

A NEW SPECIES OF *HYLA* (ANURA: HYLIDAE) FROM THE SIERRA MIXES, OAXACA, MEXICO, WITH COMMENTS ON ONTOGENETIC VARIATION IN THE TADPOLES

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ABSTRACT: We describe a new species of *Hyla* that differs from the similar-looking species *H. pentheter* by reaching a larger size, having a smaller tympanum, more webbing on the feet, more extensive nuptial excrescences, and a different color pattern on the flanks. We tentatively place this new species in the phenetic assemblage commonly referred to as the *H. bistincta* group. We describe and illustrate the tadpole and discuss ontogenetic variation among tadpoles, with reference to existing information on tadpoles of other species from the *H. bistincta* group.

Key words: Amphibia; Anura; Hylidae; *Hyla bistincta*; *Hyla calthula*, new species; Tadpole; Oaxaca; Mexico

IN HIS monograph on hylid frogs of Middle America, Duellman (1970) included only nine species in the *Hyla bistincta* group. In the three decades since this major work, additional specimens have been collected and existing material has been critically re-examined, bringing the total number of species in the group to 15 (Mendelson and Toal, 1996; Toal and Mendelson, 1995). Most of the species in the *H. bistincta* group have restricted distributions in the Mexican highlands northwest of the Isthmus of Tehuantepec, with ranges from southwestern Durango, eastward to Puebla, and southward to the Pacific versant of Oaxaca (Duellman and Campbell, 1992; Toal and Mendelson, 1995). Several species are known only from the type-locality. In this paper, we describe another member of the *H. bistincta* group known only from the Atlantic versant of the Sierra Mixes of Oaxaca, Mexico.

While exploring a separate taxonomic question concerning species within the *Hyla bistincta* group, we examined available specimens catalogued as *H. pentheter* and *H. bistincta*. Currently, populations of *H. pentheter* are known only from the Pacific versant of the Sierra Madre del Sur (Duellman, 1970). Among specimens catalogued as *H. pentheter* in the collections

at The University of Texas at Arlington (UTA) is a series of frogs from the Atlantic versant of the Sierra Mixes that we determined to represent an undescribed species.

MATERIALS AND METHODS

Measurements (in millimeters) were made using a dissecting microscope and dial calipers (0.05 mm accuracy) and were rounded to the nearest 0.1 mm; measurements, ratios, and terminology follow those of Duellman (1970). Sex of specimens was determined by presence or absence of nuptial excrescences or by direct observation of the gonads. Museum acronyms follow Leviton et al. (1985). Webbing formulae follow Myers and Duellman (1982). Snout-vent length is abbreviated SVL throughout. Because of small sample sizes for females, morphometric comparisons (*t*-test, ANCOVA) were only made among males. Color pattern in life was taken from field notes and color transparencies. Data for collecting sites were converted to metric equivalents where necessary. A list of specimens examined is given Appendix I.

SYSTEMATICS

Hyla calthula sp. nov.

Holotype.—UTA A-5885 (original field no. JAC 3546), an adult male from Mexico:



FIG. 1.—*Hyla calthula* in life. Adult male (UTA A-5883) from Sierra Mixe, Totontepec, 1798 m, Oaxaca, Mexico; SVL, 55.9 mm. Figure reproduced from UTA Color Transparency 16154, photographed by J. A. Campbell; specimen collected by J. A. Campbell.

Oaxaca: Sierra Mixe, Totontepec; obtained by J. A. Campbell on 8 April 1978.

Paratypes.—All adults from Oaxaca, Mexico: Sierra Mixe, Totontepec (UTA A-5788, 5876–84, 5886, 6929–32, 8508–09, 13369); Sierra Mixe, E side Totontepec (UTA A-13370–71).

Referred specimens.—Adults: from Oaxaca, Mexico: Sierra Mixe, Totontepec (UTA A-7636, 7951); tadpoles (lots) and metamorphs: from Oaxaca, Mexico: Sierra Mixe, Totontepec (UTA A-5888, 6168, 27804–34, 44990, 44999, 45000).

Diagnosis.—A large, robust tree frog tentatively referred to the genus *Hyla* and to the *H. bistincta* group sensu Duellman (1970) and Toal and Mendelson (1995); see Remarks. *Hyla calthula* may be distinguished from species in the genus *Plectrohyla* by lacking projecting prepollical spines in males and from *Phrynohyas venulosa* by having smoother skin dorsally, lacking vocal slits in males, and by lacking webbing on the hands. *Hyla calthula* may

be distinguished from the widespread species *Smilisca baudinii* by lacking vocal slits in males and by being smaller [SVL in male *H. calthula* to 56.1 mm versus SVL in male *S. baudinii* 75.9 mm (Duellman, 1970)]. *Hyla calthula*, with its large size and distinctive, bold color pattern (Figs. 1–3), cannot be confused with any other known species of *Hyla* in Mexico, with the exception of the superficially similar species *H. pentheter* and *H. bistincta*. Consequently, we have limited our detailed comparison of diagnostic characters to these two species. The adults of *H. calthula* (Fig. 1) are most similar in appearance to *H. pentheter* and may be distinguished from the latter species by reaching a larger size (males to 56.1 mm SVL, females to 61.3 mm SVL in *H. calthula* versus males to 51.1 mm SVL, females to 55.5 mm SVL in *H. pentheter*), by having a smaller tympanum (diameter of tympanum approximately 35% diameter of eye in male *H. calthula* versus approximately 50% diam-

