



Vertigo botanicorum sp. nov. (Gastropoda: Pulmonata: Vertiginidae)—a new whorl-snail from the Russian Altai Mountains

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Abstract

Vertigo botanicorum sp. nov. is described from the Russian Altai Mountains. The species was recorded in 8 out of 118 study sites and totally 21 live individuals and 15 empty shells were collected. It is a medium-sized *Vertigo* species living in various tall-forb meadows, shrubby and forest habitats; avoiding only dry and strictly open sites. Mostly it was found in rather acidic sites of higher altitudes (above 1300 m a.s.l.).

Key words: *Vertigo*, terrestrial microgastropods, new species, southern Siberia, distribution, ecology

Introduction

The terrestrial snail genus *Vertigo* O.F. Müller, 1774 includes approximately 70 described living species distributed mainly throughout the Holarctic, with the global diversity centre of the genus in North America (see Nekola & Coles 2010) and with ca. 30 species distributed in Eurasia (Pokryszko 2003; von Proschwitz 2007; Pokryszko *et al.* 2009; Sysoev & Schileyko 2009). The members of this genus have ovoid to cylindrical shells that generally range between 1.5 and 3 mm in height and have a rounded aperture with 0–9 lamellae at maturity.

Vertigo species of particular geographical and palaeontological interest have recently been found to be commonly distributed in Central Asia (Pokryszko & Horsák 2007, Meng 2008, White *et al.* 2008, Horsák *et al.* 2010). Several of these are typical fossils in Central European glacial deposits and were previously known extant from only limited areas in Europe. In the course of ecological and palaeoecological research at 118 sites in the Russian Altai Mountains in August 2005 and July 2006, an undescribed species within the genus *Vertigo* was discovered.

Sites inventoried for snails were distributed along an approximately 300 km-long NNW–SSE transect (49°56′–52°19′N, 85°35′–88°31′E, 260–2570 m a.s.l.), running across the Russian part of the Altai Mountains in the Altai Republic, a part of the Russian Federation, in southern Siberia (Fig. 1). The sites were selected to include the whole regional range of habitat types as determined by physiognomy and dominant plant species. Along the transect there is a steep climatic gradient of decreasing continentality from dry and cold conditions in the south-eastern part to relatively wet and warm conditions in the northern foothills (for details see Horsák *et al.* 2010). The wide climatic amplitude and range of habitat types of the sites studied make it possible to delimitate the new species' ecological requirements. For full locality information see Appendix 1. Further information on the study area and sites, sampling protocol and other methodologies are available in Horsák *et al.* (2010). All adult and undamaged shells (n=22) found at all eight sites were used for measurements and description of the conchological variability. Institutional abbreviations: DBZB—Department of Botany and Zoology, Masaryk University, Brno, Czech Republic; NMWP—Natural History Museum, Wrocław University, Wrocław, Poland; NMPC—National Museum, Prague, Czech Republic.

