, especially, the detached aperture, which is usually heart-shaped and with three or four apertural teeth (Panha *et al.* 2010; Sutcharit *et al.* 2020; Lin & Lin 2022). These characters make this genus easily distinguished even for the non-expert. Currently, 11 species and three subspecies of *Moellendorffia* are known, with seven species reported from China (Sutcharit *et al.* 2020; Lin & Lin 2022).

The genus *Moellendorffiella* Pilsbry, 1905 is conchologically similar to *Moellendorffia*. It is characterized by its flattened shell, keeled last whorl, subcircular aperture, and presence of two furrows behind the aperture (Sutcharit *et al.* 2020). Currently only two species of *Moellendorffiella* are known, and both are endemic to central China (Yen 1939; Sutcharit *et al.* 2020).

In this paper, we describe two new species of *Moellen-*

*dorffia* and one new *Moellendorffiella* from China. Newly collected specimens of *Moellendorffia trisinuata trisinuata* and *Moellendorffiella erdmanni* are illustrated. The diagnostic characters of *Moellendorffiella* are supplemented based on the new material of the type species (*Moellendorffiella erdmanni*) and *Moellendorffiella yifengi* sp. nov. In addition, the distributional range of *Moellendorffia* is extended to Sichuan and Hainan, and that of *Moellendorffiella* to Yunnan, Guizhou, and Chongqing.

### MATERIALS AND METHODS

The shells were photographed using a Canon EOS RP and Mount Adapter EF-EOS R with a Laowa 100 mm f2.8 CA-Dreamer Macro 2× lens (Figs 1–4). The distribution map (Fig. 5) was produced and downloaded from <https://www.simplemappr.net> (Shorthouse 2010). All figures were modified in Adobe Photoshop CC 2019. The studied specimens are deposited in the Invertebrate Collection of Mianyang Normal University, Sichuan, China (MYNU) and the private collections of Chao Wu (CWC; Beijing, China), Ran-Xi Lin (RXLC; Guangdong, China), and Yan

Sun (YSC; Guizhou, China). The counting of shell whorls follows the method of Kerney & Cameron (1979). Names of administrative units below the provincial level are given in Chinese Pinyin (“shi” = city, “xian” = county, “zhen” = town). To abbreviate and differentiate the names of the two genera in this study, “*M.*” is used for *Moellendorffia*, and “*Mo.*” for *Moellendorffiella*.

## SYSTEMATICS

### Family Camaenidae Pilsbry, 1895

#### Subfamily Camaeninae Pilsbry, 1895

#### Genus *Moellendorffia* Ancey, 1887

**Type species.** *Helix trisinuata* E. von Martens, 1867; by original designation.

#### *Moellendorffia trisinuata trisinuata* (E. von Martens, 1867)

Figure 1A

*Helix trisinuata* Martens 1867: 50, 51.

*Moellendorffia* (*Moellendorffia*) *trisinuata trisinuata*—Zilch 1966: 210, 211.

*Moellendorffia trisinuata*—Richardson 1985: 186; Sutcharit *et al.* 2020: 80.

**Type locality.** Hong Kong.

**Material examined.** 1 shell (RXLC, Fig. 1A): China, Hong Kong, Pokfulam [薄扶林], 2012, leg. Zhi-Cheng Yang.

**Diagnosis.** Shell (Fig. 1A) depressed-globular, with raised, domed spire. Last whorl bluntly angular. Shell with small nodules on surface (dorsally prominent and ventrally sparser), but periostracum without hairs or scales. Umbilicus small and deep, only c. 1/10 of shell diameter. Two palatal lamellae, one large, prominent nodule, and one wide, strong columellar lamella.

