

## Catalogue of American Amphibians and Reptiles.

TRUEB, LINDA 1969. *Pternohyla*, *P. dentata*, *P. fodiens*.***Pternohyla* Boulenger  
Burrowing treefrogs***Pternohyla* Boulenger, 1882:326. Type-species *Pternohyla fodiens* Boulenger, 1882, by monotypy.

• CONTENT. Two species are recognized, *P. fodiens* and *P. dentata*.

• DEFINITION. The frogs in this genus attain sizes between 54 and 63 mm, and have a pale brown dorsum with dark brown dorsal markings. The skin of the head is partly co-ossified with underlying cranial bones. The skull is as wide as, or slightly wider than long. The snout, in dorsal view, is broadly rounded, and the canthal ridges are distinct. The surface configuration of dermal roofing bones consists of a network of prominent bony spines. The skin is co-ossified with most of the underlying cranial elements except in the regions of the frontoparietal fontanelle, the sphenethmoid, and the nasals immediately anterior to the orbits. The maxillaries are expanded laterally to form a moderate labial flange. A prenasal bone is absent, but an internasal bone is present in one species. The squamosal-maxillary arch is complete and the dermal sphenethmoid is absent. The medial ramus of the pterygoid is reduced and does not bear a bony articulation with the prootic. Bifid, spatulate teeth are present on the premaxillaries, maxillaries and pre-molars; the palatines and parasphenoid are edentate. The pupil is horizontal, and the palpebral membrane is not reticulated. The limbs are short and robust; the fingers lack webbing, and the toes are less than half webbed. The terminal discs are small and the inner metatarsal tubercle is large. Large, round, non-bifid subarticular tubercles are present, and supernumerary tubercles are poorly developed. A broad, partially bifid palmar tubercle is present. The tongue is broadly cordiform and shallowly notched behind. The *M. depressor mandibulae* consists

of two parts; one arises from the dorsal fascia and the other from the posterior arm of the squamosal. The mandibular branch of the trigeminal nerve passes between two branches of the *M. adductor mandibulae*. The vocal sac is subgular and bilobate. Breeding males have horny, nuptial excrescences on the thumbs. The tadpoles (known only in *P. fodiens*) are short-tailed, pelagic types, characterized by an anteroventral mouth with robust beak, large papillae laterally and ventrally, and 2/3 tooth rows. The haploid number of chromosomes is 12 (known only in *P. fodiens*).

• DESCRIPTIONS. Significant descriptions are given at the generic level by Boulenger (1882), Günther (1885-1902 [1901]), Kellogg (1932), and Trueb (1969).

• ILLUSTRATIONS. The skulls of this genus are illustrated by Trueb (1969). For references and other illustrations, see species accounts.

• DISTRIBUTION. This genus ranges throughout xeric environments from south-central Arizona in the United States southward through western México to the Tepalcatepec Valley in Michoacán. Throughout most of its range, *Pternohyla* occurs at low elevations from sea level to approximately 1500 meters, but is present on the Mexican Plateau in the states of Jalisco and Aguascalientes at elevations of 1800 to 1900 meters.

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. Important references are cited in this and the accounts of the species. Goin (1961) provided a brief generic definition. Starrett (1960) discussed the relationships of the genus on the basis of jaw musculature and Trueb (1969) on the bases of cranial anatomy and vocal sac structure (see Comment).

• KEY TO THE SPECIES (adults only).

1. Bony ridge extending from point between nostrils to tip of snout; snout in dorsal profile acutely rounded; tips of digits expanded into small discs; vocal sacs connected medially in breeding males ..... *P. fodiens*
2. No bony ridge extending anteriorly from a point between nostrils; snout bluntly rounded in dorsal profile; tips of digits not expanded; vocal sacs widely separated medially in breeding males ..... *P. dentata*

• ETYMOLOGY. The generic name, derived from the Greek *pterna*, with reference to heel, and *Hylas*, a character in Greek mythology, refers to the spade-like, inner metatarsal tubercle.

## COMMENT

The modifications of the limbs, the squat body, and heavily ossified head adapt *Pternohyla* to a fossorial existence. Osteologically, the crania are significantly similar to those of *Smilisca* (Trueb, 1969) and the jaw musculature of these genera is identical (Starrett, 1960). Trueb (1969) suggested that *Pternohyla* originated from a *Smilisca baudinii*-like stock, which evolved adaptations for a fossorial existence in xeric environments.