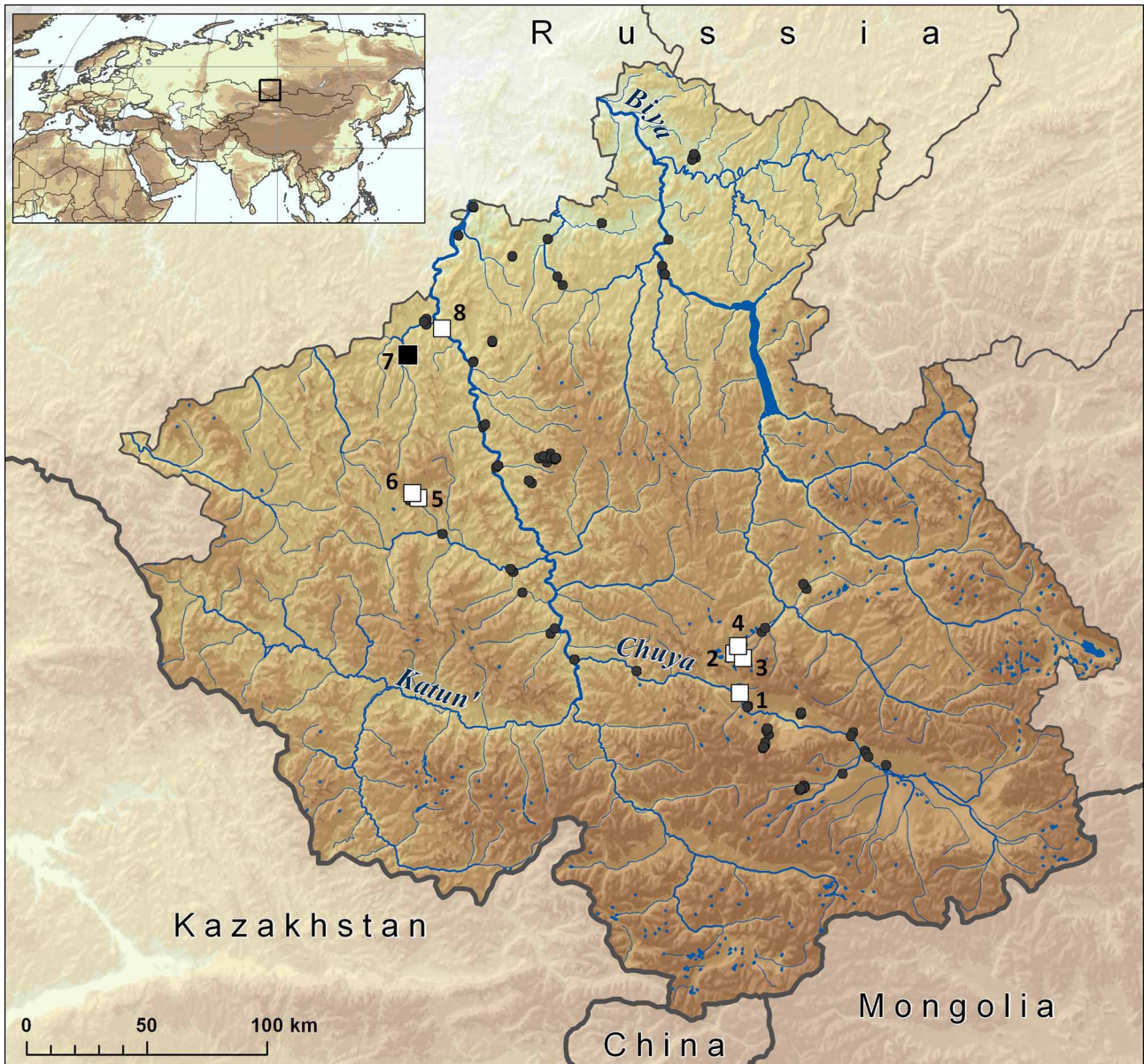


FIGURE 1. Map of the Altai Republic (Russia) with sampling sites. Squares—sites with *Vertigo botanicorum* **sp. nov.** (black square = type locality; for site numbers see App. 1); dots—sites without *Vertigo botanicorum*.

Vertiginidae Pilsbry, 1918

Vertigo O.F. Müller, 1774

Type species: *Vertigo pusilla* O.F. Müller, 1774 (monotypy)

Vertigo botanicorum **sp. nov.**

(Fig. 2)

Type locality. Loc. no. 7: 51°30'26.6"N, 85°35'48.6"E, Russian Altai Mts., Aktel: Seminski Ridge, Aktel creek valley, 4 km W of the settlement, 13 Aug. 2005, M. Horsák lgt.

Type material. Loc. no. 7: holotype and 1 paratype (NMWP), 2 paratypes (NMPC), 1 paratype (DBZB); Loc. no. 2: 6 paratypes (DBZB); Loc. no. 3: 2 paratypes (DBZB); Loc. no. 4: 1 paratype (DBZB); Loc. no. 6: 1 paratype (DBZB); Loc. no. 8: 1 paratype (DBZB).

Other material examined. Loc. no. 1: 1 specimen; Loc. no. 4: 1 specimen; Loc. no. 3: 1 specimen; Loc. no. 2: 3 specimens (all in DBZB).

