

Phreatodrobia coronae, a New Species of Cavesnail from Southwestern Texas

Robert Hershler

Department of Invertebrate Zoology
National Museum of Natural History
Smithsonian Institution
Washington, DC 20560, USA

Glenn Longley

Edwards Aquifer Research and
Data Center
Southwest Texas State University
San Marcos, TX 78666-4615, USA

ABSTRACT

Phreatodrobia coronae new species, a blind and unpigmented cavesnail, was collected from spring orifices at two sites in or near Del Rio, Val Verde County, Texas. This new species is separable from other known congeners by its free and largely uncoiled apex and has affinities with similar-shelled forms occurring in Balcones Fault Zone and Hill Country to the east.

INTRODUCTION

Edwards limestone and associated aquifers in southwestern Texas support a large phreatic fauna of about 50 species (Longley, 1981; Hershler and Longley, 1986a). Subterranean aquatic conditions in the region vary from air-exposed to deep artesian, with habitat size ranging from interstitial pores in limestone matrix to large solution caverns. Structural complexity of this phreatic system has facilitated differentiation of taxa, with the most speciose elements consisting of amphipod crustaceans (Holsinger and Longley, 1980, and references cited therein) and cavesnails of the family Hydrobiidae, comprising seven species of *Phreatodrobia* Hershler and Longley, 1986a, as well as three monotypic genera (Hershler and Longley, 1986a,b).

Fieldwork by the senior author during 1984 included collection of phreatic organisms from two springs in vicinity of Del Rio, Val Verde County (figures 1-3). Among the diverse fauna discovered was a highly distinctive blind cavesnail that we describe herein as a new species of *Phreatodrobia*.

SYSTEMATICS

Phreatodrobia coronae Hershler new species
Del Rio cavesnail
(figures 4-21; table 1)

Materials examined: Holotype (figure 6; USNM 859219), a dry shell of 1.27 mm width, from unnamed spring on E side of Devils River in canyon just downflow from Slaughter Bend, Val Verde County, Texas, Satan Canyon

(1972) 1; 24000, ca. 5.1 km NW of SE corner of quadrangle, elevation ca. 342 m, R. Hershler and S. Corona, 17 IX 1984. Additional series from type locality include 7 (dry shells) paratypes (USNM 859154, collected by S. Corona, 26 VIII 1986), and a lot split into dried (10) and alcohol (13) specimens (USNM 859156, collected by S. Corona, 1-8 IX 1986). Single series (USNM 859164; 13 empty shells and 2 alcohol specimens) also from small spring (San Felipe Springs) on W side of San Felipe Creek by #2 hole on San Felipe Country Club N of HW 90 in Del Rio, Val Verde, Texas, Del Rio SW (1972) 1; 24000, ca. 1.1 km SW of NE corner of quadrangle, elevation ca. 290 m, R. Hershler, 14 IX 1984.

Diagnosis: A small-sized species with near-planispiral to low-trochoid shell having loosely coiled, protruding apex. Teleoconch sculpture consisting of 10-20 collabral varices or costae and 30-40 strong spiral lines. Opercular peg well-developed. Ctenidium absent. Central tooth of radula with single pair of basal cusps. Intestinal coil in pallial roof complex.

Description: Shell measurements and counts for 7 paratypes (sexes mixed) are in table 1. Shell (figures 4-13) transparent, colorless, about a millimeter wide with 3 tubular, moderately expanding whorls. Protoconch whorls, 1.25. Periostracum light brown. Sutures deeply impressed. Translation rate (and therefore shell height) variable (ranging from ca. 1.0 to 2.0), yielding diversity in shell form (figures 6-9). First ¼ whorl of protoconch (figure 10) free and nearly uncoiled, producing horn-like apex strongly contrasting with teleoconch shape. Aperture ca. 30-40° oblique to coiling axis with adapical portion extended forward, near-circular in cross section, moderately flared all around, often slightly fluted above and below. Inner lip well-thickened and either separate from or narrowly adnate to body whorl above. Umbilicus broadly open (figure 5). Protoconch with wrinkled pits (figures 4, 12, 13). Strong spiral lines beginning at end of protoconch, with costae beginning 0.5-1.0 whorl later. Lines are uniformly spaced all around exposed portions of whorls and cross collabral sculpture (figure 11). The

