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Camaenidae in Bhutan, with the description of a new species (Gastropoda, Eupulmonata: Helicoidea)

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Keywords: Gastropoda, Camaenidae, Bradybaeninae, new species, NE India, Nepal, Bhutan.

Shells of 3 species of Camaeninae, viz. *Bouchetcamaena* cf. *fusca*, *B. subdelibrata* and *Burmochloritis bhutanensis* spec. nov., and 2 Bradybaeninae species, viz. *Bradybaena radicolica* and *Aegista tapeina*, are described from Bhutan. The status of *Bradybaena elatior* versus *B. radicolica* is discussed. Anatomical or molecular data are not available.

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INTRODUCTION

This article results from the ongoing malacological inventory project in Bhutan (see Gittenberger et al., 2017). Shortly after the publication of our preliminary field guide to the common molluscs of Bhutan, Páll-Gergely et al. (2022) published a revision of *Helix delibratus* Benson, 1836 and showed that the Bhutanese species referred to as *Trachia delibrata* by Gittenberger et al. (2017: 102) is not identical with Benson's species. Using these new data, we here treat the samples of Camaeninae from Bhutan in more detail.

The shells are discoid, with a strongly depressed spire, a broadly reflected and thickened apertural lip, and a wide umbilicus.

The Bhutanese samples can only provisionally be classified since only few shells are known, most of which poorly preserved. The presence, prominence and distribution of hair-scars for example, considered diagnostic by Páll-Gergely et al. (2022), cannot always be judged due to the poor preservation status.

Following Páll-Gergely et al. (2022) two genera of Camaeninae are accepted for the Bhutanese species. The colour pattern of the shells forms the basis for this classification, viz. (1) without or with a single spiral band versus (2) with multiple spiral lines or bands. There are neither anatomical nor molecular data known to support this distinction. Therefore, because of the common homoplasy in shell shapes and banding patterns, the generic classification remains speculative.

Additionally we present data regarding 2 more species of the same family, but from the subfamily Bradybaeninae, from Bhutan. Schileyko & Kuznetsov (1998) led up to a problem with Himalayan *Bradybaena* species, which is elaborated, but cannot be solved without additional material for study. The widespread bradybaenid *Aegista tapeina* (Benson, 1836) is reported as new for Bhutan.

MATERIAL AND METHODS

The shells were collected by hand searching (see Gittenberger et al., 2021: 6). Most specimens, including all holotypes, are in the molluscan collection of the National Bio-

diversity Centre (Serbithang, Thimphu, Bhutan). Some duplicates are in the National Biodiversity Center Naturalis (Leiden, The Netherlands).

Photographs were made by E. G. with a Canon EOS 7D or Ricoh WG-4.

The number of whorls was counted in accordance to Kerney & Cameron (1979: 13). We follow the nomenclature used in MolluscaBase.

The number of specimens is indicated after the slash after the collection number. The locality numbers are indicated within square brackets.

The following abbreviations are used: H = height; NBCB = National Biodiversity Centre, Serbithang, Ministry of Agriculture and Livestock, Thimphu, Bhutan; RMNH.MOL = 'Rijksmuseum van Natuurlijke Historie, Mollusca', or Naturalis Biodiversity Center, Leiden, The Netherlands; SMF = 'Senckenberg Museum Frankfurt', or Senckenberg Research Institute and Natural History Museum, Frankfurt am Main, Germany; W = shell width; ZMB = 'Zoologisches Museum Berlin', or Natural History Museum, Berlin, Germany.

SYSTEMATICS

Superorder Eupulmonata Haszprunar & Huber, 1990

Superfamily Helicoidea Rafinesque, 1815

Family Camaenidae Pilsbry, 1895

Subfamily Camaeininae Pilsbry, 1895

Genus *Bouchetcamaena* Thach, 2018

Type species: *Bouchetcamaena huberi* Thach, 2018 [= *B. foveata* (Morlet, 1886), by original designation (see Páll-Gergely et al., 2020)].

Remarks. — Páll-Gergely et al. (2022) mentioned 4 *Bouchetcamaena* species and a problematic taxon of that genus from the Garo and Khasi Hills in Meghalaya, India. We hesitantly identify the small samples from Bhutan as two of these.

Bouchetcamaena cf. *fusca* Páll-Gergely, 2022

Figs 4, 6, 7

Bouchetcamaena fusca Páll-Gergely, in Páll-Gergely et al., 2022: 16-18, fig. 12. Type locality: "India, Manipur".

Material. — Sarpang Dzongkhag: [85] Salpara, Themba, 100 m a.s.l., 26°50'18"N 90°11'53"E, Sherub leg. iii.2019 (NBCB1455/1); [310] subtropical broadleaf forest, 220 m a.s.l., 26°51'12"N 90°29'44"E, Sherub leg. x.2021 (NBCB1454/5; RMNH.MOL.452093/1).

Description (n = 7). — The fresh, transparent shells are dark brown, with a weak, narrow spiral band above the periphery. There are 4 $\frac{1}{8}$ -4 $\frac{1}{4}$ whorls. The umbilicus takes $\frac{1}{5}$ - $\frac{1}{4}$ W. Most teleoconch whorls have fine hair-scars, which become obsolete on the last whorl.

