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A NEW GENUS AND SPECIES OF CYPRINODONTID FISH FROM SAN LUIS POTOSI, MEXICO, WITH REMARKS ON THE SUBFAMILY CYPRINODONTINAE

BY ROBERT RUSH MILLER

THE richness and diversity of the continental Mexican fish fauna is emphasized once again by the discovery of the novelty reported here. This surprising find, the second endemic Mexican genus in the family Cyprinodontidae, takes its place among the distinctive types already made known in such varied groups as the characins, catfishes, goodeids, atherinids, synbranchids, and brotulids (Hubbs, 1936, 1938; Hubbs and Turner, 1939; de Buen, 1941, 1945; Alvarez, 1948, 1950; Carranza, 1954). It is evidently an ancient relict, isolated on the elevated valley of the upper Río Verde, where it is associated with a limited but noteworthy fish fauna.

Cualac, new genus
(Pls. I–II; Figs. 1–2)

TYPE SPECIES.—*Cualac tessellatus,* new species.

DIAGNOSIS.—Body form resembling that of *Cyprinodon* but more slender (especially the caudal peduncle) than usual in that genus, the snout noticeably more pointed and the dorsal profile less arched. Scapular scale indistinguishable from others, the underlying cleithral process reduced to a low knob (Fig. 1). Supraorbital canal system typically disrupted at two points—between pores 2a and 2b and between 6a and 6b (Fig. 2) or 7a and 7b; no other American cyprinodontid is known to have this pattern (see description for variability). Mandibular and lachrymal pores lacking, the latter represented by neuromasts. No marked sexual dimorphism in body shape or size. Nuptial tubercles on unpaired fins of males, the scales with weak, if any, cilia. Coloration distinctive, the nuptial males with body dusky, overlain by pale bluish spots and chainlike reticulations, and with a

