

SEXUAL APPARATUS OF SELECTED PLANORBID SNAILS
OF THE CARIBBEAN AREA OF INTEREST IN
SCHISTOSOMIASIS CONTROL^{1,2}

FREDERICK F. FERGUSON, A.B., M.S., Ph.D.

CHARLES E. GERHARDT, B.S., M.S.

Puerto Rico Field Station, San Juan, Puerto Rico

Genus Drepanotrema—Snails of the genus *Drepanotrema* Fischer and Crosse are of interest to those engaged in the control of *Australorbis glabratus* (Say), the Caribbean vector of *Schistosomiasis mansoni*, since some *Drepanotrema* resemble the vector species in gross morphology (when of a similar size), and occupy the same habitats under certain conditions.

Taxonomically, the subfamily Segmentininae which contains the genus *Drepanotrema* is differentiated from others of Planorbidae by the possession of a flagellum attached to the vergic sac of the penial complex. Generically, *Drepanotrema* has a flagellum which is shorter than the penial complex, not swollen at the summit, and may often be bifid. Organs of the sexual apparatus are not grossly pigmented and are relatively small in this genus.

Certain of the new species of *Drepanotrema*³ described herein estivate in soil under conditions of drying. Studies of the ability of *Drepanotrema* to live in damp or dried soil were made using type locality soil samples from known habitats procured by a post-hole digger. Soil samples were covered with tap water which was aerated and observed daily for a week by a hand lens. Snails began to emerge and move about actively at about two hours and continued to do so for one or two days. During a wet month (November) random ditch soil samples of Sabana Seca, Puerto Rico, yielded snails in 14 of 18 tests, while random samples taken during a dry

month (January) produced snails in 4 of 11 tests. They may be regularly taken during the dry season from one station where the soil is so hard the sample must be procured by use of a pick ax. It was possible to induce estivation in soil by slow drying in the sun and to induce emergence of the same snails by the addition of water and direct exposure to strong electric light.

Drepanotrema simmonsii,⁴ new species, commonly seen in temporary waters of cane field drainage systems of Sabana Seca and Arroyo, Puerto Rico,⁵ is deep brownish-black in color when collected, except for clear shell areas near the major aperture. The head-foot is colorless, while the mantle is lightly mottled with black pigment. The thin, slightly dextral shell (see figures 1, 2 and 3) is simple, having only a few whorls (averaging from two and three-quarters to three) and has a medium flare at the aperture. When clean, the entire shell is seen to be clear. There is a flat under side and a markedly concave upper side. The main body whorl is large and expanded. Average greatest body diameter is 6 mm.⁶ The shell of this very active species is carried at an angle of about 45 degrees with the flat side uppermost. Two or three "growth rings" are present in most specimens indicative of major growth periods.

Internally, the ovotestis is light golden brown and heavily granular in appearance due to the usual predominance of ovarian

⁴ Named in honor of Dr. S. W. Simmons, medical biologist of the Communicable Disease Center.

⁵ *Drepanotrema* also occurs in Texas, Mexico, Central America, Brazil, Bolivia, and Argentina. This description is based on species native to Puerto Rico and St. Croix, V. I.

⁶ Observed range of size in hibernating snails is from 3.0 to 6.0 mm. in greatest diameter.

¹ Received for publication October 1955.

² From the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare, Atlanta, Georgia

³ *D. simmonsii* and *D. fausti*.

follicles. The ovotestis is equipped with a discrete thin-walled ciliated ventral sac or common atrium which remains distended by a clear fluid. This sac extends for about one-fourth the length of the common cytogenic gland. The common gonoduct (or ovisperm duct) originates from this sac as a thin clear tubule. From three to five eggs are laid per mass. The ciliated ovisperm duct is relatively large in diameter in all reaches and, especially, where it expands into the semi-lobate seminal vesicle. There are no lateral nodules on the duct. The seminal vesicle consists of the expanded, simply-coiled upper portion of the common gonoduct. In mature specimens it is always filled with whitish masses of filamentous sperm cells. The outer walls of the tubule are grossly mottled with reddish-brown pigment. The carrefour is a relatively large ciliated saccular structure with thin transparent walls, which receives the common gonoduct and serves as the origin of the vas deferens and oviduct. The albumen gland is finely granular and pinkish in appearance. It has a saddle shape, is permanently indented by the intestine, and is relatively thin. The ciliated oviduct is large in diameter, being about five times that of the ciliated vas deferens. Both tubules have a finely granular, relatively colorless appearance. The nidamental gland is a light yellow, finely granular section of the female tubule, which is about one-third longer than the prostate gland and is situated somewhat dorsal to the latter. The bulb of the spermathecal sac is almost spherical in shape. The organ is essentially sessile, having a very short duct. It generally carries a pinkish mass of granulated material of unknown origin. Serial follicles of the prostate gland are attached to the vas deferens, are arranged in two rows, and have reflexed ends. Previously described species have a single row of rather widely-spaced follicles.