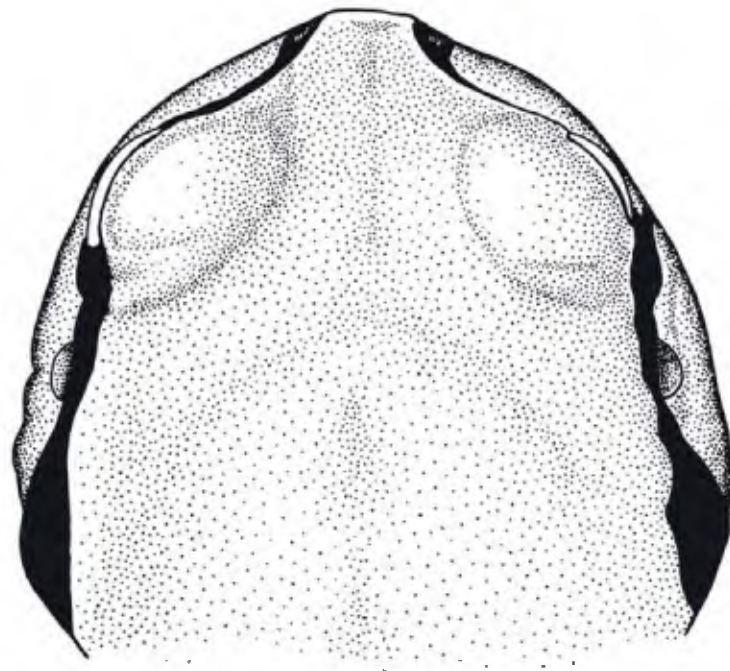
eter of eye in male *H. pentheter*; Table 1; Fig. 2), by having more webbing on the feet (**I1—2II2—2½III1—2½IV2½—1V** in *H. calthula* versus **I2—2½II2—3III2—3IV3—2V** in *H. pentheter*), by having a different color pattern on the lateral surfaces of the body, lips, and rear of thighs (black markings distinctly separating dorsal and ventral coloration in *H. calthula* versus black markings separated from dorsal coloration above by thin, whitish tan line and fading ventrally into yellow coloration in *H. pentheter*; Fig. 3), and by having more extensive nuptial excrescences (more extensive on Finger II and usually present on Finger III in *H. calthula* versus less extensive on Finger II and absent on Finger III in *H. pentheter*). *Hyla calthula* may be easily distinguished from the widespread *H. bistincta* by the lack of vocal slits in males, which also are absent in *H. pentheter*. *Hyla calthula* further differs from *H. bistincta* by having different webbing formula on the feet (**I1—2II2—2½III1—2½IV2½—1V** in *H. calthula* versus **I1—2II2—1½III2½—1IV2—1V** in *H. bistincta*) and a different color pattern (bold dark markings on the loreal and tympanic regions, nearly uniform dark markings on lateral surfaces of body and posterior surfaces of thighs in *H. calthula* versus no dark markings on loreal and tympanic regions, dark markings forming distinct reticulated pattern on lateral surfaces of body and posterior surfaces of thighs).

Description of holotype.—Adult male, measurements (in mm): SVL 53.7; tibia length 28.5; foot length 25.1; head length 17.2; head width 19.6; snout length 6.6; diameter of tympanum 1.8; diameter of eye 5.1; interorbital distance 6.1; eye-tympanum distance 3.0; body robust; head wider than long; snout truncate in profile, bluntly rounded in dorsal view, without rostral keel; canthus rostralis distinct, rounded; loreal region concave; lips not flared; nostrils teardrop-shaped, not protuberant, directed posterodorsally; internarial region concave. Top of head flat; interorbital region 31% width of head; diameter of eye 26% width of head. Supratympanic fold distinct, thick, extending posteroventrally from posterior margin of

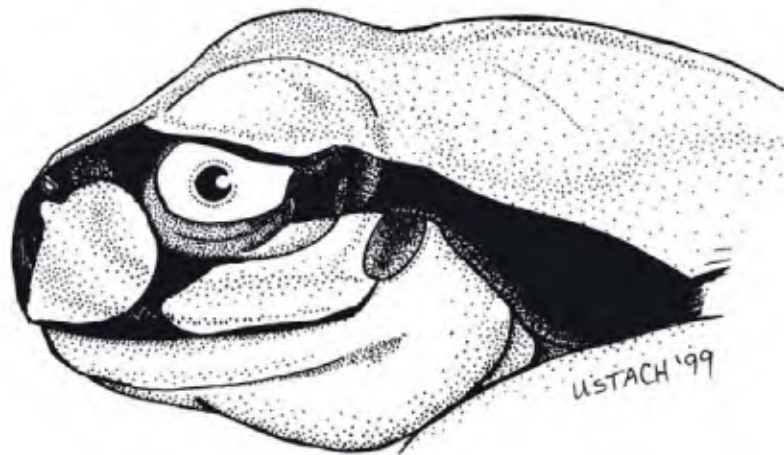
orbit, becoming indistinct at level of insertion of forearm; tympanum distinct, round; tympanic annulus distinctly raised anteriorly, indistinct ventrally and posteriorly, obscured by supratympanic fold dorsally; diameter of tympanum 35% diameter of eye; diameter of tympanum 60% eye-tympanum distance.