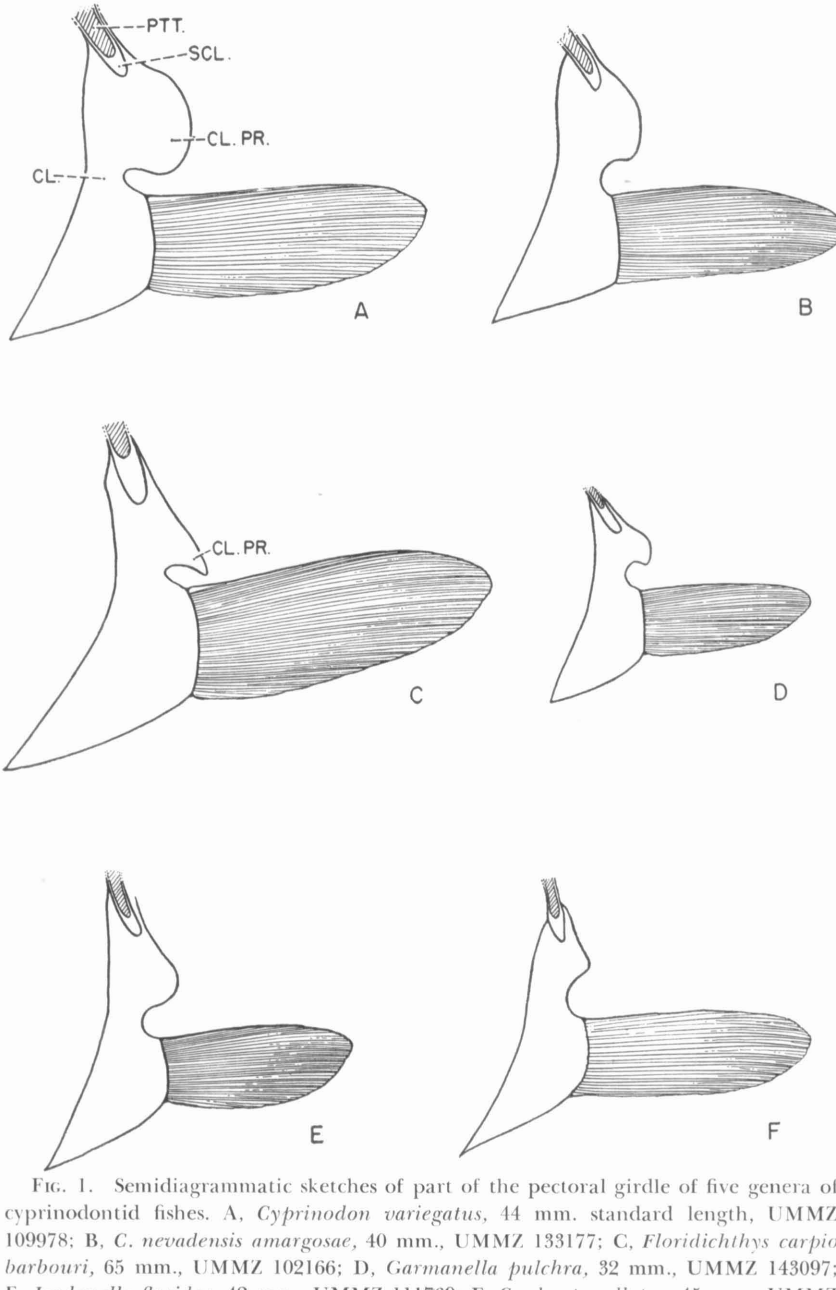

FIG. 1. Semidiagrammatic sketches of part of the pectoral girdle of five genera of cyprinodontid fishes. A, *Cyprinodon variegatus,* 44 mm. standard length, UMMZ 109978; B, *C. nevadensis amargosae,* 40 mm., UMMZ 133177; C, *Floridichthys carpio barbouri,* 65 mm., UMMZ 102166; D, *Garmanella pulchra,* 32 mm., UMMZ 143097; E, *Jordanella floridae,* 42 mm., UMMZ 111769; F, *Cualac tessellatus,* 45 mm., UMMZ 170948. PTT, posttemporal; SCL, supracleithrum; CL PR, cleithral process; CL, cleithrum.

disrupted lateral band comprising squarish black spots anteriorly; the dorsal fin finely tessellated, the caudal fin bright orange between an outer and a basal blackened area; females very similar, generally lighter, the dorsal nearly plain (no ocellus), none of the fins blackened, and with a conspicuous, dark, semicontinuous lateral band (also present in young). Pectoral fin long and narrow, particularly at base, with few rays (11–13, typically 12). Preorbital region partly scaled, but rarely so above lower level of pupil. Two to three short, broad scales between pelvic fins arranged in tandem order. Gill opening restricted, the membrane adnate to body below level of base of uppermost pectoral ray. Jaw teeth in a single series, tricuspid.

RELATIONSHIPS.—Largely on the basis of its external morphology, *Cualac* appears to be closest to *Cyprinodon* or *Floridichthys*. Like those genera it has a single series of tricuspid teeth firmly imbedded in each jaw. It also shares this feature with two other related American genera, *Garmanella* and *Jordanella*. In addition to the unique arrangement of the supraorbital canal system, *Cualac* differs from *Cyprinodon* in having: (1) an unmodified scapular scale; (2) the cleithral process reduced to a low knob (Fig. 1); (3) tubercles on dorsal and caudal fins in nuptial males; (4) the oviduct of mature females elevated to form a small pouch (Pl. I); (5) a long and narrow pectoral fin; and (6) distinctive life colors (see Table I). From *Floridichthys* it is readily separated by: (1) the absence of mandibular pores, which are not even represented by pit organs: (2) the distribution of nuptial tubercles; (3) the fewer pectoral rays (11–13 versus 18–20); (4) the squamation atop the snout; (5) its life colors; and (6) the much slenderer body, especially the gently arched dorsal profile and the more attenuate caudal peduncle. *Garmanella* and *Jordanella* differ from *Cualac* in many features, particularly in the longer dorsal fin and the life coloration (Table I), and also in the more robust body.

In possessing two breaks in the supraorbital canal system, *Cualac* resembles *Fundulus* and *Profundulus* (Gosline, 1949; Miller, 1955), although the second break in the canal in those genera occurs at different points (between pores 4a and 4b or 4 and 6). The new genus shows a further approach to those two genera in the development of an elevated lip to the oviduct, which forms an incipient or weak genital pouch that typically surrounds the first anal ray, although it may surround the first two rays or none at all. The attenuate form of the new genus closely approaches that of a funduline type. *Cualac* may well be as closely related to *Fundulus*, with conical teeth, as to the cyprinodontids, with tricuspid teeth. I believe that it represents an

TABLE I

Comparison of Five Related Genera of Cyprinodontidae

These are the only New World genera with uniserial tricuspid jaw teeth.[1]

Character	Cyprinodon	Floridichthys	Garmanella	Jordanella	Cualac
Supraorbital canal system (Fig. 2)	Continuous	Continuous	Continuous	Disrupted between pores 3-4	Disrupted between pores 2a-2b and 6a-6b or 7a-7b
Mandibular pores ..	Typically 0 or 2, usually 2	3 pores on each mandible (Fig. 2)	Absent	Absent	Absent
Scales of breeding males	Strongly ciliated on head, nape, and sides	Not ciliated	Ciliated on sides of head only	Ciliated on sides of head and body	At most, weakly ciliated on sides of head and body
Tubercles on fins of breeding males	Present on anal fin and, occasionally, near dorsal base	On anal fin only	On anal fin only (very weak)	On anal fin only (very weak)	On dorsal, caudal, and anal fins
Caudal fin of males	With dark terminal band in 19 of 20 species	No terminal band	No terminal band	No terminal band	Orange between outer and basal black areas
Dorsal rays	8-13	11-13	14-17	16-18	10-12

