

MOLLUSCS OF THE GENUS *ONCOMELANIA*, IN BRAZIL, AND THEIR POSSIBLE EPIDEMIOLOGICAL SIGNIFICANCE

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SUMMARY

Molluscs of the family *Hydrobiidae* (= *Amnicolidae*), very similar to those of the genus *Oncomelania* which transmit schistosomiasis japonica in Asia, were discovered by the A. in the State of Mato Grosso, Brazil, and considered by him a new species: *Oncomelania brasiliensis*. First description of shell and animal is done in this paper.

Their natural habitats were represented by brooks with plenty of vegetation, irrigation ditches and plantations of water-cress (*Nasturtium officinale*). Most of the snails were found submerged but a few could be seen on the wet margins of the breeding places.

The shell is very similar to that of *Oncomelania nosophora*, measuring about 5.5 millimeters in height and 2.2 millimeters in width, and showing six or seven round and smooth whorls, without axial ribs or a varix on the outer lip. This last character distinguishes this shell from that of the Eastern *Oncomelania*.

The dark animal, like the vectors of schistosomiasis japonica, bears the characteristic "false eyebrows" formed by coarse yellowish patches. Operculum and radula as in *Oncomelania*. Gills with 45-50 filaments.

The molluscs are very resistant to desiccation.

The A. was unable to detect any case of schistosomiasis japonica in the region investigated, but as this is settled mostly by Japanese immigrants, who are still coming from Japan, the above finding deserves the most careful attention and further study.

INTRODUCTION

In January 1958, we led a group of students of the Department of Parasitology in a trip to the State of Mato Grosso, for teaching and research purposes. While searching for planorbid snails in a variety of water collections during the trip, we found populations of the family *Hydrobiidae* (= *Amnicolidae*) morphologically resembling the genus *Oncomelania* which in East Asia is responsible for the transmission of *Schistosoma japonicum* (REY & col.¹³). We think they belong to a new species, *Oncomelania*

brasiliensis, whose first description is made here.

The counties then visited (Campo Grande, Terenos, Aquidauana, Miranda and Corumbá) are inhabited also by settlers that came from Japan and Okinawa during the last fifty years, and their descendants. Besides, more and more of these excellent agricultural workers are still migrating to the region.

It seems to us that these facts are more than enough to justify our concern over the possibility of *Schistosoma japonicum* establishing itself in this country in case any patients with the disease are brought into the area and the above mentioned *Hydro-*

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biidae snails prove to be potential vectors of the trematode.

We must remember that BERRY & RUE⁷ showed that *Pomatiopsis lapidaria* (a *Hydrobiidae* of wide distribution in the United States) is able to transmit schistosomiasis japonica under experimental conditions.

GEOGRAPHICAL AND ECOLOGICAL DATA

The places investigated are situated in Southern Mato Grosso, in counties crossed by the "Estrada de Ferro Noroeste do Brasil" (Northwestern Brazilian Railway).

Campo Grande county is located within the limits of the physiogeographic region called "Vertente Ocidental do Paraná" (Paraná's Western Slope) and the "Região da Encosta" (Slope Region) as well as the "Baixada do Paraguai" (Paraguai's Lowlands), on a plateau 500 meters high and slightly sloping down to the Paraná valley. Basaltic sills have formed spots of "terra rôxa" (red loams on basalt) which are very fertile and where agriculture is taking the place of cattle-breeding. The Plateau's limit is well marked on the West, forming a "cuesta" which encompasses the "pantanal" (swamps) of Mato Grosso, that is to say, the wide alluvial plain periodically flooded by the Paraguay river and its tributaries.

The "pantanal" is an area characterized by cattle-breeding. The counties of Aquidauana and Corumbá are here situated but the towns have been built respectively on the slopes (valley of the Aquidauana river) and on terraces near the Paraguay river.