Axillary membrane absent; thoracic fold and dermal fold on wrist absent; fingers long, slender, with narrow lateral fringe, bearing large, ovoid terminal discs; relative lengths of fingers: $I < II < IV < III$; discs on Fingers II–IV equal in size, as wide as tympanum; disc on Finger I smaller than discs on other fingers, width approximately 60% diameter of tympanum; subarticular tubercles large, diameter about one-half width of terminal disc on same finger, rounded, elevated, none bifid; supernumerary tubercles few, small, indistinct; prepollical tubercle distinct, large, elliptical; palmar tubercle bifid, large, diffuse; nuptial excrescences finely granular, brown, covering dorsal and medial surfaces of prepollex and medial surfaces of Fingers II and III; ulnar tubercles absent; webbing on hands vestigial. Heels of adpressed hindlimbs overlap, tibiotarsal articulation extending to eye; tarsal fold distinct; tibia length 53% SVL; foot length 47% SVL; inner metatarsal tubercle distinct, large, ovoid; outer metatarsal tubercle barely evident, low, diffuse; subarticular tubercles distinct, large, diameter about one-half width of terminal disc on same toe, rounded, low; supernumerary tubercles few, restricted to phalangeal areas; toes long, slender, with broad lateral fringe, bearing ovoid terminal discs approximately same size as discs on fingers; webbing thin, formula: **I1—2II2—2½III1—2½IV2½—1V** (Fig. 4).

Cloacal opening directed ventrally at lower level of thigh; cloacal sheath long. Skin on all dorsal surfaces smooth; skin on venter granular; skin on ventral surfaces of limbs smooth; tongue large, round, barely free posteriorly; vocal slits absent; vomerine dentigerous processes with eight teeth on left side, four on right side, dentigerous processes transverse, situated at midlevel



A.



10 mm

B.



of choanae, narrowly separated medially; choanae round, widely separated.

Coloration of holotype.—In preservative, dorsum of body, limbs, and head, and lateral surfaces of head steel gray; nine small, distinct black markings scattered over posterior half of dorsum; distinct black lateral stripe extending from anterior margin of upper lip, through narial and orbital regions, following the supratympanic fold, extending to insertion of hindlimb, margins of stripe smooth in all regions, except undulating on the flank; lateral surface of forearm and shank with distinct, smooth-edged black stripe; tympanum black; distinct suborbital bar extending ventrally from margin of orbit to margin of upper lip. Ventral surfaces of body, forelimbs, and hands dull cream; ventral surfaces of hindlimbs and feet dull gray; throat area dull cream with five diffuse pale gray markings; flank region below lateral stripe dull cream.

Coloration in life.—(Fig. 1: UTA A-5883, male, paratype; from UTA color transparency 16154) Dorsum of body, limbs, head, and lateral surfaces of head yellowish tan; nine small, distinct black markings scattered over posterior half of dorsum; distinct black lateral stripe extending from anterior margin of upper lip, through narial and orbital regions, following the supratympanic fold, extending to insertion of hindlimb, margins of stripe smooth in all regions, except undulating on the flank; lateral surface of forearm and shank with distinct, smooth-edged black stripe; tympanum black; distinct suborbital bar extending ventrally from margin of orbit to margin of upper lip; margin of upper lip narrowly edged with black; distal portion of digits and upper surface of discs dull gray; axillary and inguinal areas below black flank stripe bright yellow; venter mostly cream; iris gold, heavily reticulated with black.

Variation.—Morphometric variation among adults is summarized in Table 1.

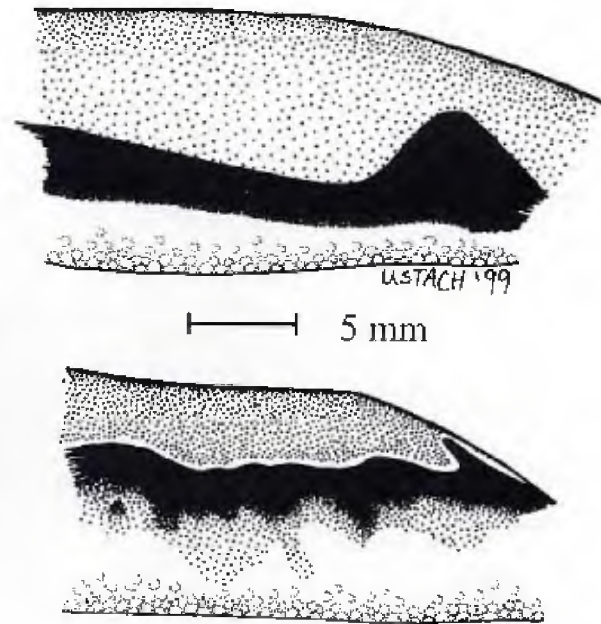


FIG. 3.—Lateral markings of *Hyla calthula* (top) (UTA A-13371) and *H. pentheter* (KU 136873) (bottom).

Most (13/21) individuals have 10–16 distinct, black markings scattered over posterior half of dorsum and distinct black flecks scattered over anterior half of dorsum and on the dorsal surface of the tibia. The black lateral stripe on the flank is interrupted posteriorly in some specimens, and the suborbital bar that extends ventrally from the margin of the orbit to the margin of upper lip is absent in some specimens. Most individuals (19/21) have brown markings scattered over the ventral surfaces of the body. These marks vary from faded gray to bold brown (may be an artifact of preservation). Nearly half of the specimens (10/21) have a ring of brown pigment around the pectoral region. The markings on the throat area vary from pale gray to dark brown. Nearly half of the specimens (10/21) have scattered markings on the flank region below the lateral stripe; these marks also vary from pale gray to dark brown. The concentration of the minute spinules forming the nuptial excrescences varies from dense to light. A few

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FIG. 2.—(A) Dorsal and profile aspects of the head of a male *Hyla calthula* (UTA A-5885, holotype) and (B) profile of a male *H. pentheter* (KU 136873) for comparison.

TABLE 1.—Comparison of morphometric variation among adults of *Hyla calthula* and *H. pentheter*: Mean \pm SD above range (in parenthesis); all measurements in mm.

