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A New Subgenus of *Helminthoglypta* (Gastropoda: Pulmonata: Helminthoglyptidae)

by

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Abstract. A new subgenus ***Rothelix*** is described for the land snail genus *Helminthoglypta* in southern California. It is distinguished from the nominate subgenus by its long, sausage-shaped, lower sac of the penis and by its atrial sac in which the vagina enters just below the dart sac instead of near the genital pore.

INTRODUCTION

THE SPECIOSE GENUS *Helminthoglypta* comprises over 100 species and subspecies of western North American land snails. Classification within the genus has consisted mainly of allocating species into series whose characteristics are primarily based on shell sculpture, size, shape, and color.

Subgeneric classification has been limited to the designation of two subgenera, namely the nominate subgenus, whose type species is *Helminthoglypta tudiculata* (Binney, 1843), and *Charodotes* Pilsbry, 1939, whose type species is *H. traskii* (Newcomb, 1861). *Helminthoglypta* s.s. is characterized by a double-walled penis with an outer tube (i.e., an eversible inner tube with an outer tube) and *Charodotes,* as reported by PILSBRY, 1939, by a single, thick, muscular tube. PILSBRY (1939:68) also prepared a key in which *Charodotes* was listed as having a large dart sac with a short common duct of the mucus glands, while *Helminthoglypta* s.s. was divided into two main groups of species, one group having the dart sac and common duct as in *Charodotes* and the other having the dart sac small and much shorter than the common duct.

Between 1956 and 1964, the late Wendell O. Gregg and I undertook to conduct a careful examination of the anatomy of nearly every known (and many yet undescribed) species and subspecies of *Helminthoglypta* in order to find characteristics that could be used to establish additional subgeneric categories. Publication of our findings was delayed by Gregg's declining health and eventual death. Foremost among our determinations was the fact that all species examined, including *H. traskii,* had a double-tubed penis, of varying length, thereby synonymizing *Charodotes* with *Helminthoglypta* s.s.; this information has been reported by MILLER (1981), and the name *Charodotes,* while available, is invalid because it is a junior synonym. Furthermore, we found that the comparative measurements of dart sac and common duct of the mucus glands were generally useless diagnostically, because we could find specimens with a large sac and short duct in the same populations with specimens with a small sac and long duct. On the other hand, the studies revealed that the lower sac of the penis, which PILSBRY (1939:69) refers to as "a short neck with a simple wall," differed considerably and consistently in one group of species which includes *H. lowei* (Bartsch, 1918), *H. cuyamacensis cuyamacensis* (Bartsch, 1916), and several additional species yet to be described. The reproductive anatomy of this group of species differs so markedly from that of all other species of the genus, including the type species, *H. tudiculata,* that it warrants classification in a separate, new subgenus, described below. It is imperative, in comparing reproductive system anatomies, that the terms used in describing the accessory organs be unequivocally defined. BERRY (1953) described and compared the reproductive systems of *H. lowei* and *H. thermimontis* Berry, 1953, in minute detail. In *H. lowei,* however, he considered the epiphallus to include the double-tubed, eversible portion, and he then identified the lower sac of the penis, which is long and saccular in this species, as the entire penis. In this report, in order to be consistent with Pilsbry's earlier definitions, the epiphallus (Figure 1, ep) is considered to be the muscular, single-tubed duct which begins at the junction of the vas deferens and the epiphallic caecum, and ends at the beginning of the double-tubed, eversible duct. The penis, then, consists of an upper part (Figure 3, upe)