The penial complex (figure 12) consists of vergic sac, preputium, and flagellum. A broad penial retractor muscle attaches at the union of vergic sac and preputium. The vergic sac is a muscular tubule which re-

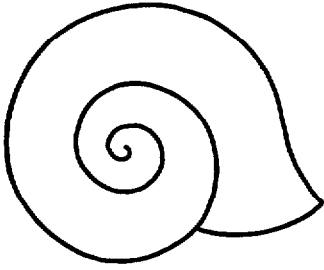
ceives the vas deferens at its proximal end. Lateral to this is the origin of the two tubular branches of the flagellum which unite longitudinally for most of their length. The bifid nature is retained for the length of the semi-hyaline structures. When extended, the flagellum is slightly shorter than the vergic sac. These flagella consist of paired glands, each with a restricted central duct. The lumen is bordered by a low, cuboidal, very regular epithelium of one cell thickness. The gland cells have oval, rather large, central nuclei. The secretion is a watery granular material which is carried into the upper vergic sac. Each digitiform gland is invested with a thin tunic, a portion of which holds the glands together where they are joined. Gross histologic features are easily seen when live material is held with slight pressure of a coverslip. The vergic sac contains a discrete, simple, tubular verge which protrudes into the ciliated preputium through a strongly developed muscular diaphragm. The preputium and vergic sac are about equal in length, the two together measuring about 2 mm.

Drepanotrema harryi, new species,⁷ which is very common in ponds of St. Croix, Virgin Islands, is easily differentiated from *A. glabratus* because of its very clear thin shell, pale yellow cast, and the peculiar "half shell" morphology as seen in figures 4, 5, and 6. The shell of this species has an average greatest diameter of 8.5 mm. with a height of 1 mm. The number of whorls, which are evenly developed, average from 4.25 to 5.25 for both top and bottom surfaces. Terminal whorl concavities are very minor on both surfaces, which are uniformly and finely striated. The aperture is dextral and located at a rather sharply oblique angle, but is not markedly flared. The shell is carried parallel to the substratum when mobile.

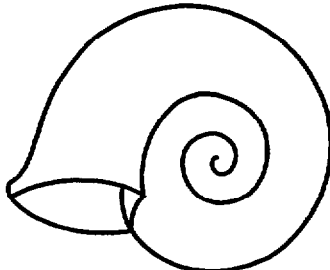
The animal's soft parts are rather striking, since the mantle typically has a dark brown anterior pigmented band, while another is

⁷ Named in honor of Dr. Harold Harry, malacologist, Tropical Research Medical Laboratory, U. S. Army, San Juan, Puerto Rico.

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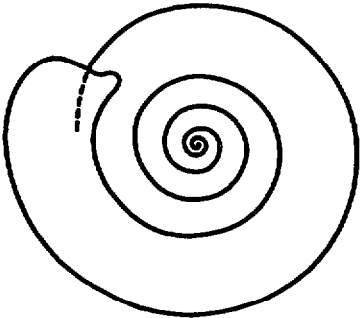
①
Drepanotrema simmonsii
UPPER SHELL X8



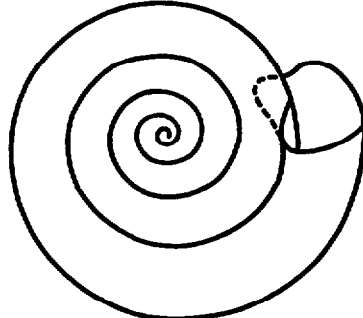
②
Drepanotrema simmonsii
LOWER SHELL X8



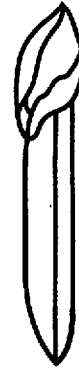
③
Drepanotrema simmonsii
APERTURE VIEW X8