Pectoral rays	12-18, modally 14-17	18-20	15-17	14-16	11-13
Caudal rays	13-22, modally 14-18	15-19, modally 16-18	12-16	17-21	13-15, rarely 16
Squamation on top of snout	Formed of several scales, usually irregular, with narrow scaleless strip anteriorly	Formed of one broad, thick scale that covers width of snout, leaving a wide scaleless area anteriorly	With a wide scaleless strip as in *Floridichthys* but scale number irregular, like *Cyprinodon* or *Floridichthys*, or intermediate	Like *Cyprinodon*	Like *Cyprinodon*, but scale arrangement typically more irregular (as in *Fundulus*)
Preorbital region ..	Usually scaled above level of lower part of eye	Naked above line from lower part of orbit to lower part of maxillary	As in *Floridichthys*	Scaled well above level of lower part of eye	Not scaled above level of middle of pupil
Prepelvic scales ...	Variable in size and development; 15 or more (usually 20-25) when present	Large, regular, fewer than 15	Like *Floridichthys*; about 9-14	Similar to *Floridichthys*; about 13-15	Fairly large and regular; 13-17
Scapular scale	Weakly to strongly enlarged; when weak, the underlying cleithral process is larger than in *Floridichthys*	Not larger than adjacent scales on body	Not enlarged	Not enlarged	Not enlarged

TABLE I (Cont.)

Character	*Cyprinodon*	*Floridichthys*	*Garmanella*	*Jordanella*	*Cualac*
Cleithral process (Fig. 1)	Variable in size and shape but typically more expanded than in *Floridichthys*	Not notably enlarged; hooked around pectoral base	Similar to *Floridichthys*, but the hook more distant from pectoral base	Like *Floridichthys* but not hooked around pectoral base	Little modified; not hooked around pectoral base
Shape of dorsal fin	Relatively short and high, the posterior rays not elongated in breeding males	Relatively long, low anteriorly, the posterior rays much elongated in nuptial males	As in *Floridichthys*	Long and low, the posterior rays elongated in the male	About as in *Cyprinodon* except posterior rays longest in nuptial males
First dorsal ray of adult	Slender to greatly thickened and spinelike	Slender, like the succeeding rays	Not notably thickened, all the rays moderately enlarged	Greatly thickened and spinelike	Slender, like those that follow
Life coloration ...	Vertical bars on sides of young and females typically like those of *Garmanella*, the males with broad bars or none; no suborbital bar	Sides silvery, adults with brassy or orange spots ringed with blue, with faint and irregular vertical bars or blotches; no suborbital bar	Sides with irregular vertical bars, widely spaced in young and females, becoming numerous and reticulated in larger males; a dark suborbital bar	Sides with orange or brassy horizontal streaks along the scale rows, especially prominent in males; a dark suborbital bar	Sides with a semi continuous dark stripe, and with pale blue spots forming chainlike reticulations; no suborbital bar

Habitat	Fresh, brackish and salt waters; associated with alkaline and saline deposits and with highly mineralized warm springs in interior waters	Open salt and brackish waters and ciénegas over sand and/or mud bottoms; rare in fresh water	Nearly fresh to brackish water of ciénegas, boggy pools and coastal sloughs over marl and sand bottoms	Fresh and brackish waters of swamps, swamp streams and ditches, over mud, sand, and silty bottoms	Warm-spring ditches of clear, sulfurous water associated with rocks over firm sandy-silt bottom
Range	Atlantic seaboard, southern and southwestern United States; México, West Indies, and northern South America (Venezuela)	Florida Keys northward on Peninsular Florida to about 29° N. lat. (and possibly to Pensacola); coastal parts of the Yucatán Peninsula in Campeche and Yucatán	Yucatán Peninsula southward to Corozal, British Honduras[2]	Peninsular Florida, to the base of the Panhandle	Restricted to an elevated spring area in San Luis Potosí, México

[1] Carrionellus, from the Tertiary of Ecuador (White, 1927), is described as having the tricuspid teeth arranged in at least two rows, and is otherwise obviously very different from any of the above genera (see text).

[2] Based on 6 specimens in the University of Michigan Museum of Zoology collected by Rev. Gerald Fairweather in San Rogue Creek, Orange Walk, Corozal Road, British Honduras.

early (Pliocene?) divergence from the basal stock which gave rise to such generalized types as *Fundulus* and *Cyprinodon.*