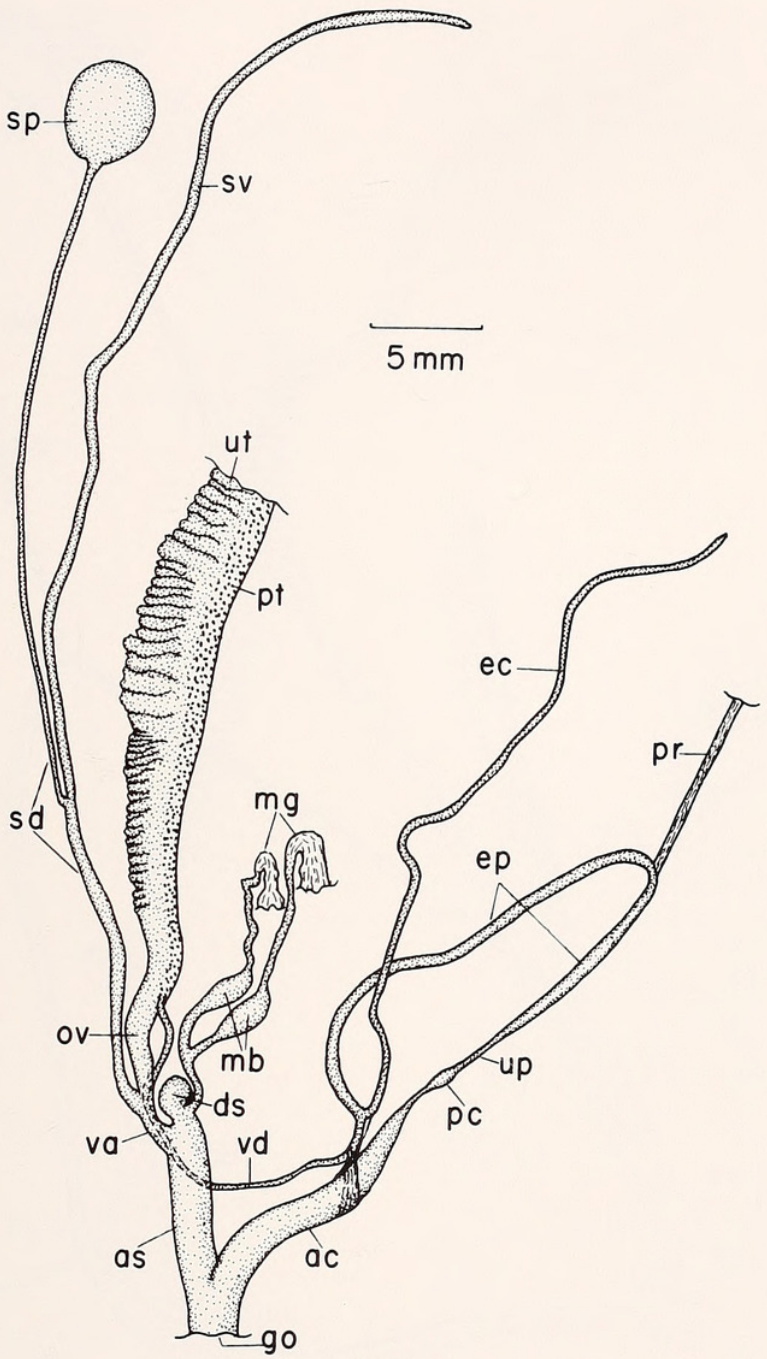

Figure 1

Reproductive system of *Helminthoglypta* (***Rothelix***) *lowei* (Bartsch); ovotestis and albumen gland region omitted. Drawing made from projection of stained whole mount, WBM 7366, collected on Palomar Mountain, San Diego County, California, along bank of Fry Creek at about 1500 m (4800 ft) elevation, 5 January 1984. ac, anterior chamber of lower part of penis; as, atrial sac; ds, dart sac; ec, epiphallic caecum; ep, epiphallus; go, genital orifice; mb, mucus gland bulbs; mg, mucus gland membranes; ov, oviduct; pc, posterior chamber of lower part of penis; pr, penial retractor muscle; pt, prostate; sd, spermathecal duct; sp, spermatheca; sv, spermathecal diverticulum; up, upper part of penis; ut, uterus; va, vagina; vd, vas deferens.

which is the double-tubed, eversible duct, and a lower part (Figure 3, lpe) which is a single-walled, saccular duct that connects with the atrium. The penial retractor muscle is always attached to the epiphallus. This is in accord with the description of the epiphallus and the penis of the typical subgenus *Helminthoglypta* in PILSBRY (1939:67). The term "atrial sac" also is in accord with Pilsbry's definition of that term (PILSBRY, 1939:63 and fig. 31).