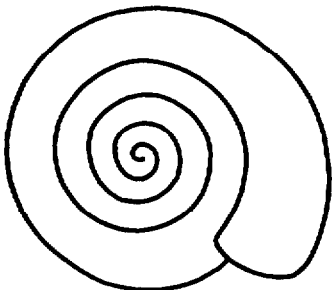
④
Drepanotrema harryi
UPPER SHELL X5.5



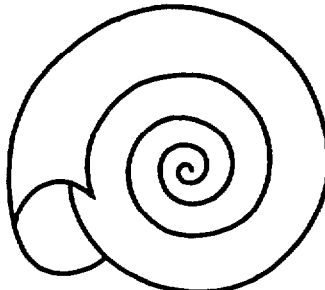
⑤
Drepanotrema harryi
LOWER SHELL X5.5



⑥
Drepanotrema harryi
APERTURE VIEW X5.5



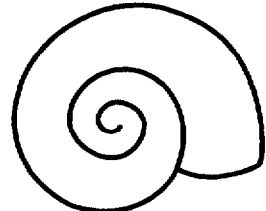
⑦
Drepanotrema anatinum
UPPER SHELL X6



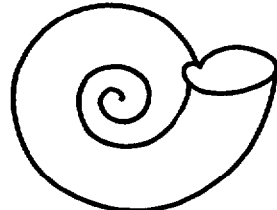
⑧
Drepanotrema anatinum
LOWER SHELL X6



⑨
Drepanotrema anatinum
LATERAL VIEW X6

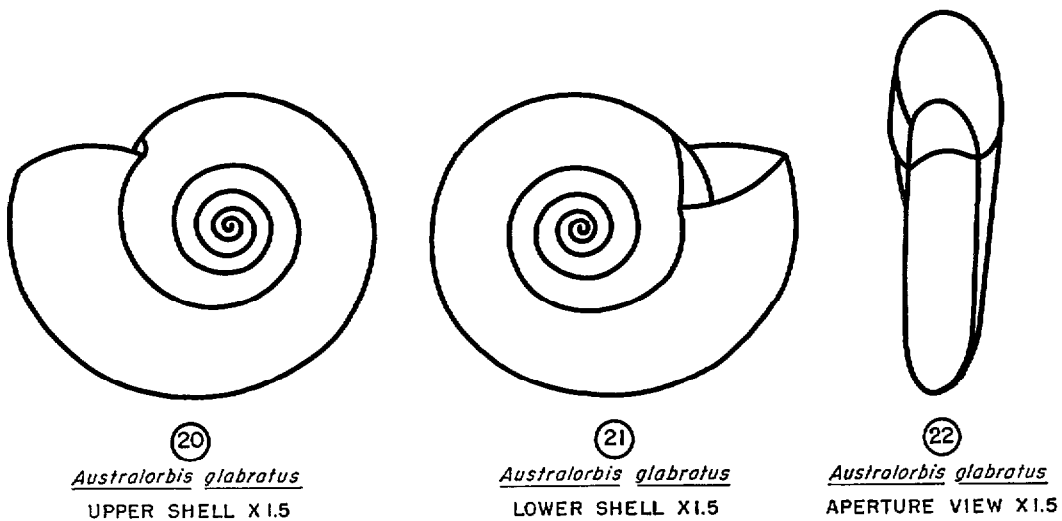
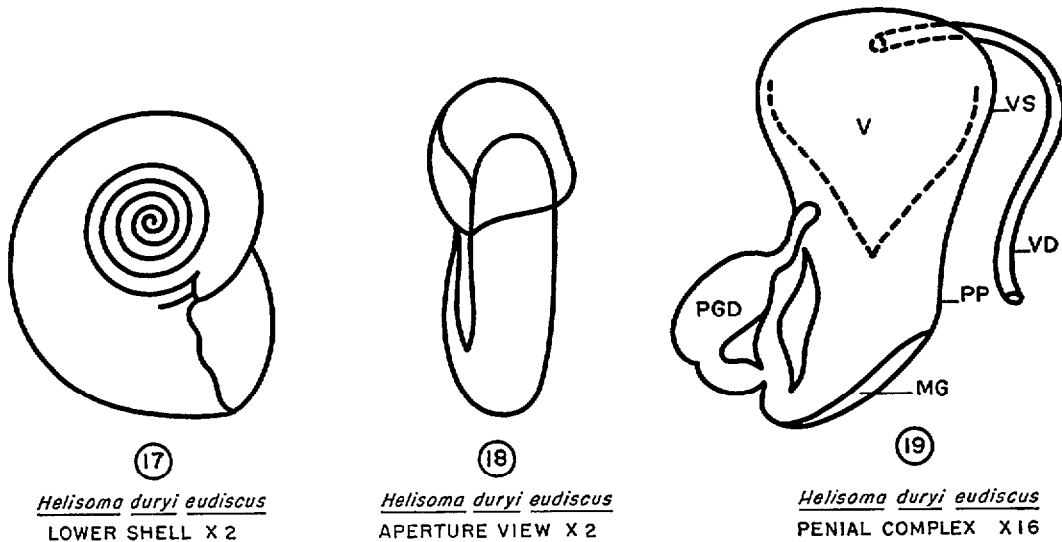
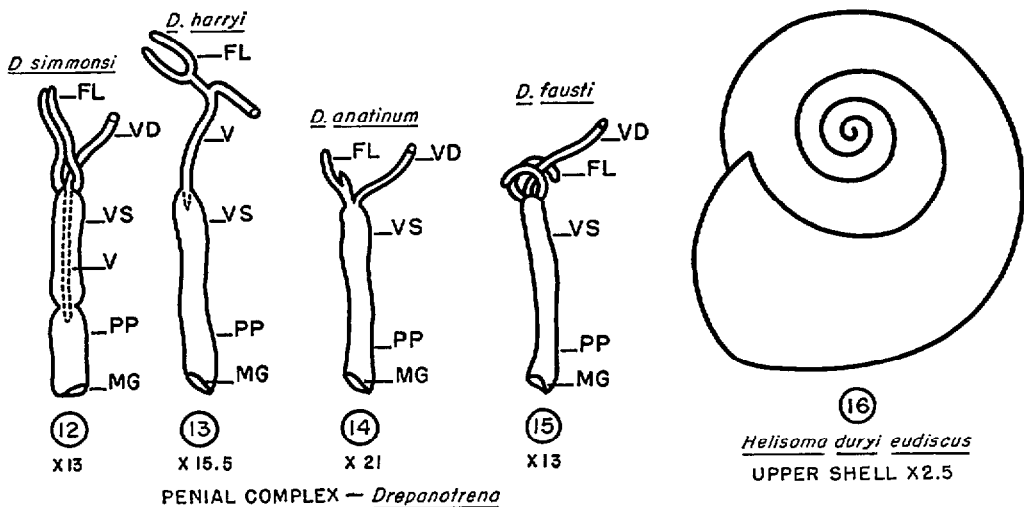