Variable	Males		Females	
	<i>H. calthula</i> n = 18	<i>H. pentheter</i> n = 31	<i>H. calthula</i> n = 3	<i>H. pentheter</i> n = 2
Snout-vent length*	52.3 \pm 1.9 (49.5–56.1)	45.0 \pm 2.6 (39.0–51.1)	59.2 \pm 2.7 (56.1–61.3)	53.8 \pm 2.3 (52.2–55.5)
Tibia length†	28.0 \pm 1.4 (26.4–31.8)	23.7 \pm 0.9 (21.9–26.1)	31.5 \pm 1.0 (30.9–32.7)	29.9 \pm 1.1 (29.1–30.6)
Foot length‡	24.9 \pm 1.4 (21.6–27.4)	20.0 \pm 1.2 (16.6–23.7)	27.9 \pm 0.5 (27.4–28.3)	25.6 \pm 0.2 (25.5–25.8)
Head length†	17.2 \pm 0.8 (15.7–18.5)	14.3 \pm 1.3 (10.8–16.9)	19.3 \pm 1.6 (17.7–21.0)	18.0 \pm 0.7 (17.5–18.5)
Head width†	19.8 \pm 1.0 (18.1–21.9)	17.0 \pm 1.3 (14.2–20.0)	22.2 \pm 0.7 (21.4–22.8)	21.5 \pm 0.7 (21.0–22.1)
Tympanum diameter†	2.0 \pm 0.1 (1.7–2.2)	2.7 \pm 0.3 (2.1–3.4)	2.5 \pm 0.8 (1.7–3.2)	2.8 \pm 0.3 (2.6–3.0)
Eye diameter‡	5.6 \pm 0.4 (4.9–6.3)	5.1 \pm 0.4 (4.2–6.0)	6.6 \pm 0.7 (6.0–7.4)	5.5 \pm 0.8 (4.9–6.1)
Snout length†	6.7 \pm 0.3 (6.3–7.2)	5.8 \pm 0.3 (5.2–6.5)	7.5 \pm 0.1 (7.5–7.6)	7.4 \pm 0.1 (7.3–7.5)

* *t*-test (males only), $F = 3.15$; $P = 0.0001$; $df = 45$.

† ANCOVA (males only), $P = 0.0001$; $df = 3$.

‡ ANCOVA (males only), $P = 0.003$; $df = 3$.

specimens that have a light concentration of minute spinules also lack any on the third digit.

Distribution and ecology.—The type-locality, Totontepec, lies at the headwaters of the Río de la Lana, at about 1830 m on the Atlantic versant of the Sierra Mixes. One of us (J. A. Campbell) found the holotype at night in secondary cloud forest habitat. We collected tadpoles at night, in pools of a small stream formed from springs emanating from a grassy hillside; the water temperature was approximately 15 C. We also saw them by day hiding under large boulders. Other amphibians found by us in the immediate vicinity of these springs were *Eleutherodactylus berkenbuschii* and *Pseudoeurycea belli*.

Tadpole.—The format of the tadpole description follows that of McDiarmid and Foster (1981) and the terminology follows that of Altig (1970, 1987). The tadpoles described were preserved in 10% buffered formalin. An ontogenetic series was obtained by raising tadpoles in the field through complete metamorphosis. Diagnostic comparisons of tadpoles were made against *Hyla pentheter*, a similar-looking species of the *H. bistincta* group (Duellman, 1970). Tadpoles were staged according to Gosner (1960).

Knowledge of the tadpoles of the 15 species in the *Hyla bistincta* group is incomplete. Larvae of *H. calvicollina*, *H. cembra*, *H. charadricola*, *H. chryses*, *H. labedactyla*, *H. mykter*, *H. pachyderma*, and *H. sabrina* are unknown; descriptions of tadpoles of the remaining species were presented by Duellman (1970) and Caldwell (1974).

The tadpole of *Hyla calthula* is similar to other known tadpoles of the *H. bistincta* group (i.e., occur in cold mountain streams, continuous fringing papillae on the upper lips, and expanded labia with one or more rows of large submarginal papillae medial to the fringing papillae: Duellman, 1970; Duellman and Campbell, 1992; Toal and Mendelson, 1995). One of us (J. A. Campbell) collected 100 tadpoles in Stages 26–46 at the type locality. This description is based on a single tadpole (UTA A-27805; Stage 36).

Measurements (in mm): total length 66.6; body length 17.9; tail length 48.7; height of tail muscle (at base of tail) 7.9; width of tail muscle (at base of tail) 7.0; maximum height of dorsal fin 4.2; (at point 27.6 posterior to body terminus); maximum height of ventral fin 4.1 (at point 29.5 posterior to body terminus); body width 12.2; body height 12.5; eye diameter