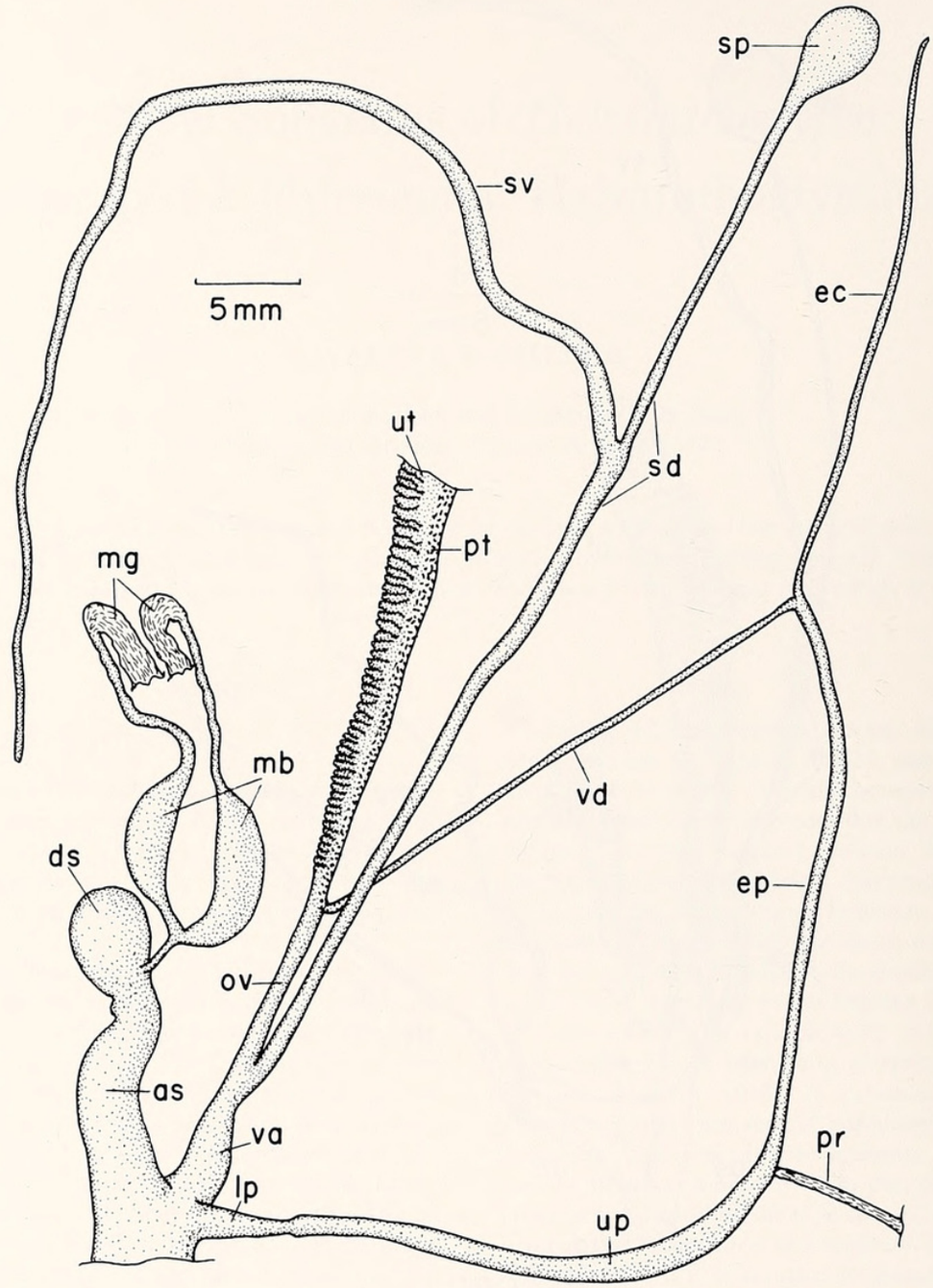

Figure 2

Reproductive system of *Helminthoglypta tudiculata* (Binney); ovotestis and albumen gland region omitted. Drawing made from projection of stained whole mount, WBM 4426-A, collected along Sweetwater River, 2.6 km (1.6 mi) upstream from confluence of Harbison Creek, San Diego County, California, 9 February 1963. as, atrial sac; ds, dart sac; ec, epiphallic caecum; ep, epiphallus; go, genital orifice; lp, lower part of penis; mb, mucus gland bulbs; mg, mucus gland membranes; ov, oviduct; pr, penial retractor muscle; pt, prostate; sd, spermathecal duct; sp, spermatheca; sv, spermathecal diverticulum; up, upper part of penis; ut, uterus; va, vagina; vd, vas deferens.

