

*L. chaquensis* are described. Lungs well developed, about length of floor of mouth; partially inflated. Filamentous gills present.

**VENTRAL ASPECT.**—*Buccal Cavity*: Medial pair of infralabial papillae fused on common base; papillae smaller and less elaborate than in *L. chaquensis*; prenarial arena without additional pustulations (Figure 53a). Four lingual papillae in forwardly arching row; all simple and attenuate. BFA V-shaped; 8–10 papillae on each side; all thin and conical, lacking bifurcations. One or two small prepocket papillae. Three or four papillae lateral to BFA just posterior to medial edge of pockets. Buccal pockets perforated. Single papilla on either side of median notch.

*Pharyngeal Cavity*: Branchial baskets slightly smaller than in *L. chaquensis*. Tops of filter plates slightly more tipped than in *L. chaquensis*; cb 1 with 9–10 filter rows, cb 2 with 11, cb 3 with 9 or 10, cb 4 with 7. Filter mesh with quaternary folds. Filter canals 90% canopied. Glottal lips thicker than in *L. chaquensis*; faint laryngeal disk.

**DORSAL ASPECT.**—*Buccal Cavity*: Anterior narial wall pustulate, without distinct papilla. Small, posterolateral, secondary papillae in postnarial arena; larger pair of papillae not as large as in *L. chaquensis* and not abutting on midline. Median ridge broader than in *L. chaquensis*. Lateral-ridge papillae non-branching. Four or five BRA papillae on each side. Free medial margin of dorsal velum more pustulate and less papillate than in *L. chaquensis*.

### *Leptodactylus knudseni* Heyer

FIGURE 21

**MATERIAL.**—USNM field 44780 (one specimen dissected, stage 39, SVL 18.9 mm). Collected from forest pond at Reserva Biologica Rio Trombetas, Pará, Brazil, 9 February 1979, by Ronald I. Crombie.

**REFERENCE.**—The larval external morphology is being described by Ronald I. Crombie (pers. comm.). The habitus is very similar to that of *L. labyrinthicus* or *L. pentadactylus*.

**GENERAL REMARKS.**—Only those features that differ from *L. chaquensis* are described. Lungs average size; left lung larger than right, left lung about same length as buccal floor, right 20% smaller; not inflated.

**VENTRAL ASPECT.**—*Buccal Cavity*: Five infralabial papillae as two tiny knobs far forward, third one posteromedial on midline in form of anteriorly cupped palp with deep anteromedial cleft; last pair posterolateral and largest, consisting of multiangular knobby palp-like structures; no infralabial papillae touching, all well separated from each other (Figure 53b). BFA a bit more open posteriorly than in *L. chaquensis*; up to 10 BFA papillae on each side; no BFA papillae with bifurcations, not as tall or attenuate as in *L. chaquensis*. Two or three tiny prepocket papillae. Only 1 or 2 papillae lateral to BFA just posterior to medial edge of pockets. Buccal pockets perforated. Marginal papillae on ventral velum shorter than in