Measurements. — W 16.0-19.0 mm, H 8.4-9.1 mm.

Remarks. — The shells fit the original description of *Bouchetcamaena fusca* in particular in colour, but are not clearly different otherwise from the specimens considered *Bouchetcamaena subdelibrata* here. The presence of a spiral band is not mentioned by Páll-Gergely et al. (2022). A shell of *Burmochloritis bhutanensis* spec. nov. was found together with *Bouchetcamaena fusca* at loc. 310.

Bouchetcamaena subdelibrata Páll-Gergely, 2022

Figs 3, 6, 7

Bouchetcamaena subdelibrata Páll-Gergely, in Páll-Gergely et al., 2022: 25-27, fig. 17. Type locality: "S. Silhet" = Sylhet Hills, Bangladesh.

Material. — Chhukha Dzongkhag: [378] Jigmechu to Allay, 265 m a.s.l., 26°45'35"N 89°44'00"E, Kezang Tobgay, Phuentsho, Phub Gyeltshen & E. Gittenberger leg. 16.x.2024 (NBCB4026/2; RMNH.MOL.452094/1). Pemagatshel Dzongkhag: [74] Nganglam, c. 500 m a.s.l., 26°50'N 91°15'E, Sherub leg. 6/8.xi.2018 (NBCB1694/1). Samdrup Jongkhar Dzongkhag: [282] 8 km NNW of Samdrup Jongkhar, 815 m a.s.l., 26°52'13"N 91°28'48"E, E. Gittenberger, Choki Gyeltshen & Kezang Tobgay leg. 29.ix.2019 (NBCB1457/1). Sarpang Dzongkhag: [316] Jigmeling, 6 km NW of Panbang, 357 m a.s.l., 26°54'58"N 90°24'48"E, Tshering Pem leg. 31.viii.2023 (NBCB3006). Zhemgang Dzongkhag: [270] ENE of Panbang, 260 m a.s.l., ca. 26°52'N 91°00'E, E. Gittenberger, Choki Gyeltshen & Kezang Tobgay leg. 26.ix.2019 (NBCB1456/3; RMNH.MOL.452095/1).

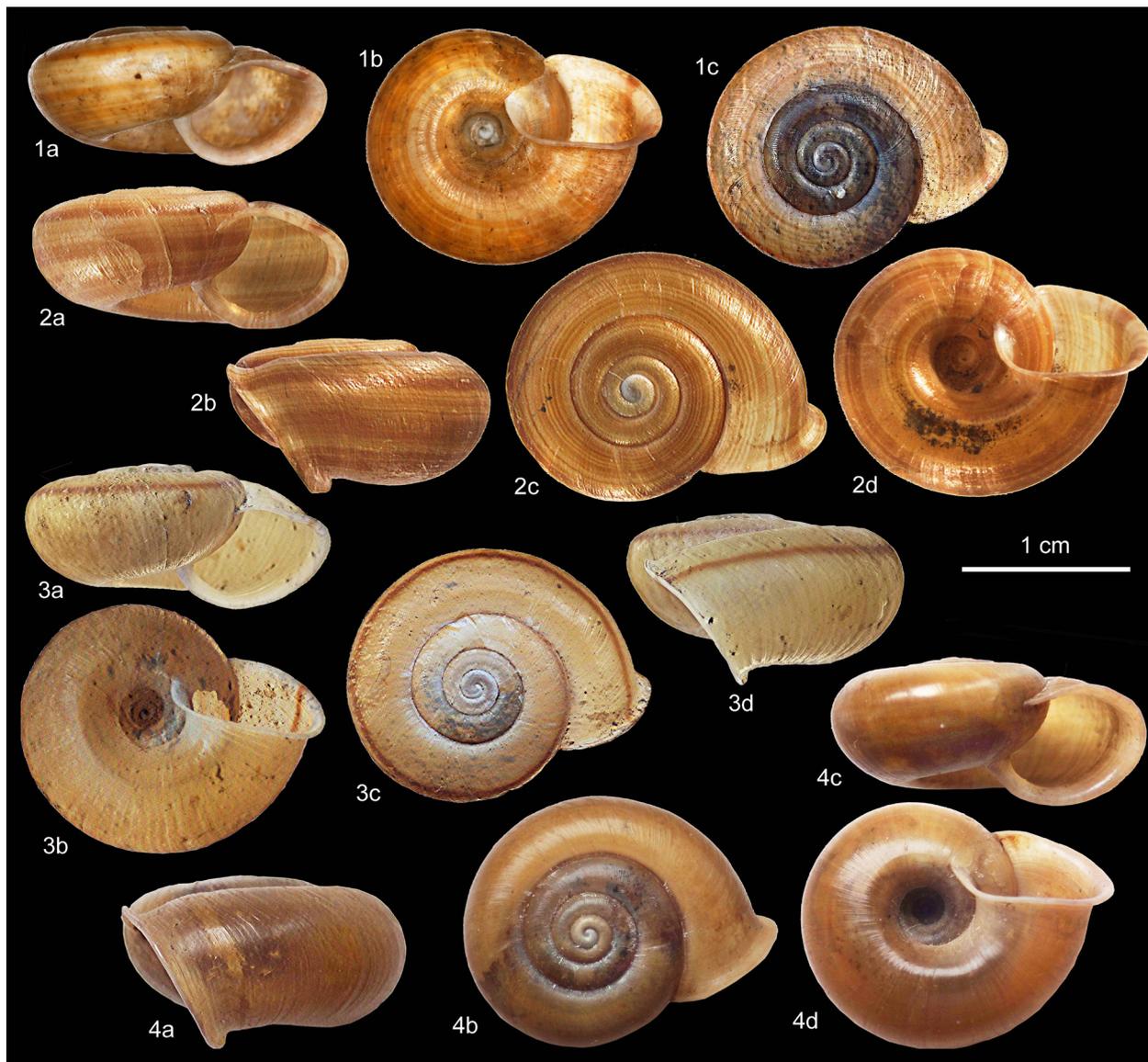
Description (n = 5). — The fresh, transparent shells are pale yellowish brown, with a prominent, narrow, reddish brown, spiral band above the periphery. There are 4 $\frac{1}{8}$ whorls. The umbilicus takes $\frac{1}{5}$ W. All teleoconch whorls have fine, simple hair-scars.