A consideration of the relationships of *Cualac* focuses attention on whether it is desirable to recognize the Cyprinodontinae as well as the Fundulinae—a problem that I have commented on briefly (Miller, 1955: 10). In the last general classification of the oviparous cyprinodonts, Myers (1931: 12) pointed out that the only character used to distinguish the Cyprinodontinae is the tricuspid jaw teeth; except for this feature, they differ little from the Fundulinae which have these teeth typically conical, although bicuspid in *Crenichthys* (not tricuspid in *Empetrichthys,* as stated by Akşiray [1952: 36]; see Hubbs, 1932). To base higher classification solely or largely on dental features may be misleading, as it surely was in the diversified Mexican fishes of the family Goodeidae. The Tertiary fossil cyprinodontid *Carrionellus* (White, 1927), of Ecuador, has been included in the Cyprinodontinae because of its tricuspid teeth (in at least two rows rather than a single row), but a study of the published figure indicates that this fish differs importantly from the American genera assigned to this subfamily. Like *Cualac,* its fusiform body is strongly suggestive of the generalized *Fundulus* types and it also resembles that genus in the posterior position of the dorsal and anal fins. It is pertinent to note here that the recently described Anatolian genus *Kosswigichthys,* with conical teeth, was first thought to be allied to *Valencia,* of the Fundulinae. Experimental hybridization and cytological studies (Akşiray, 1952; Öztan, 1954), however, demonstrate that *Kosswigichthys* actually is closely related to *Aphanius* and *Anatolichthys,* both of which have tricuspid jaw teeth.

I think it highly probable that tricuspid teeth have been derived independently at least three times in the New World genera, once each in *Cualac* and *Carrionellus* and again in the other four American genera (*Cyprinodon, Floridichthys, Garmanella,* and *Jordanella*). Consequently, I favor recognizing a single subfamily, the Cyprinodontinae, to include all genera currently placed in the Fundulinae[1] and in the Cyprinodontinae. Those recently regarded as members of the latter subfamily are: *Cyprinodon, Floridichthys, Garmanella, Jordanella,* and *Carrionellus*—all New World, and *Aphanius, Tellia, Anatolichthys, Kosswigichthys,* and *Pachylebias* (fossil)—all Old World. With the two modifications proposed previously for the diagnosis of the Fundu-

[1] Apparently the earliest available name for this group is Hydrargyrinae (Gill, 1861, *Proc. Acad. Nat. Sci. Phila.,* 1862, suppl., p. 51).

linae (Miller, 1955: 9–10), the subfamily Cyprinodontinae would then include genera with conical, bicuspid and tricuspid teeth (in one or more rows). Such a classification appears to be more reasonable at this time, although it is not necessarily a final one. Many questions regarding the precise relationships of the numerous genera, particularly the fossil forms, remain to be solved. It is entirely possible that the Old World genera with tricuspid teeth have been independently derived from ancestors there and are not intimately related to their New World representatives.

ETYMOLOGY.—The generic name *Cualac* is derived from a Mexican place name of Indian (Nahuatl) origin which means "where there is good water" (Griffin, 1953: 20). It seems appropriate that a fish endemic to the spectacular spring area of La Media Luna should bear this name. The gender is masculine. The specific name is derived from the Latin word *tessella,* in reference to the mosaic-like or checkered pattern so prominently displayed on the dorsal fin of the male.

The following abbreviations are employed: UMMZ=University of Michigan Museum of Zoology; TU=Tulane University fish collection.

Cualac tessellatus, new species

(Pl. I; Figs. 1–2)

HOLOTYPE.—An adult male (Pl. I), UMMZ 171135, 38.5 mm. in standard length, from an outlet ditch of La Media Luna, about 7 airline miles SSW of the settlement of Rio Verde, San Luis Potosí, México; approximately 21°52′ N. Lat., 100°02′ W. Long. Collected by Robert R. Miller and John T. Greenbank on March 19, 1955.

PARATOPOTYPES.—UMMZ 171136 (45, 26–41 mm.) taken with the holotype; UMMZ 170948 (9, 23.5–44.5 mm.) collected at La Media Luna by Richard T. Gregg on July 1, 1952; TU 6557 (32, 19–45.5 mm.), a part of the previous collection; and UMMZ 170947 (14, 14–44 mm.) taken at the same place by Gregg on June 20, 1954.

DESCRIPTION.—The generic diagnosis of this monotypic species includes most of the important specific characters. Form and coloration are portrayed in Plate I, and other diagnostic features are illustrated in the figures. Proportional measurements are detailed below. Methods of counting and measuring follow those used by Miller (1948: 9–13); the last two closely approximated rays in the dorsal and anal fins are counted as a single ray rather than as two rays.

Dorsal rays: 10(1), 11(28), 12(21); anal rays: 10(9), 11(41); pectoral rays (both fins): 11(9), 12(80), 13(11); pelvic rays (both fins): 6(2), 7(70), 8(28); caudal rays: 13(2), 14(35), 15(9), 16(1). The holotype has dorsal, 12; anal, 11; pectorals, 12–12; pelvics, 8–7; and caudal, 14.