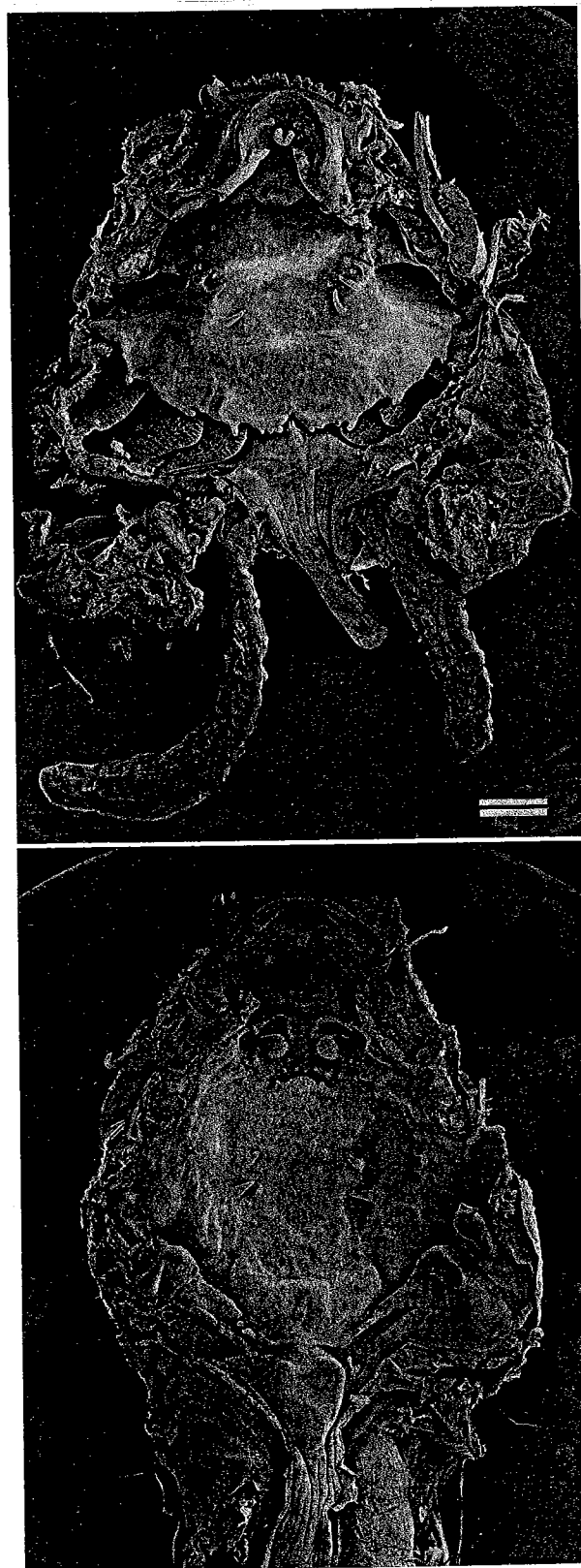


FIGURE 21.—SEM micrographs of floor (above) and roof (below) of oral cavity of *Leptodactylus knudseni*; scale line = 1 mm.

*L. chaquensis*; secretory pits not as conspicuous as in *L. chaquensis*.

**Pharyngeal Cavity:** Branchial baskets wider than long by 20%; irregularly oval. Third and fourth filter plates with distinct upward curving peaks; 2nd filter plate with straight dorsal margin; 3rd filter plate overlapping 4th more extensively than in *L. chaquensis*; cb 1 with 11 filter rows, cb 2 with 12, cb 3 with 12, cb 4 with 7.

**DORSAL ASPECT.—Buccal Cavity:** Prenarial arena with faint posteriorly directed broad V-shaped notch on midline flanked directly laterad by 1 or 2 pustulations. No papillae on prenarial wall; single, large, globose, postnarial papilla directly posterior to median half of nares with completely smooth surface. Median ridge broader than in *L. chaquensis*, with serrate lateral edges; no distinct terminal papilla; anterior surface smooth (Figure 61b). Lateral-ridge papillae small, simple, triangular structures with rugose margins; each about  $\frac{1}{4}$  size of median ridge. BRA triangular, poorly defined by 2 or 3 papillae on each side; about 3 dozen pustulations scattered about BRA and postnarial arena. Anterior margin of ventral velum smooth.

*Leptodactylus mystacinus* (Burmeister)

FIGURE 22

**MATERIAL.**—USNM 241303 (single specimen dissected, stage 37, SVL 12.2 mm). Collected from a temporary pond in a clearing at Fazenda do Veado, Serra da Bocaina, São Paulo, Brazil, 3 January 1977.

**REFERENCE.**—Sazima (1975) described and figured the external larval morphology.

**GENERAL REMARKS.**—Only those features that differ from *L. chaquensis* are described. Lungs well developed, 80%–90% length of buccal floor; not inflated. Filamentous gills present.