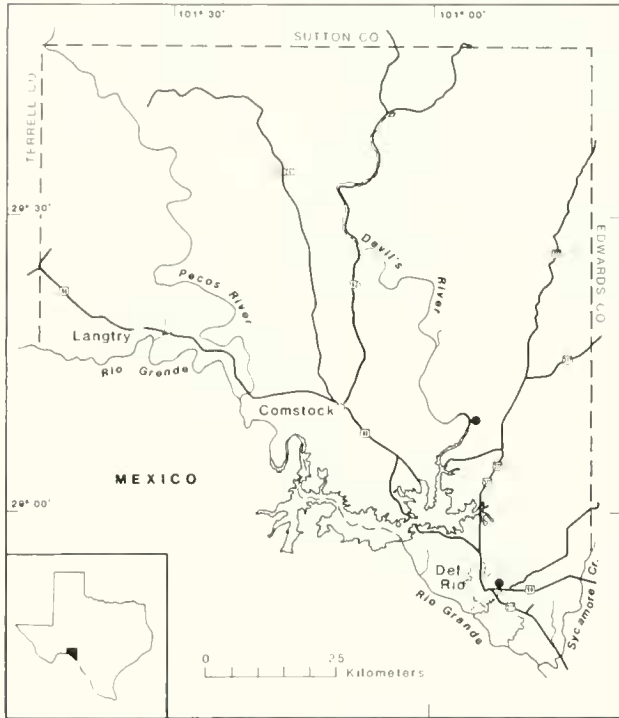


Figure 1. Map of Val Verde County, Texas, showing drainage and collecting sites (filled circles). Adapted from General Highway Map, Val Verde County, Texas.

latter varying from low varices to lamelliform costae, typically slightly curved forward.

Operculum (figures 14–16) amber, paucispiral, near-circular, with 4 whorls and strong peg located sub-centrally on inner (ventral) surface. Operculum and peg corneous. Peg height several times thickness of remaining operculum (figure 16). Pedal attachment scar elliptical.

Radular formula (from figures 17–20): centrals, 6(7)-1-(7)6/1-1; laterals, 5-1-6; inner marginals, 17-18; outer marginals, 18. Central teeth (figure 17) broadly trapezoidal. Cusps on all teeth elongate, often dagger-like.

Animal without eyespots and melanic pigment. Scattered black (internal) granules on dorsal stomach and ventral style sac.

Pallial cavity longer than wide, with majority of roof occupied by intestine (In, figure 21). Osphradium (Os) small, positioned anterior to pallial intestine near mantle collar.

Stomach slightly longer than style sac. Pallial intestine looping twice, with first loop inside of second; long axes of loops parallel to pallial cavity length (figure 21). Anus located along columellar edge near mantle collar.

Testis (Ts, figure 21) a simple sac filling much of digestive gland posterior to stomach. Seminal vesicle (Sv) con-

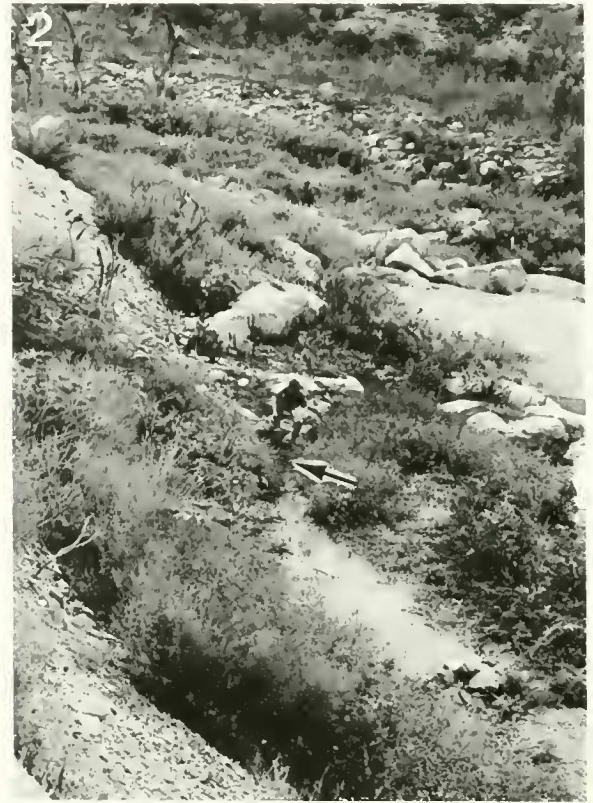


Figure 2. Photograph (8 IX 1986) of collecting site at unnamed spring on E side of Devils River just downflow from Slaughter

Bend, Val Verde County, Texas. Arrow indicates location of spring source. **Figure 3.** Photograph (8 IX 1986) of collecting site at San Felipe Springs on W side of San Felipe Creek on W side of San Felipe Country Club, Del Rio, Val Verde County, Texas. Arrow indicates location of spring source.