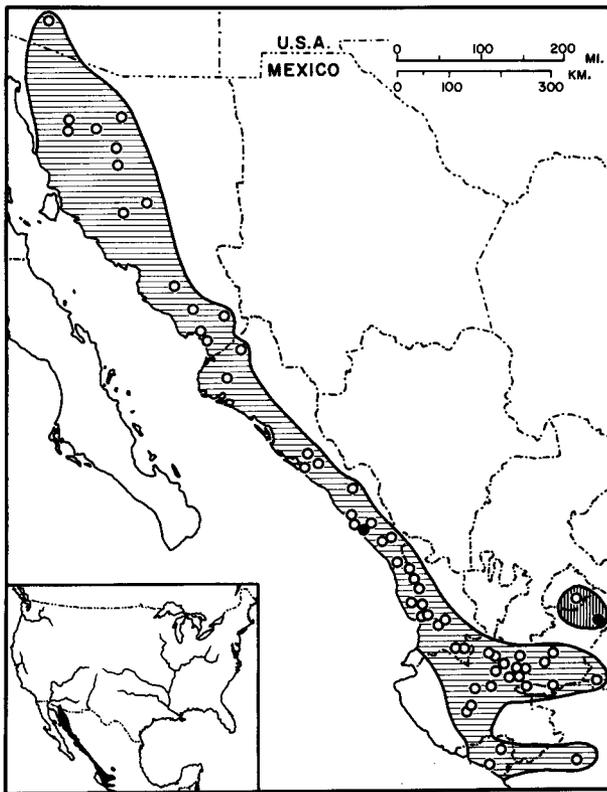
***Pternohyla dentata* Smith  
Upland burrowing treefrog**

*Pternohyla dentata* Smith, 1957:1. Type-locality, "8 mi. NE Lagos de Moreno, Jalisco, Mexico." Holotype, Univ. Illinois Mus. Nat. Hist. 40551, an adult male collected by Wayne H. Davis, William Z. Lidicker and John R. Winkelmann, on 12 July 1956 (examined by author).

• CONTENT. No subspecies are recognized.

• DEFINITION AND DIAGNOSIS. This is a moderate-sized species; males attain a snout-vent length of 62 mm and females reach 54 mm. Females do not differ significantly from males in proportions. The head is about as wide as long and somewhat spatulate. In dorsal profile, the snout is bluntly rounded, whereas, laterally it is acutely rounded and protrudes beyond the leading edge of the lower jaw. The lips are broadly flared. An internasal ridge and internasal bone are absent. The skin is not co-ossified with the pars dentalis of the maxillary at its distal edge.

The fingers are short, robust, and lack terminal discs.



MAP. Distribution of *Pternohyla fodiens* (horizontal hatching) and *P. dentata* (vertical hatching). Solid spots mark type-localities; circles indicate other records.

Poorly developed supernumerary tubercles are present on the proximal segments of the third and fourth fingers in some specimens. The hind limbs are short; the heels of the adpressed limbs overlap by about one-fourth of the length of the shank. The inner metatarsal tubercle is elongate, elliptical and round in section. The toes are moderately short, slender, and lack terminal discs.

The anal opening is directed posteriorly at the level of the upper edges of the thighs; no anal flap is present. The skin on the dorsal surfaces of the body is weakly granular, and that on the dorsal surfaces of the limbs and the ventral surfaces of the forelimbs, shanks and feet is smooth. The skin on the belly and ventral surfaces of the thighs is heavily granular.

The tongue is free posteriorly for about one-third of its length. The vocal sac is bilobate, with the halves ventrolateral in position; the sacs are connected by a narrow tube, but there is a broad separation of granular skin between the two halves of the sac.

The color in life is unknown. In preservative, the dorsal ground color varies from grayish brown to pale reddish brown. The dorsum is variously marked with dark brown to reddish brown spots and longitudinal marks. In those individuals having reddish brown blotches, the blotches are narrowly outlined by dark brown or black. Most individuals have dark spots on the upper eyelids and a dark dash on the head anterior to