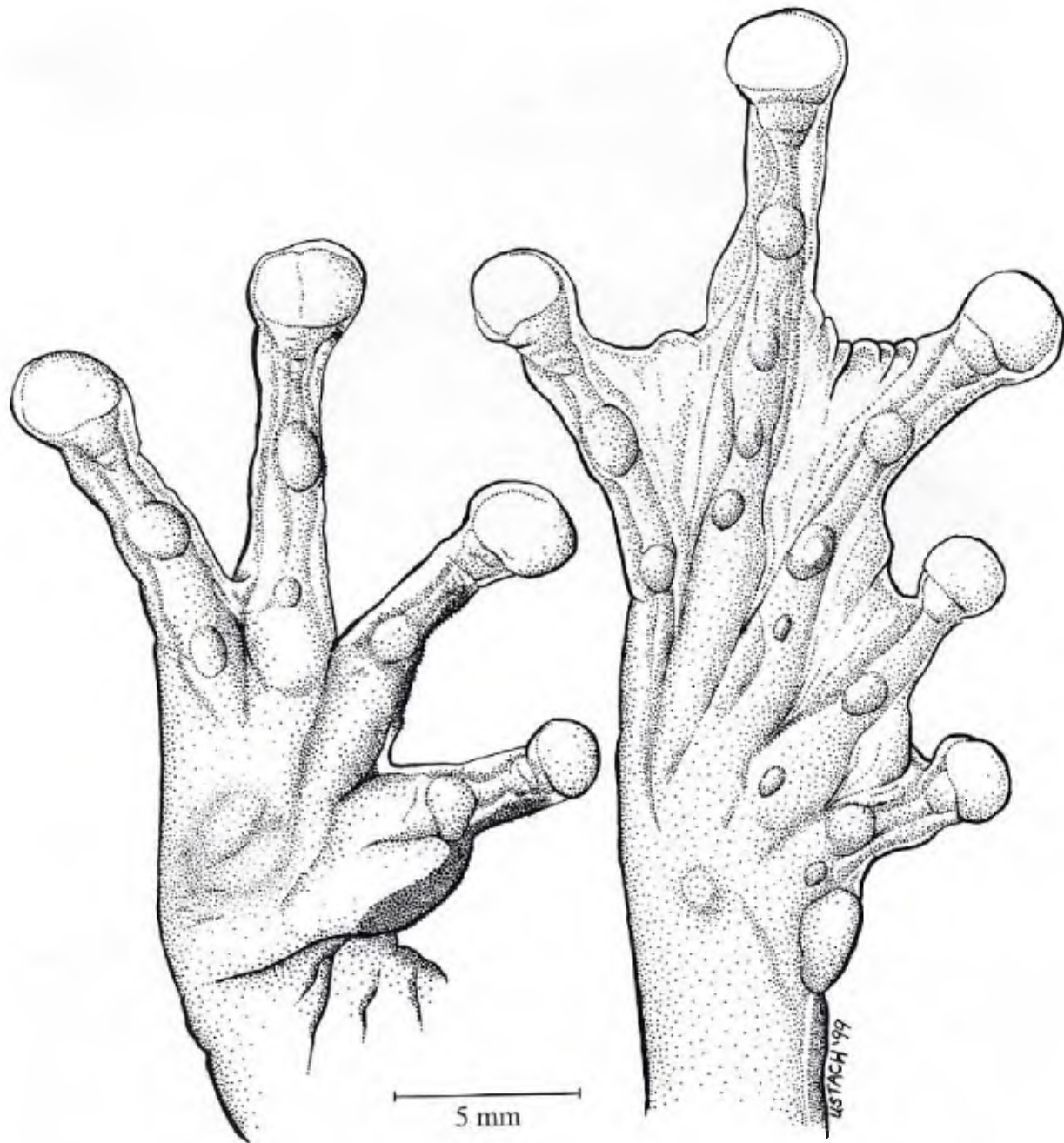


FIG. 4.—Ventral aspect of the hand and foot of the holotype of *Hyla calthula*; (UTA A-5885).

2.0; pupil diameter 0.6; interorbital distance 7.1; narial diameter 0.4; internarial distance 4.6; snout–naris distance 1.3; snout–eye distance 6.6; snout–spiracle distance 10.8; naris–eye distance 3.1; oral disc diameter (transverse) 6.1.

Body bluntly ovoid in dorsal view, widest at about midpoint, taller than wide, bullet-shaped in lateral view; neuromasts visible; snout nearly semicircular in dorsal profile, rounded in lateral profile; eyes

moderate, not part of dorsal profile, directed laterally, separated by distance about 3.5 times eye diameter; nostrils large, directed laterally, closer to eye than tip of snout. Spiracle sinistral, short, opening near midbody slightly below midline, directed posterodorsally at about 45°, lateral wall slightly shorter than medial wall, forming round aperture. Vent tube dextral. Caudal musculature robust, highest at base, gradually tapering to pointed tip, ris-

