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STUDIES ON THE NONMARINE MOLLUSCA OF YUCATÁN

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AMONG the malacological studies of the fauna of Yucatán, those of Bequaert and Clench (1931, 1933, 1936, 1938) are particularly prominent, for they furnish references to most of the nonmarine mollusks of the area, with critical analyses and many new records. Since their papers appeared the several contributions by H. B. Baker (1940, 1941, 1945) and a list of shells reported from Chichen Itzá by Richards (1937) seem to be the only studies dealing directly with the region. The reports of Goodrich and van der Schalie (1937) and van der Schalie (1940) on Guatemala are useful for faunal comparison.

Through the generosity of Dr. J. Harvey Roberts, Mr. George Lowery, Jr., and other members of the Zoology Department of Louisiana State University, I was able to spend a week in Yucatán in April, 1948. This expedition was made primarily to study the spring migration of birds, and the collection of mollusks discussed in this paper was assembled while I was not engaged in other tasks. For much encouragement and constructive help in studying the collections I wish to express my gratitude to Dr. H. van der Schalie.

The Museum of Zoology of the University of Michigan is especially favored in having a great many mollusks from the

Caribbean area. Besides many miscellaneous lots, it has collections by H. B. Baker (1923, 1924, 1928, 1930) from Mexico, Venezuela, and the West Indies; by van der Schalie from Guatemala (Goodrich and van der Schalie, 1937) and Puerto Rico (van der Schalie, 1948) ; and the Creaser and Pearse collection from Yucatán, which was determined and reported on by Bequaert and Clench (1936).

HABITATS AND LOCALITIES

The geology (Bequaert, Richards, Lundell), botany (Bequaert, Lundell), meteorology (Page), sociology (Shattuck), and other aspects of the Yucatán Peninsula have recently received much attention, particularly by the authors cited. Extensive bibliographies may be found in their works. The account of the flora by Lundell (1938) is especially commendable, for it gives an understanding of the terrestrial habitats of Yucatán. Pearse (1940) presented a detailed compilation of the nonmarine fauna of Yucatán, and although his list of mollusks is compiled from the works of Bequaert and Clench several original plates of shells are included. I have not had access to the complete *Encyclopaedia yucatanense.*

Despite the apparent monotony of the region on preliminary observation, my own experience and the published records show that there are more habitat niches than some writers imply. Doubtless my collection did not encompass all of them, but it is significant that of the twelve nonmarine stations visited, all chosen at random and with little previous knowledge of the region, seven distinct habitat types were represented. In spite of limited observations I tentatively propose the following classification.

Natural Areas

Lundell and others have emphasized the fact that none of the "natural" vegetation of Yucatán can rightly be called natural, for a large human population has cultivated the region intensively for the past thousand years, and frequent fires have reduced almost the entire state to an area of secondary growth.

The term "natural area" is used here as H. B. Baker (1928: 4) used "natural forest" in his Mexican studies. Although he emphasized that "in a country where agricultural development is as ancient as that of Mexico, primeval forests are probably absent," yet he considered the term "natural forest" one which "may be loosely applied to those forests in which the leaf humus as well as the trees themselves show no obvious signs of recent disturbance."

CIÉNAGA: A TYPICAL SALT MARSH HABITAT.—Stations 1 and 2.

Station 1. Along the edge of the road from Progreso to Mérida, in the center of the salt marsh just south of the coastal town. Mangroves predominate, with some submerged vegetation. The water here is shallow (to about two feet) and exposed to direct sunlight. There is evidently very little if any tidal action. Large quantities of small fish were seen. On the artificial road embankment, which is short but well sloped, glassworts (*Salicornia*) and grass (*Distichlis*) predominate; numerous calcareous stones (placed there by human agency) provide some shelter for mollusks and arthropods. All of the mollusks collected were at the edge of the water, and members of *Cerithidea* were particularly plentiful. Human influence seems to have extended the transitional zone (Station 3) by inducing a change in the water table when building the highway.

Station 2. West of Progreso, about one-half mile. A small arm of the salt marsh leading directly toward the sea, but failing to establish a surface drainage connection because of sand dunes. Though somewhat dryer, it is comparable to Station 1, containing mangroves and members of *Distichlis* and *Salicornia.* Many of the *Cerithidea* were living in an area of several square feet just at the water's edge.

TRANSITION ZONE: SALT MARSH TO NONMARINE HABITAT.—Station 3; the transition zone on the north side of the *ciénaga* is not closely comparable, since the terrestrial habitat is of loose sand, and there is a notable absence of fresh-water species in the biota.

Station 3. Situated a few hundred yards south of Station 1, along the road embankment. There is less surface water than in the *ciénaga.* Wherever temporary pools occur, they are filled with cattails (*Typha*). Marsh elder replaces mangrove in the dryer situations. The road embankment is carpeted with a grass (*Distichlis*), although composites are more common in the higher parts. A heavy dodder with thick green stems is common. The molluscan fauna, at least, is distinctive. This was the only natural fresh-water habitat in which I collected. Ants, other insects, and terrestrial arthropods are common under the loose stones and wayside debris.

SAND DUNE COASTAL RIDGE.—Station 4.

Station 4. A terrestrial situation on the sandy ridge between the western edge of Progreso and Station 2. The sandy calcareous substrate contained no stones, and leaves covered the ground under the shrubs. Rubbish furnished some covering for terrestrial invertebrates. The water level is at a considerably greater depth than at Stations 1 and 2, which may be considered at zero water table.

LIMESTONE FLATS AREA.—Station 5.

Station 5. Near the road to Mérida, about eight miles south of Progreso. This situation is probably only a few miles north of H. B. Baker's (1928) "station 61," since we had not yet reached the first henequen plantations nor San Ignacio. Although Baker's subsequent designations (1928: 46; 1941: 60) of his Station 61 are sometimes given as "Progreso," it is likely that he means San Ignacio, since he originally designated that locality as his Station 61 (1928: 24) and described it as "semidesert about 10 kilometers south of Progreso." As indicated by Lundell (1938), this region is characterized by a greater number of cacti than the region farther south. The substrate is of fossiliferous limestone with occasional loose stones, and the first ten miles south of the marsh-terrestrial transition zone (Station 3) is almost without soil. As Bequaert (1933) indicated, the soil is a dark red residuum of weathered limestone with accumulated organic remains. The terrain is very flat in contrast to the rolling topography of the region south of Mérida. Mollusks were mostly under loose stones, where the crevices were filled to varying degrees with small amounts of soil and leaves. An increase in the number of living (aestivating) snails was noted in the deeper recesses of loose rocks in which the temperature was lower and greater amounts of moisture were evident.

INLAND AREAS IN THE REGION OF CHICHEN ITZÁ.—Stations 6, 7, and 8.

Station 6. Eight miles northwest of Chichen Itzá, near the road to Mérida. Although the substrate is very similar to that of Station 5, the region is marked by more relief, consisting of rounded hills and basins (karst topography) but lacking a surface drainage pattern. The vegetation attains larger growth with some trees reaching a height of about thirty feet. These characteristics are evidence of a greater rainfall than that at Station 5, and this is confirmed by the climatological data presented by Page.

Station 7. Several miles east of Station 6, in a wooded area near the road to Mérida, in which conditions are similar to those of Station 6.

Station 8. Between the hacienda at Chichen Itzá and the First Era ruins. The terrain is much like that of Station 6, but there are occasional cleared areas for growing corn (milpas). When I collected, the morning was foggy and the ground moist, with moisture dripping from the trees. Page noted that fogs are very common in the interior, a condition which may well be significant to snail life.

Artificial Areas

This includes areas in which the present biota has been much influenced by human endeavor. Some molluscan species have been introduced by that agency.

HABITATS WITH HIGHER MOISTURE CONTENT THAN SURROUNDING "NATURAL AREAS."—Stations 9, 10, and 11.

Station 9. The gardens at Mayaland Lodge, Chichen Itzá.