⑩
Drepanotrema fausti
UPPER SHELL X8



⑪
Drepanotrema fausti
LOWER SHELL X8

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located behind, which is densely pigmented in front but gradually loses its color posteriorly. The foot has laterodorsal bands of pigment. Eyes are black and prominent, while each tentacle is centrally pigmented.

Internally, unusual features are rare in the distal parts of the reproductive system. The ovotestis has a golden granulated appearance while the contorted seminal vesicle is thinly stippled with dark red pigment. The carrefour is fairly small, while the appended albumen gland is pinkish and granular in appearance, having the usual saddle-shape morphology. The vas deferens is about one-third the diameter of the oviduct. Prostatic follicles appear to originate from the vas deferens in a single close file, each having a bent end. A large pyriform spermatheca has a duct which is about one-half the length of the bulb. The penial complex (as seen in figure 13) has a preputium about 1.75 mm. in length and of simple structure. The attached vergic sac is short and relatively thick. It is about one-third as long as the sheath. A Y-shaped flagellum is appended at the right-angled juncture of vas deferens and vergic sac.

Taxonomically, *D. harryi* is rather easily differentiated from other species because of its "half-shell" shape, its extreme shell clarity, and the distinctive features of the penial complex, especially the morphology of the bifid flagellum.

Drepanotrema anatinum (Orbigny) may be found sparsely in grass-lined creeks of Sabana Seca and ponds near Isabela, but commonly occurs in southwestern and northwestern lakes and lagoons of Puerto Rico. The species differs from *A. glabratus* in the clarity of its golden brown shell, and other gross features (figures 7, 8 and 9).

This snail with its golden brown, relatively clear shell and gradual spacing of whorls is the most attractive Puerto Rican planorbid. Shells are semidiscoid, there being a moderate concavity on the flat under side and a minor concavity on the upper side. They measure up to 7 mm. in greatest diameter and are about 2 mm. in height.

Whorls average 4.5 in number and on both top and bottom are externally marked with thin dark-red lines of pigment at their margins. Shells are carried parallel to the substratum when in motion. The foot ventrum and laterodorsal margins have stripes of blackish pigment. The tentacles have single grayish central stripes, while the head proper has paired bands of blackish pigment median to the prominent eyes and extending up into the dorsal mantle area.