DESCRIPTION

Rothelix W. B. Miller, subgen. nov.

Diagnosis: Shell varying from medium to small for the genus, finely papillose above and below. Reproductive anatomy distinguished by the long, sausage-shaped, lower sac of the penis and by the vagina which enters the atrial sac at its apex, next to the dart sac.

Type species: *Helminthoglypta* (***Rothelix***) *lowei* (Bartsch, 1918).

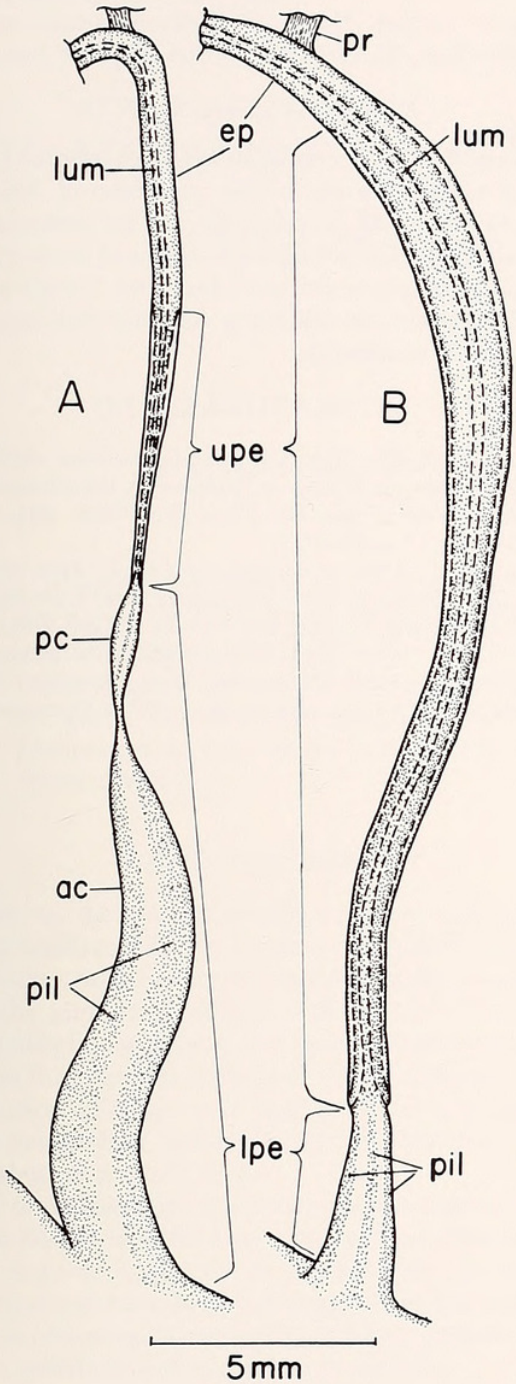

Figure 3

Enlargement of penes shown in Figures 1 and 2, showing inner structures in dotted lines. A, penis of *Helminthoglypta* (***Rothelix***) *lowei*; B, penis of *H.* (*H.*) *tudiculata.* ac, anterior chamber of lower part of penis; ep, epiphallus; lpe, lower, saccular part of penis; lum, lumen of epiphallus and penis; pc, posterior chamber of lower part of penis; pil, pilasters; pr, penial retractor muscle; upe, upper, double-tubed part of penis.