This cultivated area is well watered and contains well-kept gardens, tropical flowers, and large shrubs and trees. Some trees were said to have been brought to this place when already large plants. This region, resembling in some respects a natural area of the humid tropics, contains a large percentage of the native Yucatán snails (mostly near the garden's edge) as well as exogenous species.

Station 10. The orchard of a hacienda about three miles north of Mérida is situated in the flat limestone regions. It is well watered and contains palms, bananas, and citrus and other cultivated trees. Aquatic snails were found beside the irrigation cistern—a low open concrete tank. They had evidently been removed when the tank was recently cleaned, for none were seen in the tank at the time of my visit.

Station 11. A well-watered site in the small patio in front of the museum across from the cathedral in Mérida, among unkept grass-filled flowerbeds surrounding a few palms.

HABITAT WITH SAME MOISTURE CONTENT AS SURROUNDING "NATURAL AREAS."

Station 12. A railroad slope, five miles north of Mérida. Here collecting was selective; the ground was littered with dead shells, many charred by the frequent fires made to keep vegetation to a minimum. Other species than those reported were also present. The surrounding fields were almost entirely used for henequen plantations, which in this system of classification fit into this ecological type.

Table I contains the faunal assemblages found in these habitat types. Although the number of specimens of each species collected at the different stations is given, the figures indicate little more than the number of specimens on which this study is based since collecting was selective. Occasionally, only empty shells were found. The relative abundance of living material is indicated in the table. Of the minute forms, only specimens of *Gastrocopta* were seen in the field; the others were recovered in the laboratory, where they were observed in concealment within larger shells from certain stations.

TABLE I

SPECIES AND STATION CORRELATION

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12
Anomalocardia cuneimeris	2*	1										
Cerithidea costata	25*	75*										
Pomatopyrgus coronatus	9	6	2									
Polymesoda salmacida		2										
Melampus coffea		4‡										
Truncatella bilabiata		1	1									
Tropicorbis obstructus			22							18		
Aplexa spiculata			6							21		
Polygyra cereolus carpenteriana			37*	17*								
Succinea sp.			2†		4							
Gastrocopta pellucida pellucida				1	2			4				
Helicina arenicola				2	5	10†		3				
Bulimulus ignavus				18	20‡							
Drymaeus serperastrum				4	4	1	2*	1	5*			
Streptostyla meridana					9	7	7	6				
Streptostyla ventricosula					5		8	6	1			
Aperostoma dysoni berendti					2	45	14‡	19‡	7			
Choanopoma largillierti					107‡	56‡	9‡	43	29‡			
Choanopoma gaigei						6	1	6				
Euglandina cylindracea					7	7‡	3*	19‡	3			
Euglandina sp.								1				
Orthalicus princeps						3	1	7	3			
Averellia coactiliata						5		4†	4			
Caecilioides consobrina prima						1						
Brachypodella speluncae						7						
Thysanophora caecoides								1				
Drymaeus dominicus								2				
Microceramus concisus					32	6‡		14‡	5			3
Lamellaxis micra					2			4	1			4
Bulimulus unicolor								7	5	1		
Lamellaxis martensi									1			
Guppya sp.									1			
Praticolella griseola				4						1	9†	23
Subulina octona									22*	1	3	

* All or most found alive. † One found alive. ‡ A few found alive.

SYSTEMATIC ACCOUNT OF SPECIES

GASTROPODA, POLYGYRIDAE

Polygyra cereolus carpenteriana (Bland) 1860

Specimens of this supralittoral species agree well with the description and figures given by Pilsbry (1940) and with numerous shells from many localities in Florida. The internal lamella is of opaque, white material, and usually sufficiently prominent to be visible through the body whorl of freshly cleaned shells which were taken alive. This lamella occurs from one-half to three-fourths of a whorl within the aperture, at about the place where the subcarinate periphery is transformed into the rounded ultimate portion of the body whorl. While it is possible that this species has been introduced into Yucatán, as suggested by Bequaert and Clench (1936), it seems more likely, as Pilsbry (1940) has noted, that it is native to that region. There is no evidence that it has been imported, nor does it fit the distribution pattern of most "tourist" snails.

Praticolella griseola (Pfeiffer) 1841

This species was only taken in habitats considerably altered by human occupation. I am inclined to agree with Bequaert and Clench (1936) that it is an imported species. The specimens from Station 4 were collected at the very edge of Progreso, but the species was not taken in the more natural areas of the coastal ridge.

A comparison of the Yucatán material with several extensive lots of this species from Guatemala (Goodrich and van der Schalie, 1937) shows that each region has a homogeneous population (as known at present), each representing an incipient race. If the variation in members of the *P. griseola–P. berlandieriana* complex from other regions was unknown, it would seem advisable to distinguish the Yucatán and Guatemalan forms as separate species. But both assemblages are *P. griseola,* as Pilsbry (1940) defined the concept of this species, for they lack the heavily thickened, somewhat more rectangular lip of *P. berlandieriana.* Although the use of such a character is inadvisable for the separation of species, a review of a considerable number of specimens of this complex from many parts of the range shows that these two can be separated by this character in nearly every case.

Shell variation between the Guatemalan and Yucatán specimens involves size, shape, and color pattern. With the possible exception of one lot of three shells designated merely as from "Guatemala," all material from that republic was collected in an area circumscribed by a circle of about twelve miles in radius. The center of this range is about three hundred miles directly south of a circle twelve miles in radius, which surrounds the area of the Yucatán material I obtained.

Intergrades may occur between these two incipient races in the region between their known ranges; also, from the nature of variation in this species complex, as well as the possibility that one or both races may have been imported from other regions, we may reasonably expect intergrades elsewhere. Goodrich and van der Schalie note that their Guatemalan material was found only in grassy "savannas" much used for grazing and frequently burnt over by cattlemen. This habitat is apparently at contrast with the conditions of occurrence of this species in Yucatán. The limited area from which we have precisely reported findings of this snail in Guatemala and the fact that its habitat is much influenced by human agency at least suggest that it is not indigenous there.

On casual observation the two races seem to be about the same size, though the Guatemalan material has a more elevated spire. Measurements given in Table II reveal that the altitude has about the same range, but the maximum diameter is slightly but consistently larger in the Yucatán material, so that there is a significant difference in the altitude/diameter ratio in the two groups.

Some minor characteristics of the shell in the two races are as follows: the protoconch is smooth in both; a thin cuticle is present in all fresh material, but is strongly deciduous, so that it is frequently absent in old specimens; the sutural part of the lip is prominently reflexed in the Guatemalan race, and

TABLE II

Comparative Measurements of *Praticolella griseola* from Guatemala and Yucatán

All Guatemalan localities except the last one are from the Department of Petén. Only shells with mature apertures were measured. Measurements are in millimeters. The first number in each column represents the average; the numbers in parenthesis represent the extremes. Throughout this paper all whorl counts signify the number of revolutions of the suture line. This measurement is easier to take and admits less subjective error than counting the revolutions of the primary cone of the shell. The whorls of a shell, in the conventional sense, can be obtained by adding one-half to the total number of suture whorls.

Locality	Altitude	Maximum Diameter	Height/Diameter Ratio	(Suture) Whorls	Specimens
Guatemala:					
Two miles north of Lake Eckibex	7.0 (5.9–7.6)	9.3 (8.5–10.3)	1.32 (1.23–1.47)	4 (3½–4½)	26
South shore of Lake Eckibex	6.7 (6.0–7.6)	9.0 (8.7– 9.7)	1.34 (1.22–1.45)	4 (3¾–4¼)	7
Top and south side of Taysal ruins	7.1 (6.4–7.7)	9.7 (8.8–10.5)	1.36 (1.26–1.43)	4 (3¾–4½)	14
Taysal ruins north of Flores	6.9 (6.3–8.0)	9.2 (8.4–10.5)	1.33 (1.30–1.39)	4 (3¾–4¼)	6
South shore Lake Petén at Flores	7.1 (6.5–7.9)	9.3 (7.9–10.5)	1.27 (1.18–1.37)	3¾ (3¾–4½)	36
"Guatemala"	7.2 (6.8–7.5)	9.5 (9.2– 9.7)	1.31 (1.22–1.41)	4 (3¾–4¼)	3
Yucatán:					
Station 11	7.0 (6.6–7.5)	10.6 (10.1–11.3)	1.49 (1.46–1.53)	3¾ (3¾–4)	4
Station 12	6.7 (5.9–7.5)	10.4 (10.0–11.5)	1.57 (1.50–1.74)	3¾ (3½–4¼)	15
Station 10	7.3	11.3	1.54	4	1
Station 4	8.2 (7.7–8.8)	11.8 (11.7–11.9)	1.43 (1.32–1.54)	4 (4 –4½)	2

only slightly or not at all reflexed in shells from Yucatán; no parietal tooth was present in any shell; and spiral incised lines were lacking in both races.