**VENTRAL ASPECT.—Buccal Cavity:** Medial pair of infralabial papillae fused to common base. Four lingual papillae in a transverse row; tall, simple, subequal in size. Seven or eight BFA papillae on each side; no papillae with bifurcate tips; largest 2 BFA papillae rising from common base. No papillae lateral to BFA posterior to medial edge of pockets. Buccal pockets perforated.

**Pharyngeal Cavity:** Branchial baskets wider than in *L. chaquensis*. Third and 4th filter plates curving upward more extensively and abruptly than in *L. chaquensis*; 3rd filter plate slightly taller and more imbricate than in *L. chaquensis*; cb 1 with 10 filter rows, cb 2 with 10, cb 3 with 10, cb 4 with 8. Filter rows not as abutting as in *L. chaquensis*. Filter canals 80% canopied.

**DORSAL ASPECT.—Buccal Cavity:** Roof about as long as wide. Prenarial arena with transverse ridge broadly V-shaped; rest of prenarial arena featureless. Anterior narial walls simpler than in *L. chaquensis*, lacking papillae. Small, posterolateral, secondary papillae in postnarial arena; larger pair of papillae not as large as in *L. chaquensis* and not abutting on midline.

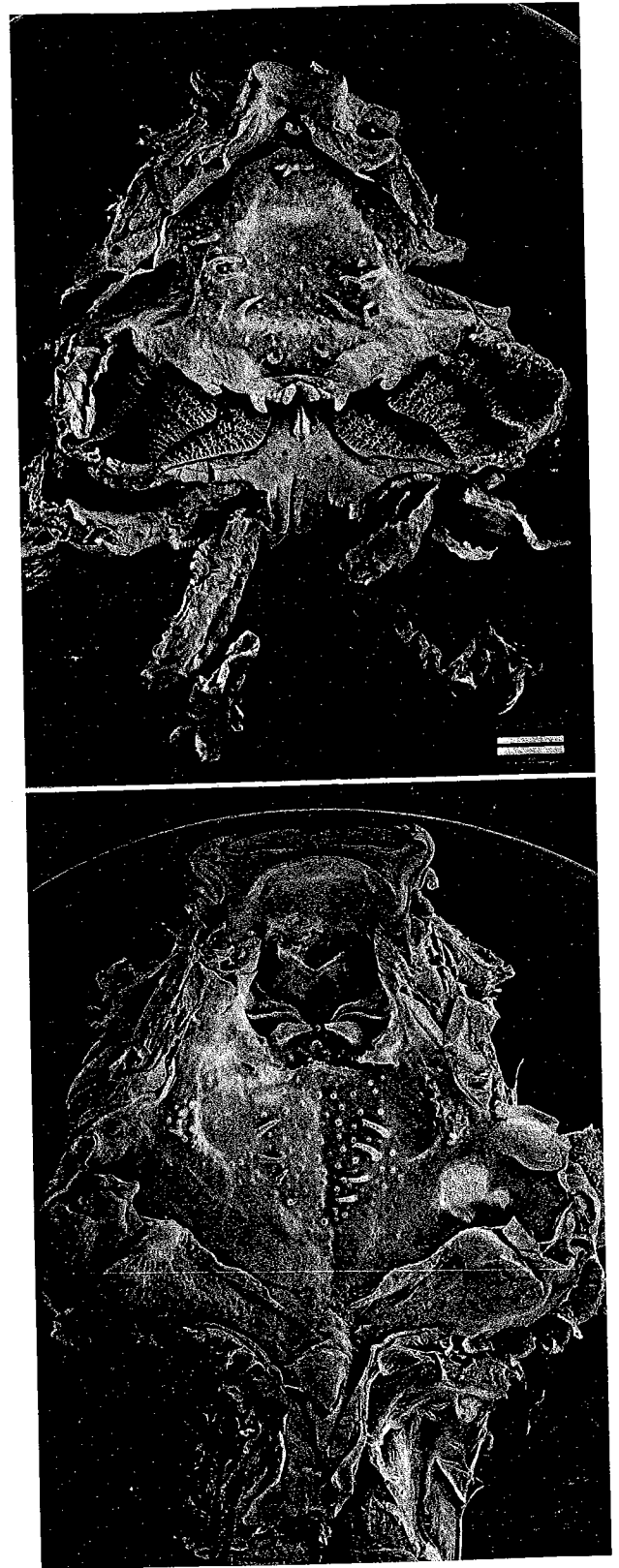


FIGURE 22.—SEM micrographs of floor (above) and roof (below) of oral cavity of *Leptodactylus mystacinus*; scale line = 1 mm.