Scales in lateral series: 26(5), 27(37), 28(7), 29(1); scales between dorsal and anal fins: 9(1), 10(22), 11(26); scales between dorsal and pelvic fins: 10(20), 11(28), 12(2); scales around caudal peduncle: 16(50);

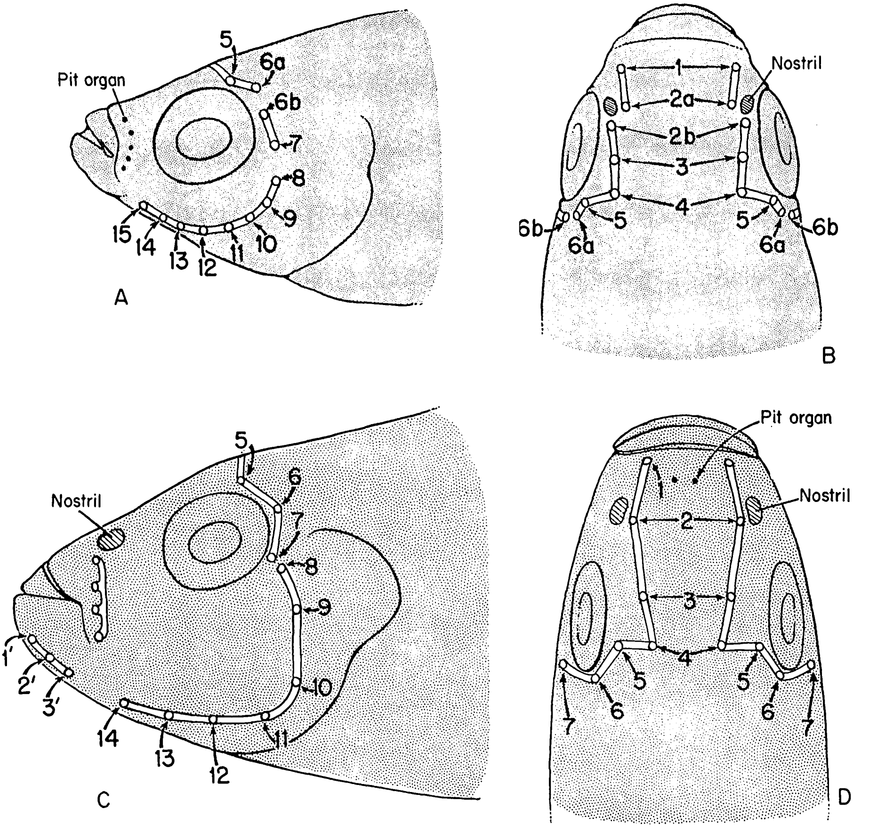

FIG. 2. Lateral-line system of sensory canals and pores on the head of *Cualac tessellatus* (A, B) and *Floridichthys carpio barbouri* (C, D) from Yucatán (UMMZ 102166; compare with Gosline, 1949, Pl. I). Based on semidiagrammatic sketches (for variation in *Cualac,* see text). Note absence of mandibular pores and reduction of lachrymal pores to pit organs in *Cualac*.

and scales around body: 24(29), 25(6), 26(14?), 27(1)—several counts recorded as 26 are questionable. There are fewer than 18 scales along mid-line of abdomen between isthmus and insertion of pelvic fins: 13(2), 14(6), 15(7), 16(7), 17(3). The holotype has 27 lateral scales, 10 from dorsal to anal, 11 between dorsal and pelvic, 24 around body, and 14 along mid-line before pelvic fins.

Vertebral counts (including urostyle), made from X-ray photographs, vary as follows: precaudal, 12(1), 13(35), 14(6); caudal, 14(10), 15(32); and total: 27(5), 28(38), 29(1). Holotype, $14 + 14 = 28$.

Gillrakers number: 23(4), 24(13), 25(10), 26(6), 27(2). Head pores vary as follows, both sides counted: mandibular, 0(100); preopercular, 6(1), 7(40), 8(52), 9(7); and lachrymal, 0(100). Holotype has 7–7 preopercular pores. Branchiostegals: 4(1), 5(14).

Proportional measurements on 21 specimens, stepped with a pair of precision dividers under appropriate magnification, are given below for 10 males, 28.0–38.0 mm. (av. 34.3) in standard length, 10 females, 31.0–41.0 mm. (35.5) long, and the holotype, 38.5 mm. long. Except where sexual dimorphism is marked, the data for the sexes are combined. The range of variation is followed by the value, in parentheses, for the holotype and then the average value of the measurement.

In standard length: head length, 3.1–3.4 (3.35), av. 3.3; greatest body depth, 2.75–3.1 (2.95), 3.0; caudal peduncle length, 3.1–3.55 (3.35), 3.4; origin of dorsal fin to snout tip, 1.8–2.0 (1.95), 1.9; origin of dorsal to caudal base, 1.85–2.0 (1.95) 1.9; insertion of pelvic fin to snout tip, 1.9–2.1 (2.0), 2.0.