The climate is hot with low humidity and prevailing summer rains. The flora is made up of two types of vegetation: the "cerrado" (thicket) on the plateau, and the so-called "complexo do pantanal" (swamp complex) on the plains.

The country population is thinly scattered. People concentrate in the towns or neighboring agricultural farms. Cattle-breeding is the main source of income, but in Campo Grande there is plenty of agriculture.

The *Hydrobiidae* snails were found in shadowy and swift brooks as well as irrigation ditches and growths of water-cress (*Nasturtium officinale*) (Fig. 13). As a

rule they were found side by side with molluscs of the genera *Ampullaria*, *Physa*, *Lymnaea* and *Australorbis*, the latter being represented by only one species — *A. nigricans*.

Most of the *Hydrobiidae* snails were found under water, moving almost imperceptibly on the mud or over algae, plants or decaying vegetable matter. Sometimes they were found under clay at the bottom of the habitat or moving along its banks if these were covered by a film of water.

When not buried in the mud the snails could be seen with relative facility, sometimes by the thousands on a small area, either dispersed or assembled in big colonies. Many of them could be caught at a time by scraping the mud, the roots of aquatic plants or other vegetation, with a fine-mesh sieve.

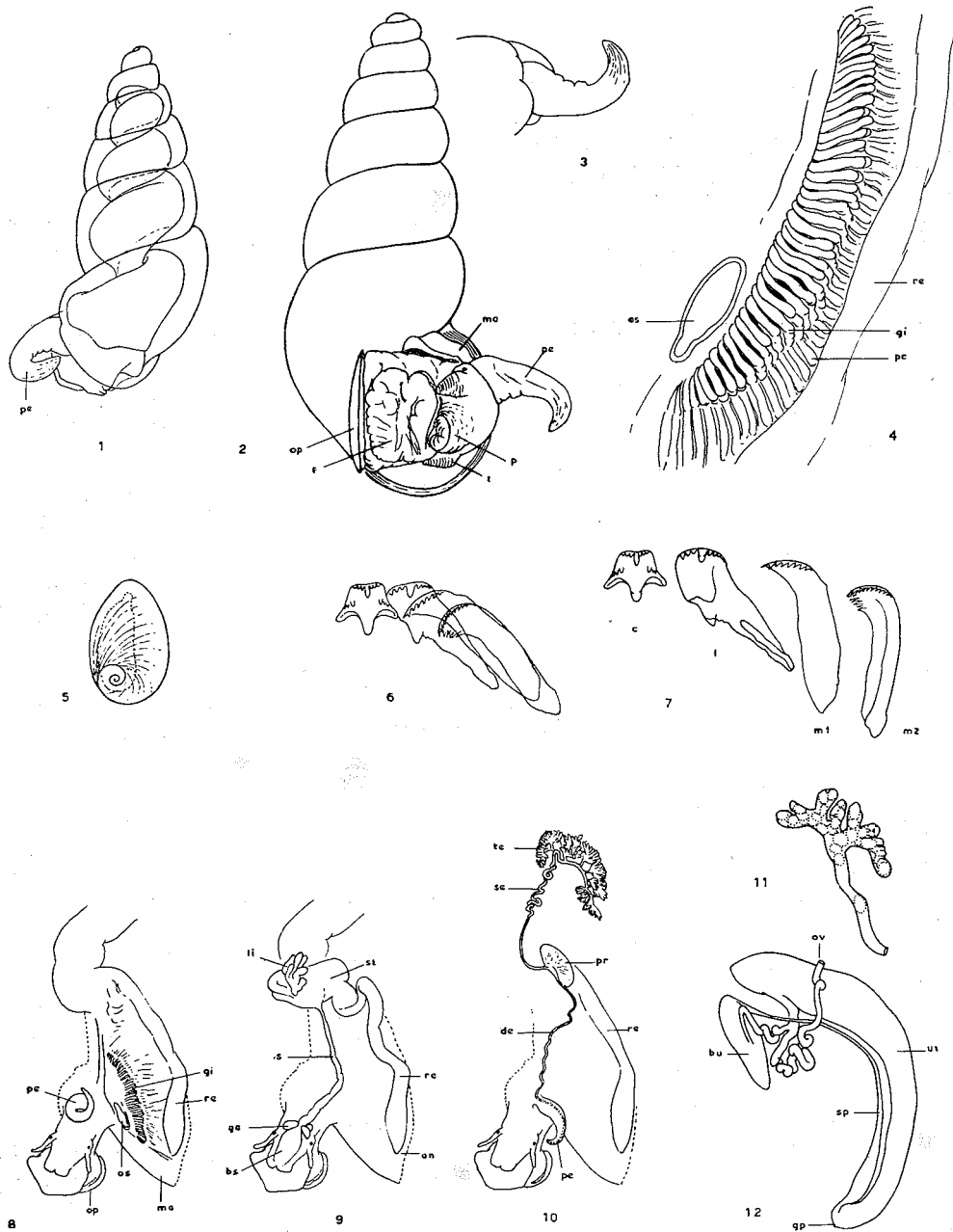
In Campo Grande, *Hydrobiidae* snails were caught in all streams investigated in the Paraguay basin (affluents to Ceroulas and Aquidauana rivers), whereas none was found in tributaries of the Pardo river, which belongs to the Paraná system.