Anterior surface of median ridge smooth, median ridge broader than in *L. chaquensis*. Lateral-ridge papillae smaller than in *L. chaquensis*, lacking terminal branches, with jagged terminal edges. Four BRA papillae on each side. Free medial margin of dorsal velum slightly pustulate, lacking papillae.

*Leptodactylus pentadactylus* (Laurenti)

**MATERIALS.**—USNM uncatalogued (single specimen dissected, stage 34, SVL 18.4 mm). Collected from 6 km west of Turrialba, Cartago, Costa Rica. Specimen subsequently destroyed in SEM preparation.

**REFERENCES.**—External descriptions are in Heyer (1970, 1979). Discussions of ecology, habitat occurrence, and facultative carnivory are found in Heyer, McDiarmid, and Weigmann (1975) and Muedeking and Heyer (1976).

**GENERAL REMARKS.**—Only those features that differ from *L. chaquensis* are described.

**VENTRAL ASPECT.**—*Buccal Cavity*: Floor of mouth relatively wide anteriorly. Four infralabial papillae, 2 fused at midline; the 2 lateral infralabial papillae simple, round palps with single, medially directed, apical projection; all infralabial papillae relatively small but distinct and anteriorly-posteriorly flattened. Three lingual papillae; medial papilla anteriorly-posteriorly flattened, distinctly bifurcate; other 2 lingual papillae simple, attenuate, posterolateral to medial one. Elongate oval BFA, not distinctly defined anteriorly; 6 BFA papillae on one side, 5 on other, simple attenuate cones; no pustules or bifurcations. Randomly scattered pustulations anterior to buccal pockets and on posterior half of BFA. Buccal pockets long, not as wide as in *Leptodactylus chaquensis*; transversely oriented; distinctly perforated. Posterior margin of ventral velum crenulate, peaks over filter cavities relatively small, but distinct; median notch wide and jagged; secretory pits of velar surface very conspicuous, but limited to free margin of velum; secretory pits densest medially, except right in front of median notch.

*Pharyngeal Cavity*: Area of both branchial baskets about 80% of buccal floor area. Second filter plate largest, 40% larger than 1st or 3rd; 3rd filter plate imbricating 3rd filter cavity covering  $\frac{1}{2}$  the filter cavity; cb 1 with 9 filter rows, cb 2 with 11, cb 3 with 10, cb 4 with 9. Filter mesh moderately dense with tertiary and higher order folds present. Filter rows moderately wide, intermittently abutting, but filter canals exposed; filter canals about  $\frac{1}{4}$  width of filter rows. Glottis small with tall, moderately thick lips.

**DORSAL ASPECT.**—*Buccal Cavity*: Roof of mouth wide, trapezoidal, almost as wide as tall; nares located about  $\frac{1}{4}$  distance from front of mouth to esophagus. Weak, posteriorly directed, wide, V-shaped elevation in middle of prenarial arena, located about  $\frac{2}{3}$  distance from upper beak to nares, otherwise no other structures (pustulations or papillae) in prenarial arena. Nares large; transversely directed; anterior narial wall thick, short, lacking papillae. Postnarial arena with 2 short, stout,

postnarial papillae with rounded apices together with a few small pustulations in the postnarial region. Median ridge small, rounded, but with slightly jagged ventral margin; median ridge lacking any secondary papillae or pustulations. Lateral-ridge papillae small, stout, with jagged apices, located far lateral and slightly anterior to median ridge. BRA poorly defined, with only 1 or 2 small attenuate papillae on each side; BRA papillae not bifurcate. Several dozen randomly distributed pustulations on buccal roof; fewer pustulations laterally. Glandular zone wide and smooth; secretory pits dense, not distinct under light microscope. Dorsal velum short; interrupted medially; with a slightly rough medial margin on each side.