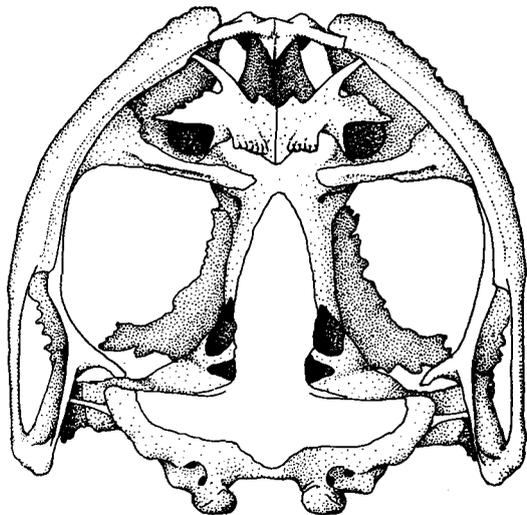
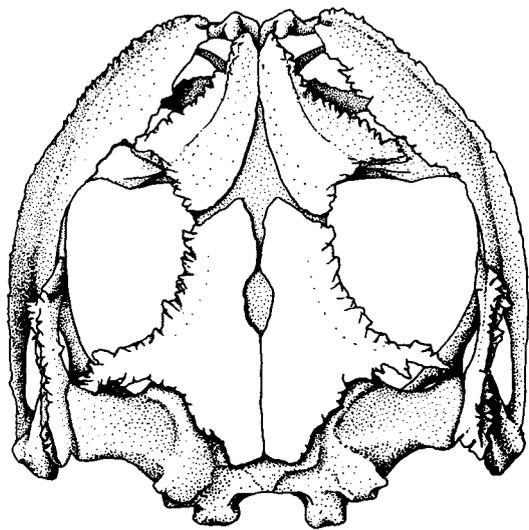


FIGURE 1. Dorsal and ventral views of skull of *Pternohyla dentata* (KU 106293), female.  $\times 5$ .

the eyes. Dark bars are present on the upper lips. The dorsal markings are either longitudinal stripes or discrete spots irregularly arranged in about four longitudinal rows. The usual pattern consists of a pair of paravertebral stripes flanked by a row of dorsolateral spots on each side. The flanks are creamy tan with dark brown spots. Brown blotches or transverse bars are present on the limbs; there are two or three such bars on each shank and thigh, and usually two on the foot and forearm. The posterior surfaces of the thighs are creamy white with brown flecks and dashes. The venter is creamy yellow and the vocal sacs brownish gray.

The tadpoles and mating call of *P. dentata* are unknown.

*Pternohyla dentata* is readily distinguished from *P. fodiens* by the presence of a rounded inner metatarsal tubercle and distally unexpanded digits, whereas *P. fodiens* has a spade-like inner metatarsal tubercle and distinct terminal discs on the digits. The two halves of the vocal sac are broadly separated medially in *P. dentata*, and connected medially in *P. fodiens*. *Pternohyla fodiens* has a distinct internasal ridge and acutely rounded snout, whereas *P. dentata* lacks the ridge and has a bluntly rounded snout.

• DESCRIPTIONS. The only description of *Pternohyla dentata* is the type description by Smith (1957).

• ILLUSTRATIONS. Trueb (1969) illustrated dorsal and ventral views of the skull of this species. There are no other published illustrations of *P. dentata*.

• DISTRIBUTION. *Pternohyla dentata* is known from the upper Río Santiago Basin in southern Aguascalientes and northern Jalisco, México, at elevations between 1800 and 1900 meters.

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. Chrapliwy, Williams, and Smith (1961) reported a large series of *Pternohyla dentata* from Aguascalientes. Trueb (1969) discussed the evolutionary relationships of *P. dentata* and *P. fodiens*.

• REMARKS. Smith (1957) described *Pternohyla dentata* as having parasphenoid and palatal "teeth." Despite this statement, the parasphenoid is edentate and the palatine bones bear only slightly irregular ridges.

• ETYMOLOGY. The specific name is Latin meaning tooth and refers to the supposed presence of parasphenoid teeth in this species.

#### COMMENT

Trueb (1969) has shown that the skull of *Pternohyla dentata* is considerably less ossified than that of *P. fodiens*. She proposed that *P. dentata* is similar to an ancestral *Pternohyla* stock in which the cranium was only moderately ossified and the internasal bone was not present. Presumably the *Pternohyla* prototype was widespread over the Pacific lowlands of México during the Pleistocene. Further evolution of this group resulted in the appearance of the more advanced *P. fodiens* and in the survival of a relict population of the ances-