OBSERVATIONS ON THE MOLLUSCS IN LABORATORY

When taken out of water the animals shrink into the shell and survive for two to three weeks or even more. When back in water they resume activity within a few minutes to half an hour. They grow well in aquaria having some soil on the bottom and plenty of vegetation, specially algae. A biologically balanced aquarium may be obtained if the soil covering the bottom of the container offers a sloping surface, so as to allow for the presence of something like a beach at one side, and deep water at the other side. This aquarium has to be kept under direct sunlight and the water that evaporates must be periodically replaced.

ONCOMELANIA BRASILIENSIS, new species

Shell — dextral, spiral, thin, slender, turreted, colored dark by a thin layer of mud-slime (reddish brown on specimens collected at Campo Grande) or yellowish and translucent (on laboratory reared animals) (Figs. 1 and 2).



Figs. 1 to 12: 1 — Young animal of *Oncomelania brasiliensis* reared in the laboratory, with transparent, five-whorls shell. 2 — Adult snail collected at Campo Grande (Mato Grosso); fixed in partially retracted position (as in fig. 1) but showing the verge. 3 — Verge or penis. 4 — Gills and osphradium. 5 — Operculum. 6/7 — Central, lateral and marginal teeth from the second row of a radula. 8 — Mantle cavity widely open to show the verge, osphradium, gills and rectum. 9 — Digestive system dissected. 10 — Male reproductive system. 11 — Ovary. 12 — Female reproductive organs from oviduct to genital pore.

an, anal opening; bs, buccal sac; bu, bursa or spermatheca; c, central or rachidian tooth; de, vas deferens; f, foot; ga, periesophageal ganglia; gi, gills; gp, female genital pore; l, lateral tooth; ll, liver (only first branches represented); m1, first marginal tooth; m2, second marginal tooth; ma, mantle border; op, operculum; os, osphradium; ov, oviduct; p, proboscis; pc, para-ctenidial folds; pe, penis or verge; pr, prostate; re, rectum; s, esophagus; se, seminal vesicle; sp, spermathecal duct; st, stomach; t, tentacle; te, testis; ut, uterus, pallial oviduct or mass membrane gland.



Fig. 13 — Irrigation ditches with growths of water-cress, near Campo Grande, Mato Grosso, where *Oncomelania brasiliensis* has been found.

Adult shells small; on field collected specimens they measured from 4 to 7 millimeters long (average 5.5 mm) and 2.2 mm wide, with 6 to 7 whorls, well rounded and smooth. Apex truncate in 55% of the specimens. Last whorl longer than the other ones in the spire. Aperture obliquely ovate. Lip simple or slightly thickened and reflected, but always without a varix.