**Geographic range.** China (Hong Kong).

#### *Moellendorffia wuchaoi* sp. nov.

Figures 1B, 4C, D, 6C, D

**ZooBank identifier.** urn:lsid:zoobank.org:act:F31B6603-F44C-4E32-8A94-6F9A6C899792

**Type material.** Holotype. MYNU-00038 (Fig. 1B; diameter 14.2 mm, height 6.1 mm), China, Hainan Province, Ledong Li Autonomous County [乐东黎族自治县], Mingfenggu Valley [鸣凤谷], 950 m elev., 18°44'15"N 108°50'28"E, 2022.V.12, leg. Chao Wu.

Paratypes. 2 shells (1/MYNU-00039, diameter 14.7 mm, height 6.7 mm; 1/CWC, diameter 14.9 mm, height 6.9 mm), same data as holotype.

**Diagnosis.** Shell (Fig. 1B) depressed-globular, with almost flat spire. Last whorl rounded at periphery, not keeled. Periostracum with long, thin bristles. Umbilicus 1/5 of shell diameter. Two palatal lamellae, one large prominent nodule, and one small columellar lamella.

**Description.** Shell (Fig. 1B) depressed-globular; uniformly brown, dextral; whorls 4.25–4.55. Suture rather indented. Spire low, almost flat. Last whorl well rounded, clearly descending behind aperture, without keel at periphery. Surface without nodules, but periostracum with even, dense, micro-cuticular scales. Long, thin, sparsely and evenly distributed bristles present both dorsally and ventrally. Aperture vastly extended, heart-shaped. Peristome expanded, equally reflected, free from last whorl. Parietal wall in-curved to form a blunt, prominent nodule; two sharp palatal lamellae present; columellar lamella low and tiny. Umbilicus deep, moderate in size, approximately 1/5 of shell diameter; protoconch visible inside umbilicus.

**Variation.** The paratypes are larger than the holotype. In all other respects, the type specimens are identical.

**Derivation of name.** This species is named in honour of Mr Chao Wu (Beijing, China) who collected and sent us the samples.

**Geographic range.** Known only from the type locality.

**Habitat.** This species inhabits tropical rainforest on Hainan Island (Fig. 6B).

**Remarks.** This new species differs from most of its congeners, including *M. trisinuata trisinuata* and *M. blaisei*, in having two palatal lamellae (Sutcharit *et al.* 2020). However, this new species differs from *M. trisinuata trisinuata* in the rounder whorls, flat apex, larger umbilicus (nearly 1/5 of shell major diameter, while only 1/7 of shell major diameter in *M. trisinuata trisinuata*), and it clearly differs from *M. blaisei* in the sparser bristles, darker shell colour, and thinner, bicolour and less expanded aperture with angled corners between prominent nodule (Sutcharit *et al.* 2020).

#### *Moellendorffia gulinensis* sp. nov.

Figures 2, 4A, B, 6A

**ZooBank identifier.** urn:lsid:zoobank.org:act:8FC715A2-3B39-46DA-9D91-B90172EE2CE7

**Holotype.** MYNU-00034 (Fig. 2; diameter 19.6 mm, height 6.5 mm): China, Sichuan Province, Luzhou Shi [泸



Figure 1. *Moellendorffia* species from China. A, *M. trisinuata trisinuata* (E. von Martens, 1867) from Hong Kong. B, *Moellendorffia wuchaoi* sp. nov., holotype MYNU-00038 from Jianfengling, Ledong, Hainan. Scale bars: 5 mm.





**Figure 2.** *Moellendorffia gulinensis* sp. nov., holotype MYNU-00034 from Gulin, Luzhou, Sichuan. Scale bar: 5 mm.

州市], 6 km southwest of Gulin Xian [古蔺县], Bajiao Cun [芭蕉村], Zhicaogou [纸槽沟], 830 m elev., 105°45'15"N, 27°59'33"E, 2019.V.2, leg. Lu Qiu.

**Paratype.** 1 shell (MYNU-00035; diameter 24.6 mm, height 7.7 mm), same data as holotype.

**Diagnosis.** Shell depressed, sub-lenticular, with shouldered whorls and spire slightly raised. Surface with prominent tubercles. Surface without long bristles or scales. Umbilicus approximately  $\frac{1}{4}$  of shell diameter. One strong palatal lamella, one small, prominent nodule, and one strong columellar lamella.