Measurements. — W 17.0-20.2 mm, H 8.6-9.0 mm.

Differentiation. — This species differs from *Bouchetcamaena delibrata* (Benson, 1836) and *B. foveata* Páll-Gergely, 2022 by shells less than 2 cm broad, with simple hair-scars all over. In *B. fusca* the shell is darker brown, with less prominent hair-scars.

Genus *Burmochloritis* Godwin-Austen, 1920

Type species: *Burmochloritis kengtungensis* Godwin-Austen, 1920, by original designation (Godwin-Austen, 1920: 9).



Figs 1-4. Camaenininae. **1, 2.** *Burmochloritis bhutanensis* spec. nov. **1.** [269] Zhemgang Dzongkhag, 19.5 km SE of Tingtibi, 780 m a.s.l. (NBCB1406/paratype); **2.** [320] Sarpang Dzongkhag, Pantang, near bridge, 277 m a.s.l. (NBCB3007/holotype). **3.** *Bouchetcamaena subdelibrata* Páll-Gergely, 2022, [270] Zhemgang Dzongkhag, ENE of Panbang, 260 m a.s.l. (NBCB1402). **4.** *Bouchetcamaena* cf. *fusca* Páll-Gergely, 2022, [310] Sarpang Dzongkhag, Gelephu, subtropical broadleaf forest, 220 m a.s.l. (NBCB1454). **1,** W = 17.7 mm; **2,** W = 18.9 mm; **3,** W = 18.1 mm; **4,** W = 18.6 mm.

Remarks. — Following MolluscaBase (2025) and Páll-Gergely et al. (2023), we use the generic name *Burmochloritis* Godwin-Austen, 1920 instead of *Trachia* E. von Martens, 1860. The type species of both nominal genera, i.e. *B. kengtungensis* and *Trachia asperella* (L. Pfeiffer, 1846), are known by shells only. These shells are similar by the discoid shape and the presence of a main peripheral colour band and some narrower ones. Anatomical or molecular data are needed to enable a more solid generic placement.

***Burmochloritis bhutanensis* E. Gittenberger, Choki Gyeltshen & Sherub spec. nov.**

Figs 1, 2, 5-7

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Material (paratypes, unless stated otherwise). — Chhukha Dzongkhag: [44] near the Allay waterfall, 32 km ESE of Phuentsholing, 451 m a.s.l., 26°45'N 89°43'E, calcareous roadside, Sherub & Ugyen Tenzin leg. 07.ii.2017 (NBCB1444/1). Pemagatshel Dzongkhag: [74] Nganglam, c. 500 m a.s.l.,

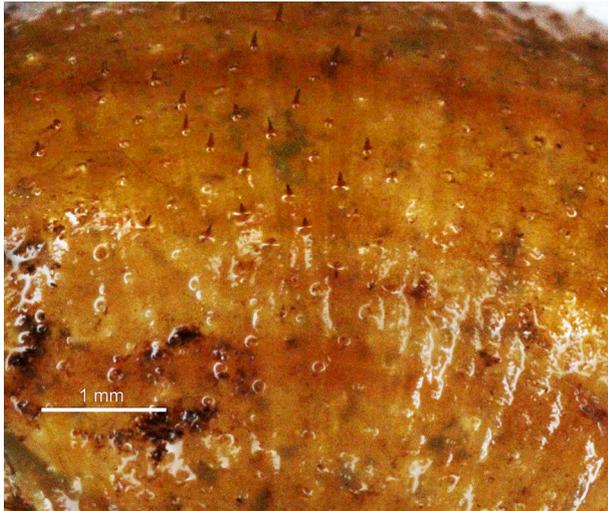


Fig. 5. *Burmochloritis bhutanensis* spec. nov., detail with hair-scars and hairs, [408] Samdrup Jongkhar Dzongkhag, 3.5 km E of Samdrup Jongkhar, 233 m a.s.l. (NBCB4027).