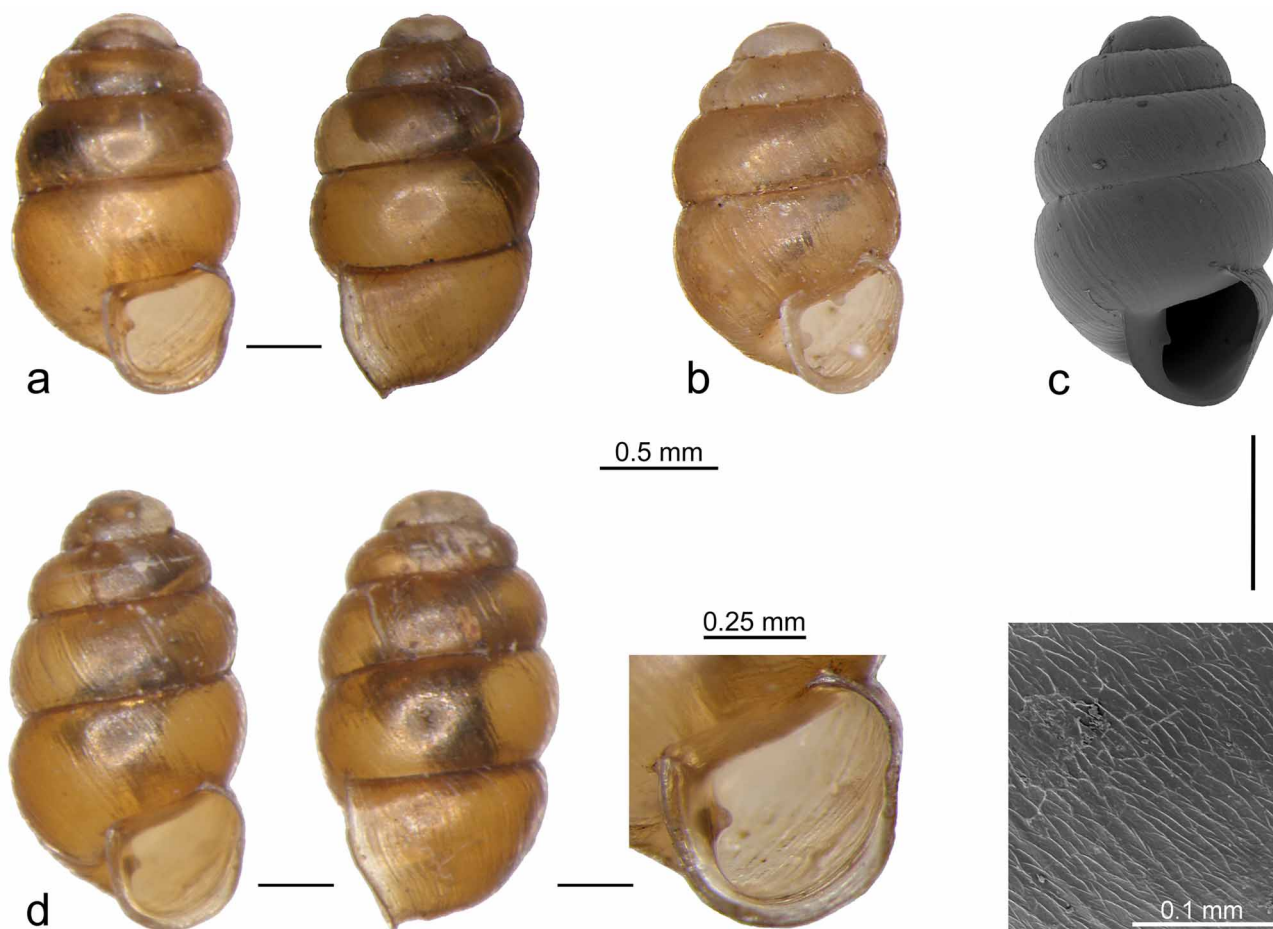


FIGURE 2. *Vertigo botanicorum* sp. nov. from the Altai Republic (Russia); **a**, Holotype, NMWP, Loc. no. 7 (see Appendix 1); **b**, Paratype, DBZB, Loc. no. 8; **c**, Paratype, DBZB, Loc. no. 7; **d**, Paratype, DBZB, Loc. no. 6. Photos by M. Horsák (a, b, d) and P. Kment (c).