**Description.** Shell (Fig. 2) depressed, sublenticular, uniformly reddish brown except aperture, dextral; whorls 4.10–4.25. Spire slightly raised. Prominent tubercles present on first three whorls, larger at periphery of last whorl and gradually diminishing on spire whorls. Surface without bristles or scales. Protoconch with uniform micro-tubercles. Last whorl descending behind aperture. Aperture vastly extended, subtriangular. Peristome expanded, equally reflected on all sides, free from preceding whorl. One large,

strong palatal lamella, one small, prominent nodule, and one columellar lamella. Umbilicus deep, wide, approximately  $\frac{1}{4}$  of shell diameter.

**Variation.** The paratype is distinctly larger than the holotype. The granules on the shell surface of the paratype are weaker than in the holotype.

**Derivation of name.** The name of the new species refers to the location of the type locality in Gulin Xian.

**Geographic range.** Known only from the type locality.

**Habitat.** This species inhabits a mountainous karst area (Fig. 6B). The living holotype individual was observed crawling on the ground during a rainy day. Dead shells have been found in the bush.

**Remarks.** This is the northernmost *Moellendorffia* species known to date. It is similar to *M. trisinuata sculpticoncha* (Zilch, 1951) in having enormous tubercles, but in the new species the tubercles are relatively weaker and somewhat unevenly distributed, the umbilicus is larger and is not covered by the expanded peristome (small and partially cov-

ered in *M. trisinuata sculpticoncha*), and there is only one palatal lamella (two in *M. trisinuata sculpticoncha*) (Sutcharit *et al.* 2020). Compared to *M. qinglongi*, the new species differs by its obvious tubercles and the absence of scales or bristles (Lin & Lin 2022). Compared to species outside of China, *M. gulinensis* sp. nov. differs from *M. loxotata loxotata* in having the aperture less descending and the whorls more angular, and it can be distinguished from *M. loxotata exasperata* and *M. spurca* in its more depressed shell and widely open umbilicus not covered by the expanded peristome; additionally, the tubercles are less spinous than those in *M. loxotata exasperata*, and denser and coarser than those in *M. spurca* (Sutcharit *et al.* 2020).

### Genus *Moellendorffiella* Pilsbry, 1905

**Type species.** *Helix* (*Moellendorffia*) *erdmanni* Schmacker & O. Boettger, 1894.

**Diagnosis.** Shell strongly depressed, umbilicate, dextral. Periostracum thin, with small tubercles. Periphery keeled, large, finned bristles. Last whorl shouldered and descending anteriorly. Aperture vastly extended, ovate with lamellae inside; position of lamellae externally marked with furrows. Parietal callus thin. One palatal lamella; one columellar lamella.

### *Moellendorffiella erdmanni* (Schmacker & O. Boettger, 1894)

Figures 3A, 7A

*Helix* (*Moellendorffia*) *erdmanni* Schmacker & O. Boettger 1894: 173, 174.

*Moellendorffia* (*Moellendorffiella*) *erdmanni*—Zilch 1966: 21.

*Moellendorffia erdmanni*—Richardson 1985: 184.

*Moellendorffiella erdmanni*—Schileyko 2003: 1513; Sutcharit *et al.* 2020: 86.

**Type locality.** Chang-yang [Changyang 长阳], Hupei [Hubei 湖北], China.

**Material examined.** 2 shells (MYNU-00040-00041; one as Fig. 3A): China, Chongqing Municipality, Wulong Xian [武隆县], Shuanghe Xiang [双河乡], Xiannvshan National Forest Park [仙女山国家森林公园], 29°26.41'N, 107°49.12'E, 2023.IV.15, leg. Chen-Yu Fei & Wan-Jing Xie; 1 shell (YSC): China, Guizhou Province, Guiyang Shi [贵阳市], Kaiyang Xian [开阳县], Lengshuihe Reservoir [冷水河水库], 27°6.80'N 106°59.01'E, 2023.IV.13, leg. Yan Sun.