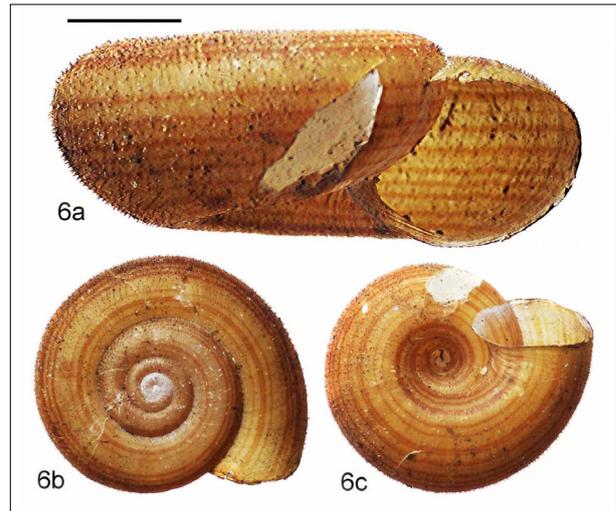


Fig. 6. *Burmochloritis* sp., [263] Sarpang Dzongkhag, 10 km NNE of Gelephu, 750 m a.s.l., (NBCB1409/1). W = 22.7 mm. Scale bar for 6a 5 mm.

26°50'N 91°15'E, Sherub leg. 6/8.xi.2018 (NBCB1692/3; RMNH.MOL.452096/1); [323] Goshing, 353 m a.s.l., 26°56'43"N 90°53'0"E, Choki Gyeltshen & Tshering Pem leg. 13.iii.2023 (NBCB3008/5 juv.). Samdrup Jongkhar Dzongkhag: [408] 3.5 km E of Samdrup Jongkhar, 233 m a.s.l., 26°48'32"N 91°33'51"E, Tshering Pem, Sangay Tshomo & Tashi Phuntsho leg. 15.ii.2023 (NBCB4027/4; RMNH.MOL.452097/2). Sarpang Dzongkhag: [126] Royal Manas National Park, 310 m a.s.l., 26°53'N 90°54'E, Sherub leg. 05.ii.2020 (NBCB1404/2; RMNH.MOL.452098/1); [228] SE Gelephu, 335 m a.s.l., 26°56'N 90°31'E, E. Gittenberger & Pema Leda leg., 25.iii.2016 (NBCB1691/3); [310] Gelephu, subtropical broadleaf forest, 220 m a.s.l., 26°51'N 90°29'E, Sherub leg. x.2021 (NBCB1458/1); [320] 12 km NW of Pantang, near bridge, 277 m a.s.l., 26°57'50"N 90°51'51"E, Choki Gyeltshen & Tshering Pem leg. 13.iii.2023 (NBCB3007/holotype). Zhemgang Dzongkhag: [269] 19.5 km SE of Tingtibi, 780 m a.s.l., 27°01'N 90°49'E, E. Gittenberger, Choki Gyeltshen & Kezang Tobgay leg. 26.ix.2019 (NBCB1406/1); [39] between Duenmang Tsachhu and Gonphu Zero Point, 24 km SE of Zhemgang, 335 m a.s.l., 27°02'N 90°48'E, scree in warm broadleaf forest, Sherub & Ugyen Tenzin leg. 08.i.2017 (NBCB1443/1); [323] Goshing, 353 m a.s.l., 26°56'43"N 90°53'0"E, Choki Gyeltshen & Tshering Pem leg. 13.iii.2023 (NBCB3008/5 juv.).

Diagnosis. — Shell slightly shouldered, with many dark spiral bands and prominent dark hairs leaving clear hair-scars on all whorls.

Description (n = 31). — The pale brown, discoid shell is slightly shouldered. It has a depressed to nearly flat spire and 3½–4¾ whorls. Above the periphery there is a reddish brown spiral band, accompanied above and below by up to nearly 20 bands or lines varying in width. The shells from loc. 408 (Fig. 5) are covered by a dull brownish periostra-

cum, largely covering the spiral bands. The aperture has an inclination of 40–50°; it is broader than high. The columellar side passes gradually into the basal side. The thickened apertural lip is broadly reflected. The umbilicus takes ca. ¼W. The entire shell is covered with prominent hair-scars; near the suture there are 0.13–0.15 mm long, stiff, dark hairs.

Measurements. — H 8.5–10.2 mm, W 15.8–20.9 mm. Holotype H 9.3 mm, W 18.9 mm.

Differentiation. — The geographically close *Burmochloritis fasciata* (Godwin-Austen, 1875) from the West Khasi Hills has a similar banding pattern (Godwin-Austen, 1875: pl. 1 fig. 1; Páll-Gergely et al., 2022: 28 fig. 18) but differs by a slightly higher spire, a more regularly rounded and more prominently thickened apertural lip and hair-scars “visible only near parietal callus” (Páll-Gergely et al., 2022: 27).

