

HOLSINGERIA UNTHANKSENSIS, A NEW GENUS AND SPECIES OF AQUATIC CAVESNAIL FROM EASTERN NORTH AMERICA

Robert Hershler

ABSTRACT

Holsingeria unthakensis n. gen., n. sp., an eastern North American aquatic cavesnail (Gastropoda: Hydrobiidae) representing a monotypic genus, is described. Diagnostic features of the genus include minute, turritiform-aciculate shell with apical microsculpture of low tubercles; keel-like ventral peg of operculum; blind, unpigmented animal; reduced ctenidium; simple penis; capsule gland with ventral channel; and two sperm pouches. Affinities of this highly distinctive form lie with *Phreatodrobia* Hershler & Longley 1986 from southwest Texas, and/or with a number of eastern European cavesnail genera.

INTRODUCTION

During the course of an ongoing review of aquatic cavesnails (Gastropoda: Hydrobiidae) of North America (see Hershler & Longley, 1986a, b, 1987; Hershler & Hubricht, in press), a few examples of a distinctive, minute-sized form were found in two small collections taken by John R. Holsinger in 1980 from Unthanks Cave, Lee County, Virginia (Fig. 1). The author and Holsinger returned to the cave in 1986 and obtained a large sample of this species, which is herein both described as new and assigned to a new genus, and its possible phylogenetic relationships are discussed.

METHODS AND MATERIALS

Shell measurements were obtained by digitizing points from camera lucida outline drawings (50X) using CONCH software (Chapman, *et al.* 1988) and a GTCO Micro-Digi Pad 12x12 linked to a KAYPRO 2000 microcomputer. Shell coiling parameters are those of Raup (1966). Relaxed, alcohol-preserved specimens were used for dissection.

Specimens examined for this study are deposited in the Florida State Museum (UF), the Academy of Natural Sciences of Philadelphia (ANSP), and the National Museum of Natural History, Smithsonian Institution (USNM).

Holsingeria, new genus

Diagnosis. Minute-sized, New World group distinguished by combination of turritiform-aciculate shell with apical microsculpture of low tubercles; and operculum bearing enlarged, keel-like ventral peg. Outer shell lip strongly sinuate. Animal blind, unpigmented. Ctenidium reduced, with a few small, finger-like gills. Central radular teeth with single pair of basal cusps. Prostate elongate, largely pallial; penis simple. Females oviparous. Oviduct entering capsule gland, which has ventral channel. Two sperm pouches present.

Type species. *Holsingeria unthakensis*, new species (by monotypy).

Etymology. Named after John R. Holsinger, Old Dominion University, discoverer of this snail and a pioneering figure in North American cave biology.

Remarks. The following similar-shelled dry material represents probable additional congeners: USNM 421169, Shenandoah River drift, Jefferson County, West Virginia, J.P.E. Morrison, 16 October 1935; numerous lots, Skyline Caverns, Warren County, Virginia. Efforts to collect living representatives of these snails are in progress.

Holsingeria unthinksensis, new species

Unthinks cavesnail

Figs. 1-6, Table 1

Material examined. Holotype, USNM 860421, SH 1.78 mm; WH 5.25, Unthinks Cave stream 11.0 km southwest of Jonesville, Lee County, Virginia, U.S.A., Sneedville, TN-VA quadrangle (7.5 minute series), about 2.4 km E-SE of NW corner of quadrangle; R. Hershler, J.R. Holsinger, P. Greenhall, R. Phillips, 19 November 1986. Paratypes (data as above), USNM 860422, ANSP 372196, UF 129372. UF 25393 (mixed lot also containing *Fontigens* sp.), locality as above, J.R. Holsinger *et al.*, 1 March 1980. UF 87318 (mixed lot as above), locality as above, J.R. Holsinger *et al.*, 28 November 1980.

Description. Table 1 contains shell morphometrics of holotype and nine paratypes. Shells are illustrated in Figs. 2 and 3. Shell 1.5-2.0 mm high; height/width, 198-227%. Whorls, 4.5-5.25, rounded, shouldered above. Spire outline convex, body whorl 50-57% of shell height. Translation rate high, 7.0-8.5; whorl expansion rate moderate, 1.2-1.6. Aperture nearly circular, expanded, thickened all around, usually slightly separated from body whorl. Ad- and abaxial sides of aperture advanced (yielding sinuate appearance of outer lip), inner lip somewhat reflected. Umbilicus moderately open. Protoconch (Figs.