Etymology. We dedicate this species to all the botanists who took part in the Altai expeditions: Milan Chytrý, Jiří Danihelka, Nikolai Ermakov, Michal Hájek, Petra Hájková, Martin Kočí, Svatava Kubešová, Pavel Lustyk, Zdenka Otýpková, Barbora Pelánková, and Milan Valachovič. Because of the efforts of these colleagues, the senior author had a remarkable field experience during the Altai Mountains expeditions, and was able to collect considerable field data of a high scientific value.

Description of the shell (n=22, Fig. 2). Shell dextral, height 1.78–2.25 mm (mean 1.98, SD 0.123, holotype 1.85), width 1.08–1.28 mm (mean 1.14, SD 0.056, holotype 1.10), aperture height 0.60–0.78 mm (mean 0.69, SD 0.059, holotype 0.63), aperture width 0.60–0.78 mm (mean 0.68, SD 0.043, holotype 0.65), body whorl height 1.03–1.23 mm (mean 1.12, SD 0.061, holotype 1.05), height/width ratio 1.51–2.00 (mean 1.74, SD 0.119, holotype 1.68), relative height of body whorl 0.50–0.62 (mean 0.57, SD 0.028, holotype 0.55), whorls 4.8–5.4 (mean 4.98, SD 0.16, holotype 4.8). Shell clearly ovate, the body whorl being distinctly broadest, with convex spire and gently rounded apex. Whorls not very convex with a shallow suture. Aperture semi-oval, with palatal margin slightly flattened or with a very shallow indentation. Lip narrow, very slightly thickened, in fresh shells of the same colour as the rest of the shell, narrowly but clearly reflexed on the columellar, basal and lower half of the palatal margin; parietal callus very weak, lip insertions almost not approaching. Aperture with 1–4 vestigial or very small lamellae with the columellar and palatal rather deeply set; all teeth tubercular and white, no trace of a palatal callus even in specimens with four lamellae; the holotype possesses a small columellar and vestigial parietal lamella. In side view the body whorl suture does

not or only almost imperceptibly ascend. The outside of the palatal wall lacks a crest, and possesses only a shallow, indistinct furrow corresponding with the upper palatal (even in toothless shells). Shells with two lamellae have a columellar and parietal, shells with a single lamella may have either of the two. The umbilicus is oval and narrow. Shell semitransparent, light golden-brownish, in very fresh shells with a greasy sheen; surface almost completely devoid of growth lines and/or striation, only with the specific microstructure of subparallel, anastomosing periostracal ridges which is more pronounced than in other *Vertigo* species; the few growth lines, if present, are faint, almost invisible.

TABLE 1. List of co-occurring species in all eight sites with *Vertigo botanicorum* **sp. nov.**, sites where they occurred (see Appendix 1) and total number of each species' records.