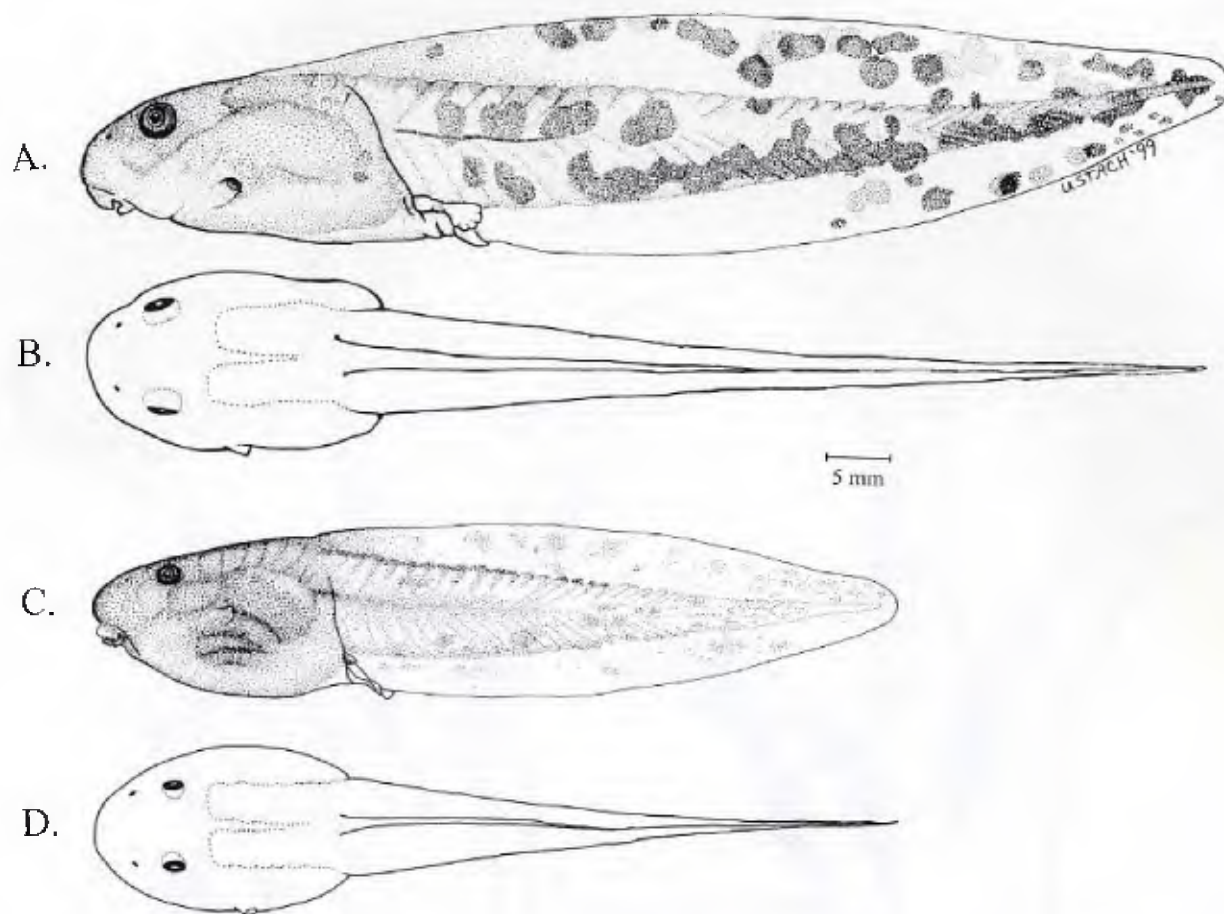


FIG. 5.—(A) Lateral view of the tadpole of *Hyla calthula* and (B) a schematic of the dorsal view; Stage 36 (UTA A-27815). (C) Lateral view of Stage 27 *H. calthula* and (D) a schematic of the dorsal view, showing difference in color pattern and body shape; (UTA A-27829).

ing slightly near tip. Caudal fin well developed, extending 2.3 mm onto body from base of caudal musculature, tip rounded; dorsal fin slightly higher than ventral fin, tallest about one-third its length from body; ventral fin shallowest near body but of nearly equal height throughout its length (Fig. 5).

Oral disc moderate in size, anteroventral in position, width about 1.2 times distance between eyes, not emarginate, completely bordered by two rows of small, truncate lateral marginal papillae; approximately 30 larger, lobate submarginal papillae at lateral tips of tooth rows from which arises a single row of submarginal papillae medial to the marginal papilla on the anterior labium; a single row comprised of approximately 16 larger truncate submarginal papillae present medial to the marginal papilla on the posterior labium. Labial tooth

row formula 2(2)/3; A_2 longest of all tooth rows, slightly longer than A_1 ; P_1 – P_3 shorter in length than A_2 with $P_1 > P_2 > P_3$; A_2 gap narrow. Upper jaw wide, jaw sheath serrate, medial part of serrate edge weakly convex, lateral processes tapering abruptly posterolaterally; lower jaw wide, width slightly greater than width of upper jaw, jaw sheath serrate, weakly V-shaped (Fig. 6).

In preservative, dorsal surface of body uniformly pale brown with some small, darker spots laterally; ventral surface of body opaque with few, brown spots; gut visible ventrally, slightly visible laterally. Throat transparent, with few brown spots. Caudal musculature cream with brown dorsal stripe, and large brown spots and blotches; dorsal and ventral tail fins opaque with uniformly distributed brown spots and blotches.