Table 1. Shell parameters for 10 specimens of *H. unthinksensis*.

WH	SH	SW	LBW	WBW	AL	AW	W	D	T	AS
5.25	1.78	0.79	0.91	0.67	0.58	0.44	1.24	0.52	8.62	1.32
5.00	1.55	0.74	0.85	0.68	0.53	0.42	1.54	0.65	8.49	1.26
5.00	1.61	0.73	0.83	0.66	0.54	0.41	1.41	0.64	8.02	1.34
5.00	1.83	0.83	1.00	0.73	0.62	0.50	1.23	0.64	7.35	1.24
5.00	1.77	0.82	0.94	0.70	0.59	0.46	1.46	0.60	7.48	1.28
4.50	1.67	0.80	0.95	0.69	0.59	0.48	1.46	0.66	6.34	1.22
5.00	1.59	0.78	0.91	0.69	0.57	0.45	1.22	0.66	6.58	1.25
5.00	1.65	0.81	0.91	0.67	0.55	0.48	1.29	0.62	6.02	1.15
4.50	1.51	0.75	0.86	0.66	0.56	0.46	1.40	0.68	6.61	1.22
4.75	1.65	0.83	0.90	0.70	0.57	0.49	1.31	0.58	7.07	1.16

WH = number of whorls, SH = shell height; SW = shell width; LBW = height of body whorl; WBW = width of body whorl; AL = aperture length; AW = aperture width; W = whorl expansion rate; D = distance of center of aperture from coiling axis; T = translation rate; AS = aperture length/aperture width. Measurements are in mm. The first specimen measured is the holotype.

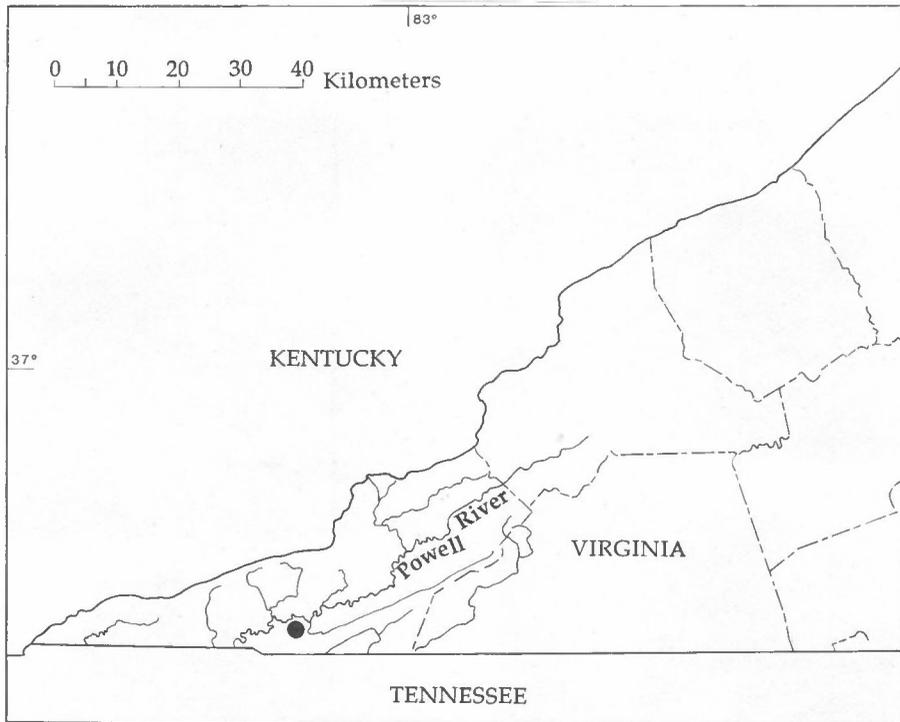


FIG. 1. Map showing location of Unthanks Cave in Lee County, Virginia, U.S.A.