In head length: head depth at occiput, 1.15–1.3 (1.25), 1.2; head width, 1.4–1.5 (1.45), 1.5; greatest body depth, 0.75–0.95 (0.75), 0.8; caudal peduncle length, 0.85–1.05 (1.0), 1.0; least depth of peduncle, in males, 1.75–2.0 (1.8), 1.8, and in females, 1.95–2.15, 2.0; bony interorbital width, 2.9–3.1 (3.0), 3.0; snout length, 3.35–3.7 (3.5), 3.5; orbit length, 2.6–3.05 (3.0), 2.9; length of upper jaw, 3.1–3.55 (3.3), 3.3; mandible length, 3.35–3.85 (3.8), 3.6; greatest mouth width, 3.2–3.45 (3.2), 3.3; length of depressed dorsal fin, in males, 0.75–1.05 (0.75), 0.89, and in females, 1.0–1.05, 1.0; length of depressed anal fin, in males, 1.05–1.25 (1.15), 1.2, and in females, 1.25–1.35, 1.3; length of pectoral fin, 1.15–1.3 (1.3), 1.3; length of pelvic, in males, 1.7–2.2 (1.8), 1.9, and in females, 2.05–2.2, 2.1; length of middle caudal rays, 1.05–1.15 (1.05), 1.1.

Length of orbit into bony interorbital width, 0.8–1.05 (0.95), 0.93, and into postorbital length, 1.0–1.2 (1.15), 1.1; greatest mouth width into bony interorbital, 1.0–1.2 (1.1), 1.1. Length of depressed dorsal into predorsal distance, in males, 1.5–1.75 (1.6), 1.6, and in females, 1.8–2.0, 1.9; length of depressed anal fin into predorsal, in males, 1.9–2.25 (2.05), 2.1, and in females, 2.2–2.4, 2.3.

As noted in Plate I and in the above measurements, morphological differences between the sexes are slight. The principal dimorphism, aside from breeding color (see below), is in the size of the dorsal, anal, and pelvic fins and, to a lesser extent, in the depth of the caudal peduncle.

COLORATION.—Differences between the sexes in color pattern and in life colors are not marked. When in full breeding dress males are the more colorful, but this dimorphism is not as pronounced as it is in species of *Cyprinodon* and in many other cyprinodontids.

Nonbreeding males (Pl. I) have the dorsal fin well tessellated, dusky, and with the outer margin pale orange; the membranes of the anal fin are dusky and its distal border is orange; the pectoral, pelvic, and caudal fins are pale yellow. The general color tone is brown above, the chainlike reticulations and spots on the sides are whitish blue, and the abdomen is light. The reticulations and spots are reminiscent of those developed in *Floridichthys carpio* (Hubbs, 1936, Pls. 3–4). The interrupted lateral stripe is blackish brown. In breeding males the dorsal and anal fins are much blackened, covered by thick mucus, and overlain with orange; the caudal fin is black at its base, has a broad black band distally, and is bright orange in between; the pectoral and pelvic fins, also darkened, are orange. The general color tone is darkened and intensified from that of the nonbreeding fish, and the semicontinuous lateral band is reduced anteriorly to about one to three dark, disconnected, squarish blotches.

Nonbreeding females (Pl. I) are very much like males except that the dorsal fin is nearly plain to weakly tessellated near its base and the other fins are paler. About 50 per cent of the 27 mature females taken in March have nearly the same development of markings on the sides as do the males; of the remainder, two-thirds have the sides plain or almost plain below the lateral stripe, whereas one-third show stages intermediate between plain to well-patterned lower sides. Of 10 mature females taken during the breeding season, in June and July, 3 have the sides plain below the stripe, 2 are well mottled, 1 is about 50 per cent mottled, and 4 show various stages of intermediacy. It is possible that females ready to spawn lose their mottling and that paleness is one attribute for sex recognition. The development of color on all the fins is presumably weaker than in the male, and the lateral band does not become disrupted. This description of life colors for breeding fish is based largely on two kodachromes of freshly killed specimens (mostly males) kindly supplied by R. T. Gregg.

HEAD PORES.—The general pattern of pore development in the supraorbital canal system has been indicated (Table I; Fig. 2). This feature is more variable, however, than in other species of cyprinodontids with which I am familiar. Ninety specimens revealed the following variations in the points at which breaks occur: (1) between pores 2a–2b and 6a–6b, 66 specimens; (2) between 2a–2b and 7a–7b, 21 specimens; (3) one break only, 2a–2b, then continuous to pore 7, on left side only of 1 specimen; (4) continuous from 1–6a and 6b–7, on left sides only of 2 specimens (2 breaks on right sides); (5) 1–6a, 6b–9, on left side of 1 specimen; (6) disrupted at 2a–2b and 8a–8b, on left side of 2 specimens; and (7) with 3 breaks, 2a–2b, 4a–4b, and 6a–6b, on left side of 1 specimen. Not infrequently, pores 2a and 2b are almost joined (unless actually fused they were always regarded as two pores); and once, pores 6a–6b were roofed over. Asymmetry in pore number or pattern was noted in 34 specimens, but two breaks in the supraorbital canal always appeared on at least one side of every fish.