Figure 4. Photograph (SEM) of apical shell aspect of *Phreatodrobia coronae* new species from unnamed spring on E side of Devils River just downflow from Slaughter Bend, Val Verde County, Texas. Scale bar = 0.5 mm. **Figure 5.** Photograph (SEM) of umbilical shell aspect of *P. coronae*. Locality and scale as above. **Figure 6.** Photograph (SEM) of holotype of *P. coronae* new species. Locality and scale as above. **Figure 7.** Photograph (SEM) of shell of *P. coronae* new species. Locality and scale as above. **Figure 8.** Photograph (SEM) of shell of *P. coronae* from San Felipe Springs, Del Rio, Val Verde County, Texas. Scale as above. **Figure 9.** Photograph (SEM) of shell of *P. coronae*. Locality as above. Scale as above.

sisting of a few thickened coils anterior to testis and abutting against prostate gland. Vas efferens absent. Prostate gland (Pr) yellow-colored, elongate (twice as long as wide), almost totally posterior to pallial cavity. Posterior vas deferens entering near posterior tip of gland; anterior vas deferens (Vd2) exiting from anterior tip and

travelling straight path in pallial cavity floor. Penis (not figured) simple, coiling on right side of "neck." Filament ca. $\frac{1}{3}$ penis length, tapering distally. Vas deferens without undulations in penis.

Description of female anatomy limited due to lack of sufficient material. Ovary a white-colored, simple sac