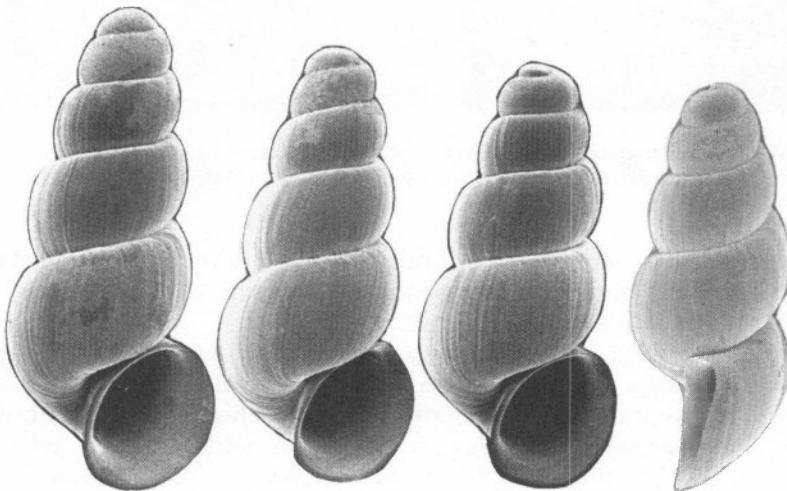


FIG. 2. Scanning Electron Microscope (SEM) micrographs of *Holsingeria unthanksensis*: a, holotype, USNM (shell height, 1.78 mm); b-d, paratypes, USNM (printed to same scale as above).

3a,d) rounded, protruding, with about 1.5 whorls. Surface of protoconch and first teleoconch whorl lined with numerous spiral rows of low rounded tubercles or