Remarks. — A shell of this species was found together with *Bouchetcamena* cf. *fusca* at loc. 310.

***Burmochloritis* sp.**

Figs 6, 7

Material. — Sarpang Dzongkhag: [263] 10 km NNE of Gelephu, 750 m a.s.l., 26°57'N 90°32'E, E. Gittenberger, Choki Gyeltshen & Kezang Tobgay leg. 25.ix.2019 (NBCB1409/1).

Remarks. — A fragile, light brown, subadult shell, with 4¾ whorls and a flat spire differs in size (W 22.7 mm, H 9.1 mm) and by a wider umbilicus (> ¼W) from *B. bhutanensis*. It is entirely covered by persistent, stiff, little more than 0.1 mm long, dark brown hairs. There are ca. 20 spiral bands, varying in width. Near the aperture the last whorl is slightly descending, without the formation of an apertural lip.

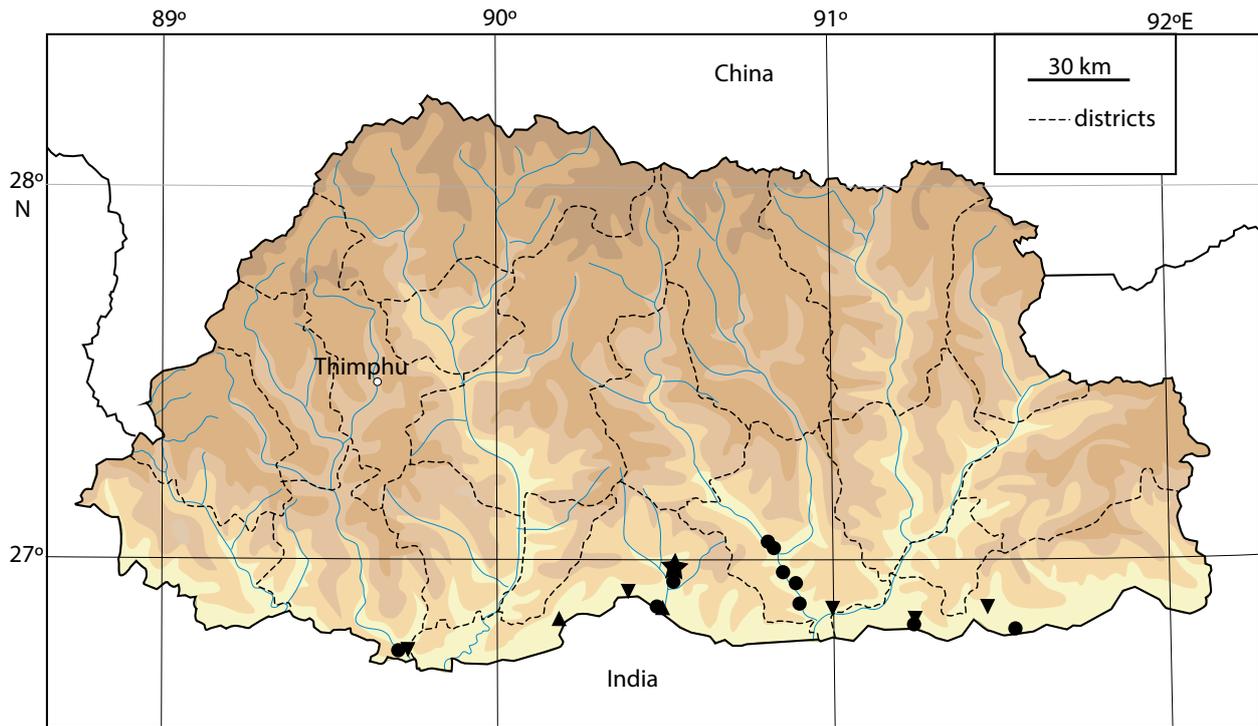


Fig. 7. Bhutanese records of *Burmochloritis bhutanensis* spec. nov. (●), *Burmochloritis* sp. (★), *Bouchetcamaena* cf. *fusca* Páll-Gergely, 2022 (▲), and *Bouchetcamaena subdelibrata* Páll-Gergely, 2022 (▼).

Subfamily Bradybaeninae Pilsbry, 1934

Genus *Bradybaena* Beck, 1837

Type species: *Helix similaris* Rang, 1831; subsequent designation by Gray (1847: 173).

Bradybaena radiculicola (Benson, 1848)

Figs 8, 9, 12

Helix radiculicola Benson, 1848: 161 (India, Himalaya, “Landour et Masuri” [Landour and Mussoorie, State Uttarakhand]).

Eulota radiculicola – Gude, 1914: 205.