The developed pores in the opercular series numbered seven (in 60), eight (24), nine (5), and ten (1). There are no pores on the preorbital region or on the mandibles; pit organs or neuromasts occur sporadically on the preorbital but were not noted on the mandibles.

HABITAT.—La Media Luna is the name given to an extensive warm-spring area that lies in a broad meadow about seven airline miles south-southwest of the town of Río Verde. A large, constant volume of water rises principally from two rather deep holes in a crescent-shaped pond (laguna) and provides all the water for three municipios. The approximate area of the laguna has been estimated to be 24,800 square meters (Piscicultura Rural, 1(5): 3–4, May, 1951, Mexico, D. F.; mimeo.). The water is blue, very clear, and has a strong sulfur odor. Water temperatures taken at various stations during different seasons indicate a variation from about 83° to 86.5°F. At 9:45 A.M. March 19, 1955, it was 85° in an outlet ditch (Pl. II lower), when the air was 77°, and was 86.5° in one spring source nearby about two hours later (air 81°). The pH varied from 6.9 to 7.3 (readings by two different parties); hardness was recorded as 92 p.p.m. of $CaCO_3$; dissolved oxygen (at two stations in the laguna) varied from 4.0 to 6.4 p.p.m.; and methyl-orange alkalinity (same two stations) varied from 138 to 158 p.p.m. of $CaCO_3$. There was no trace of CO_2 and no reaction to phenophthalein. According to our altimeter, the elevation is 3,580 ft., but since Río Verde has an elevation near 3,300 feet (according to the American Geographic Society Millionth Map NF–14), the correct altitude of La Media Luna may be closer to 3,350 feet.

Our collecting activities were restricted to the outlet ditch farthest to the west (Pl. II lower) and near the base of the prominent hill overlooking La Media Luna (from which Pl. II upper was taken). Here habitat conditions were as follows. Vegetation in the water consisted of a floating, brownish green algal scum, locally common, a green alga over the bottom, and sparse water lilies at the margins. The ditch, with slight current, averaged 15 feet wide and was about 3 to 4 feet deep. The bottom comprised firm sand, silt, and gravel, with some rocks and occasional boulders. Adjacent shore was a flat, grassy meadow. A 25-foot bag seine provided the chief means of capture (a 12-foot common-sense seine was used for only two hauls), and collecting extended over a two-hour period.

The new genus, like *Ataeniobius toweri* (taken in nearly equal numbers), prefers the shallower water, not much over 2½ feet deep, a firm bottom, rocks and boulders (perhaps as refuges from the abundant *Astyanax and Cichlasoma bartoni*[2]), with some algal cover at the margin. Mr. Gregg treated with rotenone a section of irrigation ditch about 800 yards long and, after sealing off the section with seines and recovering three wash tubs of fishes, he found only 14 specimens of *Cualac,* evidently the entire population of the area treated. This ditch was about 25 feet wide, 3 to 4 feet deep, almost without current, lacked vegetation, and had a soft mud bottom about 6 inches deep. This particular area was apparently not well suited to *Cualac.*

The vegetation of the region is arid, with few trees on the valley floor and a close growth of xerophytic plants on the hills. Mesquite and creosote bush are characteristic, along with large acacias, yuccas, and numerous cacti. Principal crops are sugar cane, corn, beans, citrus fruits, and bananas (Goldman, 1951: 246). The change in vegetation and in climate during the five-hour drive eastward from San Luis Potosí to about 10 miles west of Río Verde was striking, with a shift toward increased plant cover, greater warmth, and higher humidity (a moderate dew fell in the valley during the night of March 18). Although the vegetation zone of the area is classified in a general way as desert (Leopold, 1950, Fig. 1), it is markedly different from the other desert areas of northeastern México, and reflects the peculiar position of a depression lying between the relatively low crest (5,500 ft.) of the Sierra Madre Oriental, just to the east, and the much higher ranges (8,000 ft.) to the west (see physiographic map by Hoy, 1943). The mean annual rainfall of the depression may approach 15 to 20 inches.

ASSOCIATES.—Six other fishes are known from La Media Luna. Two of them, *Astyanax fasciatus mexicanus* (de Filippi) and *Dionda rasconis* (Jordan and Snyder), are widely distributed in the Río Pánuco

[2] The intestine of an adult female of the cichlid, 94 mm. standard length, contained chiefly detritus and algae, but 19 cichlid scales, 1–3 mm. in longest axis, and 2 cyprinodont scales, 1–2 mm. long, were also found.

basin, whereas a third species, *Ictalurus mexicanus* (Meek), has a more restricted range in that drainage. Two others, *Cichlasoma bartoni* (Bean) and *C. labridens* (Pellegrin), are known only from La Media Luna (including Río Verde at Río Verde; Meek, 1904: 212), Puerta del Río south of Villa Juarez (22° 16′ N., 100° 12′ W), and nearby Huasteca Potosina[3] (Pellegrin, 1904: 172), all of which lie in elevated basins between the Coastal Plain and the Plateau. The remaining species, *Ataeniobius toweri* (Meek), has been taken only from La Media Luna, the Río Verde at Río Verde, and Puerta del Río—all in San Luis Potosí. Our party did not collect *Dionda* or *Ictalurus* at La Media Luna, but Mr. Gregg secured these species (the catfish was checked by C. L. Hubbs), and we took *Dionda rasconis* in the headwaters of Río Verde, about 40 miles west of, and 1,000 feet higher than, Río Verde, on the road to San Luis Potosí.