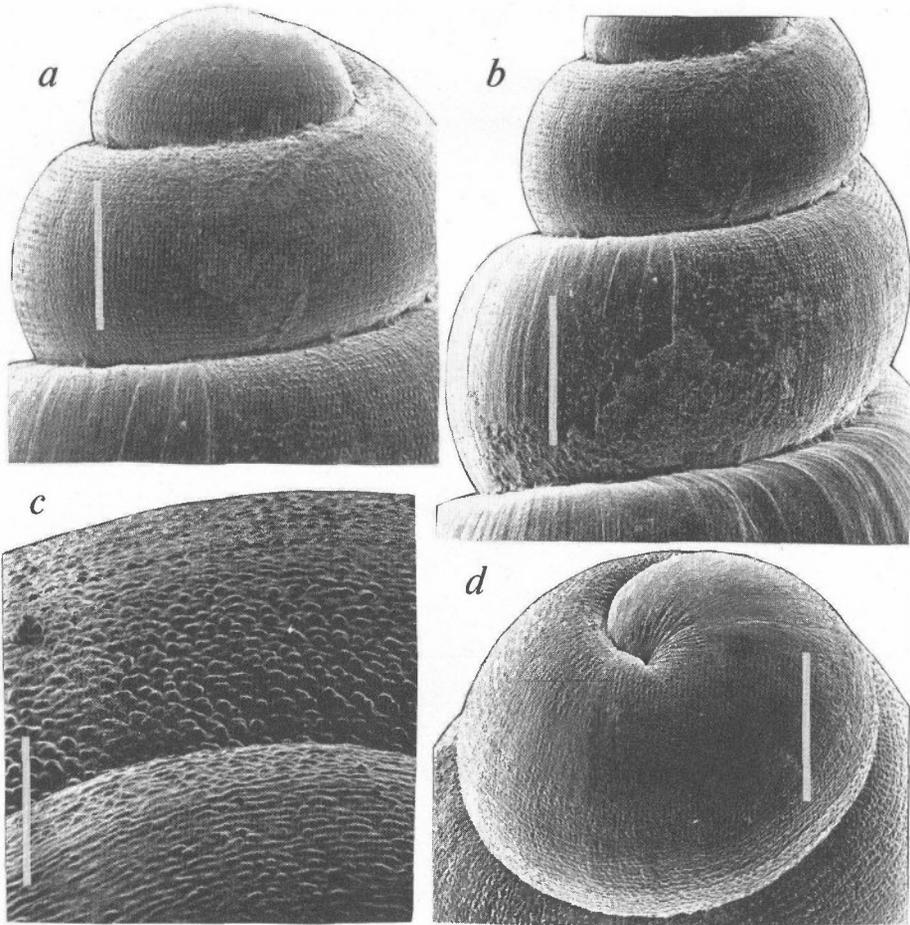


FIG. 3. SEM micrographs of *Holsingeria unthinksensis*: a, apical whorls (bar = 115 μm); b, middle whorls (bar = 150 μm); c, close-up of punctate sculpture (bar = 30 μm); d, protoconch (bar = 100 μm).

swellings sometimes coalescing into ridges. Swellings weak beyond first teleoconch whorl, usually entirely absent from body whorl. Collabral growth lines well-developed, particularly on body whorl.

Operculum (Fig. 4) paucispiral, narrowly ovate, thin, corneous, amber-colored, with about 4.0 whorls. Dorsal surface smooth, ventral surface with corneous, curving peg located at end of muscle attachment scar nearest operculum nucleus (Figs. 4b, c). Peg narrow, long relative to operculum width (Fig. 4e), with one or more moderate grooves along length (Fig. 4d). Distal tip of peg bulbous.

Animal with 4.0-4.5 whorls. Ctenidium filling anterior two-thirds of pallial cavity. Gills scarcely elevated above surface of pallial cavity roof. Osphradium large, filling about 50% of ctenidium length.

Radular (Fig. 5) formula: 4(5)-1-4(5)/1-1, 3(4)-1-4(5), 19-23, 13-16 (from paratypes). Central tooth (Fig. 5a) trapezoidal, relatively tall; basal process well excavated; basal cusps elongate (about as long as basal process). Central

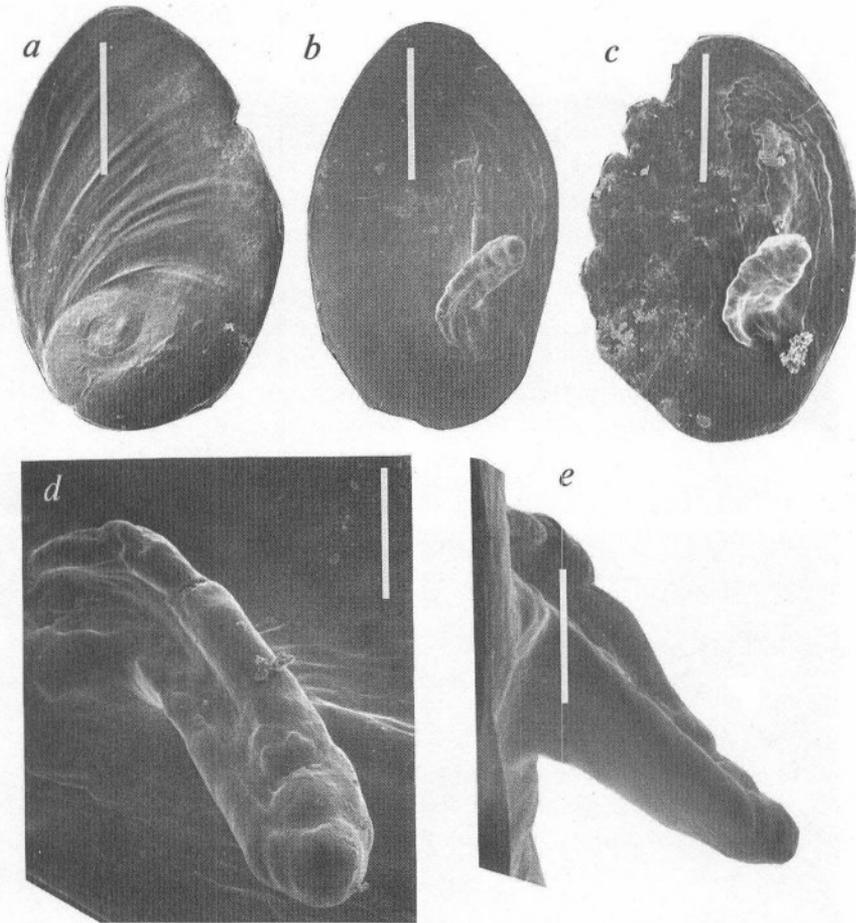


FIG. 4. SEM micrographs of operculae of *Holsingeria unthanksensis*: a, dorsal aspect (bar = 136 μm); b (bar = 150 μm); c (bar = 150 μm), ventral views showing opercular pegs; d, close-up of peg from "b" (bar - 43 μm); e, lateral view of peg, indicating height of structure (bar = 50 μm).