*Pharyngeal Cavity*: Destroyed in dissection.

*Leptodactylus wagneri* (Peters)

FIGURE 23

**MATERIAL.**—USNM 241307 (two specimens dissected, stage 37, SVL 10.8 mm; stage 38, SVL 9.9 mm). Collected from pond at Curuçá, Amazonas, Brazil, 9 November 1975.

**REFERENCE.**—Kenny (1969) described the external anatomy (as *Leptodactylus podicipinus petersi*).

**GENERAL REMARKS.**—Only those features that differ from *L. chaquensis* are described. Lungs long, about length of buccal floor, uninflated. Dense gill filaments.

**VENTRAL ASPECT.**—*Buccal Cavity*: Three infralabial papillae, one on midline bifurcate. No lingual papillae. Zero to three pre-pocket papillae. Posterior edge of ventral velum symmetrically sculptured, small papillae irregularly spaced on edge; median notch average size.

*Pharyngeal Cavity*: Cb 1 with 9 filter rows, cb 2 with 10, cb 3 with 11, cb 4 with 6. Filter rows mostly not abutting. Filter canals 80% canopied. Glottis 80% exposed when viewed from above; glottal lips thicker than in *L. chaquensis*.

**DORSAL ASPECT.**—*Buccal Cavity*: Prenarial arena lacking pustulations and ridge less relief than in *L. chaquensis*. Anterior narial papilla a knob-like structure. Postnarial arena with second small papillae between medial papilla and lateral-ridge papilla. Lateral-ridge papillae simpler structures than in *L. chaquensis*. About 6 BRA papillae on each side. Glandular zone less distinct than in *L. chaquensis*. Papillae on free velar margin smaller than in *L. chaquensis*.

*Macrogenioglottus alipioi* Carvalho

FIGURE 24

**MATERIAL.**—USNM 200456 (one specimen dissected, stage 31, SVL 17.7 mm). Collected from a forest pond near Santa Teresa, Espírito Santo, Brazil, 15 April 1971, by James F. Jackson, Jr.

**REFERENCE.**—Abravaya and Jackson (1978) described and figured the larva and discussed the reproductive behavior of the species.

**GENERAL REMARKS.**—Beaks weakly cornified. Very slight



FIGURE 23.—SEM micrographs of floor (above) and roof (below) of oral cavity of *Leptodactylus wagneri*; scale line = 1 mm.