Though the shells of both the Yucatán and Guatemalan races vary somewhat in color pattern, each race is distinct from the other in this respect. Details of shell coloration in these and other members of the genus *Praticolella* will be published shortly.

FRUTICICOLIDAE

Averellia coactiliata (Deshayes) 1839

The single live specimen died and deteriorated before the external features could be examined, but a few notes on locomotion were obtained. Sole of foot long and narrow, pedal waves about eight to ten, extending across entire sole, moving forward. Usual movement with entire sole adnate to the substrate; once, however, when suddenly placed in a very strong light, the specimen was seen to execute the "loping" movement described for *Helminthoglypta dupetithouarsi* and *Helix aspersa* by Parker (1911) and others. This occurred while the snail was moving downward on a vertical surface and then on a horizontal surface. There were three or four contacts of the foot with the intervening parts of the sole prominently arched above the substratum; each part of the foot traversed each arch in turn while the head continued to establish new arches. The snail seemed to be moving faster than usual; I could not determine whether the usual pedal waves were present.

SAGDIDAE

Thysanophora caecoides (Tate) 1870

BULIMULIDAE

Orthalicus princeps (Sowerby) 1833

No specimens were found alive. Arboreal habits were suggested by the presence of shells singly on top of the ground cover rather than under leaves and stones, where most of the other species were found.

Drymaeus dominicus (Reeve) 1850

The larger of two dead shells measures 13.0 mm. in altitude, 7.3 in maximum diameter, and 6.9 in aperture altitude, and has 4½ (suture) whorls. Both shells are evidently submature. Other than size the characters agree well with the description of Yucatán material given by Pilsbry (1899). In this species the embryonic sculpturing is continued, though more vaguely, over several postnepionic whorls.

Drymaeus serperastrum (Say) 1830

At Station 9 one immature specimen with a typical shell and one mature specimen with a completely white shell were found alive. The white shell measures 29.5 mm. in altitude and 13.5 in greater diameter, and has 5½ (suture) whorls, agreeing closely in size with the normal colored shells. The living animals of the banded shells and of the white one did not differ in external features; in both, the extended animal is uniformly dull white; the sole lacks transverse or longitudinal divisions and is broad compared to length as in *Helix* and *Achatina*. Five or six forward-moving pedal waves extending to the extreme margin are on the foot at one time. At times (as when the snail is crawling over a curved glass surface) the lateral margin may be completely raised from the substratum.

There is no caudal pore and no median-dorsal caudal groove; two closely spaced median-dorsal grooves are present anteriorally, with a mesolateral groove on either side which passes from the lower tentacles to the body stalk; a suprapedal groove is evident, though the pedal groove, if present, is not prominent.

Bulimulus ignavus (Reeve) 1848

Bulimus ignavus Reeve 1848, *Conch. Icon.*, Pl. 77, Fig. 562.

Bulimus Dysoni (variety B) Pfeiffer 1853, *Monographia heliceorum viventium,* 3: 438.

Bulimulus dysoni var. B Fischer and Crosse 1875, *Mission scientifique au Mexique,* Moll., 1: 551.

Bulimulus dysoni var. *ignavus* von Martens 1893, *Biologia Centrali-Americana,* p. 240, 250.

Bulimulus dysoni var. *ignavus* Pilsbry 1897, *Manual of Conchology,* Ser. 2, Vol. 2: 57, Pl. 10, Fig. 86.

Pfeiffer placed Reeve's *B. ignavus* in the synonymy of his own *B. dysoni.* This arrangement has been followed by all subsequent students, usually without additional remarks. The figure given by Pilsbry was apparently copied from Reeve. Bequaert and Clench (1933), following Pilsbry's account, do not consider *B. dysoni* (or the 'subspecies' *B. ignavus*) as belonging to the fauna of Yucatán.

In the field I mistook this species for *B. unicolor,* and consequently did not watch for it carefully. A more thorough examination of the material indicates that there are salient differences in shell form, and it may be significant that the two species were not taken in the same habitats.

Reeve's figure agrees with the specimens before me in general shell proportions and in the number of whorls counted in profile, but beyond that neither his figure nor description are of much use. Until the type specimen of *B. ignavus* is examined, it seems unwise to designate a new species. Von Martens (1893) gave larger shell proportions than those I observed among my specimens (Table III).

TABLE III

MEASUREMENTS OF *Bulimulus ignavus*

Height	Maximum Diameter	(Suture) Whorls
12.5 mm	6.0	$5\frac{1}{4}$
11.5	6.0	5
9.5	4.5	$4\frac{3}{4}$
7.0	4.0	$4\frac{1}{4}$
7.0	4.5	$4\frac{3}{8}$

The specimens measured are from Station 4. The shell is dextral, small, thin, high-spired, uniformly colored a light brown (in fresh shells); the shell material is uniformly translucent, with no opaque, white shell substance as in *B. dealbatus* and its allies. A thin light-brown cuticle is present in fresh shells, as in *B. unicolor* and many other Central American species. Aperture height somewhat less than half the height of the shell; whorls of spire moderately convex (less so than in *B. unicolor*) ; suture linear, simple, prominent, not puckered by growth striae; it is narrowly margined by attachment; there is no angulation of the periphery at any stage of growth.

Aperture edentate, elongate; outer lip simple, sharp, and in one plane, which is at an angle of somewhat less than 30 degrees in advance of the columellar axis; outer lip not reflected at any stage of growth, nor reinforced within by a callus. Columellar lip reflected over the deep but small

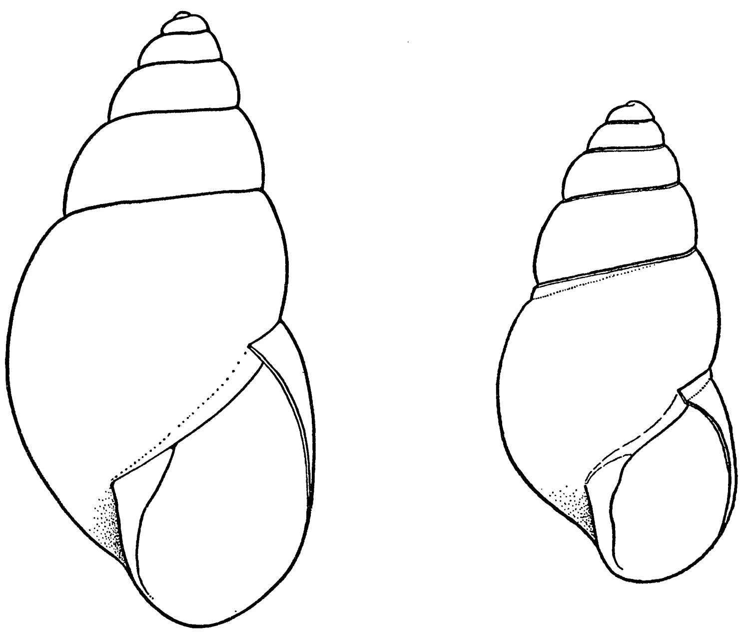

FIG. 1. Left: *Bulimulus unicolor,* Station 10; right: *Bulimulus ignavus,* Station 4.

umbilicus, concealing but not closing it. Reflexed part of the columellar lip broadest above, tapering to a point at the junction with the basal lip. The upper margin of the columellar lip joins the parietal wall at a sharp angle. In mature shells there is a circumumbilical incised line which ends below at the junction of the basal and columellar part of the aperture, but this character is often only vaguely developed. In shells of four whorls or more there is a subsutural linear indentation which produces a conspicuous angle in the upper part of the outer lip. This subsutural groove increases in distance from the suture as the shell increases in size.