**Redescription.** Shell (Fig. 3A) strongly depressed, uniformly brown except aperture, dextral; whorls 3.95–4.45. Spire low, nearly flat. Growth lines fine. Last whorl clearly descending behind aperture. Protoconch roughened by

numerous regularly arranged, rectangular granules which bear micro-scales. Last whorl with strong keel. Large, finned scales present on keel; mean length of scales about 2.4 mm. Aperture vastly extended, suboval. Peristome expanded, equally reflected on all sides. Parietal lip not detached from the last whorl. One large palatal lamella and one small columellar lamella. Umbilicus deep, wide, approximately ¼ of shell diameter.

**Measurements.** Shell diameter: 21.2–22.7 mm, shell height: 7.5–8.1 mm ( $n = 3$ ).

**Geographic range.** China (Hubei, Chongqing [new record], Guizhou [new record]).

**Habitat.** This species inhabits karst mountainous forests (Fig. 7B).

**Remarks.** Fresh specimens have intact periostracum, which allows us to conclude that this species has large, fin-like scales on the keel of the shell.

### *Moellendorffiella yifengi* sp. nov.

Figure 3B, 4E, F

**ZooBank identifier.** urn:lsid:zoobank.org:act:6A31AEA7-A9AF-4702-A5C0-5D3B889D8F6D

**Holotype.** MYNU-00036 (Fig. 3B; diameter 20.4 mm, height 6.5 mm): China, Yunnan Province, Wenshan Zhuang-Miao Autonomous Prefecture [文山壮族苗族自治州], Wenshan Shi [文山市], Kaihua Zhen [开化镇], Mount Xihuashan [西华山], 1319 m elev., 23°21.18'N, 104°14.04'E, 2023.I.16, leg. Yi-Feng Liu.

**Paratype.** 1 shell (MYNU-00037; diameter 18.9 mm, height 6.0 mm), same data as holotype.

**Diagnosis.** Shell strongly depressed, with shouldered whorls. Keel with large scales. One large palatal lamella; columellar lamella small but conspicuous.

**Description.** Shell (Fig. 3B) strongly depressed, with spire low, thin, uniformly yellowish brown, dextral; whorls 4.15–4.25. Spire almost flat. Protoconch surface smooth, without sculpture. Last whorl clearly descending behind aperture. Periphery with strong but blunt keel, with tubercles. Penultimate and last whorls with a descending pattern of long tubercles; last whorl with a few long bristles on tubercles (absent on ventral side); mean length of bristles about 0.63 mm. Aperture vastly extended, subcircular. Peristome expanded, not reflected, free from preceding whorl. One blunt, large palatal lamella; one small, low, rounded columellar lamella. Umbilicus deep, wide, approximately ¼ of shell diameter.