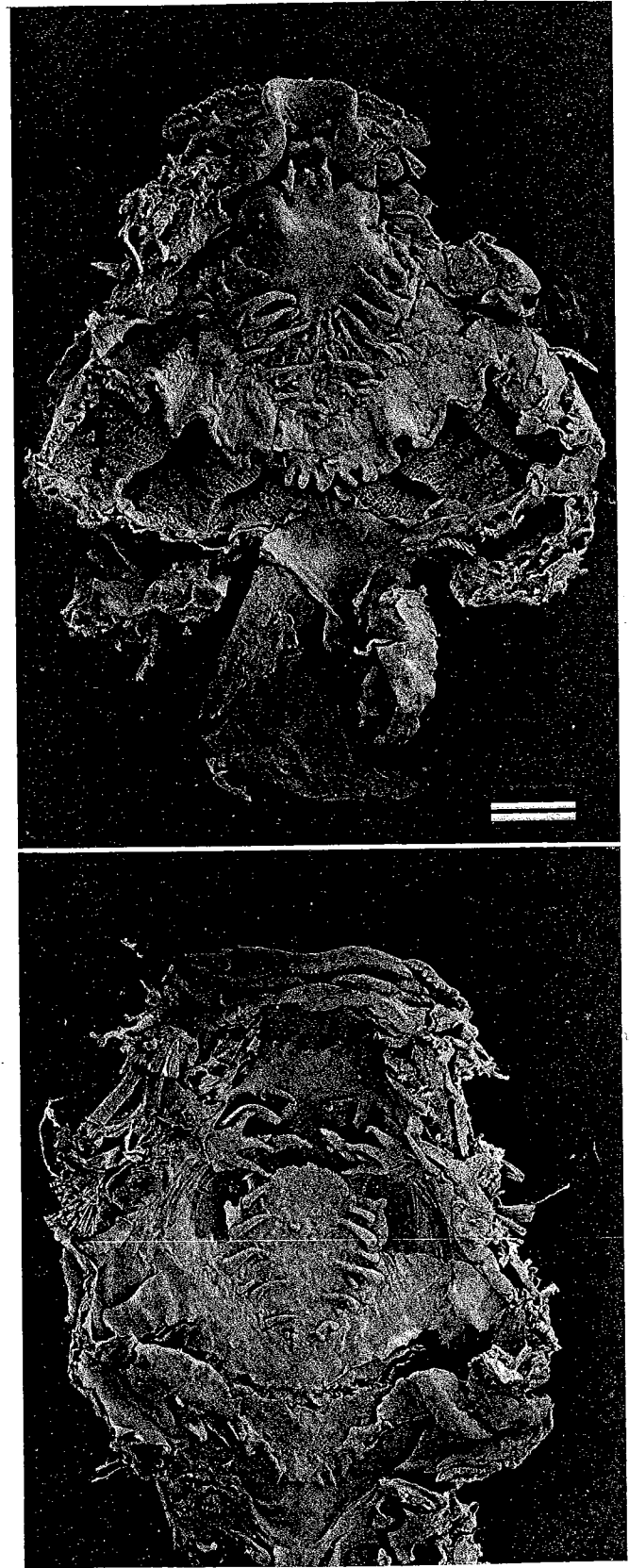


FIGURE 24.—SEM micrographs of floor (above) and roof (below) of oral cavity of *Macrogenioglottus alipioi*; scale line = 1 mm.

interhyoideus and orbitohyoideus musculature. Lungs average length, longest about equal length of buccal floor, sacculate, other lung shorter but more sacculate.

**VENTRAL ASPECT.**—*Buccal Cavity*: Floor of mouth ovoid-triangular, about as long as wide. Four infralabial papillae, 1 pair anteromedial, 1 pair posterolateral, not touching on midline, all small, conical, with serrate and rugose anterior surfaces (Figure 52c). Four lingual papillae in slightly bowed forward transverse line; lingual papillae of average size, lateral larger, with surface rugosities. BFA egg-shaped; 15–25 papillae on each side; very small, conical, anterior BFA papillae extending to base of tongue anlage; 2 larger papillae on each side medial to buccal pockets arising from common base; all BFA papillae simple, thin, lacking bifurcations or extensive surface sculpturing; 4 medium-sized papillae in one transverse row, 6 papillae in a second row running across the BFA about  $\frac{2}{3}$  distance posteriorly; assorted pustulations and small papillae scattered about the posterior half of BFA. Three or four very small, prepocket papillae on each side. Another half dozen papillae just posteromedial to buccal pockets near BFA and as a cluster continuous with posterior BFA papillae. Buccal pockets long, 50% wider than long; primarily transversely oriented; perforated (?). Free velar surface of average length; conspicuous spicular support; very wavy free margin, broad peaks over free edge of each filter plate plus additional, small, irregular peak medially, medial to peak over 4th filter plate; distinct but irregular peaks bounding median notch; median notch broad, of average depth; secretory pits small, dense, conspicuous, associated with all marginal projections and in narrow zone along posterior margin of free velar edge.