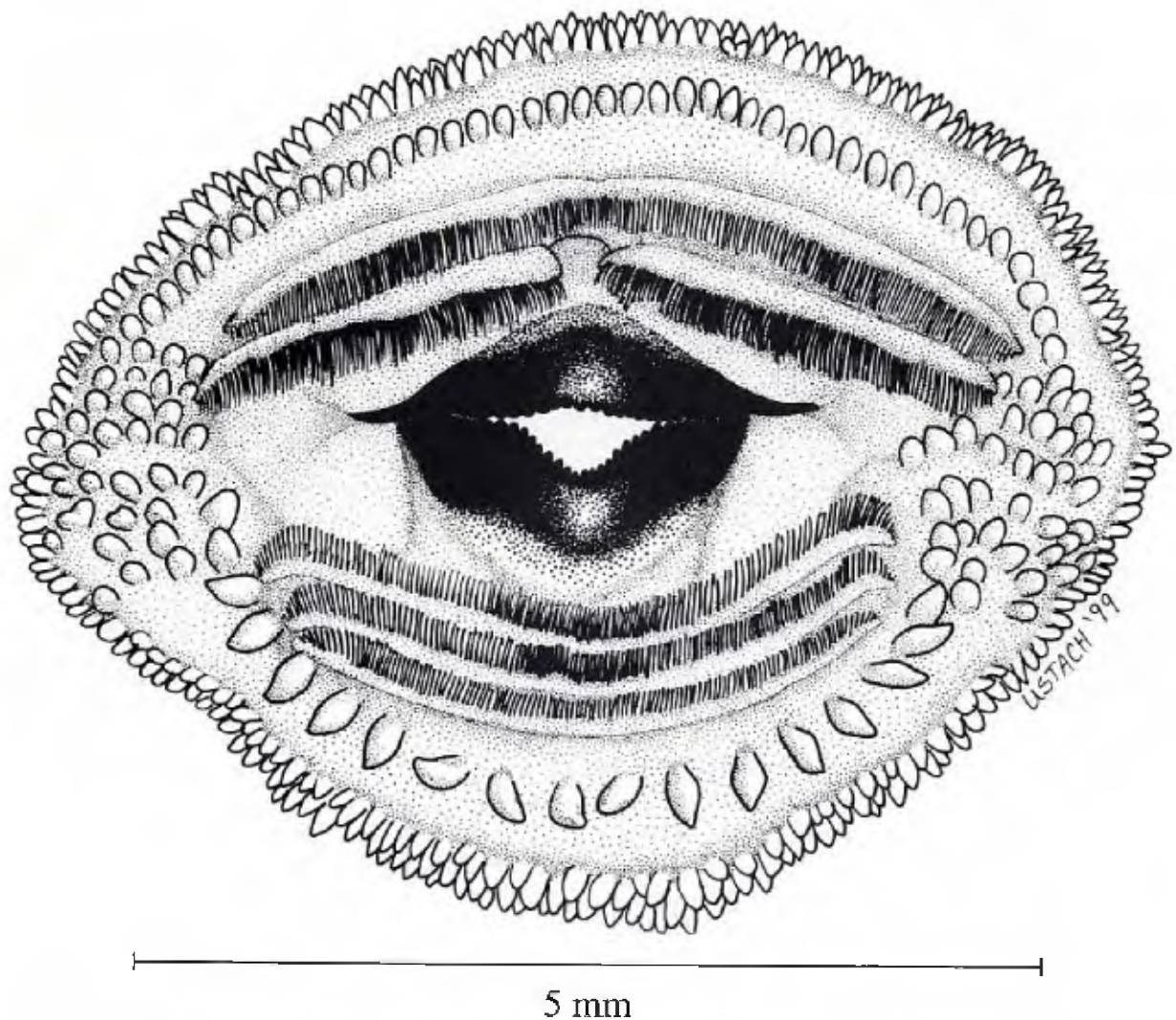


FIG. 6.—Mouthparts of the tadpole of *Hyla calthula*; Stage 36 (UTA A-27815).

Ontogenetic variation.—We initially collected tadpoles (UTA A-5888, 6168, 27804–34) in the field that were at or near Stage 26. We preserved a sample of these in 10% formalin within 2 h of capture. We brought remaining tadpoles back to camp and reared them in plastic containers (30 cm by 18 cm by 15 cm) and fed them Tetra Min®, a commercial fish food. We preserved samples representing subsequent stages through complete metamorphosis in 10% buffered formalin. We collected a series of smaller tadpoles (UTA A-44990, 44999, 45000) at Stages 25 and 26 from the same locality seven years later. Morphometric variation among tadpoles is summarized in Table 2. Specimens within specific stages are invariant with respect to

major aspects of morphology and morphometry. Among-stages variation exists in color pattern, body shape, the size of the eyes, and the number of submarginal papillae at the lateral tips of the tooth rows. From Stages 25 to 34, the dorsal stripe of the caudal musculature is present, but there are no large, dark brown spots or blotches on the lateral surface of the musculature and tail fins. Rather, the tail fins and musculature have brown flecks interspersed with faintly formed brown spots. In these younger stages, the body shape is also more ovoid in dorsal view and globular in lateral view than in the later stages and the eyes are directed dorsolaterally rather than laterally (Fig. 5). Around Stages 35 and 36, the tadpoles assume the col-

TABLE 2.—Morphometric variation among tadpoles of *Hyla calthula* before and after Stage 35.

Variable	< Stage 35 n = 39	≥ Stage 35 n = 34
Total length	50.7 ± 14.4 (22.0–73.0)	71.3 ± 4.0 (64.1–78.5)
Body length	15.2 ± 3.1 (8.3–18.9)	19.9 ± 1.3 (17.8–22.6)
Basal tail muscle height	5.9 ± 1.8 (2.3–8.5)	8.2 ± 0.5 (6.8–9.1)
Maximum dorsal fin height	33.3 ± 0.8 (1.6–4.4)	5.1 ± 0.5 (4.1–6.0)
Maximum ventral fin height	2.9 ± 0.6 (1.5–3.9)	4.1 ± 0.5 (3.2–5.1)
Eye diameter	1.4 ± 0.5 (0.6–2.5)	2.5 ± 0.2 (1.8–2.8)
Interorbital distance	5.0 ± 1.2 (2.7–7.1)	7.2 ± 0.5 (6.1–8.2)

or pattern, body shape, and eye position described for the specimen above. The spots and blotches become increasingly darker with each successive stage thereafter. Tadpoles at, or below, Stage 26 and less than approximately 12 mm body length are indistinguishable from tadpoles of *Hyla pentheter*. Tadpoles less than, or equal to, 12 mm body length have approximately 12–16 submarginal papillae at the lateral tips of the tooth rows. Tadpoles >12 mm body length have approximately 30 submarginal papillae at the lateral tips of the tooth rows. At approximately Stages 41 and 42, the tooth rows are still complete, but the denticle length is noticeably smaller and the jaw sheaths are gone. At approximately Stages 42 and 43 the tail fin begins to resorb and the tooth rows are absent. One tadpole (UTA A-6168) at Stage 43 has all four limbs emerged and a SVL of 23.6 mm and a tail length of 18.7 mm. One specimen (UTA A-6168) at Stage 44 has a SVL of 22.2 mm and a tail length of 8.4 mm. A Stage 45 specimen (UTA A-6168) has a SVL of 26.8 mm and a tail bud. Two specimens at Stage 46 have SVLs of 23.2 mm and 26.4 mm.