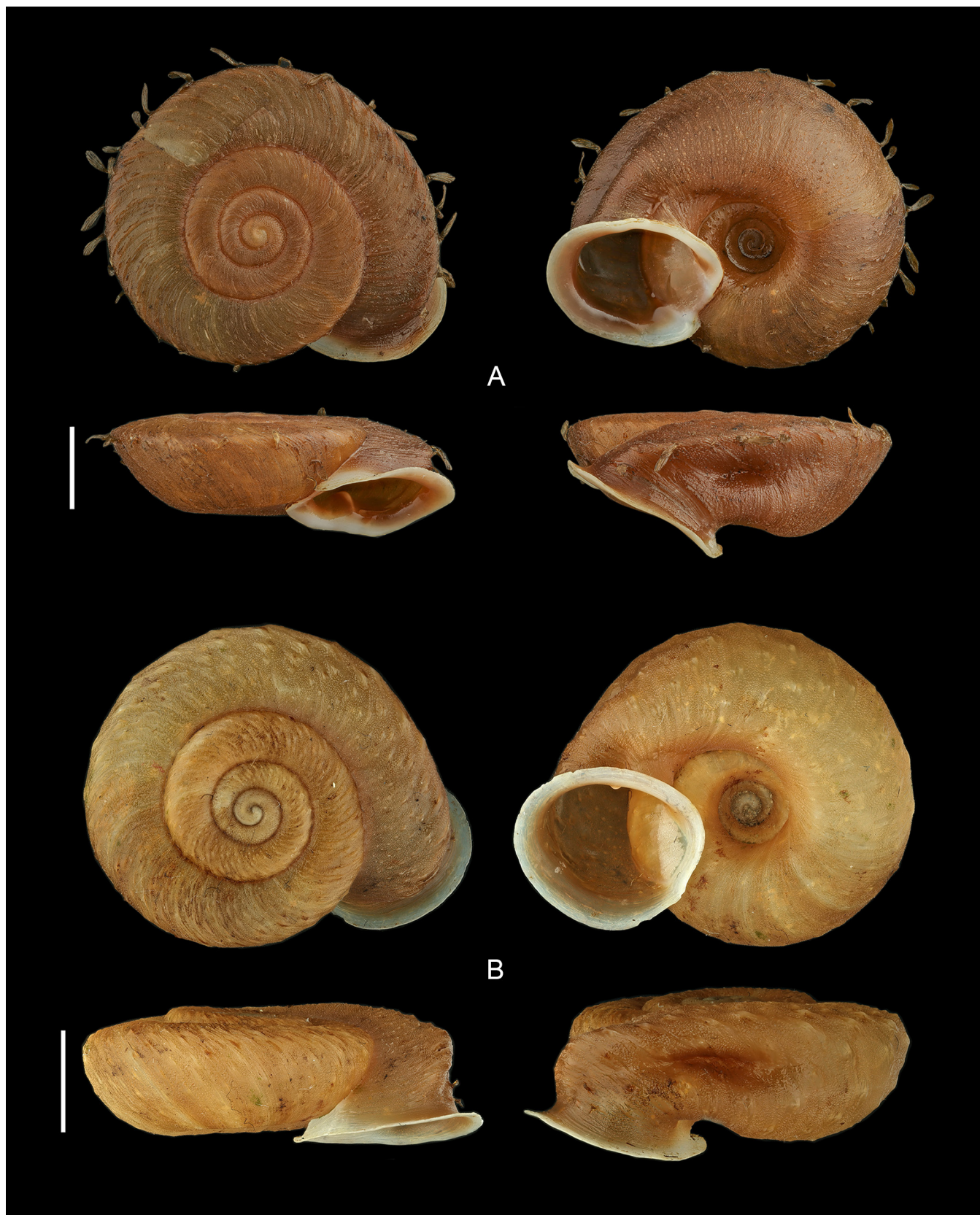