Internally, the ovotestis of Puerto Rican *D. anatinum* is a light golden gland of paved appearance. As in the other species described herein, the seminal vesicle is a contorted section of the common gonoduct made white by the impacted sperm masses. There is a ciliated ventral atrium in the ovotestis proper and the common gonoduct (or ovisperm duct) is a simple, clear, thin tubule joining the carrefour at the juncture of this latter prominent ciliated atrium with the albumen gland. The paved albumen gland is almost colorless. Both the oviduct and vas deferens are granular and colorless. The prostate gland differs somewhat from the original species description, being a simple structure with a single row of closely spaced digitiform follicles numbering from 13 to 15. The spermatheca is a simple blind sac with a relatively long duct. The penial complex (as seen in figure 14) has a thin vergic sac which is one-third longer than the preputium and one-third the diameter of the penis sheath (both measuring about 3 mm. in length). The vas deferens enters the penis at the union of the vergic sac and flagellum. This latter adenal structure which is short (measuring only one-fourth the length of the vergic sac) consists of paired, blindly-ending tubules closely united at their origins with one arm being twice as long as the other. In some specimens the paired arms are divergent—in others, conjoined for their entire length.

Drepanotrema fausti,⁸ new species, has a

⁸ Named in honor of Dr. E. C. Faust, Tulane University of Louisiana, who made basic contributions to knowledge of Puerto Rican planorbids.

small (up to 4 mm. diameter), relatively clear shell (see figures 10 and 11), with a striking peripheral blackish pigmentation in small amounts. This snail has been taken rarely from Sabana Seca, Puerto Rico, mud samples exhibiting drought resistance. The foot of *D. fausti* is colored with paired dorso-lateral black stripes of pigment. Tentacles are also pigmented.

Internally, the ovotestis is seen as a roughly granular, light golden organ. The common gonoduct (ovisperm duct) originates as a rather small, thin-walled ventral atrium of the ovotestis. Most of the common gonoduct seen on removal of the animal from its shell may be considered as the seminal vesicle, which is a greatly expanded, partly coiled section of the tubule, and is distended with cream-colored masses of filamentous sperm cells. The carrefour is a relatively small and simple atrium to which is appended a massive albumen gland. This latter gland is saddle-shaped, granular, and light cream colored. Both oviduct and vas deferens are thin-walled tubules lying parallel for most of their lengths. Each has a light cream color and finely granular walls. The oviduct has a diameter about three times that of the vas deferens. The prostate gland is a multifollicular organ consisting of a single row of diverticula originating from the vas deferens. There are about 12 follicles, some of which are bifid. The spermatheca is club-shaped, the reduced bulbous and the duct being approximately equal in length. Divisions of the penial complex (see figure 15) into vergic sac and preputium are not distinctive, the most singular character being a flagellar structure divided into two recurved arms, the origin of which is at the juncture of the vas deferens and vergic portion of the male organ.

DISCUSSION

The Caribbean species of *Drepanotrema* described herein may be confused with *Australorbis glabratus* under field conditions, when the two are of similar size. The ability of certain *Drepanotrema* to withstand desic-

cation presents another problem in bilharzia control work since, at times, this explains otherwise unaccounted large populations of small planorbid snails. It appears that *Drepanotrema* and *Australorbis* may be most commonly found together in ponds, lakes, lagoons, drainways, or in irrigation waste waters which are slow flowing and relatively impermanent. *Drepanotrema* have not been indicted as a vector of human schistosomes, but *D. anatinum* may be found infected with *Cercaria marini*, a larva of blood flukes of nonhuman origin in Puerto Rico.

Taxonomically, the important diagnostic features of the internal anatomy of *Drepanotrema* are known only from descriptions of sex apparatus in *D. anatinum* (Orbigny) from Pueblo Viejo, Puerto Rico, *D. hoffmani* (Baker)⁹ from Isabela, Puerto Rico, *D. lucidum* (Pfeiffer) from Havana, Cuba, and *D. cultratum* (Orbigny) from Bolivar, Colombia. The sex apparatus of *D. cultratum* and *D. lucidum* was first figured by Pilsbry (1) 1934, while that of *D. lucidum*, *D. hoffmani*, *D. cultratum*, and *D. anatinum* were presented by Baker (2) 1945. The 14 species¹⁰ of *Drepanotrema*, based taxonomically on shell characteristics alone are in need of redescription, using the sound approach founded on study of morphology of the reproductive system from living specimens.

Comparison of the penes of the three new species with one of those previously described is afforded by figures 12 through 15. Preserved whole paratypes of *D. simmonsii*, *D. fausti*, *D. harryi* from respective type localities, as well as representative specimens of *D. anatinum*, have been deposited in the U. S. National Museum.

Genus Helisoma—Some species of the genus *Helisoma* Swainson are significant in schistosomiasis control, since they grossly

⁹ The flagellum of this species, taken occasionally in Puerto Rico, is bifid and very short.