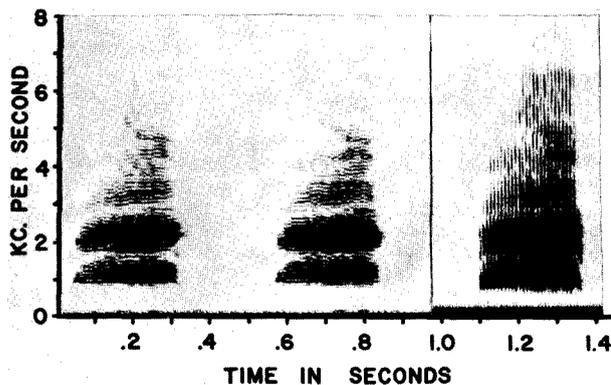


FIGURE 2. Audiospectrogram of mating call of *Pternohyla fodiens*: first and second calls narrow band (45 cycles per second), last call wide band (300 cycles per second). Santa Ana, Sonora, México, 24 July 1958, body temperature 24.3°C. (Amer. Mus. Nat. Hist. Dept. Herpetology tape library).

tral stock represented today by *P. dentata* which is known only from a population in the upper Río Santiago Basin on the Mexican Plateau.

***Pternohyla fodiens* Boulenger**  
**Lowland burrowing treefrog**

*Pternohyla fodiens* Boulenger, 1882:236. Type-locality, "Presidio, W. Mexico" [Sinaloa, Mexico]. Holotype, British Mus. Nat. Hist. 1947.2.24.26, collected by Alphonso Forrer (not seen by author).

*Hyla rudis* Mocquard, 1899:163. Type-locality, "Guadalajara," Jalisco, México. Holotype, Museum National d'Histoire Naturelle, Paris, 373a, juvenile collected by Léon Diguët (not seen by author).

• CONTENT. No subspecies are recognized.

• DEFINITION AND DIAGNOSIS. This is a moderate-sized species; males attain a maximum snout-vent length of 62 mm, and females reach 63 mm. Females do not differ significantly from males in proportions. The head is relatively small and slightly wider than long. The snout is moderately long; in dorsal profile, the snout is acutely rounded, whereas laterally it is bluntly rounded. The lips are broadly flared. A bony internasal ridge is formed by the convergence of the canthal ridges posterior to

the nostrils; the ridge extends anteriorly, between the nostrils, to the tip of the snout. An internasal bone is present at the anterior end of the skull. The skin is not co-ossified with the pars facialis of the maxillary along the upper edge of the lips.

The fingers are moderately long and slender and have small discs. The hind limbs are short and robust; heels of the adpressed limbs barely overlap. The inner metatarsal tubercle is large, elliptical, and spade-like with an elevated outer edge. The toes are moderately long and slender and bear discs that are slightly smaller than those on the fingers.

The anal opening is directed posteriorly at the upper level of the thighs; a short anal flap is present. The skin is smooth except on the dorsum, belly and proximal segments of the thighs where it is granular.

The tongue is free posteriorly. The vocal sac is subgular and bilobate; the halves are narrowly separated medially.

In life, the dorsal ground color varies from tan to pale olive-brown, grayish brown or pinkish brown. The dorsum is variously marked with longitudinal stripes and small spots; these marks are dark brown or reddish brown outlined with dark brown or black. Most individuals have a dark spot on the head anterior to the eyes, a dark stripe along the canthal ridge and dark vertical bars on the lips. A dark mark usually extends posteriorly from the tympanum to the level of the insertion of the arm. The flanks are creamy tan with dark brown reticulations. The dorsal surfaces of the limbs are tan with dark brown or reddish brown transverse bars. The posterior surfaces of the thighs are brown with creamy yellow flecks, spots, or dashes. The venter is white, except for the vocal sac in breeding males, which is grayish brown. The iris is dull bronze with fine black reticulations. In preservative, the dorsal ground color varies from pale grayish tan to creamy or pinkish tan. The dorsal markings are dark brown and the venter is creamy white, except for the vocal sac which is dark gray with white flecks.

Tadpoles have tails only slightly longer than the body. The caudal fins are moderately deep; the dorsal fin does not extend onto the body. The anal tube is dextral and the spiracle is sinistral. The mouth is small, and anteroventral in position and direction. The median part of the upper lip is bare. Partially fused labial papillae are present in a single row mid-ventrally and anterolaterally, and in two rows laterally. There are two upper and three lower tooth rows. All tooth rows are complete except the second upper row which is broadly interrupted medially. In life, the tadpoles are dull tan with olive-brown mottling dorsally; the belly is dusty white. In preservative, the body is dark brown and the caudal musculature is creamy tan with dark brown flecks; dark brown flecks are also present on the caudal fins.