The ontogenetic variation observed in this series of a species from the *Hyla bistincta* group is important to note when considering the tadpole illustrations presented by Straughan and Wright (1969) and Duellman (1970) from the same group. Straughan and Wright (1969) illustrated and described similar changes in

shape and color pattern in a developmental series of *H. bogertae* (= *H. crassa*) tadpoles. The four tadpoles of the *H. bistincta* group illustrated in Duellman (1970) show the same variation in color pattern and shape according to stage as we observed in this series of *H. calthula*. Tadpoles of *H. pentheter*, *H. bistincta*, and *H. robertsoni* illustrated by Duellman (1970) are all earlier than Stage 34 and exhibit the same color pattern that we observed in tadpoles of *H. calthula* earlier than Stage 34. Moreover, tadpoles of *H. pentheter* at or earlier than Stage 26 and <12 mm body length are indistinguishable from tadpoles of *H. calthula*. The tadpole of *H. siopela* illustrated by Duellman (1970) is at Stage 36 and exhibits the same dark spots and blotches and streamlined body shape as observed in *H. calthula* in the same stage. Based on these similarities, there is reason to suspect that other tadpoles in the *H. bistincta* group may exhibit similar ontogenetic variation, although no study has addressed this issue. Consequently, we suggest that these tadpoles may be difficult to identify when they cannot be positively associated with known adults.

Etymology.—The specific epithet, *calthula*, is derived from a Latin noun and means “yellow robe” in allusion to the dorsum of this frog which is set off dramatically from the black border on the flanks.

Remarks.—One of us (J. R. Mendelson III) visited the type locality in 1992 and found virtually no remaining forest in the

region. It is unlikely that this species persists in this area, and we are unaware of any other populations.

The genus *Hyla* is demonstrably paraphyletic (da Silva, 1998), and our referral of this species to this genus is necessarily tentative. Duellman (1964, 1970) referred several Mexican species of treefrogs to the phenetic *H. bistincta* group, and this name has been used frequently in the systematic literature (e.g., Caldwell, 1974; Duellman and Campbell, 1992). The monophyly of this group has not been established, and thus its content and definition (based on synapomorphies) are unclear (see Toal and Mendelson, 1995). We tentatively refer *H. calthula* to the *H. bistincta* group because it has been confused with *H. pentheter* (a member of the *H. bistincta* group; Duellman, 1970) and bears superficial similarity to other members of the group. However we agree with Toal and Mendelson (1995) and da Silva (1998) that recognition of the *H. bistincta* group and other species groups in *Hyla*, are acts of taxonomic convenience and tradition, pending a complete phylogenetic analysis of these frogs.

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APPENDIX I

Specimens Examined

Adults

Hyla bistincta.—MEXICO: GUERRERO: 4.5 km E El Limon, 1525 m (KU 140420–23); 3.3 km N San Vicente, 920 m (KU 87117); MICHOACAN: 14 mi. [22.5 km] from rt. 15 on Valle de Bravo rd. (KU 148653); Uruapan, 5500 ft. [1676 m] (KU 68077–78); Uruapan, 5500 ft. [1676 m] (UMMZ 112838–39, 115232–33); Dos Agnas (UMMZ 119193–34); OAXACA: 5.6 km WSW Tlaxiaco (UTA A-3652); 38.1 km E Teotitlan on road to Huautla, 2118 m (UTA A-13148); El Tejocote (UTA A-17133).

Hyla pentheter.—MEXICO: GUERRERO: 5.6 km (by road) NE Yerbabuena, 2000 m (KU 140424–26); OAXACA: 29 km SSE Juchatengo, 1980 m (KU 86936); 37 km N San Gabriel Mextepec, 1860 m (KU 100931–33); 0.2 km N Jalatengo, 1280 m (KU

136863-71); 5.1 km S Jalatengo, 1390 m (KU 136872-77); 36.7 km N San Gabriel Mixtepec, 1690 m (KU 136878); 32.9 km N San Gabriel Mixtepec, 1530 m (KU 136879-83, 136885); 37 km N of San Gabriel Mixtepec [about 100 km airline SSW of Oaxaca de Juarez], 1700 m (UMMZ 125377-81); Putla (USNM 304860).

Hyla calthula.—MEXICO: OAXACA: Sierra Mixe, Totontepec, head waters of Rio de la Luna, 6000 ft. [1829 m] (UTA A-5788, 5876-86, 8508-9); Sierra Mixe, Totontepec, 6220 ft. [1896 m] (UTA A-6929-32); Sierra Mixe, Totontepec, 1798 m (UTA A-13369); Sierra Mixe, E side Totontepec, 1780 m (UTA A-13370-71).

Larvae

Hyla pentheter.—MEXICO: OAXACA: Putla, 25 mi [40 km] N of, on Highway 125, 4480 ft. [1366 m] (USNM 304934); San Gabriel Mixtepec, 36 km N of, on Oaxaca Rte. 131, 5440 ft. [1658 m] (USNM 304945); San Gabriel Mixtepec, 30 km N of, on Oaxaca Rte. 131, 4590 ft. [1399 m] (USNM 304949); San Gabriel Mixtepec, 37 km N of, on Oaxaca Rte. 131, 5550 ft. [1692 m] (USNM 304950-1); 9.3 km S Sola de Vega (UTA A-27538).

Hyla calthula.—MEXICO: OAXACA: Sierra Mixe, Totontepec, (UTA A-5888, 6168, 27804-34, 44990, 44999, 45000).