Protoconch of one (suture) whorl, the initial part of the suture deeply indented, and somewhat wider apically than later. Uniform sculpturing of numerous short, obliquely directed, ill-defined rugae, which are symmetrically placed so that the rows are uniformly spaced in both transverse-oblique directions, as well as spirally. The pattern becomes fainter toward the last part of the protoconch and does not extend onto the postembryonic shell. Later whorls uniformly sculptured; they are smooth with only ill-defined growth lines of irregular size and spacing and no trace of spiral sculpturing (Fig. 1).

Richards (1937) compared his *Bulimulus sanmiguelensis* from Cozumel with *B. unicolor*. It probably should be distinguished from the species described above on the basis of its larger size and greater number of whorls, if for no other characters. I have not, however, seen specimens of *B. sanmiguelensis*.

An immature specimen from Station 5 was kept alive in the laboratory for eight months, during which time it reached maturity and developed the subsutural groove on the shell. The surface reticulation of the living animal is like that of *Drymaeus serperastrum*. Foot long and broad, tapering to an acute point behind; no longitudinal or transverse grooves. Pedal waves eight to ten, moving forward, with the waves extending to the margin. Entire exposed tegument straw-colored, including the sole of the foot, though a narrow margin of the foot is slightly darker than the general surface. Both pairs of tentacles appear light gray from the pigmented capsules which they contain.

Bulimulus unicolor (Sowerby) 1833

Although the material for measurements is limited, the body proportions vary considerably (Table IV).

The circumumbilical, linear indentation is plainly visible in a few, but not all, specimens, and the base of the shell is roundly angular, even to the base of the aperture; this provides an almost flattened area facing the umbilical cavity. Alternate stripes of lighter and darker brown (not present in

TABLE IV
MEASUREMENTS OF *Bulimulus unicolor*

Height	Maximum Diameter	Altitude/ Diameter Ratio	(Suture) Whorls	Station
15.0 mm.	8.0	1.78	5¼	10
7.5	5.0	1.50	3¼	9
10.0	6.0	1.66	4¼	9
12.0	6.0	2.00	4½	9
6.5	4.5	1.44	3¼	8
10.5	6.5	1.61	4½	8
10.5	6.0	1.75	4½	8

some shells) may be a phenomenon of the cuticle and not alternations of translucent and opaque shell substances, as seen in *B. dealbatus* and its allies. Yucatán shells bear no trace of spiral indented lines, which are to be seen in shells of this species from Guatemala and elsewhere in Central America. In all other respects the Yucatán specimens agree with those from Guatemala. Specimens of *B. unicolor* are broader in proportion to height than are those of *B. ignavus;* they are larger in size as adults; immature shells frequently are obtusely angular at the periphery, a feature which I cannot detect in *B. ignavus.* There is never a subsutural linear indentation in *B. unicolor* (Fig. 1). Young shells of the two species may also be separated by height/diameter proportions.

UROCOPTIDAE

Brachypodella speluncae (Pfeiffer) 1852

The numerous fragments of this species at Station 6, and its apparently complete absence at other stations indicates a spotty distribution in Yucatán.

Microceramus concisus (Morelet) 1849

Not all of the specimens seen of this common species were collected. Several were taken alive at Station 6 (one mature, three immature). The aestivating animal is evidently capable of contracting its entire body two and a half to three whorls inside the shell, which indicates a very high attachment of the columellar muscle, a characteristic of the family.

No cuticle is evident, even at higher magnifications; the coloration of the shell is apparently due to the arrangement of light-brown, translucent and opaque, white shell material.

Though designating the Yucatán species of *Microceramus* as *M. concisus,* Bequaert and Clench (1933) noted: "We are inclined to regard *concisus* and *arctispirus* as plain synonyms of *M. gossei,* by which name the species should be known." Pilsbry (1904) has pointed out the close affinities, as characterized by shell morphology, of the group of *M. gossei:* size, coarseness of sculpture, number of whorls, conic-cylindric form. The various species which he designated are of rather distinct range, and some, if not all, are isolated from each other in their distribution. In comparing the material which I collected in Yucatán with the Jamaican *M. gossei,* I find that Pilsbry's (1904: 155) observations are essentially valid. This species differs from *M. gossei* of Jamaica in having narrower whorls, there being more whorls in shells of the same length; the sculpture is usually less coarse, the form of well-grown specimens is more cylindric, though small adults of both species may be conic. There is no evidence, however, as to whether this variation is merely environmental or whether it is brought about by distinct genetic constituents.

The shells collected by van der Schalie in Guatemala seem even larger than the Jamaican species, though none of them approach the size of *M. kieneri* (18 mm. long) reputedly found in Honduras. The sculpturing of the Guatemalan *M. concisus* is relatively coarse, comparing favorably with Jamaican specimens in this respect.

Four specimens of *Microceramus gossei arctispirus* (Ancey) of Utilla Island, Honduras, have been examined. This material is part of the original lot collected by C. T. Simpson. All four are badly bleached, weathered specimens, and only two have a mature aperture. A comparison of the measurements given in Table V will show that this subspecies is within the size range of *Microceramus bonariensis* (Smith) and its subspecies. H. B. Baker (1924) has given comparative measurements for these several forms. The measurements of other specimens of the original lot of *M. gossei arctispirus* are reported by Pilsbry (1904): "Length of types 7–8, diam. 3 mm., whorls 9½ to 10. Other specimens of the original lot measure 6 to 7.5 mm. long." He considered it a subspecies of *M. concisus,* which it may well prove to be. All the known specimens of the original (and only) lot of the form *arctispirus* are of small size, and in this respect they are comparable to the *M. bonariensis* group, to which they bear a strong superficial resemblance. They do, however, seem to differ from that species complex by having much stronger sculpturing as well as prominent sutural papillae. In both forms the spiral basal ridge is variously developed, very prominent or completely absent, with many intermediate conditions.

The Guatemalan species is as distinct from the Yucatán form as the Yucatán is from the Jamaican (typical) one. It is interesting that Pilsbry (1930*a*) later cited *M. concisus* from the Little Swan and St. Andres islands in the Caribbean, but without giving measurements or comment on sculpture and form.

ACHATINIDAE (after Pilsbry 1946)

Lamellaxis martensi (Pfeiffer) 1857

A single dead shell, submature and with slightly broken aperture, which compares favorably with the shells of this species from other Central American localities, was collected. Cited in the genus *Leptinaria* by Bequaert and Clench and others, it has more recently been referred to *Lamellaxis* by H. B. Baker (1940, 1945), on anatomical grounds.

Lamellaxis micra (D'Orbigny) 1835

This species was considered to belong to *Opeas* by Bequaert and Clench and previous authors. On the basis of its anatomy H. B. Baker (1945) has more recently placed it in the present genus.

TABLE V

COMPARATIVE MEASUREMENTS OF *Microceramus*

All measurements are in millimeters. The first number in each column represents the average; numbers in parenthesis represent the range.