The call of *Pternohyla fodiens* consists of a series of low-pitched notes, resembling the quacking of a duck. The following data were derived from analyses of six recordings of *P. fodiens*: note repetition rate is 81 to 115 (mean, 95) notes per minute; notes have a duration of 0.21 to 0.28 (mean, 0.25) of a second; fundamental frequency is 122 to 134 (mean, 126) cycles per second; dominant frequency is 2200 to 2278 (mean, 2230) cycles per second; and pulse rate is 118 to 125 (mean, 122) pulses per second. The six calls were recorded between temperatures of 26.5 and 29.0° C; no correlations between call characteristics and temperature are evident on the bases of these data.

*Pternohyla fodiens* is most easily distinguished from *P. dentata* by the presence of spade-like inner metatarsal tubercles and distinct terminal discs on the digits; the inner metatarsal tubercle is rounded and the digits slender distally in *P. dentata*. *Pternohyla fodiens* is further distinguished by the presence of an internasal bone, and expanded dermal roofing bones. Also, *P. fodiens* has the halves of the vocal sac connected medially, whereas in *P. dentata* they are broadly separated medially.

• DESCRIPTIONS. The most useful descriptions of *Pternohyla fodiens* are found in Boulenger (1882), Kellogg (1932), Stebbins (1966), and Hardy and McDiarmid (1969). Some miscellaneous notes on the behavior of *P. fodiens* are provided by Davis and Dixon (1957), and breeding behavior of this species is described by Hardy and McDiarmid (1969). Webb (1963) gave accounts of larvae and breeding habitat. Porter (1962) described and provided an audiospectrogram of the mating call of *P. fodiens*. The cranial osteology and internal anatomy are described in detail by Trueb (1969).

• ILLUSTRATIONS. Adults of *Pternohyla fodiens* are illustrated by Stebbins (1966) and Günther (1885-1902[1901]). Boulenger

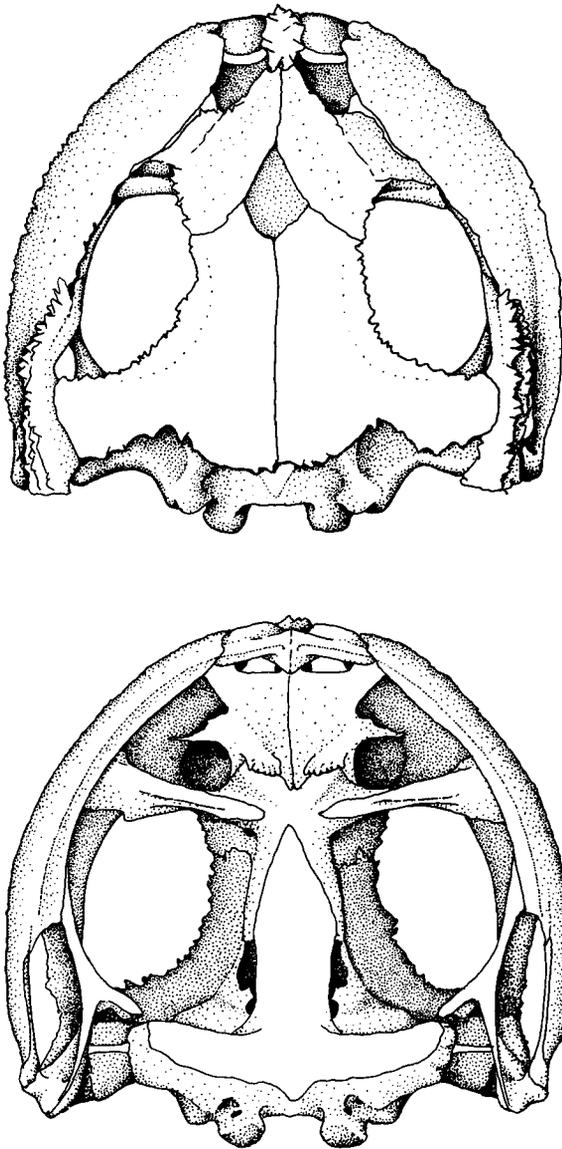


FIGURE 3. Dorsal and ventral views of skull of *Pternohyla fodiens* (KU 86615), male  $\times$  5.