cusps of central and lateral teeth dagger-like, slightly enlarged. Stomach relatively small, chambered portion and style sac about equal in length. Posterior edge of stomach without protruding caecal appendix. Digestive gland simple, consisting of two, thin, hollow sacs filling 2.0-2.5 whorls and extending almost to posterior tip of visceral coil. Initial loop of intestine on dorsal surface (rather than edge) of style sac. Pallial intestine with several slight undulations. Fecal pellets orange-colored.

Testis an unlobed mass filling 1.0-1.5 whorls posterior to stomach. Seminal vesicle emerging from anterior end of testis and consisting of a few, thickened coils partly overlapping posterior stomach. Prostate gland about three times longer than wide, with two-thirds or more of length pallial. Vas deferens entering posterior portion of gland and exiting (as thickened tube) from gland's anterior tip. Penis (Fig. 6b) thin, blade-like. Vas deferens positioned near mid-line of

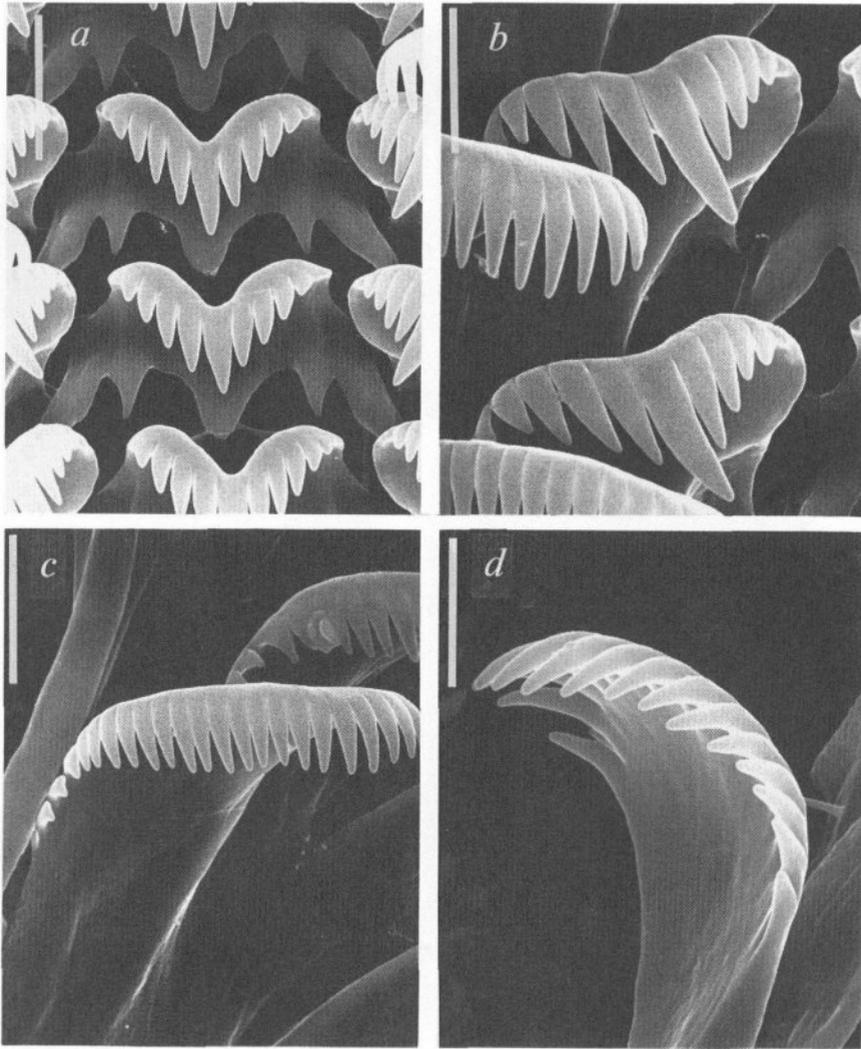


FIG. 5. SEM micrographs of radula of *Holsingeria unthanksensis*: a, centrals (bar = 4.3 μm); b, laterals and inner marginals (bar = 2.7 μm); c, inner marginal (bar = 3.8 μm); d, outer marginal (bar = 2.3 μm).