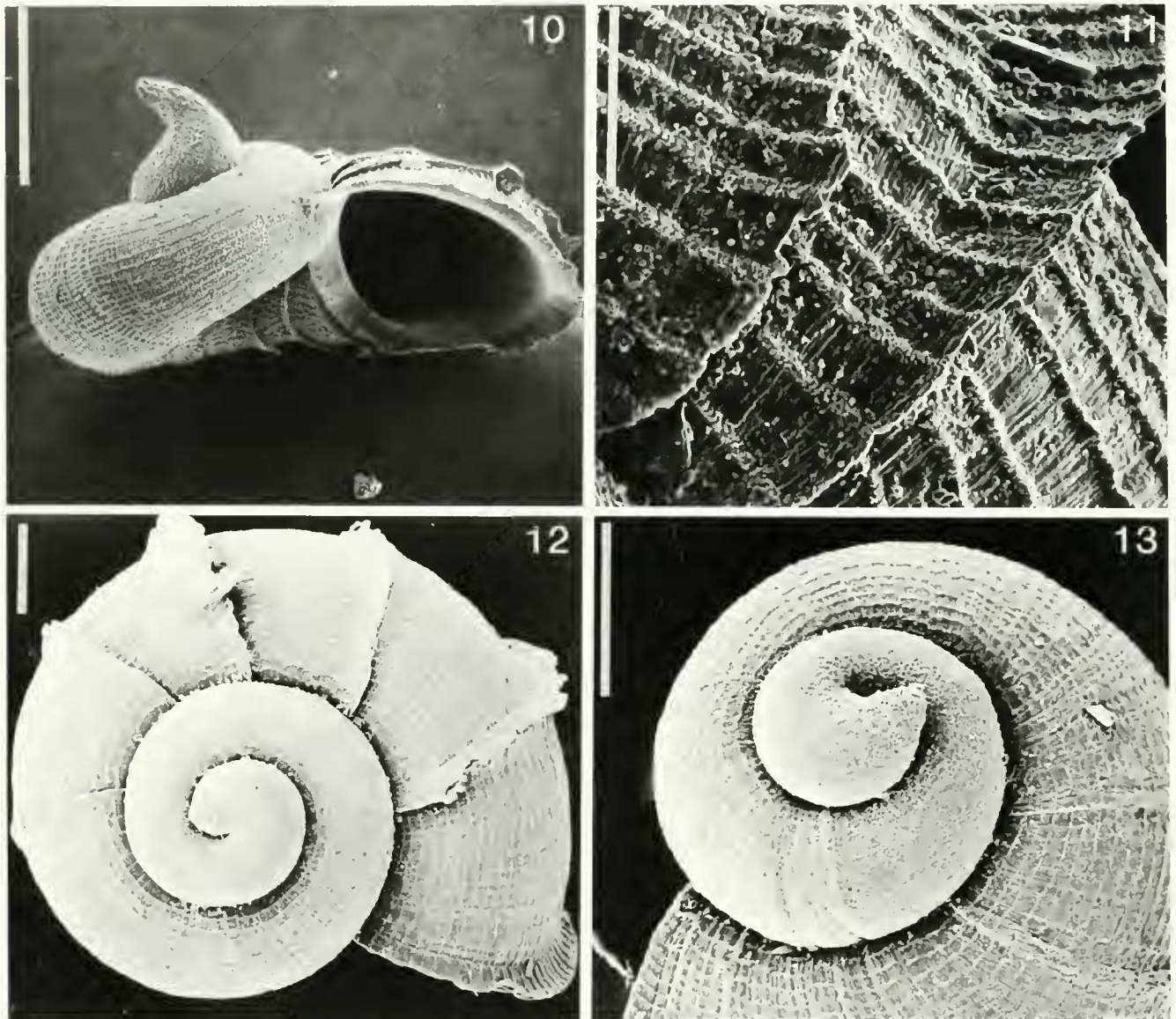


Figure 10. Photograph (SEM) of juvenile shell of *P. coronae* from unnamed spring on E side of Devils River just below Slaughter Bend, Val Verde County, Texas. Scale bar = 240 μ m. **Figure 11.** Photograph (SEM) showing teleoconch sculpture of *P. coronae*. Locality as above. Scale bar = 23 μ m. **Figure 12.** Photograph (SEM) of apical shell aspect of *P. coronae* from San Felipe Springs, Del Rio, Val Verde County, Texas. Scale bar = 150 μ m. **Figure 13.** Photograph (SEM) showing shell apex of *P. coronae*. Locality as above. Scale bar = 200 μ m.

filling ca. 20% of body length. Anterior end of pallial oviduct simple, with broad, slit-like, terminal opening. Bursa copulatrix largely posterior to albumen gland. Seminal receptacle not seen; sperm storage perhaps occurring in single, highly swollen oviduct coil located just proximal to opening into albumen gland.

Variation: Differentiation among the two known populations is evident, as shells from spring on Devils River vary from near-planispiral to low-trochoid (shell height/width, 45–85%) and typically have well-developed and numerous collabral costae, whereas examples from San Felipe Springs are usually low-trochoid (shell height/

width, 80–100%), with collabral sculpture weakly developed (figures 6–9 show extremes of shell form). It is clear that shell form and sculpture pattern overlap in these populations and we therefore choose to consider them as a single species.

Etymology: Named in honor of Mrs. Susannah J. Corona and family for their assistance in obtaining material of this species from the type locality.

Comparisons: *Phreatodrobia coronae* is separable from all other congeners by its unique protoconch. While resembling *P. imitata* Hershler and Longley, 1986a, in