Locality U.M.M.Z. Nos.	Altitude	Maximum Diameter	(Suture) Whorls	Specimens
Jamaica*				
141478	9.2 (7.9–10.5)	3.4 (2.9–4.6)	9½ (8¾–10)	5
141459	8.6 (7.2– 9.7)	3.4 (3.2–3.8)	9 (8¾– 9½)	3
33775	9.8 (9.6–10.0)	3.2 (3.2–3.3)	9¾ (9½–10)	3
141480	10.9 (10.0–11.7)	3.4 (3.3–3.6)	10 (9½–10½)	3
141479	9.5 (9.4– 9.6)	3.2 (3.0–3.3)	9½ (9½– 9¾)	2
Guatemala†				
64526	9.4 (8.2–10.7)	3.5 (3.0–4.5)	9½ (8¾–10½)	22
64529	11.4 (8.5–13.8)	3.9 (3.2–4.4)	10¾ (9½–12¼)	20
64530	12.3 (11 –12.9)	4.2 (3.7–4.8)	11 (10½–11¼)	4
64533	12.1 (11.2–12.9)	4.7 (4.7–4.8)	10¾ (10¼–11¼)	5
64528	10.9 (10.5–11.3)	3.6 (3.9–4.0)	10¼ (10 –10½)	2
64532	12.3	4.4	11	1
Yucatán‡				
Station 5	8.4 (6.7–11.6)	2.9 (2.5–3.4)	10¼ (8½–11½)	17
Station 8	9.1 (8.3– 9.8)	3.3 (3.0–3.5)	9½ (9¼–10)	8
141472	9.7 (9.2–10.3)	3.1 (3.0–3.3)	10½ (10 –11)	7
Station 6	8.3 (7.4– 9.3)	3.1 (3.0–3.3)	9½ (8¾–10)	3
Station 9	9.3 (7.6– 9.8)	3.3 (2.9–3.5)	9½ (8½–10½)	5
141473	11.5	3.5	10½	1
Station 12	8.5	3.0	9½	1
Utilla Island§	7.3 (7.1– 7.5)	2.9 (2.8–3.0)	9 (8¾– 9¼)	2

* *Microceramus gossei:* all lots lack exact locality data.

† *Microceramus concisus;* all lots are from the Department of Petén, and the exact localities are as follows: No. 64526, ruins of Taysal, north of Flores; No. 64528, knoll along Santa Anna Road, two kilometers south of Puebla Nueva; No. 64529, limestone knoll, east of road to Santa Anna, about one-quarter mile south of Flores; No. 64530, north shore of Lake Petén, west of San Andreas; No. 64532, Libertad Road, seven to nine miles southwest of San Benito; No. 64533, woodland, east of Paso Caballo.

‡ *Microceramus concisus;* No. 141472, Tunkas, Yucatán; No. 141473, Mérida, Yucatán.

§ *Microceramus gossei arctispirus,* part of the original lot.

Subulina octona (Bruguière) 1789

Caecilioides consobrina prima (de Folin) 1870

Caecilioides consobrina veracruzensis Crosse and Fischer, Goodrich and van der Schalie, 1937 (Guatemala).

A synonymy of this species was given by Dall (1926). Richards (1937) first discovered it in Yucatán at Chichen Itzá.

The empty shell which I found has 3¾ (suture) whorls, and is 1.7 mm. high by 0.6 mm. in maximum diameter. It agrees well with several hundred specimens collected by van der Schalie in Guatemala. Pilsbry (1909: 40) noted that in specimens from continental America, "the microscopical spiral striation is more distinctly developed than in *consobrina,* visible from the suture to the base, the striae appearing crimped or waved. There is no other difference" (see also Pilsbry, 1930*b:* 351). Though the question of subspecific distinctness of the continental material awaits further study, preliminary observations tend to confirm his opinion. There is considerable variation in the several hundred shells from Guatemala examined, both with respect to the form of the columella and the internal partitions of the spire. Immature specimens have a more truncate columella, as in *Achatina* or *Euglandina,* and as the shell matures, this character tends to become transformed into a columella with scarcely more than a notch at the juncture of the columellar and basal lip. The internal partitions of the spire seem to be absorbed to a varying degree. In most mature shells and some submature ones, there is only a narrow shelf bordering the suture internally. This recalls the condition in certain Ellobiidae, particularly *Pythia.* The phenomenon is evidently rare in the Stylommatophora. It is variable in the present species, and some shells from any large lot may not exhibit it, but have the normal, fully developed pattern of internal partitions. In a very few shells only, there was seen a distinct twisting of the internal partition edge, forming a pronounced angle at the columellar-parietal junction of the aperture.

No cuticle was to be seen in any specimens of these shells, at least at such magnification as is necessary to reveal the spiral lines. All fresh shells are translucent and colorless, but weathering renders the shells opaque and white. This condition was observed in a lot from Tampico, Mexico. In an occasional specimen from Guatemala, a well-formed epiphragm was noted. It was translucent and colorless. These "dried in" specimens contained the animal, but the heartbeat could not be detected. Attempts to revive specimens in a moist chamber proved futile, perhaps because of the age of the material (twelve years). A few specimens showed a single large egg in the spire. The eggshell is smooth, dull white, and opaque. It is slightly elongate-oval, as is the egg of *Euglandina rosea.*

OLEACINIDAE (Glandinidae of authors)

Streptostyla ventricosula (Morelet) 1849

Not collected alive.

Streptostyla meridana (Morelet) 1849

Not found alive. Bequaert and Clench (1933) were not able to recognize *S. yucatanensis* Pilsbry (1907) in their material, nor did they report it in their subsequent papers. They noted its close similarity to *S. ventricosula* as pointed out in Pilsbry's description. H. B. Baker (1941) recorded all three species at his Station 61, and listed them under different subgenera.

Euglandina cylindracea (Phillips) 1846

The external anatomy is typically that of the genus; it has been well described and figured by Strebel (1878) and others. H. B. Baker (1941) cited this species from "under rocks, Progreso, E, I, a, 6." It is probable that he intended this citation to read "under rocks, San Ignacio, E, I, a, 61." Material from Guatemala is identical with that of Yucatán; lots from both regions have the same range of variation in shell form.

A large fragment of another species of *Euglandina* was found at Station 8, but unfortunately it was too imperfect to identify to species.

ZONITIDAE

Guppya sp.

The single immature shell collected has only two (suture) whorls, but compares favorably with immature shells of the same size of *Guppya gundlachi* (Pfeiffer) 1840, a species of which van der Schalie obtained several hundred specimens in Guatemala. This genus has not previously been reported from Yucatán.

SUCCINEIDAE

Because of the small number of specimens collected, and the present confusion regarding the identity and classification of species in this family, it is advisable to withhold any definite designation of the material at hand. I am inclined to consider the species taken at Station 3 to be *S. luteola* Gould 1848, and the one taken at Station 5 to be *S. carmenensis* Fischer and Crosse 1878 (Fig. 2). None of them are *S. avara* Say.

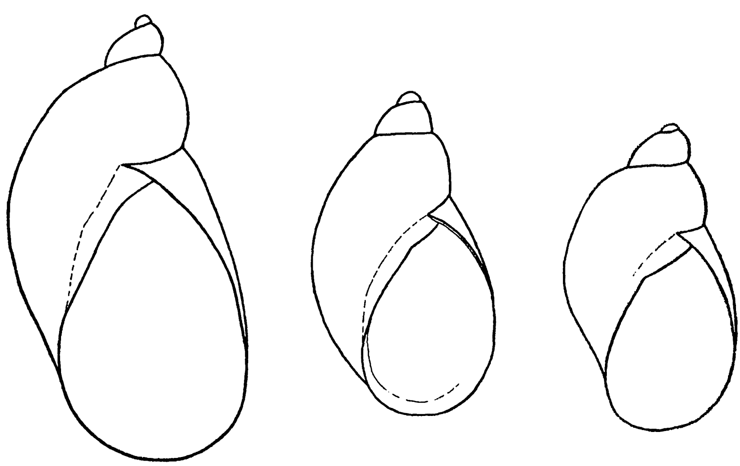

FIG. 2. *Succinea* sp. Left: Station 5; center and right: Station 3. Scale-line = 1 millimeter.

PUPILLIDAE

Gastrocopta pellucida pellucida (Pfeiffer) 1841

Gastrocopta pellucida (Pfeiffer), Pilsbry, 1916, *Manual of Conchology,* Ser. 2, Vol. 24: 75, Pl. 15, Figs. 1, 2, 5.