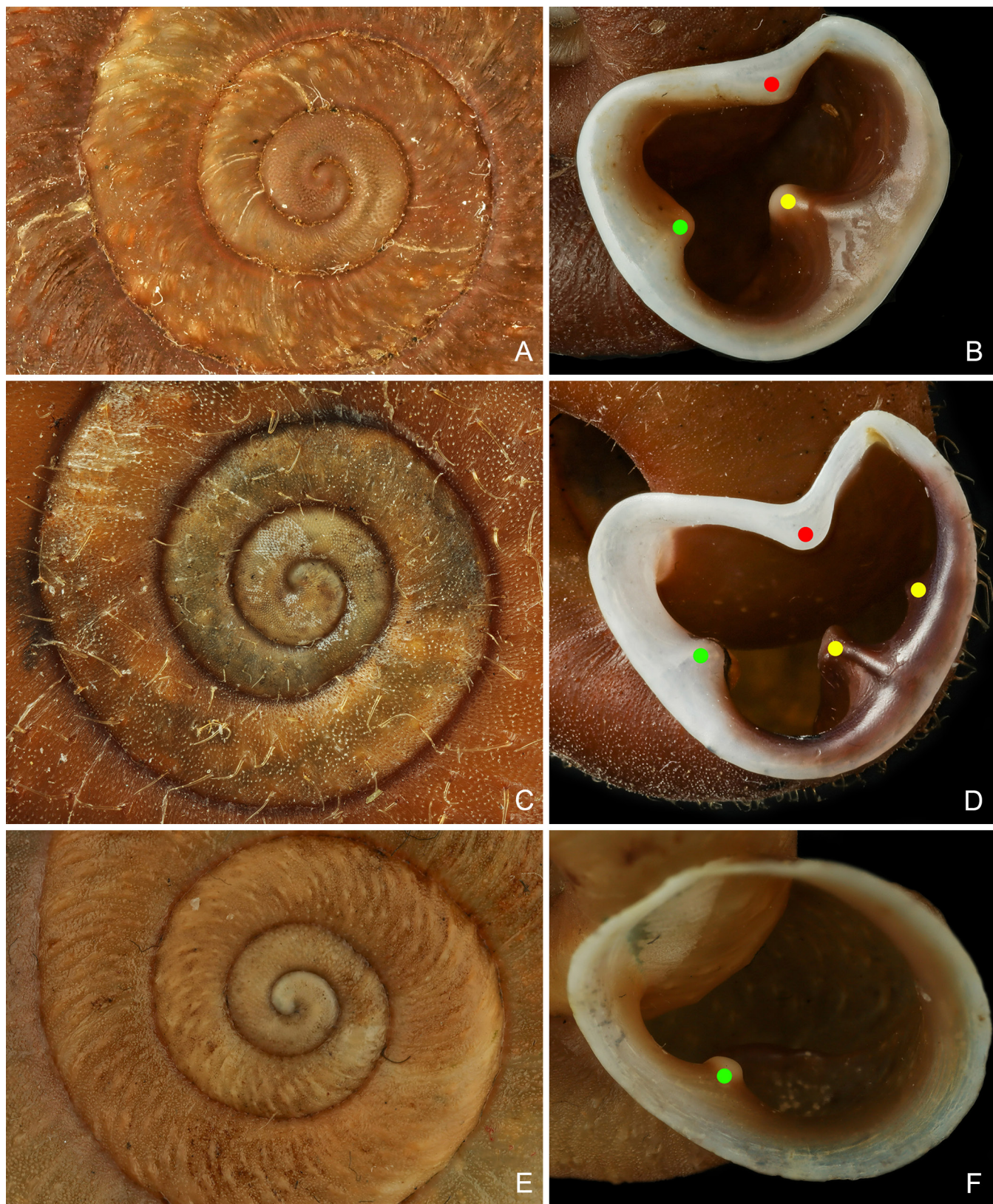