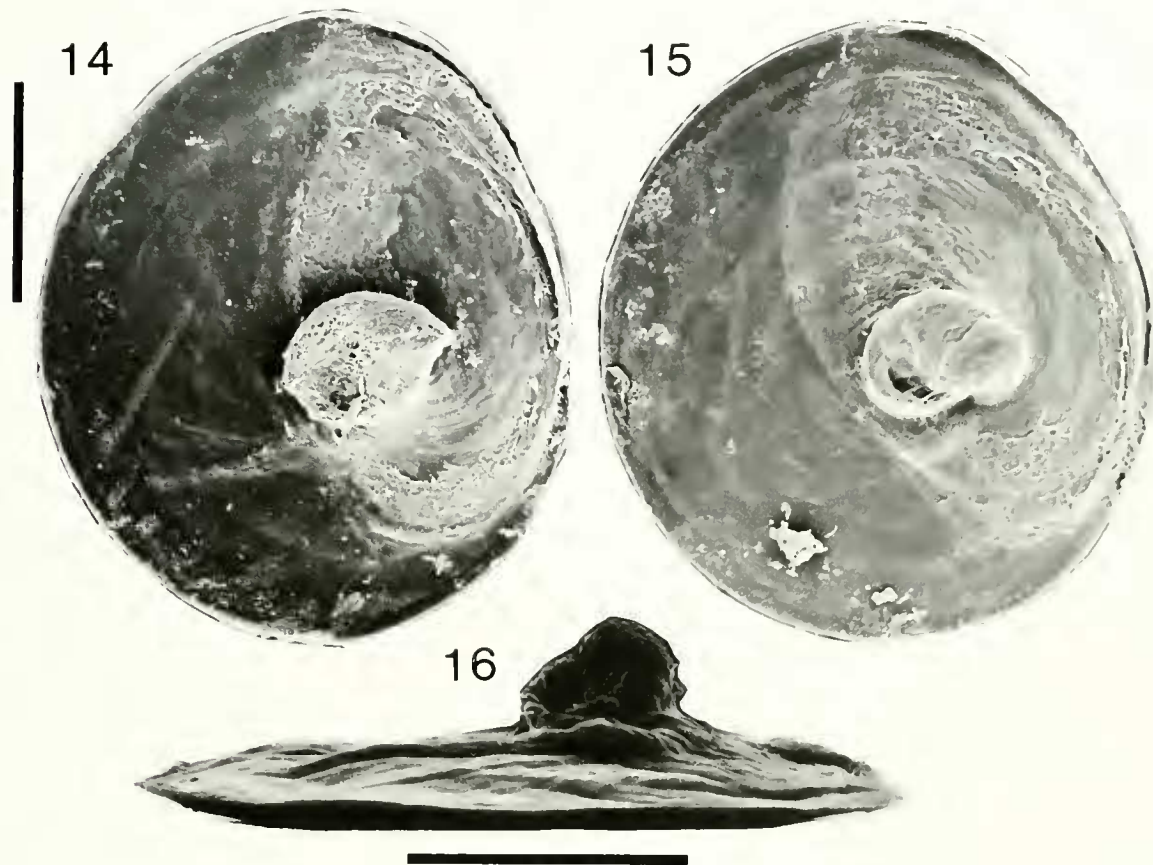


Figure 14. Photograph (SEM) of ventral aspect of operculum (showing peg and muscle attachment scar) of *P. coronae* from unnamed spring on E side of Devils River just below Slaughter Bend, Val Verde County, Texas. Scale bar = 150 μ m. **Figure 15.** Photograph (SEM) of ventral aspect of operculum of *P. coronae*. Locality and scale as above. **Figure 16.** Photograph (SEM) of lateral aspect of operculum (showing height of peg) of *P. coronae*. Locality as above. Scale bar = 150 μ m.

terms of teleoconch sculpture pattern, *P. coronae* is clearly allied to *P. nugax* (Pilsbry and Ferriss, 1906) and *P. micra* (Pilsbry and Ferriss, 1906) from Balcones Fault Zone and Hill Country (to the east) on basis of simple, near-planispiral to low-trochoid shells and similarities in radular and female reproductive morphology (see Hershler & Longley, 1986a). The novelty described herein is distinguished from both of the above by well-developed teleoconch sculpture (collabral costae known from single population of *P. nugax*; Hershler & Longley, 1986a: fig. 4U), complex pallial intestine, and absence of gill filaments; and further separable from *P. nugax* by smaller size and more highly developed opercular peg.

Discussion: Both sites (figures 2, 3; latter also shown in Brune, 1975: fig. 6) are moderate-sized rheocrenes having single, discrete orifices that were netted (for method, see Hershler & Longley, 1986a:130–131) to collect phreatic biota. Nets could not be tightly fitted into the rather large orifice at San Felipe Springs and small size of resulting samples is probably due to sweeping of specimens out of net or feeding by fishes. With current decreased flow of Goodenough and Comal Springs, San Felipe

Table 1. Measurements (mm) and counts from seven shells (paratypes) of *Phreatodrobia coronae* new species from unnamed spring on E side of Devils River just below Slaughter Bend, Val Verde County, Texas.