There are some data on the relative abundance of the six species. On June 20, 1954, Mr. Gregg found that the two cichlids were most abundant, each comprising approximately 40 per cent of his collection, *Astyanax* about 10 per cent, *Ictalurus* 5 per cent, *Ataeniobius* 3 per cent, and *Dionda* and *Cualac* 1 per cent each. In the irrigation ditch worked by us the cichlids were the most numerous although *Astyanax* was abundant (more so than Mr. Gregg found where he worked); and *Cualac* and *Ataeniobius* were taken in almost equal numbers (46 versus 56 specimens). Catfish were neither seen nor collected and likely were absent from the ditch; their preferred habitat would be the deeper and quieter waters of the laguna. *Dionda* is probably quite scarce in the area.

The tropical affinities of the fish fauna of La Media Luna are pronounced, and other vertebrates of the area show similar relationships. The presence of the most primitive genus of goodeid, *Ataeniobius,* however, is strong evidence of an earlier connection across the Mexican Plateau with the now isolated Lerma system, which is the center of abundance for this viviparous family. *Cualac,* like *Ataeniobius,* is evidently a relict that is able to survive in an isolated habitat under limited competition.

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[3] This is a region rather than a specific locality and is interpreted to mean the Huasteca of San Luis Potosí and not, as Pellegrin thought, a place in Guanajuato. Dugès' types of *Cichlasoma bartoni* and *C. labridens* very probably came from the vicinity of the town of Río Verde or else from a similar area in the adjacent Río Santa María basin.

the first to collect the new genus, and he has generously supplied me with valuable data regarding La Media Luna, its fish fauna, and the interpretation of the locality "Huasteca Potosina." Dr. Royal D. Suttkus, Tulane University, forwarded the first collection to me for study and report. William A. Brudon made the photograph (Pl. I) and finished the rough sketches (Figs. 1–2). I was generously issued a scientific collecting permit by Corl. Ignacio Bonilla Vazquez through the kind co-operation of José Alvarez del Villar. All of these people have my grateful thanks.

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PLATE I

Cualac tessellatus

Above: Holotype, adult male, UMMZ 171135, 38.5 mm. standard length.
Below: Paratopotype, adult female, UMMZ 171136, 41.0 mm. standard length.

PLATE I

PLATE II

La Media Luna

Fig. 1. View eastward across the main laguna to the relatively low crest, in distance, of the Sierra Madre Oriental. From kodachrome by author.

Fig. 2. View northward down outlet ditch showing habitat of *Cualac*. From kodachrome by author.

PLATE II

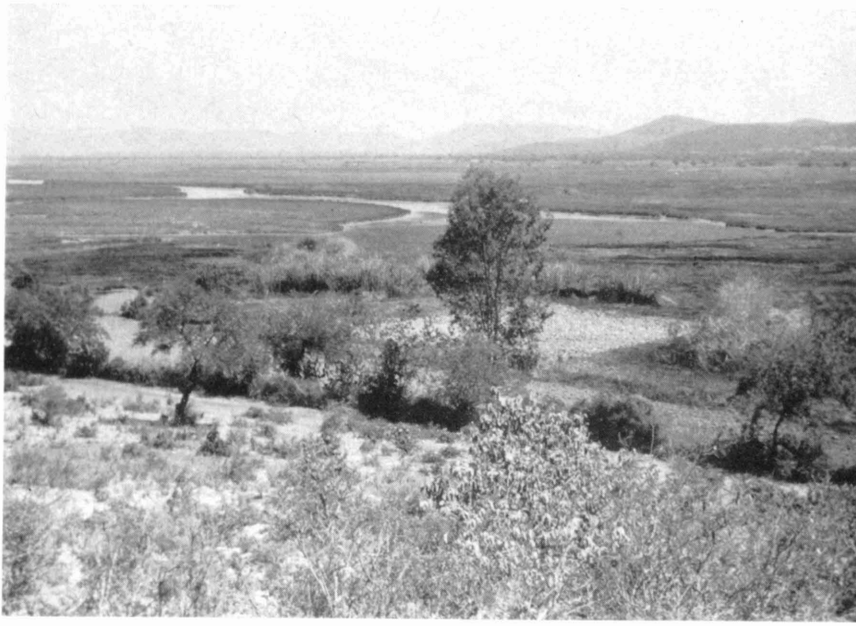

Fig. 1

Fig. 2.