*Pharyngeal Cavity*: Branchial baskets slightly wider than long, triangular; each branchial basket about 70% or more of remaining buccal floor area; deep, twice as wide as deep; 2nd filter cavity largest, 50% larger than 1st, 3–4 times 3rd; 1st filter cavity more longitudinally oriented than 2nd or 3rd. Second filter plate with straight dorsal edge; 3rd filter plate with slightly upward-bowing dorsal edge; 2nd filter plate 50% longer than tall, 3rd as long as tall; 2nd filter plate tipped medially at 45°, ventral portion of 3rd filter plate horizontal, dorsal portion of free edge curving upward overlapping lateral half of 3rd filter cavity by about 45°; cb 1 with 11 filter rows; cb 2 with 13; cb 3 with 10, cb 4 with 8. Filter mesh dense; filter rows wide with quaternary and higher order folding common. Filter rows of relatively even size, fully abutting. Filter canals 50% or less width of rows; 100% canopied except where exposed in dissection. Branchial food traps with secretory ridges. Glottis 50% covered by ventral velum; relatively small; lips average thickness; laryngeal disk not evident. Esophageal funnel narrow; esophagus of small diameter.

**DORSAL ASPECT.**—*Buccal Cavity*: Roof of mouth triangular, about as wide as long; nares 25% distance from front of mouth to esophagus; median ridge 40% distance from front of mouth to esophagus. Prenarial arena with largely transverse

but irregular row of 8 large pustulations. Nares large; internarial distance about 30% length of naris; nares largely transversely oriented; anterior narial wall thin, not tall, with tall, posteriorly directed, conical, pre-narial papilla with some surface rugosities arising from midportion; posterior narial wall large with gently curved margin pointing downward, but no distinct narial-valve projection. Postnarial arena defined by 6 papillae on each side with largely transverse orientation although smaller more medial papillae turning anteriorly; largest papillae in middle of row; larger papillae with rugose anterior surfaces; transverse row of 4 unequal-sized conical papillae in posterior portion of postnarial arena. Median ridge large; semicircular free edge with many tiny serrations; anterior surface largely smooth with only 1 or 2 pustulations. Lateral-ridge papillae laterally compressed, flap-like structures, each with 3 conical projections, each projection with surface rugosities/pustulations; each lateral-ridge papilla about  $\frac{1}{2}$  size of median ridge. BRA egg-shaped; 10 papillae on each side; smallest papillae most caudal; pustulations scattered within BRA, a few extending anteriorly onto posterior surface of median ridge; all BRA papillae thin, pointed, not bifurcate. Few small papillae on far lateral midportion of buccal roof. Glandular zone very distinct; medium small secretory pits, barely continuous on midline; maximum length  $\frac{1}{8}$  length of buccal floor. Dorsal velum interrupted on midline; of average size; medial third on each side with papillate fringe, turning medially into esophagus.

*Pharyngeal Cavity*: Two distinct pressure cushions, lateral one (partially destroyed in dissection) apparently smaller, more medial cushion an elongate oval running anteromedial to posterolateral. Ciliary groove destroyed in dissection.

#### *Megaelosia goeldii* (Baumann)

##### FIGURE 25

**MATERIAL.**—USNM 241293, 241297 (two specimens dissected, stage 25, SVL 21.8 mm; stage 37, SVL 54.7 mm). Collected from a stream near Teresópolis, Rio de Janeiro, Brazil, 25 December 1977. Stage 25 specimen illustrated.

**REFERENCE.**—Lutz (1931) described and illustrated the external morphology.

**GENERAL REMARKS.**—Description based on stage 37 specimen, stage 25 specimen differences indicated in parentheses. Luxuriant gill filaments. Lungs slightly smaller than average, about equal to length of buccal floor (75%); not inflated.

**VENTRAL ASPECT.**—*Buccal Cavity*: Floor of mouth oval, but very broad, slightly wider than long, buccal floor overall strongly concave. Three pairs infralabial papillae in approximately transverse row; most medial pair small with unbifurcated rugose apices; 2nd pair lateral and slightly anterior, also of simple shape; largest pair posterolateral with hand-like palps bearing 6 long, rough fingers. (Two pairs of infralabial papillae; one huge anterior and lateral pair of hand-like structures with about 7 long, attenuate, interdigitating fingers; second pair simpler, smaller, each with a bifurcation, apices