The shells from Station 8 are immature, and the shell from Station 4 is somewhat weathered and so is perhaps an unreliable record for this habitat. The three mature shells (Table VI) have a slight though distinct ridge behind the aperture. The sizes are small for *G. p. hordeacella* (Pilsbry).

TABLE VI

MEASUREMENTS OF *Gastrocopta pellucida pellucida*

Height	Maximum Diameter	(Suture) Whorls	Station
1.9 mm.	0.9	4	5
1.5	0.8	3½	5
1.9	0.8	4½	2

Although this species was cited by von Martens (1897) from Yucatán, Pilsbry (1916) considered that citation and many of the earlier Central American records to be dubious, because earlier authors did not distinguish it from *G. servilis* (Gould). Haas (1945) recorded a specimen of *G. pellucida* from presumably Pleistocene or prehistoric Holocene deposits in Copan, Honduras. He suggested that Guatemala and Yucatán may harbor an endemic population of this species. Specimens collected in Yucatán agree well with large lots of *G. p. pellucida* collected in Puerto Rico (van der Schalie, 1948). I could not distinguish *G. pellucida* in numerous lots of *G. servilis* collected in Guatemala. A small percentage of a lot of more than a hundred shells collected on the "banks of San Pedro River, at Paso Coballo, Department of Petén, Guatemala," however, had a very prominent ridge behind the aperture. They show no other discrepancy from *G. servilis* as described by Pilsbry (1916). In a lot of over a hundred specimens of *Gastrocopta pellucida hordeacella* (Pilsbry) from Presidio County, Texas, the preapertural ridge is variously developed, but absent only in rare instances. Size and form, rather than the preapertural ridge, are probably the best criterion for separating these snails.

PHYSIDAE

Aplexa spiculata (Morelet) 1849

The shells from Station 3 were taken in very moist earth at the bottom of a dried pool containing a thick growth of cattails. It is likely that *Aplexa,* when it has been reported from the *ciénaga* of Yucatán, was taken in this transitional zone, and not in the more saline parts of the *ciénaga.* The shells from

Station 10 seem to be typical of the species in form and size, but the lot from the *ciénaga* has a smaller form, a lower spire (but the same number of whorls), is slightly more bullate than the typical variety, and has the spiral incised lines more prominent. One might conclude that the two lots were merely ecological variations, but Bequaert and Clench (1936), who studied much more material, report that all three varieties of this species are present in the same locality in Yucatán, and this would suggest genotypic difference. In the many lots of Guatemalan *A. cisternina* (= *A. spiculata* according to Bequaert and Clench, 1936) reported by Goodrich and van der Schalie (1937), the shells average less than half the size of those from Yucatán, and the largest by no means approaches the maximum size of the latter. The Guatemalan shells are also more fragile than those from Yucatán. I doubt that the Guatemalan and Yucatán material is conspecific, though much more evidence would be necessary to resolve the question.

PLANORBIDAE

Tropicorbis obstructus (Morelet) 1849

The shells are from the same stations as are those of *Aplexa spiculata,* with which they were associated. Shells from Station 10 are larger than those from Station 3, as was the case in *Aplexa,* again perhaps suggesting a more favorable environment for these species at Station 10 than at Station 3. None of the shells of Station 10 has denticles, but seven of the twenty-two shells of Station 3 do have them. Both the dentate and edentate shells are of varying growth stages. Goodrich and van der Schalie noted the occurrence of both forms at ten different stations in Guatemala. The generic designation used here is that of F. C. Baker (1945).

ELLOBIIDAE (AURICULIDAE of authors)

Melampus coffea (Linnaeus) 1758

Four immature live specimens presumably of this species were clustered under a bit of coconut husk at the edge of the *ciénaga.*

CYCLOPHORIDAE

Aperostoma dysoni berendti (Pfeiffer) 1861

Poteria berendti (Pfeiffer), Bequaert and Clench, 1933, *et ff.*

The minute differences which have been used to separate this subspecies from the typical one are discussed by Bequaert and Clench (1933) and Bartsch and Morrison (1942). Careful scrutiny of the material collected in Yucatán and of several lots of *A. dysoni* from Guatemala (listed as *Poteria dysoni* by Goodrich and van der Schalie, 1937) seems to confirm the following distinction: the angle of the aperture in *A. d. berendti* is slightly separated from the penultimate whorl, whereas in *A. d. dysoni,* the parietal callus being somewhat thinner, the angle is completely adnate. However, this character is only recognizable when a snail approaches its maximum size; in submature shells, the callus and angle may be thick but adnate. Still earlier the parietal wall of the aperture is formed by the penultimate whorl with little or no added material. The number of whorls in mature shells (as here defined) is a variable character in the shells of any given lot. In both subspecies there is a dark brown cuticle of some prominence which becomes deciduous in weathered shells. The subcuticular shell substance is translucent in living shells, and reinforced within by a layer of lustrous, almost iridescent, opaque material. On weathering the whole shell quickly becomes opaque and white. Apparently, the olive-green spiral bands which led Pilsbry (1891) to distinguish a "var. *multilineatus*" among the Yucatán specimens are entirely limited to the cuticle, and not evident in the shell substance below it. Since there are linear spiral lines of a peculiar sort in the shell substance, a character best seen in weathered shells, it may on further examination show some correlation to the color pattern developed by the cuticle. About half the shells from Yucatán have the olive band but in varying width; such shells were present at all localities from which this subspecies was taken. None of the Guatemalan shells of *A. dysoni* has them. Elevation of the spire is variable in both subspecies and unsuited for separating the two.

Bartsch and Morrison (1942) have designated *Aperostoma dysoni sallei,* a new name for "variety *minor*" of von Martens (1890), as another form of *A. dysoni* from Yucatán. It differs from the other "races" by its smaller size. In his uncritical review of the American cyclophorids H. B. Baker (1923) suggested that von Martens may not have intended to honor small shells with a name. Bequaert and Clench apparently shared Baker's opinion, for they make no mention of von Marten's "var. *minor.*"

POMATIASIDAE

Choanopoma largillierti (Pfeiffer) 1846

The generic designation here accepted is that decided upon by Bequaert and Clench (1936), who commented extensively upon the citation of *Choanopoma* from Yucatán by H. B. Baker (1928). My specimens varied considerably in size, color, and sculpture, but all extremes were connected by intergrades. Apparently, larger snails are more finely sculptured, though this does not always hold. There is some tendency for the snails from a single locus to develop a uniform sculpture pattern.

Choanopoma gaigei Bequaert and Clench 1931

This species is evidently much less common than is *C. largillierti.* Probably the two species have slightly different though broadly overlapping ranges. Bequaert and Clench reported *C. gaigei* only from the vicinity of Chichen Itzá (that is from the interior). My collecting did not extend the records much toward the coast. Goodrich and van der Schalie (1937) reported *C. gaigei* from the northern region of the Department of Petén, Guatemala, though *C. largillierti* is unknown from that region.