Description of penis and dart apparatus of type species (Figure 1): The penis consists of a double-tubed, upper part, which is relatively short and narrow, and a single-tubed, saccular, lower part which is long, sausage-shaped, and consists of a small, short, thin, bulging, posterior chamber and a long, thick, wide, anterior chamber lined with spongy, glandular, anastomosing pilasters; the two chambers connect via a very narrow venturi-shaped constriction. The dart sac and mucus glands are typical for the genus, but the atrial sac, below the dart sac, connects with the vagina at its posterior end, immediately below the dart sac. The mucus gland membranes completely envelop the mucus bulbs, dart sac, and atrial sac, as well as the base of the anterior chamber of the lower part of the penis where they anastomose with additional connective tissues to form a penial sheath that attaches by several strong strands to the vas deferens, the epiphallus, and the epiphallic caecum, where the three ducts join together.

DISCUSSION

The reproductive system (Figure 2) of the type species of the nominate subgenus, *Helminthoglypta tudiculata,* is characterized by a long, cylindrical, double-tubed, upper part of the penis, and a very short, thin, saccular, lower part of the penis. The dart apparatus consists of a large dart sac, mucus glands, and a capacious atrial sac, in which the vagina and the penis enter at its anterior end, next to the genital orifice. The mucus membranes completely envelop the dart apparatus, including the lower part of the penis where they form a thin penial sheath that attaches to the vas deferens where it connects with the epiphallus (not shown in Figure 2, in order to show individual structures fully stretched).

In ***Rothelix,*** the upper part of the penis is relatively short and thin, compared to that of *Helminthoglypta* s.s. (Figures 3A, B), while the lower part of the penis is long and large. Furthermore, the penial sheath in ***Rothelix*** is long and tough, whereas it is short and fragile in *Helminthoglypta* s.s.

Included in this subgenus are *Helminthoglypta cuyamacensis* (Bartsch, 1916) and several additional species, yet to be described, from the vicinity of the Cuyamaca Mountains. Not included are *H. cuyamacensis piutensis* Willett, 1938, and *H. c. avus* (Bartsch, 1916), whose anatomy is typical of *Helminthoglypta* s.s., thereby requiring that they be elevated to specific rank, namely *H.* (*H.*) *piutensis* and *H.* (*H.*) *avus* respectively. *Helminthoglypta lowei* was originally described by Bartsch as *Epiphragmophora cuyamacensis lowei* and was subsequently raised to specific status by Berry (1953). It is selected as the type species of the subgenus because its type locality, Palomar Mountain, is precisely known, and it has been collected and dissected by several workers, including Berry, Gregg, and the author. The type locality of *H. cuyamacensis cuyamacensis* on the other hand, "Cuyamaca Mountains, San Diego Co.," covers a large area that is home to many species of *Helminthoglypta,* several of which are undescribed and, therefore, topotypes could not be obtained for dissection. Gregg and I have obtained anatomies from snails whose shell measurements and characters correspond closely with those of the holotype and may pos-

sibly be topotypes; these anatomies reveal them to belong in the subgenus ***Rothelix***. PILSBRY (1939:146, fig. 73) illustrates the "genitalia of a *Helminthoglypta* of uncertain status"; it is obviously a member of the subgenus ***Rothelix***, and probably came from the same lot whose shells were described by Bartsch as *Epiphragmophora cuyamacensis cuyamacensis*.

Zoogeography: At present, the subgenus ***Rothelix*** is known only from San Diego County where it inhabits the inland montane region from Palomar Mountain in the north to the Cuyamaca Mountains in the south, including several intervening localities. It is primarily a log snail, living in rotting logs of oaks, firs, and incense cedars, but it can be found also in large rat nests. It is sympatric with species of the *Helminthoglypta traskii* group, which is widespread in southern California and northern Baja California. Accordingly, it probably evolved from an *H. traskii*-like ancestor and spread, during pluvial times, throughout the area that it now occupies.

Etymology: This subgenus is named after Barry Roth, a friend and colleague, who has taken up systematic research of western North American terrestrial mollusks from his tutor, the late and beloved Allyn G. Smith.

ACKNOWLEDGMENTS

I am indebted to the late Wendell O. Gregg for pointing out the salient features of the anatomies of *Helminthoglypta lowei* and *H. cuyamacensis* and for companionship on many field trips to collect specimens of these species as well as other species yet to be described. I wish to thank Carl C. Christensen and Barry Roth for their critical reviews of this manuscript.

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