penis, nonundulating. Filament short, separated from proximal penis by slight constriction. Penis without large glands. Dense "grape-like" clusters of microscopic glandular units filling much of penis length (proximal to filament).

Ovary a small, unlobed mass filling about 0.25 whorl posterior to stomach. Pallial oviduct (Fig. 6a) large, filling 1.0 whorl. Albumen gland (Ag) clear, larger than orange capsule gland (Cg). Oviduct (Ov) with single, thickened coil on albumen gland. Bursa copulatrix (Bu) moderate-sized, pear-shaped, with posterior edge positioned along posterior edge of albumen gland. Seminal receptacle (Sr) small, club-shaped, partly overlapping bursa copulatrix. Seminal

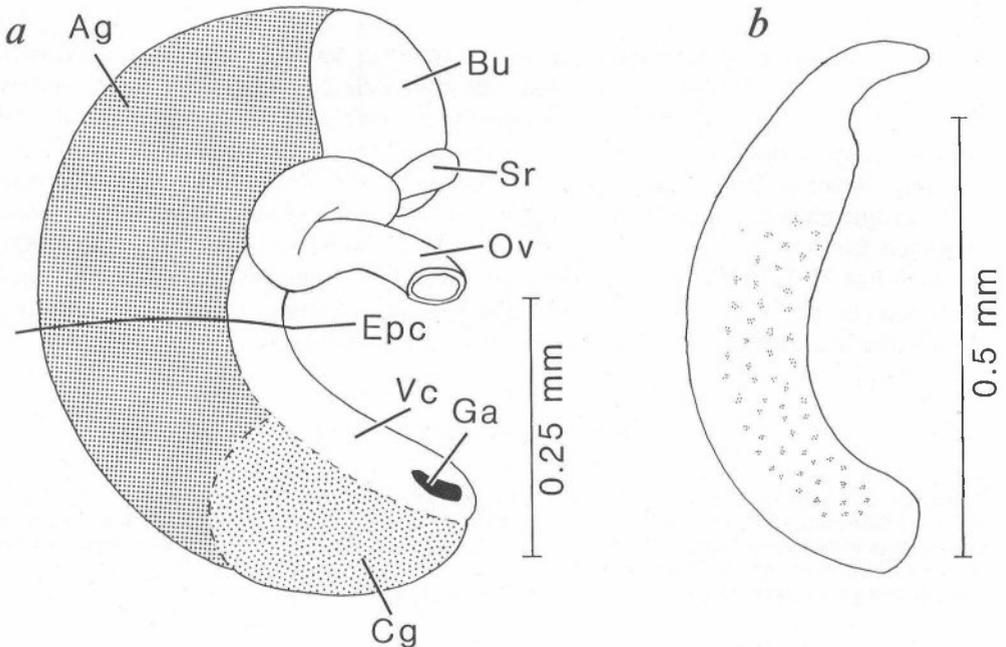


FIG. 6. Reproductive anatomy of *Holsingeria unthanksensis*: a, left lateral view of pallial oviduct complex; b, dorsal aspect of penis, with glandular clusters indicated by stipples. Abbreviations: Ag, albumen gland; Bu, bursa copulatrix; Cg, capsule gland; Epc, posterior end of pallial cavity; Ga, genital aperture; Ov, oviduct; Sr, seminal receptacle; Vc, ventral channel of capsule.

receptacle and bursa copulatrix with short ducts entering oviduct one after another, respectively. Distal to above junctures, thin-walled oviduct entering anterior albumen gland. Genital aperture (Ga) near-terminal, wide.

Etymology. Named after Unthanks Cave.