In both species of *Choanopoma* which I collected, 10 to 25 per cent of all the shells have a peculiar hole, usually on the middle whorls of the spire, of a remarkably uniform character (Fig. 3). The hole is round, about 1 mm. in diameter, with the beveled margin sloping inward. It has a striking similarity to that produced in molluscan shells by several species of predaceous marine snails, and it is not comparable to the thin beveling over a large area which is seen in shells rasped by snails hungry for shell substance. I do not find this sort of beveling in any of the shells from the highly calcareous region of Yucatán. Von Martens (1903) discussed similar holes which have been reported in the literature in *Helix cincta* and *H. aspersa* of Europe and in species of *Buliminus* from Palestine; he regarded the beetle larva *Drilus* as possibly the borer responsible. The hole is too small for the larva to enter; it is used to stimulate the snail to extend, whereupon it is eaten. In shells from Yucatán there was never more than one hole to a

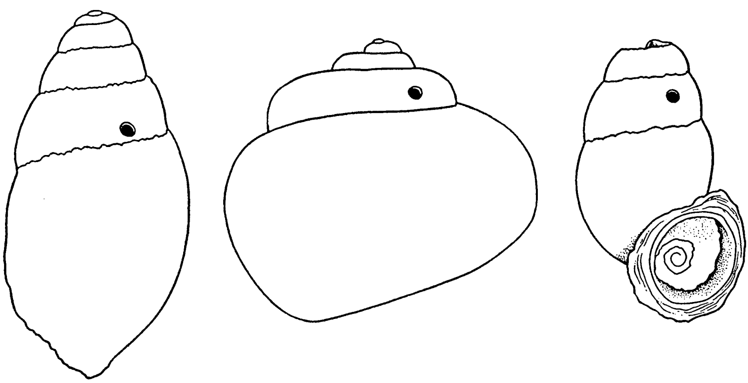

FIG. 3. The bored hole. Left: *Euglandina cylindracea,* Station 8; center: *Aperostoma dysoni berendti,* Station 7; right: *Choanopoma largillierti,* Station 6.

specimen, but in some instances from Europe von Martens reported a partly bored hole, evidently indicating unsuccessful attempts of the larva, farther down on the same shell in which a complete hole was present. It is difficult to understand how the operculum remains in place in many of the Yucatán specimens, if the beetle larva uses its bored hole merely to stimulate the snail. Subsequent search revealed a similar imperfection in the shells of *Aperostoma* both from Yucatán and Guatemala, in *Choanopoma radiosum* (Morelet) from Guatemala, in *Euglandina cylindrica,* and in one specimen of *Succinea* (from Station 5).

In both *C. largillierti* and *C. gaigei* all the whorls before the final body whorl are strongly angled at the periphery. During the formation of the final body whorl, however, the angulation becomes obliterated, and by the time of completion of the whorl, the curvature of the base and shoulder region is even and continuous. This criterion allows us to distinguish the stages of shell growth even if the expanded aperture is not yet formed. As to decollation, the process is only brought about during the later stages of shell growth. Both species build a partition callus in one of the whorls of the spire before the spire is broken off. In *C. gaigei* this callus is formed in the first or second (suture) whorl from the apex, whereas in *C. largillierti* it forms in the third. The higher position of the callus in *C. gaigei* results in a higher percentage of perfect apices, though even in such an example the presence of a callus may be recognized by the darker and more opaque character of the shell at the position of the callus, when the shell is viewed in strong transmitted light. The callus is obliquely placed, so that it extends over an area of about one-fourth whorl, although only the upper, terminal part is closed off. In my small series of *C. gaigei* no mature shell lacked the apical callus. Because the callus position may vary (slightly less than one whorl) in these species, and because decollation results in a jagged edge extending upward from the position of the callus, there is even a greater need for care in making exact measurements of these shells (that is, correlation between size and number of whorls) than in measuring nondecollating snails.

CERITHIIDAE

Cerithidea costata (da Costa) 1778

Specimens agree closely with Bequaert's (1942) description.

TRUNCATELLIDAE

Truncatella bilabiata Pfeiffer 1840

A mature specimen from Station 2 agrees well with the recent descriptions of Pilsbry (1948) and Clench and Turner (1948).

AMNICOLIDAE

Potamopyrgus coronatus (Pfeiffer) 1840

From previous accounts (von Martens, 1899; van der Schalie, 1948) and the present record it is clear that this species can tolerate a wide range of salinity. Most of my specimens have evenly rounded whorls, with occasional shells having growth striae and even more rarely an indication of spiral lines. One or two have a single, low, smooth, spiral carina situated a short distance below the suture. None has the prominent spined carina of *P. coronatus* (*s. s.*). In size the specimens are comparable to the material reported from Guatemala by Goodrich and van der Schalie, whose material contained all three forms. Further studies on this species should consider H. B. Baker's account of *P. parvulus* (Guilding) 1828, from the Dutch Leeward Islands (1924) and Venezuela (1930). That species apparently undergoes the same variation of form as does *P. coronatus,* at least in parts of its range (Baker, 1930). Baker indicated some doubt as to the distinctness of the two species and stated (1924: 71): "This species is more slender and slightly smaller than *P. coronatus* (Pfr.); *parvula* is, of course, the older name."

HELICINIDAE

Helicina arenicola Morelet 1849

Oligyra (Succincta) arenicola (Morelet) Bequaert and Clench, 1933, *et ff.*

The Guatemalan specimens cited by Goodrich and van der Schalie (1937) are indistinguishable from the shells from Yucatán. Whether *Oligyra* should be a subgenus of *Helicina* or a distinct genus is a matter of opinion. Thiele (1929) and Bequaert and Clench apparently have followed H. B. Baker's precedent of 1922, when he decided to elevate *Oligyra* to generic rank on the basis of radular studies. Goodrich and van der Schalie (1937), van der Schalie (1948), and Pilsbry (1948) have followed H. B. Baker's (1926) later work on the anatomy of this family, in which he recognized *Oligyra* as of subgeneric value only.

PELECYPODA

CYRENIDAE

Polymesoda salmacida (Morelet) 1851

Neither of the two specimens was found alive, although both are complete and in good condition. The larger is 25 mm. long. These specimens show practically no variation from each other, and both agree closely with Prime's (1865) figure. Bequaert and Clench (1936) considered this species synonymous with *Polymesoda floridana* (Conrad), stating that their Yucatán material agreed well with the figure of *P. salmacida* given by Prime (1865) and by Fischer and Crosse, but that they could find specimens among Floridian lots of *P. floridana* which "are shaped and colored exactly like those of Yucatán." Dall (1903) seemed to have arrived at the opinion that *P. floridana* extends to Yucatán, though he mentioned it only in passing, and did not consider its possible identity with *P. salmacida.* On two points it seems advisable to retain Morelet's species as distinct, at least until larger quantities are studied and the range of this species complex is better known: (1) none of the Yucatán material as yet reported has the extensive variation of form characteristic of *P. floridana* from Florida; (2) differences among other members of this genus, particularly those approaching *P. caroliniana* (Bosc), are quite as trivial as those separating the present species.

VENERIDAE

Anomalocardia cuneimeris (Conrad) 1846

Figures and extensive synonymy are given by Palmer (1926), whose higher taxonomic categories should be viewed in the light of Frizzel's more recent account (1936). My specimens are evidently immature, the largest measuring only 8 mm. long. They have the concentric ribs more closely spaced than those of *A. leptalea* Dall. Engraved, linear, radiating lines which are closely spaced can be seen on the specimens under magnification. The thickness of the shell is moderate, considering its size (certainly not "paper thin"). There are a few irregular, narrow, light brown stripes, of variable length, oblique, radially arranged, and not angled on themselves. The pallial sinus is prominent but small (not extending anterior to the posterior muscle scar). The posterior acuteness seems about intermediate between that of *A. leptalea* and *A. cuneimeris.* In comparing the 1936 and 1938 studies of Bequaert and Clench, I can only conclude that they recognize both species from the *ciénaga* near Progreso, though they point out that *A. leptalea* is probably only an ecological form of *A. cuneimeris.* It seems strange that two ecological forms of the same species of clam should occur in the same habitat, presumably affected by the same conditions; larger series are needed to clarify this point.

The size of my specimens is about that of *A. nesiotica* Pilsbry (1930) from the Bahamas. His description is too limited to allow indubitable differentiation of his species from *A. leptalea* and *A. cuneimeris.*

LITERATURE CITED

BAKER, FRANK C.

1945 The Molluscan Family Planorbidae. Urbana, Ill.: Univ. Ill. Press. Pp. i–xxxvi, 1–530.

BAKER, H. BURRINGTON

1922 Notes on the Radula of the Helicinidae. Proc. Acad. Nat. Sci. Phila., 74: 29–67, Pls. 3–7.

1923 The Mollusca Collected by the University of Michigan–Williamson Expedition in Venezuela. Occ. Papers Mus. Zool. Univ. Mich., 137: 1–58, Pls. 1–5.