Character	Mean	Range	Standard deviation
Number of whorls	3.0	—	—
Shell height	0.67	0.53–0.81	0.09
Shell width	1.11	1.04–1.17	0.05
Body whorl length	0.55	0.42–0.66	0.08
Body whorl width	0.81	0.73–0.89	0.05
Aperture length/width	1.01	0.85–1.22	0.13
Number of collabral varices	16.71	14.0–21.0	2.7

Springs, collectively discharging ca. 70–100 feet³/sec, now rank as second largest in the state and may be increasing due to local recharge from Amistad Reservoir (Brune, 1975). Water source for these springs is Georgetown limestone of Edwards Aquifer (Brune, 1975). The unnamed spring on Devils River is periodically sub-

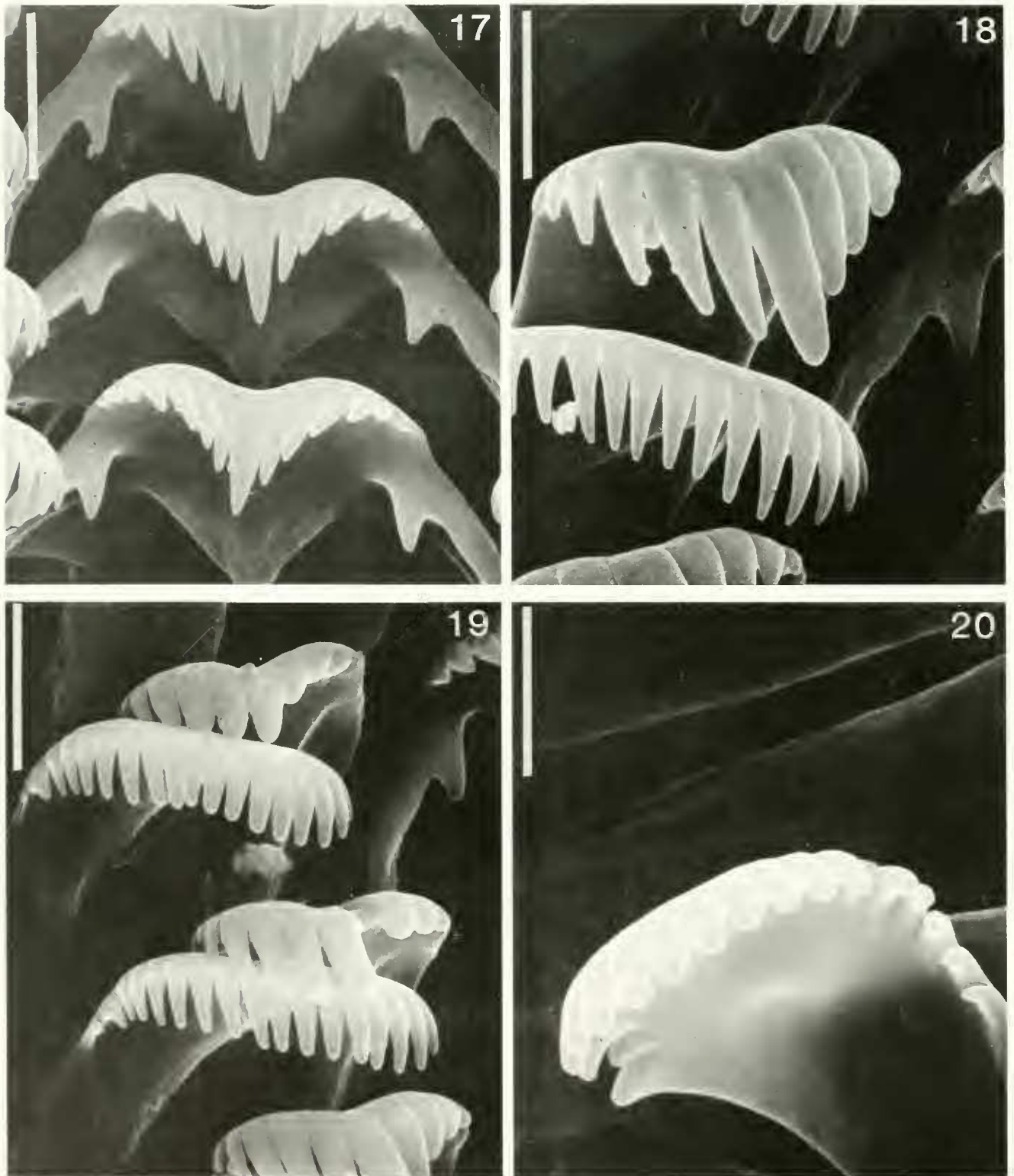


Figure 17. Photograph (SEM) of central radular teeth of *P. coronae* from unnamed spring on E side of Devils River just below Slaughter Bend. Scale bar = 3.5 μm . **Figure 18.** Photograph (SEM) of lateral (above) and inner marginal (below) radular teeth of *P. coronae*. Locality as above. Scale bar = 2.7 μm . **Figure 19.** Photograph (SEM) of lateral (3) and inner marginal (2) radular teeth of *P. coronae*. Locality as above. Scale bar = 3.8 μm . **Figure 20.** Photograph (SEM) of outer marginal radular tooth of *P. coronae*. Locality as above. Scale bar = 1.76 μm .

merged when Amistad Reservoir crests above conservation level (340.4 m). Discharge of this spring is *ca.* 2–4 feet³/sec and water source is likely the same as that for nearby Slaughter Bend springs: Georgetown limestone (Brune, 1975).