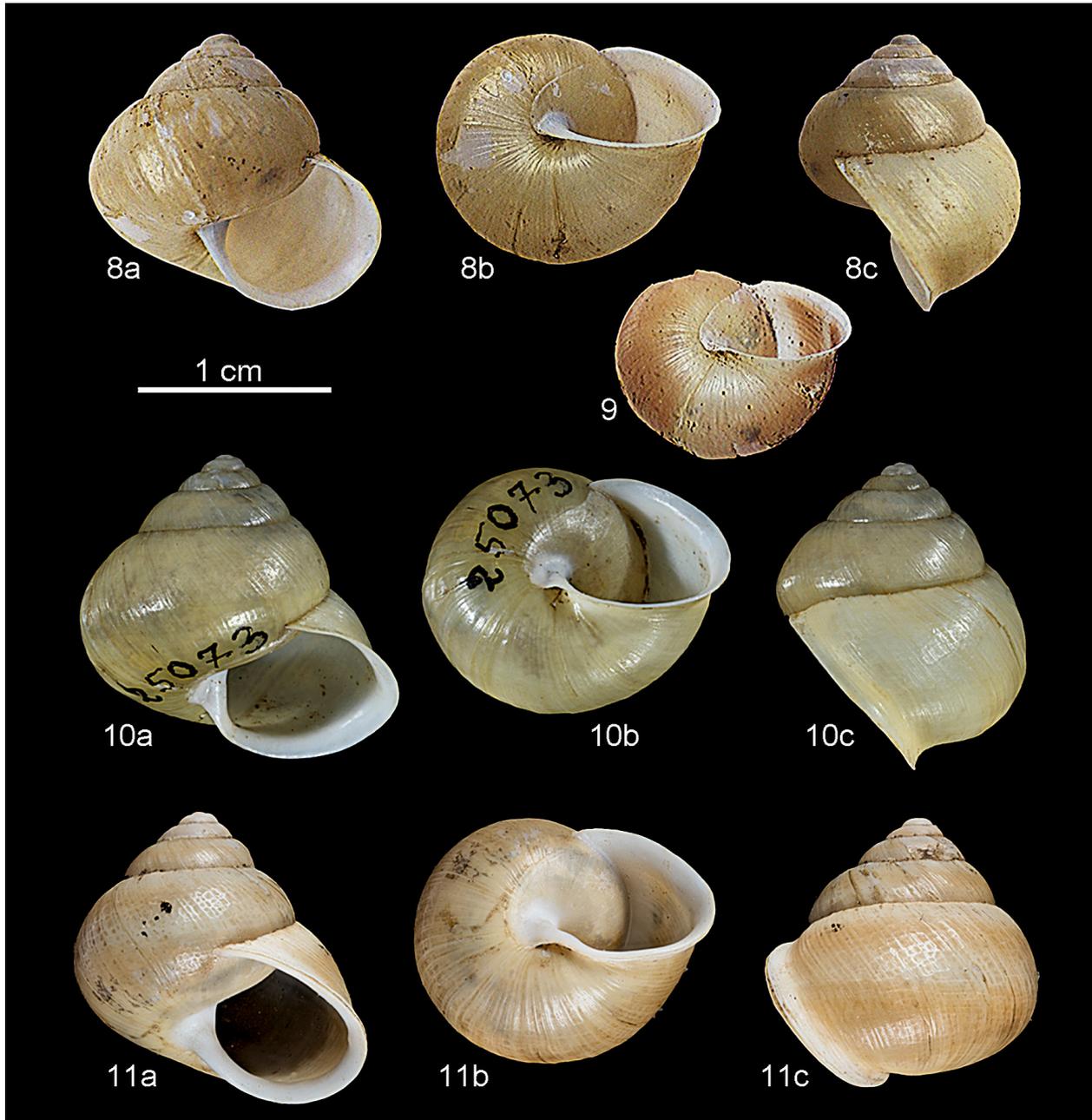
Bradybaena radiculicola – Schileyko & Kuznetsov, 1998: 51, figs 1H, 3; Ramakrishna et al., 2010: 336; Preece et al., 2022: 209–210, 337 figs 100F–G (syntypes).

Material. — Gasa Dzongkhag: [13] Khame, Kabena, 1782 m a.s.l., 27°47'10"N 89°43'53"E, rocks under warm broadleaf forest, Rinchen Singye leg. iii.2015 (NBCB1447/7); [258] Kabena (16 km S of Gasa), warm broadleaf forest along river, 1710 m a.s.l., 27°46'56"N 89°43'42"E, E. Gittenberger, Choki Gyeltshen & Pema Leda leg. 25.x.2018 (NBCB1448/7; RMNH.MOL.452099/2); [216] 15 km S of Gasa, 1725 m a.s.l., 27°46'N 89°43'E, E. Gittenberger & Pema Leda leg. 22.iii.2016

(NBCB1449/2). Lhuentse Dzongkhag: [41] Garbrag (Phag Sang), 11 km W of Gorgon, 1800 m a.s.l., 27°30'N 91°04'E, Ugyen Tenzin, Dawa Yoezer & Sherub leg. 22.ii.2017 (NBCB1450/2). Punakha Dzongkhag: [Bhutan Portal] Dompola, 27°33'36"N 89°54'25"E, Phuentsho leg. Thimphu Dzongkhag: [161] W of Geneykha, 2.5 km E of Chhuzom, 2825 m a.s.l., 27°18'43"N 89°36'10"E, E. Gittenberger et al. leg. 16.vi.2012 (NBCB1451/1).