1924 Land and Freshwater Molluscs of the Dutch Leeward Islands. *Ibid.,* 152: 1–158, Pls. 1–21.

1926 Anatomical Notes on Some American Helicinidae. Proc. Acad. Nat. Sci. Phila., 78: 35–56, Pls. 5–8.

1928 Mexican Mollusks Collected for Dr. Bryant Walker in 1926—I. Occ. Papers Mus. Zool. Univ. Mich., 193: 1–65, Pls. 1–6.

1930 The Mollusca Collected by the University of Michigan–Williamson Expedition in Venezuela—Pt. VI. *Ibid.,* 210: 1–96, Pls. 27–33.

1940 Mexican Subulinidae and Spiraxinae with New Species of Spiraxis. Nautilus, 53: 89–94, Pl. 11.

1941 Outline of American Oleacininae and New Species from Mexico. *Ibid.*, 55: 51–61, Pl. 5.

1945 Some American Achatinidae. *Ibid.*, 58: 84–92.

BARTSCH, P., and J. P. E. MORRISON

1942 The Cyclophorid Mollusks of the Mainland of America. *In* Carlos de la Torre, P. Bartsch, and J. P. E. Morrison, U. S. Nat. Mus. Bull., 181: i–iv, 1–306, 42 pls.

BEQUAERT, J. C.

1933 Botanical Notes from Yucatan. Carnegie Instit. Wash. Publ., 431: 505–24.

1942 *Cerithidea* and *Batillaria* in the Western Atlantic. Johnsonia, 1, 5: 1–12.

BEQUAERT, J. C., and W. J. CLENCH

1931 Three New Terrestrial Snails from Yucatan. Occ. Papers Boston Soc. Nat. Hist., 5: 423–26.

1933 The Non-marine Mollusks of Yucatan. Carnegie Instit. Wash. Publ., 431: 525–45, Pl. 68, Fig. 26, 2 maps.

1936 A Second Contribution to the Molluscan Fauna of Yucatan. *Ibid.*, 457: 61–75, Pls. 1–2.

1938 A Third Contribution to the Molluscan Fauna of Yucatan. *Ibid.*, 491: 257–60.

CLENCH, W. J., and R. D. TURNER

1948 The Genus *Truncatella* in the Western Atlantic. Johnsonia, 2, 25: 149–64.

DALL, W. H.

1903 Contributions to the Tertiary Fauna of Florida, Part VI. Trans. Wagner Free Instit. Sci., 3: vii–xiv, 1219–1654, Pls. 48–60.

1926 Land Shells of the Revillagigedo and Tres Marias Islands, Mexico. Proc. Calif. Acad. Sci., 15: 467–91, Pls. 35–36.

FISCHER, P. H., and H. CROSSE

1870–1900 Étude sur les mollusques terrestres et fluviatiles du Mexique et du Guatemala. Mission scientifique au Mexique et dans l'Amerique Centrale. Recherches zoologiques, Pt. 7, Vols. I and II, and Atlas. Paris.

FRIZZELL, D. L.

1936 Preliminary Reclassification of the Veneracean Pelecypods. Bull. du musee royal d'histoire naturelle de Belgique, 12, 34: 1–84.

GOODRICH, CALVIN, and H. VAN DER SCHALIE

1937 Mollusca of Petén and North Alta Vera Paz, Guatemala. Misc. Publ. Mus. Zool. Univ. Mich., 34: 1–50, 1 pl., 1 map.

HAAS, FRITZ

1945 Malacological Notes—IV. Fieldiana, Zoology, 31: 3–14.

LUNDELL, C. L.

1934 Preliminary Sketch of the Phytogeography of the Yucatan Peninsula. Carnegie Instit. Wash. Publ., 436: 253–355.

1938 The 1938 Botanical Expedition to Yucatan and Quintana Roo, Mexico. Carnegie Instit. Wash. Year Book, No. 37 (for 1937–38): 6–11.

MARTENS, E. VON

1890–1901 Land and Freshwater Mollusca. *In* Biologia Centrali-Americana, Zoologia, 9: i–xxviii, 1–706, Pls. 1–44.

1903 Durchbohrte Schalen von Landschnecken. Sitzungsber. d. Gesellsch. naturforsch. Freunde zu Berlin. Pp. 393–96.

PAGE, JOHN L.

1933 The Climate of the Yucatan Peninsula. Carnegie Instit. Wash. Publ., 431: 409–22.

PALMER, K. VAN W.

1929 The Veneridae of Eastern America, Cenozoic and Recent. Palaeontogr. Amer., 1: 209–522, Pls. 32–76.

PARKER, G. H.

1911 The Loping of Land Snails. Biol. Bull., 72: 287–89.

PEARSE, A. S.

1940 La Fauna. *In* Encyclopedia Yucatanense, Mexico City. Vol. 1.

PILSBRY, H. A.

1891 Land and Fresh-water Mollusks Collected in Yucatan and Mexico. Proc. Acad. Nat. Sci. Phila., pp. 310–34, Pls. 14–15.

1899 Manual of Conchology, Second Ser. Philadelphia: Acad. Nat. Sci., 12: i–iii, 1–258, Pls. 1–64.

1903–04 Manual of Conchology, 16: i–xl, 1–329, Pls. 1–37.

1907–08 Manual of Conchology, 19: i–xxvii, 1–366, Pls. 1–52.

1909–10 Manual of Conchology, 20: i–viii, 1–336, Pls. 1–43.

1916–18 Manual of Conchology, 24: i–xii, 1–380, Pls. 1–49.

1926 Costa Rican Land Shells Collected by A. A. Olsson. Proc. Acad. Nat. Sci. Phila., pp. 127–33, Pl. 11.

1926*a* The Land Mollusks of the Republic of Panama and the Canal Zone. *Ibid.*, pp. 57–126, Pls. 9–10.

1930 List of Land and Freshwater Mollusks Collected on Andros, Bahamas. *Ibid.*, 82: 297–302.

1930*a* Results of the Pinchot South Sea Expedition. I. Land Mollusks of the Caribbean Islands, Grand Cayman, Swan, Old Providence and St. Andrew. *Ibid.*, 82: 221–61, Pls. 15–19.

1930*b* Results of the Pinchot South Sea Expedition. II. Land Mollusca of the Canal Zone, The Republic of Panama and the Cayman Islands. *Ibid.*, 82: 339–54, Pls. 28–30.

1940 Land Mollusca of North America. Acad. Nat. Sci. Phila., Monogr. 3, 1, Pt. 2: i–viii, 575–981.

1946 Land Mollusca of North America. *Ibid.*, 2, Pt. 1: i–viii, 1–520.

1948 Land Mollusca of North America. *Ibid.*, 2, Pt. 2: i–xlvii, 521–1113.

PRIME, T.

1865 Monograph of American Corbiculidae, Smithsonian Misc. Coll., 7, Art. 5: i–xi, 1–80.

RICHARDS, H. G.

1937 Land and Freshwater Mollusks from the Island of Cozumel, Mexico, and their Bearing on the Geological History of the Region. Proc. Amer. Microscop. Soc., 77: 249–62, Pls. 1–4.

SHATTUCK, G. C.

1935 The Peninsula of Yucatan. Medical, Biological, and Sociological Studies. Carnegie Instit. Wash. Publ., 431.

STREBEL, H.

1873–1882 Beitrag zur Kenntniss der Fauna mexikanischer Land- und Süsswasser Conchylien. Hamburg: G. J. Herbst. 374 pp., 76 pls.

THIELE, J.

1929 Handbuch der systematischen Weichtierkunde. Erster Teil. Jena: Gustav Fischer. 376 pp.

VAN DER SCHALIE, HENRY

1940 Notes on Mollusca from Alta Vera Paz, Guatemala. Occ. Papers Mus. Zool. Univ. Mich., 413: 1–11, 1 map.

1948 The Land and Fresh-water Mollusks of Puerto Rico. Misc. Publ. Mus. Zool. Univ. Mich., 70: 1–134, Pls. 1–14.