Collections from San Felipe Springs included an additional undescribed cavesnail belonging to Hydrobiidae: Littoridininae and having affinities with *Balconorbis* Hershler and Longley, 1986a, from Uvalde County. This was also collected from the unnamed spring on Devils River as were blind and unpigmented amphipod crustaceans, asellid and cirrolanid isopods, and copepods. Included among the amphipods are forms having affinities with taxa from Comal, Kendall, and Hays counties to the east (J. R. Holsinger, letter to senior author dated 13 IX 1986).

ACKNOWLEDGEMENTS

We thank the National Park Service at Amistad National Recreation Area (especially staff at Rough Canyon) and San Felipe Country Club for permission to sample springs. The former also provided transportation to collecting sites on several occasions. The study could not have been completed without the field assistance of Mrs. S. Corona. Fieldwork of the senior author was partly funded by United States Fish and Wildlife Service (Contract No. 14-16-0002-S4-228, Amendment No. 1).

LITERATURE CITED

- Brune, G. 1975. Major and historical springs of Texas. Texas Water Development Board Report 189:94 p.
- Hershler, R. and G. Longley. 1986a. Phreatic hydrobiids (Gastropoda: Prosobranchia) from the Edwards (Balcones Fault Zone) Aquifer region, south-central Texas. *Malacologia* 27: 127–172.
- Hershler, R. and G. Longley. 1986b. *Hadoceras taylori*, a new genus and species of phreatic Hydrobiidae (Gastro-

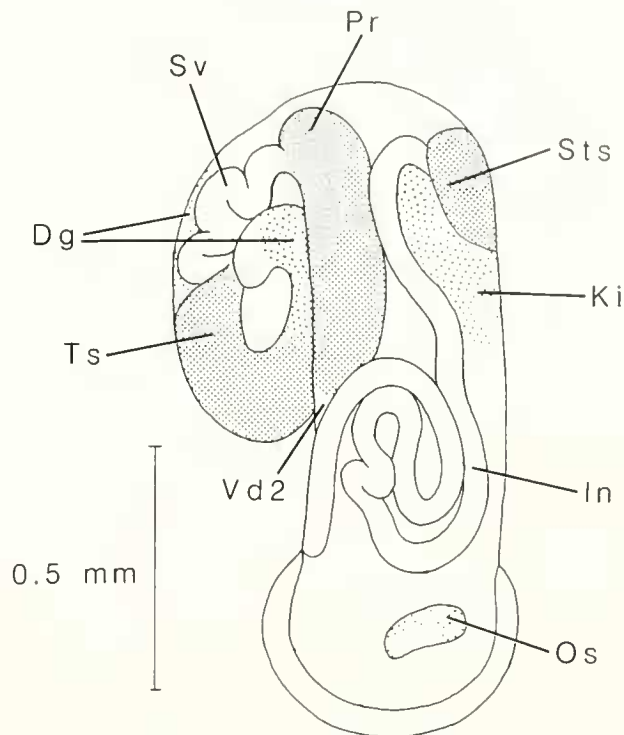


Figure 21. Dorsal aspect (minus head/foot) of male *P. coronae* from unnamed spring on E side of Devils River just below Slaughter Bend, Val Verde County, Texas. Dg = digestive gland; In = intestine; Ki = kidney; Os = osphradium; Pr = prostate; Sts = style sac; Sv = seminal vesicle; Ts = testis; Vd2 = anterior vas deferens.

poda: Rissoacea) from south-central Texas. *Proceedings of the Biological Society of Washington* 99:121–136.

- Holsinger, J. R. and G. Longley. 1980. The subterranean amphipod crustacean fauna of an artesian well in Texas. *Smithsonian Contributions to Zoology* 308:62 p.
- Longley, G. 1981. The Edwards Aquifer: earth's most diverse groundwater ecosystem? *International Journal of Speleology* 11:123–128.