¹⁰ *D. chittyi*, *D. parapseide*, *D. ahenum*, *D. castaneomitens*, *D. melleum*, *D. anitense*, *D. duodasianum*, *D. labrosum*, *D. panuco*, *D. cimex*, *D. pistiae*, *D. depressissimum*, *D. kermatoides*, *D. sumichrasti*. For conchologic data see Baker (2) 1945.

resemble *A. glabratus*. Identification of the schistosome vector in Puerto Rico may become complicated by the simultaneous occurrence of the two planorbid snails in endemic areas.¹¹

Taxonomically, members of the subfamily Helisomatinae are differentiated from others of the family Planorbidae by having a penial gland duct located outside of the preputium and having both the diverticula of the prostate and ovotestis glands arranged fanwise when seen in cross-section.¹²

Helisoma duryi eudiscus Pilsbry is mostly brownish-black, presenting a yellowish or greenish cast in limited shell areas. The greatest shell diameter is about 21 mm. the lower surface showing about four and three-quarters whorls. Morphology of the shell is presented in figures 16, 17, and 18. In some specimens, the major concavity of the upper shell surface is extremely deep. The snail shell is carried in erect position as it moves about sluggishly.

When dissected, the golden brown ovotestis is seen located in the terminal coils of the body. It is follicular, consisting of many simple diverticula in numerous ranks which originate from a central (i.e. "ventral") common gonoduct. Only the distal portion of each follicle is pigmented in a granulated manner. The common gonoduct (ovisperm duct) is covered by a very thin transparent tunic which is easily disclosed upon removal of the snail from its shell. The common gonoduct is seen in "exposed" condition parallel to the heart, from whence it courses to the right side of the heart posteriorly towards the ovotestis. Anterior to the ovotestis, the common gonoduct receives many radiating, whitish lobules which carry filamentous sperm cells. Distal to this lobular structure, the seminal vesicle, the flattened common gonoduct, is characterized by receiving bilaterally arranged nodules which are short,

¹¹ *Helisoma* also occurs in Guatemala, Nicaragua, Panama, Mexico, Cuba, and St. Croix, V. I. This description is based on living material from St. Croix and Puerto Rico.

¹² For further taxonomic details see Baker (2) 1945.

tubular, blunt-ended, and sparse. These nodules are distributed on the duct practically to the union with the carrefour. This latter small bulb which receives the contents of the albumen gland, and serves as the origin of the vas deferens and oviduct, is not distinctive. The albumen gland extends dorsoposteriorly from the carrefour juncture. It is an orange-colored structure and is large (about 3 mm.) and saddle-shaped, presenting a pebbled surface.

Both oviduct and vas deferens are thin-walled tubules lying parallel. The diameter of the oviduct is about twice that of the vas deferens, which in turn is of greater diameter than that of the common gonoduct. The massive nidamental gland section of the female duct is light golden in color and extends essentially for the entire length of the oviduct. The grayish, club-shaped spermatheca lies closely pressed to the outer walls of the oviduct. The terminal bulb is in contact with the lower part of the prostate gland. The duct of the spermatheca is about twice as long as the bulbar portion. The golden brown prostate gland is comprised of numerous digitiform follicles arranged in many ranks. Many small ducts enter the vas deferens from the prostate gland. This gland is about two-thirds as long as the nidamental gland. As the vas deferens loses contact with the duct of the spermatheca and the proximal reaches of the oviduct in its anterior course, it becomes a tubule of smaller diameter. The vas deferens is carried buried in the musculature of the foot between the preputial portion of the penis (figure 19) and the vaginal section of the female tubule.¹³ Beyond this it reflexes dorsally to enter the dorsoposterior wall of the vergic portion of the massive bulbous penis. The entrance of the vas deferens into the penis bulb (vergie sac) is placed eccentrically. The distal part of the penis complex (measuring 3.5 by 1.5 mm.) is reddish and club-shaped, possessing a strong muscular

¹³ The vas deferens may be easily confused with the mayor nerve trunks which course in this region.

wall. The basal penis, or preputium, has a distinct lateral bulge containing the penis gland. This structure is thin-walled in part (marked in figure 19 by stippled area), and is characterized by concentric rolls of glandular tissue when seen internally. A wide, thin muscle band, or penial retractor, unites this part of the penial complex to nearby foot tissues. The penial gland has an external duct which extends from the center of the basal lateral bulge of the preputium to a point midway in the walls of the male organ at the level of the verge. The light cream-colored external duct of the penis gland has a delicate proximal part, a well defined central bulb, and a twisted distal part where it joins the preputium. The cream-colored verge of the penis occupies about two-thirds of the lumen. It is shaped like a toy top and is sharply pointed distally. The terminal part has a tiny stilette. The verge consists of homogeneous, semi-spongy tissues.