Operculum thin, horny, translucent, paucispiral, with very excentric nucleus (Fig. 5). When the animal is disturbed this is withdrawn into the shell.

Animal — dioecius, males being recognized by the external copulatory organ (penis) which is attached to the dorsal side of the neck, on the midline, and held in a coiled position, hidden by the mantle (Figs. 1, 2, 3 and 8).

General color dark grey, almost black, but sometimes lighter. Two slender tentacles with a color-streak or "eyebrow" made of bright yellow, closely packed, coarse granules imbedded in the skin just above the eyes.

The small black eyes are buried at the swollen base of the tentacles on the external side.

Head small, prolonged by a distensible and almost cylindrical snout or proboscis, blunt and slightly bilobed in front, where the mouth is situated.

The foot is simple, longer than broad, truncate in front, where the fine mucus slit is located, and rounded behind.

Mantle edge smooth.

Internal anatomy — the mantle cavity contains the gills with 45-50 plate-like flesh folds which extend from a short distance above the mantle collar to the renal pore located at the posterior end of the mantle cavity. Gills composed of closely assembled lamellae starting at the left side of the mantle wall and changing after a short distance into low filaments (or para-ctenidial folds) that extend to the rectum (Figs. 4 and 8).

Paralleling the left anterior third of the gills is the osphradium.

The digestive system is represented in fig. 9.

Radula (Figs. 6 and 7) — There are about 80 rows of teeth with 5 elements each. The general shape of the teeth is as in figures of BARTSCH⁵ for *S. slattery* (= *O. nosophora*). The central tooth has denticle formula: 3—1—3

but with great variations so as:
 2—2
 2—1—2 2—1—2 3—1—3
 2—2 3—3 3—3

and some assymetrical combinations. Lateral tooth has mostly 2—1—3 or 3—1—3 or 2—1—4 denticles; first marginal, 9; and second marginal about 10.

Male reproductive system (Fig. 10) — the verge is a simple, large and fleshy prong with a cylindrical extremity and the base rather flattened. As it keeps a curved position we can see two or three serrations on the inner, concave edge (Figs. 1, 2 and 3).

Inside the penis is the vas deferens running from the tip of the organ and always near the convex edge. After leaving the base of the verge it continues posteriorly in an almost parallel course with the esophagus and reaches the prostate gland which is kidney-shaped and adjacent to the right side of the rectum. The posterior part of the vas deferens is enlarged and convoluted (seminal vesicle), and communicates with a number of short and transparent ducts coming from the racemose testis. Digitiform and irregular diverticula, brown in color, constitute the male gonadial gland which extends through the last two whorls of the body, merged in the bulk of the digestive gland or "liver".

Female reproductive system — the ovary is light yellow and also lies embedded in the collumelar side of the "liver". It has only a few short branches (Fig. 11).

The oviduct becomes convoluted when it reaches the level of the kidney. Then it divides into two branches: one for the bursa (or spermatheca) and the other for the pallial oviduct (also called accessory gland, mass membrane gland, or uterus) (Fig. 12).

The bursa is a flattened, oval-elongated sac. From its posterior pole comes another duct — the spermathecal duct — which runs adnate to the pallial oviduct, the two fusing together near the anal end, a short distance from the mantle collar.

The pallial oviduct is a large, elongated mass which extends from the anterior region of the stomach (paralleling the rectum) down to the right side of the anus. There is a common opening for this organ and the spermathecal duct.

Type locality — Campo Grande (State of Mato Grosso), Brazil.

Locality records — Aquidauana and Corumbá, in the same State of Mato Grosso.

Type and topotypes — deposited in the collection of the Dep. of Zoology (Secretaria da Agricultura) under number 14,598; topotypes in the Dep. of Parasitology (Fac. Med. Univ. São Paulo).