Co-occurring species	Sites	No. of Records
<i>Euconulus fulvus</i> (O.F. Müller, 1774)	1, 3, 4, 5, 6, 7, 8	7
<i>Perpolita hammonis</i> (Ström, 1765)	1, 2, 3, 5, 6, 7, 8	7
<i>Novisuccinea altaica</i> (Martens, 1879)	1, 2, 3, 4, 6	5
<i>Vertigo microsphaera</i> Schileyko, 1984	1, 5, 6, 8	4
<i>Deroceras altaicum</i> (Simroth, 1886)	4, 6, 7	3
<i>Perpolita petronella</i> (L. Pfeiffer, 1853)	5, 6, 8	3
<i>Pupilla muscorum</i> (Linné, 1758)	2, 4, 6	3
<i>Columella intermedia</i> Schileyko et Almuhambetova, 1984	4, 5	2
<i>Pupilla loessica</i> Ložek, 1954	2, 4	2
<i>Vallonia costata</i> (O.F. Müller, 1774)	6, 7	2
<i>Vallonia kamtschatica</i> Likharev, 1963	1, 2	2
<i>Cochlicopa lubrica</i> (O.F. Müller, 1774)	8	1
<i>Columella edentula</i> (Draparnaud, 1805)	1	1
<i>Fruticicola schrenkii</i> (Middendorff, 1851)	8	1
<i>Punctum pygmaeum</i> (Draparnaud, 1801)	8	1
<i>Vallonia ladacensis</i> (Nevill, 1878)	2	1
<i>Vertigo genesii</i> (Gredler, 1856)	4	1
<i>Vertigo parcedentata</i> (Al. Braun, 1847)	4	1
<i>Vertigo pseudosubstriata</i> Ložek, 1954	4	1
<i>Vertigo pygmaea</i> (Draparnaud, 1801)	7	1
<i>Vitrina rugulosa</i> Martens, 1874	6	1

Comparative notes. The species appears to be a member of a basically northern group including *Vertigo modesta* (Say, 1824), *V. ronneyensis* (Westerlund, 1871), *V. ultimathule* von Proschwitz, 2007, *V. extima* (Westerlund, 1877) and some North American members of the *V. modesta* clade, especially *V. modesta hoppii* (Möller, 1842), *V. cristata* (Sterki, 1919), *V. coloradensis* (Cockerell, 1891), and the undescribed “*Vertigo* AK 2” (see Nekola *et al.* 2009, Nekola & Coles 2010). It is also conchologically similar to *V. parcedentata* (Al. Braun, 1847) and *V. nangaparbatensis* Pokryszko et Hlaváč, 2009. It differs from *V. modesta*, which it resembles in shell shape and dentition pattern, in lighter colour (*V. modesta* is chestnut-reddish), smaller size (ca. 2/3 height and width), sheen (fresh *V. modesta* glossy, as if wet) and much smoother shells (in *V. modesta* clear and rather regular though delicate striae are present). It differs from *V. ronneyensis* mainly in surface structure; *V. ronneyensis* has fine regular ribs, spire striation and more cylindrical shape. *Vertigo botanicorum* **sp. nov.** differs from *V. ultimathule* and *V. extima* in weaker striation and much more pronounced microscopic periostracal ridges of the surface, less convex whorls with shallower suture, smaller size (especially from *V. extima*) and more ovate shape. It differs from conchologically similar North American species in its microsculpture (Fig. 2c) and the absence of regular small ribs. In addition, both *V. coloradensis*

and *V. cristata* possess a marked crest and much stronger lamellae (especially palatal), *V. modesta hoppii* has a darker, chestnut-red shell with a glossy sheen and weak crest, while “*Vertigo* AK 2” has pronounced shell striation and often a weakly developed crest that somewhat narrows the aperture. *Vertigo botanicorum* **sp. nov.** resembles the syntopic *V. parcedentata* in shell shape, colour and dentition, but it differs in being somewhat smaller, having a shallower suture and less convex whorls, by possessing a matte sheen (fresh *V. parcedentata* is glossy as if wet), being more oval (*V. parcedentata* is often somewhat cylindrical), and having pronounced microscopic periostracal ridges. It also differs from *V. nangaparbatensis* in being smaller, more ovate, more tumid, having poorly developed dentition and much more pronounced microscopic periostracal ridges (Fig. 2c). This characteristic microsculpture is also developed in other sympatric *Vertigo* species, such as *V. pygmaea* (Draparnaud, 1801), *V. substriata* (Jeffreys, 1833) and *V. microsphaera* Schileyko, 1984, which differ in many external features and the apertural barriers. However, no studies of this microsculpture have been conducted and its phylogenetic relevance is completely unknown.