Figure 3. *Moellendorffiella* species from China. A, *Mo. erdmanni* from Wulong, Chongqing. B, *Mo. yifengi* sp. nov., holotype MYNU-00036 from Wenshan, Yunnan. Scale bars: 5 mm.





**Figure 4.** Protoconch and apertural characters. A, B, *Moellendorffia gulinensis* sp. nov., holotype MYNU-00034. C, D, *Moellendorffia wuchaoi* sp. nov., holotype MYNU-00038. E, F, *Moellendorffiella yifengi* sp. nov., holotype MYNU-00036. Red dot: prominent nodule, green dot: columellar lamella, yellow dot: palatal lamella. Not to scale.



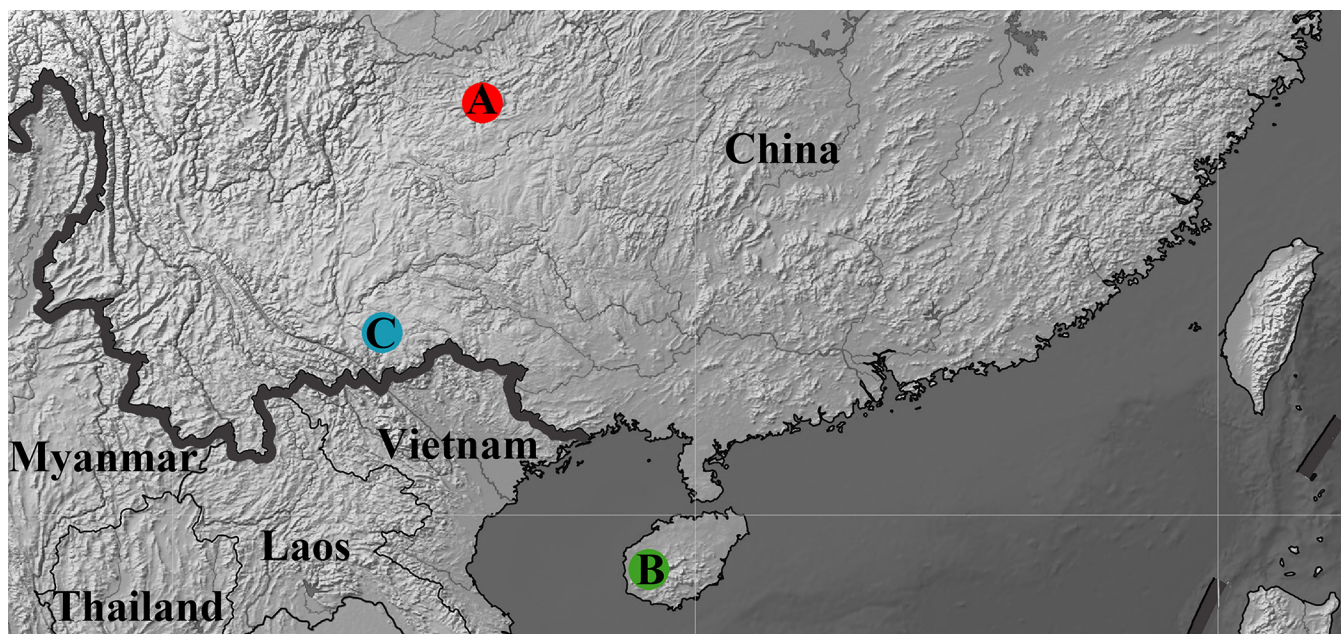


Figure 5. Distribution map of the three new species. A, *Moellendorffia gulinensis* sp. nov. B, *Moellendorffia wuchaoi* sp. nov. C, *Moellendorffiella yifengi* sp. nov.



Figure 6. Living snails and habitat of *Moellendorffia* species. A, B, *M. gulinensis* sp. nov., living holotype and its type locality, Zhicaogou, Gulin, Sichuan. C, D, *M. wuchaoi* sp. nov., living snail from Jianfengling, Hainan (D was photographed under ultraviolet light to show the snail's bristles). Photo credit: Lu Qiu (A, B) and Chao Wu (C, D).





**Figure 7.** Living snail and habitats of *Moellendorffiella* species. **A, B**, *Mo. erdmanni* and habitat at Wulong, Chongqing. **C**, type locality of *Mo. yifengi* sp. nov., Kaihua, Wenshan, Yunnan. Photo credit: Chen-Yu Fei (A, B) and Yi-Feng Liu (C).

**Variation.** The paratype is smaller than the holotype. In all other respects, they are identical to each other.

**Derivation of name.** This species is named in honour of Mr Yi-Feng Liu (Southwest University, China) who collected and sent us the samples.

**Geographic range.** Known only from the type locality.

**Habitat.** The empty shells were found in crevasses of a huge limestone cliff (Fig. 7C).

**Remarks.** This species differs from its congeners in having obvious tubercles on the penultimate and last whorls, the aperture much more descending, and the peristome free from the last whorl. It can further be distinguished from the type species, *Mo. erdmanni*, by the less strongly keeled whorl and the lighter colouration (Sutcharit *et al.* 2020).

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