(1882) contains black and white drawings of the head of *P. fodiens*, and the larva was illustrated by Webb (1963). The skull of this species is illustrated by Trueb (1969).

• **DISTRIBUTION.** *Pternohyala fodiens* inhabits xeric regions from south-central Arizona (3 miles southwest of Hickiwan, Pima County) in the United States (Chrapiwy and Williams, 1957) southward through western Sonora and the coastal region of Sinaloa, and thence into the foothills of the Pacific slopes of the Sierra Madre Occidental in Nayarit and southward onto the Mexican Plateau in Jalisco, at elevations up to 1500 meters. This species also occurs on the Colima Plateau and in the Tepalcatepec Valley in Michoacán, México. It is found between elevations of sea level and approximately 1500 meters.

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** Firschein (1951) describes phragmotic behavior and the "unken reflex" in *Pternohyala fodiens*. The haploid number of chromosomes is reported by Duellman and Cole (1965), and Brattstrom (1968) includes *P. fodiens* in his study of thermal acclimation of amphibians. Starrett (1960) studied the structure of the jaw musculature of this species. Trueb (1969) discusses the evolutionary relationships of the genus and species.

Davis and Dixon (1957) list collecting sites of *P. fodiens* in the Mexican states of Jalisco, Nayarit, Sonora, and Sinaloa. Additional localities are given by Smith and Van Gelder (1955), Taylor (1936), Fugler and Dixon (1961), and Hardy and McDiarmid (1969) for Sinaloa. Sonoran localities are provided by Allen (1933) and Zweifel and Norris (1955). Collecting sites in Jalisco are given by Tanner and Robison (1960) and in Colima by Oliver (1937). Duellman (1961) lists localities and measurements of *P. fodiens* in Michoacán, and in a later paper (1965) discusses the biogeographic significance of this treefrog as a member of the herpetofauna of Michoacán. Gadow (1905) suggests that the distribution of *P. fodiens* and the morphological similarity between it and some other South American forms provide evidence for a South American center of origin for the hylids. Various distributional records and miscellaneous notes are found in the following: Kellogg (1932), Smith and Taylor (1948), Savage (1954), and Chrapiwy, Williams and Smith (1961).

• **REMARKS.** Kellogg (1932) shows that the type of *Hyla rudis* Mocquard is a juvenile of *Pternohyala fodiens*.

• **ETYMOLOGY.** The specific name *fodiens* is the genitive of the Latin *fodio*, meaning to dig or to dig up and apparently refers to the presumed digging adaptations of the spade-like inner metatarsal tubercles.

#### COMMENT

According to Trueb (1969), *Pternohyala fodiens* is more highly specialized and better adapted to a fossorial existence than *P. dentata*. *Pternohyala fodiens* has a more extensively ossified skull in which an internasal bone and labial flanges and well developed and integumentary-cranial co-ossification is extensive. The addition of the internasal and labial flanges are probably functional, morphological adaptations related to the phragmotic behavior of this species described by Firschein (1951). *Pternohyala fodiens* seems better adapted for the more xeric environments it inhabits because of the increased amount of co-ossification in this species as compared with *P. dentata*. The probable evolutionary relationships of these two species are discussed in the commentary following the account of *Pternohyala dentata*.