Ecology. This new species has a rather broad ecological amplitude. It was found in different mesic and wet habitats such as hemiboreal forests, subalpine shrub vegetation, and mostly shrubby meadow steppes (*Festuco-Brometea*). It avoided only strictly open and dry sites. This snail occurred along a relatively broad range of site basicity (topsoil electric conductivity 33–164 $\mu\text{S}/\text{cm}$ and pH 5.4–6.7). Like *V. modesta hoppii* from North America (Nekola & Coles 2010), *V. botanicorum* **sp. nov.** was mostly found in rather acidic sites and avoided calcareous substrates. Most sites were at high altitudes (above 1350 m a.s.l.), but occurred also at two rather low sites (around 500 m a.s.l., see Appendix 1). Population densities were intermediate or low, varying from 1 to 10 recorded specimens per site. All species co-occurring with *V. botanicorum* **sp. nov.** at the studied sites are given in Table 1. *Euconulus fulvus* (O.F. Müller, 1774), *Perpolita hammonis* (Ström, 1765), *Novisuccinea altaica* (Martens, 1879) and *Vertigo microsphaera* were the species most often co-occurring with the species described here (Tab. 1).

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Appendix 1. Account of studied sites in the Russian Altai Mountains with the occurrence of *Vertigo botanicorum* sp. nov. Data in the list are arranged as follows: site number (bold, corresponds with the map); original site number (in square brackets) for easier reference to databases, geographical co-ordinates (N, E); district; location; habitat description; altitude (m a.s.l.); collection date; number of recorded specimens. All sites were investigated by M. Horsák.

- 1** [MC210]; 50°18'03.3"N; 87°38'59.7"E; Ulagan distr.; Aktash: above the right bank of the Menka river 4 km ESE of the village; hemiboreal forest with *Picea obovata* on a steep N-facing slope; 1397 m; 20.vii.2006; 2 specimens. **2** [MC209]; 50°26'50.0"N; 87°36'28.1"E; Ulagan distr.; Aktash: near the road to Ulagan 16 km N of the town, south of the Ulagan pass; species-rich grassland on a steep slope; 1976 m; 19.vii.2006; 10 specimens; data published in Horsák *et al.* (2010). **3** [MC208]; 50°32'49.9"N; 87°47'05.1"E; Ulagan distr.; Ulagan: near the road to Aktash 16 km SW of the village; species-rich grassland; 1615 m; 19.vii.2006; 3 specimens. **4** [PL201]; 50°28'36.0"N; 87°37'48.4"E; Ulagan distr.; Ulagan: plateau near Uzunkel' lake 28 km SW of the village; shrubby tundra dominated by *Betula humilis* and *Betula rotundifolia*; 1994 m; 18.vii.2006; 2 specimens; data published in Horsák *et al.* (2010). **5** [MC149]; 50°59'05.5"N; 85°40'32.4"E; Ongudai distr.; Zaisanskaya Elan' (S of Seminskii pereval): Seminskii Ridge, above right bank of Tuekta creek 2 km NW of the settlement; taiga with *Picea obovata* and *Pinus sibirica* on a gentle NNE-facing slope; 1382 m; 12.viii.2005; 5 specimens. **6** [MC152]; 50°59'30.9"N; 85°40'18.8"E; Ongudai distr.; Zaisanskaya Elan' (S of Seminskii pereval): Seminskii Ridge, above left bank of Tuekta creek near a road bridge 2 km NW of the settlement; hemiboreal forest with *Larix sibirica* on a gentle SE-facing slope; 1397 m; 12.viii.2005; 1 specimen. **7** [PH144] **Type locality**; 51°30'26.6"N; 85°35'48.6"E; Shebalino distr.; Aktel: Seminski Ridge, Aktel creek valley, 4 km W of the settlement; tall-forb meadow in a floodplain, dominated by *Filipendula ulmaria* and *Trollius altaicus*; 575 m; 13.viii.2005; 7 specimens. **8** [MC101]; 51°36'47.7"N; 85°47'32.5"E; Chemal distr.; Katun' valley, Ust'-Sema: left bank of the Katun' river 1 km SE of the village; *Pinus sylvestris* forest with *Pteridium aquilinum* and *Brachypodium pinnatum*; 360 m; 30.vii.2005; 6 specimens.