DISCUSSION

As already published in a previous report (REY & col.¹⁴), the stools of about 2,000 residents in Campo Grande, Aquidauana, Terenos, Miranda and Corumbá counties, were examined and not a single infection by *Schistosoma japonicum* was found. A few cases of schistosomiasis mansonica were detected among patients coming from known endemic areas of other Brazilian States.

A previous survey performed by PELLON & TEIXEIRA¹², in 1953, among school children of the same region, yielded similar results.

By questioning physicians who, for a long time, have been engaged in clinical or laboratory practice in the area, we also failed to

get any information which might indicate the possible occurrence of *Schistosoma japonicum*.

Nevertheless, one infection by this trematode had been reported by BANDEIRA & PIRES³, in a Brazilian boy less than six years old, born and resident in Campo Grande. The diagnosis was made by fecal examination and the finding of the trematode's eggs. Because at the time (1940) no possible vector of the disease was known to exist in the region, and also due to insufficient documentation, the report met with general skepticism.

Having no further information about the above mentioned case, we are, anyway, much concerned over the possibility that the disease might find its way into this country, should the *Hydrobiidae* snails be potential hosts of the trematode, since asiatic immigration from endemic areas to Brazil still continues. Japanese immigrants already numbered 140,693 in 1940, according to official data¹⁰, and this figure has been steadily increasing over the years. Immigrants from China and Korea have also been recently admitted.

Anatomically *O. brasiliensis* is quite similar to the oriental species of *Oncomelania*, as described and figured by different authors (ABBOTT^{1,2}, BARTSCH^{4,5}, HSU⁹, ITAGAKI¹¹). The main morphological difference lies in the absence of a varix just behind the edge of the outer lip of the shell aperture.

This character does not seem a very reliable one for generic determination because, although *O. nosophora*, *O. hupensis* and *O. formosana* show a strong varix, the same thickening is "only slightly developed" in *O. quadrasi* (ABBOTT¹); in *O. nosophora* it may be either greatly or slightly thickened, and in *O. hupensis* only adults develop a strong varix². On the other hand, in *Blanfordia*, "the varix on the outside of the lip is very similar to that found in *Oncomelania*"².

Our *O. brasiliensis* can be readily distinguished from *Pomatiopsis*^{6,8} by the radula, by the shape and number of gill filaments and by the almost exclusive aquatic habits of the Brazilian species.

RESUMO

Moluscos do gênero Oncomelania, no Brasil, e sua possível importância epidemiológica

Moluscos da família *Hydrobiidae* (= *Ammnicolidae*), morfológicamente muito semelhantes aos do gênero *Oncomelania*, transmissores da esquistossomose japonesa na Ásia Oriental, foram descobertos pelo Autor no Estado de Mato Grosso, Brasil, e considerados como nova espécie: *Oncomelania brasiliensis*. Uma primeira descrição da concha e do animal é dada neste trabalho.

Eles são encontrados em pequenos cursos d'água com muita vegetação, em valas de irrigação e em plantações de agrião (*Nasturtium officinale*). Permanecem quase sempre submersos, encontrando-se poucos sobre as margens úmidas.

A concha, semelhante à de *Oncomelania nosophora*, mede em torno de 5,5 milímetros de altura por 2,2 de largura, com 6 a 7 giros, sem esculturas axiais e sem espessamento varicoso do lábio, no que se distingue das espécies do Oriente.

O animal mostra semelhanças mais acusadas, trazendo as "falsas sobranceiras", constituídas de manchas amarelas grosseiras sobre os olhos, tegumento escuro, opérculo e rádula como em *Oncomelania*. Filamentos branquiais em número de 45 a 50.

Apresentam grande resistência à dissecação e se criam facilmente no laboratório.

Ainda que nenhum caso de esquistossomose japonesa tenha sido encontrado pelo Autor, no inquérito coprológico efetuado na região, deve-se ressaltar a importância de estudos mais aprofundados, em virtude de ocuparem os moluscos extensas áreas de colonização japonesa.

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