Description. — The more or less fragile, pale yellowish or brownish shell is globular with a conical spire and 4½–5 moderately convex whorls. There may be light spiral bands at about the periphery and below the suture. The shell is about as high as broad or slightly higher. The protoconch is densely sculptured with fine, radially arranged wrinkles. The teleoconch has coarse growth lines and a very fine sculpture of spiral lirae. The short final part of the last whorl descends so that the aperture has an inclination of ca. 30°. The aperture is rounded, with an adapical angulation. The white, thickened apertural lip is reflected; it is broadly interrupted with a thin callus at the parietal side. The narrow umbilicus is half covered by the reflected columellar lip.

Measurements. — The 2 syntypes figured by Preece et al. (2022: 337 fig. 100F–G) are relatively small, i.e. H 9.5–9.9 mm and W 9.9 mm. Shells reported from Nepal measure H 11.0–11.4 mm and W 10.4–10.9 mm (Schileyko & Kuznetsov, 1998:



Figs 8-11. *Bradybaena* sp. **8, 9**, *B. radicolica* (Benson, 1848); **8**. [41] Lhuentse Dzongkhag, Garbrag (Phag Sang), 11 km W of Gorgon, 1800 m a.s.l. (NBCB1450); **9**. [13] Gasa Dzongkhag, Khamé, Kabena, 1782 m a.s.l. (NBCB1447). **10, 11**. *B. elatior* (E. von Martens, 1868), Himalaya; **10**. SMF25073; **11**. ZMB17904, holotype. **8**, W = 15.0 mm; **9**, W = 11.6 mm; **10**, W = 16.4 mm; **11**, W = 15.0 mm.

51). The shells from Bhutan (n = 8) are larger, viz. H 12.0-15.3 mm, W 11.6-15.0 mm.

Differentiation. — According to Schileyko & Kuznetsov (1998:51) *B. radicolica* is smaller and more fragile than *B. elatior* (E. von Martens, 1868), with “more reflexed margins” and a narrower umbilicus. The latter species, described from only “Himalaya” (von Martens, 1868: 157) and figured by Pfeiffer (1869: 461, pl. 101 figs 1-3), is poorly known. The number of shells available to Martens is not

indicated. We received excellent photographs of a syntype (ZMB17904, Fig. 11), with (1) a broadly expanded umbilical callus, covering most of the umbilicus, (2) a strongly thickened, reflected, apertural lip, and (3) a 40° inclination of aperture. The shell from “Himalaya” figured as *B. radicolica* by Yen (1939: 134, pl. 13 fig. 64) (SMF25073, Fig. 10) is very similar to this syntype by a broad columellar callus, with the umbilicus sealed off nearly completely, and a similarly sloping aperture. We consider this also *B. elatior*,