DISCUSSION

Since this *Helisoma* occurs at widely scattered points in Puerto Rico, and since it may be confused under field conditions and on laboratory examination taxonomically with *A. glabratus*, knowledge of its biology may clarify and simplify control of the latter blood fluke vector in particular situations. This *Helisoma* species seems to prefer permanently impounded waters. *Australorbis* prefers flowing water, or associated nonflowing water, as well as a variety of impounded waters. Countless numbers of *H. duryi eudiscus* may develop in the secondary reservoirs of the irrigation system of southern Puerto Rico.¹⁴ It has also been taken in vegetated upper arms of reservoir lakes. *Helisoma* has not been indicted as a vector of any type of schistosomiasis to date.

Australorbis glabratus (Say)—This species of planorbid snail is the principal New World vector of Manson's blood fluke and may be found in countries of South America and

¹⁴ It occurs abundantly in certain ponds of St. Croix, V. I. where it is thought to be a recently introduced species.

certain islands of the Antillean chain.¹⁵ The following observations on Puerto Rican living material are presented for comparative purposes.

Shells measure up to 32.5 mm. in diameter and 5 mm. in height, are relatively large, generally smooth, biconcave, and slightly sinistral. There are about 6 whorls per shell (see figures 20, 21, and 22).

The animal is dark gray or blackish and has a mantle which is usually mottled with brownish black pigment. Some physiological strains in Puerto Rico have very clear shells through which one may see the mottled mantle. These snails have been studied in series extending from very small to large specimens.

Upon dissection¹⁶ the golden brown follicles of the common gonad are seen arranged in semifan shape, originating as stout tubules from the common gonoduct. The more mature portion of the cytogenic gland is seen on the left side in most specimens when viewed ventrally. The common gonoduct (ovisperm duct) is easily exposed upon removing the animal from the terminal shell coils. The duct is about 8 mm. in length. This tubule is cream-colored and is essentially of the same diameter, except for the region specifically named the seminal vesicle. It may be seen coursing posteriorly under the thin semitransparent mantle to the right of the reddish stomach. The ciliated tubule crosses diagonally to the left side in the terminal coils. Beyond the seminal vesicle there is, generally, a discrete expanded thin-walled atrium (of extended pyriform shape), which measures up to 5 mm. in length by 1 mm. in greatest diameter. Both eggs and sperm cells may be seen massed in this common atrium, often in circular motion induced by ciliary action. The seminal vesicle section

¹⁵ The species occurs in Haiti, Dominican Republic, Puerto Rico, Vieques Island, and Guadalupe. It has been reported in South America from Venezuela southward to Argentina.

¹⁶ The reproductive anatomy based on Puerto Rican material is adequately figured in Baker (2) 1945. Pl. 9. Fig. 10.

of the gonoduct is convoluted and sparsely nodular, and is generally distended with sperm cells which appear white. The lateral nodules may be filled with orange pigment. The carrefour is a simple, cream-colored bulbous proximal portion of the common gonoduct. The inner walls are densely ciliated. It serves as the origin of the albumen gland duct, the ciliated vas deferens, and the ciliated oviduct. A large (6 mm. long) orange-colored, saddle-shaped albumen gland has a follicular make-up, giving the appearance of a pebbled surface. The indentation made by the intestine is marked. This gland is almost sessile, being closely attached to the carrefour via a thin, very short duct, the endothelium of which is ciliated. The light orange oviduct is about 18 mm. long and is about five times the diameter of the fairly clear vas deferens. The two gonoducts are closely attached in the region of the carrefour. The part of the female tube called the nidamental gland is very long and wide (about 8 mm. by 1.5 mm.) It is sacculate, has ciliated inner walls, and is light orange in color. The duct of the usually pinkish spermatheca is narrow and is about as long as the pyriform bulb.

There are no unusual features of the uterine and vaginal sections of the female tube, which sections are smaller in diameter than the more distal portions. The prostate gland¹⁷ which is about 12 mm. long, consists of about 24 diverticula, the first few anterior ones being single and the last few posterior ones being bifid. The other diverticula send off three branches from a single stem, each branch subsequently dividing two or three times. The primary diverticula originate from the vas deferens in a single rank, there being no separate prostate gland duct. The ciliated vas deferens, which is about 10 mm. long, is almost as great in diameter as the vergic sac portion of the penis. At the juncture of the male duct with the penis there is a small but prominent bulb. The narrow vergic sac measures about 5 mm. and is

slightly longer than the cylindrical, elongated preputium (measuring about 4 mm. long and 0.7 mm. wide). The penial complex is principally supported by so-called retractor muscles, which attach at the union of the preputium and vergic sac and originate in nearby head tissue. The verge (which has a ciliated central canal) is long and sharply pointed, but it does not have a stilette. It has approximately the same length as the vergic sac. Paired pilasters, or grooves, occur in the densely ciliated walls of the preputium.