Habitat. This species is thus far known only from the small cave stream in Unthanks Cave. Snails were common on undersides of small, submerged rocks and were syntopic with larger-sized *Fontigens* sp.

RELATIONSHIPS

A simple penis and "Hydrobia-like" female reproductive system are found in hydrobiid taxa from many parts of the world. Although this group includes a number of apparently distinct lineages assigned to two or more separate subfamilies (i.e., contrast brackish-water *Hydrobia* Hartmann 1821 with fluviatile *Lithoglyphus* Hartmann 1821, and relatives), the snails are often separable (on the generic level) only on basis of relatively subtle features of shell and non-reproductive anatomy, and phylogenetic analysis thereof is proving difficult owing to paucity of character states. Given this situation, only a brief

and largely conjectural assessment of the systematic relationships of *Holsingeria* can be provided at this time.

Among the group of snails considered above, *Phreatodrobia* Hershler & Longley 1986, from southwest Texas, are most similar to *Holsingeria* as they are also minute-sized, subterranean in habit, and (in some cases) have turritiform shells (protoconch sculpture wrinkled, not tubercular) or opercular pegs. A few eastern European cavesnails also closely resemble *Holsingeria* in shell and reproductive features, including *Belgrandiella* Wagner 1927; *Iglica* Wagner 1927; *Lanzaia* Brusina 1906; *Paladilhopsis* Pavlovic 1913; and *Plagigeyeria* Tomlin 1930, although neither opercular pegs nor tubercle-like shell sculpture have been reported for any of these (see data in Bole, 1970; Boeters, 1971; Radoman, 1983). Additional data will be required to determine whether the above and *Holsingeria* represent disjunct components of a single lineage (paralleling Amnicolinae and Emmericiinae) or a convergent assemblage.

ACKNOWLEDGEMENTS

I thank Dr. John Holsinger for arranging and participating in the field trip to Unthanks Cave. National Museum of Natural History staff of the Electron Microscopy Laboratory assisted with preparation of Scanning Electron Microscope micrographs. Molly Ryan and C. Flamer assisted with drafting of the map, and Paul Greenhall provided diverse forms of assistance. Helpful comments on the manuscript were provided by Holsinger and an anonymous reviewer.

LITERATURE CITED

- BOETERS, H.D. 1971. *Iglica pezzolii* n. sp. und ein neues Merkmal zur Unterscheidung zwischen *Bythiospeum* und *Paladilhia*. *Archiv für Molluskenkunde*, 101: 169-173.
- BOLE, J. 1970. Beitrag zur Kenntnis der Anatomie und Taxonomie der unterirdischen Hydrobiiden (Gastropoda, Prosobranchia). *Razprave Dissertaciones Slovenska Akademija Znanosti in Umetnosti*, Ljubljana, 13: 87-111.
- HERSHLER, R. & LONGLEY, G. 1986a. Phreatic hydrobiids (Gastropoda: Prosobranchia) from the Edwards (Balcones Fault Zone) Aquifer Region, south-central Texas. *Malacologia*, 27: 127-172.
- HERSHLER, R. & LONGLEY, G. 1986b. *Hadoceras taylori*, a new genus and species of phreatic Hydrobiidae (Gastropoda: Rissoacea) from south-central Texas. *Proceedings of the Biological Society of Washington*, 99: 121-136.
- HERSHLER, R. & LONGLEY, G. 1987. *Phreatodrobia coronae*, a new species of cavesnail from southwestern Texas. *The Nautilus*, 101: 133-139.
- HERSHLER, R. & HUBRICHT, L. In press. Notes on *Antroselates* Hubricht, 1963 and *Antrobia* Hubricht, 1971. *Proceedings of the Biological Society of Washington*.
- RADOMAN, P. 1983. Hydrobioidea a superfamily of Prosobranchia (Gastropoda). 1. Systematics. *Serbian Academy of Sciences and Arts, Monographs*, 57: 1-256.
- RAUP, D.M. 1966. Geometric analysis of shell coiling: General problems. *Journal of Paleontology*, 40: 1178-1190.

ROBERT HERSHLER

*Department of Invertebrate Zoology
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560*