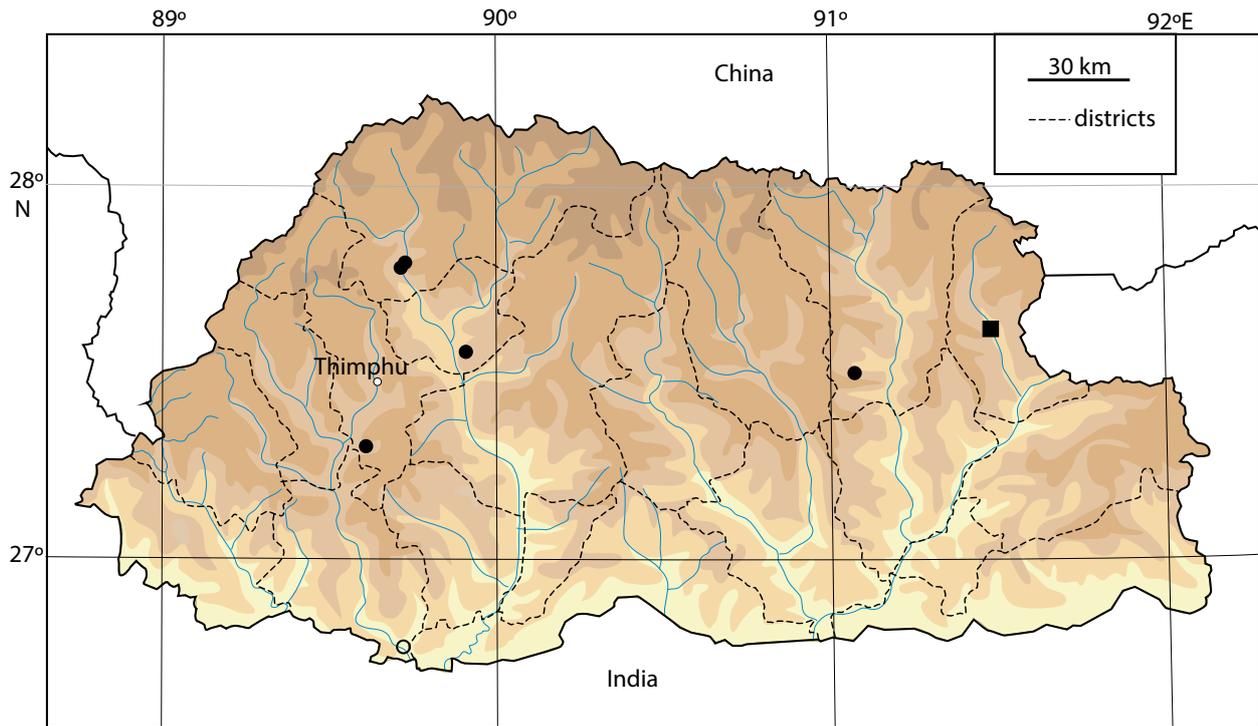


Fig. 12. Bhutanese records of *Bradybaena radiculicola* (Benson, 1848) (●) and *Aegista tapeina* (Benson, 1836) (■).

wondering whether the identical meagre geographical data might result from a single sample, split later on. Gude (1914: 206-207) studied the syntype of *B. elatior* and accepted the taxon as a variety “at the most” of *B. radiculicola*, referring to a similar shell from Sikkim, measuring W 16.5 mm, H 15.0 mm. The more fragile Bhutanese shells, with a less broadly expanded umbilical callus, and a smaller inclination of the aperture, are provisionally considered here relatively large *B. radiculicola*. Without more material, a more detailed analysis is not possible.

Habitat. — According to Schileyko & Kuznetsov (1998: 51), referred to by Budha et al. (2015: 29, 2017: 40), *B. radiculicola* is “very rare” in Nepal, where it occurs in the “Rhododendron forest zone at 2600-2700 m”. In Bhutan the species is also uncommon. Fresh shells, nearly always damaged (by predators?), are found at lower altitudes, i.e. at 1710-2825 m a.s.l., in broadleaf forest.

Distribution. — Ramakrishna et al. (2010: 336) reported *B. radiculicola* from the Indian states of Himachal Pradesh, Sikkim and Uttarakhand, while neglecting *B. elatior*. Preece et al. (2022: 210) mentioned northern India, Nepal and Bhutan.

Genus *Aegista* Albers, 1850

Type species: *Helix chinensis* Philippi, 1845; by monotypy.

Aegista tapeina (Benson, 1836)

Figs 12, 13

Helix tapeina Benson, 1836: 352 (“North-East Frontier of Bengal”, probably Sylhet, Bangladesh).

Aegista (Plectotropis) tapeina – Ramakrishna et al., 2010: 339.

Aegista tapeina – Preece et al., 2022: 210, 338 fig. 101C.

Plectotropis tapeina – Subba Rao et al., 1995: 83, pl. 24 figs 2-3.

Material. — Bhutan, Trashiyangtse Dzongkhag: [147] Trashi Yangtse, 27°37'04"N 91°29'26"E, 1765 m a.s.l., Choki Gyeltshen leg. 2022 (NBCB1426/2).

Description. — The shell has a depressed, domed spire above the peripheral keel and 5½ flattened whorls. The final 1/16 of the last whorl descends so that the aperture has an inclination of ca. 50°. The umbilicus is little broader than ¼W. The roundish aperture is broadly interrupted at the parietal side; the apertural lip is most clearly reflected at the basal and columellar side. In fresh specimens the surface is delicately sculptured with dense periostracal radial ridges and spirals.

Measurements (n = 1). — H 6.3 mm, W 12.1 mm. According to Gude (1914: 215) this species “varies considerably in size”. Benson (1836: 352) indicated a diameter of “0.6 poll” (= 15 mm). Two shells from “Khasi Hills”, Meghalaya, NE



Fig. 13. *Aegista tapeina* (Benson, 1836), [147] Trashiyangtse Dzongkhag, Trashi Yangtse, 1765 m a.s.l. (NBCB1426). W = 12.1 mm. Scale bar 3 mm.

India (RMNH.MOL.309669) measure H 3.2 mm, W 9.7 mm, and H 3.9 mm, W 10.2 mm.

Distribution. — There is only one record for this species, in E Bhutan, Trashiyangtse Dzongkhag at 1765 m a.s.l. It is reported by Ramakrishna et al. (2010: 340) as “widely distributed” from NE India, including the northern part of West Bengal, and Bangladesh (Sylhet) and Myanmar. Gude (1914: 215) mentioned “Prome” (= Pyay) (18°50'N 95°15'E) in Myanmar, as the southernmost record for the species. The species is not known from Nepal (Budha et al., 2015, 2017).

DISCUSSION

The species dealt with in this article are uncommon in Bhutan and known by small samples of shells only. That implies some uncertainty regarding the results. Aiming at a general overview of the Bhutanese molluscan fauna within a reasonable period of time, we prefer not to wait for more material. Calling attention to the *Burmochloritis* sp., certainly an undescribed species, may accelerate its collecting, description and naming.

Aegista tapeina and the Camaenininae species dealt with here, also occur in nearby India, in particular the state of Meghalaya, or there is at least a congeneric species in that area. None of these species is known from Nepal. This illustrates once more the conspicuous biogeographic borderlines in this part of the eastern Himalaya (Gittenberger et al., 2018).

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