The male opening, located at the base of the left tentacle, appears to be controlled by sphincter action. This gonopore may be increased to a diameter similar to that of the lower preputium.

DISCUSSION

Because of its large size and simple reproductive anatomy, the internal features of greatest taxonomic value may be easily elucidated by elementary microscopic dissection techniques. Care should be exercised in avoiding contact with the aquarium water, should the specimens be field material. Observations are facilitated by bathing small dissected parts in physiological salt solution.

SUMMARY

1. Species of *Drepanotrema* may be easily differentiated from *Australorbis* by dissection of the hermaphroditic sexual apparatus, by shell characteristics, and by knowledge of the required habitat.

2. Cardinal diagnostic features of the reproductive system of *Drepanotrema* include a flagellum which is shorter than the rest of the penis complex, and which has either a double branch or single origin at the apex of the vergic sac.

3. Nonhuman schistosome cercariae found in some *Drepanotrema* may account for dermatitis induced by contact with certain waters.

4. *Helisoma duryi eudiscus* may be grossly differentiated from *A. glabratus* by shell characters, of which the extremely deep

¹⁷ Description taken from Baker (2) 1945.

lateral concavity and the prominently flared major opening are noteworthy.

5. *Helisoma* may be definitely differentiated from *Australorbis* through dissection of the sexual apparatus. Two primary characters are of diagnostic value: the very large bulbous penial complex equipped with an internal penis gland and a prominent external duct of the latter gland; and the fan-wise arrangement of the diverticula of both the prostate gland and ovotestis, when viewed in cross-section.

6. *Helisoma* has significance in schistosomiasis control only as it becomes a factor causing identification among planorbid species to be difficult in the field.

7. Significant differential features of *A. glabratus* include general shell morphology and possession of a simple penial complex.

8. Rapid taxonomic diagnosis of *A. glabratus* may easily be made by teasing out parts of the hermaphroditic reproductive system, concentrating on the morphology of the penial complex and the prostate gland.

REFERENCES

- (1) Pilsbry, H. A.: Review of the Planorbidae of Florida with Notes on Other Members of the Family, *Proc. Acad. Nat. Sc.*, 1934, Phil. 86:29-66.
- (2) Baker, F. C.: *The Molluscan Family Planorbidae*, University of Illinois Press, Urbana, Ill. 530 pp.

EL APARATO REPRODUCTOR DE UNA SELECCION DE CARACOLES PLANORBIS DE LA REGION DEL CARIBE, DE INTERES EN EL CONTROL DE LA SCHISTOSOMIASIS (*Resumen*)

1. Las especies del género *Drepanotrema* pueden distinguirse fácilmente de las del *Australorbis* mediante la disección del aparato sexual hermafrodita, por las características de la concha y por el conocimiento de su habitat.

2. Uno de los caracteres del sistema reproductivo más importantes para el diagnóstico del *Drepanotrema* es la existencia de un flagelo, más corto que el resto del órgano del pene y que, o bien tiene un doble canal, o un sólo origen en el ápice del saco peneal.

3. Las cercarias de esquistosomas no humanas que se encuentran en algunas especies de *Drepanotrema* pueden explicar las dermatitis producidas por contacto con ciertas aguas.

4. El *Helisoma duryi eudiscus* puede distinguirse, *grosso modo*, del *A. glabratus* por las características de la concha, entre las que destacan la concavidad lateral extremadamente profunda y la abertura principal muy sobresaliente.

5. El *Helisoma* se puede distinguir clara-

mente del *Australorbis* por medio de la disección del aparato sexual. Dos características principales tienen valor diagnóstico: el crecido desarrollo del órgano peneal bulboso, provisto de una glándula interna del pene, y un prominente conducto externo de esta última glándula; y la disposición en forma de abanico de los divertículos tanto de la glándula de la próstata como del ovotestis, vistos en sección transversal.

6. El *Helisoma* únicamente tiene importancia para el control de la esquistosomiasis en cuanto dificulta la identificación en el campo de las especies del género *Planorbis*.

7. Los caracteres diferenciales importantes del *A. glabratus* son la morfología general de la concha y el tener un órgano peneal sencillo.

8. Se puede hacer fácilmente un rápido diagnóstico taxonómico del *A. glabratus* separando partes del sistema reproductor hermafrodita y concentrando el estudio en la morfología del órgano peneal y de la glándula de la próstata.