#### LITERATURE CITED

- Allen, Morrow J. 1933. Report on a collection of amphibians, reptiles from Sonora, Mexico, with the description of a new lizard. Occas. Papers Mus. Zool. Univ. Michigan (259):1-15.
- Boulenger, G. A. 1882. Descriptions of a new genus and species of frogs of the family Hylidae. Ann. Mag. Nat. Hist. ser. 5 (10):326-328.
- Brattstrom, Bayard H. 1968. Thermal acclimation in anuran amphibians as a function of latitude and altitude. Comp. Biochem. Physiol. 24:93-111.
- Chrapiwy, Pete S., and Kenneth L. Williams. 1957. A species of frog new to the fauna of the United States: *Pternohyala fodiens* Boulenger. Nat. Hist. Misc. Chicago Acad. Sci. (160):1-2.
- Chrapiwy, Pete S., Kenneth Williams, and Hobart M. Smith. 1961. Noteworthy records of amphibians from Mexico. Herpetologica 17(2):85-90.
- Davis, William B. and James R. Dixon. 1957. Notes on Mexican amphibians, with description of a new *Microbatrachylus*. Herpetologica 13(2):145.
- Duellman, William E. 1961. The amphibians and reptiles of Michoacán, México. Univ. Kansas Publ. Mus. Nat. Hist. 15(1):1-148.
- 1965. A biogeographic account of the herpetofauna of Michoacán, México. *Ibid.* 15(14):627-709.
- Duellman, William E. and Charles J. Cole. 1965. Studies of chromosomes of some anuran amphibians (Hylidae and Centrolenidae). Syst. Zool. 14(2):139-143.
- Firschein, I. Lester. 1951. Phragmotic behavior and the "unken reflex" in a Mexican hylid frog, *Pternohyala fodiens*. Copeia 1951(1):74.
- Fugler, Charles M. and James R. Dixon. 1961. Notes on the herpetofauna of the El Dorado area of Sinaloa, Mexico. Publ. Mus. Michigan State Univ. Biol. Ser. 2(1):1-23.
- Gadow, Hans. 1905. 2. The distribution of Mexican amphibians and reptiles. Proc. Zool. Soc. London 2:191-244.
- Goin, Coleman J. 1961. Synopsis of the genera of hylid frogs. Ann. Carnegie Mus. 36:5-18.
- Günther, A. C. L. G. 1885-1902. Biologia Centrali-Americana. Reptilia and Batrachia. Dulau and Co., London. xv + 326 p., pls. 1-76.
- Hardy, Laurence M. and Roy W. McDiarmid. 1969. The amphibians and reptiles of Sinaloa, México. Univ. Kansas Publ. Mus. Nat. Hist. 18(3):39-252.
- Kellogg, Remington. 1932. Mexican tailless amphibians in the United States National Museum. Bull. U. S. Natl. Mus. (160):1-224, pl. 1.
- Mocquard, M. F. 1899. Reptiles et batraciens recueillis au Mexique par M. León Diguët en 1896 et 1897. Bull. Soc. Philom. Paris (9), 1:154-169.
- Oliver, James A. 1937. Notes on a collection of amphibians and reptiles from the state of Colima, Mexico. Occas. Papers Mus. Zool. Univ. Michigan (360):1-28.
- Porter, Kenneth R. 1962. Mating calls and noteworthy collections of some Mexican amphibians. Herpetologica 18(3):165-171.
- Savage, Jay M. 1954. Notulae herpetologicae 1-7. Trans. Kansas Acad. Sci. 57(3):326-334.
- Smith, Hobart M. 1957. A new casque-headed frog (*Pternohyala*) from Mexico. Herpetologica 13(1):1-4.
- Smith, Hobart M. and Edward H. Taylor. 1948. An annotated checklist and key to the amphibians of Mexico. Bull. U. S. Natl. Mus. (194):1-118.
- Smith, Hobart M. and Richard G. Van Gelder. 1955. New and noteworthy amphibians and reptiles from Sinaloa and Puebla, Mexico. Herpetologica 11(2):145-149.
- Starrett, Priscilla. 1960. A redefinition of the genus *Smilisca*. Copeia, 1960(4):300-304.
- Stebbins, Robert C. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston xiv + 270 p.
- Tanner, Wilmer W. and W. Gerald Robison, Jr. 1960. Herpetological notes for northwestern Jalisco, Mexico. Herpetologica 16(1):59-62.
- Taylor, Edward H. 1936. Notes on the herpetological fauna of the Mexican state of Sinaloa. Univ. Kansas Sci. Bull. 24(20):505-537.
- Trueb, Linda. 1969. Evolutionary relationships of casque-headed treefrogs with co-ossified skulls (Family Hylidae). Univ. Kansas Publ. Mus. Nat. Hist. *In press*.
- Webb, Robert G. 1963. The larva of the casque-headed frog *Pternohyala fodiens* Boulenger. Texas J. Sci. 15(1):89-97.
- Zweifel, Richard G. and Kenneth S. Norris. 1955. Contribution to the herpetology of Sonora, Mexico: descriptions of new subspecies of snakes (*Micruroides euryxanthus* and *Lampropeltis getulus*) and miscellaneous collecting notes. Amer. Midland Nat. 54(1):230-249.

LINDA TRUEB, MUSEUM OF NATURAL HISTORY, UNIVERSITY OF KANSAS, LAWRENCE, KANSAS 66044.

Published 20 June 1969 by the American Society of Ichthyologists and Herpetologists. Publication is supported by National Science Foundation grant G24231.

Primary editor for this account, Richard G. Zweifel.